View: Agrivoltaics for the Indian condition

-By Saptak Ghosh

Of India's nearly 62 GW installed solar capacity, about 50 GW is ground-mounted photovoltaic (PV) plants. Recent trends show that obtaining land parcels for large solar projects is becoming increasingly difficult. Innovative and viable alternatives are needed to reach the 450 GW renewable energy (RE) target for 2030. Among the buzzwords circulating in the upper echelons of policy and decision-making is 'agrivoltaics'. The concept aims to optimise land usage by combining agriculture with PV (agriPV). AgriPV has gained traction in countries such as Germany, Japan, and Italy and is being actively explored in the Indian context.

Potential and Challenges

Initial estimates by industry experts show that India has an agriPV potential of about 2.8 TW, highlighting the immense scope of this technology. AgriPV bears the potential to provide improved conditions for the growth of specific shade-loving crops. These include leafy greens, tomatoes, root vegetables, and tubers. However, for a majority of Indian crops such as rice, wheat, and oilseeds, agriPV is likely to cause yield reduction. Hence, in an agrarian economy such as ours, regulations need to be put in place with respect to agriPV. In Germany, the yield reduction is restricted to 33% compared to the baseline scenario to qualify as agriPV. Such parameters for India need to be developed scientifically and from an economic standpoint. Deliberations with stakeholders—policymakers, decision-makers, farmers, agricultural universities, and economists—need to be conducted, and food security concerns need to be prioritised to ensure a holistic implementation plan for agriPV.

The agriPV potential might drop significantly if important crops such as wheat, rice, and oilseeds are excluded. Despite this, the realisable agriPV potential in India remains large enough (still in TWs) to warrant an aggressive exploration plan. The primary element of risk for sustainable business plans in agriPV is farmers. History has shown that any deviation from normal farming patterns leads to disturbances and even government bills being repealed.

Identifying Suitable Business Models

Presently, some solar parks are commissioned on arid land that has been leased from farmers. In the Pavagada Solar Park (>2 GW) in Karnataka, about 13,000 acres have been leased from nearly 1,800 farmers for 28 years. The rate is ?21,000/acre/annum with a 5% biennial escalation, purportedly benefitting farmers struggling in harsh conditions. However, this rate is unlikely to woo farmers in fertile regions receiving adequate rainfall. The required lease rate will be more because the revenue/produce yield is much higher compared to arid regions. Additional compensation will be required for farmers with reduced crop yields. Higher tariffs will be quoted by developers, and subsidies will be required from the government. Adding these to a significantly higher per MW cost compared to ground-mounted PV, this business model can get prohibitively expensive. Moreover, disgruntled farmers might renege on lease rates or periods, increasing the risk for financing institutions.

A farmer or farmer producer organisation (FPO) with an ineluctable stake in an agriPV project is key to its financial viability. Similar to Component A of the PM KUSUM scheme, farmer-based investments can be made in agriPV system(s). Power can be sold at a predetermined tariff to a distribution company (DISCOM). This will include a compensation component in case there is crop yield reduction. Compared to the previous scenario, the tariff will be lower since there is no lease component. At present, most states supply free/subsidised power to the agricultural sector. This leads to thousands of crores being doled out to DISCOMs annually from the state treasury. This business model allows farmers to generate their own electricity and make a profit from it. The electricity will be consumed in neighbouring fields with minimal losses. Furthermore, the tariff is expected to be lower than the average cost of supply (ACoS) of Indian DISCOMs.

The Way Forward

A lacuna in the farmer(s)-owned model is the operation, maintenance, and management of the PV plant. The learning curve is steep and only a minority of farmers have the technical and financial acumen. A more elegant model will be a joint venture (JV) between a reputed developer—private or state-owned—and an FPO. Mutually agreed-upon lease rates and stake ratios will lead to reductions in risk exposure and loan rates. This model can work at higher scales since JVs will explore larger land parcels to reduce costs and increase margins. Regular interaction between these primary stakeholders will ensure longevity and productivity.

Sustainable business models with benefits for all stakeholders can be replicated to scale up agriPV in the future. Thorough scientific research needs to be conducted to understand crop suitability based on geography. The resultant quantum of reduction or increase in crop production requires accurate analyses. This needs to be translated into a tariff component on a case-by-case basis. Policy and regulatory frameworks need to be built around these pillars for a successful agriPV road map for India.

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