Is Solar a solution to Blackouts in India: A case study with agriculture diesel pumps sets?

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Introduction

India suffered the worst blackouts in history this year, which left over 600 million people without power. The lights are back on, for now, but the crisis is evidence of deep problems in a sector teetering on the edge of bankruptcy for the second time in a decade. The deeper problem, however, stems from decades of populist pricing and inefficiency that have pushed losses at state utilities to an estimated $10 billion in the year that ended in March 2012, according to the Planning Commission, a top government advisory body. Politicians currying favour with the farm vote have granted free or heavily subsidized power for agriculture, while idealists have fought to bring affordable light to the poor.

The electricity consumption in agriculture sector amounts to 27% of total consumption of electricity of 317 TWh in the country during 2000-0. Irrigation pumps used in the agriculture sector account for about 25% of electricity consumption in India. This share is reported to be
48.89% in Gujarat, 43.39% in Haryana and 42.27% in Karnataka. Most electrical consumption in this sector goes towards operating pump sets for irrigation. There are about 21 million irrigation pump sets in India, of which about 9 million are run on diesel and the rest are grid-based. Irrigation water pumping Solar Photovoltaic (SPV) theoretically has an advantage in meeting the needs of remote communities because of the high distribution costs of grid-power to this market and the competitive position with respect to diesel has improved with the recent rising oil prices. A surface pump powered with a 1.8 kWP PV array can deliver about 140,000 litres of water on a clear sunny day from a total head of 10 meters. This quantity of water drawn has been found to meet the irrigation requirement of 5-8 acres of land by using improved techniques for water distribution.

**Government of India Policy and Current Status**

A SPV Pumping System installation program has been taken up by the Horticulture Department of the Government of Rajasthan (GOR). Applicants may avail of an 86% subsidy from the Jawarhalal Nehru National Solar Mission (JNNSM) and the Rashtriya Krishi Vikas Yojana (RKVY). MNRE is providing 30% subsidy under the JNNSM, while the Government of Rajasthan through the RKVY makes the remaining 56% available. This is a special scheme by GOR. For other states only MNRE is providing 30% subsidy under the JNNSM. Only 7334 solar PV water pumps having been installed across the country, as of March 2010.

**Challenges with Diesel to Solar Conversion**

If farmers get free electricity, they have no incentive to switch. For diesel pumpsets, there may be an incentive but subsidies are limited for a large scale switch from diesel to SPV pumpset. The key barrier to the large-scale dissemination of solar PV water pumps is the high capital cost incurred by farmers compared to the much lower capital cost of conventional pumps. SPV The cost of 2-HP solar water pump is Rs 4 lakh (8,000 USD) while a 5-HP pump costs Rs 10 lakh (18,000 USD).

**Financial Analysis of SPV versus Diesel systems**

<table>
<thead>
<tr>
<th>Year</th>
<th>Solar Pumpset (3 HP ) 3000 Wp</th>
<th>Diesel Pumpset (5 HP)</th>
<th>Cumulative Difference (A-B)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital Cost</td>
<td>Running Cost</td>
<td>Maintenance Cost</td>
</tr>
<tr>
<td>1</td>
<td>10,364</td>
<td></td>
<td>10,364</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0</td>
<td>2,304</td>
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<tr>
<td>3</td>
<td>9</td>
<td>9</td>
<td>2,534</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>9</td>
<td>2,788</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>9</td>
<td>3,067</td>
</tr>
</tbody>
</table>
1 USD = 55 INR

From the above table, it is clear that the SPV pump sets break-even is for 3 years. After that the same results in substantial savings for rest of the life (expected life of a solar panel is around 20-25 years)

**Recommendations for a massive phase out of Diesel Pumpsets**

There is a need to aggregate demand for SPV pumpset at the national level to benefit from economies from scale and bring the price down. It can be assumed that one third of the total diesel pump sets in India (i.e. 3 million) could be switched in SPV as there are some states like Gujarat where ground water availability is as low and SPV pump sets may not work efficiently in these states. However water level in states like Bihar, Uttar Pradesh, and West Bengal is high and are predominantly agriculture states. After aggregation MNRE could invite expressions of interest from solar pump set manufacturers on auction system. MNRE may follow the similar route like JNNSM where bidding system for 500 MW of grid connected SPV brought the tariff down to 7.49 INR/unit (15 US cents/unit) from a reference price of 15 INR/unit (30 US cents/unit). MNRE could help manufacturers enter into agreements with financial institutions like multilateral development banks (MDBs) to obtain soft loans offer pumps to the farmers.

MNRE, MDBs and manufacturing companies with other partners could roll out a new Non Banking Financial Company (NBFC) soon for providing loans to farmers. Main activities of NBFC would include financing farmers for MIS, agri projects, contract farming, small businesses, setting up solar pumps and other appliances. As an NBFC, companies can leverage capital by as much as 7 times, and this would enable it to finance management information systems, contract farming, small business loans, etc, to farmers. As a result, the company's requirements for funds, relative to sales, could decline, which in turn could streamline its debt and reduce the interest cost, leading to better earnings in coming years.
Impact of Switching 3 Million diesel pumpsets to solar

It saves the consumption of fossil fuels, wherever diesel pumpsets are being used. (For 500 pumpsets, it results in a saving of around 2500 litres of diesel on 5 hours running every day i.e. for one year (240 days) approx. 12,00,000 litres of diesel is saved). Wherever electric pumpsets are used, it would yield in saving of valuable electric energy which could be diverted for other useful purposes. (For 50 pumpsets, it results in a saving of around 600 units of electricity per day i.e. for one year approx. 300 (300 days) MW Hrs. of electric energy is saved.

Conclusion

In India enough sunlight is available along with clean sky almost all through the year, there is a need to encourage the nonconventional energy systems like SPV pumps in agriculture sector. This experience is being replicated at farmers field with more than 7000 SPV pumps in different states of India. The experience of the ongoing and completed projects makes a compelling business case for this sector to go ahead and a project of 3 million solar pumps could be implemented.