

## Solar Irrigation for Agriculture Resilience in South Asia (SoLAR-SA) Project

**Bangladesh - Country Project Management Committee (C-PMC) | 3rd Meeting**

**Date: 8 December 2021 | Time: 14:00-15:30 hours (BST)/13:30-15:00 hours (IST)**

**Venue: Zoom meeting**

### **A) List of attendees**

*(Attached in Annex II)*

### **B) Agenda**

#### **Welcome remarks**

- Dr Alok Sikka, Country Representative, IWMI-India, welcomed all the participants to the third Bangladesh CPMC meeting. This was followed by a brief and formal introduction by all the members.
- Dr Sikka emphasised the larger goal of the SoLAR project in South Asia that is to contribute to the climate-resilient, gender equitable and socially inclusive agrarian livelihoods by supporting the government programmes and policies focused on solar irrigation. He further mentioned that the outcomes and deliverables of the said project are centred around impact evaluation and gender equity and social inclusion (GESI) of the SIPs. Many scale pilots are being implemented and various business models have been designed for promoting solar irrigation pumps (SIPs). In Bangladesh, the main aim is to replace diesel pumps with SIPs in off-grid areas, thereby saving foreign exchange, reducing subsidy burden and further reducing GHG emissions. Groundwater sustainability is another important aspect that will be explored through this project.

### **Bangladesh Project Progress and Year 3 Plan**

Archisman Mitra, Country Project Manager, SoLAR, IWMI, gave an update on the status of the overall project in Bangladesh and the plans therein for year 3.

- *Activity 1.1.1* deals with the impact evaluation and GESI case study of existing and new SIP programmes in Bangladesh.
  - Two major surveys will be carried out, viz., baseline survey (2021) and endline survey (2023) covering 900 farming households under SIP and diesel-based pumps. Furthermore, telephonic surveys for 82 IDCOL SIPs will be furnished. It has started

for Aman 2020 and will continue till Boro 2023, thereby covering 3 surveys for 3 seasons in the country.

- Four broad policy questions will be answered through this impact evaluation that will be centred around the impact of IDCOL's SIP model on agricultural practices and groundwater usage; impact of grid connection; evolution of IDCOL SIP operations over time and the inclusivity of the current SIP models.

Deliverables achieved: The following have been achieved in the past one year-

1. Draft paper on policy analysis in Nepal and Bangladesh through a GESI outlook has been written which is currently in the editing and reviewing stage.
2. The Situation Analysis report has been published. A journal article will be written that will provide an overview of SIP in Bangladesh. This will combine the secondary data provided by IDCOL along with the data from the SIP surveys.
3. Three SIP surveys have been completed and the fourth SIP survey is ongoing (Nov-Dec 2021). This will be a telephonic interview of SIP operators
4. Baseline household survey has been completed for 900 farmers across 60 villages in October 2021.

Planned deliverables: The following will be done in year 3-

1. Three more rounds of SIP surveys will be done in 2022 that will cater to primary level data using phone interviews.
2. Analysis from the primary survey data will be carried out in 2022 that will look co-benefits of SIP at the farmer level and heterogeneity in outcomes and estimating the mitigation role of solar irrigation.
  - *Activity 2.1.1* deals with the case study on different SIP promotion models in Bangladesh. Three models, viz., fee-for-service model by IDCOL, group ownership models by BADC, BMDA, RDA&DAE and individual ownership model by BREB are currently in place targeting different modes of irrigation and the type of crops grown.

Deliverables achieved: The following have been achieved so far:

1. Contacts with various government organisations, viz., BREB, BMDA and BADC have been established. Beneficiary details from BADC and BMDA have been obtained.
2. Focus Group Discussion (FGD) and Key Informant Interviews (KII) guiding protocol has been prepared and field visits to the NW region of Bangladesh has been carried out to pre-test the FGDs.
3. Invitations have been sent out for stakeholder interviews, i.e., academicians, government officials, sponsors, NGOs, etc.

Planned activities:

1. To understand modalities of different SIP promotion model with respect to scope and scalability
2. Key informant interviews, FGDs, household surveys will be carried out
3. Interviews with water buyers will also be carried out to understand the functioning of local groundwater markets
4. To conduct FGDs with IDCOL, BADC and BMDA beneficiaries
5. To write an article based on qualitative interviews that will explore the comparative case

studies of different SIP models and the influence of SIP on the local groundwater market

6. Transcription of recorded FGDs and KIIs accompanied by translation.

- *Activity 1.2.1* deals with the groundwater sustainability studies in Bangladesh. The overarching question in this regard will look into the possible impacts of large-scale adoption of SIPs on groundwater resources.

Deliverables achieved: The following have been achieved so far-

1. Secondary data collection has been completed and methodology and monitoring protocol has been finalised
2. Survey of selected SIPs (SIP design plans, field and farmer mapping) has been completed to select plots for monitoring instruments. A total of 235 farmers have been selected
3. Instrumentation of flow meters have been completed at selected sites
4. Training of operators for data collection has been completed along with the selection of control diesel farmers
5. Conceptual model for GW modelling in the project areas have been developed.

Planned activities:

1. Monitoring for Rabi and Bodo season to start for 2021-2022.
  2. Analysis of 2022 monitoring data will be carried out to compare groundwater use.
  3. The conceptual GW model will be developed into a numerical GW model for simulating the impact of SIP.
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- *Activity 2.2.1* deals with demonstration pilots for grid connection of SIPs. Under this activity, grid integration modalities have been considered that entails clustered SIP sites via an HT line. A maximum of 4 sites/clusters is a site selection criterion, wherein the maximum output  $\leq 10$  MW and the output power  $\leq 70\%$  of the transformer rating. Distance of SIP sites was another criterion considering the cost of installation. Both overhead and underground cabling is allowed. Grid-integration and net-metering are piloted under this activity.Implementation process:
    1. 3 sponsors have been chosen as they quoted lowest cost per site with complete BOQ. Gazi, Wave and KHM are the respective sponsors.
    2. For grid connection, 50% of the cost will be borne by IWMI through a partnership agreement with IDCOL and the remaining 50% by the sponsors as equity.
    3. The project has been approved by IDCOL and the contract has been signed between IDCOL and the sponsors.
    4. The sponsors are in the process of getting NOCs from utilities for smooth implementation and is anticipated to be completed by January 2022.
  - *Activity 2.3.1* deals with innovation funds. KHM power was the IF grantee from round 1. The project aims to promote poultry farming below the solar panels and/or fisheries in the space between two sheds. Four sheds at two locations have been constructed and three rounds of chicken rearing and selling have been achieved. A pond has been excavated and catfish is being reared. This is still in the initial stages.
  - *Activity 3.1.1* deals with the training of local technicians and farmers. A training programme was conducted on the 28<sup>th</sup> of October 2021 at Jhenaidah, Bangladesh that trained 31 farmers on improved agricultural and irrigation practices along with irrigation scheduling and use of underground pipe system.

- *Activity 3.2.2* deals with National Forum. The 2<sup>nd</sup> National Forum is slated for January 2022 to be held in virtual mode where relevant stakeholders will be invited.
- Kazi Ahsan, IDCOL requested the CPMC members to assist and support the endeavour of the sponsors that will expedite the process of implementation which will further aid the studies of the relevant stakeholders. The technical knowhow and results will be shared by IDCOL in the days to come.

## **Q&A**

**Q: Md Rashedul Alam, SREDA-** Is the grid-integration of SIP financially viable? What is your opinion regarding this?

**A: Kazi Ahsan, IDCOL-** We have already started the approval process of the pilot. We have done some mathematical simulations that will determine what type of output will come. But those assumptions need to be verified. As soon as these projects are implemented, we will get the results in terms of energy output. Based on the output, we will consider the tariff and the revenue that is received by the sponsors. After which, analysis will be made whether it is viable or not.

**Q: Sarwar Hossain, BADC-** If you have gone to the field, some discussion on the observation would be nice. The grid-integration in India is much better for example in Rajasthan. If someone from India could assist us with sharing the grid-integration process, it will be very helpful.

**A: Dr Alok Sikka, IWMI-** Yes, definitely. That's what we are trying to do. We have shared earlier about the status of grid-integration in Gujarat over the past few years. We will be more than happy to give our further inputs.

**Archisman Mitra, IWMI-** During the National Forum, we will try to bring in India experts so that it can be discussed in a forum. The subsequent presentations in this meeting will throw some light on the household survey. Hopefully, we can give some answers to what we found.

## **Results from the Impact Evaluation Study**

- Marie-Charlotte Buisson gave brief insights on the impact evaluation study. She presented the early analysis from the HH survey and the SIP survey that covered over 900 farming households.
- Under the fee-for-service model, the irrigation cost is lower, and less time is spent on irrigation with over 99% of the farmers agreeing to reduction in irrigation time. Over 70% of the SIP farmers indicated that they saved irrigation cost. The farmers are able to spend their saved time in other income generating activities, personal time and household care work. On the other hand, the farmers spend their saved costs on household expenses with investment in livestock and agriculture. Hence, these are some of the relevant steps in poverty reduction.
- On hours spent on irrigation per day during the Boro season, there is not much of a difference between an SIP user and diesel pump buyer. But farmers who have their own diesel pumps spend greater time on irrigation.
- A qualitative perception on farmers' satisfaction with this model was presented. Under the categories of satisfaction with quantity, quality, timing and cost of irrigation. Three types of farmers are considered, viz., SIP buyers, diesel pump buyers and electric pump buyers.
- In terms of quantity and quality, there is high satisfaction among SIP buyers and lower for diesel-based buyers. In terms of timing, the satisfaction is higher for SIP and electric buyers as compared to diesel irrigation buyers. In terms of cost, the satisfaction is higher for electric pump buyers, followed by SIP and diesel pump buyers.

- On cropping choice, the shape of farmers cultivating Boro (and areas) is significantly higher for SIP and electric pump users. However, both cropping intensity and crop diversity is higher for diesel irrigated plots. More understanding on the causality of SIP on cropping choice is required in the coming years.
- On the dynamics of cropping pattern, diesel pump owners tend to be larger farmers, followed by SIP users. Water buyers from diesel pumps cultivate smaller areas on an average. SIP users have increased the area under cultivation in the last 5 years, while farmers who have irrigated from their own diesel pump decreased their areas on an average. The Boro cultivation was lowest for diesel water buyers. In the last 5 years, increase in share of farmers cultivating Boro has been highest for SIP users, but also very high for diesel water buyers. SIP farmers are therefore less diversified.
- For SIP operation and diversification, it was found that Southwest (SW), SIPs serve larger areas in Rabi and Kharif 2 seasons (non- Boro seasons) but lower areas in Kharif 1. The gross irrigated areas are higher in SW than Northwest (NW) SIPs. There is a greater dependency on Boro in NW regions because of higher diversification of crops.
- In terms of financial dependency on Boro, SIP incomes are largely dependent from Boro season wherein 69% of the total fees is collected in SW and 90% in NW. Even in SW with more diversification and operation in non-Boro season, there is high dependency on Boro for the financial sustainability of the SIP.
- In terms of operation and grid integration, SIP operation does not use the full potential of panels in terms of number of days and number of hours of operation per day. The potential is slightly higher in SW with higher irradiation.
- In terms of SIP as a job opportunity, the SIP operators have a huge role to play. The operators are usually the SIP landowners or a relative of the landowner. These operators usually receive a fixed wage, along with a %age of the fees collected and other co-benefits like poultry raising, aquaculture and growing vegetables, etc. Furthermore, there has been a shift from water selling to becoming SIP operators.
- In terms of operators being extension agents, even though they are well-trained on SIP O&M, yet there is still a higher demand for further training. These trained farmers can act as a point of contact for farmers. Therefore, there is a potential for SIPs to become multi-service hubs for agriculture.

## Q&A

**Q: Md Sakil Ibne Sayeed, BREB-** The presentation shows that SIP users are satisfied with the timing, but during the implementation of our project, in most cases, it has been found that farmers don't like the timing, i.e., SIPs cannot be used at night. Can you explain the topic more elaborately?

**A: Marie-Charlotte Buisson, IWMI-** It was the time at which irrigation is done and the duration. We were also under the same assumption as yours that farmers may prefer the timing at night. But that is not necessarily the case. The farmers don't have to come to the field, and they don't have to work hard for irrigation.

**Q: Sarwar Hossain, BADC-** If you find any scheme that is suitable for economy in NW & SW, then how do the farmers go to the field and what is the cropping pattern? Secondly, SIPs have a command area. In case of IDCOL SIPs, what is the average command area, especially in the Boro season?

**A: Marie-Charlotte Buisson, IWMI:** In terms of cropping pattern, what we in the SIPs from the NW region, on an average, the SIPs are mostly used in Boro paddy irrigation and in SW, those are used for

Bodo season crops and also for non-Bodo crops. There is more diversity in terms of crops cultivated in SW, as compared to NW. The average command area is 50 acres.

**Q: Dr Alok Sikka, IWMI-** Boro area is least with diesel-buyers and high with SIPs. So, where could be this implication going forward?

**A: Marie-Charlotte Buisson, IWMI-** Yes, that's what we need to understand. I don't want to go into the implication before being absolutely sure why we are making these observations. Faiz's work on groundwater will be needed to support this. In other words, when irrigation is cheaper, farmers go for more water-intensive crops.

### **Discussions:**

#### **Divya Kashyap, SDC**

The results which seem to be emerging from the work that the team has done could give us some great insights into what we observe after the grid-connection is completed. There is an opportunity cost for this energy that is being fed into the grid, does it lead to enhancement into the price of water as it gets distributed to farmers? Can this also be an instrument to bring about behavioural change? Is Bodo farming desirable or not? These things have to be kept in mind.

#### **Kazi Ahsan, IDCOL**

Two important things have to be kept in mind. Firstly, in a village, SIP location is chosen to service Bodo cultivated lands and hence a comparison with diesel pumps from the same village might be misleading since they are influenced by the presence of SIPs? Secondly, the cropping intensity estimate is an average over 83 SIP sites, where the mandate is Bodo cultivation, which takes longer time to cultivate and might have impacted cropping intensity.

#### **Marie-Charlotte Buisson, IWMI**

I do agree, this is something we need to look at. We surveyed SIP and non-SIP sites and the comparison between diesel and SIP site are based on different villages. So, it's unlikely that the SIP sites have an influence on the diesel-based sites. We will be able to dig in further once we have the HH level information. Currently, we only have the block level information.

### **Updates on GW Study**

- Md Faiz Alam, IWMI gave a brief update on the aspect of GW sustainability studies in Bangladesh. The broader policy question of what the possible impact could be of large-scale adoption of SIP in GW resources was focussed upon. The idea is to look into the relationship between higher satisfaction, lower effort and costs and if it leads to GW abstraction.
- In the recent past, there has been a growing concern over the depleting GW resources in Bangladesh and most of it is attributed to human impacts. GW depletion has been higher in the pockets of NW which is a cause of worry. With depletion, GW levels will go down, as the country is largely dependent upon diesel pumps. These pumps are shallow water pumps and they do not operate after a certain depth, i.e., when GW tables are below the suction limit (> 6 m). A recent study found that the GW levels have gone below 6 metres in a large number of pumps, i.e., around 80% of them during most parts of the year. If continuous depletion happens, there will be more instances of diesel pumps becoming dysfunctional.
- Another issue that was focussed upon was cropping pattern, i.e., if it does not change, does it mean, people might be irrigating more but the actual use remains the same. Therefore, evapotranspiration (ET) will remain the same. But, at the regional levels, there have been

studies which show that with more abstraction/depletion, there will be more space for GW recharge. This will be investigated further through GW modelling.

- Installation and GW abstraction is currently underway, and the results will be available after Bodo season. Selection of SIPs are differences in cropping pattern. Corresponding diesel farmers have also been selected in the nearby villages.
- A total of 12 SIPs have been selected across 36 outlets covering 235 farmers in 320 plots in both NW & SW regions. A detailed site plan has been designed for each SIP selecting 3 outlets per site that will serve multiple farmers.
- With the help of IDCOL and NGOF, flow meters have been installed. IDCOL SIP operators will be trained for data collection where they will be maintaining detailed logbook of selected outlets. This will give an accurate idea of water application vis-à-vis SIP vs diesel farmers.
- To understand the actual water use and irrigation efficiency, and for sustainable GW use, vadose zone flow processes have to be understood. For this, HYDRUS-1D model will be used. This will help in the quantification of irrigation return flow in Bodo (dry) season.
- Regional GW model will look into the effect of solar-based irrigation on long term GW storage relative to business as usual under climate scenarios. This model will be developed for whole of NW region. A detailed review has been carried based on research work carried out by other researchers. This will help the policymakers to understand the current field scenario as well as assess the future projections. This will be a beneficial tool in a changing climate especially at a time when rainfall patterns are erratic.

#### **Presentation on Novel filter technology for arsenic treatment**

- Divya Kashyap from SDC gave a brief presentation on the novel filter technology for arsenic treatment. This is a technology that has been tested in India, prior to which this was tested in Latin America. This technology has been very useful in treating arsenic, fluoride and other heavy metals and biological contaminants from groundwater.
- This technology could be of interest in Bangladesh where the issue of arsenic contamination is quite prevalent. It is an adsorption-based technology where the filter is made from milk protein. It does not require energy and does not lead to any wastage of water.
- This technology has been deployed in parts of Chhattisgarh and Hyderabad and in Guwahati, Assam. This technology has an efficacy of more than 99.5% in removing arsenite (III) and arsenate (V). these results are overall are very promising.
- A certification was issued by CSIR-NGRI (National Geophysical Research Institute), Hyderabad for the testing carried out in India.
- A start-up named Blue Act has developed individual filters for serving numerous households in rural areas. Currently, hundred of such filters are in place. The filter is priced at USD 50. The government of Uttar Pradesh is testing this technology in 30 villages, as part of their rural water supply scheme.

#### **Discussions**

**Alok Sikka, IWMI-** These are arsenic filters that are used for drinking purposes that are limited to domestic use.

**Divya Kashyap, SDC-** Blue Act has developed filtration technology for industries on a large scale which is essentially used for extraction or recovery of metals.

**Alok Sikka, IWMI-** Arsenic has become an issue of concern in India over the past few years. The acceptable levels of the presence of Arsenic in water has been lowered by WHO (World Health Organisation) in the recent past.

#### **Q&A**

**Q: Kazi Ahsan, IDCOL-** You mentioned that the filters are used for drinking but cannot be used for irrigation due to high volume and cost. What is the amount of water that could be filtered? In a year, how much water should be filtered? Is the technology open-sourced? If the Bangladeshi government wants to introduce this technology, what should be the method to approach?

**A:** The technology is patented, so it is not open source. This was a technology that was developed in Switzerland, i.e., in ETU- Zurich, nearly 7-8 years ago. Commercially, it is being used in many countries of Europe. Since 2018, this technology is being tested for small-scale use. There is also a filter that can be directly connected to the tap. They are currently running a campaign to test these filters out on a larger scale and Bangladesh can also take interest and I would be happy to connect with you on this.

#### **Closing remarks**

- Divya Kashyap, SDC, expressed her heartfelt gratitude to all the CPMC members who took out time from their busy schedule to present meaningful insights on the project in Bangladesh. Next year is very crucial and more work will be implemented on the ground as Covid restrictions ease.
- Dr Alok Sikka, IWMI thanked everyone for their presence and ensured to accommodate the queries and suggestions in the best possible manner.
- Kazi Ahsan, IDCOL, was positive about the project despite covid-related restrictions and delays and more will be done next year.

*Meeting notes prepared by Zeba Ahsan, IWMI.*

## Annex I: Program Agenda

Time	Agenda	People
14:00-14:10	Welcome remarks and introduction	Chair for the event
14:10-14:25	Bangladesh Project Progress+ Workplan for Y3	IWMI+IDCOL
14:30-14:45	Results from the IE study + field visit	IWMI
14:45-15:00	Updates on GW study	IWMI
15:00-15:05	Novel filter technology for arsenic treatment	SDC
15:05-15:20	Q&A on presentations	
15:20-15:30	Closing remarks	

## Annex II: List of Participants

Sl no	Name	Role	Institution	Attendance
1	Dr Alok Sikka	Invitee	IWMI Country representative	Yes
2	Md Sarowar Hossain	Member	Representative of BADC	Yes
3	Engr Ashok Biswas	Member	Representative of DAE	Yes
4	Kazi Ahsan	Member	Representative of IDCOL	Yes
5	Engr Md Rashedul Alam	Member	Representative of SREDA	Yes
6	Md Ahasan Habib	Member	Representative of NGO Forum	Yes
7	Engr Md Nazrul Islam	Member	Representative of BMDA	Yes
8	Md Sakil Ibne Sayeed	Member	Representative of BREB	Yes
9	Divya Kashyap	Member	Representative of SDC	Yes
10	Mofazzal Hossain (Farid)	Member	Representative of IDCOL	Yes
11	Bilal Siddique	Invitee	Representative of IDCOL	Yes
12	Ms Iffat Ara	Invitee	Representative of BADC	Yes
13	Archisman Mitra	Member Secretary	IWMI	Yes
14	Marie-Charlotte Buisson	Invitee	IWMI	Yes
15	Md Faiz Alam	Invitee	IWMI	Yes
16	Mansi Chopra	Invitee	IWMI	Yes
17	Smaranika Mahapatra	Invitee	IWMI	Yes

Abbreviations: IWMI is International Water Management Institute, BADC is Bangladesh Agricultural Development Corporation, DAE is Department of Agricultural Extension, IDCOL is Infrastructure Development Company Limited, SREDA is Sustainable and Renewable Energy Development Authority, BMDA is Bangladesh Multipurpose Development Authority, BREB is Bangladesh Rural Electrification Board, SDC is Swiss Agency for Development and Cooperation

## Annex III: Photo Section

**IWMI** International Water Management Institute

**IDCOL** TOGETHER FOR TOMORROW

**NGO FORUM FOR PUBLIC HEALTH**

**CGIAR**

# Solar Irrigation for Agriculture Resilience – Bangladesh Work plan and current work status

- Third Bangladesh CPMC Meeting
- 08 Dec, 2021
- Zoom Meeting

Innovative water solutions for sustainable development  
Food · Climate · Growth

### 3. Cropping choice: dynamics of cropping pa

Source: Data collected from household survey of 900 farmers during Oct -2021.

Irrigation Method	5 years back	2020-2021
SIP user	1.2	1.4
Own diesel pump	1.8	1.6
Water buying from diesel pumps	0.7	0.7
Water buying from BMDA/electric pumps	0.9	1.0

Irrigation Method	5 years back	2021
SIP user	85.0%	93.7%
Own diesel pump	80.1%	83.7%
Water buying from diesel pumps	68.1%	76.1%
Water buying from BMDA/electric pumps	-	-

- Diesel pump owners tend to be **larger farmers**, followed by SIP users; diesel water buyers cultivate smaller areas on average.
- **SIP users have increased their area cultivated** in the last 5 years, while farmers irrigated from their own diesel pump decreased their areas on average.
- Boro cultivation lowest for diesel water buyers
- In last 5 years, **increase in share of farmers cultivating boro** highest for SIP users, but also very high for diesel water buyers

16:22 / 146:55

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**IWMI** International Water Management Institute

