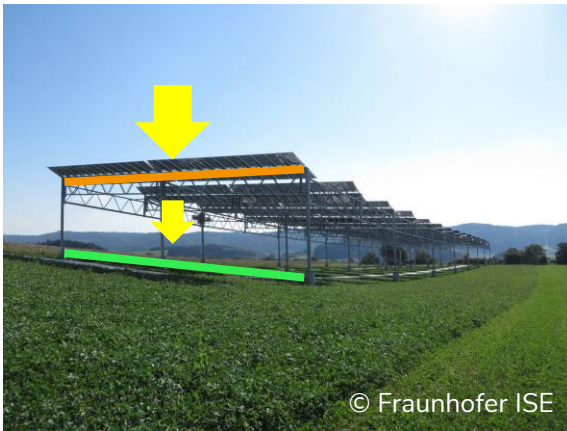


Vertical bifacial Agri-PV Innovative Solution for India



Next 2 Sun

Different types of Agrivoltaics known so far



High elevated



Double land use
on two levels



Vertikale bifacial



Double land use
In different dimensions

(PV: vertical ⇔ Agriculture: horizontal)



Other ground mounted concept



Land use side by side

SYNERGY

Chances from vertical bifacial Agri-PV



Dual land use works!

- ✓ PV Installation covers less than 1% of the plant
 - Unchanged water supply
 - Only small change in solar radiation (10-15% of annual energy)
- ✓ App. 90% of the land can be cultivated with conventional agricultural machinery
- ✓ Positive impact on vegetation and crop yield possible

Hay harvest in Europe's largest Agri PV plant in Donaueschingen, Germany



Pea harvest in Donaueschingen, Germany



Harvest of winter and spring wheat in France



Source: Totalenergies, sas de Bel-Air, Jean-Philipp Delacre, Channay

Harvest of lentils in France



Source: Totalenergies, sas de Bel-Air, Jean-Philipp Delacre, Channay

Potato cultivation in Guntramsdorf, Austria



Source: Wien Energie/Christian Hofer

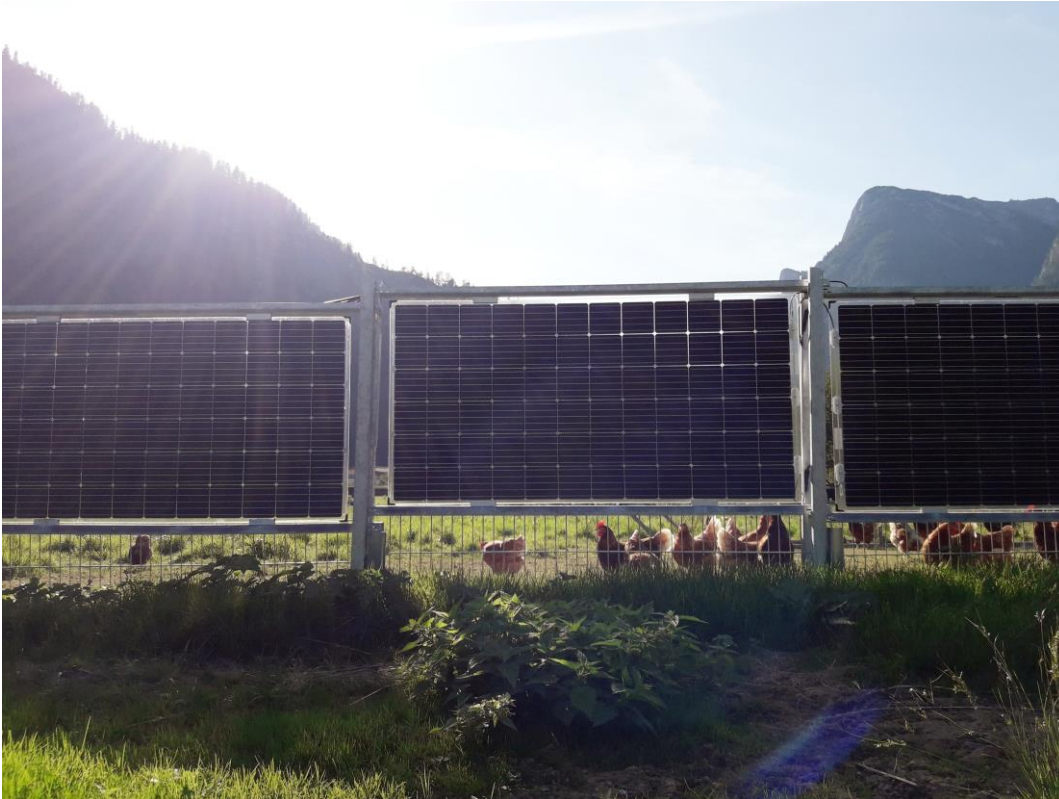
Arable farming in Nihonmatsu, Japan



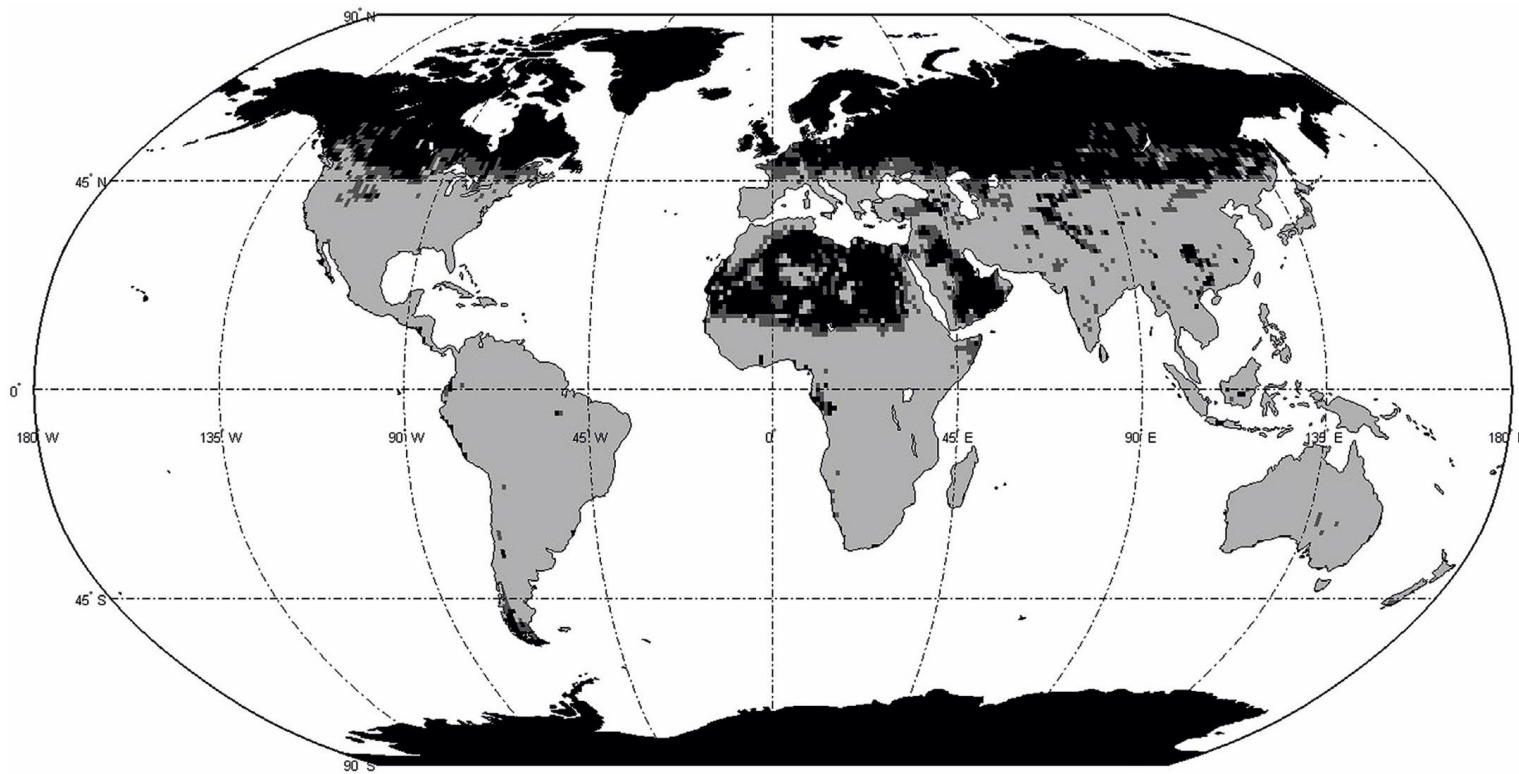
Bifacial solar fence for cows in Ireland



Bifacial solar fence for chicken enclosure in Austria



Vertical bifacial Next2Sun-Systems with additional energy production in many regions



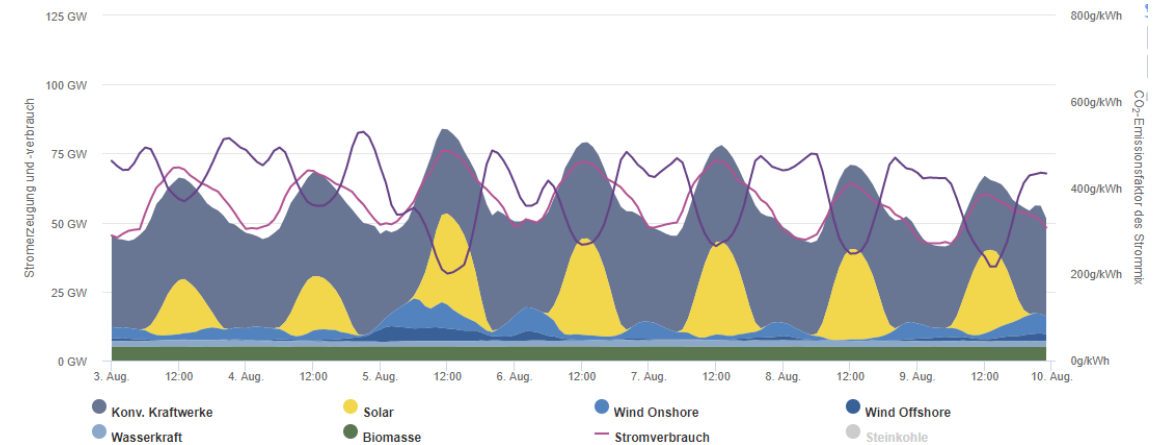
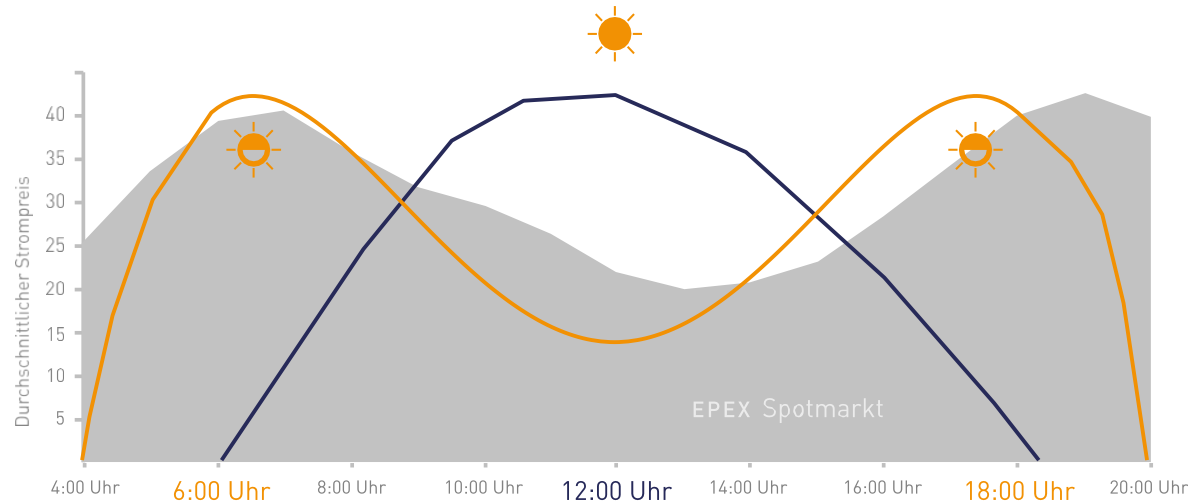
Global map that representing which kind of module configuration results in better performance in a certain place.
Black: vertical bifacial
Light grey: conventional monofacial

From:

Guo S, Walsh TM, Peters M.
“Vertically mounted bifacial photovoltaic modules: a global analysis.”, in: Energy 2013;61:447–54.

<https://doi.org/10.1016/j.energy.2013.08.040>

Vertical bifacial Next2Sun systems produce electricity when needed



PV systems with east-west orientation consistently thought to the end:

- The modules surfaces are aligned **vertically** to the east and west
- By using **bifacial** (light-sensitive) solar modules on both sides, both sides can generate power with a single solar module

→ Electricity production primarily in the morning and evening hours!



Additional ecological upgrading of the areas

- Due to the vertical construction, no floor surfaces are overbuilt
 - Unchanged water supply
 - Only small change in solar radiation (10-15% of annual energy)
 - Low impact on vegetation development
- The module series result in strip-shaped structures with many design options:
 - Grass/ flower strips
 - Stones, wood
 - Floor design



Further benefits from vertical bifacial Next2Sun-Systems



- higher self-consumption potential for self-generation systems
- beneficial effect on the power grid
- Advantage of direct generation at off-peak times compared to electricity storage
- generation benefits in particular
 - in higher latitudes
 - with stronger ground reflection (albedo)
 - at low temperatures
- less cleaning required due to vertical position
 - ➔ **Win-win-win case snowy regions:**
 - Low temperature
 - high albedo
 - Plants not covered by snow
- Benefits based on: Sami Jouttijarvi, Gabriele Lobaccaro, Aleksi Kamppinen, Kati Miettunen: "Benefits of bifacial solar cells combined with low voltage power grids at high latitudes", in: Renewable and Sustainable Energy Reviews Volume 161, June 2022, <https://doi.org/10.1016/j.rser.2022.112354>

Chances from vertical bifacial Agri-PV at a glance

- Agri-PV can avoid „food-or-fuel“-dilemma, the overall production (energy & crops) can be much higher than on a stand alone basis
- Agri-PV can stabilize the electricity yield from PV
- Agri-PV can increase acceptance of renewable energy



Challenges: Regulatory needs to avoid abuse

- The installed capacity per ha is necessarily much lower than in a pure PV environment
- Due to higher economic valuation of energy production compared to crop growth a strong incentive to substitute agriculture against PV

**High risk of „pseudo-Agri-PV“:
conventional PV „greenwashed“ as Agri-PV**



Regulatory needs of Agri-PV

- Agricultural subsidies:
 - It need to be assured, that agriculture in Agri-PV-plants (and only Agri-PV-plants) are on par with Agriculture elsewhere and get the same subsidies (EU area payment)
- Building laws:
 - It need to be assured, that (only) Agri-PV is allowed to be realized on agricultural land
- Feed-in tariffs:
 - Feed-in tariffs for Agri-PV need to be granted also on agricultural land (and only for AgriPV)
 - It might be an option to give special feed in tariffs and/or special subsidies for Agri-PV



All these rules need to be based on a simple and abuse-proof definition of Agri-PV

Possible definition of Agri-PV:

IMPORTANT: Definition need to be clear, ex ante objectively verifiable and open to all types of technologies!

>> Agrivoltaic systems (Agri-PV) are photovoltaic systems whose base area remains usable for agricultural cultivation without significant restrictions. 90 % of the base area may not be built over up to a height of 4 meters; plant growth may not be impaired in this area, or only to an insignificant extent. For plants with adjustable components, the maximum horizontal extension of the plant is to be used when determining the quota.>>



Thank you for your attention!



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