SolarEdge dual use solar grazing installation, Japan

How smart solar energy can fuel the next revolution in Ag-Tech

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The agriculture industry is at the cusp of a major shift. Climate change impacts, rising energy costs, shifting government subsidies, increasing demand for food, and international conflicts are reshaping global market dynamics more than ever before. As farmers, governments, and other stakeholders plan for these disruptions, new agribusiness models can, and should, include agrisolar as an opportunity to significantly reduce energy costs and meet clean energy targets.

The convergence between the agriculture and solar industries makes perfect sense. The respective industries can benefit each other in several ways, without being detrimental to land productivity or solar production.

Agriculture was one of the earliest industries to adopt solar energy. Today, many farmers have PV systems on rooftops of barns, sheds, or other farm structures that can be used to generate free power for driving irrigation pumps and other critical systems or for selling to the local utility.

But agrisolar can also be used for so much more. Agri-PV solutions, where both a PV installation and agricultural activities coexist on the same piece of land, are increasingly seen as a viable solution for sustainable land use.

Dual-use farming: a win-win solution

With about 14 GW of global capacity installed as of 2021[1], agrivoltaics is the means to drastically reduce electricity bills with clean, renewable energy while boosting crop yields and balancing competing land interests.

Dual-use farming occurs when elevated PV systems are installed on farmland where crops are cultivated. This method, also referred to as co-locating, can yield impressive results when done correctly and using the right technology. With dual-use farming, solar modules produce electricity, while providing optimal sunshine and shade for the crops underneath, reducing heat stress and water loss.

According to one recent study on a Kenyan farm, crops such as cabbage, lettuce, and eggplant grew up to a third larger than those farmed in the open, while the farm's energy costs were halved. In addition, elevated solar modules reduced the water loss from plants and soil while the shade provided was able to mitigate UV damage to the crops.[2]

Another major study by the Fraunhofer Institute for Solar Energy in Germany looked at a raspberry farm in the Netherlands, whereby three hectares of the four-hectare farm were converted into a 2MW agrivoltaic system with raspberries being grown underneath. After testing different types of solar modules, they could produce raspberries of the same quality or better. Another benefit was that the fruit grown under the PV modules did not sustain any damage from summer storms or hail, unlike the fruit that was grown in the open field or under traditional plastic crop covers. [3]

Several similar studies from around the globe show that agri-PV can improve the yields of shade-tolerant crops or high-value crops, including berries, soft fruits, asparagus, hops, and more, all while providing shade for workers and producing clean energy.

One of the major challenges to successful agri-PV lies in planning the solar and agriculture projects. For the two ecosystems to work in tandem, smart, responsive PV technologies must be leveraged in order to maximize both solar energy harvesting and crop yields. That is why equipment selection is critical. As crops have individual Light Compensation Points, also known as LSPs, and are extremely susceptible to weather, agri-PV installations should include specialized systems to support cultivation.

Elevated solar modules can reduce the impact of hail, wind, and heavy rain while producing shade to protect crops from overexposure to the sun and keeping the soil moist. In this case, it is critical to use the correct type of solar module so as not to overexpose or underexpose the crops growing underneath. However, changing the structures of the modules, or using modules which allow more light to shine through, may diminish energy production.

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For optimal results, maximizing both the crop harvest and the solar energy yield is best achieved by installing a Module Level Power Electronics (MLPE) based PV system. This is because MLPE technology, such as Power Optimizers, enables each module to produce at its maximum energy level independently, regardless of module orientation or shade / dirt exposure.

A SolarEdge system with Power Optimizers paired with SolarGik solar trackers can further help maximize both the harvest and energy yield. SolarEdge Power Optimizers ensure that each module delivers the maximum amount of solar power possible. At the same time, the SolarGik trackers use Artificial Intelligence (AI) to understand solar and agricultural seasonal patterns to tilt the modules as the sun moves in various directions throughout the day to boost power production.

Together, these key technologies allow for the optimization of both solar energy and crop growth, reducing Levelised Cost of Electricity (LCOE) and maximizing the Return on Investment (ROI) for the PV system owner while facilitating optimal conditions for agricultural cultivation.

In other cases, vertically mounted bifacial modules that can produce solar PV from both sides can be used to allow for more arable land. Here too, using MLPE, such as Power Optimizers, more power can be harvested from the installation. They can also help mitigate power losses caused by module mismatch, which is not uncommon in bifacial modules, due to reduced surface albedo and irradiance differences on the rear side together with increased levels of dirt or shade due to the ground proximity.

Solar grazing: Let the livestock do the work

Agri-PV also offers another major benefit to farmers: new land for grazing herds. Ground-mounted PV systems often require

1 https://www.ise.fraunhofer.de/en/key-topics/integrated-photovoltaics/agrivoltaics.html

2 https://www.theguardian.com/global-development/2022/feb/22/kenya-to-use-solar-panels-to-boost-crops-by-harvesting-the-sun-twice

3 https://www.youtube.com/watch?v=sT7PqUDGqmw

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mowing contracts to keep the weeds and grass from overgrowing and reducing the module efficiency. When vegetation grows too thick underneath the modules, livestock can be used to graze.

This model, when appropriately managed, provides another win-win for both parties involved, as the herds benefit from access to feed, extra shade from the modules, and additional safety from predators due to secure fencing. In turn, the PV system owners and EPCs benefit from grazed pastures, reduced O&M costs from mowing, additional monitoring from on-site farmers, and strengthened relationships with local communities.

Pollinator-friendly solar farms: what's all the buzz about?

Some studies show that solar farms can have many benefits for bee and butterfly farmers, when designed with pollinator-supporting plants such as prairie-clover or other wildflowers. The most significant threat to pollinators are climate change and habitat loss, due to human conversion of grasslands for other land use.

About 25% of native bee populations in the US are at risk of extinction, while monarch butterfly populations have declined about 68% over the past two decades.[4] This is leading some ground-mount PV installation owners to introduce pollinator-supporting plants that are critical to our ecosystem, planning in conjunction with local beekeepers and conservation specialists to develop habitats that research and support bee or butterfly species over long periods of time.

It starts with knowing what to pick

Selecting the right PV system components is critical to the success of any agrivoltaic project. SolarEdge's smart C&I solutions are ideal for agriculture as the Power Optimizers maximize renewable energy generation while the SolarGik solar trackers can improve crop yields. Having a smart PV system that can provide a combination of added benefits like module-level monitoring, remote troubleshooting, and enhanced safety features is key to maximizing power generation, increasing the lifetime revenue of the system, and improving ROI.

When agri-PV projects are planned in cooperation with local farmers, the solar and agriculture industries can work together to make significant progress towards both transforming food supplies and accelerating the transition to clean energy. At first glance, cooperation between the two industries may seem complex but new smart PV innovations can tackle today's challenges and ultimately create a brighter future for our planet.

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4 https://www.youtube.com/watch?v=sT7PqUDGqmw
https://www.scientificamerican.com/article/solar-farms-shine-a-ray-of-hope-on-bees-and-butterflies/