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Summary

- Agrivoltaics are solar systems which allow the land they are situated on to be simultaneously used as farmland
- Following the example of Japan, China, France and the United States, Germany has now also taken steps to promote agrivoltaics, through regulatory and financial incentives.
- Whilst these changes are not expected to give agrivoltaics an immediate major boost, uptake should increase, especially by German horticulture.
- Potential implications for New Zealand are threefold: German farmers' competitiveness could increase, but equally there will be new opportunities for export of relevant New Zealand technologies and for knowledge transfer.

Report

Agrivoltaics are solar energy systems which allow the land they are situated on to be simultaneously used as farmland. The technology involves elevated solar panels that have a slightly lower energy yield than standard products, but still allow for the cultivation of crops underneath, providing moderate shade to protect crops from increasing sun intensity. A less common but equally available technology is vertical, bifacial solar panels facing east and west. Starting from a low base, agrivoltaics has expanded in recent years, with globally installed capacity now exceeding 14 GW (peak) – most of it in China. National funding programmes already exist in Japan, China, France, the United States and South Korea, with Germany now following.

Germany's potential for agrivoltaics and experience so far

The potential for standard agrivoltaics alone in Germany – largely based on the cultivation area used for shade-tolerant plants and suitable crop rotations – is estimated at around 1.7 TW (peak), more than 30 times the total solar capacity in Germany today. On top of this, the use of vertical modules with cultivation of feed on pasture continuing in between, would add a further potential of 1.2 TW (peak). So far, at least five research projects have been set up, and more than a dozen commercial agrivoltaic sites are currently operating in Germany. These combine agrivoltaics with a wide range of cultivated plants, such as berries, apples, grains, vegetables, as well as with animal farming. Experience so far is promising, including the possibility of increasing land use to 160% or more, notwithstanding the need to overcome technical challenges and for careful planning and implementation.

New Government incentives to give agrivoltaics a boost

The German Government wants to increase solar electricity capacity from the current 60 GW (peak) to 215 GW (peak) in 2030. This will involve the extensive use of roofs and extra capacity on the ground, preferably on already sealed surfaces. In addition, the use of agricultural land is seen as having great potential, provided food production and conservation are not jeopardised. The Government hopes that agrivoltaics can square the circle in this regard, and generate other benefits, such as extra income for farmers and improved resilience in the context of climate change.

In order to make investment in agrivoltaics more attractive, the Government has now made agrivoltaics eligible for guaranteed grid access and feed-in tariffs provided by the Renewable Energies Act (EEG). Since access and tariffs for larger projects are determined through auctions equally open to more cost-efficient solar parks, agrivoltaic projects will receive a "technology bonus" for each kWh. The Government has also clarified that agricultural land used simultaneously for agrivoltaics remains eligible for 85% of the standard subsidies (direct payments) granted under the EU's Common Agricultural Policy (CAP), provided at least 85% of the land can still be used for cultivation (sheep-

grazing between and underneath standard, i.e. not elevated, solar panels will not be eligible in future). Protected areas, and agricultural land with relevance for conservation are excluded from eligibility.

Potential uptake by German farmers and emerging industry expertise in Germany

Stakeholders welcome these improvements, but whether they will be sufficient to ensure a major uptake of agrivoltaics remains to be seen. The current energy crisis in Europe has led to greater awareness that Germany needs to diversify its energy sources and accelerate its transition to renewable energy. Horticulture (including wine, vegetables, berries) that could benefit from the increased shade is identified as having the greatest potential, whereas crop farming appears to be less suitable given how much the panels would have to be elevated to allow room for harvesters etc. to pass underneath. The initially disputed but finally agreed eligibility of pastoral land under the EEG is welcomed, in particular for leaner pastures. Perhaps one of the greatest challenges in the current volatile economic environment with highly fluctuating steel and energy prices will be to calculate the economic viability of agrivoltaic investments.

So far, only a handful of German businesses are focusing on agrivoltaics. The [Fraunhofer Institute for Solar Energy Systems](#) (ISE) offers R&D services for the industry (covering strategy, project development, engineering, procurement and operation monitoring). [BayWa r.e.](#) (a daughter company of BayWa, T&G's majority shareholder) was one of the first movers in this area and is actively seeking interested farms for co-investment into agrivoltaics. [SunFarming](#) started with standard solar plants but is now increasingly focused on agrivoltaics, offering elevated horizontal systems for fruit and vegetables, herbs, flowers, special cultures such as wine, and berries. [Next2Sun](#) provides vertical, bifacial agrivoltaic systems, and [Tubesolar](#) is developing photovoltaic thin-film tubes.

Relevance for New Zealand

Agrivoltaics could over time increase the competitiveness of Germany's horticulture sector, in particular. At the same time, Germany could become a major market for relevant technologies, including from New Zealand. An increased uptake of agrivoltaics in Germany could create knowledge and establish good practice around this still relatively new technology, offering opportunities for New Zealand to learn from this experience.

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