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IWMI International Water Management Institute

National Stakeholders Consultation in Pakistan

29 April 2019

Organized by IWMI at Marriot Hotel, Islamabad

WORKSHOP REPORT

Solar Irrigation for Agricultural Resilience

(SoLAR) Project

Acknowledgements

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1. Introduction

The project titled "Solar Irrigation for Agricultural Resilience (SoLAR)" is a new regional partnership program of Swiss Agency for Development and Cooperation (SDC) and the International Water Management Institute (IWMI). SoLAR aims to support climate-compatible development of energy and water systems in rural South Asia for resilient livelihoods, particularly in four countries: Bangladesh, India, Nepal, and Pakistan). This project will contribute to mainstreaming context-specific, and socially, economically, and institutionally-viable models for solar-powered irrigation systems (SIPs) to reduce the carbon footprint of irrigation sector while promoting efficient use of groundwater resources under climate-induced uncertainties in the region. The objectives of the project are:

- To assess and evaluate continuously the various approaches to managing the Water-Energy-Climate nexus in South Asia;
- To develop, propose, and undertake field experiments and pilots to demonstrate techno-social, economic, and institutional viability of such projects; and
- To undertake policy outreach and market uptake activities with objective of mainstreaming successful solutions/approaches to managing the Water-Energy-Climate nexus at local levels.

The project implementation has been planned in three phases. In this **entry phase**, we identify, assess, and prepare a detailed design of the pilot interventions through literature review, field visits, and stakeholder consultations in each of the proposed countries to identify suitable models (social, economic, and institutional) for promoting solar irrigation pumps (SIP).

A one-day national stakeholders' consultation was held in Islamabad, with participation of stakeholders from across Pakistan on 29 April 2019[1]. The objectives of the workshop were as follows:

- to gather input for mapping the concerns of key stakeholders;
- to learn from their experience and reflections, to identify potential options/sites for the pilots;
- to explore potential partners who can also leverage the fund for solar installation; and
- to develop a detailed design of the most suitable model for promoting solar-irrigation systems in Nepal.

A day long national consultation workshop began with the recitation of Holy Quran. Dr. Arif Anwar (IWMI) welcomed the audience and especially the Federal Secretary from the Ministry of National Food Security and Research (MNFSR) as Chief Guest.

In his remarks, Dr. Anwar emphasized the importance of modernizing agriculture and the importance of high value crops and horticulture. He reminded the participants if Pakistan will achieve per capita GDP of 6,000 USD 2047 on a consistent growth rate, we have to change the business as usual approach. Anwar said the country has to shift towards a service-oriented approach and provide our farmers with opportunities where then can earn more money.

[1] A full list of participants and their affiliations is available in Annex 2 below.

Dr. Anwar went on to stress the importance of having robust value chains wherein high value produce from farms could fetch higher prices from international markets rather low prices at local carts. He also stressed the importance of innovative farming techniques and machinery to help the farmers increase yield and reduce input costs. In that context, Dr. Anwar mentioned the importance of SIPs and innovative ways through which this technology can be scaled out in the country without compromising groundwater sustainability. After his introductory remarks, Dr. Anwar invited the Federal Secretary to address the audience.

Dr. M. Hashim Popalzai, the Federal Secretary for MNFSR began his address with appreciation for IWMI and MNFSR in convening the workshop. He emphasized the need to have collaborated efforts on this initiative with other organizations like the Food and Agriculture Organization. The main highlights of his address were as follows:

- If surface water is available, then farmers are not interested to install drip or sprinkler irrigation systems. Therefore, he stressed the need to study the conditions that will encourage farmers to transition to high-efficiency irrigation systems (HEIS), such and drip or sprinkler.
- Dr. Popalzai also said research was needed to minimize solar panel breakage due to hailstones, which are common during monsoon in Pakistan.
- The Federal Secretary said his Ministry would extend its full support to SoLAR and any partners (national and international) working SIP in Pakistan.

Session 1. Experiences with Solar Irrigation Pumps (SIP) in Pakistan[2]

Presentations

1.1 Dr. M. Ashraf, Director General, Pakistan Council of Research in Water Resources (PCRWR)

The key highlights of the presentation are as under:

- All the Provincial Governments are promoting solar power systems for pumping groundwater. For example, the government of Punjab is providing an 80% of subsidy on solar system installation, and HEIS is a pre-requisite for solar system installation: http://ofwm.agripunjab.gov.pk/info_subsidies)
- With SIPs, there is almost no chance of ingression of saline groundwater due to intermittent pumping and sufficient recession time. This is because SIPs can only pump 5-6 hours per day with available sunlight.
- SIPs are not feasible for water tables at greater depth. He gave an example of solar pumping system installed at the Pakistan Council of Renewable Energy Technologies (PCRET) in Islamabad, which required significant land and huge investment for installing solar panels, an option which is not feasible for farmers.
- PCRWR along with colleagues from other departments have developed criteria for the installation of solar pumps:
    - Pumping depth should not exceed from 100 feet.

[2] Full workshop agenda is available in Annex 1 below.

- Maximum pump size should be 5 horsepower with a DC motor.
- Maximum discharge should be 0.5 cusecs.

- The reason for the failure of a tile drainage system in Sindh was the excessive fuel cost to operate the engines or the interrupted electricity supply needed to pump out drainage water from the sumps. Therefore, solar pumping can also be a beneficial solution for these types of projects.
- Standardization of the equipment is necessary so that the desired benefits from solar pumping technology could be obtained, and this standardization will require cooperation from government agencies.
- It is important to have strict quality control of the equipment being imported from various countries.

1.2 Dr. M. Munir Ahmad, Chief Scientific Officer/Director Pakistan Agriculture Research Council (PARC)

- There has been success with SIPs coupled with HEIS in the Pothowar region. The reason for success is low energy power requirement. The five-horsepower pump operating with solar has replaced a 25-horsepower diesel engine operated pump running at 20% efficiency.
- PARC pilots have identified areas where application efficiency of water and distribution uniformities are needed.
- Dr. Ahmad also identified potential sites across the country for expanding SIP technology.

1.3 Mr. M. Tahir Anwar, Director General, Federal Water Management Cell (FWMC), Ministry of National Food Security and Research

- Currently, the Islamic Development Bank is conducting a SIP feasibility study, the result of which will be available in a couple of months. The study will include a detailed assessment of improving the productivity and sustainability of small dams in the Potohar region with a focus on SIP systems.
- The government is currently reviewing a proposal for enhancing the command areas of small and mini-dams in the Barani Areas of Pakistan.

Session 2 - Panel Discussion

Panelists included:

- Mr. Asad Zafar (Asian Development Bank)
- Dr. Robina Wahaj (Food and Agriculture Organisation)
- Dr. M. Ramzan Baprani (Agricultural Engineering Department, Sindh)
- Dr. Rabnawaz (Agriculture Department, Kyber Pakhtunkhwa Province)

Key points from the panel discussion included:

- Mr. Zafar said the ADB had funded projects for Jalal Pur Irrigation, the Baluchistan Development Project (in the Mula and Zhob river basins), and the Pehur High Level Canal extension (FATA, KPK Mohmand, and Bajur Agencies) for piloting High Efficiency Irrigation Systems (HEIS) with SIPs. In Punjab, 40% of the farmers were starting to work with SIPs.

- HEIS adaption failed in the LBDC project in Baluchistan province due to inadequate farmer knowledge of operation and maintenance of HEIS and high upfront costs of installation.
- Dr. Rabnawaz said farmers in KPK Province are slow to adopt SIP because they do not know how to operate the systems. Moreover, government subsidies didn't attract the farmer's interest to use the technology.
- The command areas of many canal systems had not been developed because of lack of co-ordination between the departments while developing new irrigation systems (e.g., Water and Power Development Authority, WAPDA) constructs the dam or canal system and hands it over to the department concerned and the government officials are not ready to own the system because they have not been involved in the project). Similarly, installation of tube wells is a mandate of several different organizations. This disaggregated approach is hindering command area development. Command area development should be a parallel activity with the construction of an irrigation system. For this reason, an integrated approach is required between the organizations like WAPDA, and the federal Irrigation and Agriculture departments.
- Because farmers are not familiar with the drip and sprinkler irrigation systems, other efficient irrigation application systems like bed and furrow with laser land levelling should be promoted. These systems have low capital costs and can easily be implemented. Implementation of drip irrigation systems in canal command areas is a big challenge. Therefore, a gradual shift from laser land levelling to bed and furrow and then to drip or sprinkler should be the sequencing used for enabling efficient use of available water.
- Vendors of HEIS present oversized solutions to farmers because they have limited knowledge in irrigation system design and because they want to increase their profits. For the successful implementation of the system, vendors should provide the economically-sensible solutions to the farmers.
- In the Sindh, farmers are not willing to adapt drip irrigation systems because they are unaware of its benefits. Therefore, successful implementation of HEIS depends on the complete subsidy of the HEIS cost. Laser land levelling had a similarly slow acceptance rate with farmers, but today that is a popular technology today.
- During 2016-2018, 284 tube wells were installed in Sindh by different prequalified vendors. However, some farmers reported the breakage of solar panels and others problems with solar pumps not long after installing their systems.
- Drip systems should be installed in the tail areas of irrigation system for successful uptake of the technology because these area receive less water as compared to farmers at the start or middle of an irrigation network.

2.1 Discussion on the Quality Issues of Solar Panels and Pumps:

- ADB personnel said that solar quality passports have been launched to ensure better quality for imported solar panels. The minimum thickness of a panel should be 3.22 mm of tempered glass.
- Diesel pumps should be replaced with solar pumps.
- Incentives should be given to local industry to reduce the cost of technology.

- It is difficult to convince a farmer to purchase a high-quality pump because farmers do not understand the standardization and buy the cheapest one available in the market.
- Institutes exist for standardizing equipment but how do implement those standards? The government has to set standards of quality and enforce those standards in the marketplace. For example, Lawrence pumps should be considered as the standard to inspire more competition in the market.
- The Punjab government says HEIS has been installed in 50,000 acres in their province. Of that are, 5,000 acres are equipped with 500 units of solar panels and no reports of broken panels has been reported to date.

Session 3 – IWMI's Field Experiments with SIPs in Pakistan

This session began with two videos produced by IWMI India to provide an overview of the Institute's work with SIP in the region. Both are available online:

1. The Promise of Dhundi Solar Pump Irrigators' Cooperative
   https://www.youtube.com/watch?v=SneJ3plzz5I
2. Equitable Water Markets Powered by the Sun
   https://www.youtube.com/watch?v=CJsMAfaeTR4

Audience response to the videos was generally positive. More specific comments included the following contributions:

- Using cooperatives to bundle excess electricity to sell to the grid is a good idea.
- Many farmers do not realize the potential to de-couple solar power from HEIS.

Dr. Azeem Shah followed with a presentation about the SDC-IWMI SoLAR initiative and the reasons for assembling this national workshop. Those organizations in attendance, particularly from PARC and MNFSR, pledged their full support to develop and support the project.

3.1 Other key highlights of the afternoon

- If farmers can be convinced to use HEIS to improve productivity, the green economy initiative without subsidies can be implemented.
- Questions remain regarding whether or not Pakistan needs more area under irrigation for food production.
- Farmers lack knowledge about how to operate HEIS and SIPs, and how much to apply water for irrigation.
- Until1990, in the Potohar area, no fruit plants were grown; however, today, farmers are growing more fruit than ever thanks to finding the most suitable crops for the area.
- If one's solar energy production capacity is more than required to pump water, then small agricultural equipment can be powered by the excess. In Chakri, solar energy is being used for household activities. Similarly, in Baluchistan, if governments convert all electric tube wells (~30,000) to solar power, then they could be connected with grid system.
- More empirical research is needed to investigate the hypothesis of groundwater depletion.
- The testing sites available at PARC have been constructed and officials there have requested to upgrade those sites using automation techniques and equipment for remote monitoring.

- A remaining major challenge is how to shift farmers from low value crops to high value crops.

3. Conclusions

- HEIS such as drip or sprinkler irrigation should not be part and parcel with solar pumping. Instead, focus should be on solar pumping with other irrigation methods such as basin, bed and furrow, and precision/engineered surface irrigation. Success stories from such interventions should be presented to decision makers for further uptake.
- Feed-in tariffs and selling electricity back to the grid should be an important component in future projects. In Baluchistan, this has been possible as the existing pumps are connected to the grid.
- Farmers with sufficient income and reasonable land holdings can adapt SIPs without any subsidy. The Punjab agricultural secretary said he knows several farmers who converted their pumping systems from diesel to solar without a subsidy. When these farmers compared the return on investment to the diesel pumping, they were convinced that solar is cheaper in the long run.
- Generally, in Punjab, the solar system with HEIS (pressurized) has been successful in the Potohar region with orchards and tunnel farming. Moreover, the farmers who installed solar systems with government support in irrigated areas of Punjab are applying water using flood irrigation methods.
- In the Rajanpur district towards the Koh-e-Suleman range, there are many SIPs installed for irrigation in the foot hill areas and even at the high altitude. The geological formation supports the availability of water at lower depths. Further exploration of this area is needed to determine the potential for installing SIPs and measuring their impact on groundwater sustainability. Farmers predominantly use flood irrigation in this area.
- Finally, there is still disagreement among provincial governments and within private circles about the number of effective daylight hours during which solar pumping can take place. More robust research is needed to compile evidence to suggest whether or not solar pumping would lead to groundwater depletion, or be prevented by it due to limited sunlight per day.

4. Photographs

Annex 1

National Stakeholder Consultation

Solar Irrigation for Agricultural Resilience (SoLAR)

29 April 2019 | Marriott Hotel, Islamabad

Agenda

9.30-10.00	Registration and networking Arrival of the Chief Guest	
10.00-10:15	Setting the context and objectives of the Consultation	Dr. Arif Anwar
10.15-11.15	Experience from Solar Powered Irrigation Projects (SIP) in Pakistan • Dr. Muhammad Ashraf (PCRWR) • Mr. Muhammad Tahir Anwar (FWMC) • Dr. Muhammad Munir Ahmad (PARC)	
11.15-11:30	Remarks by the Chief Guest	Secretary of MNFSR
11:30-11.45	Tea Break	
11.45-12:45	Panel Discussion on Policies and Finance for Solarization of Agriculture in Pakistan • Dr. Rabnawaz (Agr. Deptt. KPK) • Dr. M. Ramzan Baprani (Agr. Engg. Sindh) • Dr. Robina Wahaj (FAO) • Mr. Asad Zafar (ADB)	Facilitator Dr. Arif Anwar
12.45-13.30	Lunch Break	
13.30-14.00	IWMI's Field experiments with solar irrigation in the region (Videos)	Dr. Azeem Shah
14.00-14.20	SoLAR: Solar irrigation for agriculture resilience Project overview	Dr. Azeem Shah
14.20-15.30	MODERATED DISCUSSION – Implementing SoLAR in Pakistan: Opportunities for Pilots and Partnerships	Dr. Arif Anwar (Facilitator)
15:30-15:45	Conclusions and Ways Forward	Mr. Tahir Anwar (FWMC)

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