

Bifacial Agri-PV

technology, chances and challenges

C.Klyk

Bifi Workshop 01.04.2022 Konstanz



Contents



Installations Worldwide

Potential

Chances

Challenges

Technologies

- 3500 Agri-PV-System Worldwide
- 3 GWp installed capacity

- 1 GWp Agri-PV-System on Desert
- 1.8GWp installed

- Research Agri-PV-System with focus on resilience of plants

ms with

- New regulatory since end 2021

Technical Potential Germany

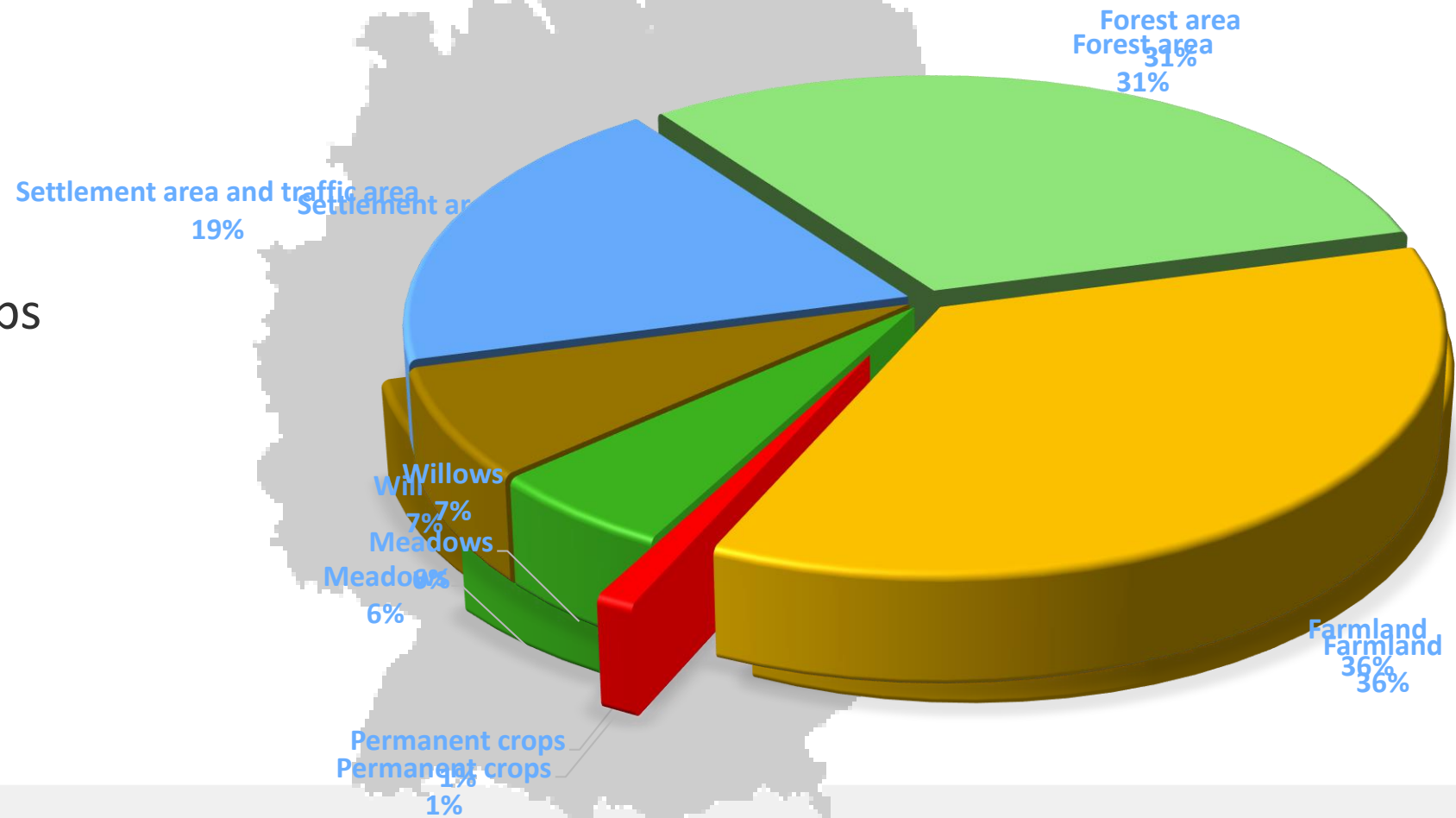
Potential

Chances

Challenges

Technologies

- 1700 GWp in Germany
- 81 GWp on Permanent Crops



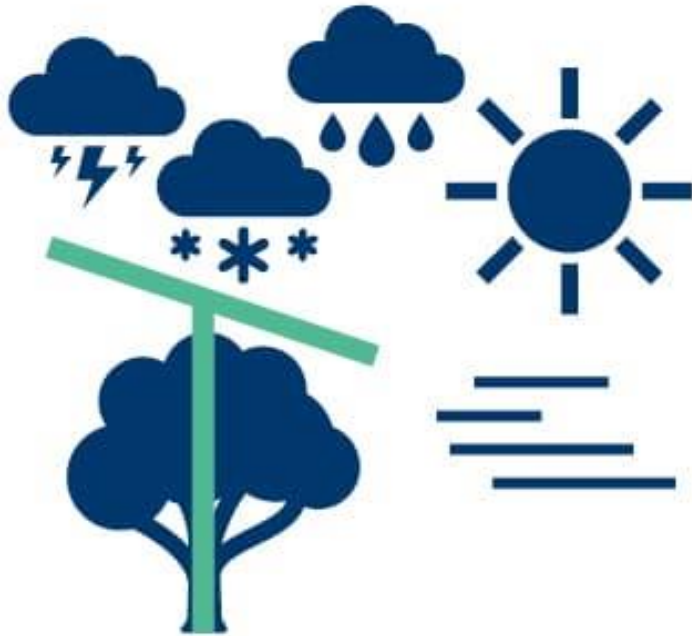
Advantages for agriculture

Potentials

Opportunities

Challenges

Technologies



<https://goldbecksolar.com/en/solaranlagen/agri-pv/>

- Protection from bad weather
- Impact on waterbalance
- Diversification of revenue sources
- Protection from erosion
- Increased land use efficiency
- Increases in Quality

Advantages for Society

Potentials

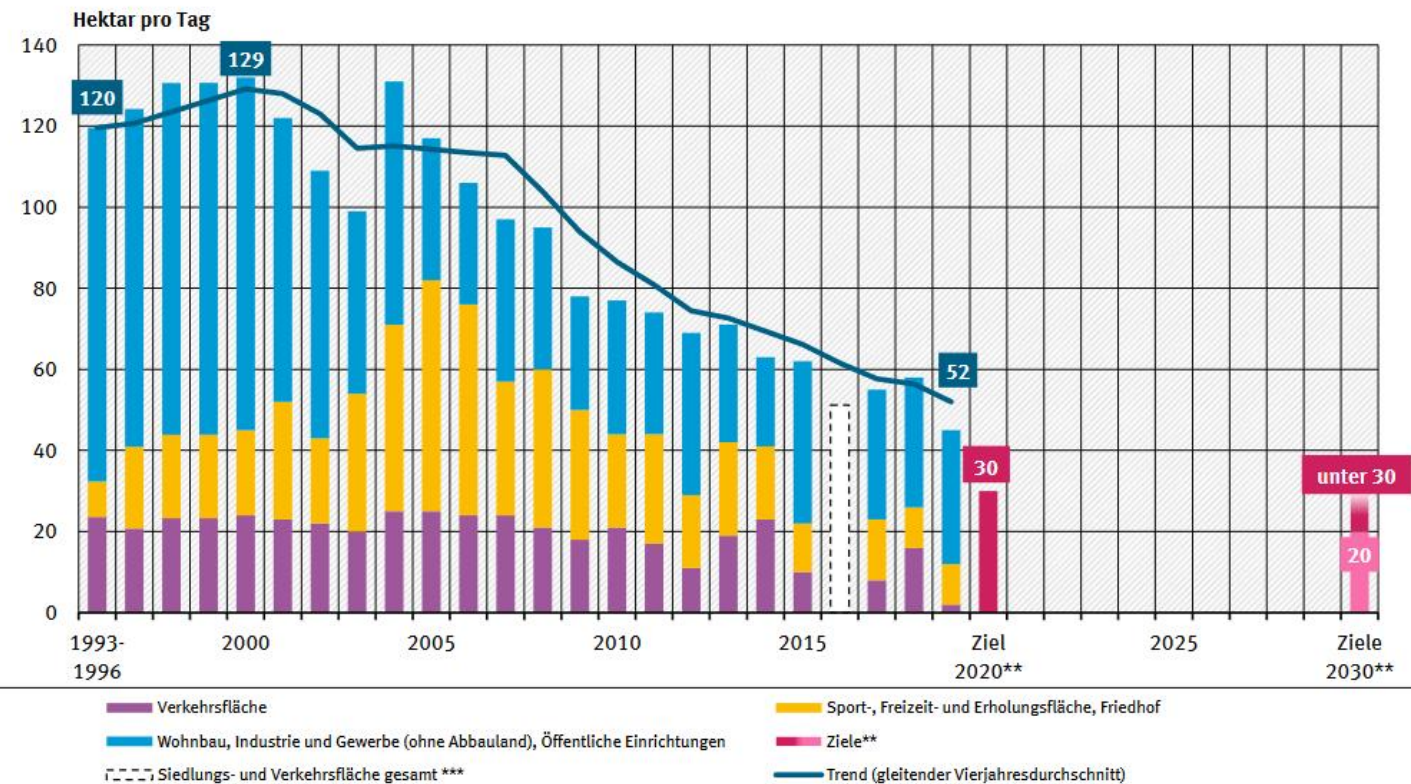
Opportunities

Challenges

Technologies

- no expansion of settlement space
 - Limited until 2030 to 30h/d
- Better acceptance of Agri-PV

Extension of Settlement Space



https://www.umweltbundesamt.de/sites/default/files/medien/384/bilder/dateien/de_indikator_terr-03_suv_2021-05-04_0.pdf

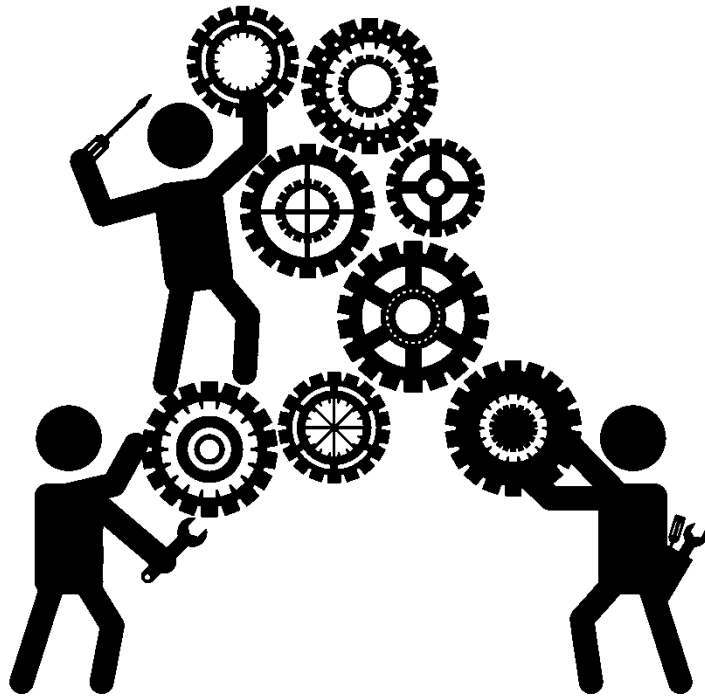
Technical Challenges

Potentials

Opportunities

Challenges

Technologies



- Higher LCOE
- Smaler Energy Density
- Not suitable for all crops
- Change in waterbalance
- Adaption to machinery

Regulatory Challenges in Germany

Potentials

Opportunities

Challenges

Technologies

- Agri-PV DIN SPEC 91434
- No EU-Area subsidies
 - Change in Definition of landuse
- No EEG compensation
- 2022 150 MW for Special tender



Category I “High Mounting”

Potentials

Opportunities

Challenges

Technologies

- 2.1 to 7 m above the agricultural area
- Regular use of the soil possible
- Possibility of optimized lightexposure for plants
- Positive effects of the roof for plants



<https://www.solarserver.de/2021/07/23/goldbeck-solar-bringt-solarbogen-fuer-agri-photovoltaik-auf-den-markt/>



<https://agri-pv.org/de/>

Category I “High Mounting”

Potentials

Opportunities

Challenges

Technologies



<https://www.pv-magazine.com/2020/03/31/a-good-year-for-solar-agrivoltaics-in-vineyards/>

Category I “High Mounting”

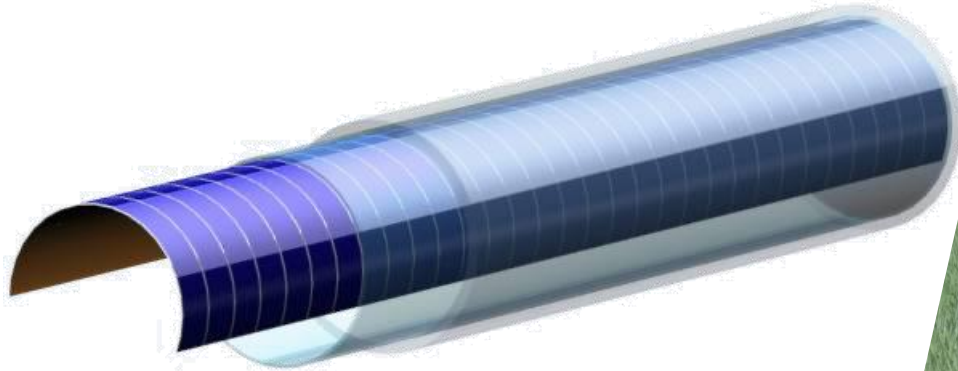
Potentials

Opportunities

Challenges

Technologies

- Light and water permeability for optimal plant growth.
- Wind and snow permeability reduce
- Lightweight
- Uniform Partial shading
- Self-cleaning
- Protection of plants
- horizontal installation



<https://tubesolar.de/>

Category II “Low Mounting”

Potentials

Opportunities

Challenges

Technologies

- Cheaper
- Minimised landloss
 - nature conservation enhancement through fl
 - Protection against desiccation
 - Unchanged water balance
 - Erosion protection through wind reduction
- Grid-serving yield curve



<https://www.next2sun.de/>

Why bifaciality?

Potentials

Opportunities

Challenges

Technologies

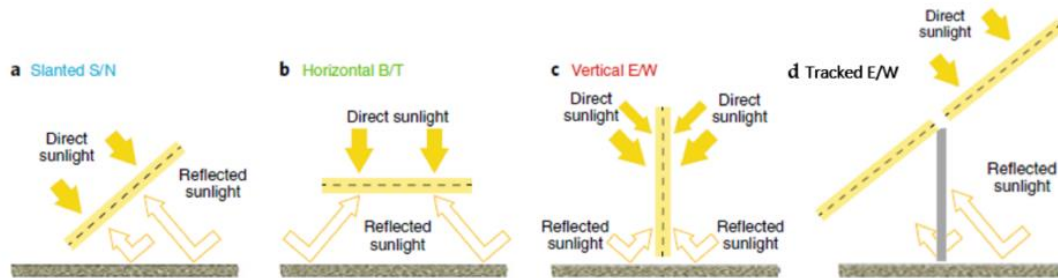
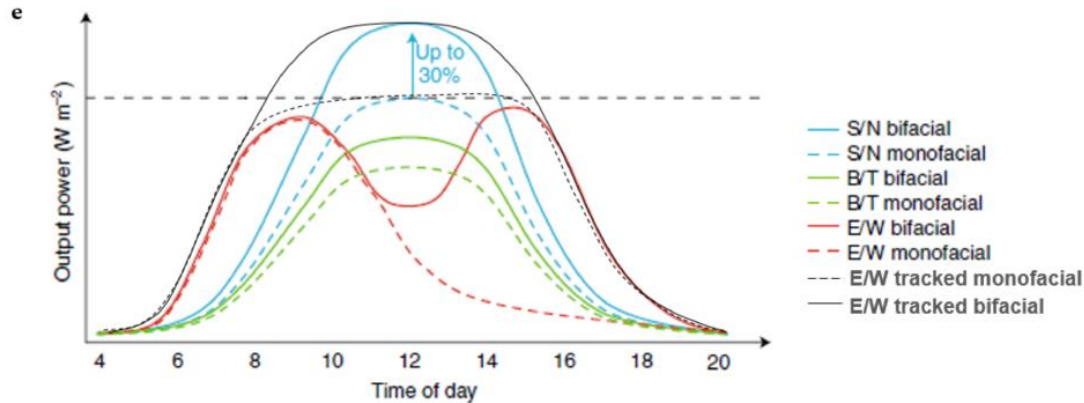


Table 2. Energy gains in systems using tracking and bifacial modules [20].

Installation Geometry	Monofacial [%]	Bifacial [%]
Fixed tilt (flat roof)	100	105–115
Fixed tilt (utility scale)	100	107–130
Vertical (utility scale)	40–50	95–140 *
HSAT	110–122	117–145

* comparison with monofacial fixed tilt.



bifacial gains
of 5-30%

Figure 5. (a–d) possibilities for installations of bifacial modules and (e) comparison of power generation curves for monofacial and bifacial modules [16]. S/N means South/North, B/T is Bottom/Top and E/W is East/West.

Agri-PV?

Potentials

Opportunities

Challenges

Technologies

- Common PV-FFA!!
- Function is optimised for PV



<https://www.enelgreenpower.com/countries/europe/greece/solar-grazing-sheep>



<https://www.faz.net/aktuell/rhein-main/alheim-selbst-ist-das-dorf-11805229.html>

Conclusion

- Benefits for Agriculture and Society
- High potential to speed up energy transformation
- Price range of small PV systems
- Biggest difficulties are in regulations



<https://www.baywa-re.de/de/solar/projektierung/projektentwicklung-projektkooperation>

Thank you for your
Attention



© ISC Konstanz e.V. C. Klyk, Bifi Workshop,
01.04.2022 Konstanz