Solar Irrigation for Agricultural Resilience (SoLAR)

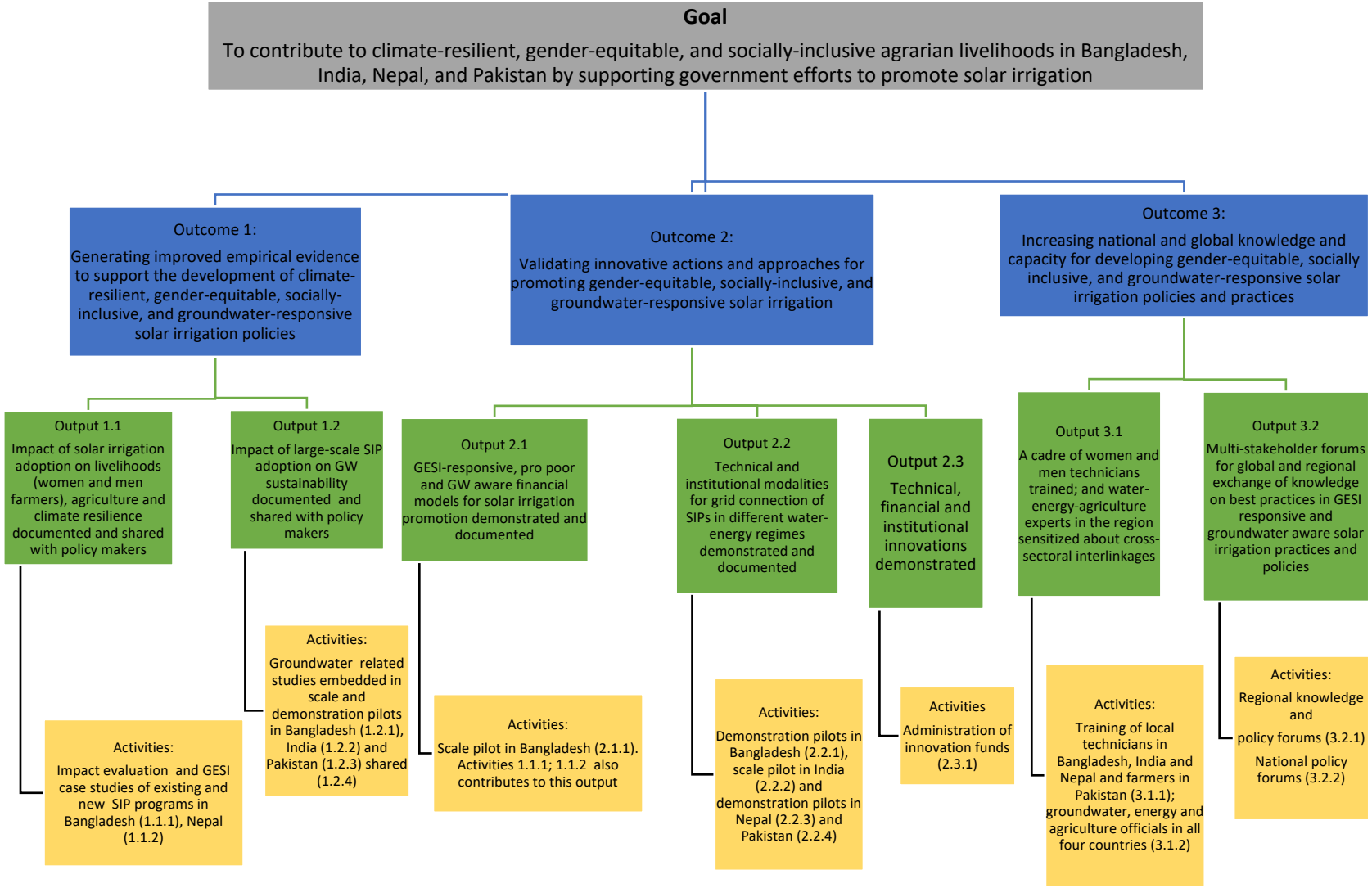
YEAR 2 WORKPLAN

FEBRUARY 2021

IWMI
International Water Management Institute

Table of Contents

SoLAR Logical Framework



1.1.1 Impact evaluation and GESI case studies of existing and new SIP programs in Bangladesh

Brief background:

Bangladesh government envisages solar irrigation as a cheaper and cleaner substitute for expensive diesel-based irrigation currently prevalent in the country. IDCOL is the primary organisation for SIP promotion with the "fee-for-service" model, where IDCOL provides loan and grant to sponsors, who installs SIPs and sell water to farmers in exchange for a fee. Given this background, it becomes imperative to understand the impact of solar pumps on irrigation accessibility and agricultural outcomes at the farmer level, GHG emissions and groundwater sustainability.

Achieved in Year 1

- Preliminary field visits
- Situation analysis report based on secondary IDCOL data
- Impact assessment methodology finalised
- Design of the SIP survey finalised (questionnaire, sample)
- Collection of the 1st round (kharif 2) of SIP level primary data using phone interviews
- Translation of relevant policy documents from Bengali to English
- Situation analysis report has been finalised

Planned for Year 2

- Design of the household survey (questionnaire, sample)
- Collection of household level primary data
- Collection of second, third and fourth round of SIP level data
- Analysis of policy documents through a GESI lens

Goals/ Objectives:

This research objective for this study is to analyse the economic and environmental impact of solar powered irrigation in Bangladesh and look into existing programmes through a lens of gender and social inclusion. Specifically the research would focus on the following questions

1. Impact of Solar irrigation on agricultural practices and outcomes (cropping intensity, yield, etc.), groundwater usage, diesel use in irrigation etc.
2. How does grid connection affect the operation of SIP and groundwater consumption?
3. How does SIP operations evolve over time and how does SIP characteristics (NGO/private sponsor, age, power installed, type of pump, financing) influence its operation?
4. How inclusive is the current SIP model i.e. factors determining farmer's access to solar

Study area/location:

Selected sites in Rangpur, Rajshahi and Khulna districts.

Methods employed:

This research component is organized into the following studies

- SIP study from secondary data provided by IDCOL on all SIP schemes to better understand the modalities of the program, its implementation and the evolutions over time. It will use standard descriptive statistics methods
- Policy analysis through the lens of gender and social inclusion
- SIP scheme level study that will collect and analyse scheme level data for each cropping season from aman 2020 to boro 2023. The data will be collected for a sample of 82 representative IDCOL SIPs.
- Microeconomic study at the household level using quasi-experimental methods to do quantitative impact evaluation. Two rounds of data will be collected in early 2021 and follow-up in end 2022/early 2023.

Timeline for each objective in Year 2:

Details of sub-activities	Start date*	End date*	Outputs/Comments	Person/s responsible
SIP Survey Rabi 2021	15/04/2021	30/05/2021	Primary data on SIP operations for 3 seasons from 82 schemes	**Partner NGO Forum** for data collection, **Marie-Charlotte**, Archisman for data analysis
SIP survey kharif 1 2021	15/07/2021	30/08/2021		
SIP survey kharif 2 2021	15/10/2021	30/11/2021		
Journal article draft based on three(Kharif 2, 2020, Rabi 2021 and Kharif 1 2021) rounds of SIP surveys	1/10/2021	31/12/2021	Draft journal article ready for submission to a journal	**Marie-Charlotte,** Archisman, NGO Forum, Aditi
HH level survey	01/05/2021	30/07/2021	- Sampling note, and Questionnaire - Primary farmer level data from 900 households	**Marie-Charlotte,** Archisman, Yashoda, Aditi

Baseline analysis	01/10/2021	30/12/2021	- Baseline report based on descriptive analysis of HH level data - Blog post	**Marie-Charlotte**, Archisman, Ahsan, Yashoda
Policy analysis	01/01/2021	30/06/2021	- Research article based on analysis of policy documents through GESI lens (Bangladesh and Nepal combined) - Blog post	**Gitta Shrestha**, Archisman, Marie-Charlotte, Aditi**

*Notes: * The dates for the surveys are tentative dates which may be adapted to consider health and regulatory conditions and cropping calendars.*

*** This research article would be a regional research paper. Archisman and Marie-Charlotte's input would be to contribute with some background information and descriptive statistics.*

Deliverables:

- SIP level database for 3 seasons in 2021 (i.e. Rabi, kharif2,Kharif 1) through telephone survey (30/11/2021)
- A draft of a journal article with findings from three rounds of SIP surveys (Kharif 2, 2020, Rabi 2021 and Kharif 1 2021) (31/12/2021)
- Household survey sampling note and Household survey questionnaire (30/4/2021)
- Household level database (30/09/2021)
- Baseline report based on descriptive analysis of HH level data (31/12/2021)
- Two to three blog posts and regular contributions to SDC-SoLAR newsletter – throughout the year
- Draft Journal article note based on analysis of policy documents through GESI lens (31/08/2021 – a combined paper with data from Bangladesh and Nepal)

1.1.2: Impact Evaluation (IE) and GESI Case Studies of SIP Program in Nepal

Brief background:

AEPC, the nodal agency for renewable energy in Nepal, has financed to install over 1,300 SIPs to date. In addition, ICIMOD has also installed nearly 60 SIPs, which have been monitored since 2016. While there are data to show that these pumps have been beneficial for the farmers, an in-depth, comprehensive, and rigorous impact evaluation (IE) of AEPC's SIP program is yet to be done. In year-1, we carried out a rapid assessment of AEPC's SIP subsidy delivery mechanism including a detailed characterization of the SIPs supported by AEPC. We also prepared a sampling design for carrying out a detailed survey, initiated the process for selecting a vendor for data collection, and identified 1st and 2nd choice vendors. In Year-2, we will implement the impact evaluation survey, analyze the data, and prepare an impact evaluation report. This activity was actually planned in Year-1 but got delayed due to COVID-19.

Achieved in Year 1 (list in bullet points)

- A short note on the same size, sampling framework, and survey instruments (questionnaire) prepared
- Vendor hired for conducting impact evaluation (IE) survey
- Detailed methodology, GESI framework, and guiding questions/checklist for FGDs prepared
- Field notes, FGD transcripts prepared
- A rapid assessment of subsidy delivery mechanism in SIP conducted, a report prepared, submitted to AEPC, and a presentation session organized for AEPC personnel
- Two Op-Eds focusing on subsidy delivery mechanism and the need for appropriate targeting of SIPs published

Planned for Year 2 (list in bullet points)

- Working paper on review of SIP policies and program in Nepal and region
- Phone surveys with AEPC recipients in all Provinces except Province 1 and 2 and a draft report
- A research paper on impacts of SIPs from GESI lens in Nepal
- Implementing IE survey, data analysis, and draft report
- A journal article draft based on phone surveys and IE field survey.

Goals/ Objectives:

- Evaluate impacts of SIP program in Nepal to provide feedback to AEPC in better designing the SIP program in Nepal and disseminate the findings

Study area/location:

- 15 Palikas (i.e., local governments) in Seven districts (i.e., Morang, Sunsari, Srlahi, Rautahat, Parsa, Saptari and Bara) in Province 1 and 2 in Eastern Nepal.

- Phone surveys in all districts in provinces other than Province 1 and 2.

Methods employed:

- Qualitative studies that captures perception of farmers, including small and marginal farmers and women farmers about benefits and challenges of SIPs using a GESI-framework;
- Phone surveys with recipients of AEPC pumps in all Provinces except Province 1 and 2 where IE field survey will be conducted.
- Quantitative surveys covering farmers/plots using solar (treatment group), electric and diesel pumps (control group). Farmers/plot with similar characteristics will be matched for creating credible comparison groups for evaluation
- Analysis of secondary data on various aspects of SIPs – already collected, analysed, and reported in Year-1.

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible
Draft journal article based on report submitted to AEPC in May 2020, plus additional work done as a part of Situation Analysis Report	01-01-2021	30-06-2021	Journal article submitted	**Kashi**/Shiser/Aditi/Manohara
Phone surveys with AEPC grantees in all Provinces except Province 1 and 2	15-03-2021	31-06-2021	Compiled and clean data from phone surveys, and preliminary report, blogs	**Aditi/**Kashi
Quantitative and qualitative data collection (by FCB-vendor) from GESI lens and data analysis	01-01-2021	30-09-2021	Data analysis and preliminary report, blogs	**Kashi/Gitta** (data collection by Full Bright Consultants FBC)
Develop a journal article from quantitative aspects of IE study and phone survey	01-05-2021	31-12-2021	Submission of Journal Article	**Kashi**/ Aditi/Manohara/ Gitta/ Labisha
Review of GESI policies and/or programs in solar irrigation in project countries and synthesize the findings	01-01-2021	31-08-2021	- Research article based on analysis of policy documents through GESI lens (Bangladesh and Nepal combined)	**Gitta**/ Labisha/ Manohara /Aditi/Marie Charlotte/Archisman
Develop a journal article from qualitative aspects of IE study	01-05-2021	31-12-2021	Research article/paper – Impacts of SIP from GESI lens in Nepal using field data	**Gitta**/ Labisha/ Manohara et al

Deliverables:

- A journal article based on the report submitted to 2020 (30-06-2020)
- Impact Evaluation Report (Draft and Final versions) based on phone surveys and IE survey (31-12-2021)
- Draft Journal article note based on analysis of policy documents through GESI lens (31/08/2021 – a combined paper with data from Bangladesh and Nepal)
- Research article/paper –Impacts of SIP from GESI lens in Nepal using field data (31/12/2021)
- Two to three blog posts and regular contributions to SDC-SoLAR newsletter – throughout the year

1.2.1 Groundwater-related studies embedded in demonstration pilot in Bangladesh

Brief background:

In Bangladesh, in partnership with the Infrastructure Development Company Limited (IDCOL), the project will assess the impact of SIP on farmers' irrigation behaviour, and subsequent impacts on overall groundwater levels and resources. The project will also analyse and compare the farmer's groundwater abstraction patterns/behaviour and volumes of water pumped by SIP (both grid-connected and off grid) and non-solar (diesel/kerosene pumps) farmers.

Achieved in Year 1

- Field visits were carried out to project locations to understand the context.
- Methodology and monitoring protocol for GW sustainability studies was developed
- District data, biophysical and groundwater, where feeders are located was collected
- Selection of SIPs based on the analysis of SIP collected data.
- Instrument to be installed in field has be identified and final selection to be done in 2021 after local vendors have been identified through local partners.

Planned for Year 2

- Spatial analysis of groundwater data and overlay with SIPs.
- Detailed collection of data for selected SIPs (design plans, field and farmer mapping).
- Selection of farmers in selected SIPs for monitoring.
- Installation of instruments at farmers site and regular monitoring of data from kharif 2021 season
- Secondary data collection and primary field work to build conceptual model for groundwater modelling in the project areas.

Goals/ Objectives:

Groundwater studies in Bangladesh will focus on the following objectives:

- How does the pumping behaviour of farmer-irrigators differ:
    a. Between farmers who buy water from diesel pumps vs farmers who buy water from solar pumps?
    b. Among SIP operators who cater to irrigation in SIP command area and diesel operator (owner) who provides water to diesel command area?
- How different is the water use across SIPs with different cropping patterns and climatic regions?

- How will groundwater sustainability be affected if SIPs were to be up-scaled, while also accounting for return flows and other changes, such as climate change?

Study area/location:

The SoLAR project's groundwater activities in Bangladesh will be concentrated in North and South West region of Bangladesh covering two divisions: Rangpur division and Rajshahi division that comprise of 16 administrative districts.

Methods employed:

- Collection and analysis of secondary data on biophysical and groundwater characteristics in the selected project sites; installation of instruments for measurement of water and energy data; establishing and measuring GW use patterns at a representative number of farmers within SIP command area and farmers outside SIP command area using (either owning or buying) diesel pumps.
- Assess flow dynamics and return flows in sub-set of plots selected via instrumentation (soil moisture at different depths) and soil modelling (e.g. SWAP, HYDRUS-1D, APSIM) to estimate difference between net and gross water application.
- Groundwater model at representative scales in alluvial study sites to simulate SIPs upscaling scenarios

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible
Spatial analysis of groundwater data and overlay with SIPs.	01-12-2021	28-03-2021	Preliminary report on groundwater levels and trend in regions and in areas with Solar SIPs	**Faiz,** Smaranika and Alok
Collection of plot level water application for SIP farmers and adjoining diesel farmers through surveys, installation of field instruments	01-01-2021	30-04-2021	Farmers selected for data collection and instruments installed at monitoring site	NGO forum
Monitoring and data collection [pumping, GW levels, agriculture and climatic data]	30-04-2021	31-12-2021	Database on collected data	NGO forum
Data analysis of kharif II season collected data	01-08-2021	31-12-2021	Draft report on data analysis	**Faiz**, Smaranika
Set up of soil model to estimate return flows, and groundwater model of the region	01-06-2021	31-12-2021	Draft report on conceptual groundwater model	Smaranika

Annual Reporting	01-12-2020	31-12-2020	Preliminary report on data analysis & review paper	Faiz and Alok

Deliverables:

- Database on farmers' pump, well, groundwater, and water management practices in selected SIPs and diesel plots in NW and SW Bangladesh.
- Report on instrumentation installation and data collection protocol.
- Brief report on data analysis of kharif II season.
- Report on conceptual soil and groundwater model for the study area.

1.2.2 Groundwater-related studies embedded in scale pilot in India

Brief background:

The state of Gujarat has implemented on-grid solar under the most ambitious programmed 'Suryashakti Kisan Yojana (SKY). However, it is important to assess how solarisation of farmers' irrigation has an impact on their pumping behaviour, and subsequent impacts on overall groundwater levels and resources in the state. In this component of the project, we aim to monitor the groundwater abstraction under SKY and Non-SKY feeder and establish a relationship between energy consumption and groundwater abstraction. The research monitoring activities will be carried out in partnership with Gujarat Energy Research and Management Institute (GERMI).

In year 1:

- Field visits were carried out to SKY feeders to understand the context.
- Methodology and monitoring protocol for groundwater sustainability studies was developed.
- The data on district-level admin, biophysical and groundwater level in the location of SKY feeders were collected.
- A census questionnaire to carry out the census was prepared.
- Selected and finalised groundwater measurement instruments with providers quotations for procurement and installation after travel restrictions.
- IARI made as partners where one PhD student will work on the project. Phd plan is also prepared accordingly.

In year 2:

- Analysis of state groundwater data and overlay with SKY feeders.
- Selection of Non-SKY feeders adjoining selected SKY feeders.
- Census will be carried out in selected SKY and Non-SKY feeders to collect basic information on size & type of pumps, water table, type of crops, irrigation details etc. Selection of farmers based on the census for detailed monitoring of discharge, energy use etc.
- Installation of instruments at farmers site and regular collection of data
- Brief analysis to develop abstraction-energy relationships from 1 season (Kharif 2021) collected data
- Secondary data collection and primary fieldwork to build a conceptual model for Groundwater modeling [IARI Phd Student]

Goals/ Objectives:

- To develop groundwater abstraction-energy relationships and quantify GW use of individual tube well (TW) owners under solarized and non-solarized conditions using the developed relationship and data on energy used in pumping.
- Establish patterns in groundwater abstraction volume by accounting for confounding factors such as landholding size, crop patterns, water markets, energy exports, climate, soil type, irrigation practices etc.

- Differentiate changes in GW use between solar and non-solar farmers, accounting for the potential factors that may confound groundwater use.

Study area/location:

The feeders, both SKY and non-SKY, for study would be distributed among contrasting hydro-geologies of Anand district (Alluvial aquifers) and *Botad district* (Saurashtra hard rock aquifers) Gujarat.

Methods employed:

- Collection and analysis of secondary data on biophysical and groundwater characteristics in the selected project sites.
- Baseline data collection on well, pump characteristics and water management practices used by farmers through census.
- Installation of instruments for measurement of water and energy data and monitoring of selected sample of well-owners.
- Carry out direct and indirect measurements of groundwater and energy use on a representative subset of TWs for solar and non-solar farmers
- Analysing the monitored data for developing a robust relationship between energy use and groundwater pumped.

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible (Activity lead by Faiz)
Spatial analysis of state groundwater data and overlay with SKY feeders.	01-12-2020	28-02-2021	Preliminary report on groundwater levels and trend in SKY and non-SKY areas	Faiz
Census/survey at farm level in selected feeders to collect data on Pump and well details	01-12-2020	28-02-2021	Selection of farmers in selected feeders for groundwater monitoring	INREM Foundation
Installation of instruments in field	30-02-2021	30-04-2021	Instruments installed on monitoring site	INREM Foundation
Monitoring and data collection, and data analysis based on data from kharif season	30-04-2021	31-12-2021	Database on collected data, draft report on data analysis	INREM Foundation, Faiz
Data analysis of kharif season collected data	01-08-2021	31-12-2021	Draft report on data analysis	Faiz
Set up of conceptual Groundwater model of the region	01-12-2020	30-08-2021	Draft report on conceptual groundwater model	PhD student
Report/journal article	01-12-2020	31-12-2020	Draft report showing energy-groundwater pumping relationship	Faiz

Deliverables:

- Preliminary report on groundwater levels and trend in SKY and non-SKY areas (28-02-2021)
- Census database on farmers' pump, well, groundwater and water management practices in selected feeders (01-04-2021)
- Report on instrumentation installation and data collection protocol (31-05-2021)
- Report on conceptual groundwater model (31-08-2021)
- Brief report on data analysis with draft GW abstraction-energy relationship (31-12-2021)
- Blog posts and regular contributions to SDC-SoLAR newsletter – throughout the year

1.2.3: Groundwater-related studies embedded in demonstration pilot in Pakistan

Brief background:

- 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 PARC, FAO and others have had somewhat contradictory results, and hence the need for a study with the experimental method
- With this study, we want to objectively assess the situation on the ground using rigorous science on the impact on groundwater by collecting data from SIP and diesel pump farmers. This would help us to evaluate the policy direction for further promotion of SIPs in Pakistan

Achieved in year 1:

- The methodology that involves a selection of the sample for the behavioral study was developed in the year 2020. It involves the criteria for the selection of respondents from various districts in Punjab province, sample size and details regarding the sample sizes in different districts.
- An IRB application was submitted to collect data from the human respondents which was approved by IWMI before the start of the data collection.
- A pre-survey questionnaire was developed for the diesel and SIP farmers and a phone-based pre-survey was conducted with the SIP farmers.
- The data for the pre-survey was digitized and preliminary analysis has been conducted

Planned for year 2:

- A rapid enumeration of the diesel and SIP farmers in selected districts will be conducted in three zones of Punjab i.e. Northern, Central and Southern. This will form the basis of the pool of farmers from which a random sample will be selected for the detailed groundwater survey.
- Based on the results of the rapid enumeration of diesel and SIP farmers, a random sample for the diesel and SIP farmers will be selected to conduct the main survey to extract detailed data on the behavioural patterns of water use of the diesel and SIP owners.
- After the main survey, representative farms of Diesel and SIP farmers will be selected to gather detailed in-situ data for a complete cropping season.
- The results of the surveys will be analysed to evaluate how does the introduction of SIPs alters the groundwater extraction regime in the province of Punjab. The merits and demerits of the promotion of SIPs in Pakistan will also be evaluated to guide the Government of Pakistan on the policy related to SIPs.
- A research manuscript will be drafted and submitted to a peer-reviewed journal for possible publication.

Goals/ Objectives:

The objective of the study is to provide empirical evidence for the Government of Pakistan for the policy regarding the promotion of SIPs in the country. The Government of Pakistan wants to reduce the oil import bill by reducing the amount of fossil fuel used in the agriculture sector. The study aims to provide evidence on the behaviour of farmers when they have the option of switching to SIPs from the existing diesel/electric pumps, use SIPs simultaneously with diesel/electric pumps, or use SIPs and diesel/electric pumps under different modes of irrigation.

Study area/location:

- The location of the study is in three different zones of Punjab, in selected tehsils of representative districts to incorporate variations in groundwater quality and demographic variability. These districts that are chosen in the northern, southern and central zones will be the ones where we have maximum number of SIP owners as per the data provided by PARC.

Methods employed:

- Undertake a rapid enumeration of diesel and SIP owners in three different zones of Punjab provinces to provide a pool of farmers for random selection the sample.
- Undertake a survey of diesel and solar pump owners using a random sample approach in three zones of the province of Punjab.
- A subset of the group of SIP and Diesel farmers will be selected for detailed data collection on weekly basis throughout the kharif season.
- Both groups will be observed over a period of at least one complete season to record temporal variations and quantify the amount of groundwater extracted.
- The discharge flowing through the tubewells will be instrumented to measure the actual flow of groundwater from the pump.
- The analysis will be carried out to identify whether SIPs lead to more groundwater extraction.

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible
Rapid Enumeration of Diesel and SIP Farmers	01/01/2021	31/04/2021	Data Set	**Azeem**/Zain/Kashi Yashodha
Main <socio-economic survey> Survey of Diesel and SIP farmers	15/04/2021	31/06/2021	Data Set	**Azeem**/Zain / Kashi/ Yashodha. Main survey to be conducted through Survey firm
Weekly collection of data for Karif season on groundwater abstractions	01/04/2021	30/10/2021	Data Set	Z**ain**

Analysis of Data <Data groundwater and socio-economics> survey	01/06/2021	31/07/2021	Working paper	**Azeem**/Kashi
Collection of Data<<Data groundwater or socio-economics> > for Rabi Season	15/10/2021	30/04/2022	Data Set	**Azeem**/Zain

Deliverables:

- Data set on groundwater usage of diesel vs solar pumps in Punjab sites – July 2021 socio economic survey and Nov 2021 for Kharif season report/working paper on impact of SIPs on groundwater – Nov 2021
- A policy brief for the Government on promotion of SIPs – Dec 2021
- Collection of Data for the Kharif season – April 2021 – October 2021
- Draft Manuscript based on analysis – Dec 2021
- Blog posts and regular contributions to SDC-SoLAR newsletter – throughout the year

2.1.1 Scale pilot for testing different SIP promotion models in Bangladesh

Brief background:

IDCOL is the largest organization for SIPs in Bangladesh covering about 80% of the SIPs in the country. In the first year of the project, it was planned to evaluate the farmer's preference for the "fee-for-service" and "ownership" model supported by IDCOL. In year 1, IWMI and IDCOL planned to conduct a choice experiment to elicit farmers' preference for the ownership model. Due to some reasons, IDCOL has decided to hold back the ownership model to be rolled out in Bangladesh. Therefore the activity planned in year 1 is invariably needed to be changed.

Around 20% of the SIP in the country are supported by BADC, BMDA, BREB, DAE, and RDA by following different modalities and targeting different groups of farmers. For example, BADC target the SIP for very small and marginal farmers. Since IDCOL and other organizations differ in their financial and institutional modalities with respect to the loan, grants, equity, ownership and other supports like training, etc, it is important to generate evidence on how different SIP promotion models are working, their effects on farmer's dependency on diesel, production and livelihood outcomes. In this line, the revised aim of this activity is to conduct a case study to evaluate the performance of different SIP proportion models and their implications on farmer's livelihoods.

Achieved in Year 1

- The activity has been modified as the IDCOL decided not to roll out the Ownership model.
- Relevant stakeholder of other SIP promotion model was mapped and established first-hand contacted. Initial round discussion with key informants of these stakeholders was done

Planned for Year 2

- Collection of secondary information on different SIP modalities
- Conduct field level study to understand the performance of different SIP models
- A case study on upazila irrigation permit and how it affects SIP decisions under various models.

Goals/ Objectives:

Comparative case study of different SIP promotion models in Bangladesh in order to compare advantages and disadvantages of each of the models as poposed by ADB's solar irrigation roadmap document.

Study area/location:

Selected sites in northwest Bangladesh and Khulna region

Methods employed:

- Use focus group discussion (FGD) and Key Informant Interviews (KII), and case study method
- Collect secondary data will be collected from IDCOL
- Employ mix methods which use both quantitative and qualitative methods

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible
Develop the Research note after collecting secondary data, literature review, develop instruments for FGD and key informant interview, a sample section	01-01-2021	30-04-2021	Research note, questionnaire, Secondary data, Descriptive journal article	Yashodha and Aditi Mukherji
Conduct FGD and Key informant interview	01-05-2020	30-06-2020		
Data Analysis	01-07-2020	30-08-2020		
Final Report	01-09-2020	30-12-2020	Preliminary report and a journal article	

Deliverables:

- Descriptive journal article based on different SIP models 31/12/2021
- Case study report on upazila permit policy and it's implementation, and its implications for SIPs 31/12/2021

2.2.1 Demonstration pilots for grid connection of SIPs Bangladesh

Brief background:

In Bangladesh, solar pumps are used primarily in the initial four months of a year and they remain mostly idle the rest of the year. Consequently, capacity utilization for these solar pumps is very low and it becomes important to find ways to increase the capacity utilization of these solar pumps. Grid connection of SIPs is a viable alternative use of solar power and 5 SIPs will be grid-connected under this project. Results from the study will be shared with SREDA and will provide inputs towards policy design in the future.

SREDA has finalized the "Grid Integration Guideline for Solar Irrigation Pumps-2020" in the first half of 2020. 5 cluster locations have been selected in Kushtia, Chuadanga, Bogura, Rangpur and Dinajpur districts, where sponsors have been nominated to collect and submit the design in 2020. After finalization of the design, the sponsors will be asked to apply for NOC from the respective utility at the end of 2020 and early 2021. Based on approval of utility and as per the requirements of the Grid Integration Guideline for Solar irrigation, 2020, SIPs will be grid-connected, no later than June 2021. The impact of Grid connection on energy and water uses, and profitability for sponsors, and impact on farmers would also be analysed through the SIP survey and HH level surveys as described in activity 1.1.1

Achieved in Year 1

- 5 cluster locations have been selected in Kushtia, Chuadanga, Bogura, Rangpur, and Dinajpur districts
- Sponsors have been nominated to collect and submit the design.

Planned for Year 2

- Finalization of design and application for NOC from the respective utility by the sponsors.
- On the basis of approval of utility, SIPs will be grid-connected, no later than June 2020

Goals/ Objectives:

This demonstration pilot will help us understand the technical and institutional feasibility of grid connection. It will also give evidence on how grid integration of SIPs might affect individual farmer's access to irrigation and their income. Moreover, there is a growing concern for groundwater usage for irrigation purposes in Bangladesh. In such a scenario, connecting solar pumps to the grid to sell electricity can result in the sponsors to pump less and sell more to the grid.
This demonstration pilot in Bangladesh will specifically answer the following policy questions:

- How does the grid connection of solar pumps affect the irrigation service business of sponsors/IDCOL partners in terms of capacity utilization of Solar PV, price of water, changes in water schedule, etc.?

Study area/location:

5 SIP sites in Kushtia, Chuadanga, Bogura, Rangpur and Dinajpur districts

Methods employed:

This research component is organized into the following studies

- SIP scheme level study that will collect and analyse scheme level data between grid-connected and off-grid IDCOL SIPs
- Microeconomic study at the household level by comparing between grid-connected and off-grid IDCOL SIPs. Two rounds of data will be collected in early 2021 and follow-up at end of 2022/early 2023.
- GW study on how does SIP pumping, operations, and groundwater level dynamics change after grid connection of SIP relative to a BAU scenario (non-grid connected SIPs)?

Timeline for each objective in Year 2:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible
Getting approval of Utility, Identify different systems architecture and designs, and identify equipment requirements.	01-01-2021	28-02-2021	Detailed report on each of the five grid integration projects with technical parameters and socio-institutional features	IDCOL
Identify the EPC for the installation and commission of grid connection equipment, and connecting SIPs to the grid	01-03-2021	31-06-2021		
Baseline data collection and SIP level survey at selected sites (also see 1.1.1)	01/06/2021	15/08/2021	Primary data on grid-connected and off-grid solar pumps	Marie-Charlotte, Archisman, Ahasan Habib, Yashoda

Deliverables:

- Detailed report on each of the five grid integration projects with technical parameters and socio-institutional features (IDCOL)

2.2.2 : Scale pilot on institutional aspects of grid-connected SIPs in Gujarat, India

Brief background:

Under Suryashakti Kisan Yojana (SKY) scheme, the government of Gujarat and GUVNL have solarized nearly 82 agricultural feeders in the state. According to the SKY program, farmers under the SKY feeder can generate solar energy which can be used for pumping purposes and excess energy can be sold back the grid at the pre-specified feed-in-tariff (FIT) mentioned by GUVNL. It is presumed that FIT will give incentive to farmers to save more energy and thus efficiently use groundwater to increase the additional earning from selling energy back to the grid. In this component, IWMI aims to assess the impact of SKY program on farmer's energy consumption, likelihood and informal groundwater market.

Year 1 activities include

- Preliminary field visits to understand the context and characteristics of SKY feeders.
- Preliminary assessment of SKY feeder using primary survey instrument in collaboration with local DISCOMs in central Gujarat and Saurashtra.
- Evaluation protocol and methodological note
- Download SKY web-portal data for the year 2019- 2020
- Coordinate with Gujarat Urja Vikas Nigam Ltd. (GUVNL) a state energy company to collect secondary data related to the SKY program

Year 2 (Planned Activities)

- Obtain secondary data from GUVNL for SKY feeders relevant Non-SKY feeders for matching[1]
- Analyse the secondary data from GUVNL and/or SKY web-portal and report writing
- Finalize sample selection and develop a questionnaire for the household survey
- Carry out the field survey with SKY and Non-SKY farmers
- Obtain SKY 2021 data from GUVNL and/or download SKY web-portal data for 2021
- Analyse the data from the household survey and prepare a report

Goals/ Objectives:

1. To determine the impact of the SKY program on farmers' energy consumption and pumping behaviour
2. To assess the impact of solar irrigation on farmers' livelihood and informal groundwater markets.

[1] If data from GUVNL is not accessible, the contingent plant is to go for pre-survey of Non-SKY feeders in the same location as that of SKY feeders.

Study area/location:

The feeders for the study are located in the Anand district (Alluvial aquifers) and Botad district (Saurashtra hard rock aquifers) of the state of Gujarat. They were selected due to their contrasting hydrogeological characteristics.

Methods employed:

The impact of the SKY program will be assessed using the Differences-in-Differences method. That means, we eould be comparing the SKY feeders and farmers with Non-SKY feeders and farmers before and after solarisation of feeders. Since the solarisation under the SKY program is not randomized, selection of Non-SKY feeders is crucial to have the right counterfactual to evaluate the effect of the SKY program. Therefore,

- We select all the Non-Sky feeders within the taluk admin of SKY feeders. We assume that this ensures the bio-physical characteristics of Non-sky are similar to that of SKY feeders.
- Principle of matching technique will be followed to match Non-sky feeders with SKY feeders characteristics which ensure that the selected Non-SKY feeders have similar characteristics as that of SKY feeders. For this we will be collecting feeder level characteristics such as total consumers, number of non-agri connections, total load (Kw), average load (Kw), and farmers list from both SKY and Non-SKY feeders.
- From the selected SKY and Non-SKY feeders, a sub-sample of farmers will be selected following random sampling strategy and a household survey will be carried out to compared the difference energy consumption, water usage, cropping intensity and water selling between SKY and Non-SKY farmers.
- The same steps from 1 – 3 will be followed to compare SKY and SKY-SPICE to test if the solar cooperative intensify the energy and water conservation behaviour among farmers.[2]

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible (Overall responsible: Yashodha)
Collection of Non-sky feeder data, Cleaning and analysis of SKY data	1/01/2021	28/02/2021	SKY feeder and farmer level data	Yashodha, Aditi Sanjay, and Alok Sikka
Intermediate report on SKY data	1/03/2021	31/04/2021	Technical report/draft research paper/blog post	Yashodha, Aditi Sanjay and, Buisson, Marie-Charlotte

[2] Since the sufficient handholding of farmers under solar cooperatives and capacity building will now be largely undertaken in year 2, this comparison will be initiated in year 2 but will be carried forward to year 3.

Sample selection and questionnaire preparation	1/04/2021	30/05/2021	Questionnaire	Yashodha, Aditi Sanjay and Buisson, Marie-Charlotte
Carrying out the household survey (piloting, and monitoring survey)	1/06/2021	30/08/2021	Primary data	A survey company (yet to be contracted) and monitored by Yashodha
Analysis of primary data	1/09/2021	31/12/2021	Report /research article	Yashodha, Aditi Sanjay Buisson, Marie-Charlotte

Deliverables:

- Compilation of secondary data from SKY web-portal and GUVNL (28/02/2021)
- Compilation of primary and secondary data (30/08/2021)
- Technical report/paper/blog piece on SKY feeder data (1/06/2021)
- Preliminary report on the impact of the SKY program. (31/12/2021)

2.2.3: Demonstration pilots on Grid Connection SIPs in Nepal

Brief background:

All SIPs in Nepal are currently off-grid and stand-alone pumps Nepal is also investing in hydropower and will achieve electricity self-sufficiency in the near future. National electricity girds are also being extended to every corner of the country. The grid connection of solar pumps will ensure that the stand-alone SIPs do not become obsolete once the grid connection reaches those sites. In Year-1, we developed a set of criteria for prioritizing potential sites for piloting grid-connected SIPs, identified a set of potential sites, and prioritized them as per the criteria. Based on that, a report titled "Targetting pilot site to install microgrid system for SIPs in Nepal" was prepared. Year-2 will focus on implementing the grid-connected SIPs in the identified site.

Achieved in Year 1

- Site prioritization report prepared based on a framework and subsequent field study and two potential sites (with priority) are identified
- Review of various institutional models for grid-connected solar systems, their pros, limitations, and suitability conducted and a research report prepared based on the review.
- 1 OpEd focusing on implications of grid-connected SIPs published
- Broader agreement between AEPC, working Palika, and IWMI on working together on piloting MG system (expected by end of December 2020)

Planned for Year 2

- Procure a vendor and install a microgrid (MG) system for connecting SIPs to the grid
- Technical report with installed MG system and its functioning
- Develop a methodological note and instruments for conducting baseline and effectiveness evaluation survey.
- Baseline report with results from the survey, including GESI outcomes
- Initiation of regular monitoring of various parameters for evaluating the effectiveness of MG system (to be continued until the end of the project)

Goals/ Objectives:

- Design and implement demonstrate pilot on grid-connected SIPs
- Establish baseline and design and implement a monitoring system to evaluate impacts of grid-connected SIPs
- Carry out continuous monitoring of parameters to evaluate the impacts

Study area/location:

- Two potential sites for piloting the grid-connected SIPs are identified as – i) Sambhawata village, Chhipaharmai Rural Municipality-2, Parsa district, Province-2; ii) Ram Nagar village, Belaka Municipality-2, Udayapur district, Province-1. We will consider either both or one of those sites for piloting grid-connected SIPs.

Methods employed:

- Design the grid-connected SIP program, identification of treatment and control sites, and design impact evaluation framework, including GESI impacts, etc.
- Carry out a baseline survey in the treatment and control sites
- Procure and install the micro-grid system, including connecting to the SIPs in at least one location

Timeline for each objective:

Details of sub-activities	# days required	Start date	End date	Outputs/Comments	Person/s responsible
Baseline surveys (including GESI studies) in selected grid connection and control sites		01-05-2021	31-07-2021	Draft baseline report summarizing results from qualitative and quantitative surveys, including GESI outcomes	Labisha/ Shisher et al
Procure a consultant/vendor to install MG		01-04-2021	31-05-2021	Agreement with vendor/consultant	IWMI
Installation of grid connection in one or two SIP site		01-06-2021	30-08-2021	Grid connection completed in at least one site Technical report with installed MG system & its functioning	Shisher
Develop a framework, including indicators/ parameters to monitor, monitoring frequency, etc. for evaluating the effectiveness of the MG system		01-03-2021	30-05-2021	A framework for evaluating the effectiveness of the MG system	IWMI/ Consultant
Regular monitoring of various parameters related to the micro-grid system, crop production, and change in behaviour of farmers, etc.		01-09-2021	31-12-2021	An Excel database of regular monitoring	Labisha/ LFA (local field assistant/ Shisher et al

Deliverables:

- Technical note, methodological note and instruments for surveys
- Draft baseline report summarizing results from qualitative and quantitative surveys including GESI outcomes
- Technical report with installed micro-grid system and its functioning

2.2.4: Demonstration pilots and simulation of grid-connected pumps through heat sinks in Pakistan

Brief background:

This activity will build on the sample of farmers using SIPs in Activity 1.2.3. It would be technically too-time consuming and expensive to connect pumps to the grid and negotiate with electricity suppliers, hence we propose to simulate feed-in-tariffs by having a heat/energy sink. The farmer will have the choice to flip a switch to run his/her pump or to send the electricity to a meter to the heat sink with the understanding that s/he will be paid at a given tariff for any electricity diverted to the heat sink. Thereby it will be possible to set different tariffs to observe the effect if any of feed-in-tariffs on farmer behaviour.

Achieved in year 1:

- This activity will start in year 2021 as per the original work plan submitted in the proposal.

Planned for year 2:

- Methodology development for the demonstration pilots and simulation of grid-connected pumps through heat sinks in Pakistan
- Procurement of hardware and instruments to be installed in the field
- Pre-survey of choice experiment
- Main survey of choice experiment
- Data collection through instruments for the Rabi 2021-22 and Kharif 2022 to continue for a complete one year

Goals/ Objectives:

This activity offers considerable potential for groundwater pumping to be managed through feed-in-tariffs rather than through licensing and/or pumping exclusion zones. It also provides opportunities to the farmers with saline groundwater and minimal access to canal water to earn a decent livelihood by utilizing their land and selling electricity to the grid

Study area/location:

- Location of the study is five districts in the province of Punjab to incorporate variations in groundwater quality and demographic variability. These districts include Toba Tek Sing, Chakwal, Jhelum, Faisalabad, and Lodhran.

Methods employed:

- To test this hypothesis, we will use the group of farmers (identified in activity 1.2.3) who are currently using SIPs. A random sample of 30-60 farmers from this population will be selected as the control group and their pumping behavior measured. A second sample of 30-60 farmers will be provided the option to 'sell' electricity. Because it would be too expensive and time-consuming to connect pumps to the grid and negotiate with electricity suppliers, we propose to simulate feed-in-tariffs by having a heat/energy sink. The farmer will have the choice to flip a switch to run his or her pump or to send the electricity to the heat sink with the understanding that s/he will be paid at a given tariff for the electricity diverted.
  In this scenario, we will set different tariffs to observe the effect of feed-in-tariffs on farmer behavior. This test will be conducted with 10-20 farmers randomly selected from the larger group of 30-60 farmers while the data from the other 20 farmers will be collected using choice experiments. Choice experiments represent an alternative to analysis of revealed preference or contingent valuation exercises and avoid the weaknesses or pitfalls associated with both. We hypothesize that farmer behavior will respond to feed-in-tariffs, but in a non-linear fashion: at low feed-in-tariffs, the behavior will be invariant but at higher feed-in-tariffs, farmers would switch to 'selling' electricity and perhaps only undertake minimal farm activities for self-consumption purposes.

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible
Method Statement including design of Choice Experiments	01/04/2021	31/07/2021	Methodological Note	Azeem/Kashi/Yashodha
Procurement of hardware/instruments	15/08/2021	31/09/2021	Hardware	Azeem/Zain
Field deployment of Instruments and Data collection for Rabi Season	01/10/2021	30/04/2022	Data Set	Azeem/Zain
Pilot for testing the choice cards and making sure tariff range are relevant	01/10/2021	30/10/2021	Data Set	Zain
Choice Experiment Survey	15/11/2021	31/12/2021	Data Set	Azeem/Zain

Deliverables:

- Method Statement – July 2021
- Data Set for Choice Experiment – Dec 2021

2.3.1 Administration of innovation funds

Brief background:

The Innovation Fund (IF) will support the development and field-testing of technical, financial and, institutional innovations to address the constraints and challenges of upscaling solar irrigation, with a special focus on the constraints faced by small, marginal, and women farmers. The IF will especially support innovations and practices that can influence policy or be expanded and integrated into regular programs and practices with the support of additional funding sources.

IWMI will administer a SoLAR-SA innovation fund worth USD 400,000. Through this fund, the project seeks to support 6-8 innovations total at an approximate level of USD 50,000 per innovation for a maximum duration of 24 months. Three broad groups of innovations will be supported by the IF: technological, financial and institutional.

Achieved in year 1:

- Five innovation funds were granted to 5 organisations. These 5 organisations were chosen from among 87 applicants through a transparent process.
- Of these, two were from India and one each from Bangladesh, Nepal and Pakistan.
- The five organisationd whicj were granted IF in 2020 were: KHM Power, Bangladesh, KARMA and SwitchOn, India, Gham Power, Nepal and PARC, Pakistan.

Planned for year 2:

- Call for proposals, followed by shortlisting, presentations and selection by panel. We will continue with the same panel we had in 2020.
- 3 or 4 grants will be awarded in 2021. This will be last year when IFs are granted

Goals/ Objectives:

IF funds are used to:

- To support innovations to bridge any identified gap that hampers adoption, use, and upscaling of SIPs in South Asia;
- To support innovations targeted at reducing barriers for adoption by small, marginal, and women farmers; and
- To support innovations that are cost-effective and have potential for scaling up.
  Any location in the four project countries of Bangladesh, India, Nepal and Pakistan

Study area/location:

Any location in the four project countries of Bangladesh, India, Nepal and Pakistan

Methods employed:

1. Call for IF grants to be advertised
2. Applications screened, shortlisted, and panel will choose 3 to 4 proposals for 2021 IF Grant.

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments
Finalisation of IF grant call and announcing the call on IWMI SoLAR website	01/01/2021	01/03/2021	Call for IF grant advertised on IWMI website and a newsletter sent
Screening of applications, shortlisting by Country Leads, further scoring by technical panel members, interviews with semi-finalists and announcement of final awardees	01/04/2021	31/07/2021	All screening and shortlisting done
Signing of contract and commencement of work by 2nd round of IF grantees	31/07/2021	31/10/2021	Contracts with IF grantees of 2021

Deliverables:

- Final call for Innovation grants – with details about themes for which innovation grants will be given, selection criteria for choosing grantees, and roles and responsibilities of grantees [March 2021].
- Three to four grant agreements; and minutes of one review meeting [December 2021]

3.1.1 Training of farmers and local technicians in Bangladesh, India and Nepal and Pakistan

Brief background:

In our preliminary research, all of our partner organizations expressed the need for a cadre of local technicians or trained farmers who can repair and maintain SIPs. Currently, all the projects funded by national governments and donors include a 2-3 year of a maintenance contract with the SIP vendor. However, these initial contracts are nearing expiration in all the partner countries and thus there is an urgent need to train local technicians, including young electrical engineering diploma holders. In doing so, the project will pay extra attention to ensure that at least 33% of the technicians trained are women. We will also work closely with the national implementing agencies to ensure these trained mechanics are closely allied with the private sector players and existing SIP programs so they can find gainful employment.

Achieved in year 1

- Bangladesh 1 training done another is yet to be conducted
- In India, due to CoVID-19, the training couldn't be conducted. But planning has been done
- In Nepal, training could not be conducted as per plan in 2020. Training is now scheduled from 26th Feb onwards, for 5 days. This will be a residential training where 15 engineers (nominated by AEPC) will be trained a partner agency.
- In Pakistan, an online training for setting up precision agriculture with surface water was undertaken.

Planned in year 2

- In Bangladesh, two trainings (both farmers trainings) will be conducted in 2021
- In India 2 trainings will be conducted, training modules are under preparation, and agreements with GERMI, NDDB and Junagadh University are being finalised. Trainings need to be face to face trainings, as mostly farmers will be trained.
- In Nepal, two training is planned in 2021. One is scheduled from 26th of February, and next one will be scheduled around October/Nove 2021
- In Pakistan, second training wil be conducted towards end of 2021
-

Study area/location:

At a location of choice by the country leads

Methods employed:

Each country will prepare its own training activity for the year and get it's training proposal approved at one of the C-PMC meetings. They will also share the training plans with the PMU, who will keep the PSC informed. In Bangladesh and Nepal, we will organize a 3-5 day annual technician training and have 15 participants each year. In India, we will conduct lead farmer training and farmer-to-farmer training workshops with a group of 15-20 farmers every year. In Pakistan, up to 10 farmers will be trained to use precision surface irrigation on their fields and 10 professionals will be trained to use WinSRFR software and

how to design of fields using this software every year.

Timeline for each objective:

Details of sub-activities	Start date	End Date	Outputs/Comments	Person/s responsible
Preparation of training curricula, training modules and selection of trainers and trainees	1/01/2021	31/12/2021	Training materials finalised and trainees are chosen, and all technical logistical arrangements for training done	
Training workshop/school (3-5 days training)	1/07/2021	31/12/2021	Training conducted	

Deliverables:

- Training curricula, including training modules
- Training report, including details of personnel, trained

3.1.2 Training of groundwater, energy and agriculture officials in all four countries

Brief background:

The premise of this project is that water, energy and agricultural issues are deeply interlinked, but often these linkages are not well understood. As a result, work on one element by itself – say, water – can have unintended negative impacts on energy or agriculture. For example, highly subsidized SIPs in groundwater over-extracted areas pose immediate and long-term threats to groundwater sustainability. Professionals from each of these sectors are often not aware of the trade-offs and potential synergies. In view of this, we will organize regional training events where energy professionals will be trained in the basics of hydrogeology. And water and agriculture professionals will be trained in the basics of SIP technology. We will conduct two regional trainings over the course of the project.

Achieved in year 1

- Outline of a training program, lectures and tentative speakers identified
- Preliminary discussions with ISA, SAARC Energy Centre and IISc Bangalore for hosting the training, but no decisions yet.

Planned in year 2

- Develop all training modules, finalise speakers and develop training materials
- Formalise partnership with an academic institution which can grant certificates to participants, and help host the training
- Countries nominate participants, and we run the training program online in 2021

Study area/location:

Online training of four to five weeks duration/

Timeline for each objective:

Details of sub-activities	Start date	End Date	Outputs/Comments	Person/s responsible
Preparation of training curricula, training modules and selection speakers/lecturers	1/01/2021	30/06/2020	Training materials finalised and trainees are chosen, and all technical logistical arrangements for training done	Aditi Mukherji

Partnership with an acamdemic institution to host the program and issue certificate to the participants	1/01/2021	30/06/2021	Partnership agreement signed	Aditi Mukherji
Selection of participants (nominated by respective country Ministries)	30/06/2021	31/08/2021	Participants nominated and selected	Aditi Mukherji
Online training conducted and curated	1/09/2021	31/12/2021	Training conducted and training report prepared	Aditi Mukherji

Deliverables:

- Training curricula, including training modules
- Training report, including details of personnel, trained

3.2.1 Regional knowledge and policy forums

Brief background:

All SoLAR-SA partners and innovation fund grant recipients will meet each year to share information on progress. The SoLAR Project Steering Committee will also attend this meeting to approve work plan, review progress and provide feedback. The annual meetings will be a platform for the project partners to come together and exchange information and knowledge on various aspects of their work. Whenever feasible, field visits to SIP sites will be organized. The first regional forum was held in Sri Lanka in January 2020, and it was also the Inception Workshop for the SoLAR project.

Goals/ Objectives:

- Share updates and findings from work conducted in Year 1
- Provide detailed work plan for Year 2
- Discuss with relevant partners and stakeholders about policy uptake and future colloborations

Study area/location:

- The 2nrd Regional Forum will be an online event. This is will held on 23rd and 24th of Fberuary, 2021.

Timeline for each objective:

Details of sub-activities	Start date	Outputs/Comments	Person/s responsible
2nd Regional Forum	1/1/2021	28/2/2021	Aditi Mukherji
Detailed report	23/02/2021	15/03/2021	Aditi Mukherji

Deliverables:

1. Approved workplan for year 2 (24/02/2021)
2. Inception workshop report ready, with editor for copy edits, then to be formatted and shared (15/03/2021_
3. MOU signing ceremony with IDCOL

3.2.2 National forums

Brief background:

The project countries will regularly organize national policy forums to solicit feedback from national, provincial and local policymakers, and to disseminate information to these groups. The frequency of these national policy forums will be need-based, but no fewer than three policy consultation forums will be held in each country during the 4-year span of the project. In year 1, due to COVID-19, we could not organise national workshops as planned. Instead, we conducted a series of 6 webinars in the week of 1st to 5th February, 2021.

Goals/ Objectives:

- To dessiminate project findings by the country teams to country partners
- To seek feedback, and policy partnerships with national nodal agencies
- To initiate discusisons on issues of national important visavis solar irrigation.

Study area/location:

- Online or offline, at a location deemed appropriate by coutry leads

Methods employed:

- Either online meetings, or face to face meetings

Timeline for each objective:

Details of sub-activities	Start date	End date	Outputs/Comments	Person/s responsible
National forum (20-30 participants – mostly policy makers) or else, a webinar	01/08/2021	31/12/2021	National Forum Workshop Reports	Respective country leads

Deliverables:

- National workshop reports – 31/12/2021