PA³C³ - Potential analysis of agrivoltaics in Austria in the context of climate change

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Aims

The project PA³C³ assesses the **potential of agrivoltaics (APV) in Austria** as climate change mitigation measure with special respect to (techno-)economic, environmental and social aspects.

Agrivoltaics…

…is the **combined use of agricultural land for food/feed production and PV electricity production**

- APV-systems: stilted or ground mounted
- Increase of land use efficiency [1]
- Shading can effect crop yields negatively (dependent on plant) [2]
- APV systems can reduce heat stress [2]
- Potential reduction of irrigation demand [3]
- Benefits for local climate due to possible increase of temperature up to 3 to 4 °C above the panels compared to open areas [4]

(Techno-)economic assessment

Area selection for APV in Austrian agriculture by using agricultural and technical parameters.

Economic assessment:

- Identification of areas on which crop yields are most affected by climate change by using EPIC module
- Assessment of economic potential of the APV system by calculating the opportunity costs at pixel level based on simulated crop yields, crop production costs and revenues
- Identification of potential areas for agrivoltaic systems in Austria based on opportunity costs

PV electricity assessment of APV systems in Austria and its impacts on the power system with PV-GIS:

- Determination of possible areas based on agricultural area selection
- Identification of additional exclusion zones for APV from a thorough literature review
- Calculation of levelized costs of electricity for all grid points in Austria

A **preliminary assessment of open space PV potential** on agricultural areas in Austria shows significant potential (Figure 1). In total, 1614 TWh can be potentially produced. This is reduced to 165 TWh on current vegetable production sites - sites which are potentially highly interesting to agrivoltaic.

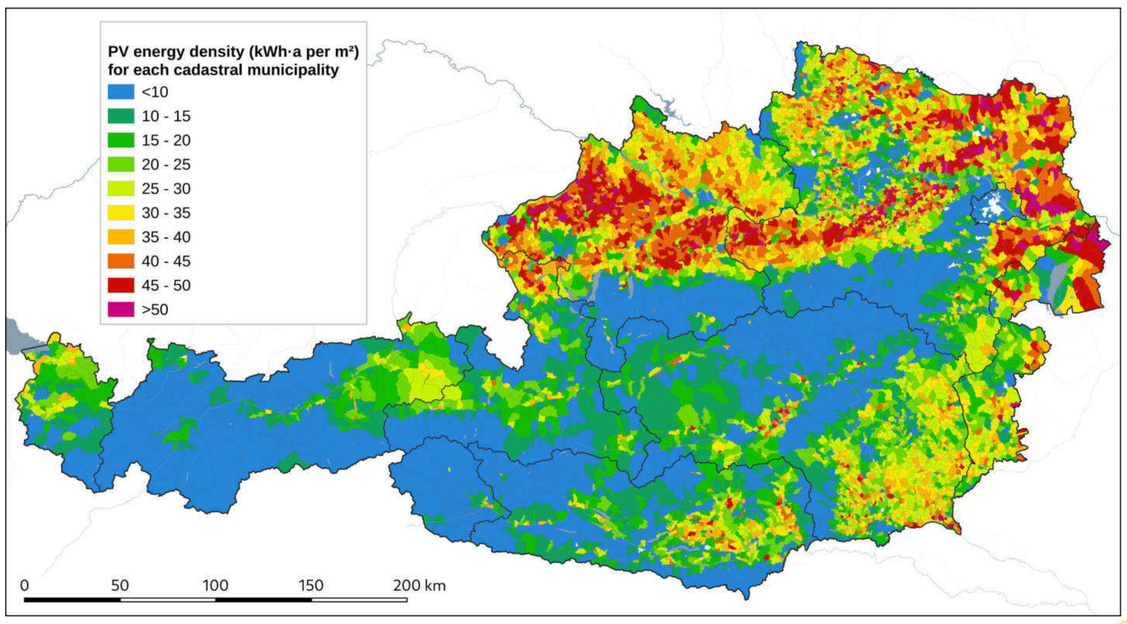

Figure 1. The open space PV potential for all cadastral municipalities in Austria, potentially suitable for agrivoltaics [5]

Environmental assessment

Environmental impact assessment of selected utilization concepts using a **comprehensive life-cycle assessment (LCA) method** to estimate the potential environmental impacts of the whole production of electricity and food for the defined scenarios**.** For the comparability of LCA-results, every scenario needs to have the same total output, i.e. agricultural- and energy supply

- Scenario 1: Continued agricultural production: no changes in the agricultural practice; for the LCA study additional production chains of electricity will be modelled (for example according the average Austrian electricity mix)
- Scenario 2: Complete substitution of agriculture by photovoltaics: whole available area is used to produce electricity with photovoltaics; food production chains will be included on different sites
- Scenario 3: APV systems: electricity and food will be obtained from one agricultural field

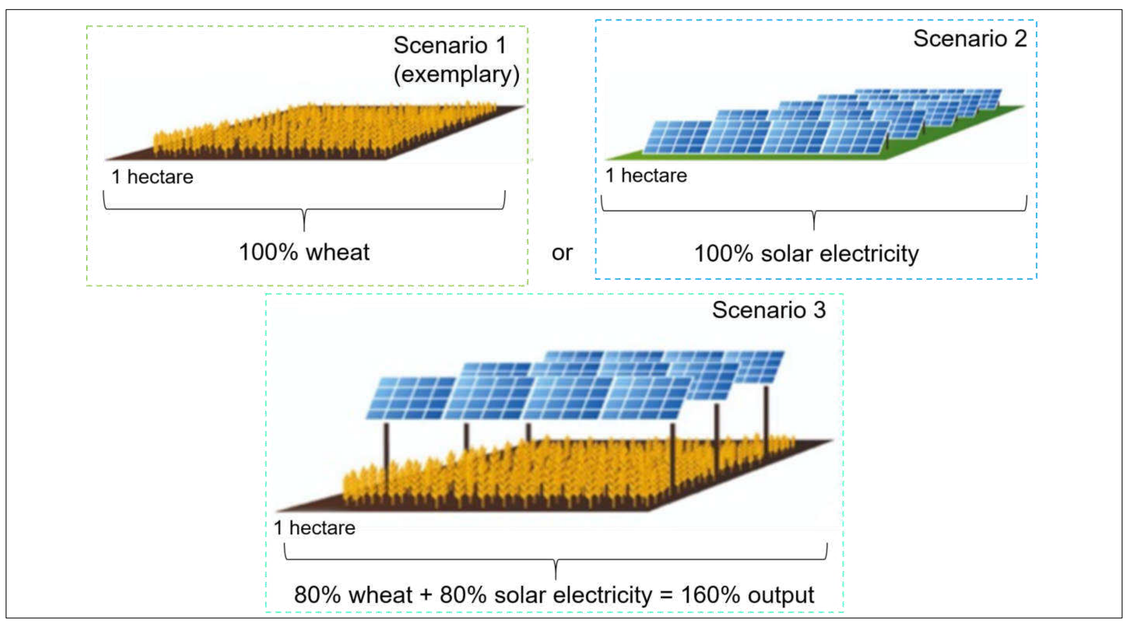

Figure 2. Overview of defined scenarios for the life cycle assessment; [6] modified

Social assessment

Case study based determination of social acceptance and visual impacts of APV using interactive 3D models and a **serious game approach with the "Landscape.Lab**. Workshops together with local inhabitants to answer the following questions:

- What effect does have an APV system on the landscape?
- What possibilities for actions have the people in the region to expand the APV system?
- What kind of synergy effects and conflict potentials occur?

Figure 3. Landscape.Lab workshop with a computer-supported board game environment for developing local agrivoltaics futures using a serious game approach

References

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Expected outcomes of the project PA³C³

- Database of agricultural outputs for a variety of common crops and grassland in Austria with a 500m resolution
- Annual, seasonal and hourly PV generation on the same grid, additionally including levelized costs of electricity and system value
- Environmental impact assessment of the whole scenarios as well as the assessment of the selected PV systems

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