

Solar Irrigation for Agricultural Resilience (SoLAR)

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

Summary Report

International Water Management Institute

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Contents

Solar Irrigation for Agricultural Resilience (SoLAR) project.....	3
Introduction to Webinar 5	3
Session 1: Keynote Presentation	3
Session 2: Panel Discussion.....	5
Key Takeaways from the webinar	8
Appendix A: Webinar Agenda.....	9
Appendix B: List of Participants	10
Appendix C: Photo Gallery	13

Solar Irrigation for Agricultural Resilience (SoLAR) project

The IWMI-led Solar Irrigation for Agricultural Resilience (SoLAR) project funded by the Swiss Agency for Development and Cooperation (SDC) organized a series of six webinars during 1-5 February 2021. SoLAR project aims to generate knowledge to sustainably manage water-energy and climate interlinkages through the promotion of solar irrigation pumps (SIPs). The goal of the project is to contribute to climate-resilient, gender-equitable, and socially inclusive agrarian livelihoods in Bangladesh, India, Nepal, and Pakistan by supporting government efforts to promote solar irrigation.

Achieving progress in poverty reduction with minimal carbon emission is at the core of the climate and sustainability challenge. This need is particularly acute in South Asia, where further expansion of irrigation holds the promise of pulling smallholders out of poverty, but will also result in large increases in carbon emissions due to overwhelming dependence on fossil fuel-based groundwater pumping. SIPs offer a “climate resilient” solution, yet adoption is slow. Little is also known about the impact of SIPs on groundwater use. In this six-part SDC-IWMI webinar series, we explored some of these larger questions around energy transition and SIPs in four South Asian countries.

Introduction to Webinar 5

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 mostly 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 the diesel-powered tube wells but adoption at scale has faced many problems in Pakistan. Farmers are unable to invest in solar due to high initial costs as well as the low discharge capacities as compared to the diesel-powered. The major concern amongst water professionals on 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?

The 5th episode of the Solar webinar series discussed these issues with the sector experts to find out 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 February 2021 which included a keynote presentation along with a panel discussion involving eminent sector professionals followed by questions and answers. A total of 65 participants attended the webinar excluding the panellists and organizers. The agenda for the webinar is included in Appendix A. The list of participants who attended the webinar is included in Appendix B.

Session 1: Keynote Presentation

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

Presenter: Dr. Imran Khalid, Sustainable Development Policy Institute (SDPI) Islamabad, Pakistan

Highlights

Presentation initially highlights subsidy programs launched by Government of Pakistan. Then use of groundwater in agriculture sector was described. In next section of the presentation, rise in use of tube wells and its pros and cons were discussed. Next in the presentation, 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 discussed. 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 rest of South Asia. Government of Pakistan has launched subsidy programs to promote SIPs in agriculture in different parts of Pakistan.

One of the major issue of irrigation in Pakistan is an exponential increase in 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 of the agricultural lands are irrigated through conjunctive use of canal water and groundwater abstracted through tube wells. Historically, back in 1960s groundwater abstraction was encouraged to address 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 increase in cultivated area, it led to increase in 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, as compared to 1.42 kg/m³ in Indian Punjab.

SIP can provide cheaper, cleaner and environment friendly source to extract groundwater. Anecdotal evidence from progressive farmer from Lahore showed that use of drip irrigation need knowledge of evapotranspiration as the farmer used mulch to ensure efficient use of water. Smog during certain months of Lahore restricted 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 key issues of introducing SIPs, in context of water governance, are lack of data availability related to water accounting. Thus, exact data of groundwater abstraction and recharge is not available, and any over-abstraction due to SIP will go unchecked. Equity and human dimension is also not being appropriately addressed, as applying for government subsidy for SIP requires form filling, which many farmers are unable to 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.

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

Q&A with Dr. Imran Khalid,

Q1: Petra Schmitter asked a question to Dr. Imran Khalid, could you please elaborate on the water accounting and at which scale you think WA according to you is most important to guide sustainable expansion of irrigation through solar powered irrigation. A follow up question is the fact that the majority is groundwater based irrigation and within water accounting framework the highest uncertainty is the estimation of availability and use of groundwater.

A: 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, who is involved in its acquisition at the community level and at the government level. 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 requires a shift from technocratic mindset that has dictated the way we govern our water. Hope this helps.

After the presentation, following opinion poll question was asked (participants were allowed to vote only)

“Do you think the Government of Pakistan should promote Solar Irrigation pumps to replace the existing diesel and electric pumps?” Answers (choose only one) – Yes/No/Don't know

Answer options	Percentage of participants that voted
Yes	84%
No	0%
Don't know	16%

A vast majority of the respondents believed the Government of Pakistan should promote SIPs to replace diesel/electric pumps.

Session 2: Panel Discussion

Panelists:

- Dr. Shoaib Ahmed
- Ms. Sara Hayat,
- Dr. Sardar Mohazzam,
- Mr. Tahir Anwar,
- Dr. Imran Khalid

Moderator:

- Dr. Mohsin Hafeez

Question 1 to all the panelists

Do you think the Government of Pakistan should promote Solar Irrigation pumps to replace the existing diesel and electric pumps?

- **Dr. Shoaib Ahmed** responded that government should promote SIPs, as it can provide environment friendly source of irrigation but it 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 solarization of tube wells at collective level for 5 to 6 farmers, and water pricing mechanism can be devised to fix water price in this case. Lastly, laser levelling of fields and use of drip and sprinkler can also be used to address possibility of over-extraction from SIPs.
- **Ms. Sara Hayat** responded that SIPs can be 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 break down that can occur with SIP, even the technical personnel at village level lack technical training to address technical hiccups that can occur 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, lessee does not have any incentive to invest in SIPs.
- **Dr. Sardar Mohazzam** responded that SIPs can help to 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. SIPs will lead to protective irrigation and equitable irrigation. Government is focusing on Baluchistan for promoting SIPs. Enhancing knowledge and technical capacity of society will be pivotal in successful adoption of SIP. It's not the diesel pump or SIP that can lead to a problem of over-extraction of groundwater, actually it is lack of defined access to common pool resource like groundwater that is leading to depletion of groundwater.
- **Mr. Tahir Anwar** responded that government should not promote SIP as a solution to irrigation. Main reason being we still have not done water accounting, and we are relying mostly on quoted figures for surface water and groundwater usage and quantity. One reason of using groundwater so extensively is an inefficient use of surface water. Government of KPK have solarized 600 tube wells but none of them is connected to grid. SIPs can contribute to electricity but net-metering is not available anywhere in Pakistan. There is lack of knowledge and technical capacity on part of farmers to use SIPs and HEIS.
- **Dr. Imran Khalid** 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 right time to move away from water intensive cash crops i.e. rice and sugarcane, rather cultivate crops that are necessary for food security.

Individual Questions to the panelists:

Q1: 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?

- SAARC has in-house expertise of solar irrigation. Our international linkages can bring in expertise that can help in promoting SIPs.
- SAARC can play a role in generating consensus, with respect to SIPs, of line departments in all of South Asia.

- We can also play a role in capacity building of departments and farmers. We can arrange visits for personnel of line departments to other SAARC countries for the purpose capacity building and sharing ideas.
- We also have the capacity to conduct research and we can aid in developing a policy document in regards to SIPs. Many policy documents are also available on-line on our website.

Q2: Question to Ms. Sara Hayat, how can GoP make sure the farmers who receive subsidies on Solar abandon using diesel/electric pumps? Any legal opinion. Secondly how do SIPs help GoP to achieve our INDC commitments?

- Enforcing SIP subsidies is not a legal problem but a social problem. After 18th amendment, agricultural policy making is a provincial matter. Most important issue with policy making is its enforcement, and enforcement of a policy can be assisted if the policy is formulated keeping demographics in mind it is catering to.
- Most farmers cannot even fill the forms to avail subsidy. To make things easy for farmers, applications forms can be in local languages. Moreover, 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.
- In my view, new policies are not needed rather finances should be used for awareness raising and capacity building of farmers and marginalized 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 in order to restore confidence of farmers into the subsidy program.

Q3: 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?

- Renewable energy policy is more focused on addressing demand side of the equation i.e. mostly renewable energy goals are set as n% reduction by 2025 or 2030.
- With regards to 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 regards to adoption of technology. In my view, technology will be inevitably adopted irrespective of the budget availability.

Q4: Question to Mr. Tahir Anwar, can you please provide overview of Government projects/plans to promote SIPs in Pakistan? Do you think SIPs can manage electricity and Ground Water crisis in Balochistan?

- Government is currently not launching any large scale program in agriculture. But there is a project of enhancing command area in Barani areas by installing SIPs on ponds, small dams or dug wells.
- Use of SIP should be linked to HEIS but capacity of farmers is an issue in order to use HEIS effectively. We can address this by first encouraging farmers to laser level their fields to increase efficiency of water use, and later farmers can switch from warbandi to HEIS for irrigation.
- Rs. 58 billion per year is given for electricity pumps. Rs. 22 billion per year is given to grid connectivity electricity.
- There is major question, how SIPs will effect groundwater in Baluchistan where groundwater has gone to 300 feet to 1200 feet at some place?

- As a first step it will be imperative to generate evidence of how SIPs will effect groundwater. For that we need to conduct feasibility studies to have reliable evidence in this regard.

Q5: 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?

- We are lacking evidence based decision making, and evidence available somewhere does not mean it will effect policy at government level.
- We need to devolve decision making further below the province level i.e. decision making should be done at farmer level.
- Equity issues has to be resolved so that those farmers should benefit who need it the most.

Q&A with Panelists

Q2: Kashi Kafle asked a question, why are we viewing solar pumps as ground water extractor only? Are not solar pumps used for pumping surface water as well?

Response: 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 are used to expand command areas where farmers use SIPs to pump water from small dams or dug wells.

Comment by Dr. Muhammad Ashraf from KFUEIT: In case of Pakistan, for sustainable use of groundwater an efficient groundwater monitoring system should be established by the government. Because, without groundwater monitoring and accounting it is difficult to manage the equitable access to groundwater resources. However, farmers are conscious to use the groundwater if there is quality issues. I think, the figures presented by Dr. Imran Khalid regarding groundwater tube wells support this perception.

[Key Takeaways from the webinar](#)

Takeaway 1:

- More finances need to be dedicated for capacity building of farmers and other technical personnel so potential of SIPs could be realized. This will also address all the apprehensions of farmers; thus, it will promote SIPs.

Takeaway 2:

- Evidence needs to be generated showing relationship between SIP use and groundwater extraction. This will help clarify apprehensions of the policy makers 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: Webinar Agenda

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

Date: Thursday, 4th February 2021

Time: 2:30 pm to 4:00 PM PST (90 minutes)

Webinar Link:

[https://us02web.zoom.us/webinar/register/WN_5pqgk1xgRwahShHsP2y4Bg?utm_source=BenchmarkEmail&utm_campaign=Solar_Irrigation_for_Agricultural_Resilience_\(SoLAR\)_%e2%80%93_Webinar_Week&utm_medium=email](https://us02web.zoom.us/webinar/register/WN_5pqgk1xgRwahShHsP2y4Bg?utm_source=BenchmarkEmail&utm_campaign=Solar_Irrigation_for_Agricultural_Resilience_(SoLAR)_%e2%80%93_Webinar_Week&utm_medium=email)

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 Panelists: 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

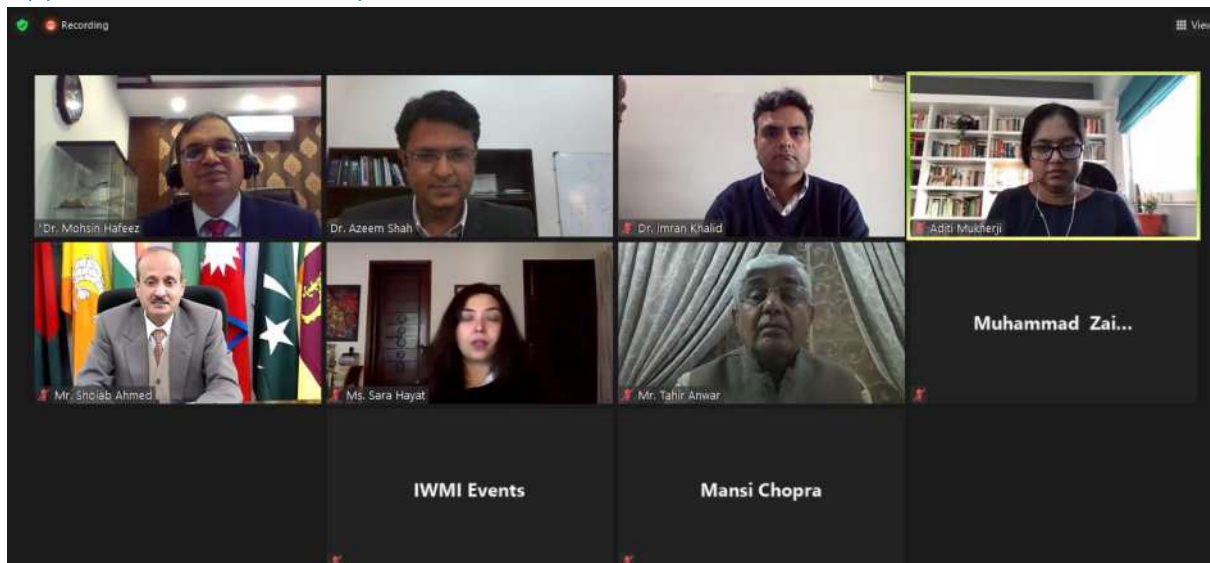
Appendix B: List of Participants

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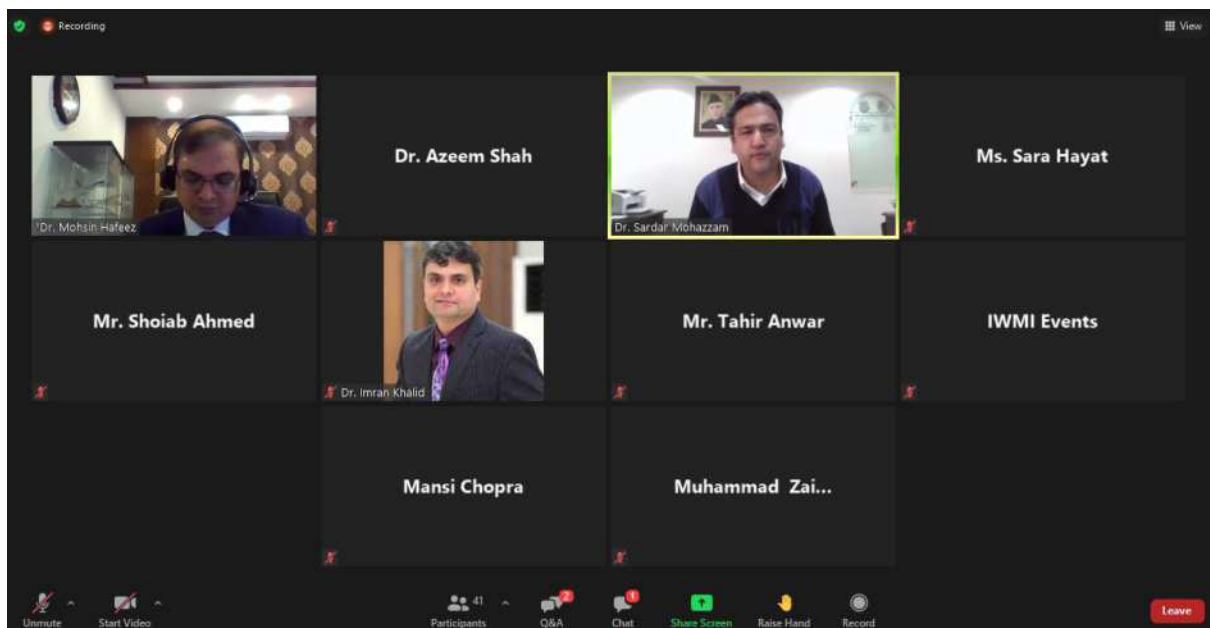
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Appendix C: Photo Gallery



Panelists of the webinar 5



Dr. Sardar Mohazzam providing his remarks