

„If solar supports farmers, who is supporting solar in Farming!?“

Farmer's Profit & Loss Perspective in Agri-PV Projects



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Farmer Perspective Ecological, Social, and Economic aspects

Poly-crises: Biodiversity loss, Climate Change (Adaptation & Mitigation), Settlement increase, Growing food demand, War, Rural Exodus, Overregulation



Floodings



Sunburn



Hail damages



Drought



Strong wind



Settlement



Plastic Cover



CO2 Emission



Biodiversity Loss

Farming is a high risk, low profit business: more resilience in agriculture is needed

- Food security becomes a top-priority for policy makers & Supply security becomes a top-priority for food-beverage & fashion industry
- Food-Energy-Water-Biodiversity Nexus & Cross-Sectorial Collaboration become more important
- Investments in the agricultural transition are necessary: renewable energy implementation mainly in rural areas, in collaboration with farmers
- Uniting the agricultural & the renewable energy sectors will substitute fossil fuels & nuclear power, while at the same time strengthen our farmers
- **What impact has an Agri-PV project on the profit and loss balance of a single farm?**
- **How Agri-PV can Boost the Transition to Regenerative Agriculture in Europe**

see link: <https://www.bcg.com/publications/2024/how-agri-pv-can-boost-the-transition-to-regenerative-agriculture-in-europe>

How Agri-PV can Boost the
Transition to Regenerative
Agriculture in Europe

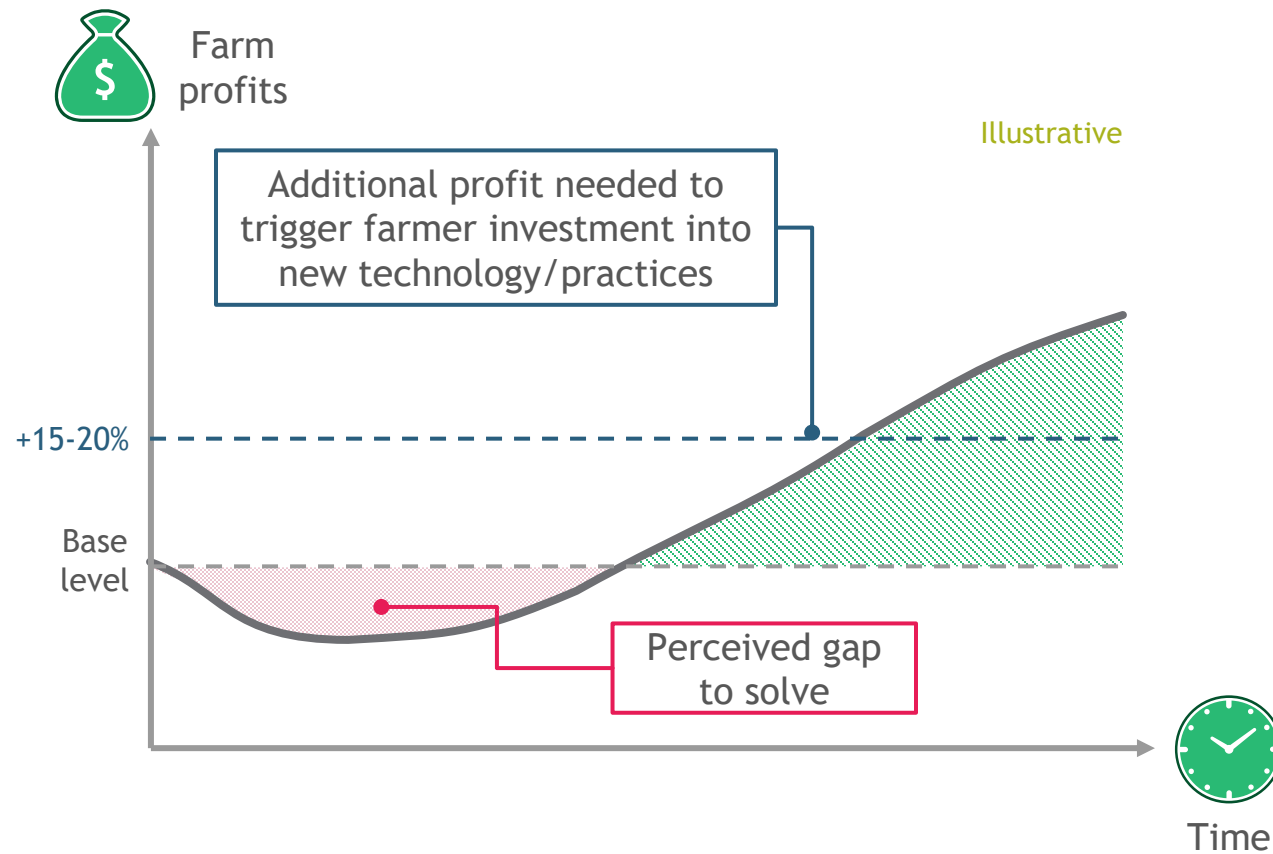
November 2024

by BCG: Tordis Kurb, Benjamin Suber, Paul Pöhlner, and Max Havermeier
In BayWa r.e.: Jochen Hauff, Dr. Stephan Schindler, Alise Leffert, Bram Vlasen,
Maximilian Tegtmeyer, and Eleni Bouzi





Farmer view: Despite proven long-term benefits from sustainable farming practices, farmers fear profitability gap & risk in transition period → Agri-PV can boost & de-risk farm transition



+ Long-term benefits

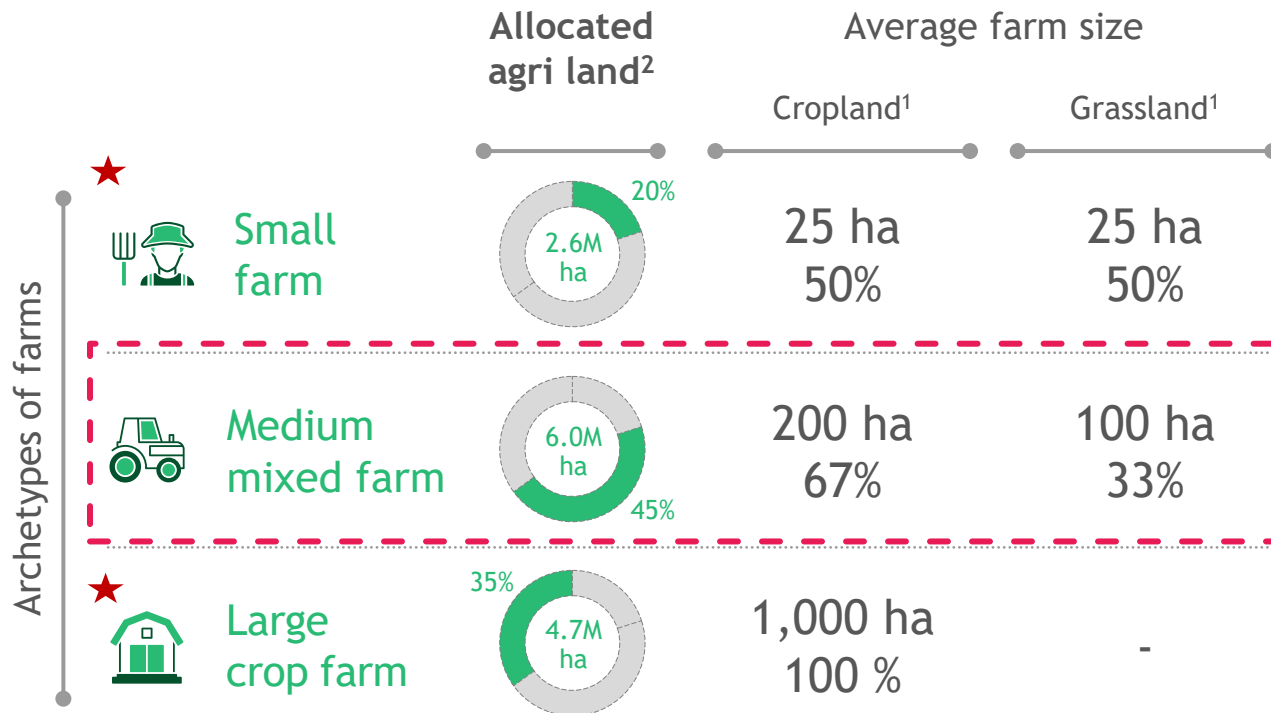
- Enhance crop yield by restoring soil fertility
- Decrease inputs required (e.g. no fungi-/insecticide, ...)
- Reduce field passes
- Improve soil structure: **better drought tolerance and flood resistance**
- Higher prices due to ESG conformity food retailers

– Short-term risk (real or perceived)

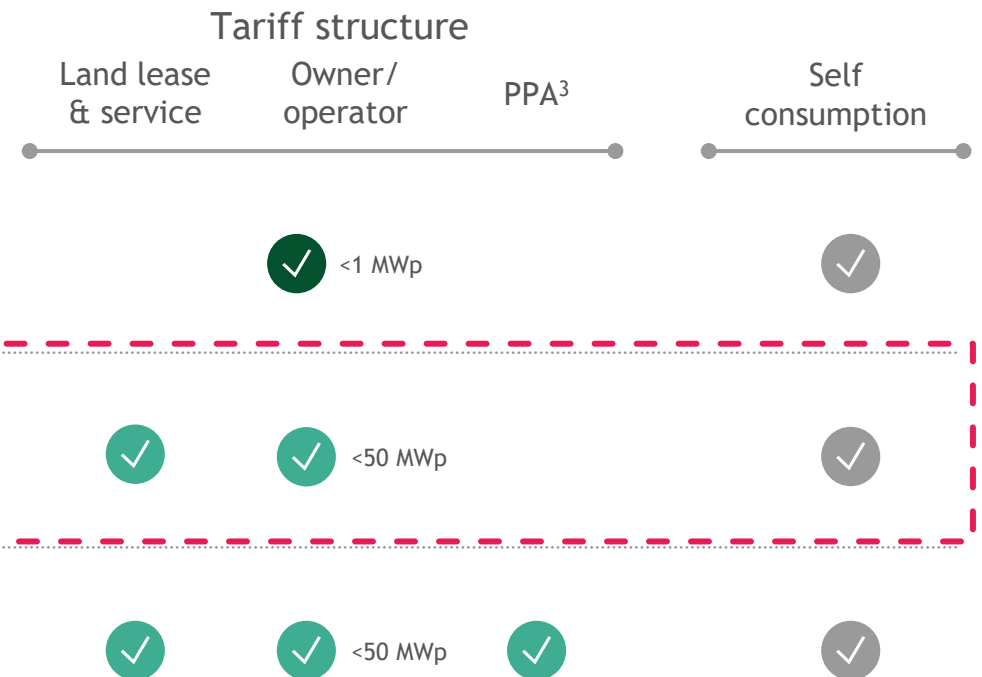
- **Cash out-of-pocket** to experiment with no-till or purchase cover crop seeds
- **Investment in equipment** like direct seeding machine and mulching equipment
- **Steep learning curve** of adapting new farm management practices & networks
- **Risk of failure and the unknown**

Farmer archetypes & Agri-PV structure: Germany Boosting organic & regenerative agriculture (regenAg)

Definition of farmer archetypes Ha and percent



Agri-PV structure

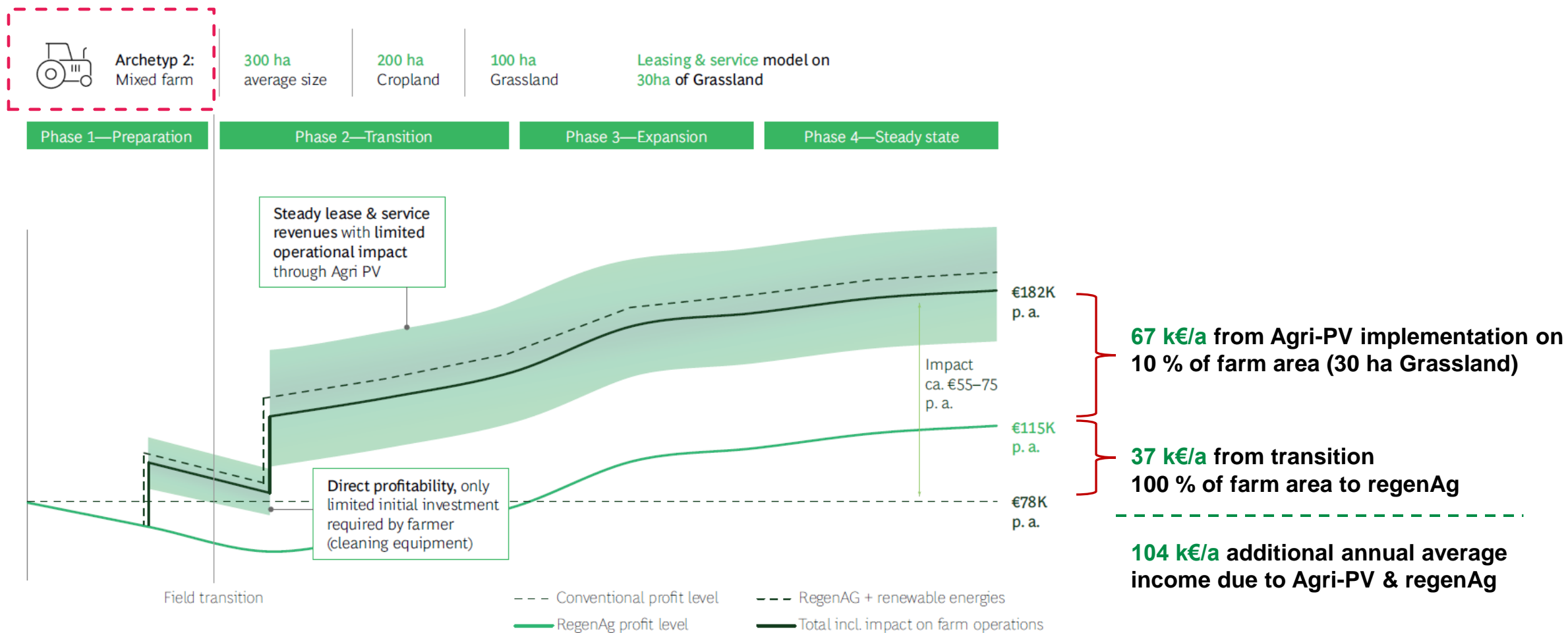


1. Split of cropland and grassland for archetype farms 2. Total share of land of archetype 3. Power purchasing agreement
 Source: Destatis - German federal statistical office, BCG analysis

Suitable Suitable only with partner
 Case Study Today ★ Appendix



Farmer's Profit & Loss perspective: Significant profit benefits through Agri-PV & regenAg practices



Note: Excluding subsidies; assuming purely conventional farming as starting point farm with 300 hectares: 200 hectares cropland & 100 hectares permanent pastureland; 2.250 €/ha/a land lease

Source: Expert & farmer interviews; BayWa r.e.; BCG analysis

Assumptions: Cow-PV; 2p-Tracker; 20 MWp; 1.292 kWh/kWp/a; Ag-Machinery working with: 9 m; tracker-pitch: 10,60 m; Paddock Cattle Grazing, Farmer investment in SPV & PPA not included

■ If Solar supports Farms, who is supporting Solar in Farming?

■ Conclusion

- Yes, Solar Saves Farms!
- Farmers demand solar to modernize their farms
- Look beyond the project site = energy only is not enough!



Opportunities > Challenges

- Yet, if the Agri-PV potential is big, and technically it is feasible, what is missing for its diffusion?
- **Who is supporting Solar in Farming?**

■ If Solar supports Farms, who is supporting Solar in Farming?

■ Question 1: Stefan Meitinger, DBV

-What is missing on European Level to support Agri-PV diffusion?

-What can policy makers on EU Level do, in EU Parliament & in the EU Commission, to support Agri-PV?

■ Question 2: Dr. Simone Fungipane & Dr. Djaber Berrian

Elevate Agri-PV seem to be more costly than inter-row tracker regards LCOE.

-How can Kiwi-PV compete on cost with Crop-PV tracker design?

-How can policy makers enable each farming segment to grow Agri-PV while at the same time promote technical Agri-PV configurations?

*-What is more important: small-scale Agri-PV (< 2 MWp) or large-scale Agri-PV (> 2 MWp)?
How can policy makers on national level address both market segments?*

■ Question 3: Alice Lefort

-What is hindering SolarGrazing with sheep or chicken to become the minimum standard in PV on farmland?

■ If Solar supports Farms, who is supporting Solar in Farming?

■ Question 4: to all = Closing Statements

-What will be the most important & successful Agri-PV application in Europe in future?

-Point out one thing that needs to be done to accelerate the implementation of this very Agri-PV application!

Alice, Djaber, Simone, Stefan

(max. 2 or 3 short sentences / quick answers)



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Thank you.

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Appendix

- Definition of Agri-PV
- Small & Large Farms & Agri-PV



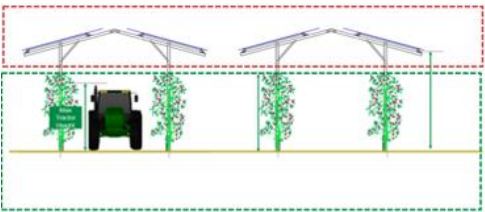
Definition of Agricultural-Photovoltaics (Agrivoltaics or Agri-PV or APV): What is Agri-PV?

Definition: “Agricultural-Photovoltaics (Agrivoltaics or Agri-PV or APV) is a multifunctional land use configuration (A) on one and the same agricultural land area (B) where solar power generation is integrated into an agricultural activity (C) thereby leveraging techno-ecological synergies and increasing agricultural land use efficiency”

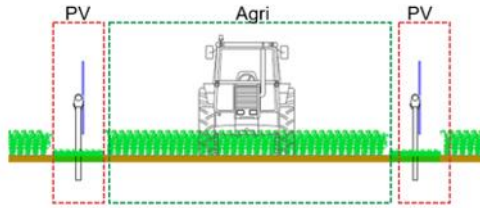
A. Configuration of Technology

A1. PV-Location

A1.1 Elevated

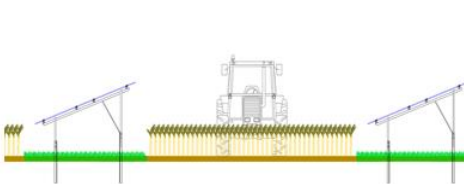


A1.2 Inter-row

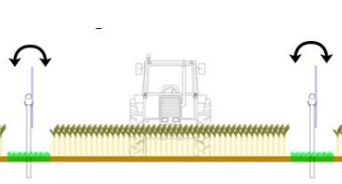


A2. System Type

A2.1 Fixed-tilt



A2.2 Tracking



B. Land Use Category

B1. Cropland

B1.1 Arable Land



B1.2 Permanent Crops



B2. Permanent Pasture

B2.1 Cultivated



B2.2 Naturally growing



C. Classification of Agricultural Activity

C1. Productive:

Food, Fuel, Feed, Fiber, Fabric, ...



C2. Non-productive:

Ecosystem Service, Natural Capital



→ **Agri-PV Specification:** combination of Configuration, Land use Category, and Classification, e.g. elevated Cow-PV, inter-row Crop- & Hay-PV,...

→ **Techno-ecological synergies (TES)**, e.g. micro-climate, lower evapo-transpiration, and increase of **Land Use Efficiency**, measured by Land Equivalent Ratio (LER) for the agricultural yield in dual-use compared to mono-use, **are must have criteria** in all Agri-PV projects

★ Today, **all EU Member States** focus their Agri-PV definition on “productive agricultural activities” and **exclude “non-productive”** agricultural activities, yet, **Eco-PV** projects in legal conjunction with set-aside Cropland (GAEC 8) could also fall under the definition of Agri-PV and increase land-use efficiency significantly

■ Definition of Agricultural-Photovoltaics (Agrivoltaics or Agri-PV or APV): What isn't Agri-PV?

Differentiation of Agri-PV from conventional ground-mounted PV (GM-PV)

- Agri-PV always includes a farmer and an agricultural activity on project area is carried out
- GM-PV may include a farmer (for instance as a landowner or/and service provider for greenkeeping) but no agricultural activity on project area is carried out
- Definition of “farmer” & “agricultural Activity” in European Union according to Article 4 of EU Council Regulation (EC) 1307/2013:
<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R1307>
- Legally, in Agri-PV the prime land use is the agricultural activity, and the secondary land use is the PV power generation. Thus, the status of farmland may remain farmland whereas in GM-PV the status farmland is very likely changed to industrial/settlement area



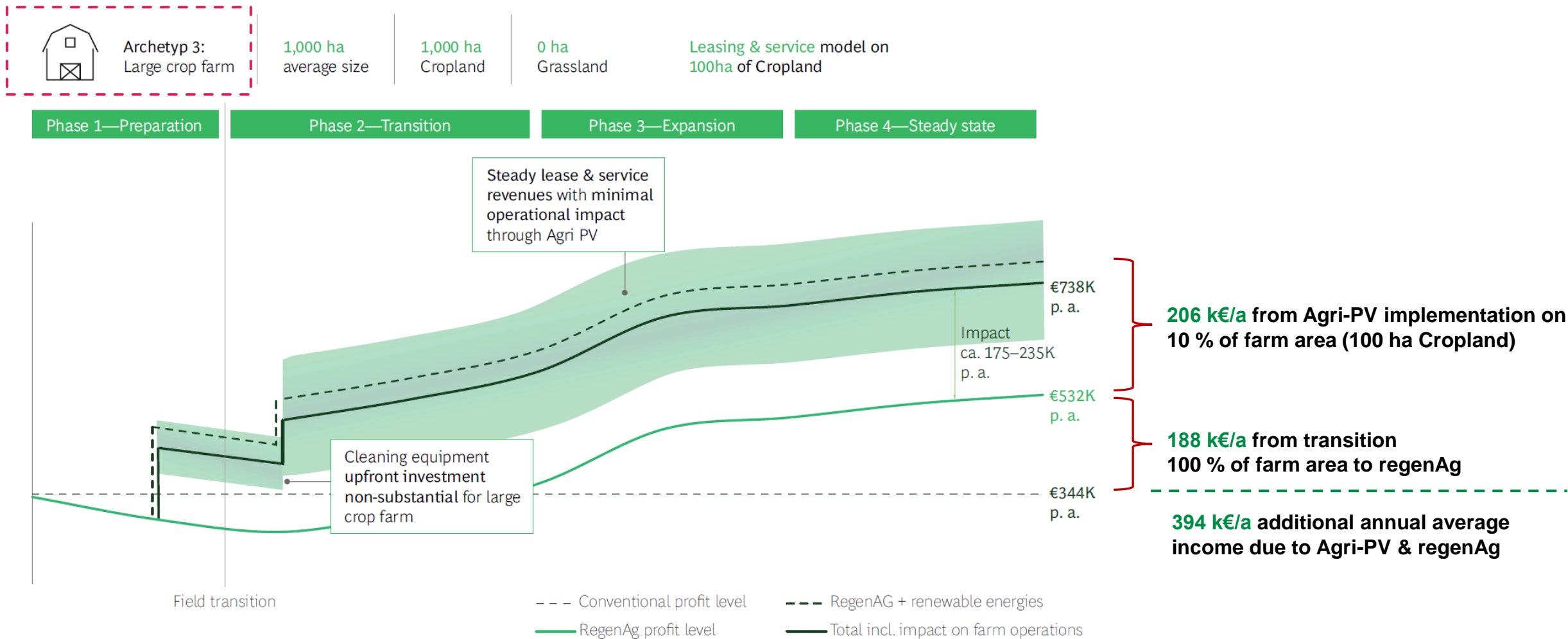
VS



- **GM-PV**, usually, high Ground Cover Ratio (GCR) and the status of farmland is lost or was not there before the project, e.g. desert land, industrial land, former military or landfill site

- **Agri-PV**, usually, lower GCR compared to GM-PV, and the status of farmland remains farmland

Farmer's Profit & Loss perspective: Significant profit benefits through Agri-PV & regenAg practices

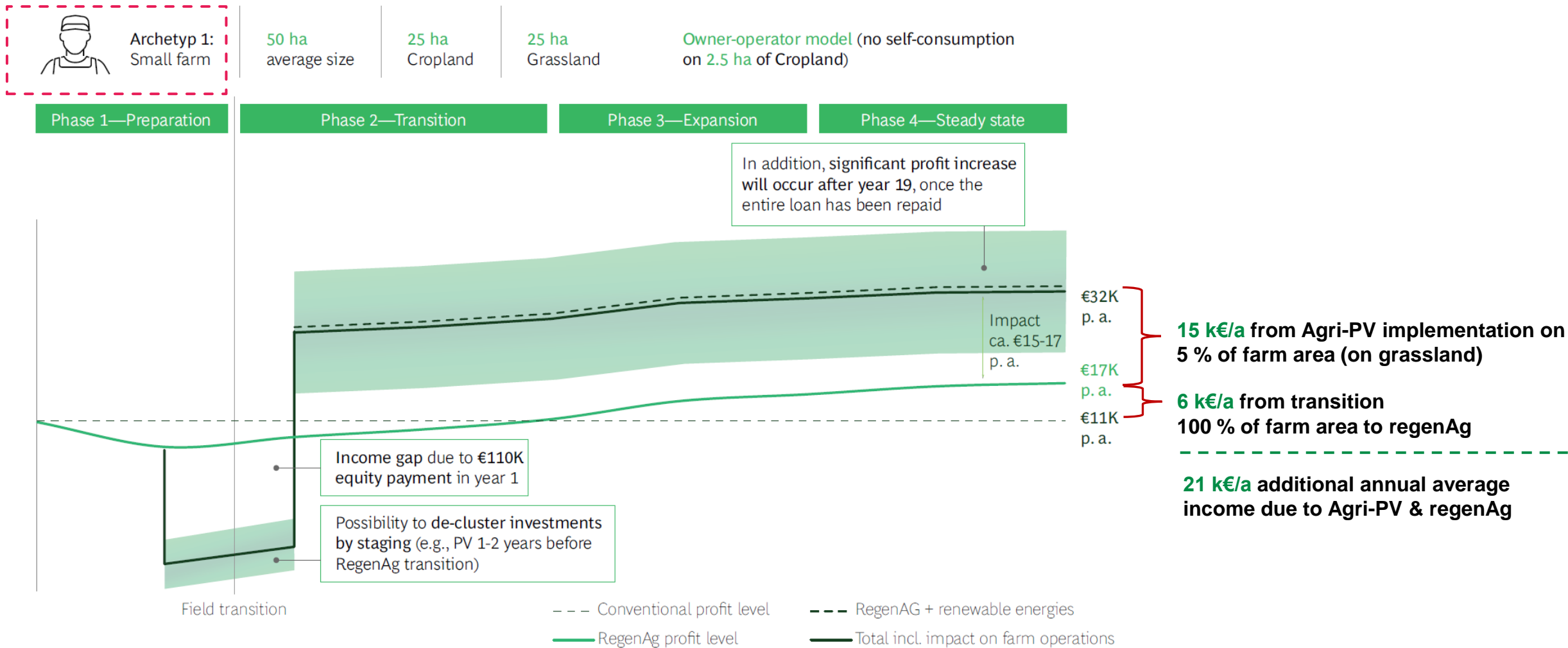


Note: Excluding subsidies; assuming purely conventional farming as starting point farm with 1.000 hectares cereal & oil seed; 2.250 €/ha/a land lease

Source: Expert & farmer interviews; BayWa r.e.; BCG analysis

Assumptions: Cow-PV; 2p-Tracker; 53,4 MWp; 1.240 kWh/kWp/a; Ag-Machinery working with: 12 m; tracker-pitch: 14 m; Crop production & Paddock Cattle Grazing, Farmer investment in SPV & PPA not included

Farmer's Profit & Loss perspective: Significant profit benefits through Agri-PV & regenAg practices



Note: Excluding subsidies; assuming purely conventional farming as starting point farm with 50 hectares: 25 ha Cropland & 25 ha Grassland; Farmer is also investor & asset manager of Agri-PV project

Source: Expert & farmer interviews; BayWa r.e.; BCG analysis

Assumptions: Cow-PV; 2p-Tracker; 998 kWp; 1.292 kWh/kWp/a; Ag-Machinery working with: 9 m; tracker-pitch: 10,60 m; Grass production & Paddock Cattle Grazing