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CASE STUDY

May 2020

Solar pump cooperative supports climate-smart agriculture in Gujarat

Key findings

- Solar pumps generating electricity for irrigation in the village of Dhundi in Gujarat are increasing farmer incomes and incentivising the sustainable use of groundwater and energy.
- The solar pumps have benefited both water sellers and buyers in the irrigation market. A farmer cooperative earns income from selling water for irrigation as well as excess electricity back to the grid, and water buyers are purchasing water at lower prices.
- Two key success factors have been a local power utility willing to experiment with a new model and buy back electricity from farmers for 25 years, as well as the farmer cooperative improving the efficiency of the sale of electricity.
- The Dhundi example demonstrates the potential of solar pumps as a 'cash crop' for farmers, since they do not require any fertiliser, irrigation or labour and are not at risk from drought and floods. However, incentives need to be in place to pump only the amount of water required for irrigation to avoid groundwater exploitation.

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A woman cleans a solar pump installed in Dhundi village.

Introduction

With a changing climate, agriculture-based economies are seeking innovations that protect farmers and their livelihoods. Groundwater is the main source of irrigation across India. Pumping of groundwater is usually either done with electrified pumps using subsidised electricity, often leading to over-exploitation of groundwater, or through expensive and polluting diesel-powered pumps. These diesel pumps reduce farmers' profit margins and increase agriculture's carbon footprint.

In the village of Dhundi, in Gujarat, solar pumps for irrigation were introduced from 2015 to 2016, with assistance from the International Water Management Institute (IWMI) and the Climate Change, Agriculture and Food Security (CCAFS) programme of the Consultative Group for International Agricultural Research (CGIAR) and Tata Trusts. The solar energy was used to generate electricity to pump water for irrigation, and to sell to the grid.

Through selling the excess electricity, farmers owning the pumps have earned 'climate-smart' income, and have been incentivised to use groundwater and energy more sustainably. Farmers using the water for irrigation have also benefited, as they are able to buy water at a low price of 250 Indian rupees (INR) ($3.3 as at 12 May, 2020) per bigha (0,4 acres), as opposed to the INR 500 ($6.6) charged for the same area by diesel pump owners.[1] The pilot also reduces greenhouse gas emissions by replacing diesel with solar pumps, contributing to climate change mitigation efforts.

Approach

To discourage the overuse of groundwater, the state government gave farmers that owned pumps incentives to use solar energy to pump only the required amount of water for irrigation and thereafter generate electricity to sell back to the grid. In 2015, six farmers came together to form a farmer-led cooperative, Solar Pump Irrigators' Cooperatives Enterprise (SPICE), to capitalise on the opportunity.[2]

The farmers contributed INR 5,000 ($66) per kilowatt peak (kWp - the peak power of a solar PV system or panel) for the pumps, totalling INR 8.4 lakhs ($11,000). The remaining INR 60.8 lakhs ($80,000) was sourced from a research grant from IWMI and CGIAR.

The pumps formed a microgrid that was connected to a transmission line by the Madhya Gujarat Vij Company Limited (MGVCL), a local power utility. SPICE farmers gave up their electricity subsidy and accepted a 25-year power purchase agreement with MGVCL to sell electricity generated at INR 4.63 ($0.06) per kilowatt hour (kWh). In addition, IWMI offered INR 2.50 ($0.03) per kWh as a bonus to the farmers, taking the effective tariff to INR 7.13 ($0.09) per kWh.[3] With a 25-year power purchase agreement, the solar cooperative in Dhundi faces no price risk.[4]

Within six months of the microgrid operating successfully, three more farmers joined the cooperative.

Results

In the 12 months between June 2017 and May 2018, the nine SPICE farmers generated 103,161 kWh of electricity, of which only 26 percent was used for pumping groundwater for irrigation. The remaining electricity was sold to MGVCL. The farmers earned INR 5.26 lakhs ($6,935) through the sale of electricity alone. Moreover, it is estimated MGVCL can save close to INR 8 lakh ($10,547) per annum on the subsidy costs of providing electricity for the 25-year period of the power purchase agreement, while generating renewable electricity. This makes it a win-win for both the power utility as well as farmers.[5]

Success factors

The project is supported by both water sellers and buyers in the irrigation market, and is showing promise as a climate change mitigation strategy in agriculture:

- **Water sellers** – The incomes of the SPICE farmers increased by 45 percent from the 2015-2016 to the 2017–2018 period, with nearly half of their farm income coming from energy and irrigation sales.[6]
- **Water buyers** – Without the solar-pumps, 120 water buyers would have had to spend INR 5.4 lakh ($7,119) more for the same amount of water, had they purchased water from diesel pump owners.[7]
- **Climate change mitigation** – The solar pumps were estimated to have saved close to 40,000 kilograms of carbon dioxide emissions by 2018.[8]

The project would not have been a success without the cooperation of MGVCL agreeing to experiment with the new model and buy back electricity for 25 years. Farmers also took decisions independently without the interference of the organisations involved, ensuring the sustainable growth of the SPICE Cooperative. The cooperative has also made the sale of electricity more efficient. Each farmer does not sign a power purchase agreement with the power utility; rather, the cooperative can sell electricity back to the grid on behalf of all farmer members.

The Dhundi example shows how encouraging community ownership and providing financial support in the form of grants and subsidies can promote clean energy, provide farmers with an additional 'climate-proofed' income source and encourage a sustainable and buyer-friendly irrigation market.

Way forward

In June 2018, the Energy Minister of Gujarat recognised the potential of the solar pump project and launched Suryashakti Kisan Yojna (SKY), where farmers can generate solar electricity and sell the surplus to the grid. In 2019, the Government of India announced the Kisan Urja Suraksha Evam Uttham Mahabhiyan (KUSUM) scheme, which aims to scale up the use of solar energy for irrigation pumps.[9] The example of Dhundi village has demonstrated the potential of solar power as a "remunerative crop" for farmers.[10] However, all future schemes should promote the sale of electricity back to the grid, or there is a risk of groundwater exploitation.

Endnotes

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