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INCEPTION WORKSHOP REPORT

Solar Irrigation for Agricultural Resilience (SoLAR) in South Asia

21-22 January 2020 | Yellow River Basin Auditorium, IWMI, Colombo

IDCOL TOGETHER FOR TOMORROW

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Alternative Energy Promotion Center Government of Nepal

Acknowledgements

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Abbreviations and Acronyms

AEPC	Alternative Energy Promotion Center
BADC	Bangladesh Agricultural Development Council
BAU	Business as Usual
CEO	Chief Executive Officer
CEWRI	Climate Energy and Water Research Institute
DAE	Department of Agricultural Engineering
DISCOMs	(Electricity) Distribution Companies
DWRI	Department of Water Resources and Irrigation
FGD	Focus Group Discussion
FL-SPICE	Feeder Level- Solar Pump Irrigator's Cooperative Enterprise
FWMC	Federal Water Management Cell, Pakistan
GERMI	Gujrat Energy Research and Management Institute
GESI	Gender and Social Inclusion
GW	Groundwater
IDCOL	Infrastructure Development Company Limited
ISA	International Solar Alliance
IWMI	International Water Management Institute
MAR	Managed Aquifer Recharge
MG	Micro Grid
MNRE	Ministry of New and Renewable Energy
MoEWRI	Ministry of Energy, Water Resources, and Irrigation

MoU	Memorandum of Understanding
NDCs	Nationally Determined Contributions
NEA	Nepal Electricity Authority
OFWM	On-farm Water Management, Pakistan
PARC	Pakistan Agriculture Research Council
PM-KUSUM	Pradhan Mantri Kisan Urja Suraksha even Utthan Mahabhiyan
PSC	Project Steering Committee
PV	Photovoltaic
SDC	Swiss Agency for Development Cooperation
SDGs	Sustainable Development Goals
SIP	Solar Irrigation Pump
SKY	Suryashakti Kisan Yojana
SoLAR-SA	Solar Irrigation for Agricultural Resilience in South Asia
SPaRC	Solar Power as Remunerative Crop
WEF	Water-Energy-Food
WP	Work Package

1. Introduction

Solar Irrigation for Agricultural Resilience (SoLAR) in South Asia, a four-year project spanning from December 2019 till November 2023, is a new regional partnership program of Swiss Agency for Development Cooperation (SDC), the International Water Management Institute (IWMI), and other national partners in Bangladesh, India, Nepal, and Pakistan. The project aims to sustainably manage the water-energy-climate interlinkages in South Asia through the promotion of solar irrigation pumps (SIPs). The main goal of the project is to contribute to climate resilient, gender and socially inclusive agrarian livelihoods in South Asia by supporting national government efforts to promote solar irrigation. In the process, the project will also pave the way for sustainable and equitable groundwater governance by tackling some of the policy distortions such as perverse electricity subsidies which has created the current negative interlinkages between water and energy sectors in South Asia. This project will be implemented in four South Asian countries, namely, Bangladesh, India, Nepal and Pakistan in partnership with government agencies, who have the mandate to implement policies and programs on SIPs in their respective countries. The project aims to achieve following three broad outcomes;

i) Generating improved empirical evidence to support the development of climate-resilient, gender-equitable, socially-inclusive, and groundwater-responsive solar irrigation policies;
ii) Validating innovative actions and approaches for promoting gender-equitable, socially-inclusive, and groundwater-responsive solar irrigation; and
iii) Increasing national and global knowledge and capacity for developing gender-equitable, socially inclusive, and groundwater-responsive solar irrigation policies and practices.

To formally launch the SoLAR-SA project, a two-days inception workshop was held during 21-22 January, 2020 at IWMI Headquarter in Colombo, Sri Lanka. The objectives of the workshop were following;

- To discuss and finalize year-1 work plan in consultation with various partners and stakeholders
- To enhance understanding on how this project fits within the broader policy landscape of agricultural and irrigation transitions in general, and solar irrigation in particular

The inception workshop program/agenda (please see Annex 1-1 for details) was divided into following eight sessions;

- Session 1 – Inaugural Session
- Session 2 – Work Plan for Work Package (WP) 1 – Generating evidence for achieving Outcome 1
- Session 3 – Work Plan for WP2 – Innovative pilots for achieving Outcome 2
- Session 4 – Innovation Funds
- Session 5 – Work Plan for Groundwater Thematic Group for achieving Outcomes 1 and 2
- Session 6 – Work Plan for Gender Equality and Social Inclusion (GESI) Thematic Group for achieving Outcomes 1 and 2
- Session 7 – Work Plan for WP3 – Knowledge sharing, and Capacity building for achieving Outcome 3
- Session 8 – Concluding/Closing

The workshop was attended by 52 participants, representing 17 institutions across four countries. Nearly 35% (18 out of 52) of the participants were female. Please refer Annex 1-2 for the list of participants.

Participants at the SoLAR-SA inception workshop in Colombo, Sri

2. Inaugural Session

The Inaugural session held in the first half on 21st January was chaired by Mark Smith, Deputy Director General, IWMI. Eight speakers in the inaugural session highlighted on various aspects of the project. Claudia Sadoff, Director General, IWMI, welcomed all the participants in the workshop on behalf of the organizers. In her inaugural welcome remarks, Claudia lauded the IWMI-led project team for laying out such an exciting, ambitious, challenging, and timely program. She also introduced IWMI as a 35-years old international organization with offices across 13 countries and highlighted IWMI's two decades of engagement in South Asia. In the IWMI's recently launched strategy (2019-2023), SIPs cut across all the three strategic programs – i) water for food and ecosystems; ii) water for climate change, and resilience; and iii) water for growth, and inclusion. In the context of long-standing issues such as poverty alleviation, water management, and livelihood in the face of climate change, she stressed on the need for focussing on solutions. She further added that SIPs could be one of the resilient solutions that can help countries to achieve Nationally Determined Contributions (NDCs) pledge and also achieve water-, energy-, and food security. Furthermore, she mentioned how the SoLAR project is taking up second generation issues such as groundwater sustainability and inclusion of women and marginal farmers as its core focus. IWMI also looks upon this project as an opportunity to contribute to the global goals such as sustainable development goals (SDGs) by leveraging tremendous power of solar through partnership for resources, expertise, and knowledge.

***Photo 2-1**: Welcome address from – a) Claudia Sadoff, Director General, IWMI; b) Marylaure Crettaz Corredor, Head of SDC, New Delhi*

Marylaure Crettaz Corredor, Head of SDC in New Delhi, also welcomed all the participants on behalf of SDC and expressed her pleasure to see all the partners and project members. She further introduced SDC as a part of foreign affairs of Switzerland and it's work across the regions. She introduced SDC's global programs to foster for innovations and solutions that are of interest to the South Asia region and has potential to benefit to other regions of the world. Climate change is one of the global programs, under which this SoLAR-SA project is hosted. She further revealed that "water-energy-food (WEF) nexus" was the entry point for designing this program and it was built based on small experiment in Gujarat in 2018 implemented by IWMI. Furthermore, west-east energy divide in South Asia also motivated SDC to initiate this program with the hope to minimize the divide using multi-country approach and multiple SIP solutions that match regional groundwater resource endowments. Marylaure appreciated IWMI's partnership with the International Solar Alliance (ISA), a global actor in solar. She also suggested exploring Swiss expertise and innovation for shaping context-specific solutions in the region.

Aditi Mukherji, the Regional Project Leader of the SoLAR-SA project, presented the project context, objectives, project framework, outcomes, and outputs. In the context that South Asia being the largest user of groundwater (i.e., 250 km^3 of groundwater extraction per year) with nearly 200,000 SIPs already installed in the region, SIP is a good climate mitigation cum adaptation option. The aim of the project is to look into second generation questions such as models for sustainability of the SIPs, groundwater sustainability, GESI, and others. She mentioned that the project was designed through situation analysis of existing pilots and policies, and identifying second generation questions, therefore, the project goal and three outcomes are designed in a way that support national government's efforts (Figure 2-1).

Aditi's presentation was followed by brief remarks on the relevance of the SoLAR-SA project for the South Asia region by representatives from the four countries. S. M. Monirul Islam, Deputy Chief Executive Officer (CEO) of Infrastructure Development Company Limited (IDCOL) in Bangladesh highlighted IDCOL's engagement in the SIPs and expressed happiness to have IWMI to support for better understanding of the situation, gaps, and impacts in the market. He also highlighted the need to bring all relevant stakeholders on board, and coordination will be the key challenge in this endeavour. Some of the aspects that need to give emphasis while moving forward develop capacity and enhance awareness among farmers and other stakeholders/end-users.

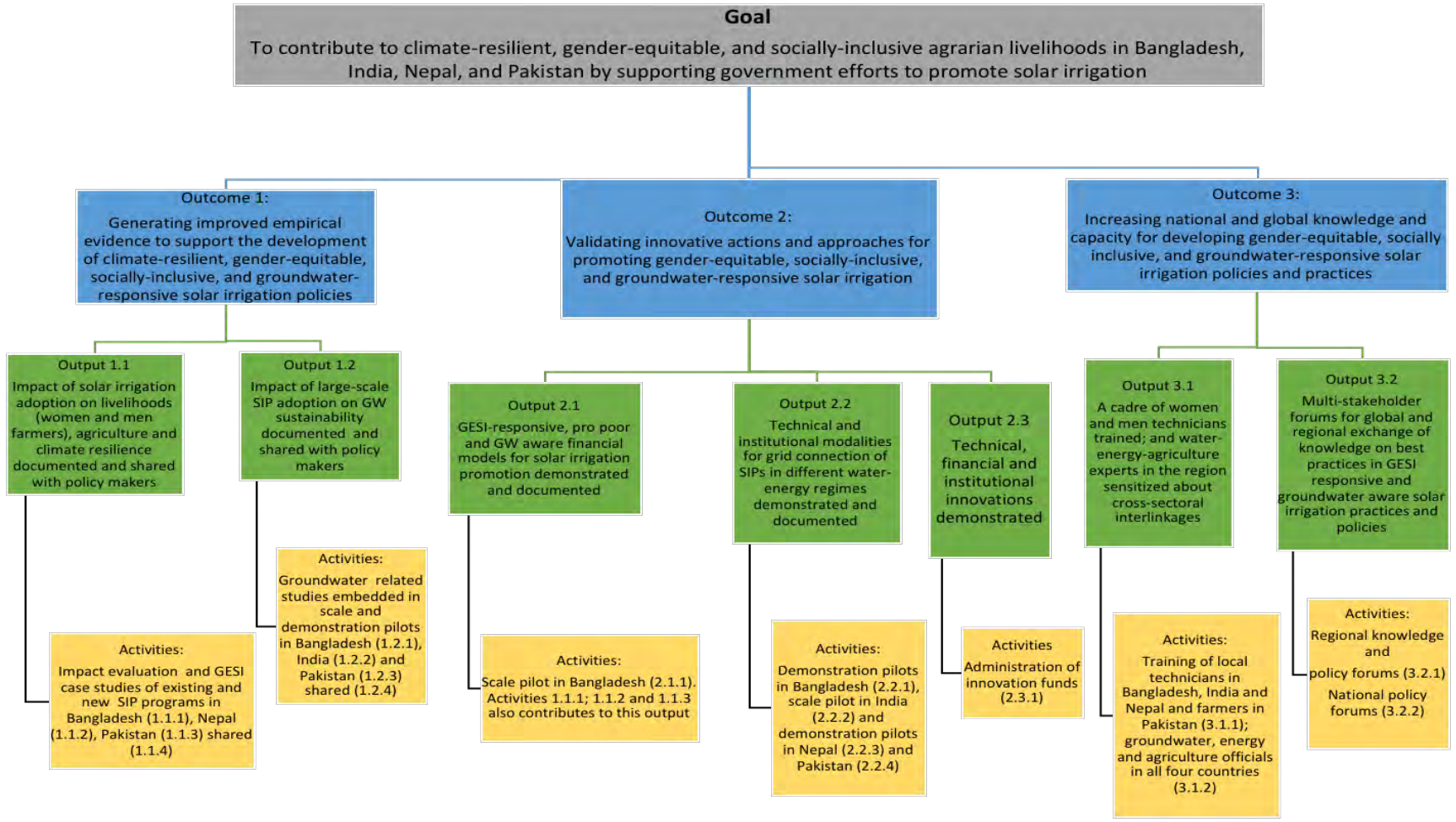


***Figure 2-1**: SoLAR-SA project goal, outcomes, outputs, and activities*

Continuing with the remark, J. K. Jethani, Director of Ministry of New and Renewable Energy (MNRE), India, stressed on the need to take into account size and diversity of the country while designing and implementing any programs such as SIPs. Balancing the growing need for water with conservation of water is a real tough challenge that we have to deal with today. Then he introduced objectives, aims, components, status and challenges of implementing the government's initiative for scaling SIP as solutions under PM-KUSUM scheme in India.

Madhukar Rajbhandari, Director General, Department of Water Resources and Irrigation (DWRI), Government of Nepal, further continued with his remarks on the relevance of SoLAR-SA project in the region. He congratulated IWMI and partners for being successful in materializing the project, which has great impacts for scaling SIPs in the region. In the context of over 1,600 SIPs already installed in Nepal and increasingly conductive environment for their expansion further, he stressed on the need to install hybrid pumps rather than only solar pumps so that it can work also in the case of presence of fogs and/or absence of sunlight. Mr. Rajbhandari also highlighted DWRI's initiatives related to SIPs such as integrated energy and irrigation program (IEIP) to support 53 districts in hill and mountain; and Tarai-Madhesh Solar Irrigation Program to support 23 Tarai districts in Nepal with solar irrigation. He considered this project as an opportunity for learning from other countries.

Similarly, Dr. Bashir Ahmad, Director at Climate Energy and Water Research Institute (CEWRI), Pakistan Agriculture Research Council (PARC), express his happiness and eagerness to move ahead with high level of enthusiasm with IWMI and project partners in this interesting project. He shared history of PARC on working on SIPs since 1992 and its evolution since then and also highlighted issues such as inadequate access by

marginalized population, concerns on sustainable use of groundwater, need for capacity strengthening, etc. Dr. Ahmad stressed that the project is timely opportunity for generating evidence for policy feedback to answer the policy questions set-forth in this project.

Rakesh Kumar, Program Director, ISA, appreciated IWMI for its work on SIP as well as nice ambience. He introduced ISA, member countries, framework for becoming a member, and highlighted SIP as one of the component/program of ISA. He also shared ISA's initiatives for scaling of SIP for agriculture. He expressed ISA's excitement to take advantage of this great body of knowledge of SoLAR-SA project members and partners for success of the ISA's program.

The inaugural session was concluded with signing of Memorandum of Understanding (MoU) between ISA and IWMI to partner on broader areas of SIPs.

3. Work Plan for Work Package 1 – Generating Evidence for Outcome 1

The second session chaired by Soumya Balasubramanya was focused on work plan under Work Package (WP) 1, i.e., generating evidence for achieving Outcome 1. There were three presentations highlighting work plans related to impact evaluations in Bangladesh, India, and Nepal. The presentations were followed by questions and answer, in which, highly valuable insights were shared by the participants.

3.1 Impact evaluation of IDCOL SIPs in Bangladesh

The first presentation led by Mr. Enamul Karim Pavel from IDCOL shared proposed activities and year-1 work plan for impact evaluation of IDCOL SIPs in Bangladesh. The presentation highlighted the policy contexts for encouraging use of renewable energy in Bangladesh and shed light on several renewable energy initiatives by IDCOL such as solar home system, biogas and bio-fertilizer program, improved cook stove program, solar irrigation, solar mini-grid, and rooftop solar programs. The presentation also highlighted present status of irrigation scenarios and SIPs in Bangladesh, trends in SIPs installation, SIP business models that IDCOL is using, and some recent initiatives to improve project performance such as ownership model, licensing, and monitoring software. The presentation also shared some impacts that SIPs are having in Bangladesh. Similarly, Md. Sarwar Hossain from Bangladesh Agricultural Development Council (BADC) and Ashok Kumar Biswas from Department of Agricultural Engineering (DAE) shared SIP programs of their respective organisations for enhancing crop production. Bangladesh has considered SIP as an instrument to reach to those deprived of fruits of energized irrigation, however there are challenges such as making them sustainable and co-ordinated implementation as various agencies are implementing SIPs in Bangladesh.

Finally, Marie Charlotte Buisson from IWMI shared methodology for impact evaluation study as well as year-1 (i.e., 2020) work plan for this activity (Table 3-1).

***Table 3-1**: Year-1 work plan for impact evaluation of IDCOL SIPs in Bangladesh.*

1.1.1 IE and GESI studies in BD	**Start Date**	**End Date**	**Outputs**
	01-12-2019	**30-12-2020**	
Gather relevant secondary data from existing IDCOL sites and data cleaning	01-12-2019	30-01-2020	Short Note prepared based on the analysis of secondary data
Analysis of secondary data	01-02-2020	30-04-2020	
Develop Methodology for impact evaluation	01-02-2020	30-04-2020	Methodological Note for IE
Preparation of quantitative and qualitative instruments for IE study	01-04-2020	30-05-2020	Questionnaire for survey and FGD guidelines
Finalize sampling methodology for IE	01-04-2020	30-05-2020	Sampling Strategy Note
Focus Group discussions/ Case study (concurrent with Baseline data)	01-06-2020	30-07-2020	1 Case study report
FGD report	01-08-2020	30-09-2020	
Baseline Data collection	01-06-2020	30-07-2020	Final data by mid-August 2020
Baseline Data analysis	01-08-2020	30-09-2020	
Baseline Report	01-10-2020	30-12-2020	Baseline Report (to be submitted to IDCOL and Project Manager)

There was a fruitful discussion after the presentation. Some of the points raised during discussion to consider in impact evaluation study were;

- We may need only a cross-section data rather than base-line and end-line
- Which financial model is likely to generate higher willingness to pay to farmers?
- What could be differential impacts of single-unit grid connection versus cluster-based approach?

- How multiple use of SIPs can be materialized (e.g., using device that can give both AC & DC currents?) and how multiple use of SIPs impacts on SIP outcomes?
- What would be the differential impacts of having and not-having storage structures for storing pumped water?
- How farmers are managing/paying their share in 50:35:15 (Subsidy: Loan: Farmer) ratio policy? What is taken as collator for issuing loan? What about interest rate for such type of loan in comparison with market rate?
- How project cost is established for providing subsidy?

3.2 Impact evaluation of Gujrat's SKY program

The second presentation by a team from India led by Rajendra Vala from the Government of Gujarat started with the invidious nexus of water-energy-climate nexus in South Asia in general, and India in particular; rising trends of SIPs in India, and drivers, opportunities and constraints/threats related to SIPs (Table 3-2). Dhundi Solar Cooperatives in Gujarat and SPaRC (Solar Power as Remunerative Crop) were also highlighted in the presentation as efforts towards harnessing potentials of solar power for larger benefits of farmers.

***Table 3-2**: Solar irrigation pumps – Drivers, opportunities, and threats*

Drivers	Opportunities	Constraints/Threats
▪ High cost of diesel irrigation ▪ Rapidly declining cost of solar PV ▪ Rationed, unreliable, poor quality farm power supply	▪ Clean energy at declining unit costs ▪ Can work anywhere ▪ Offers reliable, day-time power	▪ New technology adoption ▪ Nascent service ecosystem ▪ Cost still high for poor smallholders

▪ Increasing burden of farm power subsidies ▪ Government of India's ambitious 100 GW solar capacity target ▪ Government schemes offering 70-90% capital subsidies	▪ Zero marginal cost; Low maintenance ▪ Good fit between energy generation and irrigation demand	▪ Limits opportunities for 'intelligent rationing' of farm power supply ▪ Might create 'perverse' incentives for pumping groundwater

It was then followed by an introduction of Suryashakti Kisan Yojana (SKY), the Government of Gujrat's pioneering policy for solarisation of agriculture. The presentation highlighted context; salient features, both technical and financial; and current status of the SKY program. Furthermore, various benefits to farmers and government, society and environment, and to DISCOMs were also highlighted in the presentation. Finally, year-1 work plan for scale pilot in Gujrat to support SKY implementation through understanding, assessing, and improving was presented by IWMI's Shilp Verma (Table 3-3).

***Table 3-3**: Year-1 work plan for impact evaluation of Gujarat's SKY program*

2.2.2 Scale Pilot in India	**Start Date**	**End Date**	**Outputs**
	01-12-2019	**30-12-2020**	
Identification of 20-30 agricultural feeders for the study	01-12-2019	31-01-2020	Methodological Note for scale pilot
Primary survey – preparation of questionnaires and pre-testing	01-01-2020	28-02-2020	
Preparation of IWMI-GERMI feeder-level secondary data collection protocol	01-01-2020	28-02-2020	
Quarterly feeder-level SKY data monitoring and compilation	01-01-2020	31-12-2020	Compiled quarterly data and reports
Primary quantitative baseline surveys	01-03-2020	31-08-2020	Draft baseline report (and database) summarizing results from qualitative and quantitative surveys
Regular focus group discussions with farmers	01-03-2020	31-10-2020	At least one policy brief outlining the main

			findings and policy implications

This activity aims to answer following key questions

- Compared to grid-farmers, are SKY farmers better-off?
- Does SKY incentivize pumping behaviour change; efficient energy and groundwater use?
- Is this conservation behaviour intensified when SKY feeder farmers are organized into FL-SPICE?

Following three scenarios will be analysed to answer the key questions;

- Business as usual (BAU) feeders: Electric pumps
- SKY feeders: 70% + Solar pumps
- SKY_{SPICE} feeders: Solar pumps + FL-SPICE

3.3 Impact evaluation of SIPs in Nepal

The third presentation was made by a team from Nepal and was led by Laxman Ghimire from Alternative Energy Promotion Center (AEPC). The presentation started with highlights on enabling policies for SIPs in Nepal such as government's support in promotion of renewable energy for more than two-decades; rural energy policy (2006); 13^{th} plan of Nepal (2013-2016); 14^{th} plan (2017-2016); and budget allocation for SIPs in government budgets since 2018, among others. It was followed by current status of installation of nearly 1,150 AEPC-supported SIPs in Nepal and their distribution across the districts (Figure 3-1). The activity aims to answer at least following key questions;

- How can service delivery of SIPs be improved in Nepal?
- Who has access to SIPs in Nepal (by land-size, gender, location, etc.)
- What are the impacts of using SIPs on household well-being and GESI? How should the solar irrigation program should move forward?

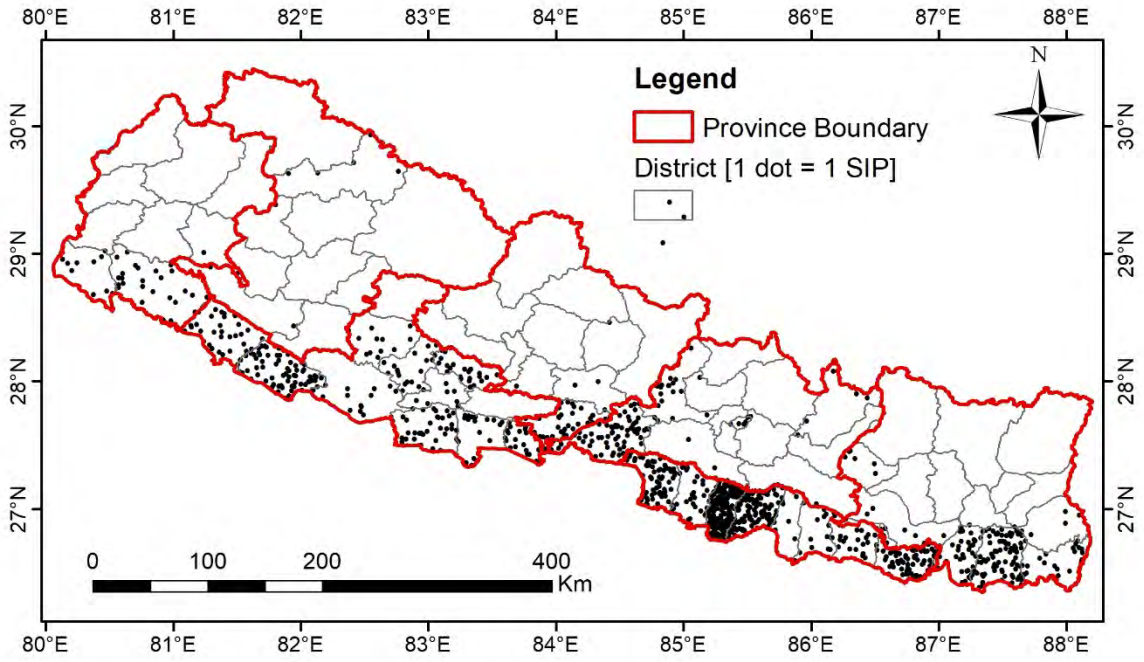


***Figure 3-1**: Distribution of AEPC-supported SIPs across districts in Nepal.*

Presentation from Laxman Ghimire was followed by Kashi Kafle (from IWMI) highlighting purpose, current modality /practice/status, proposed study (methods, data required, data analysis), and implications of results for all the three research questions outlined above. The presentation also highlighted potential outcome and impact indicators, means of verification, and unit of analysis for all the indicators (Table 3-4).

***Table 3-4**: Outcome and impact indicators for impact evaluation of SIPs in Nepal*

Indicator	Measurement (or Means of verification)	Unit of analysis
Outcome		
Groundwater market	Groundwater price	Village
Pumping cost	Energy cost of pumping	Household
Pumping behaviour	Frequency, timing and duration of irrigation	Household
Agricultural productivity	Agricultural revenue, productivity of two major crops	Household
Impacts		

Poverty	Income and assets	Household
Food and nutrient security	Food security, dietary diversification, etc.	Household
Gender equality and social inclusion (GESI)	Women's and other minority farmer's participation in decision-making on use of water, farming activities, asset ownership, and access to income, etc.	Household
Resilience	Exposure to shocks and ability to recover	Household

Finally, year-1 work plan for impact evaluation of SIPs in Nepal was presented (Table 3-5).

***Table 3-5**: Year-1 work plan for impact evaluation of SIPs in Nepal*

1.1.1 Impact Evaluation (IE)E and GESI studies in Nepal	**Start Date**	**End Date**	**Outputs**
	01-12-2019	**30-12-2020**	
Gather relevant secondary data from existing AEPC sites and data cleaning	01-12-2019	31-12-2019	Short Note on sample size, sampling framework and guiding questions
Using the secondary data for sample size calculation and selection	01-01-2020	31-01-2020	
Develop Methodology and Instruments for impact evaluation (qualitative, including GESI framework, and quantitative)	01-02-2020	28-02-2020	Detailed methodology, GESI framework, including questionnaires and checklists for FGDs
Qualitative field work, transcription and tabulation	01-03-2020	31-03-2020	Field notes, FGD transcripts prepared
Draft qualitative report	01-04-2020	30-04-2020	Draft qualitative report submitted to AEPC
Quantitative surveys and field work	01-05-2020	30-07-2020	Quantitative data collected, cleaned, and tabulated, and summary statistics report generated; final data by end July, 2020

Quantitative Data analysis	01-07-2020	30-09-2020	Data analysis and preliminary report
Final IE report	01-10-2020	30-11-2020	Final report submitted to AEPC and SDC PM

4. Work Plan for Work Package 2 – Innovative Pilots for Outcome 2

The third session on "Innovative Pilots for Achieving Outcome 2, chaired by Mohsin Hafeez of IWMI, featured four presentations related to grid-connected SIPs in Bangladesh, Nepal and Pakistan and pilot on evaluating institutional modalities of SKY feeders in India. All four presentations were followed by highly interactive discussion session.

4.1 Grid connected SIP pilot in Bangladesh

The presentation by a team from Bangladesh led by Kazi Ahsan Uddin from IDCOL highlighted current challenges under SIP programs in Bangladesh as utilizing huge amount of excess energy from solar panels when SIPs are not in use and connecting those SIPs to national grid. Though some initiatives for using excess energy for other uses such as husking, oil pressing etc. has already been started, a long-term solution could be connecting the SIPs to national grids. However, so far, no SIPs are connected to grid. Policy for grid integration is progressing and expected to be finalized soon. Once it is in place, with clearly defined rules and processes for future SIP integration, it opens up door for grid connection of SIPs. IDCOL is now in the process of identifying suitable sites for grid-connected SIP pilots and expects to implement it by December, 2020.

The proposed method comprises of selecting around 10-20 existing IDCOL financed SIP

sites and make arrangements to connect to national grids. Based on draft net metering guidelines of the government, these SIPs will receive a particular tariff for each unit of electricity evacuated to the grid. The pilot aims to conduct case studies on single unit grid integration versus cluster-based approach to understand what works locally and what are the additional cost implications. It is projected that grid integration might increase the project cost by 5-7 % but revenue increase can be greater. The additional revenue can help sponsors sustain and encourage them to propose and set up more SIPs. It also opens the possibility with the additional revenue that government subsidy can be decreased. Table 4-1 outlines year-1 work plan for piloting of grid connected SIP for SIPs in Bangladesh.

***Table 4.1**: Year-1 work plan for grid connection of SIPs in Bangladesh.*

2.2.1 - Demonstration pilot in Bangladesh – Grid connection	**Start Date**	**End Date**	**Outputs**
	01-12-2019	**30-12-2020**	
Identification of pilot sites for grid integration and developing research methodology with IDCOL	01-12-2019	30-06-2020	Methodology note for grid connection pilots
Baseline data collection and focus group discussion for selected sites (also see 1.1.1)	01-06-2020	31-07-2020	FGD and qualitative report
Identify different systems architecture and designs, and identify equipment requirements	01-06-2020	30-09-2020	Engineering and installation report
Identify the EPC for the installation and commission of grid-connection equipment, and connecting SIPs to the grid	01-10-2020	31-12-2020	
Demand generation activities and mobilization efforts in 120 Upazillas (45 days) to collect demand	15-08-2020	30-09-2020	

Some of the observations from discussion are listed hereunder;

- It would be really great if the pilot can do experiments with different tariffs
- General interest for putting money by sponsors in this kind of business is fairly high provided this pilot can give insights on viable business models.

4.2 Pilot on institutional modalities of SKY feeders in India

A joint presentation from Shilp [IWMI] and Akhilesh Magal [GERMI] presented Co-operative at SKY feeder level as institutional modalities in SKY schemes in Gujarat. In 2018, the Government of Gujarat implemented a large-scale pilot called SKY (*Suryashakti Kisan Yojana*), initially for 137 agricultural electricity feeders of the state with an initial target of solarizing 12,400 farmers within a year. Buoyed by farmers' initial response to SKY, the government has now revised the target to solarize 100,000 farmers by the end of 2019. Given that Gujarat has severe groundwater depletion problems, there is a need to know if that grid-connected solar pumps with non-trivial feed-in-tariff (as implemented under SKY) leads changes in pumping behaviour of farmers. Currently, SKY engages with individual farmers, however, there is an ongoing discussion that organizing farmers through a feeder-level cooperative (as done through another SDC supported IWMI project) intensifies the above behaviour change.

The pilot will identify 20-30 agricultural feeders in Gujarat; with 6-10 feeders belonging to each of the following categories: agricultural electricity feeders without solar connection (business as usual); SKY feeders; and SKY feeders where feeder level solar cooperatives have been registered and are operational. Feeder data monitoring and collection on a set of carefully selected parameters on a monthly / bi-monthly basis. Regular groundwater monitoring will be conducted in project sites. Feeders will be selected from two regions in Gujarat, namely, Central Gujarat and Saurashtra. Year-1 work plan for this activity is shown in Table 4-2.

***Table 4.2**: Year-1 work plan for piloting institutional modalities of SKY feeders in India*

2.2.2 Scale Pilot in India	**Start Date**	**End Date**	**Outputs**
	01-12-2019	**30-12-2020**	
Identification of 20-30 agricultural feeders for the study	01-12-2019	31-01-2020	Methodological Note for scale pilot

Primary survey – preparation of questionnaires and pre-testing	01-01-2020	28-02-2020	
Preparation of IWMI-GERMI feeder-level secondary data collection protocol	01-01-2020	28-02-2020	
Season-wise feeder-level SKY data monitoring and compilation	01-01-2020	31-12-2020	Compiled quarterly data and reports
Primary quantitative baseline surveys	01-03-2020	31-08-2020	Draft baseline report summarizing results from qualitative and quantitative surveys – to be submitted to partners and SDC PM At least one policy brief

The discussion session highlighted following aspects to consider in the pilot study;

- No private institutions are willing to introduce business model where farmers have to pay because getting money from farmers is politically sensitive.
- Feeder loss is highly dependent on power factor of pump. The losses in pumps and in feeder lines are separated and distributed accordingly – i) loss occurred in pump is measured in meter and that is to be covered by respective farmer; ii) distribution losses are distributed on pro-rata basis to farmers based on the rate of their energy transaction.
- SKY is considering not to go for co-operative model because – i) unlike handling a group of 20-30 farmers, handing many hundred farmers at feeder level through co-operative model is very difficult for various reasons. However, if results from Anand are good, Gujrat's SKY program may consider to go for co-operative model as well in future.
- While energy trading, we need to be careful to ensure it does not undermine main purpose of SIP to provide water through pumping.
- Scheduling of irrigation plan: Solar energy is not uniform throughout the day. Therefore, scheduling irrigation under this uncertainty may be a challenge and may create dispute as all farmers may want to irrigate during day time. It would

be good to capture such challenges and potential solutions too while implementing impact evaluation study. The most likely case is that farmers may choose to evacuate power to grid during day time as they can earn more from electricity selling and prefer to irrigate during morning and evening times.

- Issues and priorities, limits to subsidy, etc. could be different in different settings (e.g. food-secure versus food-insecure regions, etc.). It would be nice to capture such issues too. Furthermore, some farmers/groups might have been generating additional services too as means of income, which can be a learning from other areas.

4.3 Grid connected SIP pilot in Nepal

Mr. Sagar Gyawali and team from Nepal presented the context, need, approach, targeting, and proposed activities for grid-connected pilot in Nepal. The presentation highlighted enabling conditions for grid-connection of SIPs in Nepal such as the provisions in the 15th Approach Paper (2019/20 – 2023/24) the MoEWRI White Paper (2018), NEA's Net Metering Policy (2074 BS), existing policies and programs of various government agencies including that of Department of Water Resources and Irrigation (DWRI), etc. and concluded that there are enabling environments for uptake of the grid-connection of SIPs if the pilots become successful. Furthermore, it also shed light on potential benefits of micro-grid systems including maintain quality of voltage in the grid, benefits to farmers by selling excess energy, etc. The key issue, however, is to demonstrate a workable model for sustainability of SIPs. The activity will identify suitable pilot site through an appropriate framework for targeting, carryout detailed feasibility study, procure services for installation of micro-grid (MG) system, develop framework for impact evaluation, and continue monitoring of appropriate parameters (e.g., energy parameters, income parameters, perception parameters, social, institutional, etc.). Field study at 10 Palikas in Province 1 and 2 will be carried out to gather data/information for targeting pilot site

based on well-designed framework. The MG system will be of around 15 kW which can connect 5-7 pumps in general. Table 4.3 outlines year-1 work plan for piloting of MG system for grid connection of SIPs in Nepal.

***Table 4.3**: Year-1 work plan for grid connection of SIPs in Nepal*

2.2.3 Grid connection pilot, Nepal	**Start Date**	**End Date**	**Outputs/Deliverables**
	01-12-2019	**30-12-2020**	
Identification of potential field sites for grid connection	01-12-2019	28-02-2020	Technical note, methodological note and instruments for surveys
Design of technical parameters of grid connection pilot, identification of a control site; and design of evaluation framework, survey instruments etc.	01-03-2020	30-06-2020	
Baseline surveys (including GESI studies) in selected grid connection and control sites	01-07-2020	30-12-2020	Draft baseline report summarizing results from qualitative and quantitative surveys, including GESI outcomes
Procurement and installation of grid connection in one or two SIP site	01-09-2020	30-10-2020	Grid connection completed in at least one site Technical report with installed MG system & its functioning

4.4 Grid connected SIP pilot in Pakistan

The last presentation of this session led by Azeem Shah from IWMI (Pakistan) highlighted current status of SIPs in Pakistan. There are already couple of projects related to SIPs in different areas. They provide potential sites for carrying out the pilot on grid connected SIPs. One of the major objectives in Pakistan for introducing solar is remove the heavy subsidy that is being given to electricity pumps and then reduce import of diesel for diesel pumps. Pakistan team will carry out the project in Punjab province where current system is diesel pumps. The activity will simulate the feed-in tariff by creating heat sinks and evaluates potentials for managing groundwater pumping through feed-in tariffs. As the government is focusing on off-grid solar pumps, it is right time to generate local and context-specific evidences on various types of benefits (such as power generation, GW conservation, etc.) that grid connected SIPs can generate so that it can feed into policy. This activity will start in **2021**.

5. Innovation Funds

The fourth session chaired by Divya Sharma from SDC was dedicated to "Innovation Funds". On her opening remarks, Divya highlighted the overall importance of the innovation fund and how best this is an opportunity for entrepreneur to really explore some of the innovative ideas out there, implement it and come out with some interesting outcomes. Then, Shilp [IWMI] shared the concept of Innovation Funds and it was then followed by group activity to brainstorm types of innovations to be funded. Finally, Alok Sikka [IWMI] shared some ideas on selection procedure as well as governance mechanism for administrating the Innovation Funds.

5.1 About the Innovation Fund

The topics of discuss in SIPs five years back were different than what we are doing today. Similarly, the topics of discussion five-years down the line would be more advance than now. Therefore, to encourage and support translation of innovative ideas into practice, the project has made provision of "Innovation Fund". A sum of 400,000 USD is kept aside to materialize such innovative ideas in the areas of technical, financial, and institutional aspects of SIPs. The project is considering to support 6-8 innovations with the ticket size of 50,000 – 60,000 USD per project, each lasting for a maximum of 24 months. Ideally, the innovative ideas/concepts should help to bridge any identified gaps that hampers adoption, use, and up-scaling of SIPs in South Asia. Year-1 work plan for this activity is shown in Table 5-1.

***Table 5-1**: Year-1 work plan for Innovation Funds*

2.3.1 Innovation Funds (IF)	**Start Date**	**End Date**	**Outputs/Deliverables**
	01-12-2019	**30-12-2020**	
Identification of themes/ topics of IF, finalizing protocol for selection, and posting of IF call on IMWI, SDC, and related websites	01-12-2019	28-02-2020	Innovation grant note
Shortlisting, selection, and finalization of grant winners of 2020-2021 (maximum 3 to 4 grants)	01-03-2020	30-06-2020	Announcement of final grantees

Beginning of project grant period and one review meeting with grantees	01-07-2020	30-12-2020	One review meeting with all grantees

5.2 Group works – Potential ideas for innovation

To brainstorm on potential areas/themes/topics of innovation, three dedicated groups were formed to brainstorm on technical, financial, and institutional areas of innovations. Each group were provided with following two guiding questions;

- What innovations already exist or issues that require innovative solutions that can be supported through the project?
- What are the best ways of reaching the innovations or inviting interesting applications to this fund?

Key findings from each groups are presented hereunder;

i) Technical

- **Innovations that already exist**
    - Net meters, remote communications, cold storage with thermal is available, portable solar system, pumping and metering systems
    - Off- grid AC/DV PUMPSETS (BLD/PMC/AC)
    - Solar PV Panels with higher efficiencies
    - Grid connected Solar system with Grid tied inventors
    - IOT Based solution for remote communications
    - Cold storage through Solar/Thermal/ too easy autonomy
    - Service based Solar Pre-paid meters/pumping systems
    - Web portal agency wise
    - Mobile app
    - Innovative solutions- there should be a unified portal to monitor off grid technologies

- Farmers should have the option
- Moistening of land and irrigation requirement
- Remoting sending
- Water and energy solar
- Communications- one meter one modern where we can face this data
- Utilizing of the off-grid

- **Proposed innovative solutions**
  - Unified state/country level web portal. There is a need for a project portal (country specific and then links with other partner agencies and ISA, IWMI etc.
  - Universal mobile app
  - Solar desalinization for drinking purpose/livestock drinking
  - Scheduling of irrigation based on real time data (environmental)
  - Automatic start and stop pumping
  - Portable Solar pumping system
  - Remote sensing application for irrigation water management
  - Water/energy storage for off grid solar pumping system
  - RS-485 Communication
  - Utilization of off grid SIP
- **Ways of reaching out to prospective innovators**
  - Partner website- ISA/SDC/IWMI
  - Project portal should be developed
  - Social Media- (LinkedIn, Facebook and twitter)
  - National newspaper

- Sending letters to universities/think thanks/ research organizations etc
- Preference to women innovators

ii) Financial/Economics

- **What innovations already exist or issues that require innovative solutions that can be supported through the project?**
  - Package of services
  - Diversify end users
  - Interventions on agricultural value chains
  - Mobile/ e Payments
  - Using Local government as a garreteers and solar pumps as collectors
- **What are the best ways of reaching the innovations? How do we reach them?**
  - Universities
  - Stat up networks and incubators
  - Social media
  - Communication style is to use of simple languages. How do we make it snappy and attractive graphics?
  - Establish an inventory of inventors by registering them on a government portal. Have a ranking system for the inventors
  - Can we have bottom up approaches. District level workshops to cater to rural areas as well.

iii) Institutional

- **Potential innovative solutions**
  - Safeguard the resource (ground water) beyond feed –in – tariff
  - Groundwater quality/quantity monitoring
  - Are 'SIP' incentives accessible for tenant farmers/shared cropping

- Community vis individual pumps
    - governance structures 'if' you had SIP community systems
    - engage/train women SIP technicians
    - profitability/ value chain of farming

- **How to reach out to them-**
    - Social media/website
    - Advertising
    - Start-up networks
    - Events in country offices

5.3 Implementation of the Innovation Fund

Alok Sikka [IWMI] presented a roadmap for implementing Innovation Fund program (Figure 5-1). As per the roadmap, an Expert Committee is envisaged for finalizing evaluation criteria, shortlisting and evaluating of the proposals.

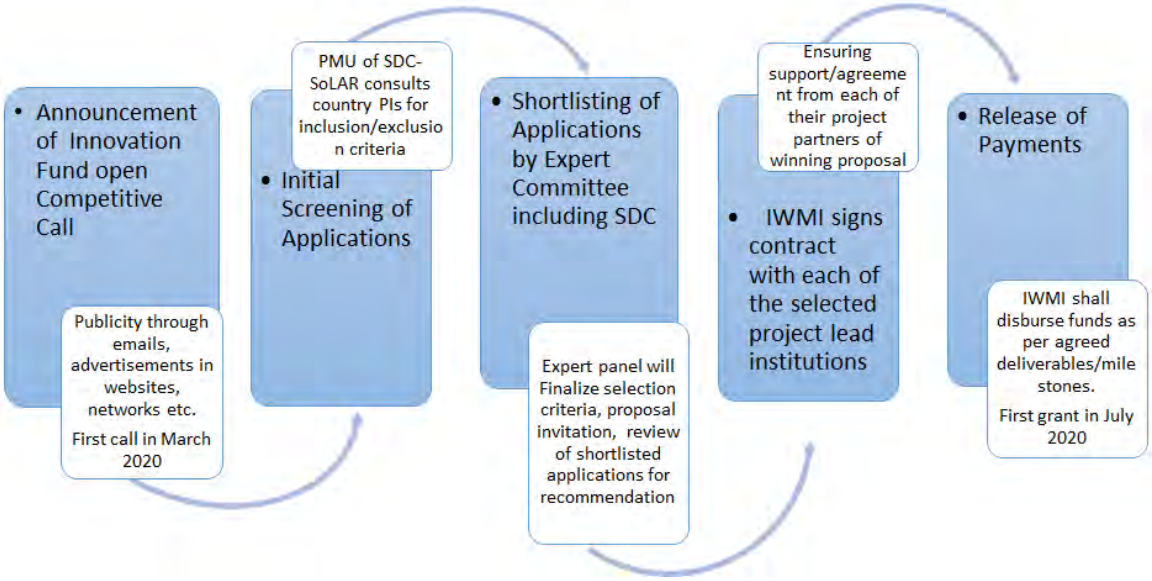


***Figure 5-1**: Roadmap for implementing Innovation Funds*

Finally, in her session-closing remarks, Divya explained the importance of providing the opportunity to entrepreneurs to explore innovative ideas and implement solar innovations in the region. She also stressed a need to explore if the Swiss technologies

have a potential to further enhance partnerships going forward though this projects. There are challenges we are facing in the use of technology with regard to its usage and easy access and safety need to be ensured while implementing any technology.

***Photo 5-1**: Some glimpse of group work*

The fourth session was followed by reception dinner hosted by Director General of IWMI to welcome all the participants in Colombo.

6. Work Plan for Groundwater Thematic Group for Outcomes 1 and 2

The proceedings from Session-5 onwards was held on the second day, i.e., 22nd January 2020. The fifth session focused on work plan for groundwater thematic group was chaired by Stefan Uhlenbrook, Strategic Program Director, IWMI. There were three presentations; two focused on proposed groundwater work plans in Bangladesh, India and Pakistan and the last one by Petra Schmitter and Thai Minh [IWMI] was focused on IWMI's innovations from Africa on groundwater, agricultural water management, and solar irrigation pumps.

6.1 Proposed groundwater work plan in Bangladesh and India

Alok Sikka, IWMI India, led the presentation on proposed groundwater work in Bangladesh and India. He provided an overview of groundwater sustainability study, hypothesis, and key questions that the proposed intervention aims to answer. The hypothesis of this activity is "In case of free power (solar) and no financial incentives to limit pumping, it may lead to an increased groundwater abstraction, and risk of over-exploitation". The policy question associated with this hypothesis is "What are the possible impacts of large-scale adoption of SIPs on groundwater resources". To answer the policy question, the proposed activity aims to answer following three research questions;

- How does farmer irrigation pumping behavior change after installation of solar irrigation pump under different development systems (on- and off-grid)?
- Does solar irrigation with efficient on-farm water management help in improving groundwater sustainability?
- How will groundwater sustainability be affected if SIPs were to be upscaled, while also accounting for other changed, such as climate change?

The presentation then introduced the study areas – Gujarat in West India, and North-West region in Bangladesh. Both of them are at different stages of groundwater development and represent different hydrogeological regions. The overall framework consists of measuring energy consumption, water discharge for different pump sizes, and aquifer characteristics at each case study location. Then develop relationship between energy use and abstraction volume so that energy consumption can be used as a proxy for groundwater abstraction at other locations with similar conditions. Finally, the presentation highlighted year-1 work plan for groundwater study in Bangladesh (Table 6-1) and India (Table 6-2).

***Table 6-1**: Groundwater work plan embedded in scale-pilot in Bangladesh*

1.2.1 GW studies in Bangladesh	**Start Date**	**End Date**	**Outputs/Deliverables**
	01-12-2019	**30-12-2020**	
Collection and analysis of secondary data on biophysical and groundwater parameters in selected SIPs	01-12-2019	30-03-2020	Short Note prepared based on the analysis of secondary data
Collection and analysis of data on IDCOL SIPs on parameters of pumps characteristics, hydrogeology and existing infrastructure (water, electricity meter)	01-02-2020	30-03-2020	Selection of SIPs for groundwater monitoring
Survey at farm level in adjoining areas of SIPs to collect data on diesel pump owners and use	01-03-2020	30-05-2020	Selection of diesel pump owners for monitoring
Develop and finalize methodology and monitoring protocol for GW sustainability studies	30-03-2020	15-05-2020	Methodological and monitoring protocol note for GW sustainability studies
Selection of instruments to put in field for measuring water and energy usage	01-04-2020	30-05-2020	Note on instruments being used and instruments bought after receiving quotations
Installation of instruments in field	30-05-2020	15-07-2020	Instruments installed on monitoring sites
Monitoring and data collection	15-07-2020	31-12-2020	Databased on collected data
Data analysis	01-08-2020	31-12-2020	
Annual Reporting	01-12-2020	31-12-2020	Preliminary report on data analysis – submitted to IDCOL and SDC PM

***Table 6-2**: Groundwater work plan embedded in scale-pilot in Gujarat, India*

1.2.2 GW studies in India	Start Date	End Date	Outputs/Deliverables
	01-12-2019	**30-12-2020**	
Collection and analysis of secondary data on biophysical and groundwater parameters in project feeders	01-12-2019	30-03-2020	Selection of feeders for groundwater study Short Note prepared based on the analysis of secondary data
Census/survey at farm level in selected feeders to collect data on Pump and well details	01-02-2020	30-04-2020	Selection of farmers in selected feeders for groundwater monitoring
Develop and finalize methodology and monitoring protocol for GW sustainability studies	01-03-2020	30-04-2020	Methodological and monitoring protocol note for GW sustainability studies
Selection of instruments to put in field for monitoring	01-03-2020	30-04-2020	Note on instruments being used and instruments bought after receiving quotations
Installation of instruments in field	30-05-2020	30-06-2020	Instruments installed on monitoring site
Monitoring and data collection	30-06-2020	31-12-2020	Database on collected data
Data analysis	01-08-2020	31-12-2020	
Annual Reporting	01-12-2020	31-12-2020	Preliminary report on data analysis & review paper

Following aspects were highlighted during discussion session;

- It would be good if we can include both electrical and diesel pumps.
- If possible, including interventions for groundwater recharge too will add value to the project as it is localized and context specific. Bangladesh already has national managed aquifer recharge (MAR) policy/program in place. There are lots of buy-in for recharge-related activities.

- If possible, considering aquifer quality in Bangladesh as a part of this project would be a real value addition.
- There are cases of local innovation such as using biogas to generate methane gas and using that for pumping groundwater instead of solar. If possible, it would be good to include other form of renewable energy too in the scope of the project.
- As a case of Gujrat may not represent whole India, if possible, it would be good to include more pilots to cover diversity within India.
- It would be good to review literatures related to response of farmers respond to replacing electrical pumps with solar, primarily for off-grid system.

6.2 Proposed groundwater work plan in Pakistan

Arif Anwar and Azeem Shah from IWMI Pakistan shared proposed groundwater work plan in Pakistan. Given the overall state of groundwater over-exploitation in Pakistan, there is an active debate on whether SIPs will further aggravate the problem of groundwater over-exploitation. So far, studies conducted by various agencies have had somehow contradictory results, and hence the need for a study with experimental method.

The proposed method includes undertaking a survey of diesel and solar pump owners using a matched sample approach in province of Punjab. Control and treatment groups would be diesel pump owners and the farmers with SIPs. Both groups will be observed over a period of one year (two seasons) to record temporal variations and quantify the amount of groundwater extraction. Pilots will be in two/three different districts of Punjab to incorporate variations in groundwater quality and demographic variability. The year-1 work plan for groundwater study in Pakistan is provided in Table 6-3.

***Table 6-3**: Groundwater-related studies embedded in demonstration pilot in Pakistan*

1.2.3 GW-related studies embedded in demonstration pilot in Pakistan	**Start Date**	**End Date**	**Outputs/Deliverables**
	01-12-2019	**30-12-2020**	
Collection of the data from the OFWM Punjab, FWMC, PARC about the diesel and SIPS in Pakistan	01-12-2019	28-02-2020	Short Note prepared based on the analysis of secondary data
Reconnaissance visit to the diesel and SIP sites in Punjab	01-02-2020	15-03-2020	BTOR of the field visit

Develop methodology for impact on groundwater use of diesel pumps versus SIPs	15-02-2020	30-03-2020	Methodological Note for the intervention
Preparation of survey instruments and selection of groundwater instruments for the study	15-03-2020	15-04-2020	Questionnaire for survey and guidelines for the physical instrumentation
Pilot testing of methodology and survey instrument & finalize sampling methodology	01-04-2020	30-04-2020	Sampling Strategy Note
Start data collection at weekly basis for the Kharif season	01-05-2020	15-10-2020	Dataset
Deployment of instruments for the selected diesel and SIP pumps	01-05-2020	30-06-2020	Field deployment notes
Analysis of data for the Kharif season	15-10-2020	15-12-2020	Working paper submitted to SDC PM
Start data collection on weekly basis for the Rabi season	01-11-2020	15-04-2021	Data set

Following points were raised during the discussion sessions;

- Is there something we need to consider on demand using solar versus other energy sources? How solar makes groundwater demand different under high efficiency scenario?
- Relatively slower flow rate with using solar may influence farmer's behavior.
- Solar energy is limited to day-time irrigation. Other sources of energy could be used in the evening. It may be good to capture how it influences or makes differences on consumptive water demand, selection of crops, etc.
- For large farms in Punjab, from economic viewpoint, using diesel is expensive. So, there could be an incentive to adopt solar irrigation.
- Capital cost associated with shifting technology could be a possible barrier. Change in technology also force farmers to change the crop. We need to create evidence, revise our plan and include technical, economic and social aspects.

- For collecting better evidence, we may also need to consider factors such as technical feasibility, economic subsidy, acceptability, capacity building, operation and maintenance, diffusion of irrigation, etc.
- There is also a learning curve for solar when you are deploying solar technology. How it affects to learning curves in terms of diffusion of technology as a part of the project?
- Social (acceptance) and economic aspects (coupling solar groundwater with surface water) to optimize may also be required.

6.3 IWMI's innovation from Africa on groundwater, agricultural water management, and solar irrigation pumps

Petra Schmitter and Thai Thi Minh from IWMI shared IWMI's activities focused on solar solutions for sustainable development of small-scale irrigation in Africa. The presentation started with a snap-shot on status of smallholder farmers and their access to resources to set context for focusing on smallholder farmer-led irrigation and solar. It was followed by IWMI's solar irrigation activities in the African region since 2015 (Figure 6-1). The presentation also shed light on how micro-landscape matters in the region; linkages between intensification of solar irrigation and water quality; changing irrigation behavior resulted through solar irrigation; targeting solar irrigation investments; correlation of wealth with biophysical irrigation suitability; and gender preferences, challenges, and opportunities.

Finally, Minh shared business canvas for scaling solar irrigation based on the experience gained so far from the African region. The scaling opportunities and challenges linked to the solar irrigation is shown in Figure 6-2.

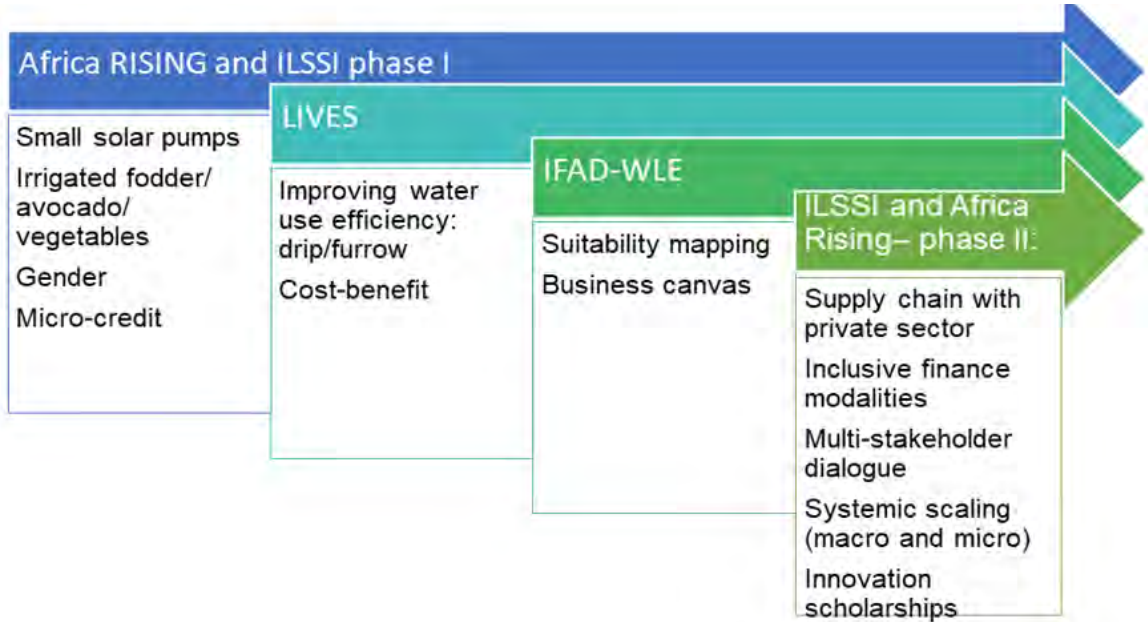


***Figure 6-1**: IWMI's solar activities in Africa since 2015.*

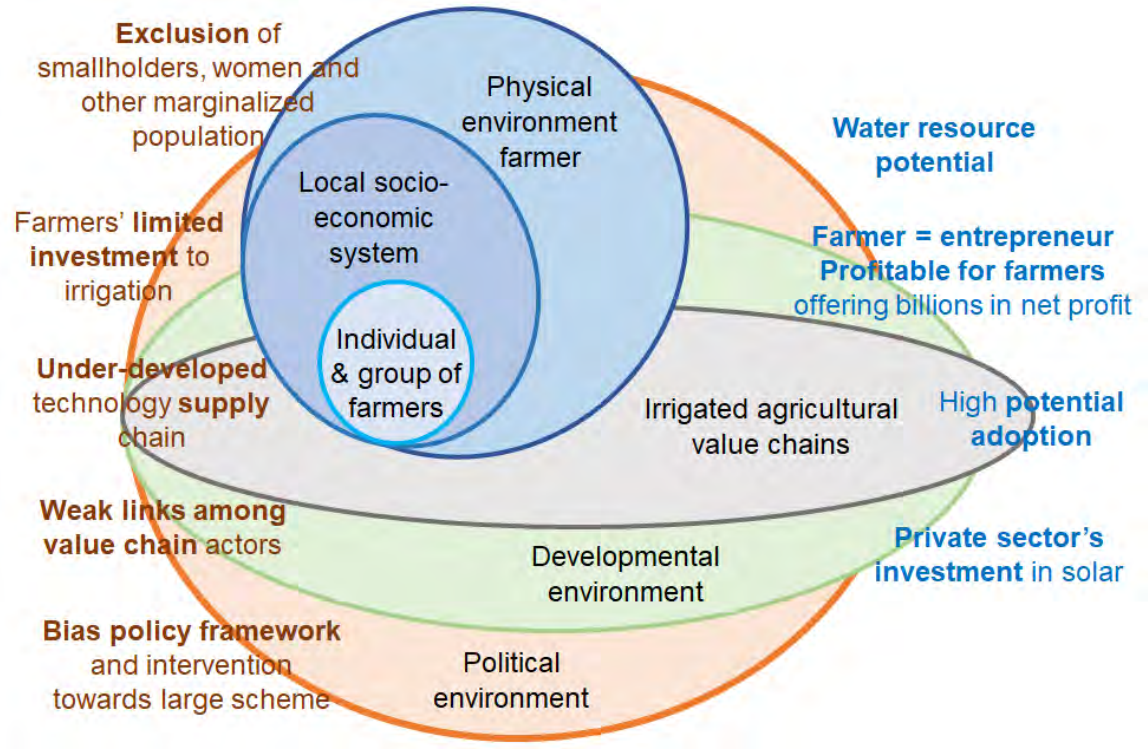


***Figure 6-2**: Scaling opportunities and challenges for solar irrigation.*

Minh also highlighted IWMI's research activities for 2019-2023 in the region, which include but not limited to identify and test sustainable scaling of solar irrigation (SSI); identify constrains and assess policy impacts; identify entry points to reduce supply constraints on technology markets; maximizing inclusivity, effective governance, women's empowerment, youth involvement; etc. Her presentation also emphasized on importance of partnering with private sectors and others for the success of scaling solar irrigation.

Key issues discussed during question and answer session are summarized hereunder;

- How do private sectors, sensors, and groundwater interact and work in reality?

7. Work Plan for GESI Thematic Group for Outcomes 1 and 2

The sixth session held on the second day was focused on work plan related to Gender Equality and Social Inclusion (GESI) for achieving Outcomes 1 and 2. The session was chaired by Deepa Joshi from WLE/IWMI. Manohara Khadka and Gitta Shrestha from IWMI-Nepal shared proposed GESI work plan for Nepal and the Region.

The policy question that GESI activity aims to answer is "*To what extent SIP systems in South Asia are sustainable, profitable, and reliable solutions to improve livelihoods of small and marginal farmers, including women farmers?*". For that analysis at solar irrigation institutions as well as solar irrigation projects (SIPs) are to be studied/analyzed. For this, data are to be collected and analyzed at various levels, including household (HH), community, private sector, and sate. And the data includes both qualitative and quantitative with clear disaggregation of intersectionality (e.g., gender, caste, ethnicity, class, and age).

The presentation started with motivation for GESI mainstreaming in SoLAR-SA. The message was that "patriarchal values and social norms are keeping gender inequalities alive in South Asian countries" and GESI is a marker for understanding development impacts. Following GESI issues in technology adoption were highlighted in the presentation – i) Gender unequal access to technology; ii) intra-household power

relations in design and adoption of small-scale irrigation technologies and operation/ management; iii) intersectionality; iv) institutional capacity and professional culture in the water-energy-food nexus sectors; and v) gap in GESI knowledge in solar narratives.

It was emphasized that GESI mainstreaming in the SoLAR-SA project cycle includes consideration in project design, implementation and monitoring/evaluation (M&E). During project design, we have set GESI responsive outcomes such as at least 30% SIPs owned by small and marginal farmers; and 1/3rd of trained technicians to be women, among others. During project implementation, following milestones/activities related to GESI are included in SoLAR-SA project: GESI integration in impact evaluation and pilots; GESI qualitative study; and GESI in training as well as knowledge/policy forums. Finally, GESI during M&E includes GESI-specific indicators in baseline and monitoring framework and GESI elements in the project evaluation.

The proposed GESI work plan includes;

- In-depth case studies with women solar pump owner [in Nepal]: It will be carried out in three-phases of technology adoption based on Theis et al. (2018) framework, which looks after – awareness, initial adoption (try out), and continued use (impact).
- Institutional analysis [Regional level]: It uses a methodological framework/instruments based on the Oxfam 12 Boxes framework. Each country team is expected to administer it to their respective organizations.
- Inclusion of GESI questions in impact evaluations: It may include aspects such as access to solar technology, decision-making, income, nutrition, information, finance, etc. as well as categorization of owner of SIPs based on caste, ethnicity, gender, age, etc.

Key discussions on GESI work plan are summarized hereunder;

- It would be good to explore possibility to align it with South Asia solar program so that we can bring cross-country learnings
- Caste/Ethnicity is not available in Bangladesh. Also it would be difficult to find women-headed farmers in Bangladesh.
- Capturing impact on farmers versus labour (who don't own) in impact evaluation study may give interesting insights. Same with women's involvement in post-harvest & post-processing.
- Sometimes women are reluctant to come up-front to visualize as owner. We need to address that too through Awareness.

8. Work Plan for Work Package 3 – Knowledge Sharing and Capacity Building for Outcome 3

The seventh session focused on knowledge sharing and capacity building was chaired by Alok Sikka [IWMI-India]. Alok introduced the session and Aditi presented elements of knowledge sharing and capacity building component for achieving Outcome-3. Aditi also presented proposed plan for organizing the regional knowledge forums and training. Her presentation also elaborated water-energy-food nexus and the stories related to Indian context, which could necessarily be learnings for other countries as well. She further emphasized on solution space (Figure 8-1) with India-specific story.

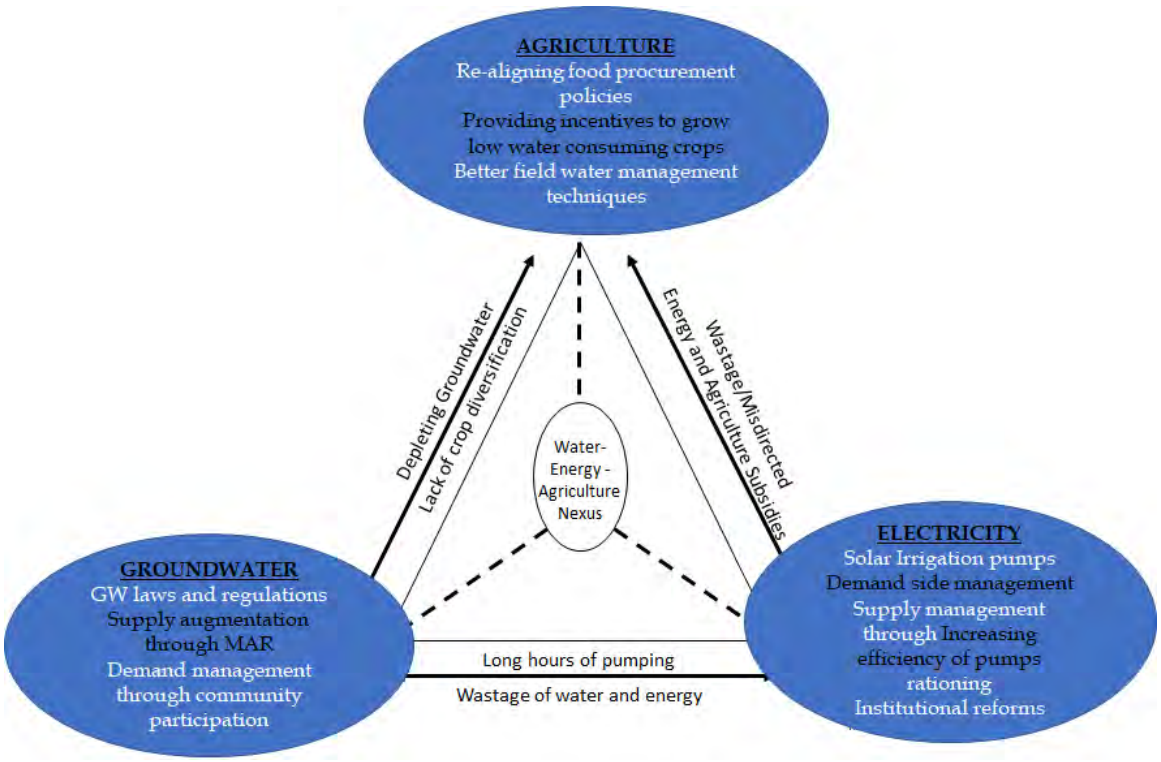


***Figure 8-1**: Solution space in WEF sectors*

The presentation as followed by facilitated group work and subsequent sharing of the outcomes of the group work. Three groups were formed, each to brainstorm potential training and capacity building activities in three areas, namely, water, energy, and food/ agriculture. Key findings from the group work are listed hereunder;

i) Water: This group differentiated technical and policy-level ideas separately as listed hereunder;

- Technical ideas-
    - Implications of water quality on irrigation and pumping sets
    - Water management/requirements
    - Technical design – Particularly to share /learn from technologies
    - Solar radiation and relationships to discharge
    - Operations and maintenance (temp/cleaning) of PV's
    - Best practices across the region
    - AC vs DC motors, submersible/ surface pumps
    - Water storage options
- Policy level ideas
    - Types of irrigation technologies- advantages/disadvantages
    - Ground water maps/quantity and quality and how this influences licensing/ guidelines for ground water development
    - Sharing/learning from partner countries. Good examples of legislation, regulatory frameworks, re solarization, ground water management
    - Socio/ economic of SIPs that something policy makers can benefit from
    - Cropping pattern change to conserve ground water/and value chains
    - Case studies on community based SIP investments vs individual SIP investments. What are the countries to learn from?
    - Solar for irrigation & portable uses

- Financial investment (subsidies, private sector investments) for SIPs. Models of feeder prices, incentives
- Gender equity

ii) Energy: Potential ideas for training and capacity building in the areas are energy that emerged out of group discussion are listed hereunder;

- Energy water relationships. So it's just not about energy alone but how do we take it for designing and sizing the pumps. For Solar irrigation
- GIS based framework for suitability assessments (NASA, WB Global Solar, planning food)
- Efficiencies of panels vis or vis pump efficiencies and flow depth
- Planning tools- Can we really make sense of the remote sensing data out there to really help the policy makers in the counties identify where to invest into energy solutions.
- How do we know about budget implementation?
- Optimizing design vs budget
- Life cycle cost of solar –how long can really certain solutions be in the field and what are the costs of those vs others. More really about learning about solutions out there.
- Sensitization on solar (evidence based) – benefits challenges. This was more about policy and break earlier beliefs to collect evidences to overcome the challenges.
- Inter sectorial designing of the water energy sectors. How do we bring them together and foster cooperation & coordination?
- Recycle of solar- Should we start thinking of this already.
- Solar Panel standards & quality – Often countries mention there are not enough proper standards of the quality panels. So we need trainings around that to know what to reach out to.
- Strengthen existing energy policies related to solar to support-
    - Cross sectoral coordination

- National standards
- Ground water management situation
- Manage risks

- Grid connection – A lot of the project here present around this. SO the team felt there was a need to develop a course around these various elements
  - Renewable
  - Efficiency
  - Sizing
  - Costing

iii) Food/Agriculture: Finally, the ideas emerged from group discussion in this group are listed hereunder;

- Agriculture value chain - how do farmers make better profits from the crops they are growing? knowledge around agriculture value chains and cultural water use.
- Agriculture technologies/ mechanization – that promote water efficient technologies, better weather information and a rage of information. Case made to sensitize policy makers about a whole range of technologies available out there
- David's coined word 'Thinking like a farmer' which is so rarely we think like one while we are making decisions on them behave. Farmer decision making games were previously played by Tushaar and Shilp where it makes us think like a farmer while making decisions for them. Design a role play or an experimental game.
- A menu of best agriculture practices – in the region and outside the region. Then there was a discussion around high value crops and technologies that lead to better use of farm ag-water –management. Improve water efficiencies but bringing forward and documenting some of the best practices in some countries
- Agriculture information system
- High value agriculture use of technology in agriculture, water intensive
- Best/effective policy initiatives with evidence- case studies, schemes in Bangladesh which have worked.

- Nutrition component -Value chain- climate resilient agriculture- how SIPS can help in food security? Use of surplus energy for value addition.
- Climate resilient agriculture. Impact & climate change reports to lean from & agriculture
- Nutritious crops – multiple cropping, livestock and orchids
- Crop insurance – best practices, what have been the modalities and where has it worked well? Why did it work, etc.
- agro chemicals and pest management focusing on water management aspects, not to over fertilize so that ground water is not damaged
- Framing the entire thing under the regional food systems and perhaps under the climate change food systems
- Remote sensing applications

This third work package includes following activities;

- Activity 3.1.1: Training of local technicians in Bangladesh, India and Nepal; and training of farmers in Pakistan.
- Activity 3.1.2: Training of groundwater, energy, and agricultural officials in all four countries
- Activity 3.2.1: Regional knowledge and policy forums
- Activity 3.2.2: National forums.

Table 8-1 provides year-1 work plan of the activities related to knowledge sharing and capacity building component.

Table 8-1*: Year-1 work plans related to knowledge sharing and capacity building*

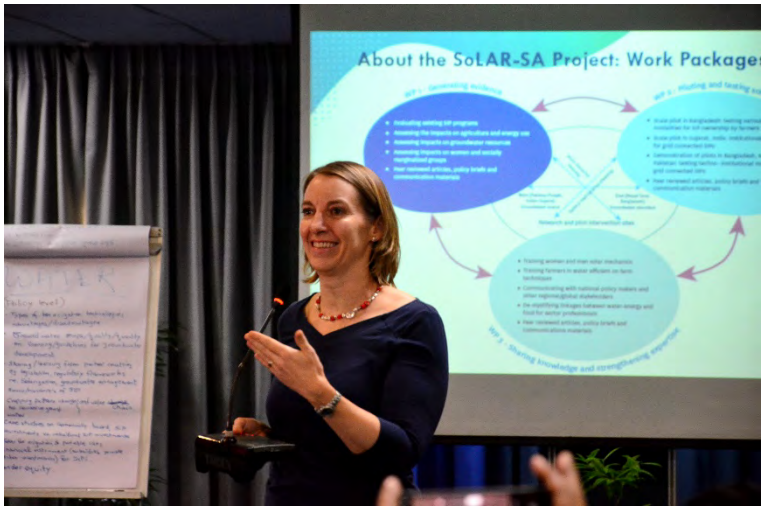
Description of Activities	**Start Date**	**End Date**	**Outputs/Deliverables**
	01-12-2019	**30-12-2020**	
3.1.1 Training of local technicians in Bangladesh, India, and Nepal; and training of farmers in Pakistan (4 in total; 1 in each country)			

Preparation of training curricula, training modules, and selection of trainers and trainees	01-03-2020	30-06-2020	Training materials (curricula/modules); Trainee chosen; All technical and logistical arrangements are done
Training workshop/school (3-5 days training)	01-07-2020	30-10-2020	Training report including details of persons attended
3.1.2 Training of groundwater, energy, and agricultural officials in all four countries (one training for each country)			
Preparation of training curricula, training modules, and selection of trainers and trainees; and finalization of venue and partnership on training with ISA and GERMI	01-03-2020	30-06-2020	Training materials (curricula/modules); Trainee chosen; All technical and logistical arrangements are done
Training workshop/school (3-5 days)	01-07-2020	30-09-2020	Training report including details of persons attended
3.2.1 Regional knowledge and policy forums			
Inception meeting cum knowledge and policy forum held in Colombo	21-01-2020	22-01-2020	Approved work plan for Year-1; Inception workshop report; All MoUs/Letter of Support signed with partners (March, 2020)
3.2.2 National forums (4 in total; 1 in each country)			
National forum (with 20-30 participants, mostly policy makers)	01-10-2020	31-12-2020	National forum workshop report; 1 policy brief around which national forum is held

9. Concluding and Closing

The last session, named as “Concluding and Closing Session” was chaired by Marylaure Crettaz Corredor from SDC in India. In this session, Aditi Mukherji summarized the feedback received from the participants and assured that the work plans will be updated incorporating the feedback to the extent possible. It was followed by closing remarks from Mark Smith, Deputy Director General, IWMI. Mark appreciated SoLAR team, all partners, and SDC for working together so hard for bringing the project to this stage through entry-phase. He also appreciated all participants for the quality dialogue, openness to share and reflect, and collegial spirit with which it kicked-off. As the project touches up on the three big areas (water, energy and food), wherein a lot of global goals are embedded, the challenge the project has taken is really considerable. Mark highlighted importance of partnership for shaping problem as well as jointly enabling the solutions and science diplomacy component of the project and re-affirmed IWMI’s commitment to the project linking that scaling solutions is a focus of IWMI’s strategy and SoLAR-SA project is an example of that.

Divya Sharma from SDC India and the project manager from SDC for this SoLAR-SA project, appreciated the team’s effort to bring the project to this stage from entry phase and cautioned on the need of traveling bumpier roads ahead to achieve the ambitious goal of the project. She also emphasized that SDC wants to see cross-country learning happening and having ISA as a partner would certainly benefit in bringing learnings form global as well as other regions.



Marylaure from SDC further added that most expectations so far are achieved. She also expressed happiness for the well mix of participants, including gender, inter-generation, and regional. She re-emphasized on the term "science diplomacy" and mentioned that it is what this project can offer. She encouraged all to present concrete results in the second forum, and make the session formats more innovative – less presentations, and more interactive sessions.

Before moving to a formal vote of thanks, representatives from each partner countries also shared final remarks. Representatives from Bangladesh re-confirmed the commitments and expressed eagerness to engage with very interesting initiatives that the project work plan has laid out. Dr. Bashir from Pakistan reflected on quite engaging and learning two days and hoped that the process would continue throughout the period of project implementation. He also expressed that government will continue to utilize knowledge and expertise of IWMI-Pakistan for other instances as well. Representative from India highlighted this project as an opportunity to learn from each other's experience citing that the issues, values, and problems across the project countries are same. The project is critical in the sense that groundwater table is depleting in the region and project aims to reflect on that and suggest some policy solutions. Chaitanya Chaudhary from Nepal mentioned that the project as an opportunity to learn and use those lessons to policy and implementations. He also expressed expectations to generate new examples from Nepal as a learning from other

countries in the region. Claudia sadoff, Director General of IWMI, appreciated the sense of energy, excitement, and determination of all partners. She hoped that the program should interest everyone in South Asia as it has tremendous importance to the South Asian countries and beyond.

Finally, Vishnu Prasad Pandey from IWMI-Nepal delivered a formal vote of thanks. He started with diversity of inclusiveness of participants with facts and then appreciated and thanked SDC, partner organizations from the project countries, participants, representative of ISA, and project team for highly valuable inputs on the proposed interventions and work plan and making two days highly rewarding. He also acknowledged highly busy schedules of all valuable participants and expressed sincere thanks for agreeing to be in Colombo, taking part in highly interactive discussions, and reflecting openly and critically while providing inputs. Sincere gratitude was extended to members of the Project Steering Committee (PSC) for sparing their valuable time, and SDC for trusting IWMI and partnering with the IWMI-led consortium. He extended special thanks to Marylaure and Divya from SDC for

guiding and supporting through the year-long process of developing the proposal with very constructive suggestions and feedback on timely manner. On behalf project leader and entire project team, he also extended appreciation to Claudia, Mark, Stefan, and other staffs in IWMI headquarter who were working very hard behind the scene for last many weeks to make this event happen. He also acknowledged contributions of all session chairs and rapporteurs; all the members of project team from various offices of IWMI for hard and continued efforts so far and encouraged to work with the same spirit over the coming years. Finally, he extended of thanks to Nirmal and his team who worked very hard and put tremendous efforts to make this event happen in truly flawless manner. He then invited all the participants to give a big round of applaud for all for successfully completing it with great level of participation and then concluded vote of thanks.

Annex 1: Inception Workshop Agenda

Solar Irrigation for Agricultural Resilience (SoLAR)

Inception Workshop

21-22 January 2020
Venue: Yellow River Auditorium, IWMI, Colombo

Day 1: 21st January 2020		
8:30-9:00	**Registration**	
9:00-10:30	**Session 1: Inaugural Session** **Session Chair: Mark Smith, Deputy Director General, IWMI, Sri Lanka** **Session Rapporteur: Vishnu Pandey, IWMI, Nepal**	
9:00-9:05	Welcome address and about IWMI	Claudia Sadoff, Director General, IWMI
9:05-9:10	Welcome address and about SDC	Marylaure Crettaz Corredor, Head of SDC, Swiss Embassy New Delhi
9:10-9:20	About the SoLAR project	Aditi Mukherji, IWMI
9:20-9:30	Brief remarks on the relevance of the SoLAR project for the South Asia region: • Bangladesh	S. M. Monirul Islam, Deputy CEO, IDCOL
9:30-9:40	• India	J.K. Jethani, Director, MNRE
9:40-9:50	• Nepal	Madhukar P. Rajbhandari, Director General, DWRI
9:50-10:00	• Pakistan	Bashir Ahmad, Director CEWRI, PARC,
10:00-10:10	• International Solar Alliance	Rakesh Kumar, Program Director, ISA
10:10-10:25	• Q&A	All
10:25-10:30	Signing of MOU between ISA and IWMI	ISA and IWMI
10:30-11:00	**Group Photo and Tea Break**	
11:00-12:30	**Session 2: Work Plan for Work package 1 – Generating evidence for achieving Outcome 1** **Session Chair: Soumya Balasubramanya, IWMI, Sri Lanka** **Rapporteur: Farah Ahmed, IWMI, India**	
11:00-11:20	Impact evaluation of IDCOL SIPs in Bangladesh	Md. Enamul Karim Pavel, IDCOL; Md. Sarwar Hossain, BADC; Ashok Kumar Biswas, DAE; Aditi Mukherji and Marie Charlotte Buisson, IWMI
11:20-11:30	Q&A for Bangladesh team	
11:30-11:50	Gujarat's SKY Program and its Impact evaluation	Anita P. Zula, Government of Gujarat; R.J. Vala, GUVNL; Akhilesh Magal, GERMI; Shilp Verma, IWMI
11:50-12:00	Q&A for India team	

12:00 -12:20 12:20-12:30	Impact evaluation of AEPC and other SIPs in Nepal Q&A for Nepal team	Vishnu Pandey and Kashi Kafle, IWMI; L.P. Ghimire and C.P Chaudhary, AEPC; Dipak Bhardwaj, DOA, GoN
12:30 -13:30	**Lunch IWMI Cafeteria**	
13:30-15:30	**Session 3: Work Plan for Work package 2 – Innovative pilots for achieving Outcome 2 Session Chair: Mohsin Hafeez, IWMI, Pakistan Rapporteur: Md. Faiz Alam, IWMI, India**	
13:30-13:50 13:50-14:00	Proposed grid connected SIP pilot in Bangladesh Q&A for Bangladesh team	Kazi Ahsan Uddin, Md. Belal Siddique, Farzana Rahman, IDCOL
14:00-14:20 14:20-14:30	Pilot on institutional modalities of SKY feeders Q&A for India team	Shilp Verma, IWMI; Akhilesh Magal, GERMI
14:30-14:50 14:50-15:00	Proposed grid connected SIP pilot in Nepal Q&A for Nepal team	Sagar Gyawali and Sagita Giri, NEA; L.P Ghimire and C.P Chaudhary, AEPC; Vishnu Pandey, IWMI
15:00-15:20 15:20-15:30	Proposed grid connected SIP pilot in Pakistan Q&A for Pakistan Team	Azeem Shah, IWMI; Muhammad Tahir Anwar, FWMC
15:30-16:00	**Tea break**	
16:00-17:30	**Session 4: Innovation funds Session Chair: Divya Sharma, SDC, India Rapporteur and Facilitator: Farah Ahmed, IWMI, India**	
16:00-16:10 16:10-17:10 17:10-17:30	Innovation funds: The concept Group activity for brainstorming on types of innovations to be funded Selection procedure and governance mechanism for Innovation Funds	Shilp Verma, IWMI All Alok Sikka, IWMI, India
18:00-20:30	**Reception Dinner**	Water's Edge (Buses will leave IWMI at 18:00 hours)
Day 2: 22nd January 2020		
8:30-10:30	**Session 5: Work Plan for Groundwater Thematic Group – for achieving outcomes 1 and 2 Session Chair: Stefan Uhlenbrook, IWMI, Italy Rapporteur: Gitta Shrestha, IWMI, Nepal**	
8:30-9:00 9:00-9:20 9:20-9:40 9:40-9:50	Proposed groundwater workplan in Bangladesh and India Q&A for Bangladesh and India team Proposed groundwater workplan in Pakistan Q&A for Pakistan team	Alok Sikka, Md. Faiz Alam, Paul Pavelic, IWMI Arif Anwar, Azeem Shah, IWMI

9:50-10:10 10:10-10:30	Groundwater, agricultural water management and solar irrigation pumps: IWMI's innovations from Africa Discussions	Petra Schmitter and Thai Minh, IWMI
10:30-11:00	**Tea Break**	
11:00-12:00	**Session 6: Work Plan for Gender Equity and Social Inclusion Thematic Group for achieving outcomes 1 and 2 Session Chair: Deepa Joshi, WLE/IWMI, Sri Lanka Rapporteur: Vishnu Pandey IWMI, Nepal**	
11:00-11:30 11:30-12:00	GESI work plan – Nepal and Regional Q&A and Discussions	Gitta Shrestha and Manohara Khadka, IWMI
12:00-13:00	**Lunch IWMI Cafeteria**	
13:00-14:15	**Session 7: Work Plan for WP3: Knowledge sharing, and Capacity Building for achieving Outcome 3 Session Chair: Alok Sikka, IWMI, India Rapporteur and Facilitator: Farah Ahmed, IWMI, India**	
13:00-13:10 13:10-14:00 14:00-14:15	Proposed plans for Regional Forums and Trainings Facilitated group work Findings from group work	Aditi Mukherji, IWMI Farah Ahmed
14:15-15:00	**Session 8: Concluding/Closing session Session Chair: Marylaure Crettaz Corredor, SDC, India Rapporteur: Azeem Shah, IWMI, Pakistan**	
14:15-14:30 14:30-14:40 14:40-14:50 14:50-15:00	Consolidated work plan and way ahead Closing remarks, IWMI Closing remarks, SDC Vote of thanks	Aditi Mukherji, IWMI Mark Smith, DDG, IWMI Divya Sharma, SDC, India Vishnu Pandey, IWMI
15:00-15:30	**Tea Break**	
15:30-17:30	**1st Project Steering Committee Meeting**	Project Steering Committee members (Ganges Room)

***Abbreviations**: AEPC: Alternative Energy Promotion Centre, Nepal; CWERI, PARC: Climate, Energy & Water Research Institute, Pakistan Agricultural Research Council; DWRI: Department of Water Resources and Irrigation, Nepal; FWMC: Federal Water Management Cell, Pakistan; GERMI: Gujarat Energy Research and Management Institute, India ; GUVNL: Gujarat Urja Vikash Nigam Limited, India; IDCOL: Infrastructure Development Company, Bangladesh; ISA: International Solar Alliance; IWMI: International Water Management Institute; MNRE: Ministry of New and Renewable Energy, India; NEA: Nepal Electricity Authority, Nepal; SDC: Swiss Agency for Development and Cooperation*

Annex 2: List of Participants

S.N.	Name	Designation	Gender	Organization
Participants from **Bangladesh** (names in alphabetical order)				
1	Ashok Kr. Biswas	Deputy Project Director (SIP)	M	Department of Agricultural Extension (DAE)
2	Effat Ara	Assistant Engineer	F	Bangladesh Agricultural Development Corporation
3	Farzana Rahman	Unit Head (Investment), Renewable Energy	F	Infrastructure Development Company Limited (IDCOL)
4	Kazi Ahsan Uddin	Manager, Renewable Energy	M	IDCOL
5	Md. Belal Siddiqui	Assistant Manager, Renewable Energy	M	IDCOL
6	Md. Enamul Karim Pavel	Head of Renewable Energy	M	IDCOL
7	Mita Kundu	Agricultural Engineer	F	DAE
8	Mohammad Sarwar Hossain	Project Director (SIP) & Deputy Chief Engineer, BADC	M	Bangladesh Agricultural Development Corporation
9	S M Monirul Islam	Deputy CEO	M	IDCOL
Participants from **India** (names in alphabetical order)				
10	Akhilesh Magal	Head, Advisory and Consulting Group	M	Gujarat Energy Research and Management Institute (GERMI)
11	J.K. Jethani	Director	M	Ministry of New and Renewable Energy
12	Rajendrakumar J. Vala	Executive Engineer	M	Gujarat Urja Vikas Nigam Limited (GUVNL)
Participants from **Nepal** (names in alphabetical order)				
13	Chaitanya Prakash Chaudhary	Engineer	M	Alternative Energy Promotion Center (AEPC)
14	Dipak Bharadwaj	Sr. Agri. Engineer	M	CAIDMP, Government of Nepal
15	Laxman prasad Ghimire	Senior Officer	M	AEPC
16	Madhukar Prasad Rajbhandari	Director General	M	Department of Water Resources and Irrigation (DWRI)
17	Sagar Gnawali	Assistant Manager (Engineer)	M	Nepal Electricity Authority (NEA)
18	Sangita Giri	Engineer	F	NEA
Participants from **Pakistan** (names in alphabetical order)				
19	Ammarah, PE, PMP, PMI-RMP	Senior Engineer / Project Coordinator	F	National Engineering Services of Pakistan (NESPAK)
20	Bashir Ahmad	Director, Climate, Energy & Water Research Institute (CEWRI)	M	Pakistan Agricultural Research Council (PARC)

21	Khalid Jamil	SO, Climate, Energy & Water Research Institute (CEWRI)	M	Pakistan Agricultural Research Council (PARC)
22	Muhammad Tahir Anwar	DG, Federal Water Management Cell	M	Ministry of National Food Security and Research
23	Sardar Moazzam	Managing Director, National Energy Efficiency and Conservation Authority (NEECA)	M	Ministry of Energy, G-5/2 G-5, Islamabad, Pakistan
Participant from **International Organization**				
24	Rakesh Kumar	Programme Director	M	International Solar Alliance
Participants from the **Swiss Agency for Development and Cooperation (SDC)**				
25	Divya Kashyap	Senior Thematic Advisor, Climate Change and Development Division	F	SDC
26	Jismon James	Head of Finance	M	SDC
27	Marylaure Crettaz Corredor	Head of Swiss Agency for Development and Cooperation in India	F	SDC
28	Meenu Chawla	Head of Finance	F	SDC
Participants from International Water Management Institute (various offices)				
29	Claudia Sadoff	Director General	F	IWMI, Sri Lanka
30	Mark Smith	Deputy Director General	M	IWMI, Sri Lanka
31	Stefan Uhlenbrook	Strategic Program Director	M	IWMI, Sri Lanka
32	Soumya Balasubramanian	Senior Researcher	F	IWMI, Sri Lanka
33	Marie-Charlotte Buisson	Researcher	F	IWMI, Sri Lanka
34	Alok Sikka	Country Representative, India	M	IWMI, India
35	Aditi Mukherji	Principal Researcher	F	IWMI, India
36	Farah Ahmed	Communication Manager	F	IWMI, India
37	Shilp Verma	Researcher	M	IWMI, India
38	Md. Faiz Alam	Researcher	M	IWMI, India
39	Nirmal Sigtia	Administrative Coordinator - India	M	IWMI, India
40	Azeem Shah	Researcher	M	IWMI, Pakistan
41	Arif Anwar	Principal Researcher	M	IWMI, Pakistan
42	Hafeez Mohsin	Country Representative, Pakistan	M	IWMI, Pakistan
43	Sumble Ghani	Researcher	F	IWMI, Pakistan
44	Vishnu Pandey	Researcher	M	IWMI, Nepal
45	Manohara Khadka	Country Representative, Nepal	F	IWMI, Nepal
46	Gitta Shrestha	Researcher	F	IWMI, Nepal
47	Petra Schmitter	Research Group Leader	F	IWMI, Laos
48	Paul Pavelic	Principal Researcher	M	IWMI, Laos
49	Thai Minh	Researcher	F	IWMI, Ghana
50	Oyture Anarbekov	Country Manager – Central Asia	M	IWMI- Central Asia
51	Kashi Kafle	Researcher	M	IWMI, Sri Lanka
52	David Stifel	Researcher	M	IWMI, Sri Lanka