

# Promoting Solar Irrigation Service Providers in Ganga Basin

Jobs, Affordable Irrigation and Accelerated Green Revolution



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## The Agrarian Challenge in Ganga-Meghna-Brahmaputra Basin

The plains of the Ganga-Brahmaputra-Meghna (GBM) basin, encompassing Bangladesh, Nepal terai and eastern India, are home to a quarter of the world's rural poor. The basin's copious aquifers are the biggest hope for millions of smallholders locked into unviable agriculture. Studies suggest shallow groundwater wells can support 2.5 crops/year in much of the basin without threat of depletion. Yet, cropping intensities hover around 1.2-1.5 in most parts. Rapid expansion in shallow tubewell irrigation has begun to show productivity improvement for tubewell owners, but marginal farmers and tenants remain in a disadvantageous position in this tubewell irrigation economy.



Picture 1: Solar Pump in Action, Credit: IWMI-TATA Programme

### The Poor Need a Better Deal in Irrigation Service Markets

Two factors limit benefits to the poor. First, extreme land fragmentation makes it uneconomic for marginal farmers to own tubewells. Marginal farmers and tenants per force depend on buying irrigation service from diesel tubewell owners. Second, high diesel prices ensure that the poor end up paying a third or more of their irrigated crop output to diesel pump owners as irrigation service charges. GBM's water markets transfer wealth from resource poor water buyers to tubewell owners.

Governments are aware of this inequity but are unfamiliar with the dynamic of water markets and how to make them pro-poor. Attempts to subsidize diesel for irrigation in Bihar and Bangladesh have been frustrated by leakages. Farm electrification is costly and time consuming. The arrival of solar pumps has opened up a new and attractive possibility. But since solar panels are costly (US\$ 400 to US\$ 800/kWp), most GBM governments are subsidizing small 1-2 kWp solar pumps to reach as many smallholders as limited budgets permit.

### Solar Pumps for Pro-poor Irrigation Service Markets

IWMI studies have shown that targeting individual solar pumps to small farmers is sub-optimal; instead, they

should be used to make village-level informal water markets pro-poor. In doing this, small solar pumps are not of much help. A 1-2 kWp solar pump can irrigate a plot where panels are laid. It operates at full power 3-4 hours daily and pumps little water in morning and evening. Its yield plummets during summer when water tables recede. Most solar farmers IWMI surveyed used solar pumps as standby but relied on larger diesel or electric pumps as their mainstay for irrigation. Many use electric pumps to lift groundwater into a farm pond and then use solar pump to lift water from the pond. Small solar pumps deliver limited power to push water in pipes to distant fields and are therefore little use for selling irrigation service. Solar pump subsidies are generally captured by large influential farmers anyway. NGO's have tried to resolve some of these issues by experimenting with cart-mounted mobile panels and by promoting group-ownership of solar pumps. But this is patchwork. A better strategy is needed to reach benefits of solar pumps to the poor.

### Tweak Solar Pump Promotion for Jobs and Pro-poor Irrigation

A much larger solar pump initiative than GBM states are pursuing today can rapidly expand pro-poor irrigation provided it is designed to transform monopolistic village water markets into competitive ones. Spattering villages with one or two small solar pumps as presently done is ill-advised. Instead, villages should be saturated with solar pump irrigation grids one after another. Setting up in every village 6-15 young entrepreneurial farmers as Solar Irrigation Service Providers (S-ISP) in overlapping command areas will help: [a] create a competitive water market offering pump-less farmers irrigation service at affordable price; [b] create 6-15 full time jobs/village; [c] crowd out diesel tubewells; [d] expand irrigated area, promote intensification and diversification of farming system; [e] improve utilization of solar pump capital; [f] allow small farmers to irrigate their plots by buying water from S-ISP close to each plot; [g] incentivize S-ISP entrepreneurs to contribute to capital investment.

### Benefits

S-ISP driven village water markets will rapidly expand pro-poor irrigation, secure farming against climate shocks, promote sustainable intensification and diversification, improve utilization factor of solar pump capital, reduce carbon footprint of tubewell irrigation and ensure food and livelihood security. By reviving up the Ganges Water Machine, increased post-monsoon groundwater draft will ease surface flooding by curtailing rejected recharge. Early evidence from ITP-CCAFA's Chakhaji pilot in Bihar suggests that ₹42 lakhs (US\$60,000) invested in 7 S-ISPs yielded the following economic benefits:

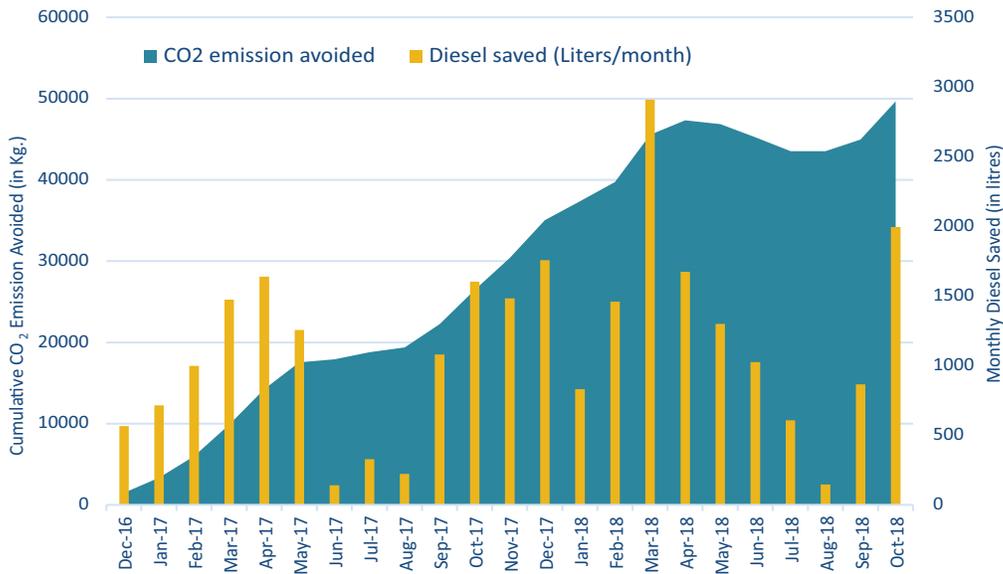
[a] Saving of diesel consumption

Since December 2016, S-ISPs have used a little over

13,000 hours of solar irrigation. Each hour of solar irrigation is roughly equivalent to two hours of diesel irrigation. This means that solar farmers have been

able to save more than 26,000 litres of diesel by using solar irrigation. In the process, nearly 50,000 Kg of CO<sub>2</sub> emissions have been avoided (Figure 1).

Figure 1: CO<sub>2</sub> emission avoided due to solarisation of irrigation pumps



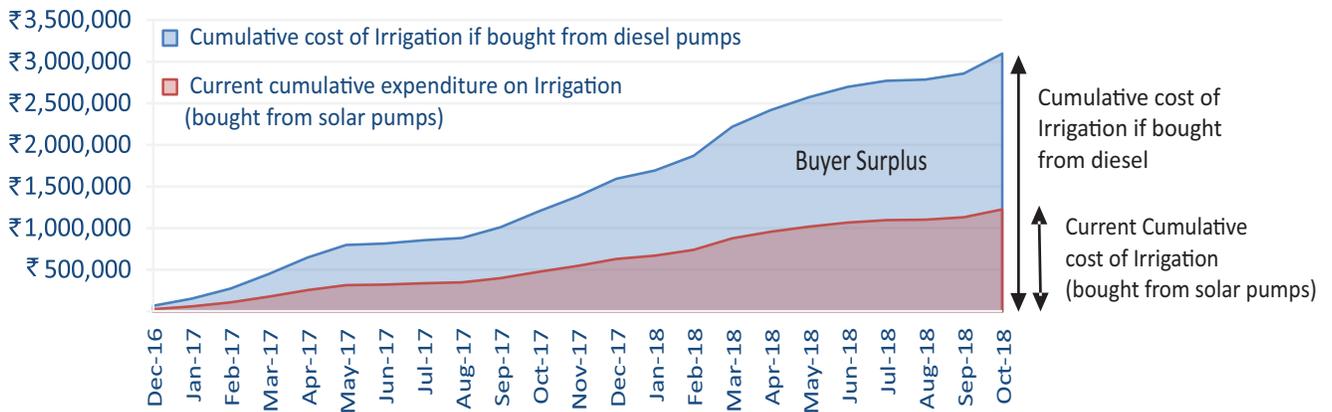
[b] Irrigation services to water buyers

The seven S-ISPs have sold more than 12,500 hours of irrigation to nearly 500 small and marginal farmers. The cost of irrigation for water buyers has gone down from ₹1892 to ₹726 per irrigation per acre. But with decreasing cost of irrigation, farmers have increased net cropped area and number of irrigations in particular crops. If the current level of irrigation in the village would

have had been bought by diesel pumps, the buyers would have had spent close to ₹ 30 lakh (US\$42,800) but they spent only ₹12.3 lakhs (US\$17,600). The net gain for buyers because of reduced cost of irrigation in Chakhaji has been ₹18.2 lakh (US\$26,000) (Figure 2).

**Gross irrigated area in the Chakhaji village has increased 48 per cent in summer.**

Figure 2 : Cumulative gain for water buyers

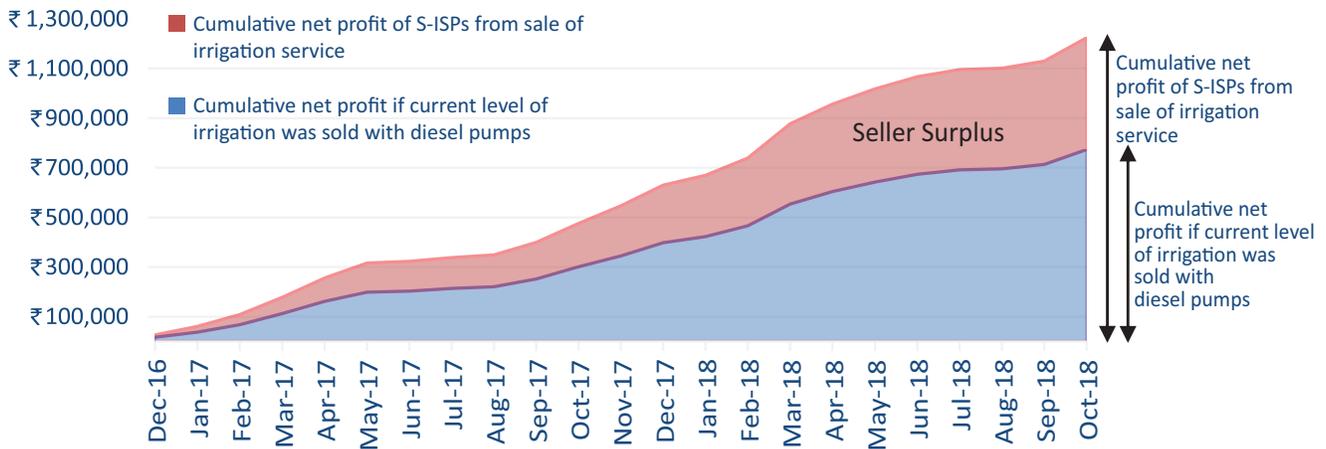


[c] Income to S-ISPs

Solar entrepreneurs have run their pump for roughly 13,000 hours, of which more than 96% is sold to water buyers. From sale of irrigation service, the S-ISPs have earned around ₹12.6 (US\$ 18,000) lakhs till October 18. If they would have had sold the same number of hours of irrigation using diesel pumps, they would have had

earned close to ₹7.7 lakh (US\$ 11,000). For meeting their own irrigation requirements, the S-ISPs used 467 hours of solar pump operations; in the process, they saved ₹0.6 lakhs. The average operating hours of S-ISPs have been 1,147 hours over the past 12 months (Figure 3).

Figure 3: Cumulative gain for water sellers by shifting from diesel to solar



The approach outlined here is specifically tailor-made for Ganga-Brahmaputra-Meghna basin states which have abundant groundwater resources, copious aquifers and an agrarian economy that has come to heavily depend on shallow tubewell irrigation. The option is ideal for small-holder fragmented farms which face high risk of crop loss from monsoon flooding and are unable to irrigate in winter and summer due to high energy costs.

*S-ISP driven village water markets will rapidly expand pro-poor irrigation, secure farming against climate shocks, promote sustainable intensification and diversification, improve utilization factor of solar pump capital, reduce carbon footprint of tubewell irrigation*

### Potential for Scale

In ITP's assessment, it is feasible under the present option to add an additional million hectare of high quality, affordable, solar pump irrigated area with a total outlay of US\$750 million. Of this, S-ISP's can contribute up to 50 per cent, provided an attractive loan product is devised for them. Thus, with this option, the irrigated area in Bihar can be doubled with a total outlay of close to US\$750 million.

The advantage of this option is its ease of implementation. All that is needed are four changes in the

design of current programs: [a] divert funds from current allocations to public irrigation, groundwater irrigation, electricity subsidies to the proposed option; [b] target solar pumps to villages instead of farmers; [c] instead of 1-3 kWp solar pumps at 90 per cent subsidy, offer 5-7 kWp solar pumps along with 1,000-2,500 feet of buried pipe distribution system at 50 per cent subsidy; and [d] involve a financial institution to offer a low-interest loan to S-ISPs to repay their share of the capital cost over 5 years in annual instalments.

Key co-benefits that will accrue are: [a] quickly expand quality irrigation to the poor at affordable cost; [b] create full-time livelihoods for 6-15 young S-ISPs per village; [c] curtail carbon-footprint of irrigation; and [d] reduce surface flooding by curtailing rejected recharge.



Picture 2: Buried Pipeline Control System  
Credit: IWMI-TATA Programme



### IWMI-Tata Water Policy Program

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