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IWMI International Water Management Institute

Solar Irrigation for Agricultural Resilience (SoLAR) Project

National Stakeholders Consultation in Bangladesh

25 June 2019 | Hotel Pan Pacific Sonargaon, Dhaka, Bangladesh

Acknowledgement

The IWMI team acknowledges the generous support received from SDC in making this workshop possible. We extend our heartfelt thanks to the Infrastructure Development Company Limited (IDCOL) for agreeing to jointly host this workshop and providing all the logistical support in a timely manner. We are extremely grateful to all the respected panellists, presenters, and participants for making this workshop successful by sharing their time and knowledge with us. We also thank the staff of Pan Pacific Sonargaon hotel for helping us with smooth organization of the workshop.

Table of Contents

Introduction ***4***

1. Overview of SoLAR Project ***6***

2. Experience from SIP pilots in Bangladesh ***7***

3. Panel Discussion: Scope of Grid-connected SIPs in Bangladesh ***12***

4. Conclusion.....***14***

List of abbreviations:

SoLAR: Solar Irrigation for Agricultural Resilience
SDC: Swiss Agency for Development and Cooperation
IWMI: International Water Management Institute
SIPs: Solar irrigation pumps
IDCOL: Infrastructure Development Company Limited
GHG: Greenhouse Gases
NDCs: Nationally Determined Contributions
UNFCCC: United Nations Framework Convention on Climate Change
BRRI: Bangladesh Rice Research Institute
USD: United States Dollar
SPaRC: Solar Power as a Remunerative Crop
MNRE: Ministry of New and Renewable Energy
SREDA: Sustainable and Renewable Energy Development Authority, SREDA
BADC: Bangladesh Agriculture Development Corporation
BARC: Bangladesh Agricultural Research Centre, BARC
BGEF: Bright Green Energy Foundation
RREL: Rahimafrooz Renewable Energy Limited
DISCOMS: Electricity distribution companies
BARI: Bangladesh Agriculture Research Institute
BAU: Bangladesh Agriculture University
BREB: Bangladesh Rural Electricity Board

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 irrigation pumps (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 SIPs.

A half-day stakeholders' consultation meeting was held in Dhaka on 25 June with the objective of mapping key stakeholders working in the solar irrigation sector, to learn from their experiences, and to develop a better understanding of the future potential and long-term sustainability of solar irrigation in Bangladesh. This work will help to identify what kind of pilots and research will be required in Bangladesh to help design better policies.

The program was jointly organized by Infrastructure Development Company Limited (IDCOL) and the International Water Management Institute (IWMI). IDCOL is a pioneer organisation in financing renewable energy in Bangladesh and has contributed immensely to the solar irrigation sector. To date, IDCOL has financed approximately 1241 SIPs of the 1,600 currently operating in Bangladesh. IDCOL also has set a target for financing 50,000 solar irrigation projects by 2025. IDCOL has been closely working with farmers through its sponsors for creating awareness about on-farm water management and additional revenue generating activities in order to make the program resilient against various environmental and economic impacts.

The consultation meeting was divided into following sessions:

1. Welcome address;

2. Brief overview of the SoLAR project in South Asia;
3. Experience from SIP pilots in Bangladesh;
4. Overall assessment of Bangladesh's groundwater situation in the context of agriculture;
5. Experience sharing from IWMI's field experiments with solar irrigation in India; and
6. Moderated panel discussion on "Scope of grid-connected SIPs in Bangladesh".

The IWMI country representative for India, Dr Alok Sikka gave the opening address to welcome all the workshop participants on behalf of the organisers and stated the objectives of the National Stakeholders' Consultation Meeting. Dr. Sikka emphasized how solar irrigation can be an effective alternative to diesel-based irrigation in Bangladesh, which is both costly and responsible for greenhouse gas (GHG) emissions. This transition from diesel to solar will help to achieve Bangladesh's intended nationally determined contributions (NDCs) under the UNFCCC. The participants included representatives from different government ministries and the departments of agriculture, power, renewable energy, and water. Other attendees included many private sector SIP partners, experts from universities, and international research organisations. Please refer to **Annex 1** for the full agenda and list of participants.

1. Overview of SoLAR Project

Dr. Aditi Mukherji explained that the project will not look into SIPs in isolation but will have a larger scope to understand how they can be an effective instrument in managing the water-energy and food nexus in South Asia. This needs to be an action research project that feeds into the needs to the needs of national partners. The project in its current initial phase is taking stock of SIPs in South Asia by studying existing policies and field pilots, examining groundwater sustainability, organizing stakeholder dialogues, and conducting situation analyses through gender and equity lenses.

This has been the basis for identifying scale pilots that are to be implemented in each country for the next four years. The information generated will help governments to design

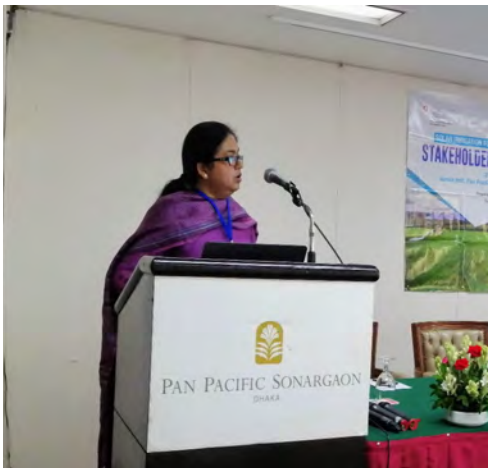
better policies for solar irrigation. The project will also have strong gender, equity and social inclusion aspects, along with a major focus on groundwater sustainability issues. Also, there will be trainings, capacity building, and knowledge exchanges across the region through this project. The knowledge exchange activities will include training local mechanics on SIPs, idea sharing through SIP forums, and trainings for energy sector officials to understand more about groundwater and hydrogeology.

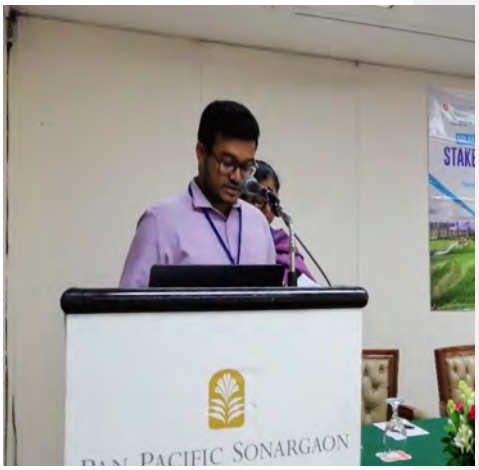
SoLAR will also feature an innovation fund to support novel technological, financial and institutional ideas, such as insurance products for farmers, and more options for using the land beneath solar panels. From year four onwards, a separate phase of the project will generate the questions and ideas to take SIPs ever further.

Dr Mukherji also gave brief descriptions of all potential pilots to be undertaken under this project in each of the four countries under varying financial models for SIP promotion and within different energy-water contexts. In Bangladesh, IWMI will collaborate with IDCOL, which is the key government organisation for solar irrigation in Bangladesh. Based on knowledge gaps and needs identified by IDCOL, two main ideas for pilot testing include:

1) Grid connection of SIPs to absorb and use the excess capacity of SIPs that is currently wasted when pumps are not operating for irrigation; and
2) Identifying the best financial models for individual ownership of SIPs, especially for small holder farmers

Dr. Mukherji emphasized that groundwater sustainability and equity concerns will be cross-cutting themes across the pilots in all four countries.





2. Experience from SIP pilots in Bangladesh

2.1 Mr. Kazi Ahsan Uddin, IDCOL

Mr. Ahsan from IDCOL presented an overview of IDCOL's solar irrigation programme in Bangladesh. IDCOL is the largest financier of infrastructure projects in Bangladesh and

the market leader in renewable energy financing. They are also the largest financiers of SIPs in Bangladesh with approximately 1300 pumps installed through IDCOL out of approximately 1600 total in Bangladesh. IDCOL has a target of 50,000 pumps to be installed by 2025.

Mr. Ahsan next described the two business models of IDCOL for solar irrigation: the "fee-for-service" model and the "ownership" model. In the fee-for-service model, a sponsor (NGO/private company) takes grant and loan from IDCOL (with a 15% upfront payment) to buy SIPs and then sell water to farmers in exchange for a fee. In the ownership model, the sponsor will sell SIPs directly to farmers. The farmers can use it for their own use and also sell water.

SIPs have resulted in substantial economic benefits for the farmers who now cultivate multiple crops during the year through increased access to water. Since the SIPs remain unused for most of the time of the year, in many schemes financed by IDCOL, excess electricity from the pumps is used to power agricultural machines for husking, thrashing, running cold storage, running oil presses, and providing household electricity supply.

IDCOL also provides extensive trainings to all stakeholders (i.e., farmers, pump supervisors, pump operators, and pump suppliers). In some schemes, IDCOL has also experimented with alternative water management practices like alternate wetting and drying and irrigation scheduling to ensure optimal usage of water. Moreover, all schemes are approved only after testing groundwater levels and water quality to ensure that the area is safe for irrigation. In this way, IDCOL promotes SIPs with an awareness that long-term sustainability of these schemes will require capacity building at all levels to stop inefficient use of groundwater.

Q&A Follow-up

Q: Dr. Md. Towfiqul Islam (Bangladesh Rice Research Institute, BRRI): How much different is the per unit energy cost of SIPs compared to diesel and irrigation pumps? Also, how many years on average it will take to get a return on initial investments on SIPs and turn profitable?

A: Both Mr. Ahsan and Aditi Mukherji mentioned that the per unit cost of solar is currently between diesel and electricity pumps. The repayment period for SIPs can vary from 3-12 years depending on the size of the pump, and type of crops grown. Moreover, the solar pump sector is very dynamic with constant technological innovation that could lower SIP prices even more in the future, and become more economically viable.

Discussion: Anwar Hossain from the Wave Foundation said large amounts of water are wasted because farmers demand 3-4 inches on water in the field, which is more than necessary. Behavioural change is required in farmers' irrigation practices and it was commented that training and awareness raising this could achieve this to some extent. Shilp Verma from IWMI pointed out that because water fees are per person in Bangladesh, a shift towards volumetric pricing for water might incentivize farmers to use water efficiently.

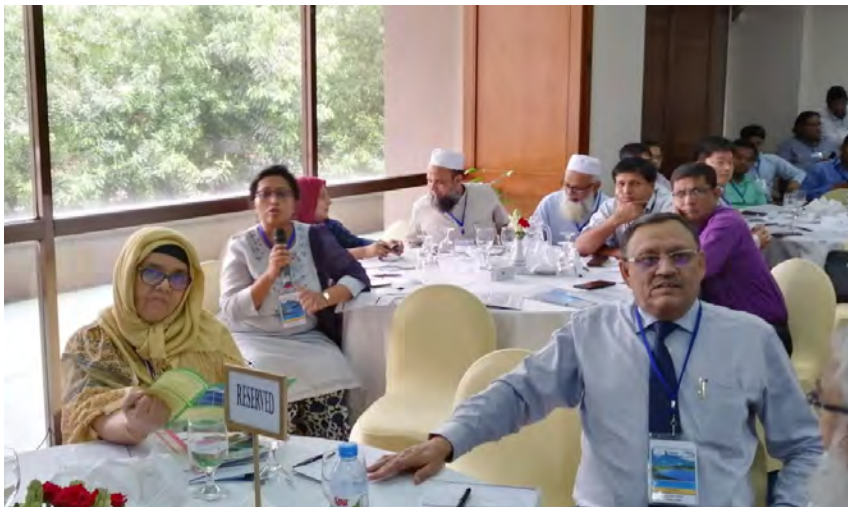
Dr. Md. Ayub Hossain (BRRI) mentioned that coastal regions of Bangladesh could be a potential testing site for surface water irrigation with SIPs because that is where surface water is used for irrigation through low-lift pumps.

3.2 Risks of groundwater irrigation in Bangladesh

Dr. Anwar Zahid (Director, Ground Water Hydrology, Bangladesh Water Development Board, BWDB) gave an overview of groundwater situation in Bangladesh. Dr. Zahid mentioned that though Bangladesh is blessed with much water during monsoon, water scarcity during dry seasons and floods in low lying areas is a common phenomenon in Bangladesh. Since the 1970s, large scale use of groundwater resources for irrigation through diesel-operated shallow tube wells (STW) have increased rapidly in Bangladesh. Due to ease of installation of STW, farmers also prefer to use them although Bangladesh's groundwater policy maintains that if surface water is present then groundwater should not be used for irrigation. Consequently, proper well-spacing is often not maintained, leading to excessive density of STWs. Different government agencies are responsible for monitoring groundwater in Bangladesh, which is an extremely crucial resource for the country as both drinking water and food security are completely dependent on groundwater. BWDB is monitoring both the quality and quantity of groundwater through its network of approximately 2,000 monitoring wells across the country.

With increasing frequency of data collection, automatic real-time monitoring, and aquifer mapping through lithographs, Dr. Zahid emphasized that Bangladesh now has enough data to operationalize water budgeting in parts of the country facing decreasing groundwater level. Dhaka and surrounding areas are facing a severe drop in groundwater levels. Also, in the Barind tract and some areas of Haor, households are facing permanent decline in groundwater levels (though the drop is much less than witnessed in Dhaka). One reason why Haor (which is completely flooded in monsoon) is facing declining groundwater is because of the thick impervious clay subsurface that prevents water from reaching deep aquifers. Although in rest of the country groundwater levels are adequate due to annual recharge during monsoon, there are concerns regarding groundwater quality like saline intrusion in the coastal areas and arsenic contamination. Dr. Zahid also mentioned that in many areas potential recharge is higher than actual recharge, implying that these areas are suitable for more groundwater pumping from shallow aquifers.

Dr. Zahir concluded that along with water budgeting to stop misuse of water and to preserve water for other ecosystem services, artificial recharge is another potential solution for Dhaka, the Barind tract, and other areas facing declining groundwater.



Q&A follow-up

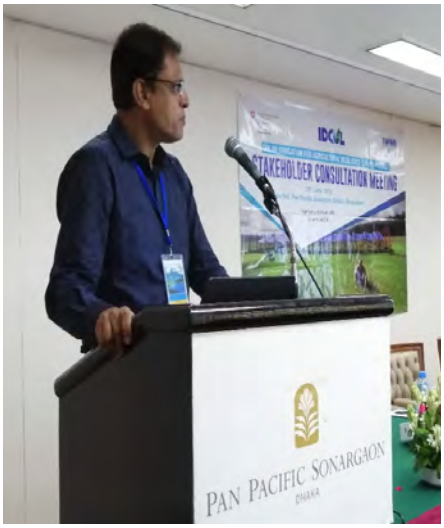
In response to Dipal Barua's question regarding how to replenish groundwater quickly, Dr. Zahid said the Bangladesh government is now interested in using managed aquifer recharge and there are other proven technologies that can be used in Bangladesh.

Toufiqul Islam of BRRI asked whether BWDB had details about the types of aquifer in Bangladesh (i.e., whether unconfined, confined or leaky aquifers) as this information would be useful for identifying area suitability for artificial recharge and for water budgeting? Dr. Zahid said that although no such map exists at a national scale, there is already sufficient data that anybody can use to define aquifer systems in Bangladesh.

Q: An audience member asked that because farmers using SIPs can extract as much water as they want without any restriction, whether widespread adoption of SIPs poses any threat for water security in Bangladesh in the long term.

A: Dr. Zahid said that the problem is not SIPs but rather irrigation's dependence on groundwater in Bangladesh, which requires proper monitoring. Also, BWDB is working on licensing requirements for installation of pumps in the future, where licenses will be issued only after taking into account the hydrogeological status of the area.

Ms. Bushra Nishat pointed out that licensing is being operationalised though upazilla (small governance unit) irrigation committees, but these groups often lack the knowledge and skill for making the correct decisions on issuing licenses. Without proper capacity development, this licensing of pumps is bound to fail.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DHAKA


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PAN PACIFIC SONARGAON

3.3. Grid-connected Solar Irrigation Pumps

Shilp Verma presented IWMI's experiments with grid-connected solar irrigation pumps in India, their rationale, and how IWMI's small field experiment has now inspired a USD 120 million solar irrigation promotion scheme in Gujarat. Shilp started with a brief overview of India's massive groundwater irrigation economy and solar irradiation potential in India. He mentioned that about a fourth of all electricity consumption in India is for pumping groundwater. This energy is supplied to farmers either free or at highly-subsidized rates, causing an annual farm power subsidy burden of USD 12 billion. He argued that if the subsidies were creating social value, they could be justified, but neither the utilities nor the farmers were happy with the current situation. Further, the subsidies were creating perverse incentives for farmers to use groundwater inefficiently and over-pump aquifers. While SIPs are good for the environment, they also offer zero-marginal-cost power to farmers and this might make things worse for India's already fragile groundwater aquifers. IWMI's experiments were an attempt to find an alternative model for promoting solar irrigation that is also groundwater benign.

Promoting 'Solar Power as a Remunerative Crop' (SPaRC) can help reverse the perverse incentives created by the current farm power supply regime. By connecting farmers' SIPs to the grid and offering them a buy-back price for surplus solar power, SPaRC incentivizes farmers to use energy (and therefore, groundwater) efficiently. SPaRC also offers farmers an additional, counter-climatic source of income; reduces the dead-weight of farm power subsidies; improves the financial viability of electricity utilities; curtails the carbon footprint of India's massive groundwater irrigation economy; and contributes to meeting India's ambitious target of 100 GW solar generation capacity by 2022. The IWMI experiments in Thamna, Dhundi and Mujkuva have inspired the Government of Gujarat to announce a state-wide scheme for solarisation of agricultural feeders – Suryashakti Kisan Yojana (SKY). Under SKY, farmers receive 30% capital subsidy from Ministry of New and Renewable Energy (MNRE), contribute 5% upfront and the remaining gets repaid from the income from sale of surplus solar power over a seven year period. Government of Gujarat has estimated that farmers will earn an additional income of ₹28,000 per annum while the loan is being repaid and ₹50,000 per annum thereafter. Since IDCOL is already planning to field test grid connecting its SIPs, Shilp concluded by highlighting some techno-managerial issues that will need to be resolved for Bangladesh to effectively replicate the model.

3. Panel Discussion: Scope of Grid-connected SIPs in Bangladesh

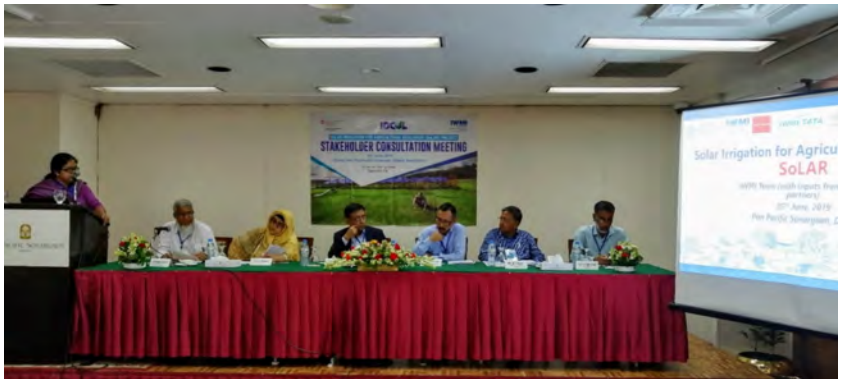
In Bangladesh, SIPs are mostly used for summer *boro* paddy season and they remain idle for the rest of the year, resulting in low capacity utilization. If running full time, the excess capacity could be used to power cold storage or other farm machines. But another long-term solution could connect these SIPs to the electricity grid where excess energy could be sold and consumed.

To understand the technical feasibility of grid connection and the required policy and institutional changes for grid connection of SIPs in Bangladesh, a discussion with six experts was organized:

- Mr. Siddique Zobair (Member, Energy Efficiency & Conservation, Sustainable and Renewable Energy Development Authority, SREDA);

- Ms. Zharna Begum (Member Director, Minor Irrigation, Bangladesh Agriculture Development Corporation, BADC);
- Rahmat Ullah Mohd. Dastagir (Additional Secretary, Planning and Renewable Energy, Power Division);
- Dr. Sultan Ahmmed (Member Director, Natural Resources Management Division, Bangladesh Agricultural Research Centre, BARC);
- Mr. Dipal C Barua (Founder & Chairman, Bright Green Energy Foundation, BGEF); and
- Mr. Syed Ishtiaque Ahmed (Head of Sales, Rahimafrooz Renewable Energy Ltd., RREL)
-

Dr. Aditi Mukherji was the moderator for this panel discussion session. Following were the key learnings from the panel discussion.



- Irrigation pumps in Bangladesh are primarily diesel operated shallow tube wells which are expensive for farmers and entail huge subsidy burden on the government. Currently SIPs form a very small proportion of the total pump sets in Bangladesh, but there is great scope for SIPs to replace diesel pumps in Bangladesh. BADC has installed some SIPs (and plans to install another 700 in future), but their main objective is to familiarize farmers with solar pump technology. So, their pumps are primarily financed through grants and they are operated and maintained by water user groups, which collect some nominal fees from their members. Other organisations like IDCOL and BREB are for mainstreaming SIPs in Bangladesh and they have similar financial models that combine grants, loans, and equity.
- SIPs have several advantages in Bangladesh: they provide a clean substitute for diesel, reduce GHG emissions, have low operation and maintenance costs, and provide uninterrupted supply of energy to the irrigation sector, especially during the dry seasons.
- SIPs also face several challenges: high start-up costs, energy production depends on the weather, lower production levels in winter, capacity utilization is low, costly storage systems, large field spaces required for installation, the panels are made of environmentally-harmful materials which are environmentally harmful, and the panels in open fields can be stolen, vandalized, or harmed through hail storms.
- One challenge to SIP grid connection lies in the fact that many operate in remote areas. Connecting grid networks to reach these SIPs might be costly.

- Grid integration is possible in Bangladesh but some technical and institutional innovations and changes in infrastructure might be needed like feeder segregation or clustering pumps at the feeder level to enable single point evacuation to 11 kV lines. If, as in Gujarat, India, farmers are organized into cooperatives of farmer producer companies, they will have to be connected through a micro-grid and the cluster will need a step-up transformer to evacuate to the 11 kV lines. SREDA is already piloting grid-connection of SIPs in Kushtia to come up with an appropriate technical model for Bangladesh.
- In terms of tariffs, electricity distribution companies (DISCOMS) will not prefer a tariff for the evacuated energy more than their bulk tariff rate as it will imply an increase in their costs. Equal tariffs for both import and export of power might be enough for farmers to sell their power back to the grid.
- Replacing grid electricity with solar electricity can reduce water usage because traditional fossil fuel stations servicing grid electricity require water for their cooling systems
- The land intensive nature of solar pump schemes has resulted in a slowdown for scaling up the technology. In Bangladesh, food security is first priority and no fertile land can be used for SIPs. The IPP holders are unable to acquire land for solar pump schemes. However, innovative use of land below the panels, or building panels over open canals or making the panels higher, could help to overcome this problem.

4. Conclusion

The objective of organizing the SoLAR national consultation in Dhaka was to better understand the solar irrigation policy environment in Bangladesh and to build links with partners and potential partners for the IWMI-SDC SoLAR project. On behalf of IWMI and IDCOL, Dr. Alok Sikka thanked the participants for actively taking part in the deliberations and enriching the discussions. He hoped that the consultation would mark the beginning of a long and productive partnership between IWMI and IDCOL in the years to come.

ANNEX 1

SoLAR Stakeholder Consultation, Bangladesh

25 June 2019

VENUE: Surma Hall, Pan Pacific Sonargaon, Dhaka

PROGRAM SCHEDULE

FROM	TO	AGENDA	PEOPLE
09:00	09:30	Registration and Reception	
09.30	09.40	Welcome note by IWMI	Dr. Alok Sikka, IWMI-India Representative
09:40	10:00	Presentation 1: Overview of SoLAR project	Dr. Aditi Mukherji, Principal Researcher, IWMI
10:00	10:20	Presentation 2: Experience from SIP pilots in Bangladesh	Mr. Kazi Ahsan Uddin, Manager, Renewable Energy Projects, IDCOL
10:20	10:30	Q&A	
10:30	10:50	Presentation 3: Assessing physical risks (overexploitation/arsenic) of groundwater irrigation in Bangladesh	Dr. Anwar Zahid, Director, Ground Water Hydrology, BWDB
10:50	11:10	Presentation 4: Grid-connected Solar pump: Experiments in India	Mr. Shilp Verma, Researcher-Water-Energy-Food Policies, IWMI
11:10	11:20	Q&A	
11:20	11:40	TEA BREAK	
11:40	12:40	Panel Discussion: Scope of Grid-connected SIPs in Bangladesh Panelists: (Sequence maintained is not as per seniority) *Mr. Siddique Zobair, Member (Energy Efficiency & Conservation), SREDA* *Ms. Zharna Begum, Member Director (Minor Irrigation), BADC* *Rahmat Ullah Mohd. Dastagir, ndc, Additional Secretary, Planning and Renewable Energy, Power Division* *Dr. Sultan Ahmmed, Member Director, Natural Resources Management Division, BARC* *Mr. Dipal C Barua, Founder & Chairman, BGEF* *Mr. Syed Ishtiaque Ahmed, Head of Sales, RREL* Panel Moderator: Dr. Aditi Mukherji	
12:40	12:50	Q&A	
12:50	13:45	Closing remarks by IDCOL	
13:45	14:45	LUNCH	
End of Event			

List of Participants

Commented [MA(1]: Archisman/Farah: Please provide full form of each of these organisations and add it to the list of abbreviations. Urgent.

Organization	Name and Designation
BADC	Ms. Zharna Begum, Additional Secretary, Member Director (Minor Irrigation)
Power Division	Rahamat Ullah Mohd. Dastagir ndc, Additional Secretary, Planning and Renewable Energy,
SREDA	Mr. Siddique Zobair Additional Secretary, Member (Energy Efficiency & Conservation)
BARC	Dr. Sultan Ahmmed Member Director, Natural Resources Management Division
BGEF	Dipal C Barua Founder & Chairman
Rahimafrooz Renewable Energy Ltd (RREL)	Mr. Syed Ishtiaque Ahmed Head of Sales
BADC	Engr. M. A. Karim Additional Chief Engineer, Minor Irrigation
BADC	Engr Md Sarwar Hossain Assistant Chief Engineer and Project Director, SIP
BARC	Dr. Nazmun Nahar Karim Chief Scientific Officer, Agricultural Engineering Unit
BARI	Dr. Md. Ayub Hossain Chief Scientific Officer, Farm Machinery and Postharvest Process Engineering Div.
BARI	Dr. Muhammad Arshadul Hoque Senior Scientific Officer, Farm Machinery and Postharvest Process Engineering Div.
BAU	Dr. Mohammed Mizanur Rahman Associate Professor
BREB	Md. Sakil Ibne Sayeed Project Director, Solar Irrigation Project
BRRI	Dr. Md. Towfiqul Islam CSO and Head, Irrigation and Water Management Division
BRRI	Dr. A. B. M. Zahid Hossain Senior Scientific Officer, Irrigation and Water Management Division
BSMRAU	Mr. Moinul Hosain Oliver, PhD Associate Professor & Head, Department of Agricultural Engineering
BWDB	Dr Anwar Zahid Director (Groundwater)
CIMMYT	Dr. Amjath Babu Agricultural Economist
DAE	Mr. Alamgir Hossain Khan Project Director, Enhancement of crop production through Improved on-Farm Water management Technologies
DAE	Muhammad Rubaiyat-ur-Rahman) Project Director, Solar energy project
Gazi Renewable Energy Ltd.	Badrul Alam Khan Director

GIZ	Md. Mahfuzur Rahman Senior Advisor, Sustainable Energy
Grameen Shakti	Mr. Sohel Ahmed Chief Operating Officer
IDCOL	Mahmood Malik Executive Director & CEO
IDCOL	S. M. Monirul Islam Deputy CEO & CFO
IDCOL	Md. Enamul Karim Pavel Head of Renewable Energy
IDCOL	Dr. Ahmedul Hye Chowdhury Vice President & Environmental Specialist, Renewable Energy Project
IDCOL	Shuvajit Mandal Manager, Renewable Energy Program
IDCOL	Kazi Ahsan Uddin Manager, Renewable Energy Program
IDCOL	Mofazzal Hossain Asst. Manager (Agriculture-Monitoring), Renewable Energy
IDCOL	Md. Belal Siddiqui Asst. Manager (Agriculture-Monitoring), Renewable Energy
Independent Consultant	Ms. Bushra Nishat
IRRI	Manoranjan K Mondal, PhD Water Scientist, Sustainable Impact Platform
IWMI - India	Dr. Alok Sikka IWMI-India Representative
IWMI - India	Dr. Aditi Mukherji Principal Researcher
IWMI - India	Mr. Shilp Verma Researcher- Water-Energy-Food Policies
IWMI - India	Mr. Archisman Mitra Researcher – Water Resource Economics
KHM Power Limited	Monjur Uddin Ahmed Managing Director
Resource Development Foundation	Md. Golam Mostofa
Salek Solar Ltd.	Md. Salek Uddin Managing Director
SAU	Prof. Md Zainal Abedin Department of Agricultural Engineering
SDRS	Golam Mostafa
WAVE Foundation	Anwar Hossain Deputy Executive Director
WB	Istiak Sobhan, PhD Environmental Specialist
GRELL	Bibekanand Ghatak DGM
BMDA	Md. Abdul Malek Chowhury Executive Engineer
GLE	Li Haw Khumpwoer

DAE	SK Farid Dep. Director
SHERPA	MA Taher
DAE	Eng. Ashok Kumar Biswas DPD Solar Project
IDCOL	Majruda Rahman Manager
RREL	Ariful Islam
RREL	Abul Kalam Azad