Evaluation of the German agrivoltaics innovation tender 2022 and overview about the agrivoltaics development in Germany

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1. Introduction

Extreme weather events are increasing in frequency and intensity worldwide and in Germany. In addition to heavy rainfall events, droughts associated with climate change is a significant problem resulting into enormous risks for agricultural production. This illustrates the latest harvest report from the German Federal Ministry of Food and Agriculture, where all month of the recent year (except of February and April) have a precipitation deficit [1]. Agrivoltaics offers the opportunity to combine climate change adaptation and mitigation. Partial shading of crops and the soil increases drought resilience, simultaneous solar energy generation reduces greenhouse gas emissions [2]. In Germany, agrivoltaics is an expanding new technology. This is particularly evident in terms of the number of agrivoltaic facilities already installed in Germany. The aim of this study is to present the status quo of agrivoltaics in Germany and show national development trends of this technology.

2. Material

Within the SynAgri-PV project [033L244A], funded by the German Federal Ministry of Education and Research, partners[1] from research and industry accompany the market ramp-up of agrivoltaics in Germany. To elaborate on the diffusion of agrivoltaics in Germany, existing facilities as well as planned facilities were surveyed. Also, the recent tender round of the innovation tender is considered. The data for this study are based on our research and the Federal Energy Grid Agency's (Bundesnetzagentur) market master data register (Marktstammdatenregister) [3].

3. Results – Legal and technological developments

Since 2000, the Renewable Energy Law (Erneuerbare Energien Gesetz – EEG) sets the legal framework for the energy transition in Germany [4]. The paragraphs 39n and 88d EEG deal with general (39n) as well as concrete cases of application for the innovation tender (88d), which itself is still specified in the Innovation Tender Regulation [5]. The actual aim of the innovation tender is to strengthen grid stability with the increasing share of volatile energies. The funding structure within the innovation tender provides a fixed market premium.

In the 2019 novelty of the EEG, agrivoltaics entered the innovation rules as part of the so-called special solar facilities (together with floating PV and parking lot PV). In the innovation tender in April 2022, a primary grant volume of 150 MWp was reserved for the special solar facilities. To participate in the tender, a bid must be within 100 kW to 2 MW and a combined facility (Agrivoltaics facility + e.g. battery storage).

Figure 1 shows existing (green) and planned facilities in Germany, which differ in their technical design. DIN SPEC 91434 differentiates between two main technical designs [6]. An interspace design and an overhead design. Both designs have different areas of application. While the interspace design is suitable for

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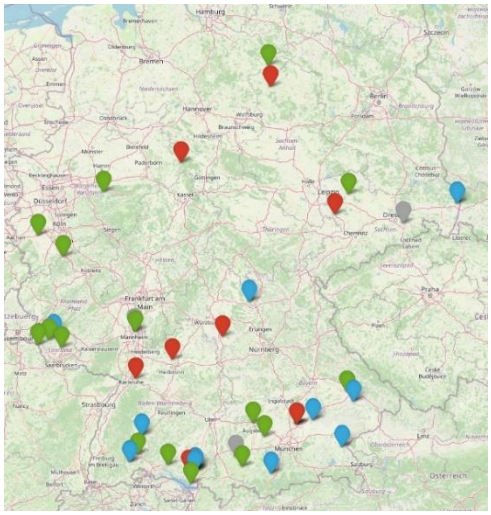

Figure 1: Location of agrivoltaic facilities in Germany

grassland farming and animal husbandry, the overhead design is mainly used in arable farming and horticulture. There are seven facilities each installed in Germany and furthermore two PV-Greenhouses with a total capacity of 11,18 MWp.

Of the 150 MWp grant volume in the innovation tender round of April 2022, just 12 agrivoltaic facilities (and one 1 MWp PV-facility on parking lot) are subsidized, with a total capacity of 22 MWp. This disappointing result could have many reasons. One reason could be the legal framework in Germany outside the EEG. There are much more law restrictions which regard the market ramp up of agrivoltaics in Germany except of the EEG. Like shown in Figure 1 most of the facilities are located or planned in southern Germany, which may be due, among other things, to the federalist structure within German subsidy policy. Federal states can adopt additional funding instruments next to law restrictions at the state level in addition to federal legislation. Even the maximum bid of two MW could be a barrier, because the economic operation of the agrivoltaic facility could not be necessarily guaranteed. Another reason could be the exhausted innovation spirit, because the innovation tender required two different innovations. As a next step, for getting more information on the reasons, the facilities of the innovation tender round will be surveyed.

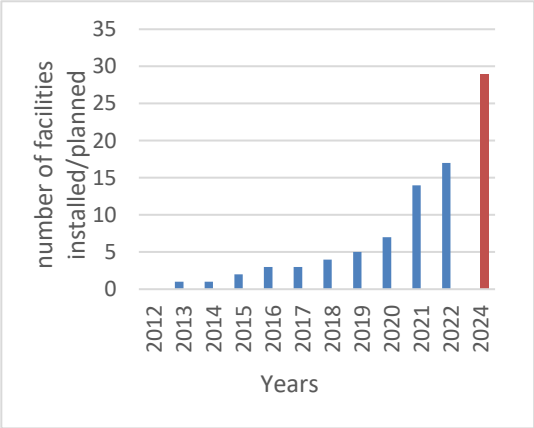

Figure 2: number of installed/planned facilities

Nevertheless, the number of agrivoltaic facilities in Germany is increasing. An upward development trend has been evident since 2012. It further shows that since 2020, the number of installations has increased sharply. This development trend is displayed in *Figure 2*. The trend also includes the facilities which are planned in the innovation tender round of April 2022 (red), which must be build in between the next two years.

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