Review of solar pumping practices in the Punjab province for agriculture-water-energy reform

Stakeholder Consultation Workshop, Multan

Summary Report

IWMI
International Water Management Institute

April 13, 2022

Contents

Review of solar pumping practices in the Punjab province to inform agriculture - water-energy reform

The Government of Punjab is undertaking a legislative and policy shift towards improved groundwater management. This is illustrated by Government's Punjab Water Policy (2018), the Punjab Water Act 2019, and the Punjab Groundwater Management Plan (under preparation). As part of the World Bank's Programmatic Agriculture Sector Review (PASA - P175667) for Pakistan, this review study is carried out to estimate the economic, climatic, and environmental effects of solar groundwater extraction infrastructure, and identify the expected trade-offs in shifting from existing systems to lower-emissions and higher-sustainability systems.

The overall objective of this study is to provide the government of Punjab with actionable recommendations that can enable the continued and sustainable abstraction of groundwater for irrigated agriculture with lower GHG emissions and reduced harm to natural resources. This study will identify reforms and intervention designs that can pave the way to a low-carbon and sustainable groundwater use in agriculture, especially for downstream and more vulnerable areas and users. Current knowledge of changes in surface and groundwater interactions between upstream and downstream canal areas will also be leveraged to identify zones where higher levels of pumping are sustainable and are therefore appropriate for promotion of solar tube wells. It will also identify opportunities to align a potential tube well solarization program with the Government of Punjab's ongoing legislative and policy shift towards improved groundwater management.

Introduction to Stakeholder Consultation on Solar Irrigation

Stakeholder consultation on Solar Irrigation was conducted in collaboration with Muhammad Nawaz Shareef **University of Agriculture** (Multan). Different stakeholders from academia, government, farmers, and industry participated in this event. The objective of this consultation was to conduct a stakeholder mapping to understand the policy and institutional landscape and the needs and motivations of different stakeholders. Additionally, this event helped in assessing how different stakeholders are affected by current water management and pumping practices. Lastly, this consultation along with other consultation events to be conducted in other district will help in paving the way for the government to promote solar technology resulting sustainable groundwater abstraction.

Introduction by Dr Mohsin Hafeez (Country Representative – IWMI)

Dr Mohsin Hafeez gave opening remarks and explained the objectives of the workshop. In his opening remarks he explained the importance of sustainable use of groundwater, upcoming Punjab government's subsidy scheme of drip system and solar pumps (PRIAT) as a continuation of Punjab Irrigated-Agriculture Productivity Improvement Project (PIPIP) and focus on finding ways to promote High Efficiency Irrigation Systems (HEIS) coupled Solar Irrigation Pumps (SIPs) in a profitable way.

Remarks by Dr Asif Ali (Vice Chancellor – MNS University of Agriculture)

Water is a most important component in our lives more so in agriculture. Water has many stakeholders i.e., agriculture, industry, and domestic sector. To save water in agriculture method of cultivation needs to be changed. With respect of SIP, without changing the mindset of the farmer this can prove to be a disaster in term of groundwater sustainability.

Session 1: Keynote Presentation

Topic: ***The potential of Solar irrigation for Pakistan***

Presenter: Dr. Azeem Ali Shah, International Water Management Institute (Pakistan)

Summary of the presentation

There are different points of view about solarizing the agriculture sector, on one hand Solar Irrigation Pumps (SIPs) can lead to decrease in carbon emissions while on the other hand it can lead to over abstraction of groundwater. There is no feed-in-tariff and farmers have not converted to net metering system in agriculture sector of Pakistan.

Salient features of pumping practices in Punjab include exponential increase in diesel tube wells overtime which has led to increase in carbon emissions, increase in cropping intensity that is supported by conjunctive use of groundwater with canal water. This has led to fall in groundwater levels in many areas. Lack of implementation of groundwater management policies has resulted in unsustainable groundwater abstraction.

Models of solar irrigation implemented in India, Bangladesh and Nepal can be examined at three levels i.e., microscale, mesoscale, and macroscale. Microscale model of solar irrigation in India 5 to 8 KWH pumps given to union of farmers. In Pakistan, individual investment is more prevalent as compared to collective ownership of pump. Mesoscale model of solar irrigation includes 30 to 50 KWP SIPs. SIP farmers can distribute electricity back to grid. Macroscale model of solar irrigation include large SIPs grids.

While designing new subsidy scheme for SIPs government must decide on factors like models, approaches, risk & market development, and regulatory practices. Net metering and feed-in-tariff can help in extending vision of agri-solarization in Punjab in sustainable manner. Finally, we also need to think about coupling SIPs with HEIS irrigation systems (should not only stick to drip but sprinklers (rain guns), centre pivot systems also provide promising alternatives) and which areas and which types of crops are suitable for such systems.

Session 2: Panel Discussion

1st Topic: *What pump size should be appropriate for the subsidy scheme?*

Malik Jahanzeb (Mango Farmer):

More than the pump size farmer's awareness to efficiently use water is more important for sustainable use of water. Without any awareness increase in pump size will lead to water wastage. Farmer quoted his personal example that by just lining his internal watercourse his tubewell usage came down from 1239 hours to 75 hours per season. In addition to this, testing for soil index and selection of crop also plays an important role in efficient use of water.

Kashif Islam (Farmer)

Farmer had 14 years of farming experience with drip system. He was of the view that uniform policy will not work i.e., expensive drip laterals need a lot of repairs instead disposable lateral would work better and it will also help develop parallel industry.

Dr Mohsin Hafeez (IWMI)

Many farmers are of the view that equipment through subsidy is expensive and privately cheaper options are available. Does private sector have any guidelines to ensure standard of the equipment?

Malik Jahanzeb (Mango Farmer):

Farmer was of the view that registered installation companies of the government have B-firms and similar equipment is available for the same price without the subsidy as well i.e., if farmer share on Rs. 160,000 is Rs. 64,000 (according to 40% subsidy) then same equipment can be bought for Rs. 64,000 from the B-firm.

Muhammad Ilyas (Progressive Farmer)

Farmer highlighted that there is no drinking water in Mirpurkhas. Canal water distribution is not equitable, few influential farmers irrigate their complete land with canal water and many small farmers do not get a drop of it. Solar panel capacity, pump size and pipe diameter change with factors like land holding and depth of water table i.e., lower water table will require high hp and high solar capacity.

Farmer suggested that government should not limit farmer to few installation firms as this leads to expensive and sub-standard equipment. To reduce water wastage lined watercourses, soil moisture sensors, water storage ponds and water efficient crop varieties are pivotal.

Dr Abdul Sattar Malik (Bahauddin Zakria University, Multan)

Pump size does not matter on its own and it depends upon land holding size and farmer requirements. Other dimension to be kept in mind for pump size with SIP is that SIP peak output time is 4 to 5 hours per day and with drip system SIP should be designed to work with it.

Malik Jahanzeb (Mango Farmer):

Soil index is most important factor in determining appropriate water flow; hence, pump size to achieve it. Inappropriately small pump size leads to slow water flow, and this can lead to root rotting as water will seep deep then it is required.

Dr Asif Ali (VC of MNS University of Agriculture)

There is no doubt that standardization needs to be assured but limiting the choice of options in terms of installation firms will lead to low quality equipment.

Dr Asif Ali was of the view that there should be no subsidy and government should directly support farmer if his crop earnings fall more than 25% of his cost of production.

2nd Topic: *Grid connected or not – which model is appropriate for SIPs?*

Kashif Islam (Farmer)

Farmers bottom line is profit. Interrupted power for water pumping leads to less coverage and greater water seepage; thus, low profits. Uninterrupted solar power is more in line with ensuring the bottom line.

He added as farmers we need technical assistance. Specifically, we want raised dams, dams in which we can store canal water, rainwater, and groundwater. At the time of irrigation farmer can pump water with SIPs to drip system.

Government needs to ensure compliance with continuous surveillance of subsidy beneficiaries, so they continue using drip system. He also added that to ensure sustainable use of groundwater, ultimately tubewells must be metered and license has to be issued for groundwater abstraction.

Dr Abdul Sattar Malik (Bahauddin Zakria University, Multan)

Such hybrid solution should be propagated that on-grid SIP should also be able to work off-grid. This will ensure constant water supply. He highlighted some limitations of on grid i.e., for net metering rates are fixed, farmer's capacity, crop type, and soil type matters in determining on-grid solution.

Mumtaz Khan Manais (Farmer)

He suggested few of the following things.

- 17% GST on the subsidy should be waived.
- Efficiency of the pump is of prime importance i.e., farmer successfully irrigated with 1 hp pump of 4 inch pipe for 5 years but pump has to be abandoned when groundwater went below 25 feet.
- For 12 acres 2 to 3 kanal dams need to be constructed. All the canal water should go to the dam then SIP pump water through automated irrigation i.e., after fixed time water go to next zone.
- Farmer should be allowed to get the equipment from company of his choice and then claim 60% of the bill from the government.

He said, "We should be watering the plants and should not be watering the fields."

Col. Rafayat (Farmer):

SIP should be a pre-requisite for the drip system. He added hose reel can be an option with SIP.

Dr Shazia Hanif (Agricultural Engineer – MNS University of Agriculture)

Community level dams should be built, and SIPs should be used to make HEIS cost free. In addition to this, industry collaboration with farmer should be established.

Irfan (MNU – University of Agriculture)

Hydrological modelling not done in places where SIPs are installed. SIP should be introduced as a package with hydrological modelling and linked with efficient irrigation systems. SIP in isolation will be unsustainable.

M Rizwan Saleem (XEN Irrigation Department)

Lining the watercourses and canals with concrete is affecting groundwater recharge, Mangla and Tarbela Dams are at dead level and the canal under my jurisdiction has flow of 600 cusecs whereas demand is 2000 cusecs. Given these challenges sustainable practices for groundwater abstraction are pivotal and metering the pumps can aid in monitoring groundwater use.

3rd Topic: *What will be the most appropriate financial model to roll out the subsidy?*

Dr. Imran Sharif Chaudhry (Bahuddin Zakariya University, Multan)

Hydel source of energy is the cheapest still as SIP has very high fixed upfront cost associated with it. Biggest hurdle in sustainable management of groundwater is the mindset of people that water for free.

With regards to SIP there is lack of planning. There is lack of standardization. SIPs should be made cost effective by promoting manufacturing at the local level ensuring god standards, until then duty on solar panels should be waived.

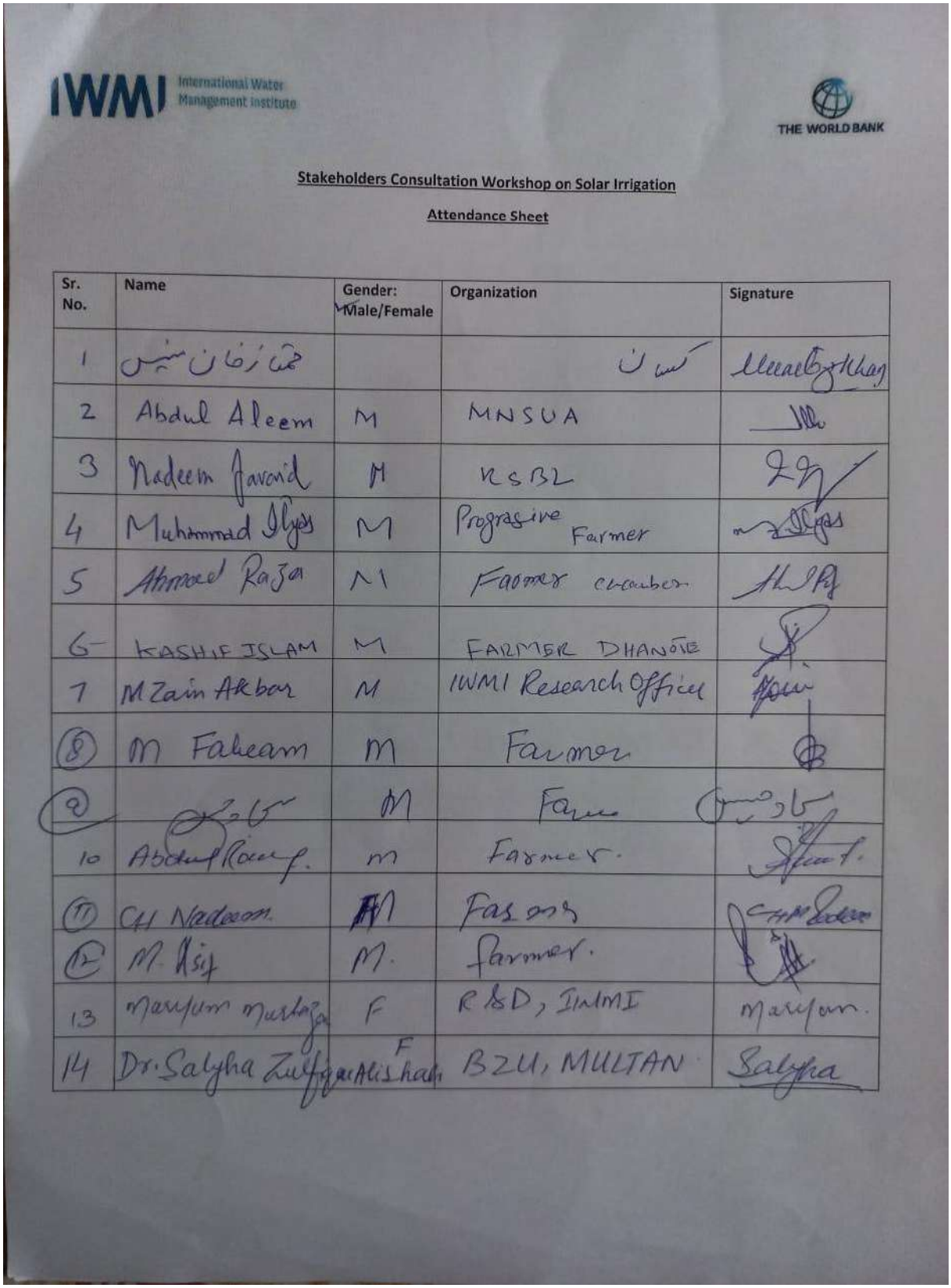
Malik Jahanzeb (Mango Farmer):

Before installing SIP, groundwater salinity should be checked, in case of salinity desalination machine should be included in subsidy package. Purchase of sub-standard machinery should be banned, and brand-new equipment is most important for efficiency.

Key Takeaways

- Standardization of equipment i.e., drip system, solar panels and supporting equipment is of utmost importance to ensure sustainable groundwater use. It is also important to reduce water losses at internal watercourse level i.e., by lining the internal watercourses.
- Combining use of SIPs with raised dams (to store canal, ground and rainwater) and High Efficiency Drip System (HEIS) will be the way forward to conserve water.
- Groundwater recharge through rainwater harvesting in both urban and rural areas will be most important to create some balance at systems level.

Appendix A: List of Participants



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Attendance Sheet

Sr. No.	Name	Gender: Male/Female	Organization	Signature
1				
2	Abdul Aleem	M	MNSUA	
3	Nadeem Javaid	M	KSBL	
4	Muhammad Ilyas	M	Progressive Farmer	
5	Ahmad Raza	M	Farmer	
6	KASHIF ISLAM	M	FARMER DHANOTE	
7	M Zain Akbar	M	IWMI Research Officer	
8	M Faheem	M	Farmer	
9		M	Farmer	
10	Abdul Rauf	M	Farmer	
11	CH Nadeem	M	Farmer	
12	M Asif	M	farmer	
13	Maryam Murtaza	F	R&D, IWMI	
14	Dr. Salyha Zulfiqar	F	BZU, MULTAN	

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Sr. No.	Name	Gender: Male/Female	Organization	Signature
15	DR ABDUL SATTAR MALIK	Male	Dept. of Elect. Engg., B.Z.U. Multan	
16	Prof Dr. Imran Shafique Ch.	Male	SoE, BZU, Multan	
17	Dr. Fatima Farooq	Female	SoE, BZU, Multan	
18	Dr. Shazia Hanif	Female	Agr. Engg MNSUAM	
19	Rous Abd	Male	Farmer	
20	Col Rafayat Rana Mah		Farmer	
21	MALIK JAHAN ZEB	MALE	Mango Farmer	
22	ch. Rashid H	Male	Farmer	
23	Asif Ali	Male	MNS Univ. of Agri. Multan	
24	Mohsin Hafeez	Male	IWMI	
25	Engr. M. Sajid	Male	Punjab Irrigation Dept	
26	Ashiq Mohammad Khan	Mal	Land Lord	Ashiq Khan

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Attendance Sheet

Sr. No.	Name	Gender: Male/Female	Organization	Signature
27	M. Sarfraz Khan	Male	Farmer	M. Sarfraz
28	Liaqat Ali Jatoi	Male	Farmer	
29	M. Jawad Khan	Male	Farmer	M. Jawad
30	Majid Khan	Male	Farmer	
31	Atta Hussain Shah	Male	Farmer	
32	Adan Hayat	Male	Engineer, SDO Irrigation Deptt	
33	Dr. Haseeb Raza	Male	Assistant Professor, MNSUAM	
34	Dr. Azeem Shah	M	SRA IWMI	
3	M. Rizwan Saleem	Male	XEN Irrigation Department Punjab	
	Dr. M. Umair Umer	Male	Doctor	
	ARSHAD ABBAS QURESHI	M	Agriculturist	

Appendix B: Photo Gallery

Background

Participants of Workshop

Opening remarks by Chief Guest (VC MNS University of Agriculture)

Presentation by Dr. Azeem Shah

Image Credit: IWMI SoLAR-Pakistan