Using Sunlight for Irrigation

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In a region that had a perennial source of water but no means to use it to irrigate fields, in a region that could not dream of having more than one crop a year, the use of solar energy for lift irrigation has ensured water supply in the fields for irrigation through the year and has transformed the lives of the farmers

Karkatalan is a small village 15 km from Kasmar block and 5 km from the main Petarbar market in Bokaro district, Jharkhand. The village comprises 40 families, 33 from the Schedule Tribes (STs) and 17 from the Schedule Castes (SCs). The village stretches across a huge geographical area of 286 ha, of which 70 ha are protected forest land and 143 ha are agricultural land, comprising 75 per cent upland, 15 per cent lowland and 10 per cent medium upland and homestead.

In 2007, PRADAN initiated work in Karkatalan village with the formation of three SHGs and some agricultural intervention. Agriculture in this area being mainly rain-fed, the major intervention was during the *kharif* season on SRI paddy and vegetables such as tomatoes, brinjals and creepers. In 2010, SHGs were supported by the Bill and Melinda Gates Foundation (BMGF) demonstration fund for Agriculture Production Cluster (APC). APC is an innovative concept, propelling agricultural productivity of a particular geography with the ultimate objective of increasing the profit margin of primary producers.

Areas with similar agriculture practices and cropping patterns are identified for the purpose. Usually, three to four crops are selected and promoted as major crops for a particular area. Based on the production patterns and market study of farmers in a hamlet, 25 to 30 farmers are mobilized into an informal collective.

The farmers in Karkatalan also became members of the APC. New techniques were introduced in agriculture such as wire stacking in tomatoes and growing creepers on trellis; the focus was on increasing and intensifying the production of select crops by adopting improved technology and optimal Package of Practices (PoP), and strengthening input market linkages.

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Farmers were given training on new crop interventions and some youth were trained to supervise the crop planning. They were to also support them in the field. This enhanced productivity by almost 1.5 times and the community began to take a keen interest in the improved agriculture. Farmers, who earlier sowed limited vegetables in their backyard, started growing vegetables in the medium uplands in the *kharif* season, using new techniques. They also began to have regular meetings, to discuss agricultural issues and review agriculture plans.

In the APC, the farmers began a common nursery and arranged for a common input supply for seeds and fertilizers. They also organized collective marketing. With Petarbar district headquarters only 5 km away, farmers began to take their produce there and were able to get reasonably good rates. Good prices and enhanced productivity have boosted the confidence of the farmers and they are now yearning for more. In an APC meeting, the community agreed that cultivating vegetables was becoming lucrative and that they should look at the *rabi* and summer crops also.

However, two issues hindered cultivation in *rabi* and in summer. First, because no farmer grew crops in those seasons, the land was left free for cattle grazing. To prevent that, farmers would have to invest in fences around their field and, second, there is no irrigation available in those seasons.

For the first issue, a farmers' rally was organized in the *gram panchayat* by SHG Clusters, where members came together and protested against free cattle grazing. The issue was discussed in the *gram sabha* meeting and a decision was taken that the land should be used for agricultural purposes and a penalty would be levied on the owners whose animals were found straying in others' fields. The farmers could then have fence-free agriculture, even in the *rabi* season, without fear of the crop being mauled by the freely running cattle.

For the second issue, the farmers in Karkatalan discussed that although a perennial *nala* (stream) flowed through the village, only those whose lands were near the *nala* could make use of it and cultivate wheat in winter. Therefore, in their *aam sabha*, the community decided to install a lift irrigation (LI), which could take the water of the *nala* and irrigate all the fields in the village. The LI could be installed as an entry point activity for the Integrated Watershed Development Project (IWMP), which had been sanctioned by the State Level Nodal Agency (SLNA) of the Jharkhand State Watershed Mission (JSWM).

The plan was that the installed LI would be able to irrigate the total command area of 7 ha of up-lands and 2 ha of medium-uplands. The capacity of the low-land well is 550 cu/m and is recharged at an average rate of 4 litres per second (LPS), making it possible to have water available round the year. In the subsequent meetings of the Gram Bikas Samiti (a village-level committee, comprising 10 women and 9 male members, who meet twice a month for the Integrated Watershed

Management Programme—IWMP—discussion) and the SHGs, there was much discussion on the various options available for installing LI. At first, the community thought of installing a diesel-operated lifting device, estimated at around Rs 2 lakhs (grant from IWMP). It came to light that a prior experience of a diesel-operated LI had not been satisfactory because it involved high operating and maintenance costs. The second option was to install an electric pump. After exploring the legalities of installing the electric pump set, it was found that it was not possible for the Village Committee to fulfill the necessary requirements.

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First, the community would have to contribute for a 64kv transformer and, second, the Village Level Committee had to be a registered consumer in the Jharkhand Electricity Board, for which they would have to pay monthly rentals. Moreover, power supply was erratic (8–10 hours per day) in the rural areas. Farmers would need an alternative mechanism for irrigating their land (a diesel pump or a generator) during power cuts.

Around that time, the Petarbar PRADAN team visited the Drinking Water Project (Gram Nal Jal Yojna—GNJY) in Koderma and observed a solar power-operated pump being used to lift water and fill a water tank, at a height of 30 m. When the idea was shared in the Village Committee and the SHG, members were easily convinced and were excited about experimenting with solar power-operated LI for their fields.

ADVANTAGES OF A SOLAR POWER LIFTING DEVICE

- Solar radiation is the largest renewable energy source.
- Solar energy is more evenly distributed in the world than wind or bio-mass.
- Solar energy is consistent.
- It is a well-proven and demonstrated technology.
- It promises to be the most cost-effective renewable power at high volumes.
- There is no recurring fuel cost.
- It is clean, silent and has no moving parts.
- It is modular, reliable and has low maintenance.
- It is environmentally sound and does not contribute to greenhouse gas emissions.
- It can be installed at the point of use and prevents transmission line losses.

Furthermore, solar panels are said to a have a life in excess to 20 years and can withstand high winds, severe hail impact, high humidity, freezing and high ambient temperatures. All these discussions were held in the GBS meeting and also in the SHG meetings and it was left on the community to look at the different options. Allhough the community was apprehensive in the beginning but looking at the benefits and more particularly that there are no recurring fuel costs, the decided to install solar panel -operated pump sets.

The water source is in the lowland, where a 25-ft diameter and 18-ft deep well is excavated by the community through its own contribution under IWMP. The water is then lifted from the well to a distance of 250 m with a 13-m head. The lifting device, as such, will be a 2 KV motor with 11 LPS discharge for a 22-acre command area development. The motor is operated by eight photo voltaic panels of 12 Volts each. The power from these

cells goes to a starter machine, which gives power to the lifting device. The starter has options to be operated in solar as well as on diesel. There are three Quick Release Coupling (QRC) hydrant outlets and a 150-m high density poly ethylene (HDPE) pipe to irrigate the whole area.

In the rabi season (2014), with the support of the solar lifting device, they have also cultivated wheat in 8 acres of land and vegetables such as green peas, carrots, radish, mustard and potatoes in another 3 acres of land

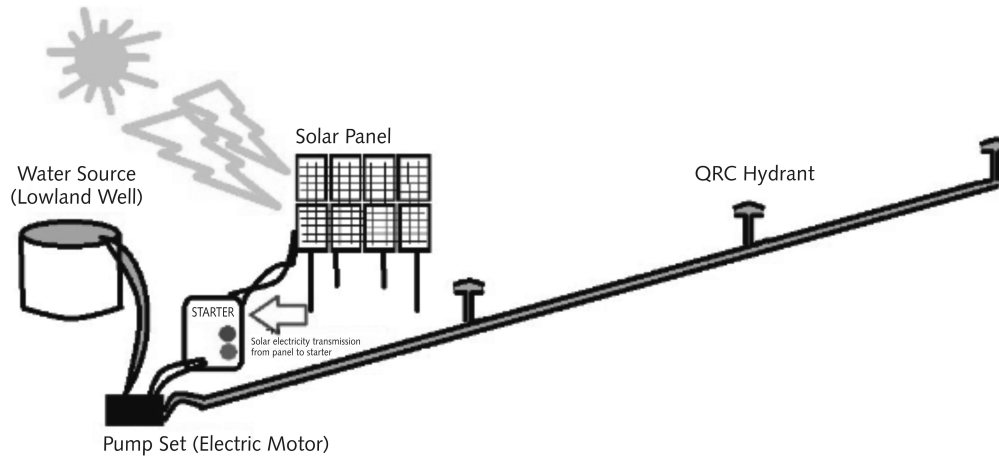
The price quoted by the vendor for the solar panels with a pump set was around Rs 2.62 lakhs whereas the total cost for the lifting device (water source, motor, solar panel, starter machine, 250 m of PVC pipes, three outlets) installation was Rs 4.86 lakhs. However, the budget allocated for installing LI, by SLNA, was only Rs 1.96 lakhs.

A revised budget of the whole EPA, with the increased cost of the lifting device, was sent to SLNA for its perusal. A grant of Rs 3.78 lakhs was the minimum requirement for such an experiment. After two months of follow-up, SLNA re-sanctioned the budget of the LI with a solar panel. The community was very excited about the plan and, in return, contributed 435 man days @ Rs158 per man day. Considerable financial contribution was also made for the creation of the water source. The entire cost of the excavation and materials for the masonry was arranged by the SHGs (Rs 300 was contributed by each family). The pipelines were to be laid from the water source—the lowland well (created by them) to their upland area. The pipeline was to be 250 m long, with three outlets.

Ramjeet Majhi says, *"Bahut accha hai yeh solar machine. Pehle khali* kharif *fasal hi le pate the, abhi to* rabi *mein bhi gehun fasal laga paye hain."*

Earlier, due to lack of irrigation in the uplands and medium uplands, people preferred to cultivate crops such as pigeon peas and *kulthi.* In the *rabi* season (2014), with the support of the solar lifting device, they have also cultivated wheat in 8 acres of land and vegetables such as green peas, carrots, radish, mustard and potatoes in another 3 acres of land.

Solar Panel-0perated Lift Pumps



Budget for the Solar Panel Lifting Device Submitted to SLNA

Water resource development coupled with lifting device for homestead & mid-up-land development to increase cropping intensity to 200%				
Village: Karkatakala; Block: Kasmar; District: Bokaro				
Total area (ha):	9.00			
Number of beneficiaries:	40			
Total project cost (in Rs):	4,86,500			
Support from the EPA fund (IWMP):	3,78,500			
People's contribution:	1,08,000	Amounts are in Rs		
No.	**Item**	**Total Amount**	**Community Contribution**	**IWMP, EPA Fund**
1	Water resource development coupled with lifting device for upland and mid upland development, to increase cropping intensity to 200%.			
1.1	Solar water pumping system (submersible) 1800 Wp	2,62,500	0	2,62,500
1.2	PVC pipes (160 mm dia @ 2.5 kgf/sq cm, 250 m), 150 m HDPE, including fittings @ Rs 210/m	1,05,000	0	1,05,000
1.3	Installation (trench digging, filling etc)	28,000	28,000	0
1.4	Pump protection arrangement	10,000	0	10,000
1.5	Development of existing water source (Dug well of 25 ft diameter x 20 ft depth)	80,000	80,000	0
1.6	Signboard and photograph L.S.	1,000		1,000
Total cost (for the patch)		**4,86,500**	**1,08,000**	**3,78,500**
Grand total				**3,78,500**

The farmers also plan to plant creepers in the summer crop. "*Hum sab Didi log 300 rupay karke jama kiye hain aur bari bari se kaam bhi kiye hain. Hum is machine aur lift ka dekh rekh badhiya se karenge*. (Each of us SHG members has deposited Rs 300 and has worked for the installation of the solar lift irrigation. We are going to take care of the machine)", the members of Soren Mahila Mandal said.

A member of the Murhu Mahila Mandal said, *"Yeh pump chalane mein itna asaan hai ki yeh to hum Didi log bhi chala sakte hain aur ab dada logon ka asa nahin dekhenge sichayi ke liye* (This pump is very easy to handle. We women can also start it; now we don't need to look for help from the men and we ourselves can irrigate the fields.)"

"Is tanr mein hum ek saal chhod ke fasal lagaate the, woh bhi barsaat mein. Abhi toh sichayi ka sadhan hogaya to bahut suvidha hua hai, aram se teen fasal le sakte hain (In this upland, we used to harvest a crop once in two years. Now, with irrigation, we can have three crops in a year.)" said Dinesh Majhi.

Although the command area to be covered under the set-up is 22 acres, at present irrigation is available for half the land. This is because the technology is totally dependent on sunlight, and in winters, bright sunlight is available only for around four hours, which reduces the efficiency of the operating device.

The beneficiaries have divided their plots into groups with fixed time-slots for irrigation. The time-table for irrigating a patch is planned in their committee meeting and is documented in their register

The beneficiaries have divided their plots into groups with fixed time-slots for irrigation. The time-table for irrigating a patch is planned in their committee meeting and is documented in their register. Arjun Majhi said, *"Humein is solar panel se bahut subidha hua sichayi ke liye, lekin surya ki roshni dheeme hone se sichayi dhang se nahin ho pata hai. Hum iske liye transformer aur bijli ke line ke liye gaon wale milke prayas jaroor karenge.* (We have benefitted a lot from this solar lifting device. However, sometimes due to lack of sunlight, proper irrigation does not happen. We will now try to get a transformer and an electric connection for our village.)"

The committee has also designated two persons to take care of the machine and to operate it to provide irrigation to the plots, as per the plan schedule. Patches of 60 decimals were identified. Every day, irrigation is done patch-wise—on an average, 60 decimals of land are irrigated through one outlet. The patch irrigated on the first day will be irrigated again after 9–12 days. These two persons have also been trained in handling and maintaining the machines. The VLC fixed a minimum charge of Rs 5 per household every month as an operating cost for the solar panel. The solar panel is also guarded for any mishap or theft during the night.

The VLC is now hopeful that, during the summer, there will be enough scope for agriculture because of the abundance of sunlight. They are very excited about increasing their crop acreage during summer. Earlier, during the summers, the area remained fallow because there was no irrigation facility. This time, however, they have a solar lift which will work more efficiently during summer due to the long hours of daylight; they will have no problem with the water source because it has been created in the lowland.

Elated at the flush of green vegetables in their fields, Dasrath Majhi says, "Now, our mono-cropped lands will be converted into tri-crop lands. The sun will now quench our thirst for water."