

Solar irrigating of small acreage

In a new IIASA-led study as part of the research project Renewables for African Agriculture (RE4AFAGRI), an international team of researchers developed an open-source modeling framework that used various datasets related to agriculture, water, energy, expenses, and infrastructure. This framework was employed to calculate local irrigation needs, determine the necessary size and cost of technology components like water pumps, solar PV modules, batteries, and irrigation systems, and assess the economic prospects and sustainable development impacts of adopting solar pumps.

Crucially, the authors of the study demonstrate the great importance of business models and investment incentives, crop prices, and PV and battery costs, in shaping the economic feasibility and profitability of solar irrigation.

The analysis and the novel open-source modeling framework can support public and private actors working along the water-energy-food-economy nexus in identifying economically feasible areas and quantifying the potential net economic benefit of developing solar irrigation, and can thus foster investment in the sector.

As climate change threatens water and food security in many parts of Africa, governments are promoting small-scale, farmer-led irrigation as a crucial climate adaptation measure. At the same time, rising incomes and changing dietary patterns among middle-income consumers are making the production of high-value irrigated crops an attractive market opportunity for smallholder farmers. But a lack of an energy source to pump water as well as various social and economic constraints are preventing many smallholders from cashing in on this opportunity.

In Ghana, for example, most smallholders do not have access to a consistent supply of electricity. In many off-grid areas, petrol and diesel pumps are commonly used for irrigation. These pumps are expensive to run and contribute to carbon emissions. With the country's abundance of sunshine and water resources, solar pumps offer smallholders an economically and environmentally sustainable alternative.

Getting the right solar technologies to the right people is often complicated by weak supply chains, high costs and a poor understanding of local market needs. IWMI, supported by the Feed the Future Innovation Lab for Small-Scale Irrigation (ILSSI) and Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) projects, has identified a bundle of innovative solutions with significant agricultural potential.

A key project objective is engaging private sector actors, who play a central role in the supply of solar irrigation technologies and services such as pumps, information, financing and after-sales support. The aim is to identify bundles of innovations that can be adapted to fit the local context and to scale these up to reach a large number of farmers. In 2020, the first scaling partnerships were established in Ghana and Ethiopia to

accelerate progress towards this objective.

In Ghana, IWMI partners with Pumptech, a solar pump distributor that combines pumps with pay-as-you-own financing. This flexible financing model helps to address the challenge of high initial investment costs by allowing farmers to use the equipment while making small, regular payments. Once the total cost of the equipment is paid off, the pump is permanently unlocked and ownership is transferred to the farmer. The pump can also be temporarily locked remotely if a farmer misses a payment, thereby de-risking private companies' investment in solar systems.

To handle the increased demand generated by the workshops, Pumptech opened a new branch office in the Upper East Region in mid-2021 with the Ministry of Food and Agriculture. In addition, Pumptech's pay-as-you-own financing model attracted USD 102,750 in funding from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to facilitate the further development of Ghana's solar-powered irrigation sector.

As Pumptech's business expanded, it became clear the company needed to improve its digital data management and marketing systems. IWMI helped to recruit two interns, as part of an evidence-based approach to building capacity and accelerating innovation scaling in agricultural value chains. Pumptech has since hired both interns as staff and adopted IWMI's internship model to fill other knowledge and skills gaps in the organization. Overall, IWMI support helped Pumptech to increase pump sales by more than 80% in 2021 compared to 2020.

IWMI also established a scaling partnership in Ethiopia with Rensys, another solar pump distributor. In the past two years, Rensys has expanded to four new regions. As a result of demand-supply linkage workshops, field demonstrations and other activities, nearly 300 farmers have indicated their interest in buying a pump and almost 100 farmers have acquired the technology, 18 of these under a pay-as-you-own credit arrangement.

Ongoing multi-stakeholder dialogues, which include the Ethiopian government's Agricultural Water Management Task Force and the World Bank's 2030 Water Research Group, are amplifying IWMI's scaling efforts by engaging a broader set of actors up to the national level.

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