

Water & wastewater

Solar power's low cost to farmers

Solar-powered water pumps offer great potential but also bring problems. Mridu Khullar Relph reports on efforts to take water-pumping technologies for India's farmers to a new level, and hopes to transform and tackle the sub-continent's water pumping in irrigation with low-cost technologies

Earlier this year, the Indian government announced that it was looking to replace 26 million ground water pumps, currently running on grid electricity or diesel, with more efficient and solar-powered water pumps. According to news reports, the government will spend US\$1.6 billion over the next five years to get the first 200,000 solar-powered units deployed by giving farmers subsidies on their units.

Solar power requires no sales pitch to Indian farmers, who either aren't connected to the electricity grid at all, and are therefore reliant on expensive diesel generators to power irrigation pumps, or have electricity but the supply of which is unreliable at best. In fact, in 2012, many Indian farmers turned to diesel after the world's biggest blackout left 360 million people across India in the dark for days.

Diesel mafia

But diesel generators come with their own set of problems. There's the cost and maintenance of the generator itself, but diesel, too, is very expensive at several times the cost per unit of electricity. Then there's a diesel mafia that makes procuring it difficult. Not to mention the noise, the pollution, and the cost to the environment.

Solar-powered pumps, given India's unique circumstances, might

very well prove to be life — and livelihood-savers.

The biggest benefit of solar powered pumps, other than the reliability and the low cost of operation after the initial capital investment, is that there's no maintenance. No gears and no moving parts means that farmers can pretty much just switch it on, let the sun shine, and get electricity. In a country like India, where the sun shines unbearably through a large part of the year, it's hard to overstate the potential benefits.

But the idea of subsidies makes many cringe. "The history of major government subsidy in doing anything in a rural area in India is fraught with failure," says Paul Polak, the founder of International Development Enterprises (IDE), a nonprofit organisation that brought nearly 20 million

He says that what happened in the Soviet Union when bread was made free, farmers used it as pig feed, and supply became so short people had to wait in line for eight hours to buy bread, is exactly what has happened in rural India with electricity. "It may be free but as a result of the free electricity, farmers use very heavy overpowered technology, which leads to brownouts, which then lead to the diesel pumps."

Private sector

Mr Polak has another idea. He's convinced that the only path to sustainable models of scale is through the private sector and so Mr Polak set up a for-profit company called SunWater that is in the process of manufacturing a solar pump at a significantly lower cost than the currently available technologies.

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of the world's poorest people out of poverty. "If you take this very field as an example, the Government of India came to the conclusion that electricity needs to be subsidised, and in fact, electricity for pumping irrigation water is now pretty much free."

Today, 19 million diesel engines are being used to pump irrigation water from shallow wells in India alone, spewing millions of tons of carbon into the atmosphere, he writes on his website. "If marketplace forces could replace a quarter of them with radically affordable

photovoltaic-powered pump systems, we could transform small farmer livelihoods and radically reduce rural carbon emissions.”

Mr Polak's team is in the process of developing a two-kilowatt solar-powered system that will do the work of a five-horsepower diesel pump, the most commonly used size. It would cost \$2,500 as opposed to the current \$7,000 solar technologies and when used in conjunction with a low-cost efficient drip-irrigation technology, could be paid off by farmers in as little as two years with no follow-up or maintenance costs.

How it All Began

Mr Polak's work began 30 years ago when he created an organisation called International Development Enterprises or IDE that helped 20 million one-acre farmers who lived on less than a dollar a day move out of poverty by doubling their income. “That started with my personally interviewing a dollar a day small farmers all over the world, places like India, Bangladesh, Vietnam and Sub-Saharan countries like Zambia, Zimbabwe, and so on,” he says. “When I asked them how they could make more money, they said most of them made their income farming and to improve it they needed water control for their crops because if they could grow crops in the dry season, the prices were double and they could make a lot more money. So what we did then as an organization in each country was make small plot irrigation devices available at scale that were affordable on a dollar-a-day income.”

The first of these water technologies was the treadle pump, a device that operates something like a Stairmaster. The farmer walks on two bamboo treadles that activate a double piston suction pump. “It produces, sustainably, about half a liter per second, which is enough to add between a quarter and three quarters an acre of vegetables in the dry season in places like Bangladesh and eastern India, which is mostly shallow ground,” says Mr Polak. The device retailed for \$25 and IDE went on to sell two million treadle pumps in the developing world.

The problem, however, was that if they could afford it, farmers didn't want to continue the manual labor that the treadle pump required and opted for diesel pumps instead. In addition to the many cost and environmental problems

associated with diesel pumps, Polak says farmers in Eastern India who bought diesel pumps then sold their excess water to other farmers and that created water markets which began to compete with treadle pumps.

Now Mr Polak wants to take water-pumping technologies to an entirely new level. Since handing over IDE, Mr Polak has created four for-profit organisations with the goal of helping 100 million \$2 a day customers move out of poverty, generating 10 billion in annual revenues, and earning sufficient profits to attract commercial investment. One of those companies, SunWater, aims to tackle water pumping in irrigation with new low-cost technologies.

For the project, Mr Polak raised \$33,000 from an online crowd-funding website and created a team to work on this project, including 20 rocket scientists from Ball Aerospace & Technologies who are volunteering their time. “They're sort of intrigued,” he says of the rocket scientists. “Because their design parameters for space are ‘price is no object’ but failure is not allowed. For designing a breakthrough in affordability pumping, price is everything. And there are tradeoffs about quality at price. The parameters I gave them was to lower the retail price of what can be accomplished by a 2 KW solar pumping system, from \$7,000 to \$1,500 and I think we've gotten there.”

Glass and mirrors

The way Mr Polak's team is doing this is by focusing on small changes. On his website, Mr Polak explains how a simple glass mirror can be used in place of a solar panel. “If we reflect the sunlight hitting ten glass mirrors that are a little bit bigger than the surface area of a 250 or 300 watt solar panel, we should be able to generate 2,000 watts from it. Since we're pumping water, we can pump a small amount of water through a simple heat exchanger on the back of the PV panel to keep it from overheating. The mirror system would need to be incorporated into a simple frame that could be rotated to track the sun. This is just one of the out-of-the-box solutions that could lower the cost.”

He notes that each component of the system will be designed or selected to provide the most cost-effective solution that optimizes total system performance. “I'm looking to raise \$100,000



Indian farmers such as this one have been beset with difficulties regarding their vital water pumps. Photography: Shutterstock.

to do the beta test and then we'll set up a practical business plan for a for-profit business than in the beginning sells these systems probably through existing diesel pump distributor networks,” says Mr Polak.

He says they expect to have two working models ready for the next phase very soon and what will follow is a six-month to a twelve-month beta test, which will mean putting the prototype on actual farmers' plots, learning from their experience, correcting and adapting the technology and also designing a business strategy. “We'll bring groups of typical farmers together in Gujarat where we'll be testing these pumps and we'll see what they find attractive, what they find unattractive and then adapting the technology. It may be radically affordable, but it may not meet consumer preferences.”

Then, it'll be a simple question of bringing the product to market and allowing the farmers, the customers, to speak with their money. ■

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