lightsource bp

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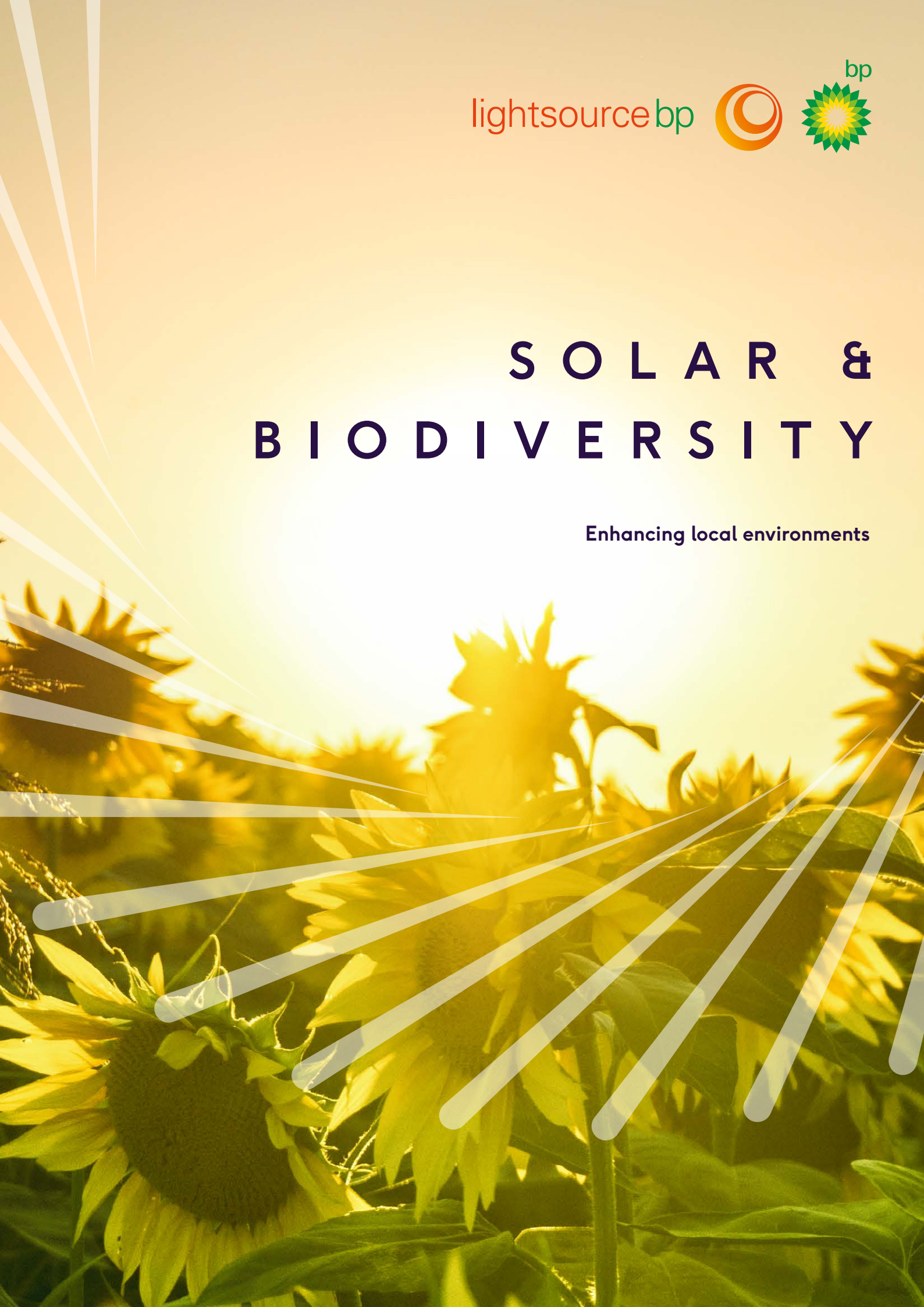
SOLAR & BIODIVERSITY

Enhancing local environments



BIODIVERSITY IS A PRIORITY

We don't just develop solar farms, we're also the long-term stewards and custodians of the land – our solar farms are typically in place for up to 40 years, and we're responsible for the entire life cycle.

At Lightsource BP, we work with various stakeholders to make sure our projects benefit the local community – not just by generating clean electricity but by improving the ecosystem. Ecological assessments are undertaken to create solar farms that boost biodiversity, assets that local communities can be proud of.

WHAT IS BIODIVERSITY & WHY IS IT IMPORTANT?

The air we breathe, the water we drink and the food we eat all rely on biodiversity.

Biodiversity refers to the variety of life on Earth – the number of species of plants, animals and microorganisms and how they interact. Biodiversity plays an important role in creating a balanced and healthy ecosystem, enabling us to live healthy lives. Almost all cultures are dependent on biological diversity in some way, and as such maintaining biodiversity and boosting ecosystem productivity is vital. For example:

- Larger number of plant species means a greater variety of crops
- Greater species diversity ensures natural sustainability for all life forms
- Healthy ecosystems can better withstand and recover from a variety of disasters

It's important for humans to recognise that the planet relies on biodiversity where each species, no matter how small, depends on each other and has an important role to play in our balanced and healthy ecosystem.

However, deforestation, increased development, pollution and climate change are all threatening the delicate balance that maintains our ecosystem. At Lightsource BP, we see our solar farms as not only a source of clean and renewable energy, but also an opportunity to maintain biodiversity and boost ecosystem productivity.

HOW SOLAR FARMS ARE IMPROVING BIODIVERSITY

In mid-summer 2013, a study of biodiversity levels at solar farms in comparison to similar plots of agricultural land was undertaken in the UK. The study leaders selected four solar farms, including one Lightsource BP site, each with a different approach to land management. Two of the solar farms had been seeded with wildflower meadows, and two were pastures with agricultural grasses. Biodiversity was measured using three indicator groups: grassland herbs, bumblebees and butterflies, as these are important markers of wider biodiversity. For each site, a control plot was selected next to the solar farm with the same land use as the solar farm prior to its construction.

The results

The results showed that all the solar farms had higher levels of biodiversity in comparison to non-solar land. The study confirms that with proper land management, solar farms present the opportunity to establish a wide range of habitats designed to increase general biodiversity and support conservation.

The study also underscored inherent features of solar farms that are beneficial to wildlife; they are relatively undisturbed by human activity once constructed and are in place for decades, which is sufficient time for appropriate land management practices to really take effect.

Findings & observations

- All four solar farms showed increased biodiversity in at least one of the three indicators, in comparison with the control plots.
- Sites re-seeded as wildflower meadows showed a significant increase in all three biodiversity indicators (herbs, bumblebees and butterflies); pasture sites showed change in one or two of the indicators.
- All sites displayed a degree of colonisation by herbs – there were more herbs present than originally sown.
- In general, bumblebees and butterflies observed in solar farms were feeding whereas those observed in control plots were in transit. This indicates that herb-rich grasslands have greater value as foraging sites.
- A wide range of wildlife was observed within solar farms, including Brown Hares, small mammals, invertebrates and a number of endangered birds of conservation concern in the UK.

GE Parker and C McQueen, August 2013, "Can Solar Farms Deliver Significant Benefits for Biodiversity?"

OUR CONSIDERATIONS FOR BUILDING SOLAR SITES

When building a solar site, we take the following steps to make sure we're creating an asset that benefits the local community and environment:

- **Custom-built landscape plans**
  Our biodiversity and planting plans are prepared by landscape and ecology experts, with feedback from the local community being fed into the design. When putting together a plan for the land management of a site, we conduct a wide range of ecological surveys and assessments, drawing on expert knowledge across the board to create a tailored plan for the site.

- **Natural screening**
  When we develop solar farms, we take care to make sure they have a minimal impact on their local surroundings, and this can include using planting to screen views. We prefer to use natural screening techniques where possible, such as planting native hedgerows, shrubs and trees. As well as minimising visual impact, this allows us to better integrate the solar farm into the local area and provide additional habitat.

- **Seeding**
  Our solar farms are typically designed with wide margins to prevent shading, if there is significant vegetation present along the boundary. The area between the solar farm fence and the site boundary, or boundary vegetation, can be seeded with a site-specific mix, such as wildflowers or pollinator species, grassland meadow or other suitable mix designed to feed and support the local wildlife. Within the solar array a balance is sought between providing greater biodiversity and allowing for maintenance requirements or livestock grazing.

- **Preserving existing vegetation**
  Part of the environmental investigations for our solar farms can involve thorough assessments of the vegetation already in place on site, depending on location. In developing our technical layouts we seek to preserve as much of the existing vegetation as practicable. When it's necessary to remove trees or hedgerows, we usually try to offset this with new planting or habitat creation on site, or through contributions to biodiversity/ecological offset funds.

- **Making local species a priority**
  When creating planting plans for our solar farms, we make sure that we seek to select species of grass, pollinators, trees, hedges and shrubs that are commonly found in or appropriate to the local area, or species that were previously common but have become increasingly rare. By selecting species that are native to the area, we can be sure that they'll acclimate and thrive, as well as be confident that the solar farm will provide a home for native insects, birds and more.

OTHER WAYS WE ENHANCE BIODIVERSITY

Mammal gates

Where appropriate we install small 'mammal gates' in the fencing around our sites, to allow for continued access for animals across our solar farms.

Insect hotels

As well as homes for birds and reptiles, our solar farm plans can include insect hotels. These little structures are made from natural materials with plenty of tiny little spaces to encourage and support populations of invertebrates.

Bird and bat boxes

Where appropriate we will install bird, bat and/or owl boxes in the vegetation around the perimeters of our solar farms. These boxes are specifically selected to suit common species in the local area, and hung under the advisement of specialists, to provide additional safe nesting habitats.

Reptile refugia

Large open spaces can be difficult places to live for lizards and other small reptiles, so to make our solar farms as hospitable as possible, we can create reptile refugia along the margins of our sites. These small piles of logs are completely natural and blend in with the environment, while the little gaps and spaces between the wood provide ideal safe havens for lizards and other reptiles.

Raised solar panels

The panels on our solar farms are elevated above the ground, providing space beneath for wildlife. Solar farms are ideal for providing protection and shelter – the panels protect from wind, rain and snow, they provide shade in hot weather, and they also give overhead coverage from birds of prey and other predators.

Beehive installation

We work with local bee farming ventures to host hives at some of our solar farms, which are seeded with species-rich grass and wildflowers, and host habitat piles – all of which contribute to instigating an ecosystem which is pollen-rich and bee-friendly. Having more pollinators amongst the farmland also furthers our aim of cultivating a more biodiverse environment for wildlife, and can even benefit food production in the surrounding fields.

LAND MANAGEMENT

Lightsource BP doesn't just fund and develop solar projects, we oversee the operations and maintenance of our sites for their entire lifecycle, and that's a responsibility we take seriously.

We're dedicated to creating solar assets that we, our customers and the local communities can be proud of. To do this, we've developed a tried and tested land management strategy to maintain and enhance our sites from day one to decommissioning.

Post-construction

- Construction tidy up – once the installation has been fully constructed and commissioned, we remove all construction equipment and tidy up the site.
- Restoration – when the site is clear, we undertake civil works and damage repairs to restore the land to close to its original state.
- Planting – during the first planting season following the end of construction, the site and boundaries will be seeded and planted as per the custom planting plan, which can include a mix of new planting and reseeding, where necessary.

Ongoing management

- Land maintenance – some of our sites are grazed by sheep, which eliminates the need to mow the grass under the panels. Our non-grazed sites are regularly mown by our ground maintenance experts.
- All our sites are managed by ground maintenance staff and subcontractors, and in some cases we contract out land maintenance to the landowner themselves. We undertake regular vegetation management and upkeep, including trimming trees and hedges, replanting any damaged plants, weed control and more.

Decommissioning

At the end of the site's lifespan, we remove the panels, the posts they're mounted on, and all other equipment and hardware, and work to ensure that the land is restored to its original state. The posts on which the panels are mounted typically take up less than 1% of the land.

We recycle or reuse as many of the components of our solar farms as possible. Panels are often sold second hand, or recycled by dedicated solar recycling depots. Solar panels typically consist of glass, aluminium, copper, silver and semiconductor materials that can be successfully recovered and reused. By weight, more than 80 percent of a typical solar panel is glass and aluminium – both common and easy-to-recycle materials.

After successful decommissioning, no elements of the solar installation are left on site, either above or below ground.

CASE STUDY

MOOR SOLAR FARM LINCOLNSHIRE, UK

Our two Moor Solar Farms in Lincolnshire, UK, are among the solar projects showcasing our bee biodiversity plan. The two solar farms sit within Long Sutton Butterfly and Wildlife Park, alongside the wildlife park's resident water buffalo and ostriches. Combined, the installations have a power output of 2.7MWp.

The solar farms were installed in 2011, on a site that was previously home to an orchard. In 2016, with the encouragement of the farm's landowner, Lightsource BP partnered with a local bee farmer and installed two hives along the site's boundary.

The planting plans for both Moor Solar Farms were designed to enhance the habitat for bees and other pollinators – new apple trees were planted along the west perimeter, and extra hedging and vegetation screening was put in around the rest of the site. The open grassed areas within the sites were planted with a wildflower meadow seed mix including clover, field poppy, cornflower, parsley and more. This mix was specifically selected to provide rich forage for pollinators.

Over 100,000
bees homed

890
human homes powered

15 hectares/37 acres
total

CASE STUDY

WILBURTON SOLAR FARM CAMBRIDGESHIRE, UK

Wilburton Solar Farm was installed in 2011. Its 19,960 solar panels continue to convert the sun's energy into electricity. The solar array provides a safe, peaceful haven for many species, while generating enough clean electricity to supply over 1,400 households.

Lightsource BP developed a tailored planting plan for the site, as well as a range of other wildlife habitat enhancement measures. The solar farm is now home to a wide range of different species, supported by the new habitats created across the 31-acre site. Species spotted on Wilburton Solar Farm include...

Brown Hare

According to the Hare Preservation Trust, the population of the Brown Hare in the UK has declined by more than 80% over the last 100 years, and in some areas may even be locally extinct. But at Wilburton Solar Farm, the Brown Hare is thriving. Before the installation of the solar farm, the local gamekeeper had only observed three or four Brown Hares on site, but since the solar farm has been established, he has regularly seen more than 50.

Small Tortoiseshell Butterfly

Banks of wildflowers behind each row of panels harbour an abundance of insect activity, including several species of butterfly. The Small Tortoiseshell is one of the most widely recognised butterflies in Britain. Sadly though, it is experiencing a worrying decline. One theory is that it is being targeted by the parasitic fly, known as Sturmia Bella, which is increasingly migrating from the continent due to the effects of global warming. Wilburton Solar Farm provides valuable habitats for these surviving British icons, whilst helping to address the issue of climate change first hand.

English Partridge

The English Partridge has become extremely rare in the UK. Before the solar farm was installed, the local gamekeeper observed between three and five breeding pairs on the farm, and there are now regularly over 20 breeding pairs on the same land – an exciting and substantial increase. The solar farm not only has the ideal habitat with plenty of shelter and insects for the birds to eat, it's also fenced off, protecting the birds from people and dogs, while the panels provide shelter from the weather and birds of prey.

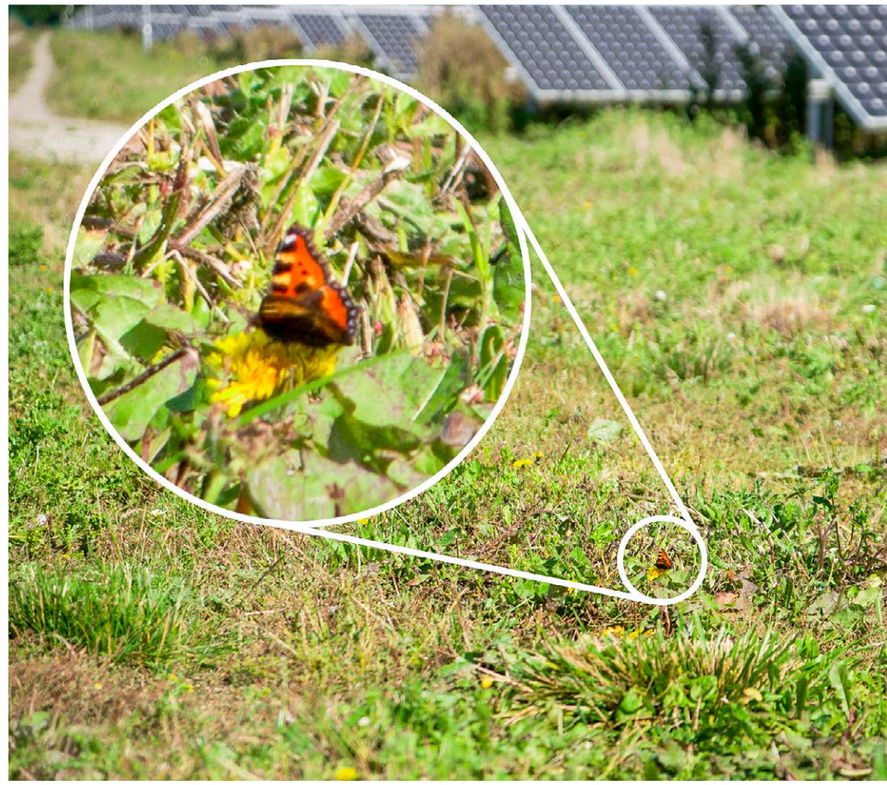
5MW
installed capacity

13 hectares/31 acres
total

9 hectares/23 acres
open grassland within the site

2,680 tons
carbon emission saved annually

596 cars
taken off the road equivalent



CASE STUDY

MOKOAN SOLAR FARM VICTORIA, AUSTRALIA

Our Mokoan Solar Farm in Winton, VIC, was one of our first greenfield Australian development projects, consisting of two neighbouring solar sites.

When developing planting and landscaping plans for this project, we had three main priorities:

Screening the site from view

A vital part of integrating our solar farms into the local landscape is screening, and we almost always opt to use natural methods. At Mokoan, we selected trees and shrubs native to the area, including specific species of Eucalyptus, Acacia and Banksia trees. The screen planting will vary depending on its location around the site's boundary, while still respecting the site's unique existing character and form.

Selecting low-water-requirement species

Due to the primarily dry nature of the local climate, we have designed a planting plan that relies heavily on species with low water requirements. Native species such as Wattle, Tea Tree, Flax Lilly and Milk Maids have been selected as they will thrive in these conditions. During the planting and establishment periods, the new planting will be watered by the use of water trucks, but once the planting on site is fully established, the site will rely on passive irrigation only.

Protecting & nurturing the Regent Honeyeater

The Regent Honeyeater (Anthochaera phrygia) is a critically endangered bird native to South Eastern Australia due to the loss, fragmentation and degradation of their habitat. As the species is present in the area, the Mokoan Solar Farm was designed to include a panel-free corridor to allow for unobstructed movement of the Regent Honeyeater. We have also worked closely with local preservation groups to make sure that our planting plan includes the food sources needed to support a growing Regent Honeyeater population.

45MW
installed capacity

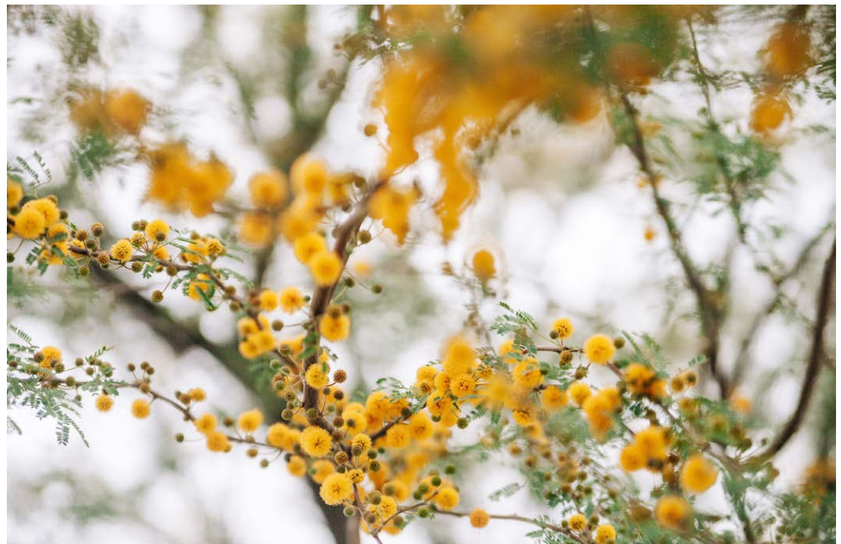
85,700MWh
supplied per year

11,830
human homes powered

67,000 tons
carbon emission saved annually

24,000 cars
taken off the road equivalent

98 hectares/ 242 acres
total



CASE STUDY

PENN STATE SOLAR FARM PENNSYLVANIA, USA

Lightsource BP is currently building Pennsylvania's largest solar project. Stretching across three locations in Franklin County, the 70 megawatts of solar farms will provide electricity solely to Penn State University.

National Model

Over and above the carbon reduction benefits of the solar farms themselves, Lightsource BP has a wider mission for this project to be a living prototype to maximise the sustainability impacts of solar farming in the US with a comprehensive approach that fosters biodiversity, improves soil health, provides pollinator habitats, and offers a living laboratory for students to learn and innovate.

Academic Research

Penn State University students will have access to the solar farms to carry out academic research in fields such as agriculture, soil management and applied soil physics, entomology, pollinator research, sustainability and energy.

Environmental Management Plans

Ecological assessments, including a survey of vegetative and woodland environments have been completed to develop a customised Environmental Management Plan (EMP) for each site and will be implemented during the spring planting season, once construction of each site in completed. Advanced survey techniques, including LIDAR (Light Detection and Ranging) equipped drones and ground mounted GPS are being used through construction to reduce soil disturbance.

The Environmental Management Plans include the following elements:

- Custom-designed plans for each site, including locations for native shrub species in existing hedgerows and new slopes.
- Seeding plans for each site, with region-specific mixes in order to increase local biodiversity and insect habitat, improve soil health, and foster pollinator friendly environments.
- Strategically identified areas to allow local beekeepers to place hives, once a pollinator environment has been successfully established.
- Study of site-specific animal and aviary habitat, including local and regional migratory patterns.
- Potential sheep grazing opportunities with local sheep farmers.

70MW
installed capacity

57,000 tons
carbon emission saved annually

12,102 cars
taken off the road equivalent

35%
greenhouse gas reduction for Penn State by 2020

25%
Penn State's annual power demand supplied

202 hectares /499 acres
total

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