

## Harvesting solar riches

Growing agrarian stress, climate change, farmer suicides and an unpopular land bill are all colluding to turn the farm sector into prime minister Narendra Modi's possible Waterloo. After decades of subsidies and sops, Indian agriculture still remains the parking lot for the poor for whom non-farm jobs remains a distant dream. Modi's promised acche din remain a pipedream unless his government finds some magic formula to quickly raise farm incomes.

One such formula remains hidden in our solar mission. An immensely promising proposition is helping farmers to make money by 'growing' Solar Power As Remunerative Crop, an initiative we can call SPARC. All we need to do is give farmers solar irrigation pumps with a power-purchase guarantee that megawatt-scale generators get. Karnataka's Surya Raitha scheme is already piloting this idea.

A one-hectare farm can generate annual gross revenue of R50,000 from field crops and R150,000 as an orchard. But if put under solar PV arrays, one hectare can generate over R1 crore/year from solar power. This revenue is free of risk from droughts, floods, pests and diseases. Moreover, growing solar power does not need seeds, fertiliser, pesticides, irrigation and backbreaking labour. All it needs is land, and farmers own half of India's land.

The National Solar Mission's goal, to install 100 gigawatt of solar capacity by 2022, can be met by 10 million farmers, each operating a 10-kilowatt solar pump. A solar pump can generate 13,000 units of power/year worth R65,000 on just 1/25th of a hectare. 10 million solar farmers can 'grow' 130 billion units of solar power and earn upto R65,000 crore/year net of input costs. This is way more than all our rice farmers earn toiling on 45 million hectares.

Going solar for irrigation could have massive collateral benefits. It can revitalise stagnant agriculture in eastern India, which is flush with groundwater but short on energy to run pumps. Solar pumps here can expand winter- and summer-cropping and reduce farmers' vulnerability to flood-losses during the kharif season.

In much of western India, perverse farm subsidies on grid power have left all stakeholders worse off. Electricity utilities are bankrupt. Aquifers are depleted. Even farmers are unhappy with poor quality of rural power supply. Yet, breaking out of this gridlock has proved difficult all these years because of invidious vote bank politics.

Solar pumps offer a smart way out of the deadweight of power subsidies. A quarter of India's power is sent to dispersed farms causing massive technical and commercial losses. Every solar pump replacing a grid-connected pump saves the utility over 12,000 units of grid power at generating stations, saving subsidies and freeing up grid capacity for the non-farm sector. In theory, the country can save R60,000 crore/year in subsidies by going solar for all 11 million electric pumps.

There is a catch, though. Solar pumps may accelerate groundwater depletion by making abundant day-time solar power available to farmers free of cost. For aquifers, solar pumps may prove worse than free power unless, as in our SPARC proposal, a credible power purchase guarantee makes it attractive to sell solar power to the grid than to use it to pump groundwater. Even at a feed-in tariff of R5/unit, SPARC will be a powerful antidote to groundwater overexploitation. But surrendering grid connection must be a pre-condition to power-purchase guarantee to prevent unscrupulous farmers selling solar power to the grid and using free grid power to deplete aquifers.

Using solar power for irrigation pumps can cut the carbon-footprint of Indian agriculture and bolster the country's role in the war against climate change. India's 11 million electric tube-wells use 117 billion units of electricity and emit 110 million metric tons of CO<sub>2</sub> annually. In addition, 9 million diesel pumps burn some 7 billion litres of diesel for irrigation and emit additional 20 million metric tons of CO<sub>2</sub>. By using solar power for groundwater, we can curtail India's annual CO<sub>2</sub> emissions by nearly 6%.

What is needed to implement such a disruptive idea as SPARC? First, the Solar Mission needs to embrace

SPARC as our national solar strategy. Second, discoms need to be incentivised to buy surplus solar power from small, dispersed farmer-generators because otherwise, they will always prefer buying solar power from megawatt-scale generators. Third, to reduce transaction cost of dealing with small, dispersed suppliers, solar pump irrigation in every village should be organised as a cooperative to pool and evacuate surplus power collectively at a single point that the discom can measure and monitor. Fourth, farmers should be provided a flat subsidy of R40-50 thousand per kW rather than pro-rata 80-90% of capital cost to minimise gold-plating of PV costs. Five, beyond irrigation needs, farmers should have freedom to expand, at their own cost, solar power generation for sale to the grid. Finally, under a credible power purchase guarantee and organised into a cooperative, solar pumps are eminently bankable and a menu of subsidy-loan products can be offered for farmers to choose from while switching from grid to SPARC-enabled solar pumps.

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