India's climate tech revolution is starting in its villages

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Camels pulling wooden carts loaded with coconuts plod down the main road amid speeding motorcycles, buses, rickshaws and cars. Farmers sit atop slow-moving oxcarts loaded with grasses and other cattle feed. In this region of central Gujarat, India, it appears that rural life has not changed for decades.

But drive down a dirt road outside the village of Thamna, about an hour north of Anand, and the 21st century comes into view. Solar panels drive a water pump that irrigates the fields of farmer Raman Bhai Parmar, 65, who grows bananas, rice and wheat on seven acres of land.

Raman Bhai Parmar. Photograph: Lisa Palmer

Parmar's solar energy pump is one of the technologies being promoted by a new project designed to help rural Indians adapt to climate change. The project, run by the international NGO, the Consultative Group for International Agriculture Research programme on climate change, agriculture and food security (CCAFS), aims to create 1,000 so-called climate smart villages across six Indian states including Haryana, Punjab and Gujarat.

Haryana and Punjab are known as the grain basket states of India, producing the majority of the country's staple wheat and basmati rice for export to the Middle East and European markets. The pumping of groundwater for irrigation over the past thirty years has led to a spike in productivity and increased food security.

However, the region faces increases in temperature up to 5C by 2080 and wheat is particularly vulnerable to heat stress. A recent study by the Indian Agricultural Research Institute indicates that climate change may reduce wheat yields in India between 6% and 23% by 2050. Environmental problems such as depleting groundwater and variable rains – delayed monsoons and intense rainfall – limit yields. Indian farmers also typically use almost twice the amount of fertiliser needed, damaging soil, contaminating groundwater and adding to greenhouse gas emissions.

For rural communities in Haryana and Punjab the issue now is how to meet these new challenges, introduce more sustainable practices of farming and still increase yields and profits.

The pilot solar energy pump being used by Parmar is just one of the solutions promoted by the climate-smart villages project. In addition to energy, it provides a financial incentive for farmers to conserve water because they can sell energy back to the grid, thus helping to relieve stress on depleted aquifers. Last quarter Parmar, whose annual income from crops is roughly 65,000 rupees (£652), received a cheque for 7,500 rupees (£75) for producing solar energy.

“When you connect the solar pump to the grid and let the farmer use the energy they need for the pumping, and you give them the chance to sell the surplus solar power to the grid at an attractive price, then they will opt to do it,” says Tushaar Shah, senior fellow at the International Water Management Institute (IWMI) in Anand, which is working with CCAFS on the project.

Shah says government subsidises had given farmers’ little incentive to limit their use of diesel-powered irrigation pumps. “The solar energy will give the farmers a crop that is worth up to 90,000 rupees (£900) a year. We think this will reverse the current incentive structure that has led to over-pumping. There are very few crops farmers grow that will give you that income,” he adds.

Crucially, the climate-smart technologies, like the solar pump, are now beginning to gain acceptance among village communities.

When Vikas Chaudhary, 34, of Taraori, Haryana, learned farming from his father, rains came predictably during the monsoon and agriculture was a safe bet. Groundwater was plentiful. Soils were rich. Now that’s all a gamble for Chaudhary, who farms 35 acres and grows rice and a small plot of maize in summer and wheat in winter to support his extended family of seven.

Chaudhary has adopted climate-smart interventions including laser-guided land leveling of his fields, which he says has conserved 20% of water resources in his fields and has increased his yields by 15% through greater precision in seeding, tillage and measuring the moisture of soils.

Green Seeker crop sensor helps farmers work out how much fertilizer to use. Photograph: Lisa Palmer

Chaudhary uses a handheld crop sensor called a Green Seeker to assess crop health, a mobile phone app helps him calculate how much fertiliser to apply throughout the growing season. He also avoids tilling his fields, which helps the soil retain moisture and leads to fewer costs and fewer greenhouse gas emissions. However, the cost of the machinery needed to plant the rotational crop amid stubble from the previous season is a barrier for small farmers, he says. Most prefer to plant on bare soil.

While climate unpredictability has made farming more difficult in the past decade, Chaudhary’s greatest challenge was to change the thinking of his father, who lives on the farm and remains involved in the decisions.

“He is now fully impressed by climate-smart practices, and my vision is to change thinking of every farmer, especially young farmers, and how we can make agriculture more profitable,” said Chaudhary.

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