Solar Water Pumping for Irrigation

Potential and Barriers in Bihar, India

Background

A complex set of factors such as global warming, increasing competitive land use, and the growing mismatch between energy demand and supply is creating new challenges for the vast agrarian population in India. Diesel for running irrigation pumps is often beyond the means of economically marginalized farmers. Insufficient irrigation can lead to crop damage, reducing yields and diminishing income. Environment-friendly, low-maintenance photovoltaic pumping systems offer new possibilities for pumping irrigation water.

GIZ under the Indo-German Energy Programme – Renewable Energy Component (IGEN-RE) commissioned a study to explore the potentials for solar irrigation pumps in Bihar. This document captures the key findings from the study.

Status of solar water pumping in India

The **first phase of market development** for solar PV water pumping in India goes back to 1993-94.The programme of the Ministry of New and Renewable Energy (MNRE), then known as Ministry of Non-Conventional Energy Sources, aimed for deployment of 50,000 solar PV water pumping systems for irrigation and drinking water across the country. MNRE provided the financial assistance required for subsidizing the capital and interest cost of the solar pumps. MNRE's funding was channelized by either the implementing agency - the Indian Renewable Energy Development Agency (IREDA) - or the State Nodal Agencies (SNAs). IREDA also provided additional financing for the unsubsidized portion of the system costs from its own budget. Yet, the programme fell short of achieving its desired target.

Market potential for solar water pumps in India

The Centre for Study of Science, Technology and Policy (C-STEP) estimates 9 million diesel water pumping sets in use in India. If 50% of these diesel pumps were replaced with solar PV pump sets, diesel consumption could be reduced to the tune of about 225 billion litres/year.

Hamburgisches Welt Wirtschaftsinstitut (HWWI) estimates the potential to be 70 million solar PV pumps by 2020 (14 million in Uttar Pradesh & 11 million in Bihar).

KPMG estimates approximately 16,200 MW as the total potential in the agricultural sector by 2017-22.

With the launch of the **Jawaharlal Nehru National Solar Mission (JNNSM)** in 2010, the solar water pumping programme of the MNRE was integrated with the off-grid and decentralized component of the JNNSM. There under, solar PV water pumping systems are currently eligible for a financial support of 30% subsidy, subject to a benchmark price of Rs. 190 per peak watt (Wp) from MNRE. Several states such as Rajasthan, Gujarat, Chhattisgarh, Uttar Pradesh, Maharashtra, Tamil Nadu and Bihar have taken up initiatives to implement solar PV water pumping programmes using the financial assistance of JNNSM and funds available from the respective state governments.

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Solar water pumping potential in Bihar

The potential for deployment of solar PV water pumping depends on a set of socio-enviromental factors. With respect to the factors mentioned below, it is evident that Bihar has a great potential for deployment of solar pumps. Moreover, the increasing costs of fossil fuels and diminishing costs of solar PV modules further facilitates the adoption of PV pumping technologies for irrigation in the state.

Factor	Situation
Availability of ground water	High water tables (2-5 mtrs) lead to low energy requirements for pumping water to the surface. Sufficient water replenishment due to adequate rain fall ensures constant and lasting availability of irrigation-water for pumping.
Availability of solar radiation	The 280 - 300 sunny days/year with an average solar radiation of 5.04-5.42 kWh/m^2 p.a. suffice the effective application of solar water pumps. The periods of low radiation coincide with the monsoon when solar pumps are not required.
Suitability of agricultural practices	To allow for a third cropping cycle irrigation is required during the summer (March-June), which coincides with high solar insulation, thus, making solar pumps an ideal solution.
Access to alternative sources of energy for irrigation	Only 50% of the state's villages or 16.4% of the households have access to electricity. Electricity for agriculture is not subsidized, thus, relatively expensive compared to other states and rationed across all consumer categories. The non-existence of reliable and economically superior energy sources (diesel is too expensive for many) makes solar energy an attractive alternative for powering irrigation pumps.

Barriers and potential solutions for large-scale application of solar pumping

Bihar's huge solar water pumping potential, estimated to be 11 million SPV pumping systems or 2,665 MWp by 2022, remains largely untapped. Regulatory as well as market and technology-related challenges keep most private actors in a "watch and wait" position. Key challenges and potential solutions are:

	Barriers	Potential Solutions
Market Related Barriers	High Upfront Cost	Smart Subsidies/Innovative Finance
	Lack of Finance Mechanisms	Innovative Consumer/Business Finance Mechanisms
	Low Awareness Among Consumers & other Relevant Stakeholders	Awareness Campaigns
	Lack of Maintenance and Support	Localised Service Infrastructure
	Lack of Market Intelligence and Information	Provision of Adequate Resources/Market Data
	Danger of Theft	Portable/Community Owned Systems, Insurance
Regulatory Issues	Restricted Financial Engineering	Innovative Policies and Financial Engineering
	Maze of Political Departments	"Single-Window" Approach
	Lack of Market-Oriented Policies	Policies providing a Level Playing Field with diesel pumps.
	Concealed Tenancy and Small Landholdings	Tenancy Reform, Leasing Mechanisms & Group Investments
Technology Related Barriers	Lack of Standardisation & Quality Assurance	Standardised Products that Cater to Local Needs
	Lack of local Manufacturers	Promotion of Local Manufacturing

Study Context: The "Indo-German Energy Programme - Renewable Energy Component" (IGEN-RE) is a bilateral technical co-operation measure between the German Federal Ministry for Economic Cooperation and Development (BMZ) and the Indian Ministry of New and Renewable Energy (MNRE). It aims at improving access to energy from renewable energy sources in rural areas of Bihar, West Bengal, Uttarakhand, and Uttar Pradesh. IGEN-RE commissioned a study titled "Solar Water Pumping for Irrigation" to identify opportunities and challenges of using solar water pumps for irrigation in Bihar. The study can be downloaded from the IGEN-RE website at www.igen-re.in

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