The Promise of Dhundi Solar Pump Irrigators' Cooperative

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In early 2016, the world's first ever Solar Pump Irrigators' Cooperative Enterprise (SPICE) began operations in Dhundi village of Kheda district in Gujarat. Solar pumps are not new to India; but Dhundi cooperative represents a novel experiment. Members of this cooperative are using solar power not only to run their irrigation pumps, but also pooling the surplus energy to sell to the Madhya Gujarat Vidyut Company (MGVCL) at ₹ 4.63/unit under a 25-year power purchase agreement (PPA). In addition, IWMI-Tata Program¹ and CCAFS² will offer ₹ 1.25/unit as Green Energy Bonus and another ₹ 1.25/unit as Groundwater Conservation Bonus, taking the total pay-out per unit to ₹ 7.13. In May 2016, the Dhundi cooperative received their first payment for solar energy sales. And by December 2016, the cooperative had already earned more than ₹ 1,60,000 from energy sales.

The Dhundi SPICE's six solar pumps, having an aggregate capacity of 56.4 kilowatt-peak (kWp), can potentially generate nearly 85,000 units (kilowatt-hours) of energy annually, assuming an average 5 units per kW daily over 300 sunny days. Of these, the six farmer-members would use some 40,000 units for watering their seven acres and inject the balance 45,000 units into the grid, grossing over ₹ 3 lakh revenues from solar energy sales.

Under the PPA, the six farmers have surrendered their right to apply for grid power connections for 25 years. Solar power for them comes much cheaper than diesel – some 7500 - 8000³

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¹ A 15 year old partnership between Colombo-based International Water Management Institute and Tata Trusts, Mumbai.
² Climate Change, Agriculture and Food Security program of the Consultative Group on International Agriculture Research.
³ In terms of gross calorific value, we need only 3600 litres of diesel to produce 40,000 units of electricity; but since the efficiency of diesel pumps in field conditions is less that 40 per cent, we need twice or more diesel to replace 40,000 units of electricity.
litres are required for producing 40,000 units equivalent of groundwater pumping – and is also more reliable than subsidised grid power that is available for 7-8 hours, that too with voltage fluctuations and during night in half of the days every month. Solar power, by contrast, is uninterrupted, predictable, available during daytime and free of cost.

Further, this is a cash crop that can be 'grown' without the need for any seeds, fertiliser, pesticides, irrigation or backbreaking labour. Income from it is free of risk from drought, floods, pests and diseases. All that is required is land for erecting panels. The farmers initially were worried about the land-footprint of solar panels; but they are already experimenting with a range of high-value crops like spinach, carrots, garlic, beet and some medicinal plants that grow well under panels. Some also planted paddy under the panels; and the yield was only marginally lower.

The Dhundi-pattern SPICE arguably deserves a better feed-in tariff than megawatt-scale solar power plants or even roof-top installations. Megawatt scale plants require large public investments in transmission, whereas in the case of Dhundi, the micro-grid was erected by farmers at their own expense. Rooftop solar plants, similarly, will ultimately deprive MGVCL of income from its highest-paying consumer segments.

The Dhundi SPICE, on the other hand, will liberate MGVCL and the state government from debilitating farm power subsidies. Had the Dhundi farmers got grid power connection of 56.4 kW instead of solar pumps, MGVCL would have been obliged to provide them over
162,000 units of electricity – taking eight hours supply for 360 days – at ₹ 0.70/kWh against its cost of ₹ 4.5/kWh to deliver. Even if only two-thirds of the power supplied was used, MGVCL would have had to bear a subsidy of well over ₹ 4 lakh annually. In addition, MGVCL would have invested ₹ 12 lakh on poles and cables to connect the tube-wells to the grid, at ₹ 2 lakh per new connection. One can take the annual interest and depreciation cost on this investment at a conservative 10 per cent or ₹ 1.2 lakh.

Lastly, MGVCL stands to earn from the sale of renewable energy certificates (REC). Under the PPA signed, the sale of RECs on the entire 85,000 units generated by the Dhundi SPICE would accrue to MGVCL. Taking the current value of ₹ 3,500/megawatt-hour for RECs traded on electricity exchanges, this works out to an additional annual income of almost ₹ 3 lakh.

Taken together, the subsidy on grid power saved, not having to bear the amortised cost of connecting tubewells, and sale of RECs would leave MGVCL better-off by about ₹ 8.2 lakh annually for 25 years, thanks to the Dhundi SPICE. This ₹ 8.2 lakh over 45,000 units would work out to a gain of ₹ 18.2 per kWh. Even if the DISCOM were to share a third of it with the Dhundi SPICE, the latter’s members would be entitled to a higher feed-in tariff of about ₹ 6.05 per unit (kWh). In buying solar energy from the SPICE, MGVCL’s break-even feed-in tariff offer can be anything up to ₹ 6.05 per kWh plus its average power purchase cost of ₹ 3.50/kWh. Even after that, it will be better-off than supplying grid power at ₹ 0.70 per kWh.

There is a lesson to be learnt here. State governments until now have promoted solar irrigation pumps by offering around ₹ 90,000/kWp subsidy on capital costs to farmers who opt out of grid power connections. But a better way to promote solar pumps could be through PPAs that guarantee attractive feed-in tariffs to such solar coops. The capital cost subsidy on solar pumps can actually be scaled down to, say, ₹ 50,000/kWp and farmers could, instead, be offered
feed-in tariffs of ₹ 6.5 - 7.5/kWh provided they shifted to solar power. Indeed, one can argue that government and DISCOMs are better off solarizing electric tubewells even if farmers are unwilling to surrender their grid connections but agree to being net-metered. Under this arrangement, farmers have access to solar energy during the day and grid energy during the night; however, they get paid only for solar energy sold net of grid power used in pumping. Effectively, thus grid power too has the same cost as the feed-in tariff for solar energy.

Power distribution companies or DISCOMs would, of course, loath the prospect of net-metering, billing and paying individual farmers supplying small marketable surplus of solar power. The transaction and vigilance costs would be too high. But a Dhundi-pattern SPICE could be the answer there. Even as new members join, MGVCL will meter the cooperative at a single evacuation point and pay the SPICE for pooled power sales. It will be the cooperative's responsibility to meter each solar pump and pay each member based on the power evacuated by him/her.

India currently has over 15 million grid-connected irrigation tube-wells accounting for an estimated ₹ 70,000 crore of power subsidies. Cutting them isn't going to be easy, given the fear of farmer backlash. The Dhundi model can painlessly eliminate farm power subsidies once and for all. They can also be the answer for groundwater overexploitation, as the existing regime of electricity subsidies mutes farmers' incentive to conserve both power and water. In this case, by weaning farmers off grid power, farmers are being helped to make money by conserving energy and water. Moreover, metering energy will make it possible for measuring water withdrawals to manage a scarce natural resource better.

With proper promotion, Dhundi-pattern SPICEs can have the kind of impact on small farmer livelihood systems that Amul-type dairy cooperatives have had in many parts of India. A 7.5 kWp solar pump, with an assured power buy-back contract at ₹ 7.0/kWh, can help a one-hectare farmer meet her irrigation needs and generate extra net income of up to ₹ 60,000 per annum, equivalent to what three buffaloes can now give.

Besides, it also has the promise of making irrigation climate-smart. Using electricity and
emissions, which is about five per cent of India’s total. Solarizing our groundwater economy will eliminate this huge carbon-footprint, reducing the carbon-intensity of the country’s economic growth.

Dhundi SPICE is albeit a small experiment. But it can go a long way in reconfiguring our power economy, our groundwater economy and agrarian livelihoods favourably towards a climate-resilient future.

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