



Agri-PV: merging solar power with agriculture

The importance of renewable energy is increasing significantly worldwide. Clear proof of this is the boom in the photovoltaic industry, which has become one of the central pillars of the global energy mix. Agri-PV, the combination of agricultural activities with solar parks, is considered an extremely promising concept in the field of renewable energies, offering the ideal combination of large-scale solar plants and modern agriculture.

In recent years, the photovoltaic industry has emerged as one of the most important sources of renewable energy, providing electricity through solar power. With 56 GW installed in the EU in 2023, this was the most successful solar year in the EU's history, bringing its total solar capacity to 263 GW.

Solar power as an alternative energy source is mainly generated by photovoltaic systems in large solar parks and on the roofs or facades of private homes and commercial buildings, and therefore offers plenty of potential.

Electricity from photovoltaic systems is not only one of the cheapest forms of green energy, but also offers many other advantages. PV systems are durable and low maintenance. Their operation is not only cost-effective, but above all clean and environmentally friendly, as there are no emissions, waste, or noise.

The perfect synergy: ground-mounted solar parks and agriculture

Ground-mounted solar power plants make a valuable contribution to the security of energy supply. They also provide a cost-effective renewable electricity source, with high regional added value. For example, they

can directly interconnect with wind power plants using shared grid infrastructure. This helps reduce the need for grid expansion, provides important system services, and distributes electricity in line with demand. At the same time, the construction can be in harmony with nature conservation and biodiversity.

Nevertheless, the solar industry is facing several challenges. In addition to regulatory requirements, land use, agriculture, and sustainability aspects such as biodiversity are particularly important issues that need to be overcome with smart, forward-looking planning.

Agri-PV is a highly promising concept in renewable energy because it integrates the advantages of solar power generation with existing agricultural land resources, fostering valuable synergies. These innovative solar parks, spanning several hectares, play a crucial role in the energy transition.

By strategically placing photovoltaic modules to harness sunlight for energy generation, the land serves a dual purpose, allowing for both solar panel efficiency and agricultural cultivation. This approach exemplifies an efficient and sustainable utilization of land for power generation, contributing



significantly to the broader goals of renewable energy initiatives.

Sustainable land use with Agri-PV

The agricultural sector naturally takes up the largest share of land in Europe. It is therefore also the sector most affected by increasing land use conflicts. Land take has been largely driven by the expansion of cities and industrial areas, mainly at the expense of fertile land.

According to reports, between 2012 and 2018, an area of 539 km² was taken up each year. This is equivalent to the size of 75,000 soccer fields. European policy is aware of the challenge and aims to achieve a situation of zero net land take by 2050. This means that agricultural land and open spaces should not be sealed. If this is the case, recultivation is required.

Some countries already have more specific targets, such as Germany, where land consumption is to be reduced to 30 hectares/day by 2030. Further progress can already be achieved through innovative and efficient solutions that avoid land use conflicts.

Agri-PV offers an integrated solution, bridging agriculture and energy markets and promoting efficient land use. By harmonizing sun harvesting and agricultural optimization, farms can transform into sustainable Agri-PV parks, providing resilience against climate change. The system, when coupled with special crops, acts as a protective shield against adverse weather conditions while generating solar power.

Agri-PV prioritizes the long-term sustainability of agriculture. Integrating PV modules, flower strips, and crops, it

contributes to environmental, economic, and community benefits. These systems aim to preserve biodiversity, restore natural cycles, and reduce CO₂ emissions.

This approach combines various sustainable concepts, creating species-appropriate conditions for flora and fauna within the PV rows. PV modules on agricultural land ensure CO₂-neutral operations and reduce the need

for irrigation and pesticides. Acting as roofing, they enhance controllable conditions, leading to increased crop yields. Surplus renewable electricity generated can be supplied to residents.

Given the substantial land occupied by agriculture and animal husbandry, stable conditions are crucial for crop success. Agri-PV's dual function of solar modules minimizes land use conflicts, allowing farmers to expand renewable energy production. This not only optimizes electricity consumption but also enhances conditions for plants and animals, providing farmers with additional income sources.

Agri-PV systems support modern agriculture

The energy sector is transitioning from finite fossil resources to renewable energies, a crucial step in reducing greenhouse gas emissions. Despite progress, significant expansion is needed to achieve climate neutrality by 2050, emphasizing the importance of solutions that don't compete with agricultural land. Agri-PV, as a cross-sector and innovative solution, addresses these societal challenges. The application also helps to save water by improving the microclimate and integrating more efficient irrigation systems.

In addition, the electrification of agriculture, automation and digitalization can be driven forward effectively in combination with Agri-PV.





Recent years have seen farmers grappling with challenges like drought, heavy rainfall, hail, and severe frost, resulting in yield losses. Traditional protective measures, such as foil tunnels or hail protection nets, involve periodic material consumption. Agri-PV, in tandem with sustainable agriculture, emerges as a promising solution to conserve resources.

GOLDBECK SOLAR plays a pivotal role in driving the shift towards sustainable multi-purpose PV solutions. Collaborating with esteemed research institutes like Fraunhofer ITWN, the company continuously improves products and develops analysis systems.

The installation of PV modules, whether close to the ground or elevated, involves customized solutions. Dynamic tracker systems in Agri-PV applications are highlighted for their flexibility and potential combinations, optimizing sunlight for optimal power generation. GOLDBECK SOLAR's experts provide comprehensive support throughout the project, from development and engineering to

procurement and implementation, ensuring efficient use of space between rows of PV modules.

Harvesting sun and supporting agriculture

The advantages of Agri-PV in modern agriculture are obvious: existing land is used efficiently for both agricultural cultivation and the generation of green electricity. In this way, the conflict between energy and food production can be avoided. It can be used for arable crops, vegetable crops and permanent crops such as orchards and vineyards.

The electricity generated benefits farmers, as they not only have the opportunity to convert their own electricity consumption to renewable energies, but also to improve the conditions for their arable farming. This enables them to adapt to climate change and extreme weather conditions, for example, by creating a more stable micro-climate or integrating irrigation systems.

In addition, shading can protect crops from excessive sunlight and thus prevent sunburns on the plants. This concept enables farmers

to adapt to climate change in an economical way, strengthen their resilience and reduce the risk of weather-related losses in crop yield or quality.

GOLDBECK SOLAR handles the complete system planning, material procurement and implementation. There is also no additional work in day-to-day operations, as operation and maintenance of the PV system can be carried out on request. All necessary and useful data such as temperature, wind speed, precipitation etc. can be viewed around the clock. Farmers are assisted in finding an individual, self-supporting solution to transform their business into a sustainable solar farm.

In addition to optimizing their own agricultural conditions for livestock and crops and for generating the electricity they consume themselves, Agri-PV offers other key benefits: the alleviation of the land use conflict that repeatedly arises with solar parks, as well as an additional source of income by feeding surplus solar power into the grid.

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