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International Water
Management Institute

Solar Irrigation for Agricultural Resilience (SoLAR)

The potential of solar irrigation for Pakistan: a critical inquiry

Summary Report of Webinar 5

4 February 2021

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List of Abbreviations

IWMI	International Water Management Institute
SIP	Solar Irrigation Pumps
HEIS	High-Efficiency Irrigation Systems
SDPI	Sustainable Development Policy Institute
DISCOM	Distribution Companies
KFUEIT	Khwaja Fareed University of Engineering and Information Technology
NEECA	National Energy Efficiency & Conservation Authority
SAARC	South Asian Association of Regional Cooperation
FWMC	Federal Water Management Cell
PV	Photo Voltaic

Webinar 5: The potential of solar irrigation for Pakistan: a critical inquiry

The fifth session of the solar webinar series discussed these issues with the sector experts to determine the best possible future course of action for Pakistan in its policy related to solar-based irrigation systems. The webinar was held on Thursday, 4th Feb 2021, which included a keynote presentation and a panel discussion involving eminent sector professionals, followed by a question-and-answer session. A total of 65 participants attended the webinar, excluding the panellists and organisers, and it was moderated by Dr Mohsin Hafeez, IWMI, Pakistan. The agenda for the webinar is included in Appendix A. The list of participants who attended the webinar is included in Appendix B, and the glimpses from the webinar are in Appendix C.

Pakistan's National Water Policy endorses the importance of irrigated agriculture for the national economy but highlights low irrigation efficiency and low water productivity as major challenges facing the sector. Groundwater currently meets about 60% irrigation water requirements of Pakistan. There are approximately 1.3 million tube wells, out of which about 83% are diesel-powered and have been installed chiefly at shallow depths (20-40 ft). These tube wells together extract about 55-million-acre feet of underground water for irrigation, which is 20% more than that available from the canals. Solar-powered irrigation systems provide a promising alternative to diesel-powered tube wells, but adoption at scale has faced many problems in Pakistan. Farmers cannot invest in solar due to high initial costs and low discharge capacities compared to diesel-powered. The primary concern amongst water professionals in Pakistan is that any conversion of diesel pumping to PV solar will result in indiscriminate pumping leading to further groundwater depletion. The government has launched various schemes to promote solar pumping in conjunction with High-Efficiency Irrigation Systems (HEIS). Is this the right approach?

Table 1: Schedule of webinar 5

Webinar	Date & Time	Speakers/Presenters	Panellists
Webinar 5	4 th Feb 2021(02:30 to 04:00 pm PST)	Dr Imran Khalid	Ms Sara Hayat Dr Sardar Mohazzam Mr Tahir Anwar R Shoaib Ahmed

YouTube link of webinar 5: <https://www.youtube.com/watch?v=cfwbE8h9lzo>

I. Presentation

Topic: The potential of Solar irrigation for Pakistan: a critical inquiry

Dr Imran Khalid, Sustainable Development Policy Institute (SDPI) Islamabad, Pakistan, presented in this session.

Highlights

The presentation initially highlights subsidy programs launched by the Government of Pakistan. Then use of groundwater in the agriculture sector was described. In the next section of the presentation, the rise in the use of tube wells and its pros and cons were discussed. The presentation followed this wherein the use of solar-powered irrigation pumps was discussed as an alternative to pumps currently being used to extract groundwater. A case study of a progressive farmer from Lahore, Pakistan, was highlighted. In the end, risk factors associated with SIPs, in terms of groundwater governance and lack of institutional and individual capacity, were discussed. Following is a brief description of the presentation.

Summary of the presentation:

The SIP landscape in Pakistan is not a lot different from the rest of South Asia. The government of Pakistan has launched subsidy programs to promote SIPs in agriculture in other parts of Pakistan.

One of the major issues of irrigation in Pakistan is an exponential increase in the use of groundwater and declining groundwater levels. Pakistan is the largest user of groundwater, consuming about 9% of the global groundwater abstracted and occupying 4.6% of the groundwater-irrigated area of the world. Most agricultural lands are irrigated through conjunctive use of canal water and groundwater abstracted through tube wells. Historically, back in the 1960s, groundwater abstraction was encouraged to address the problem of waterlogging and salinity. For this purpose, deep drainage tube wells were dug. Farmers began to use diesel-powered peter engines and shifted towards water-intensive cash crops, i.e. rice and sugarcane. According to Dr Imran Khalid, "*green revolution was more of a tube well revolution*". Though tube wells provided drought resilience and led to an increase in the cultivated area, it led to increased tube well depths since 1989 and upward movement of saline water. Despite intense groundwater use, agricultural productivity remains low in Pakistan, i.e. wheat production is 1.08 kg/m³ in Pakistan's Punjab than 1.42 kg/m³ in Indian Punjab.

SIP can provide cheaper, cleaner and environment-friendly sources to extract groundwater. Anecdotal evidence from progressive farmers from Lahore showed that the use of drip irrigation needs knowledge of evapotranspiration as the farmer employed mulching to ensure the efficient use of water. Smog during certain months of Lahore restricts the use of SIP. On the other hand, emissions from diesel pumps

added to the problem of smog. According to the farmer, lack of grid connectivity resulted in foregone earnings.

Towards the end, Dr Imran Khalid highlighted the risk factors associated with SIPs. Over irrigation, expansion of land area under irrigation, growing water-intensive high-value crops and selling water to neighbours can be some risk factors that can lead to excessive groundwater abstraction using SIPs. Among other critical issues of introducing SIPs in the context of water governance is the lack of data availability related to water accounting. Thus, groundwater abstraction and recharge data are not available, and any over-abstraction due to SIP will go unchecked. Equity and human dimension are also not being appropriately addressed, as applying for a government subsidy for SIP require form filling, which many farmers cannot do. There are capacity issues in terms of technical know-how of farmers and mechanics which need to be addressed so installed SIPs can function efficiently.

In the end, Dr Imran Khalid shed light on future steps to ensure the adoption of SIPs so possible adverse effects on groundwater can be minimised. One step can be watershed mapping and identification of areas where future SIPs can be installed. Ban on the installation of SIPs in water-stressed areas can halt further depletion of the groundwater table. In terms of technical knowledge, capacity building of farming communities should be ensured for efficient use of SIPs and HEIS. Rainwater harvesting along with net metering and grid connectivity will lead to sustainable use of water through SIPs.

Table 2:Q&A with Dr Imran Khalid

Sl no	Question	Answer
1.	Petra Schmitter asked Dr Imran Khalid: Could you please elaborate on the water accounting, and at which scale you think WA is most important to guide the sustainable expansion of irrigation through solar-powered irrigation. A follow-up question is that the majority is groundwater-based irrigation, and within the water accounting framework, the highest uncertainty in the estimation of availability and use of groundwater.	Thank you, Petra. When I talk of water accounting, it is more than numbers. I am alluding to how water is used, how it is acquired, and its acquisition at the community and government levels. Essentially, it's a water audit if you will. Up till now, the discussion around water in Pakistan is from the perspective of water availability. It is never about the human dimensions nor the governance-related challenges. So, water accounting and the details therein would help address this issue. As to your comment viz groundwater, it is quite valid, and again, I would highlight that our response needs to be holistic such that we are taking into account the needs of the society at large. Hence, this

		<p>requires a shift from the technocratic mindset that has dictated the way we govern our water. I hope this helps.</p>
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II. Panel Discussion

Panellists:

The panellists included Dr Shoaib Ahmed, Ms Sara Hayat, Dr Sardar Mohazzam, Mr Tahir Anwar and Dr Imran Khalid.

Moderator:

Dr Mohsin Hafeez moderated the session.

A question asked on 'Do you think the Government of Pakistan should promote Solar Irrigation pumps to replace the existing diesel and electric pumps?' which was answered by the panellists are as follows:

1. **Dr Shoaib Ahmed:** He responded that the government should promote SIPs, as they can provide an environment-friendly source of irrigation, although their usage can stress groundwater reserves further. Solutions to excessive groundwater extraction can be net-metering of tube wells, at least which are connected to the grid. In addition to that, farmers can be given household appliances, i.e. butter churner or juice extractor, so they can divert excessive electricity from SIP to household use. One other solution can be the solarisation of tube wells at a collective level for 5 to 6 farmers, and a water pricing mechanism can be devised to fix water price in this case. Lastly, laser levelling of fields and drip and sprinkler can also be used to address the possibility of over-extraction from SIPs.
2. **Ms Sara Hayat:** She responded that SIPs could be a solution in future, but given current ground realities, it is premature to think that SIP will be the answer. Smaller farmers do not have the technical capacity to cope with any breakdown that can occur with SIP. Even the technical personnel at the village level lacks specialised training to address technical hiccups with SIP. Placement of solar panels can be crucial as livestock and children can damage the panels. One last thing is that most large-scale farmers give their land on lease for cultivation, but due to uncertainty of contract, the lessee does not have any incentive to invest in SIPs.
3. **Dr Sardar Mohazzam:** He responded that SIPs could help achieve SDG 7 (Affordable and Clean Energy). SIPs can also help to some extent in mitigating circular debt and increasing electricity tariffs. Excessive groundwater abstraction; consequent, groundwater depletion with SIPs can be tackled with grid connectivity of SIPs. These will lead to protective

irrigation and equitable irrigation. The government is focusing on Baluchistan for promoting SIPs. Enhancing the knowledge and technical capacity of society will be pivotal in the successful adoption of the same. It's not the diesel pump or SIP that can lead to a problem of over-extraction of groundwater; actually, it lacks defined access to shared pool resources like groundwater, leading to groundwater depletion.

4. **Dr Tahir Anwar:** He responded that government should not promote SIP as a solution to irrigation. The main reason being we still have not done water accounting, and we are relying primarily on quoted figures for surface water and groundwater usage and quantity. One reason for using groundwater so extensively is the inefficient use of surface water. The government of KPK have solarised 600 tube wells, but none of them is connected to the grid. SIPs can contribute to electricity, but net-metering is not available anywhere in Pakistan. There is a lack of knowledge and technical capacity on the part of farmers to use SIPs and HEIS.
5. **Dr Imran Khalid:** He responded that given the existing ecosystem in Pakistan, it is not the right time for adopting SIPs for irrigation. 90% of clean water goes to agriculture; it is the right time to move away from water-intensive cash crops, i.e., rice and sugarcane, rather than cultivating crops that are necessary for food security.

Table 3: Further Q&A with panellists

Sl no	Question	Answer
1.	Question to Dr Shoaib Ahmed: how do you see SAARC Energy Centre play a role to help bring best practices/policy interventions from other regional countries to Pakistan? How can Government and private sector collaborate in this initiative?	<p>SAARC has in-house expertise in solar irrigation. Our international linkages can bring in expertise that can help in promoting SIPs.</p> <ul style="list-style-type: none"> • SAARC can play a role in generating consensus concerning SIPs of line departments in all of South Asia. • We can also play a role in the capacity building of departments and farmers. We can arrange visits for personnel of line departments to other SAARC countries to build and share ideas. • We can also conduct research and can aid in developing a policy

		<p>document regarding SIPs. Many policy documents are also available online on our website.</p>
<p>2.</p>	<p>Question to Ms Sara Hayat: how can GoP make sure the farmers receive subsidies on Solar abandon using diesel/electric pumps? Any legal opinion? Secondly, how do SIPs help GoP to achieve our INDC commitments?</p>	<p>Enforcing SIP subsidies is not a legal problem but a social problem. After the 18th amendment, agricultural policymaking is a provincial matter. The most crucial issue with policymaking is its enforcement, and enforcement of a policy can be assisted if it is formulated keeping demographics in mind it is catering to.</p> <ul style="list-style-type: none"> • Most farmers cannot even fill the forms to avail subsidy. To make things easy for farmers, applications forms can be in local languages. Moreover, an advertisement campaign on a large scale should be launched to raise awareness among farmers about the subsidy program. • Before small scale farmers, large scale farmers should be targeted for adopting HEIS. • New policies are not needed; rather, finances should be used for awareness-raising and capacity building of farmers and marginalised communities. • Though everyone in the government is very keen on achieving goals for mitigating carbon emission, practical implementation remains a challenge. Red-tapism should be addressed to restore the confidence of farmers in

		the subsidy program.
3.	<p>Question to Dr Sardar Mohazzam: how can SIPs help achieve GoP targets with regards to renewable energy? Is there any plan by the GoP for grid-connected agriculture SIPs to harness the potential of net metering and feed-in-tariffs?</p>	<p>Renewable energy policy is more focused on addressing the demand side of the equation, i.e. mostly renewable energy goals are set as n% reduction by 2025 or 2030.</p> <ul style="list-style-type: none"> • Regarding the mandate of irrigation policies, provincial governments have the mandate and provinces have the funds for subsidies. • The opinion leaders will have an important role to play with regard to the adoption of technology. In my view, technology will be inevitably adopted irrespective of budget availability.
4.	<p>Question to Mr Tahir Anwar: can you please provide an overview of Government projects/plans to promote SIPs in Pakistan? Do you think SIPs can manage the electricity and Ground Water crisis in Balochistan?</p>	<p>The government is currently not launching any large-scale programme in agriculture. But there is a project of enhancing command areas in Barani areas by installing SIPs on ponds, small dams or dug wells.</p> <ul style="list-style-type: none"> • The use of SIP should be linked to HEIS, but farmers' capacity is an issue to use HEIS effectively. We can address this by first encouraging farmers to laser level their fields to increase the efficiency of water use, and later farmers can switch from Warabandi to HEIS for irrigation. • Rs. 58 billion per year is given for electric pumps. Rs. 22 billion per year is given to grid connectivity electricity.

		<ul style="list-style-type: none"> • There is a major question, how SIPs will affect groundwater in Baluchistan, where groundwater has gone from 300 feet to 1200 feet at someplace? • As a first step, it will be imperative to generate evidence of how SIPs will affect groundwater. For that, we need to conduct feasibility studies to have reliable evidence in this regard.
5.	<p>Question to Dr Imran Khalid: do you think we have enough evidence-based research to support our policy to promote SIPs in Pakistan? What is your suggestion for the GoP in the existing decision space?</p>	<p>We lack evidence-based decision-making, and evidence available somewhere does not mean it will affect policy at the government level.</p> <ul style="list-style-type: none"> • We need to evolve decision making further below the province level, i.e. decision making should be made at the farmer level. • Equity issues have to be resolved so that those farmers should benefit who need it the most.
6.	<p>Dr Tahir Anwar responded: In Pakistan, surface water is distributed on gravity principle, so SIPs are not required to pump surface water. Furthermore, in Barani areas, SIPs expand command areas where farmers use SIPs to pump water from small dams or dug wells.</p>	<p>Comment by Dr Muhammad Ashraf from KFUEIT: In the case of Pakistan, for sustainable use of groundwater, an efficient groundwater monitoring system should be established by the government. Without groundwater monitoring and accounting, it is difficult to manage equitable access to groundwater resources. However, farmers are conscious of using groundwater if there are quality issues. I think the figures presented by Dr Imran Khalid regarding</p>

		groundwater tube wells support this perception.
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Top three take away from the webinar, and how and whether SoLAR future work can address them?

Takeaway 1: More finances need to be dedicated to farmers and other technical personnel's capacity-building to realise the potential of SIPs. This will also address all the apprehensions of farmers; thus, it will promote SIPs.

Takeaway 2: Evidence needs to be generated showing the relationship between SIP use and groundwater extraction. This will help clarify apprehensions of the policymakers and help them formulate evidence-backed policies.

Takeaway 3: Before moving forward, water accounting needs to be done. Therefore, areas suitable for promoting SIPs can be identified and targeted.

Appendix A: Agenda

Time Slot	Topic	Facilitator
2:30 pm to 2:35 pm	Background of the webinar	Mohsin Hafeez
2:35 pm to 2:40 pm	Introduction of Speaker and Panelists	Mohsin Hafeez
2:40 pm to 2:55 pm	Keynote Presentation Topic: The potential of Solar irrigation for Pakistan: a critical inquiry	Imran Khalid
2:55 pm to 3:00 pm	Q&A on the presentation	Mohsin Hafeez
3:00 pm to 3:02 pm	Opinion Poll Question	
3:02 pm to 3:42 pm	Panel Discussion Panellists: 1. Ms Sara Hayat, Climate Change and Legal Expert, Pakistan 2. Dr Sardar Mohazzam, NEECA, Ministry of Energy, Pakistan 3. Mr Tahir Anwar, FWMC, Ministry of National Food Security and Research, Pakistan 4. Dr Shoaib Ahmed, SAARC Energy Centre, Islamabad 5. Dr Imran Khalid, SDPI, Islamabad	Mohsin Hafeez
3:42 –pm to 3:57 pm	Q&A to the Panelists from the audience	Mohsin Hafeez
3:57 pm to 4:00 pm	Concluding Remarks and vote of Thanks	Azeem Shah

Appendix B: List of organisers & participants

Organisers cum panellists

Name	Organisation	Country
Aditi Mukherji	International Water Management Institute (IWMI)	India
Mansi Chopra	IWMI	India
Dr Mohsin Hafeez	IWMI	Pakistan
Dr Azeem Shah	IWMI	Pakistan
Muhammad Zain Akbar	IWMI	Pakistan
Dr Sardar Mohazzam	National Energy Efficiency & Conservation Authority (NEECA), Ministry of Pakistan	Pakistan
Dr Shoaib Ahmed	SAARC Energy Center	Pakistan
Ms Sara Hayat	Climate Change and Legal Expert	Pakistan
Dr Imran Khalid	Sustainable Development Policy	Pakistan

	Institute (SDPI)	
Mr Tahir Anwar	Federal Water Management Cell (FWMC), Ministry of National Food Security and Research	Pakistan

Participants/attendees

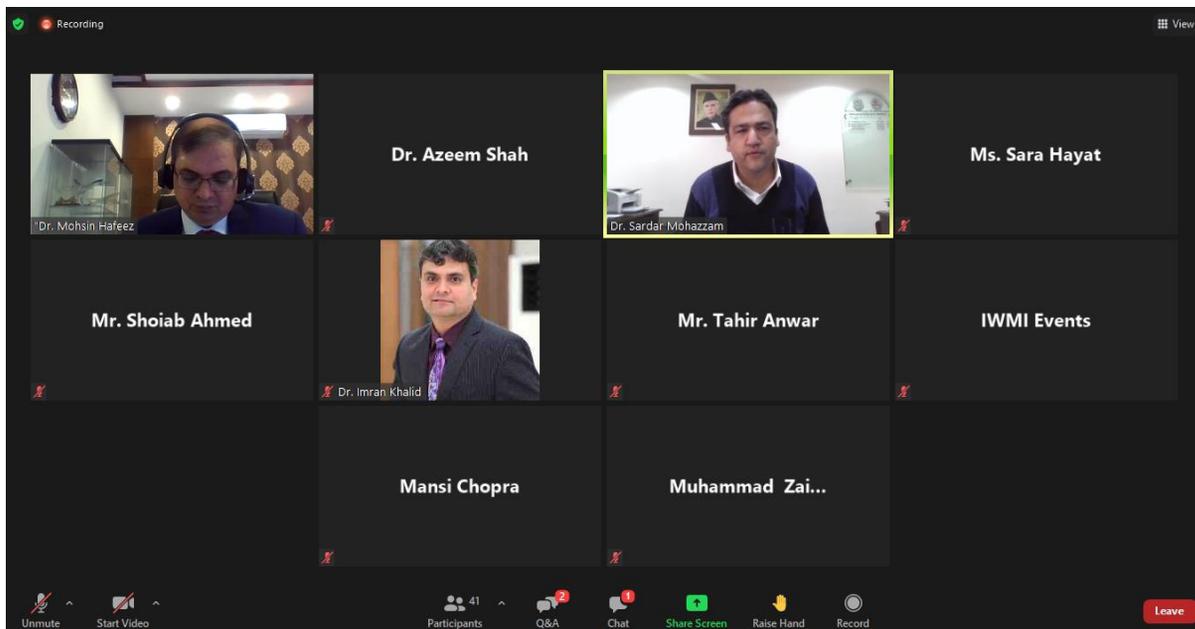
Sl no	Name	Organisation
1	Abdul Khan	U.P. irrigation department, Lucknow, India
2	Abdul Waleed	KFUEIT
3	Adnan Ahmad	KFUEIT
4	Adnan Noon	IU
5	Afaaq Zahid	
6	Alan Nicol	
7	AlbaraShalaby	
8	Ali Farooq	
9	Anjum Ahmad	World Bank
10	Archisman Mitra	
11	Asad Zafar	
12	Asghar Ali	Civil Society Organization
13	Bashir Ijaz	KFUEIT
14	Debashish Goswami	Swiss Agency for Development and Cooperation (SDC)
15	Divya Kashyap	SDC
16	Dr. Aamir Shakoor	BZU, MULTAN
17	Effat Ara	Bangladesh Agricultural Development Corporation
18	GerwinDreesmann	
19	Hamza Hameed	
20	Hassan Raza	KFUEIT
21	Hizbullah Khan	
22	Husnain Ali	KFUEIT
23	Julia Schaef	
24	Junaid Iqbal	
25	Kashi Kafle	International Water Management Institute (IWMI)
26	Kashif Hussain	IWMI
27	Kazi Ahsan Uddin	IDCOL
28	LakshyaShekhawat	Shakti Pumps India Ltd.
29	M Abdullah Al Matin	Infrastructure Development Company Ltd.
30	Manohara Khadka	IWMI
31	März Tobias	
32	Mazhar Rasool	KFUEIT
33	Md. Arafath Mostafa	Grameen Shakti
34	Mohinder Gulati	
35	Muhammad Abid	Mechanical Engineering
36	Muhammad Ahmad Rustam	KFUEIT
37	Muhammad AsfandIjaz	KFUEIT
38	Muhammad Ashraf	KFUEIT

39	Muhammad Aziz Ur Rehman	KFUEIT
40	Muhammad Farooq	KFUEIT
41	Muhammad Kashif	MNS University of Agriculture, Multan
42	Muhammad Luqman	
43	Muhammad Mohsin Waqas	KFUEIT
44	Muhammad Muneer Hassan khan	KFUEIT
45	Petra Schmitter	
46	Piyush Patidar	Shakti Pumps India Ltd.
47	Prachanda Pradhan	Farmer Managed Irrigation System Promotion Trust, Nepal
48	Razi Rehman	
49	Sana Saleem	
50	Saqib Alam	
51	Shanwar Hamid	KFUEIT
52	Shilp Verma	IWMI
53	Shisher Shrestha	IWMI
54	Sujith R	
55	Tanveer Ahmad	
56	Toby Johnson	
57	Tooba Fatima	NESPAK
58	Umar Liaqat	IWMI
59	Usama Bashir	
60	Usman Awan	IWMI
61	Waheed Nawaz	KFUEIT
62	Yashodha Yashodha	
63	Yasir Muhammad	CUI Attock
64	Zain ulhassan	KFUEIT
65	Zaineb Abid	Quaid-i-Azam University

Appendix C: Photo Section



Picture 1: Panellists from Webinar 5



Picture 2: Dr Sardar Mohazzam providing his remarks