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The Promise of Dhundi Solar Pump Irrigators' Cooperative

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The Promise of Dhundi Solar Pump Irrigators' Cooperative

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 Vij Company Limited* (MGVCL) under a 25-year power purchase agreement (PPA). The sale of solar power by the cooperative started in May 2016 and by August 2018, the cooperative had already earned more than ₹950,000 from surplus solar energy sales (Figure 1).

Six solar pumps with a cumulative capacity of 37.5 HP (with 56.4 kWp solar panels) were installed in Dhundi village in January 2016; the cooperative was formally registered in February 2016, the power sale by the cooperative only began in May 2016. Three more farmers joined the cooperative in December 2016, taking the total capacity of the solar installations to 52.5 HP (with 71.4 kWp solar panels). As part of the PPA with MGVCL, the initial six farmers got a feed-in-tariff of ₹4.63/kWh; the latter three farmers were offered ₹3.24/kWh, as by the time they joined, the solar tariffs in the country had plummeted. Apart from ₹4.63, the initial set of farmers also received ₹2.50/kWh sold to MGVCL as Water Conservation (₹1.25/kWh) and Green Energy (₹1.25/kWh) bonus from IWMI and CCAFS for 24 months, which ended in May 2018. The three farmers who joined later will continue to receive these bonuses from IWMI till August 2019. Over the last 12 months, the nine solar pumps of Dhundi cooperative[1], with an aggregate capacity of 71.4 kilowatt-peak (kWp), generated about 106,000 units (kWh) of energy. Of this, the members used some 26,500 units for irrigating their own and their neighbors' fields while injecting the balance ~79,500 units into the grid.

As part of their PPA with MGVCL, the nine member farmers gave up their right to apply for farm power connection for 25 years. If the farmers were to irrigate using diesel-powered pumps, they would need some 6,000[2] litres of diesel to produce 26,500 kWh equivalent of groundwater pumping. At ₹70 per litre, this would entail an expenditure of ₹420,000. Subsidized grid power is much cheaper but it is available only for 7-8 hours per day, that too with variable voltage profile and often during inconvenient night hours. Solar power, by contrast, is uninterrupted, predictable, available during daytime and free of cost. Further, as a cash crop that can be 'grown' without the need for any seeds, fertilizer, pesticides, irrigation or backbreaking labor, solar power offers income that is free of risk from droughts, floods, pests and diseases. All that is required is a few square meters of land for erecting panels. The farmers initially were worried about the land-footprint of solar panels and tried growing various crops including spring onions, spinach and eggplant, under the solar panels over the last two years. Now they have fine-tuned their practices for cultivating land under the panels and minimizing the land footprint.

The Dhundi-pattern SPICE arguably deserves a better feed-in tariff than megawatt-scale solar power plants or even roof-top installations as solar pumps at Dhundi not only replaced existing diesel pumps but also future subsidy-guzzling electric pumps. Megawatt-scale solar plants require large public investments in transmission, whereas in the case of Dhundi, the micro-grid was erected by farmers at their own expense and energy is being

Picture1: Hon'ble Energy Minister of Gujarat, Sh. Saurabhbhai Patel paying monthly payment to Dhundi Coop as it completes 1st year of successful electricity sale on 2nd May 2018

[1] Total nine solar pumps- three 5HP (with 5kWp panels), three 5 HP (with 8kWp panels) and three 7.5 HP (with 10.8 kWp panels).
[2] In terms of gross calorific value, we need only 2,400 litres of diesel to produce 26,500 kWh-equivalent of energy; but since the efficiency of diesel pumps in field conditions is less than 40 per cent, we need roughly 6,000 litres of diesel to replace 26,500 kWh of energy.

Picture 2: Director at Ministry of New and Renewable Energy (MNRE) at New Delhi, Sh. J.K. Jethani visited Dhundi and met the members of the Dhundi Coop.

Picture 3: Farmers participating in SKY scheme visit Dhundi to understand the SPICE model

generated much closer to where it will be used. When replicating the model in a village having electricity network for farm power, the existing infrastructure can be used. Rooftop solar plants will ultimately deprive electricity utilities of income from their highest-paying consumer segments. The Dhundi SPICE, on the other hand, liberated MGVCL and the state government from debilitating farm power subsidies. The average agriculture electricity consumption in the central Gujarat region served by MGVCL[3] is 830 kWh per HP of installed capacity[4], which translates into a subsidy of ₹3,154/HP/year considering the tariff charged to be ₹0.70/kWh against the cost to serve of ₹4.50/kWh. If Dhundi farmers were using the subsidized electricity, MGVCL would have had to bear a subsidy of around ₹170,000 annually; in addition to the capital expenditure of ₹1,350,000 on poles and cables for connecting tube-wells to the grid, at ₹150,000 per new connection. One can take the annual interest and depreciation cost on this investment at a conservative 10 per cent or ₹135,000.

Finally, MGVCL stands to earn from the sale of renewable energy certificates (REC). Under the PPA signed, the sale of RECs on the entire generation by the cooperative 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 for MGVCL of almost ₹370,000.

Solar pumps at Dhundi not only replaced existing diesel pumps but also future subsidy-guzzling electric pumps

Taken together, thanks to the subsidy saved on grid power, not having to bear the amortized cost of connecting tubewells, and sale of RECs would leave MGVCL better-off by about ₹680,000 annually for the next 25 years. This gain over the roughly 80,000 kWh/year evacuated by the farmers works out to ₹8.50 per kWh. Even if the DISCOM were to share a third of this with the Dhundi cooperative, the member farmers would be entitled to a higher feed-in tariff of about ₹7.00 per kWh. In buying solar energy from farmers, MGVCL's break-even feed-in tariff offer can be computed as this gain plus its average power purchase cost (APPC), roughly ₹3.00/kWh. Thus, even after buying surplus power from farmers at ₹10.00/kWh (₹7.00/kWh gain + ₹3.00/kWh APPC), MGVCL would be better-off than by supplying subsidized grid power at ₹0.70/kWh.

There is a lesson to be learnt here. State governments until now have promoted solar irrigation pumps by offering around 80-90 per cent subsidy on capital costs to farmers who opt out of grid power connections. A better way to promote solar pumps could be through PPAs that guarantee attractive feed-in tariffs to farmers for replacing their existing subsidized grid connections. The capital cost subsidy can easily be scaled down to 30 per cent (central assistance through MNRE), and farmers could be offered ₹3.50/kWh as base tariff for 25 years which can be topped up by an additional ₹3.50/kWh as an 'Evacuation Based Incentive' (EBI) for initial few years to aid loan repayment by farmers. In fact, government and DISCOMs would be better-off solarizing electric tubewells even if farmers are unwilling to surrender their grid connections but agree to being net-metered at the base tariff. Under such an arrangement, farmers will have access to solar energy during the day and grid energy during the night; however, they will get paid only for solar energy sold net of grid power used in pumping.

Government of Gujarat's SKY scheme (Suryashakti Kisan Yojana) has scaled up the Dhundi model to 11-kV feeders.

Electricity distribution companies or DISCOMs would not like the prospect of net-metering, billing and paying individual farmers; each supplying small amount of solar power to the grid. The transaction and vigilance costs of such an arrangement would be too high. However, a Dhundi-type cooperative of farmers that can pool the small surpluses of its members and evacuate to the grid at a single point would make the DISCOMs operations very manageable.

Picture 4: Sh. P. Parmar, Sec, Dhundi Coop, discussing Dhundi Model at SKY scheme inauguration

Inspired by the success and popularity of the Dhundi solar cooperative, the government of Gujarat recently

[3] Seven districts namely Anand, Chota Udaipur, Dahod, Kheda, Mahisagar, PanchMahal, Vadodara are served by MGVCL
[4] Considering 20 per cent T&D losses.

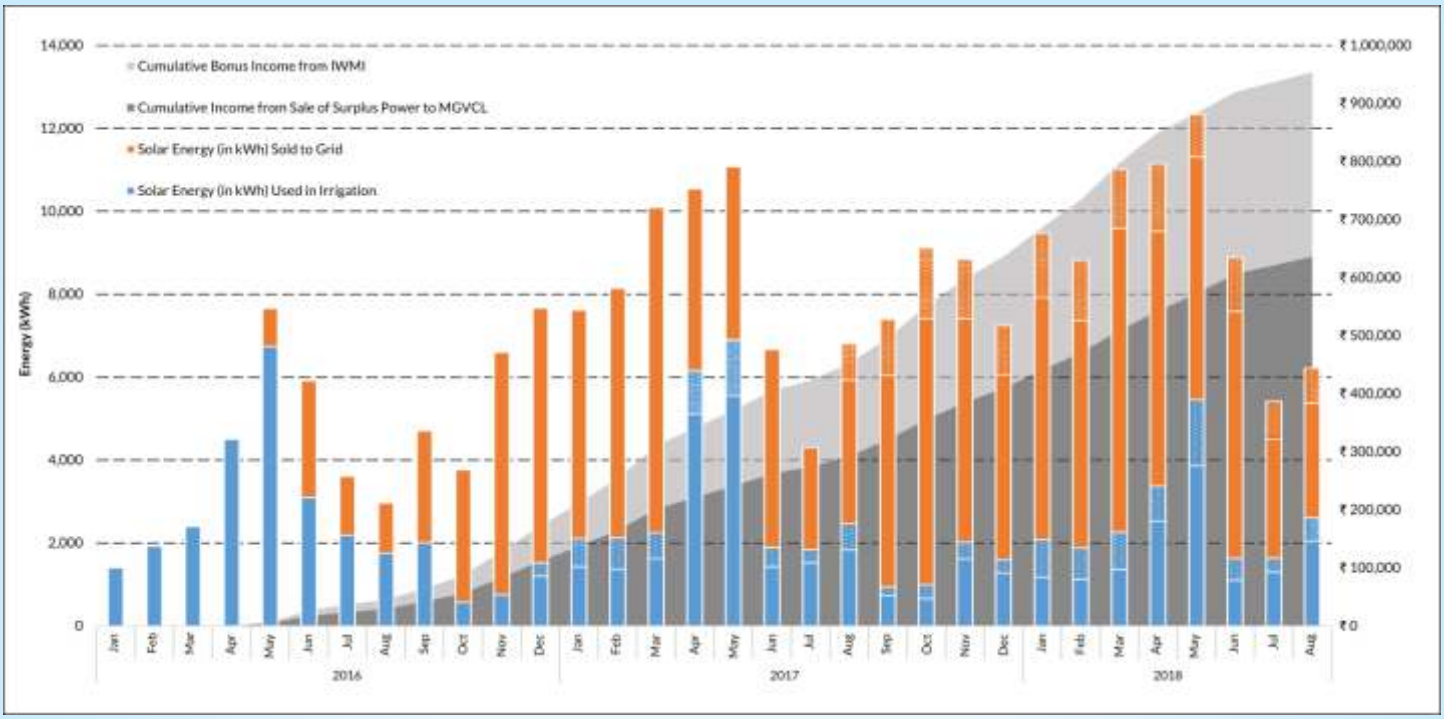

Figure 1: Monthly Electricity Used and Sold along with Income Generated by Dhundi Coop

announced SKY (*Suryashakti Kisan Yojna*) – a new solar scheme that has taken the SPICE idea to the scale of 11 kV feeders. Under the first phase of SKY, 137 feeders across Gujarat will be solarized; farmers will be offered a base tariff and an EBI for selling surplus solar power to the grid. While the scheme does not insist on farmers registering a formal cooperative, it is proposed that any T&D losses in excess of 5 per cent technical losses will be pro-rata divided among all solar farmers on the feeder. As the metering and payment for surplus electricity sold will be done for farmer, the transaction costs for the DISCOMs will increase,which will eventually have to be borne by the farmers and consumers. If it were possible for DISCOMs to avoid these transaction costs, they might have been able to offer better feed-in-tariffs to farmers.

India currently has over 15 million grid-connections for irrigation that account for an estimated ₹70,000 crore annual farm power subsidy bill for the exchequer. Reducing or eliminating farm power subsidies would require a very bold and self-assured government, for fear of strong farmer backlash. The Dhundi model of solarization offers a painless option to for eliminating farm power subsidies and reversing the perverse incentives it creates for farmers to over-use energy and groundwater. By weaning farmers off grid power, the financial viability of electricity utilities will also improve; using clean solar energy for pumping and injecting clean energy into the grid will also reduce the carbon footprint of India's massive groundwater irrigation economy. Most importantly, the ability to cultivate solar power as a remunerative crop will offer farmers an additional, reliable and counter-climatic source of income. Doing this will also significantly contribute to India's ambitious target of achieving 100 Giga-watt of installed solar capacity by 2022.

The Dhundi model of solarization offers a painless option for eliminating farm power subsidies and reversing the perverse incentives for farmers to over-use energy and groundwater.

With proper promotion, Dhundi-pattern SPICE cooperatives can have the kind of impact on small farmer livelihoods that Amul dairy cooperatives have had in Gujarat. A 7.5 kWp solar pump, with an assured power buy-back contract at ₹7.00/kWh can help a one-hectare farmer meet irrigation needs and generate a net income in excess of ₹50,000 per annum; equivalent to what three buffaloes generate. This can truly be termed as 'climate-smart' irrigation – promoting clean energy, reducing the pressure on scarce groundwater, improving the viability of electricity utilities and significantly enhancing farmer incomes.

Albeit a small experiment, the *Dhundi Saur Urja Utpadak Sahkari Mandali* (Dhundi Solar Pump Irrigators' Cooperative) promises to inspire positive transformation in the energy, groundwater and agrarian economies of the country.

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