Solar Parks and their Influence on Biodiversity

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Agenda

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First Solar Overview

- Leading manufacturer of PV solar panels and provider of solar solutions
- Largest thin-film module manufacturer in the world
- Formed in 1999 and launched production in 2002
- Lowest cost PV manufacturer in the world
  - $0.75/watt in 2011 Q2 and $0.99/watt BoS in 2011 Q2
- World's largest pipeline of utility-scale projects
- Smallest carbon footprint and fastest energy payback time
- First PV manufacturer to offer prefunded module collection and recycling

Our Mission:

To create enduring value by enabling a world powered by clean, affordable solar electricity.

The Importance of Biodiversity

"The importance of biological diversity to human society is hard to overstate. (…) The effective use of biodiversity at all levels - genes, species and ecosystems - is therefore a precondition for sustainable development. (…)" (UNEP, 2010)

2010 International Year of Biodiversity

Biodiversity refers to the uncounted variety of living things on this planet

These living organisms play a fundamental role in providing breathable air, conserving soils and stabilizing climates.

(UNEP)

Biodiversity and Solar Parks

With the growth of the solar industry there is a need to:

1. Avoid and minimize impacts on biodiversity through responsible project development,

and the opportunity to

2. Improve biodiversity by changing the use of the land (e.g. agriculturally used or sealed land and conversion land involving decontamination)

In addition to producing clean energy, solar parks can contribute to the promotion of biodiversity.

Fast Facts on Solar Parks

- Part of a sustainable energy mix
  - Will continue to gain importance with further cost reductions
- Clean energy production
  - No emissions or water use
- Potential environmental benefits
  - e.g. Re-naturalisation
- Minimal land use footprint
  - 1 MW requires 2.5 to 3.5 ha[1] of land
  - If by 2015, 100GW installed in Europe (20% ground-mount) = 1/14 000 of the available area in the EU – a footprint which is far less significant than often presented in public discussions

[1]. European Photovoltaic Industry Association (EPIA), 2011

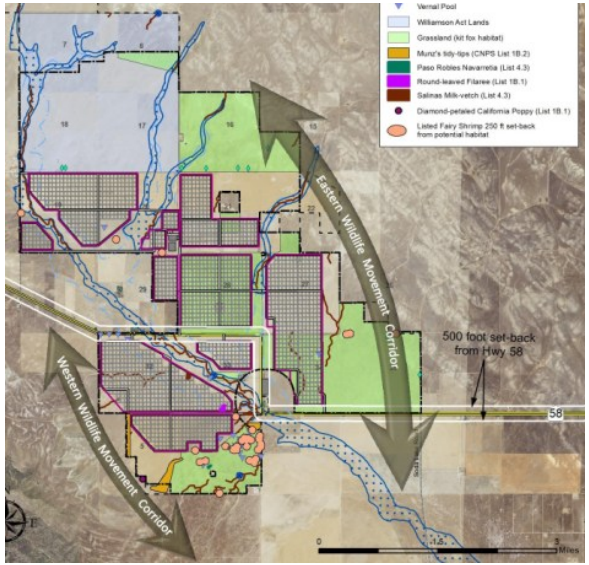
Best Practice Examples – Proposed Topaz Solar Farm

Proposed 550 MW solar PV project in San Luis Obispo County (US)

- Located on approx. 1.400 ha of optioned private land
- Provides clean affordable energy for 160,000 average California homes
- Displaces 377,000 metric tons of CO_2 emissions per year

<u>Site Selection and Layout Optimization:</u>

- Excellent solar resource
- Disturbed agricultural land with low productivity
  - Over 75% on low productivity disturbed cropland
- Avoids environmentally sensitive areas
- Enhances wildlife movement corridors (east & south)
- Close to transmission lines

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Survey effort on the site: over 13,847 hours
Cameras: 46,500 hours
Project Study Area: over 9,700 acres

Topaz: On-Site Land Stewardship

Project area existing conditions negatively impact habitat

- Farming in Project Area has substantially reduced grasslands
- Tilling of soil impacts dens and Kit Fox pups

On-site biological enhancements include:

- Kit Fox permeable fence and inclusion of artificial kit fox dens and escape tunnels
- Maintenance and restoration of grassland habitat
- Discontinuation of rodenticides
- Pre- and post-construction monitoring

Best Practice – Lieberose Solar Park 2009

- 53MW project in the district of Spree-Neisse in Brandenburg
  - One of the largest solar parks in the world using 700.000 thin-film modules
  - Sited on 162 ha of land that is part of a former military training ground
  - Displaces 35.000 metric tons of CO_2 emissions per year, the equivalent of providing clean affordable energy to 15.000 local homes

- Produces clean and affordable energy for more than 20 years
- Biodiversity enhanced through removal of dangerous munitions from the ground

Lieberose Site Selection

- Successful combination of climate protection, high technology and active environmental conservation
- Renaturalisation of former military land
  - Multiple tons of land mines, grenades and other munitions waste was removed
- Once the site has reached the end of its power generating life (20 years of more), First Solar will collect and recycle the modules at no charge to the project owner

Influence of a Solar Park on Bird Species Diversity

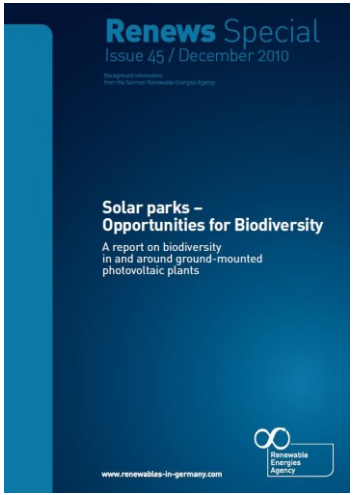
Survey of breeding birds – a comparison between 2007 & 2010

- Monitoring Avifauna PEZ Nord

German Name	2007	2010
Flussregenpfeifer	0	1
Turteltaube	1	1
Ziegenmelker	3	5
Wiedehopf	2	
Neuntöter	0	2
Raubwürger	1	
Heidelerche	7	13
Braunkehlchen	0	0
Steinschmätzer	0	4
Brachpieper	1	5

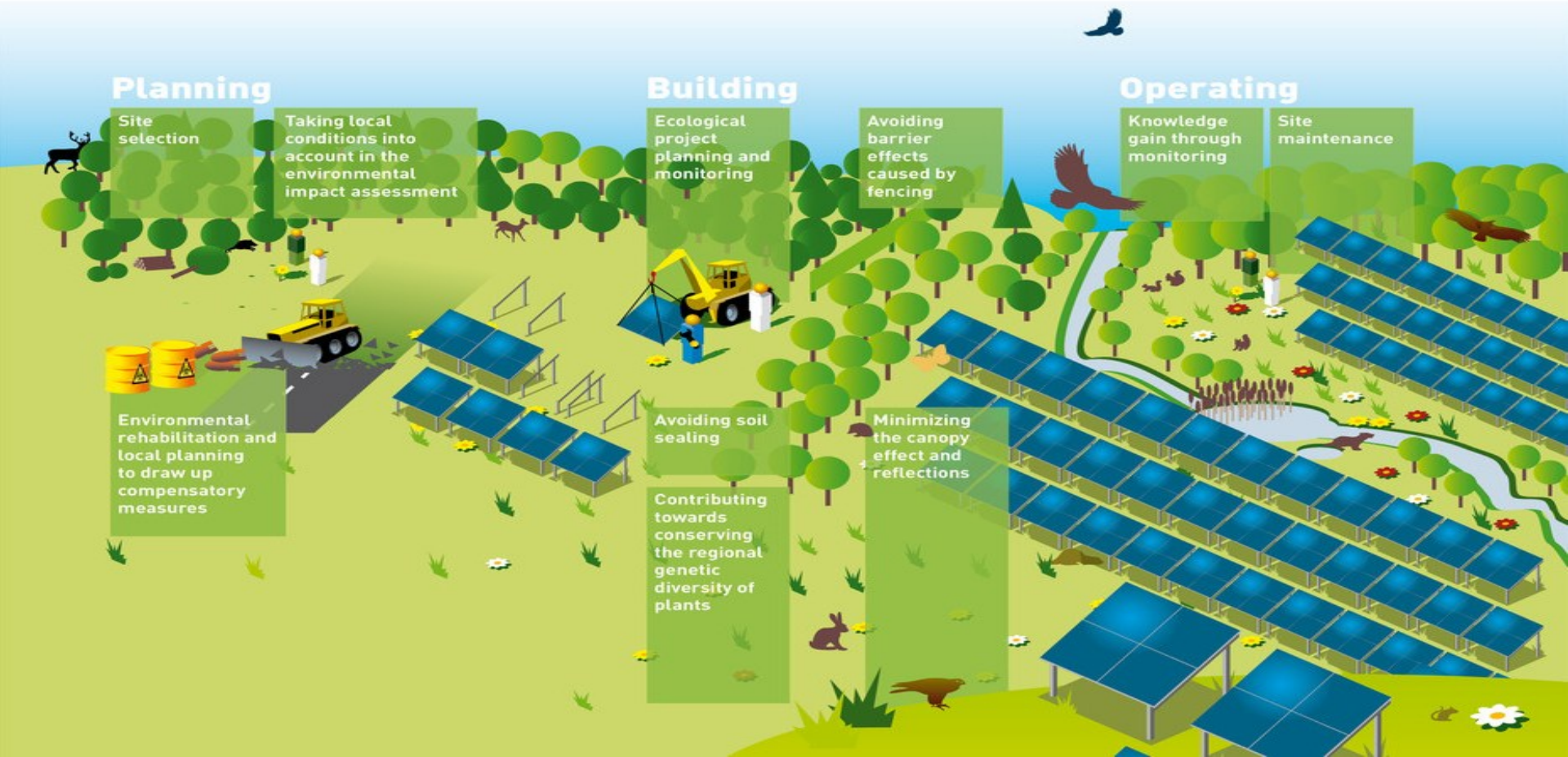
Bosch & Partner (2010): PV-Freiflächenanlagen in Deutschland: Impulse des EEG und Herausforderungen an die Planung

Study Shows Potentially Positive Biodiversity Impacts



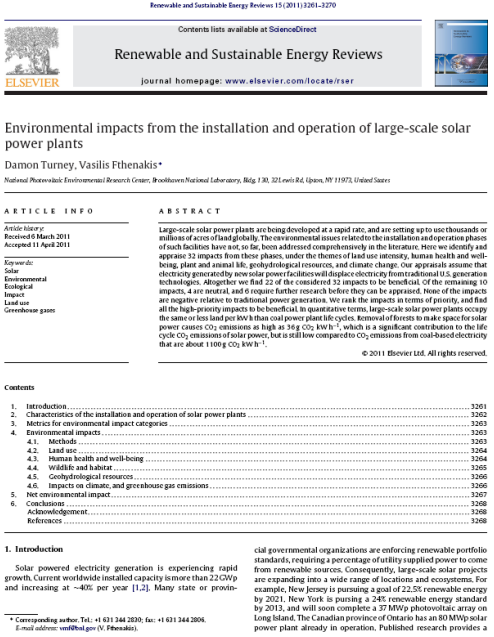
- **Renews Special Issue 45 'Solar Parks – Opportunities for Biodiversity'**
  - Project initiated by First Solar in collaboration with the Renewable Energies Agency, project developers, environmentalists and other experts
  - Documents current knowledge on the subject of solar parks and biodiversity
  - Analyzes the impacts of solar parks on biological diversity
  - Assesses measures designed to conserve or promote biodiversity
- Concludes:
  - *"As well as making an important contribution to future energy supplies, solar parks can also provide a refuge for plants and animals."*
  - *"the existing results show that solar parks can have a positive impact on biological diversity. Although construction projects always involve disturbance of existing flora and fauna, with solar parks there is a chance to improve the quality of habitats for various plant and animal species and even to create new habitats"*

Solar parks – Best practice recommendations:
Nature conservation measures



Solar Parks Compare Well Environmentally to Conventional Energy Creation

- Fthenakis and Turney (2011) state:
  - *"Solar technology is concluded to be much preferable to traditional means of power generation, even considering wildlife and land use impacts. [They] identified 32 environmental impacts for solar power plants, and found that 22 are beneficial relative to traditional power generation, 4 are neutral, none are detrimental, and 6 need further research."*
  - *"….large-scale solar power plants occupy the same or less land per kWh than coal power plant life cycles."*



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Environmental impacts from the installation and operation of large-scale solar power plants

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ABSTRACT

Large-scale solar power plants are being developed at a rapid rate, and are setting up to use thousands or millions of acres of land globally. The environmental issues related to the installation and operation phases of such facilities have not, so far, been addressed comprehensively in the literature. Here we identify and appraise 32 impacts from these phases, under the themes of land use intensity, human health and well-being, plant and animal life, geohydrological resources, and climate change. Our appraisals assume that electricity generated by new solar power facilities will displace electricity from traditional U.S. generation technologies. Altogether we find 22 of the considered 32 impacts to be beneficial. Of the remaining 10 impacts, 4 are neutral, and 6 require further research before they can be appraised. None of the impacts are negative relative to traditional power generation. We rank the impacts in terms of priority, and find all the high-priority impacts to be beneficial. In quantitative terms, large-scale solar power plants occupy the same or less land per kW h than coal power plant life cycles. Removal of forests to make space for solar power causes CO_2 emissions as high as 36 g CO_2 kW h^{-1}, which is a significant contribution to the life cycle CO_2 emissions of solar power, but is still low compared to CO_2 emissions from coal-based electricity that are about 1100 g CO_2 kW h^{-1}.

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1. Introduction

Solar powered electricity generation is experiencing rapid growth. Current worldwide installed capacity is more than 22 GWp and increasing at ~40% per year [1,2]. Many state or provincial governmental organizations are enforcing renewable portfolio standards, requiring a percentage of utility supplied power to come from renewable sources. Consequently, large-scale solar projects are expanding into a wide range of locations and ecosystems. For example, New Jersey is pursuing a goal of 22.5% renewable energy by 2021, New York is pursing a 24% renewable energy standard by 2013, and will soon complete a 37 MWp photovoltaic array on Long Island. The Canadian province of Ontario has an 80 MWp solar power plant already in operation. Published research provides a

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Fthenakis, V., and Turney, D., Environmental Impacts from the Installation and Operation of Large-scale Solar Power Plants', Renewable and Sustainable Energy Reviews, 15 (2011), 3261-3270.

Discussion

- Solar parks are key to ensure growth of PV in coming years
  - It is important to raise and agree on this among all stakeholders
- Land use for solar power plants needs to be done in a responsible and accepted way
  - Local communities should be empowered to identify suitable land that promotes climate and nature protection, in line with legal requirements and in cooperation with local stakeholders
  - Similar to the wind industry, guidelines could help to foster case by case decisions
  - Identify opportunities for biodiversity and avoid missing these due to automatic exclusion (e.g. from Natura 2000 areas in Germany)
- PV industry, nature protection organizations and political decision-makers should enter a dialogue about ecologically responsible solar power plants
  - Anticipate potential conflicts, propose solutions and help to raise acceptance for the further expansion of PV as energy source
  - → Development of guidelines or criteria for responsible solar power plant management should be considered
- Additional third party studies on the impacts/benefits will help to further understand processes and identify best practices in solar park development

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