SWITCH ON FOUNDATION

CELEBRATING 15 years

Impact Report

of Solar Water Pump
Usage by Farmers of Jharkhand

2023

www.SwitchON.org.in

INDEX

SWITCH ON FOUNDATION
CELEBRATING 15 years

BACKGROUND

Agriculture is the mainstay of Jharkhand's rural economy. About 80% of the rural population is engaged in agriculture in the state. Rice, wheat, maize and oilseeds are the main crops. However, most agricultural activities within the state have not been able to provide a reliable source of income (Sharan et.al, 2021). The major challenge is that the agriculture sector face inadequate irrigation facilities. 17.37% of the total geographical area in Jharkhand is net sown area, whereas 37% of the total land in the state is viable for irrigation. Currently, the net irrigated area of Jharkhand is only 9.3% of the total cultivated area but again less than 6% of farmers possess irrigation equipment. Out of the irrigation infrastructure available to small farmers, diesel and electric pumps are the common ones and the exorbitant rate of diesel and the erratic power supply have affected agricultural production negatively in recent times. In order to address the situation in hand, some of the thrust areas identified are building irrigation infrastructure and promotion of solar power in agriculture. Jharkhand Renewable Energy Development Agency (JREDA) is the State Nodal Agency for renewable energy in the state and it has taken an exemplary role to solarize the agriculture sector. JREDA is also the implementing agency for the Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM KUSUM) scheme in the state. The scheme has 3 components as follows- Component A- Commissioning of 1000 MW capacity of ground/ stilt mounted solar or other renewable energy source based power projects, Component B- Installation of 17.50 lakh standalone Solar Powered Agriculture Pumps of individual pump capacity up to 7.5 HP, Component C- Solarization of 1,00,000 grid connected agriculture pumps. In Jharkhand, Component B of PM KUSUM is presently being implemented actively. Jharkhand has been allocated a target of 11,000 pumps out of which 6717 have been installed as on 31st of May 2022 .

Agriculture in Jharkhand. ENVIS HUB. Jharkhand. Status of Environment and related issues. Accessed on June 20th. http://www.iharenvis.nic.in/Database/AGRICULTUREINJHARKHAND_2327.aspx.
Status of Agriculture in Jharkhand State. State Agriculture Management and Extension Training Institute. Accessed on June 20th. http://www.sameti.org/default1_1sprof.htm.
Indian Council of Agriculture Research. https://icar.org.in/files/state-specific/chapter/62.htm. Accessed on October 26th. 2021
Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan. About the scheme. Accessed on 20th January. https://pmkusum.mnre.gov.in/landing-about.html
https://pmkusum.mnre.gov.in/landing.html

EXECUTIVE SUMMARY

Jharkhand Renewable Development Agency (JREDA) has promoted the uptake of Solar Water Pumps (SWPs) by marginal farmers across the state of Jharkhand under Component B (installation of standalone solar powered agriculture pumps of individual capacity of upto 7.5 HP) of PM KUSUM scheme. Under the scheme, 10,000 solar pumps have been sanctioned for 2019-20 for Jharkhand. JREDA as the State Nodal Agency for implementation of the scheme has taken exemplary and unparalleled efforts for decarbonising the agriculture sector in the state leveraging the scheme. By virtue of the scheme, farmers received a subsidy of 96% from state and central governments (of which 30% is supported by Central Financial Assistance), thereby reducing farmer financing to only 4% which translates to Rs. 5000 to be borne by farmers for a 2HP pump, Rs. 7000 for a 3 HP pump and Rs. 10000 for a 5HP pump. SwitchON Foundation has conducted an impact study on behalf of JREDA to understand the multifaceted impacts triggered due to solar pump usage on the lives of farmers in Jharkhand

Our ground-level insights indicate that Solar Water Pumps (SWPs) are a marketable technology and can bring huge benefits for farmers. This report is an attempt to dig deeper and understand the nuances of solar irrigation and its benefits from 115 farmers located across 4 districts in Jharkhand namely, Dumka, Ramgarh, Sahibganj and Deoghar. The major findings are based on economic, social and environmental benefits and are described below.

ECONOMIC IMPACT

Income Enhancement -

While 31 farmers reported a monthly income above Rs 9,000 before solar pump usage, after solar usage, 52 farmers reported monthly income above Rs 9,000. This highlights a **67% increase in farmers, who reported income enhancement** (in the monthly income category above Rs 9,000) from before solar to after solar usage scenario, with Ramgarh witnessing maximum income enhancement.

Expenditure Reduction -

61% of farmers reported decrease in expense within the monthly expense category ranging from Rs 8000-9000 from pre to post solar installation. Within the monthly expense category ranging from Rs 8000-9000, farmers from Dumka and Deoghar districts recorded the maximum drop in monthly expense.

Time spent on farming -

Before the use of solar pumps, 57% of the farmers spent more than 4 hours on agriculture related activities while after using solar pumps, only 18% of the farmers spent more than 4 hours on irrigation related activities.

Increased cultivation -

18% of the respondents reported that they could annex new seasons to their agricultural practice. This indicates the role of solar pumps in supporting agriculture throughout the year which add to additional revenue.

Asset ownership -

77% of the respondents said to have purchased new assets such as houses, land, farm equipment and other such productive assets after installation of solar pumps indicating an increase in savings of the farmers.

Agricultural produce -

79% of the respondents have recorded to have experienced **enhancement in the quantity and quality of agricultural produce per acre.** While most of them reported enhancement in paddy production, some of them reported the same for potato, wheat, mustard and maize.

SOCIAL IMPACT

Increased Pride & Faith in Agriculture -

Around 91% of respondents said that solar pump usage has restored their faith and pride in agriculture, which has enabled them to identify agriculture as a profitable venture

Improved health status due to introduction of protein rich diets -

With increased income and savings triggered due to SWP usage, 55% of respondents stated investing the additional money available to incorporate protein-rich foods in their daily diet, which can be identified as having a positive impact in improving general health and nutrition conditions of the target group.

ENVIRONMENTAL IMPACT

Replacement of diesel/ electric pumps- 65% of the farmers stated they have completely **stopped using diesel/ electric pumps** and solely using solar pumps for irrigation.

RESEARCH OBJECTIVES

This impact study has been undertaken to understand the changes in farm-based livelihoods by assessing the livelihoods and environmental impacts of solar pump adoption **among 115 marginal farmers located in Jharkhand.** The larger objective of this report is **to broaden the understanding and analyze the overall impacts of solar water pumps on small and marginal farmers. The study has involved an in-depth assessment of the socio-economic changes of the beneficiary group in selected locales of Jharkhand after the installation of solar pumps**. The broad objectives of the study have been broken down as follows –

To assess the economic impacts of solar pump in terms of income enhancement, reduction in expenses, reduction in pump operation and maintenance cost, added time available to engage in alternative sources of livelihood generation, asset enhancement and enhancement of quality and quantity of agricultural produce and increase in the number of cropping seasons when agriculture is practiced.

To assess the social impact of solar pumps in enhancing quality of life of intervened farmers in terms of raising their faith & pride in agriculture & enhancing their health by enabling them to invest their savings to include protein-rich diets.

To assess the environmental impact of solar pump usage in terms of replacement of polluting and expensive diesel/ electric water pumps by solar pumps.

METHODOLOGY

A total of 115 farmers have been interviewed from across 4 districts in Jharkhand namely Dumka, Ramgarh, Sahibganj and Deoghar. The selected farmers have been using solar pumps **for the past 1-2 years, with 37% using 2HP solar pumps, 42% using 3HP solar pumps and 19% using solar pumps with a load capacity of 5HP and above.** While among the selected sample size, **65% recorded sole dependence on solar pumps for conducting irrigation, 35% said using diesel/electric/kerosene pumps along with solar pump usage.** Farmers' lack of knowledge regarding operation and maintenance of SWP and scattered nature of landholdings have been cited as reasons, which compel these farmers to retain usage of conventional electric/diesel pumps for irrigation.

BENEFICIARY PROFILE

87% of the beneficiaries belong to Other Backward Classes (OBC) category

To have proportionate representation from the selected districts, sample selected from each district accounts to be **1/4th of the total sample size** (ie, 29 from each district approximately).

While **16% of the respondents recorded never going to school**, a significant majority of 61% stated completing only primary schooling.

Before installation of solar pumps, **43% of the respondents lived in mud houses** whereas 24% in mud-brick houses and 33% in brick houses.

Of the people who had access to other means of irrigation before the installation of solar pumps, **77% had their own pumps** while the remaining **23% used rented pumps**.

67% farmers are marginal, 17% are small and the rest 16% are semi-medium farmers. It is interesting to note here that the majority of the farmers in Ramgarh district have landholding size below 3 acres. Sahebganj on the other hand has a significant number of farmers with landholding size above 5 acres.

Over 90% of the respondents stated that they meet both their consumption needs and also cater to market needs through their produce. In this regard, respondents said that 50% of their produce goes to meet domestic needs, while the rest 50% is sold commercially.

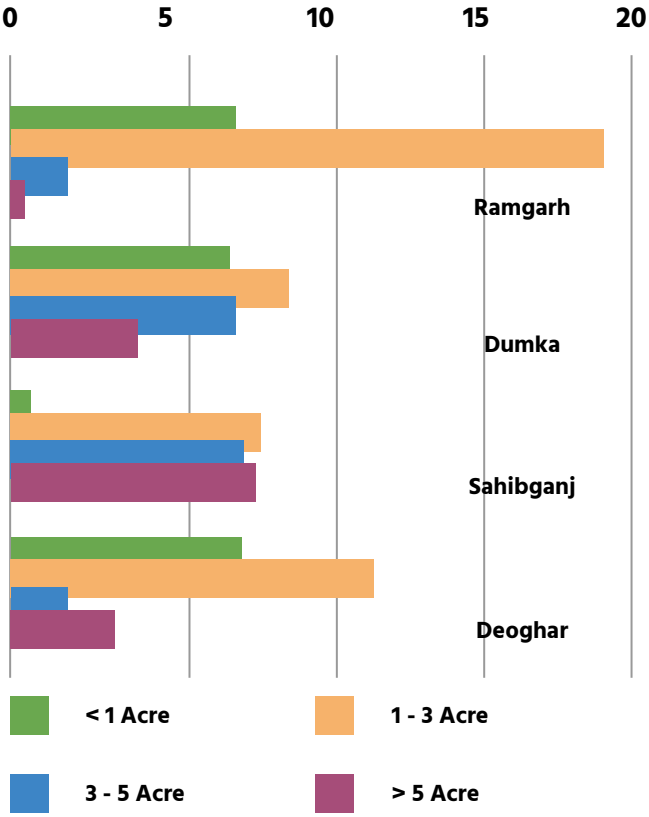

Fig. 1 - *District-wise land holding pattern which shows Ramgarh having maximum percentage of landholding size ranging from 1-3 acres (ie, implying the existence of high percentage of marginal farmers), while Sahibganj has negligible percentage of landholding below 1 acre and relatively high percentage of landholding size above 5 acres, implying high percentage of medium and large farmers*

MEANS OF DATA COLLECTION

Data has been collected using quantitative means with the help of KoboToolbox software. Quantitative data collection has been facilitated through structured questionnaires. Sample size has been selected using random sampling, with an equal proportion of target groups selected from each district.

BENEFICIARY PROFILE

87% of the beneficiaries belong to Other Backward Classes (OBC) category

To have proportionate representation from the selected districts, sample selected from each district accounts to be **1/4th of the total sample size** (ie, 29 from each district approximately).

While **16% of the respondents recorded never going to school**, a significant majority of 61% stated completing only primary schooling.

Before installation of solar pumps, **43% of the respondents lived in mud houses** whereas 24% in mud-brick houses and 33% in brick houses.

Of the people who had access to other means of irrigation before the installation of solar pumps, **77% had their own pumps** while the remaining **23% used rented pumps**.

67% farmers are marginal, 17% are small and the rest 16% are semi-medium farmers. It is interesting to note here that the majority of the farmers in Ramgarh district have landholding size below 3 acres. Sahebganj on the other hand has a significant number of farmers with landholding size above 5 acres.

Over 90% of the respondents stated that they meet both their consumption needs and also cater to market needs through their produce. In this regard, respondents said that 50% of their produce goes to meet domestic needs, while the rest 50% is sold commercially.

MEANS OF DATA COLLECTION

Data has been collected using quantitative means with the help of KoboToolbox software. Quantitative data collection has been facilitated through structured questionnaires. Sample size has been selected using random sampling, with an equal proportion of target groups selected from each district.

District wise Land Holding Pattern in Study Area

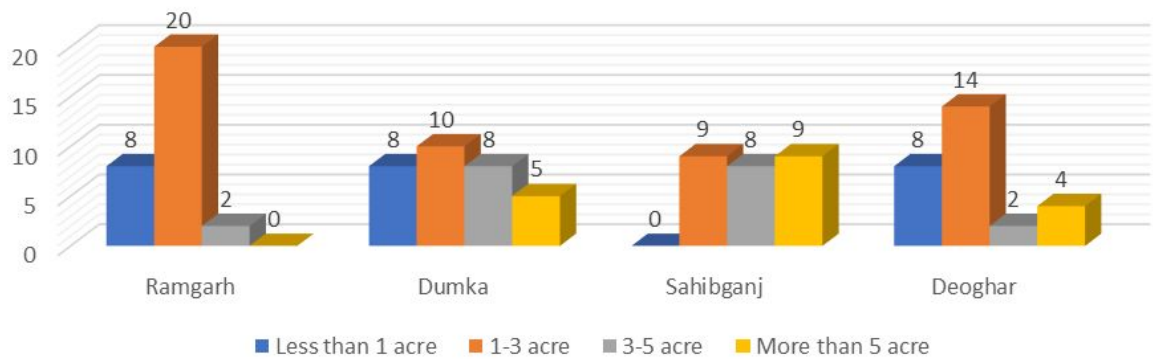

Fig. 1 - *District-wise land holding pattern which shows Ramgarh having maximum percentage of landholding size ranging from 1-3 acres (ie, implying the existence of high percentage of marginal farmers), while Sahibganj has negligible percentage of landholding below 1 acre and relatively high percentage of landholding size above 5 acres, implying high percentage of medium and large farmers*

IMPACT FINDINGS

In order to have a holistic understanding of the impact of solar pumps on farmers, the study has categorized the findings into three heads of economic impact, social impact and environmental impact. While, some of the economic impacts such as increase in income, reduction of expenditure and increase in asset ownership are measurable and tangible, some of the social impacts such as increased faith and pride in agriculture, women friendly technology enhancing women's confidence to do farming and decrease in the drudgery of women are some of the intangible and long term impacts.

ECONOMIC IMPACT

The economic impacts resulting from the study has been categorized under different categories as follows-

Income level -

While 31 farmers reported a monthly income above Rs 9,000 before solar pump usage, after solar usage, 52 farmers reported monthly income above Rs 9,000. This highlights a 67% increase in farmers, who reported income enhancement (in the monthly income category above Rs 9,000) from before solar to after solar usage scenario. While a percentage increase in income in the category above Rs 9000 has been witnessed in all the four districts, Ramgarh witnessed significant increase in the percentage of farmers, who reported increased income (income bracket - above Rs 9000) from pre solar to post solar usage.

Therefore, one interesting fact to observe is that there is an eminent overall elevation in income range. While comparing pre-post solar installation income range, there has been a reduction of respondent (around 14% of overall) from Rs. 3000-6000 income category and shift of the same volume to Rs. 9000-12000 income category.

District wise change in income group of respondents before & after installing of solar pumps

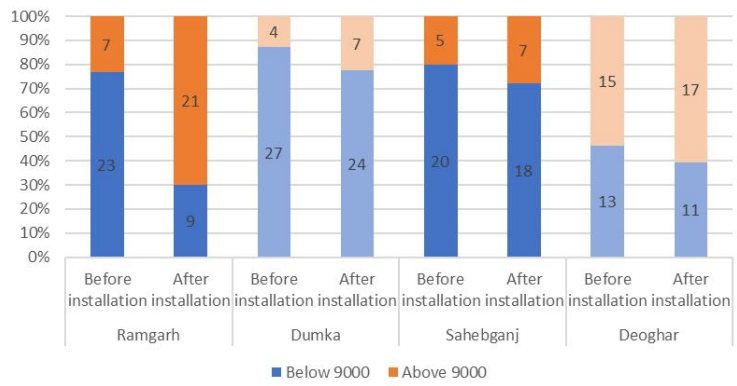

Fig 2 - *District-wise income increase from pre-solar to post solar usage*

District wise change in expenditure range of Rs. 8000 - 9000 before and after installation of solar pumps

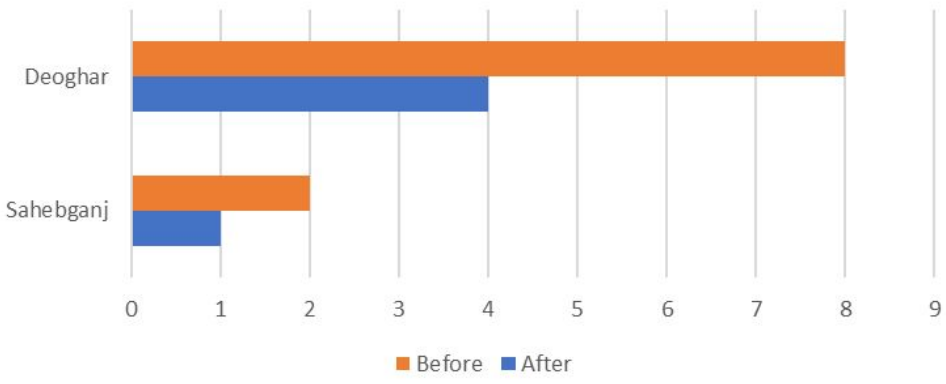

Fig. 3 - *District-wise expense drop from pre-solar to post solar usage*

Time spent on farming -

Before the use of solar pumps, 57% of the farmers spent more than 4 hours on agriculture related activities while after using solar pumps, only 18% of the farmers spent more than 4 hours on irrigation related activities thus recording a **significant reduction in the time spent on irrigation for 39 % of farmers.** Since most of the farm related activities are undertaken by women therefore this has a **phenomenal impact on reducing drudgery for women**. The reduction in time spent on irrigation related activities also allows the farmers to **engage in alternate sources of livelihood activities as has been also recorded by 71% of farmers.**

Expenditure level -

Farmers recorded a drop in monthly expenditure after solar usage. While before solar installation, 13 farmers reported a monthly expense between Rs 8000-9000, it dropped to 5 farmers with their monthly expense ranging from Rs 8000-9000. This implies 61% of farmers reported decrease in expense within the monthly expense category ranging from Rs 8000-9000 from pre to post solar installation. Within the monthly expense category ranging from Rs 8000-9000, farmers from districts like Deoghar and Dumka recorded maximum drop in monthly expense.

Pre-Solar – Number of Crops

	Respondent	Avg	Min	Max
Kharif	**112**	**1.82**	**1**	**4**
Rabi	**113**	**2.51**	**1**	**5**
Summer	**63**	**1.55**	**1**	**3**

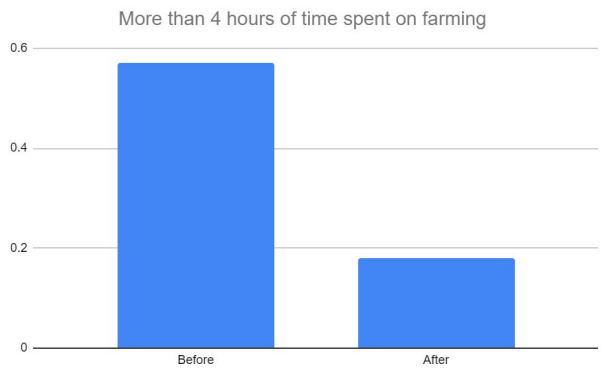

Fig. 5 - Reduced time in agriculture from pre solar to post solar usage

Post-Solar – Number of Crops

	Respondent	Avg	Min	Max
Kharif	**96**	**2.20**	**1**	**8**
Rabi	**96**	**2.37**	**1**	**8**
Summer	**110**	**2.04**	**1**	**4**

Asset ownership -

77% of the respondents said to have purchased new assets such as houses, land, farm equipment and other such productive assets after installation of solar pumps. It can be noted here that increase in ownership of productive assets, as can be seen in this case, will have multiple positive effects on the standard of living of the farmer in the long run.

Increase in Agricultural produce -

79% of the respondents have recorded to have experienced enhancement in the quantity and quality of agricultural produce per acre. This is due to moving away from other irrigation sources which have limitations of its own such as erratic rainfall and power supply and/or exorbitant price of diesel. The increase in agricultural produce both in terms of quality and quantity helps the farmers to fetch better prices in the market which adds to their income levels. Another interesting thing to note is the increase in average number of crops grown per season as is evident from the table below. This implies that installation of solar pumps also leads to crop diversification which not only leads to increase in income of the farmers but also enhances soil fertility that can lead to increase in per acre productivity.

Increased cultivation -

As agriculture in Jharkhand mostly depends on rain 88% of the farmers used to cultivate only during kharif season. After solar pump installation 50% of the farmers reported to cultivate during Zaid season whereas previously it was only 1% of farmers who used to cultivate during zaid season. A significant increase of 49% can be seen by using solar pumps for irrigation. Again, 18% of the respondents recorded that they could annex new cropping seasons to their agricultural practice.

SOCIAL IMPACT

The social impacts resulting from the study has been categorized as follows -

Increased Pride and Faith in Agriculture -

Around 91% of respondents said that solar pump usage has benefitted them in restoring their faith and pride in agriculture. While this significant majority of farmers said that initially agriculture as conducted using electric/diesel pumps was cost and labour intensive, solar pump usage has now helped them in undertaking agricultural activities independently. They no longer need to depend on external manpowers to carry out irrigation. Even women and children can now operate the solar pumps by simply switching on the pumps. All these impacts in amalgamation have contributed in restoring marginal farmers' faith and pride in agriculture.

Improved health status due to introduction of protein rich diets -

With increased income and savings triggered due to SWP usage, 52% of respondents stated investing the additional money available to improve their diet. In this regard they started introducing protein-rich components in their regular diet in the form of animal protein and leafy vegetables. High protein diet creates a positive impact in improving the general health conditions of the marginal farmers.

ENVIRONMENTAL IMPACT

The environmental impacts resulting from the study has been categorized as follows

Replacement of Diesel / Electric pumps-

Solar pump has created a major impact by replacing existing diesel pumps for irrigation. Around 57% of the farmers stated they have completely eliminated diesel pumps and are relying solely on solar pumps. Though 43% are still practicing the conventional method, the usage time has significantly decreased as around 45% of farmers are using the diesel pumps for less than 4 hours. As the extant agricultural practices have immense environmental burden (pollution, groundwater depletion) which also affects the farm productivity, leading into a vicious cycle which affects the small and marginal farmers and pushes them into poverty. This significant change in conventional irrigation methods (diesel, electric pump) and increased dependency on climate smart irrigation practice will reduce the environmental burden, increase productivity and reduce the irrigational cost.

CONCLUSIONS

In a developing country whose economy is centered around agriculture, and which is rapidly transitioning into the realm of renewable energy, the future of solar pumps seems brighter than ever. The government's ambitious target to initiate widespread usage of solar pumps is a positive indication of the growth of the solar pump industry, which is likely to flourish in the coming years and aid in accelerating the sustainable development of our country. But it becomes important to address the issue of groundwater depletion along with promoting sustainable irrigation sources as cheaper sources of irrigation as it may lead to indiscriminate use of groundwater resources. Therefore, there is a need to have effective monitoring, policy and agreements, enforcements through regulations to prevent over-extraction of precious water resources, while maintaining equity in access to renewable energy driven irrigation systems.