



KNE | Kompetenzzentrum
Naturschutz und Energiewende

Kathrin Schwarz

Nature compatible Solar Parks

Lecture as part of Summer School
Energy 2023

What's the KNE?



What's the KNE?

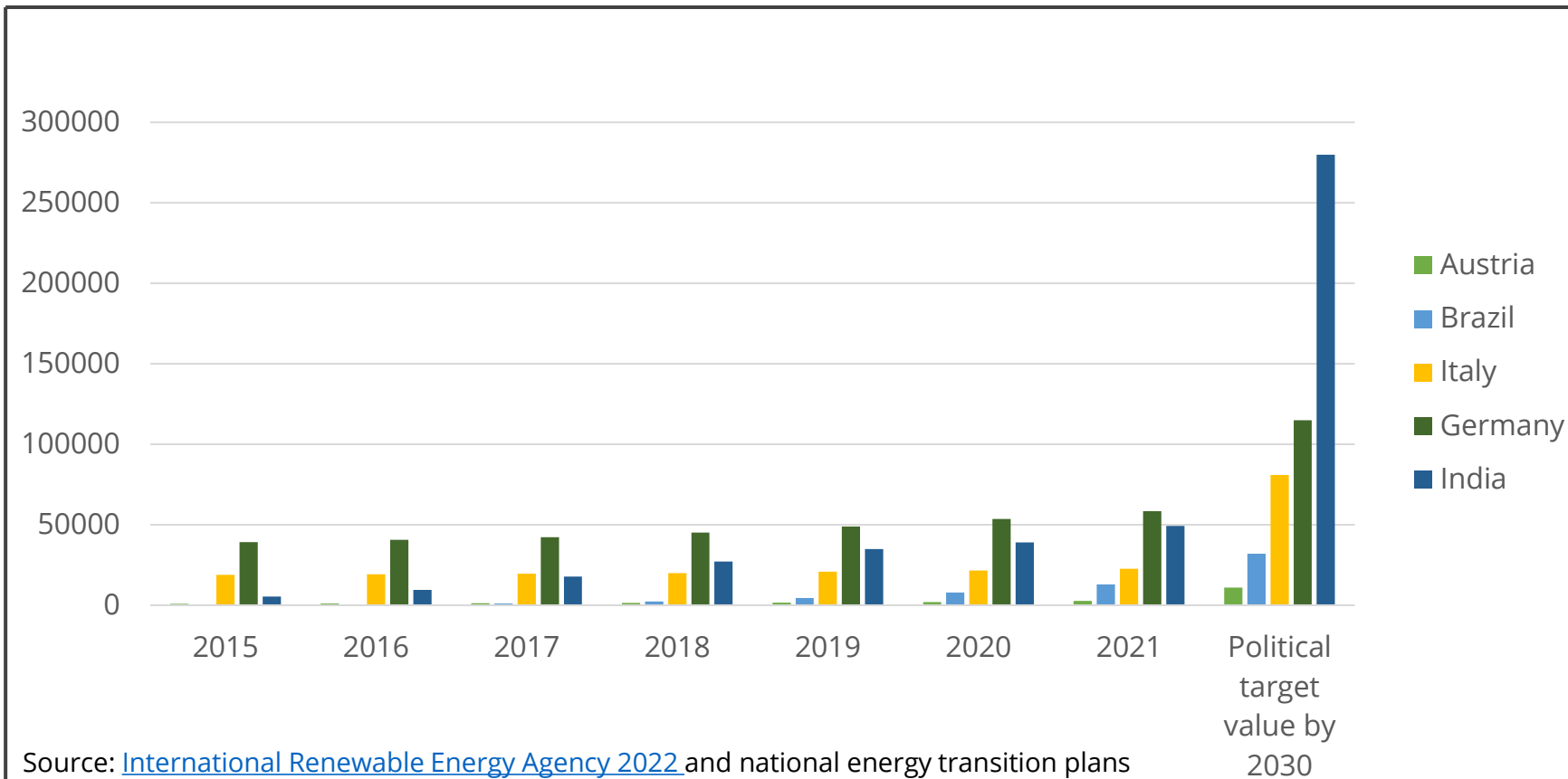
1. Promoting clean energy and nature conservation together.
2. Contribute to the objectification of debates.
3. Mediate (conflict) solutions.



Ecological Impact Assessment on ground mounted solar PV sites

- ♦ Introduction
 - ♦ International renewable solar power targets by 2030
 - ♦ Ecological effects of a PV ground-mounted system
- ♦ Ecological impact assessment on solar parks
 - ♦ Selection of site
 - ♦ Design and Construction
 - ♦ Operation
 - ♦ End of Operation
- ♦ Conclusion

Global Cumulative PV Installation from 2010 to 2021



Source: [International Renewable Energy Agency 2022](#) and national energy transition plans

International Examples of solar parks



Central India



Czech



Kazakhstan



Germany



Turkey



China

Question

Are nature compatible solar parks a topic that is discussed in your country or region?

Effects of solar parks on the environment



Selection of site> Design / Construction> Operation> End of Operation> Restoration

Effects of solar parks on the environment



Selection of site> Design / Construction> Operation> End of Operation> Restoration

Planning phase

Project phase

Effects of solar parks on the environment



Selection of site> Design / Construction> Operation> End of Operation> Restoration

Species and communities

- Habitat change/loss
- Altered microclimate
- Dissection and barrier effect
- Glare

Soil

- Pollutant input
- Compaction
- Sealing
- Degradation

Effects of solar parks on the environment



Selection of site> Design / Construction> Operation> End of Operation> Restoration

Groundwater and water bodies

- Pollutant input
- Change in water distribution within the landscape
- Reduced evapotranspiration

Landscape

- Technical character and surface texture
- Height, exposure of modules
- Glare / Dazzling

Effects of solar parks



Selection of site

Do: Open land sites without outstanding ecological value

- less fertile farmland
- former landfill sites
- Sites along roads and railway tracks or
- Along industrial sites

Don't: High value sites with diverse habitat structures

- Protected areas and forests
- extensively used grassland, intact moors and wetlands or other rare habitats
- relicts of the former ecosystem
- stepping stones and corridors of the regional habitat network, considering habitat change due to climate change

Selection of site

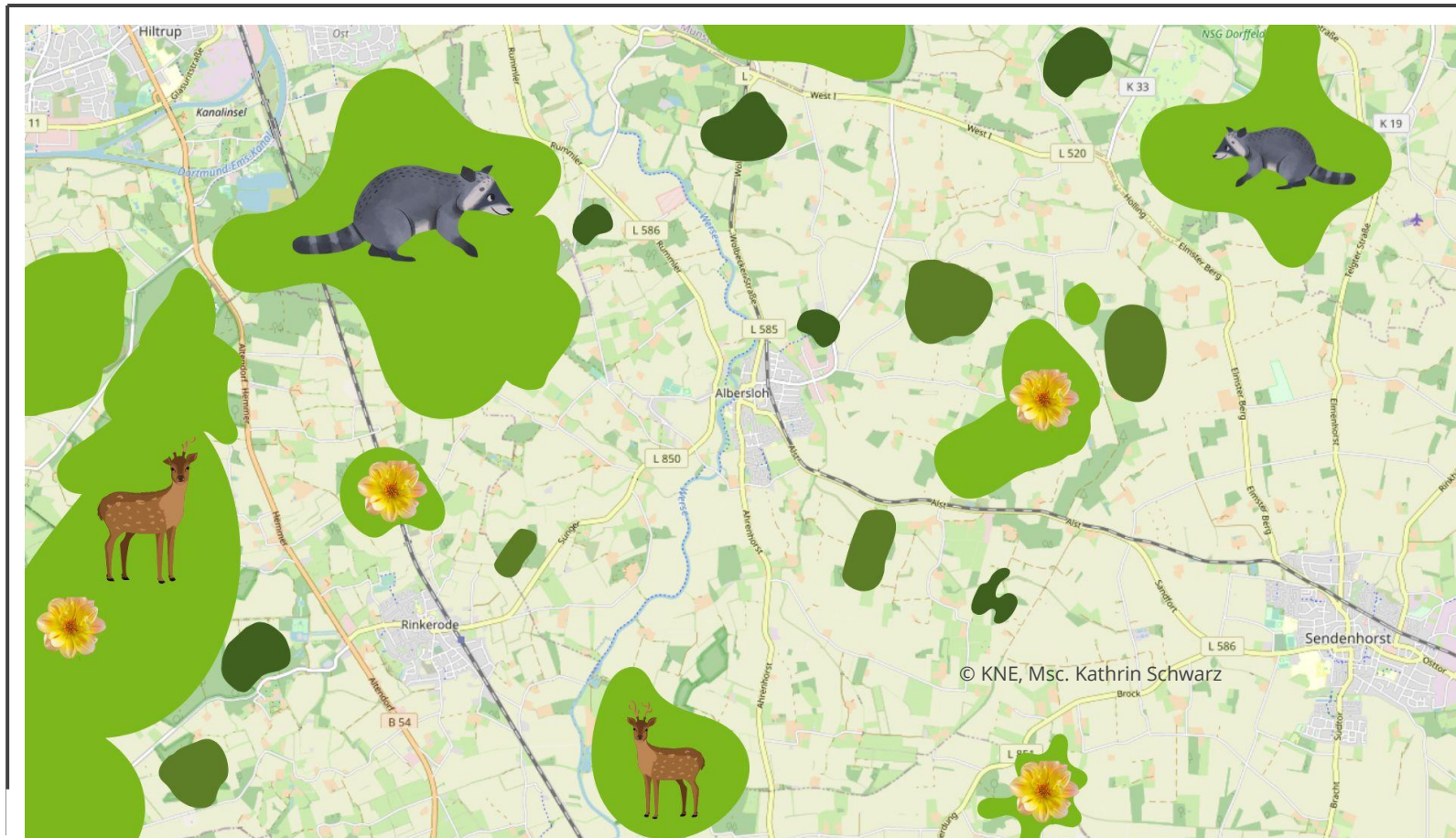
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Selection of site



Question

Is there any form of governmental regional planning the planning process, in which ecological aspects of site selection are being discussed ?

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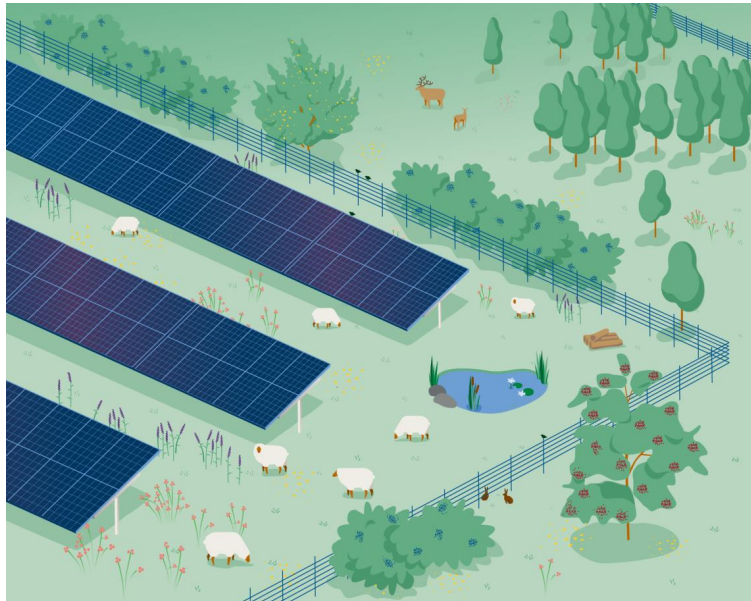
Selection of site



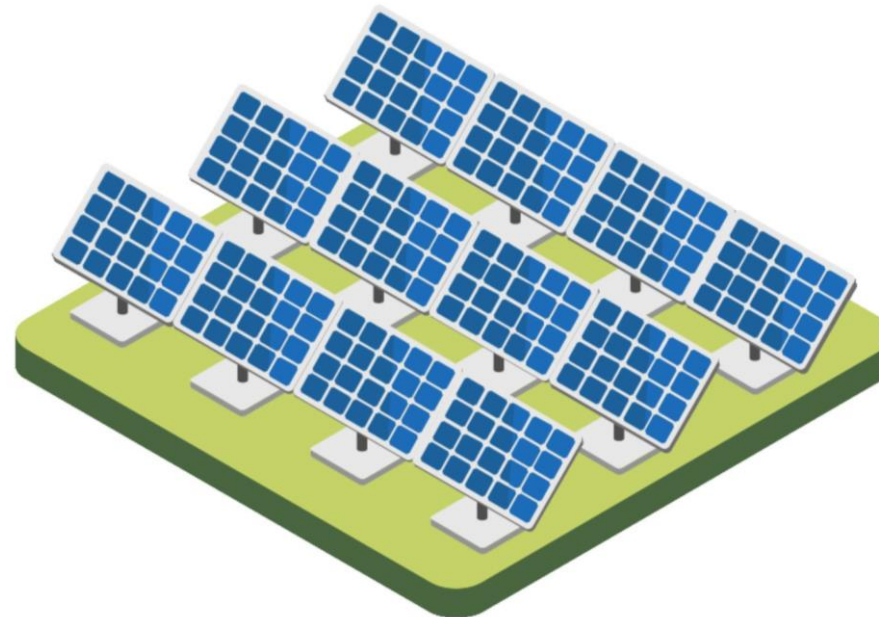
Selection of site> Design / Construction> Operation> End of Operation> Restoration

Comparison of Designs

Nature compatible Design

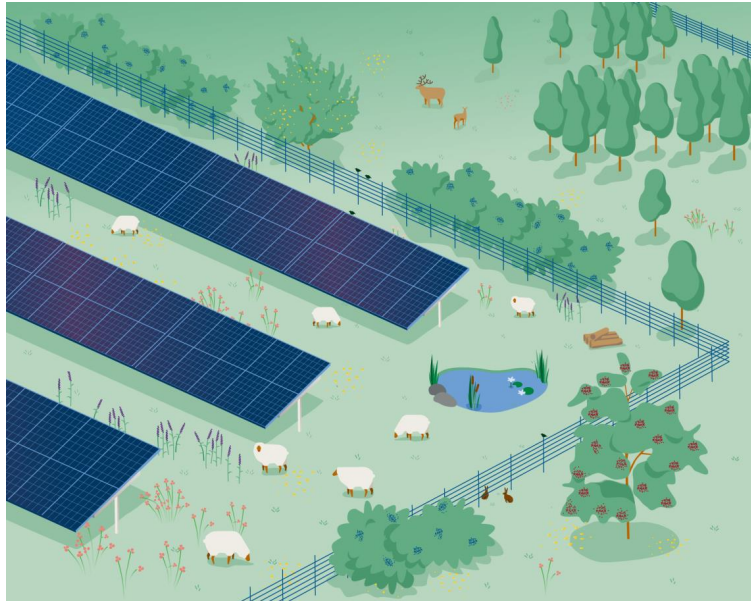


Design for maximum power output



Elements of an ecofriendly design

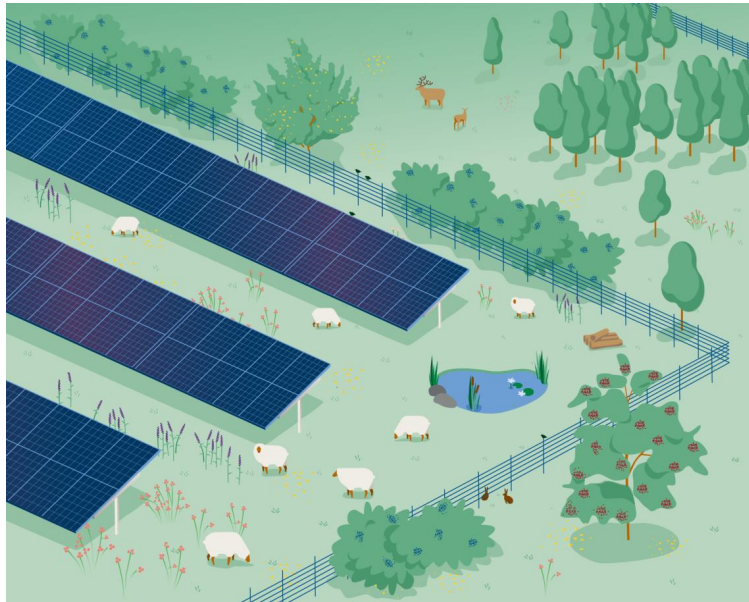
Nature compatible Design



1. Percentage of sealing
2. Covered part of the area
3. Prevention of erosion
4. Design of the fencing and permeability for wildlife
5. Habitat features
6. Height spacing of the solar panels
7. Seed mixture for native wildflower meadowland
8. Adapted grassland management

Elements of an ecofriendly design

Ecofriendly Design



1. **Percentage of sealing**
2. Covered part of the area
3. Prevention of erosion
4. Design of the fencing and permeability for wildlife
5. Habitat features
6. Height spacing of the solar panels
7. Seed mixture for native wildflower meadowland
8. Adapted grassland management

Elements of an ecofriendly design: Percentage of sealing



Choose stands and module types, that have the least effect of sealing.

Elements of an ecofriendly design: Covered part of the area

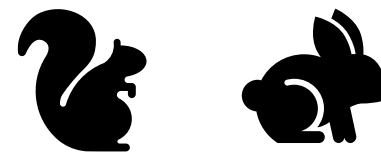
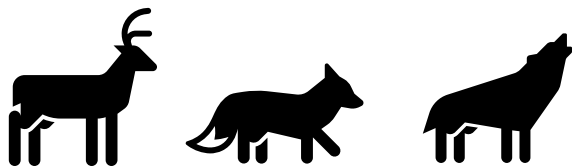


Make sure that there is enough uncovered area for the light and rain to reach the ground.

Elements of an ecofriendly design: Prevention of erosion



Elements of an ecofriendly design: fencing design and permeability for wildlife



Elements of an ecofriendly design: habitat features

Die Naturhecke

Ein komplexes Ökosystem

Bäume

Sitzplatz für Raubvögel

Insekten
(Bestäubung, Honig)

Brutstätten für Vögel

Büsche, Lianen
(Mantel)

Kleinsäuger als Beute

Kräuter,
Pilze
(Saum)

Unterschlupf für Wild
(Rehe, Hasen)

Naetiere (Waldmäuse, Feldmäuse) Lurche Mollusken (Schnecken) Reptilien (Nattern, Eidechsen) Zersetzende Bakterien Würmer, Larven Samen und kleine Früchte Schutz für Insektenfresser (Igel, Spitzmäuse)

Quelle: die hecke „Schweizer Naturschutz“ Sondernummer 1979

- If you are planning hedge chose a good mix of drought resistant species
- wild fruit provides food for birds, hedgehogs, etc.
- Make the hedge zone wide enough to achieve an ecological benefit.

Elements of an ecofriendly design: habitat features



Sitzwart / Sitting post



Insect hotel



Birdhouse

Elements of an ecofriendly design: habitat features



Ponds and trenches as aquatic elements



Deadwood- and stone piles

Question

What would be typical habitat features for the fauna and flora of your region ?

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Elements of an ecofriendly design: Height spacing of the solar panels



There are different construction methods for solar modules. These must be adapted to the plants under the solar panels.

Elements of an ecofriendly design: Height spacing of the solar panels

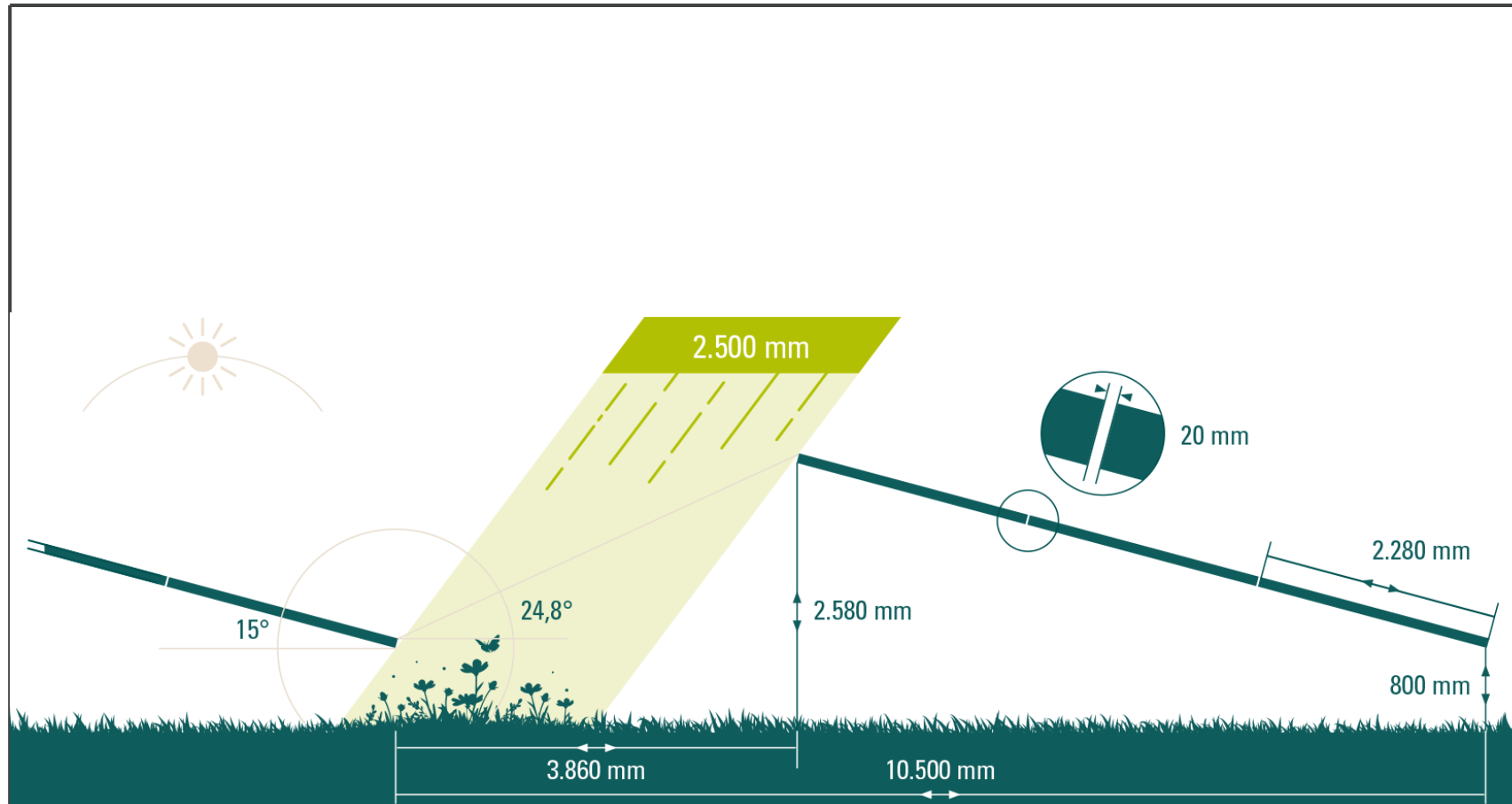


Elements of an ecofriendly design: Height spacing of the solar panels / Choice of seed mixture



- Consider what seeds might be left in the soil from former agriculture use.
- If grazing is part of the management plan, make sure your choice of plants is suitable food.
- Adapt the height of the planned vegetation to the height of the modules to prevent overgrowth.

Elements of an ecofriendly design: Seed mixture for native wildflower meadowland

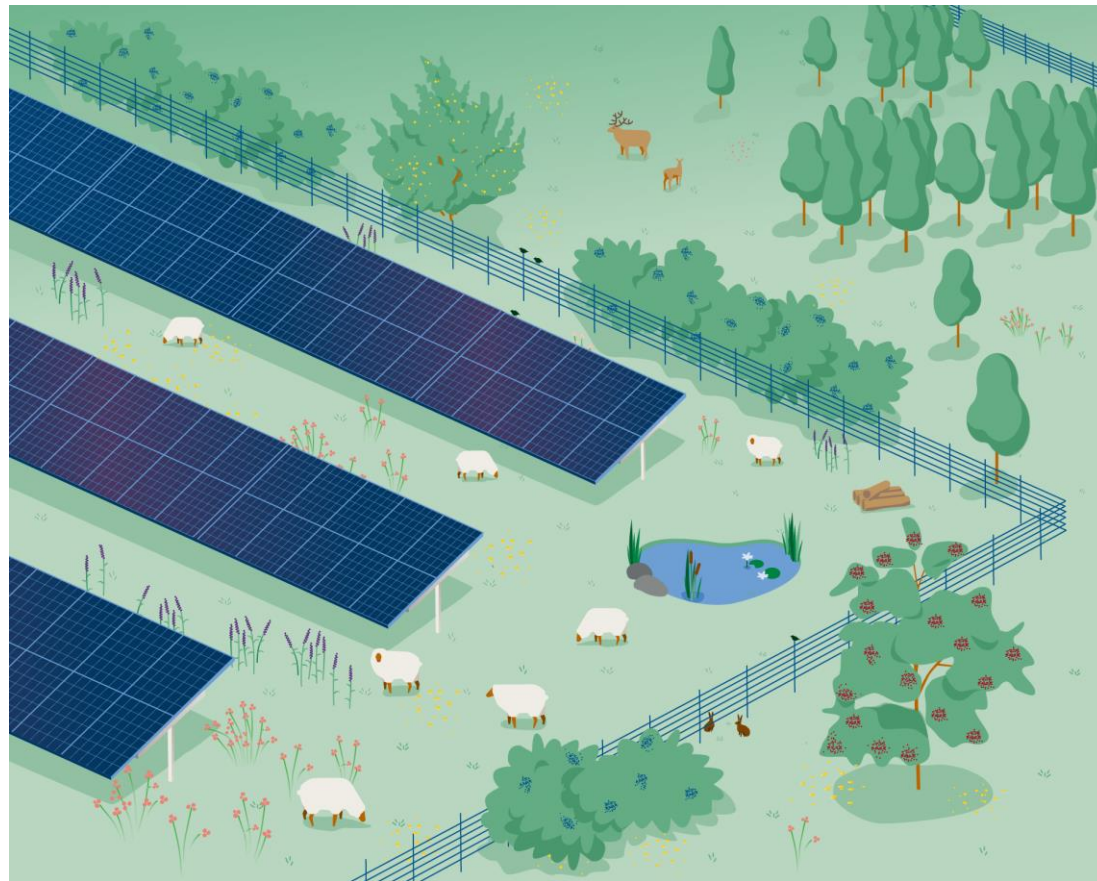


Elements of an ecofriendly design: Seed mixture for native wildflower meadowland



- Sufficient seeding rate.
- Local, native grass/sedge species that are fit for future climate conditions.
- 3 species in each bloom period: Early (April-May), Mid (June-August), and Late (August-October).
- Mix of different plant families, including legumes.

Elements of an ecofriendly design



1. Percentage of sealing
2. Covered part of the area
3. Prevention of erosion
4. Design of the fencing and permeability for wildlife
5. Habitat features
6. Height spacing of the solar panels
7. Seed mixture for native wildflower meadowland
8. Grassland management

Selection of site



Selection of site> Design / Construction> Operation> End of Operation> Restoration

Operation: Grassland Management



Operation: Cleaning of Solar Panels



- Water (and soap)
- With an electrode that pass over the panel, producing an electric field that imparts a charge to the dust particles as it goes.
- Technical tools and automatic cleaning robots for solar modules are on the market.

Selection of site



Selection of site> Design / Construction> Operation> End of Operation> Restoration

End of Operation

- The older a solar module, the lower its efficiency. The annual degradation depends on the product and varies between 0.3% and 1% per year.
- Most modules have a lifespan of 30-25 years, but become economically inefficient much earlier. The financial case for replacing panels after just a few years of use is strong.
- Currently: waste of approximately 250 thousand tons of solar panels per year.
- By 2050 78 million metric tons of solar panel waste (Source- [IRENA](#)) = ~9% of the global e-waste generated in 2050.)



End of Operation



Restoration

Conclusion

If a solar park is well planned and managed, it can provide a variety of ecosystem services:

- Power Output,
- Biodiversity and wildlife habitat provision,
- Carbon storage and climate regulation,
- Water retention and water cycle support,
- Soil erosion Mitigation and soil quality regulation,
- Air quality regulation,
- Food provision and support for sustainable agriculture.

Literature recommendation

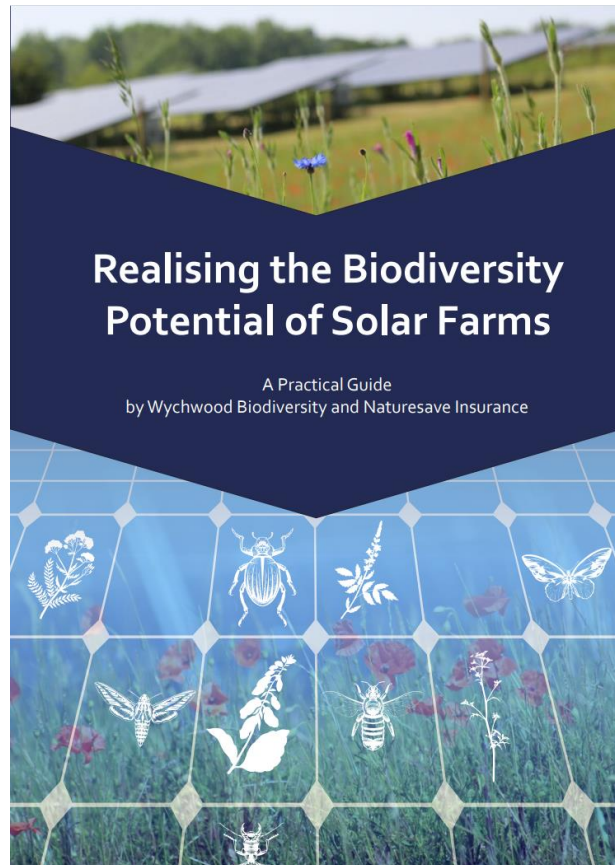


Well-prepared information and practical planning tools for solar parks in the UK

[NCBPG-Solar-Energy-UK-Report-web.pdf](https://solarenergyuk.org/NCBPG-Solar-Energy-UK-Report-web.pdf)
(solarenergyuk.org)



Literature recommendation



Practical Guide to boost Biodiversity on solar parks in the UK

[realising-the-biodiversity-potential-of-solar-farms.pdf \(buglife.org.uk\)](https://buglife.org.uk/realising-the-biodiversity-potential-of-solar-farms.pdf)




Thank you for your engagement in a nature compatible energy transition!



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