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IWMI
International Water Management Institute

2nd SoLAR Regional Forum

Session Summary Report

23-24 February 2021

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List of Abbreviations

IWMI	International Water Management Institute
SIP	Solar Irrigation Pumps
SDC	Statistics and Data Corporation
PARC	Pakistan Agricultural Research Council
IDCOL	Infrastructure Development Corporation Limited
GUVNL	Gujarat Urja Vikas Nigam
SKY	Suryashakti Kisan Yojana
DISCOM	Distribution Companies
UGVCL	Uttar Gujarat Vij Company Limited
PUGVCL	Paschim Gujarat Vij Company Limited
DGVCL	Dakshin Gujarat Vij Company

MGVCL	Madhya Gujarat Vij Company Limited
MNRE	Ministry of New and Renewable Energy
SoLAR	Solar Irrigation for Agricultural Resilience
CUF	Capacity Utilisation Factor
IE	Impact Evaluation
GESI	Gender Equality and Social Inclusion
AEPC	Alternative Energy Promotion Centre
CPMC	Country Project Management Committee
KFUEIT	Khwaja Fareed University of Engineering and Information Technology
IBIS	Indus Basin Irrigation System
CIGS	Copper indium gallium selenide
RDI	Responsive Drip Irrigation
CEWRI	Climate Energy and Water Research Institute
O&M	Operation and Management

Introduction

The second SDC Regional forum training was held on the 23rd and 24thof February 2021, wherein two-year plans regarding the Solar Irrigation for Agricultural Resilience (SoLAR) project were discussed for four South Asian countries, viz, Bangladesh, India, Nepal, and Pakistan. On 23 February 2021, the session was held for Bangladesh and India, and in the second half, the session was held for Nepal and Pakistan. The regional project leader for SoLAR and the respective country leads had spoken in this session.

On 24 February 2021, there were presentations from five innovation grantees on the kind of work that they had undertaken and the signs of progress therein.

Session 1: Bangladesh and India

List of attendees from Bangladesh and India *(Refer Annex 2)*

Bangladesh

Presentation: 'SoLAR Bangladesh: Year 1 Updates and Results'

The speakers for Bangladesh included Archisman Mitra, Kazi Ahsan Uddin and Md Faiz Alam. The presentation provided an overview of the progress made in Year 1 in Bangladesh. The primary aim of the project is to replace diesel irrigation in off-grid areas. The study will determine the extent of diesel reduction and assess the impact on farmer level outcomes. Key achievements were outlined, including completion of the situation analysis, SIP survey, methodology, monitoring protocol for groundwater studies and farmers' training. The current situation of SIPs in terms of numbers installed, capacity, targets, distribution and establishing organisations were discussed along with various deployment models in Bangladesh such as IDCOL's 'Fee-for-service' model and the Ownership Model by BREB. Preliminary results from the SIP phone survey showed a low irrigation requirement in Kharif 2 2020, SIPs were convenient for farmers to use, and a substantial number of farmer-beneficiaries (62%) were small farmers.

The results from the situation analysis of the secondary monitoring data by IDCOL reveal that a 5% reduction in emissions is feasible through IDCOL SIPs. Boro paddy is the most important crop as it accounts for around 70% of total earnings. There is a high revenue generation potential for the excess solar energy during the non-peak season to be put to alternative uses. Hence, reaping the benefits of SIPs would be necessary for equity, sustainability, food security and reducing the subsidy burden. Grid Integration topologies, site selection criteria and the sponsor selection criteria were discussed, followed by all the steps of the process, grid integration, net energy metering, equipment approval, application for net metering, and data collection. The current groundwater situation in Bangladesh had been assessed. It was found that groundwater recharge is sufficient as rainwater and floodwater contribute to increasing recharge. However, there are certain pockets of depletion, with water levels falling in the

northern, central and western regions. The objectives of the analysis were to measure the change in farmers pumping behaviour when shifting from diesel to solar-powered pumps, change in water use with SIPS in terms of cropping patterns and the impact of upscaling SIPs on groundwater sustainability (namely recharge and abstraction). Spatial Mapping for 16 SIPs was completed. The cropping intensity and NDVI changes were assessed to complement the household survey. Cropping intensity in the Kharif season has been uniformly high, and during summer, it has been the lowest but has been showing improvement over the years.

Discussion Points (Q & A)

Table 1: Q&A with Bangladesh's researchers

Sl no	Question	Answer
1	**Mahashweta (Switch On):** If Boro is essential for the financial sustainability of SIPs, how will groundwater sustainability be maintained?	**Archisman:** Currently, IDCOL SIPs using groundwater are located in regions where groundwater problems do not exist. Where there is a problem (in the areas where BREB is working), they only use surface water. Faiz has also shown that a lot of recharges is happening in these regions, which means that more irrigation increases the recharge over time. **Ahsan:** Paddy is a primary crop for food security, and groundwater extraction must be reduced. IDCOL's 'Fee for service' model uses sponsors to implement the project and regulate irrigation to reduce groundwater depletion. Alternate wetting and drying are being practised to use water in the paddy grown season efficiently. Crop scheduling was also introduced, which is especially important as farmers have many small plots. These practices have been taught to farmers through training.
2	**Mr R.J. Vala (GUVNL):** What is the solar system cost in Bangladesh per kW?	**Ahsan:** Per Kw, in terms of solar module/solar panel, the cost is 22 Taka or 18 Indian rupees. 50,000 USD is the total project cost for an 18 kW capacity which covers 20 hectares.

3	**Mr R.J. Vala (GUVNL):** What was the pump capacity?	**Ahsan:** For an 18.5 kW motor, 25 HP pumps were used. They are all AC pumps. DC pumps were not used due to a lack of local capacity with several challenges in implementation and maintenance. All are off-grid pumps.
4	**Shisher (IWMI):** Are SIPs customised based on the needs of the farmers? Do farmers prefer owning individual or community-owned SIPs?	**Ahsan:** Farmers' needs are assessed at the beginning of the project. 35% is the loan component that is being taken care of by the sponsors. So, the farmers have lower tariffs, and they need to give financial feasibility to the sponsors. Most farmers are marginal and cannot inject equity into the project. As such, farmers are targeted; they go for more extensive and community-based systems. **Aditi Mukherji:** Bangladesh has an entrepreneurship model for the deployment of SIPs.

India

The speakers for India included Yashodha Yashodha and Md Faiz Alam. The presentation provided an overview of the progress made in Year 1 in the country. It covered the current status of all four activities: impact of large-scale adoption of SIPs on groundwater resources, impact assessment of the Suryashakti Kisan Yojana (SKY) scheme, training of SKY farmers and a National Forum. The work done on the first component included completing the situation analysis report and literature review, collecting and compilation of data from the SKY portal, analysis of SKY data, and preliminary results followed by preparation for the primary household survey. For the groundwater studies component, the groundwater monitoring sub-activity involving the selection of feeders, census, data collection from GWRDC and CGWB were completed in 2020. Under SKY farmers training, the India team had fostered partnerships with training organisations, completed the initial training assessment, and developed the curriculum for the training modules. The early results from analysis of feeder and farmer level data were presented, covering key indicators such as participation rate, pump and panel characteristics, etc. The main results were that SKY farmers drastically increased their energy consumption, a significant increase in farmers' earnings from selling surplus energy to the grid and finally, suggestive evidence that farmers

do not demonstrate a strategic increase or decrease in energy consumption. This could be because they might yet have to learn to deduce the opportunity cost of solar income and water from different crops to adjust consumption and invest in water-saving technologies, which takes a considerable amount of time. The methodology for monitoring and installing measurements to develop a relationship for translating energy consumption difference to water usage difference in cubic meters was discussed. The SIP vs Block Level trend analysis revealed no clear sign that a well in a SKY feeder behaves differently from a feeder at the block level. There has also been no apparent sign of decline over the last ten years in Gujarat. This will, however, need analysis of more local level SIP data in conjunction with rainfall and crop level data.

Discussion Points (Q & A)

1. Mr RJ Vala presented briefly on the performance of the SKY scheme, which covered the following key points:

Firstly, 91 SKY feeders in total have been commissioned (orders issued for 96 feeders) with an aggregate Solar PV capacity of approximately 98 MW. Secondly, 43 feeders have been analysed and designated for more than one year as of March 2020. Thirdly, results reveal that for 72% of farmers in these 43 feeders, energy consumption had decreased since the introduction of the SKY scheme. Out of 3664 farmers, 88% inject energy into the grid after meeting their consumption requirements. Only 11% have net withdrawals because of the benefit of increased hours of power supply. The majority of the increase in net withdrawal comes from feeders in DGVCL due to sugarcane cultivation, which requires twelve hours of irrigation. Fourthly, distribution losses have significantly fallen since the introduction of the SKY scheme and have reduced overall to 7.46%. The loss, however, remains high in the DGVCL DISCOM. (>15%). Lastly, overall, 49% of the 3,664 farmers have net positive earnings after payment of the loan EMI. More than 60% in UGVCL and PGVCL receive income from the sale of power to the grid, while only 14% of farmers in DGVCL earn net positive revenues.

2. Shilp Verma's question: IWMI's early analysis showed significant differences in generation across DISCOMs. For some reason, MGVCL and DGVCL also had low generation. Could that be the reason why so many farmers are net payers or have dues?

Answers:

Mr RJ Vala: Low generation is the reason. This is due to several issues, such as a lack of awareness among farmers regarding cleaning their panels.

Shilp Verma: Yes, that is where capacity-building could contribute significantly.

Yashodha: I agree that to make a strategic decision to reduce consumption, they must first acquire a thorough understanding of the entire system.

Aditi Mukherji: We hope to conduct training using a Randomised Control Trial design to ensure that all SKY farmers receive training over a year and assess their impact on their energy generation.

Mr RJ Vala: The CUF (Capacity Utilisation Factor) is very low for 28 feeders (<15%), and this is the reason for lower incomes and energy generation for farmers. The farmers need to be made aware of this. If CUF is less than the optimum value of 16.47%, they will not realise the benefits and maximise their generation.

Aditi Mukherji: We could focus our training first on the farmers/feeders with low CUF.

YouTube link for session 1: https://www.youtube.com/watch?v=H7h5OpXZ7Kc&t=1990s

Session 2: Nepal and Pakistan

As per schedule, this session was held in the first half of 23 February 2021, wherein Nepal and Pakistan had presented the respective country updates from year 1 and plans for year 2. The regional project leader for SoLAR and the individual country leads had spoken in this session.

Nepal

List of participants from Nepal (*Refer Annex 3*)

The project planning and achievements for year one was divided under four headings, viz, impact evaluation (IE) of SIP, qualitative gender and social inclusion (GESI) study, demonstration pilot Micro Grid (MG) connected SIP and capacity development of local technicians on SIP and knowledge forums.

Table 2: Achievements & Plans in Nepal

Project plan vs Achievements	**Achieved in year 1**	**Planned in year 2**
Impact Evaluation (IE) of SIP	IE design, sample size, site selection, vendor selection and survey questionnaire were sorted. Rapid assessment of AEPC's SIP program results was	A Survey of 675 farming households, an IE report and a research paper have been planned.

	shared with AEPC as a report and webinar.	
Qualitative Gender and Social Inclusion (GESI) study	Research methodology design and Literature-based GSEI analysis (policies and programmes) were carried out.	GESI case studies in three different SIP models to be implemented by AEPC, IWMI, ICIMOD. A research paper has been planned.
Demonstration pilot-MG connected SIP	Global literature-based analysis and a national forum on institutional modality were carried out. There will be onboarding of Rural Municipality for the pilot project. Alignment between AEPC, NEA, and IWMI.	Techno-institutional modality design and implementation for micro-grid connection, baseline report would be planned—complete installation of the pilot in 2021.
Capacity development of local technicians on SIP and knowledge forums	Curriculum designs and participants finalisation, and national knowledge forums were carried out.	Delivery of training and national knowledge forums are to be continued.

Rapid Assessment results:

SIPs are primarily installed in the Terai region. The average cost is 2.6 lakh rupees, and the pump size is 1-2 HP. 1384 SIPs have been installed with AEPC's subsidy. The rate of approval of SIP subsidy is 31%. Even with a 60% subsidy, small scale farmers cannot afford SIP. Among applicants, smallholders were prioritised, i.e., those who have less than 2-4 bighas of land. Tenant farmers were discouraged from applying due to the AEPC criteria of compulsory landholding. Only a few well-off farmers knew about the subsidy policy. AEPC did prioritise female-headed households if they met eligibility criteria.

GESI responsiveness of solar energy-related policies in Nepal

Some policies recognise GESI partially, while others realise it fully but with a narrow definition. Apart from the AEPC GESI policy, most policies don't do a good job of introducing ways to address barriers. All

of the significant policies in renewable energy focus on improving access but the definition of access is very narrow. Most renewable energy policies recognise gender in some form, and GESI is part of the policy explicitly.

Based on Skutsch's framework, the motivation for gender inclusion in energy policies are as follow:

- Promotion of gender equality and empowerment wherein gender is the central part of the policy.
- Promoting welfare to increase the productive time.
- Promoting efficiency for market-based social aspect and substantiality is taken into account.

The following were the significant findings:

- Policies are welfare-focused than empowerment-focused.
- Access is understood as a blanket monetary problem for all.
- Lack of women or targeted minority-specific approaches to increase RET for irrigation uptake.
- Discretionary use of criteria – such as the requirement of land ownership papers - makes marginalised farmers dependent on the 'benevolence' of the implementer.
- Policy evolution shows a greater understanding of gender progressively.
- AEPC, as the implementing agency, stands as GESI aware during implementation.
- AEPC has shown flexibility in awarding subsidies at their discretion, even if the criteria are not entirely fulfilled. But marginalised farmers are left at the benevolence of the implementer, and the marginalised farmers always need to negotiate access to subsidies. This showcases the need for GESI friendly criteria and policies.

Demonstration pilot- MG connected SIP

The possible modalities of MG connected SIP were discussed in the National Forum, where several feedbacks and reflections were discussed:

1. Will MG-connected SIP make economic sense for the national utilities?
2. What is the availability of grid infrastructure at the pilot site? And what is the capacity of the grid available, and what is the electricity tariff for net metering?
3. The roles of local government would be critical in piloting and demonstrating the MG connected SIPs.
4. The Capacity Utilization Factor (CUF) of SIP is low, and hence grid connection would increase CUF and reduce the per-unit cost of irrigation water from SIPs.

The site finalisation for the MG pilot catered to site prioritisation with technical, social, economic, environmental, and institutional parameters. 22 RM data were reviewed, and eight candidate sites for field visits were shortlisted. Various typologies of MG-connected SIP and study of crucial attributes of institutional models were done for the pilot project. The pilot site selected was Chhipharmai RM, wherein public land is available, and the RM is willing to invest additional funds where 10-15 SIPs have been installed within a 1km radius.

Capacity development and policy engagement in Nepal

1. SIP training for local SIP technicians:
    - IWMI, in partnership with Pathibhara Himalayan Polytechnic Institute, developed a 43-hour SIP training module.
    - Seven days of residential training has been planned for 20 participants in Itahari.

2. Policy engagement and knowledge forum:
    - Institutional modality of MG-connection to SIPs and rapid assessment findings were shared. The CPMC meetings were conducted as well.
    - Knowledge production and exchange through national forums and other knowledge-sharing platforms were conducted for subsidy mechanisms, Covid-19, agriculture and water nexus, micro-grid institutional modality, and GESI policy and program review.

Takeaway

- The AEPC SIP subsidy delivery mechanism is doing well in raising interest and awareness about the technology and prioritising those with relatively less land in their process. However, actual smallholders are still not being tapped into by the project due to farmers' economic and social capital constraints.
- Energy policies are progressively intending to benefit women and marginalised groups by ensuring their access to energy technologies. Still, the conceptualisation of GESI is often limited and dissuaded by a lack of concrete measures.
- Micro-grid connection to SIP can be a solution for full utilisation of SIPs but needs piloting to understand which institutional modality would facilitate MG connection and water allocation among farmers.
- SIP technician training can benefit local technicians and farmers.

Discussion (Q&A)

Table 3: Q&A with Nepal's researchers

Sl no	Question	Answer
1.	**Dr Prachanda Pradhan:** What is the per hectare cost of the system?	**Dr Laxman P. Ghimire:** AEPC is not considering the cost of the pump per hectare. SIPs are designed in terms of the area of land and head of groundwater.
2.	**Dr Aditi Mukherji:** In Bangladesh, the size of pumps connected to the grid is large compared to Nepal. Don't you think this will be an issue in terms of grid stability?	**Mr Sagar Gyawali:** Connecting small SIPs to the grid is not a problem if you use an efficient pump and the power factor is more diminutive.
3.	**Dr Kashi Kafle:** The site identified for the pilot is unique in terms of available common land, and farmers are willing for this pilot. What is the possibility for scale?	**Mr Sagar Gyawali:** Different typologies can be adapted according to the need to scale grid-connected solar. Dedicated feeders can be developed for larger plots.
4.	**Dr Kashi Kafle:** Why is the pilot being done for already installed SIPs rather than new SIP?	**Dr Laxman P. Ghimire:** This year's list is already published. We need to wait for another 5-6 months for the new list and select the dense area, which will take much more time. **Mr Sagar Gyawali:** The utilisation of the pump is low, and the MG-connected SIP can be used to improve the utilisation factor. **Dr Aditi Mukherji:** The other factor is the practicality as we want to do the pilot this year. But we can plan for the new pilot site next year if possible for the new SIP list published by AEPC.

5.	**Anton Urfels:** What are the challenges, aspirations, and livelihood goals of the community, GESI and that aligned with the policies?	**Dr Laxman P. Ghimire:** For barriers in GESI, AEPC has already tried to accommodate it in its implementation plan by highlighting GESI and smallholders.
6.	**Nirman Shrestha:** The use of Solar in the water supply was more successful than irrigation. Do you plan to make a comparison?	**Dr Aditi Mukherji:** This project mainly focuses on irrigation, but that is a good point, and possibly we can look into it in the future. **Shisher Shrestha:** The volume of water may be a factor as the water required for drinking water projects is very small, while for irrigation, the water requirement is enormous. **Ms Labisha Uprety:** For solar drinking projects, there are additional subsidies for targeted communities.

Pakistan

Presentation by Dr Azeem Shah:

Dr Azeem Shah presented the progress on the behavioural study of the SoLAR project. In addition to that, findings from a telephonic survey conducted as a pre-survey were also presented.

In the first part of the presentation, critical achievements in terms of activities and MoUs signed with government partners were presented. Later, a background of the study was introduced, which included the exponential growth in the number of tube wells that have led to excessive use of groundwater. With this backdrop, it was emphasised that the SoLAR project in Pakistan aims to address the critical issues related to groundwater pumping to provide policy recommendations to the government. It was highlighted that behavioural study in Pakistan aims to generate improved empirical evidence to support the development of climate-resilient, gender-equitable, socially inclusive, and groundwater-responsive solar irrigation policies.

Then methodology for the behavioural study was briefly presented, which included selecting districts

from the northern, central and southern parts of Punjab. Consequently, a rapid enumeration followed by a primary survey will be conducted with SIP and diesel pump farmers.

Main findings from the telephonic survey were presented. It was conducted as a pre-survey with SIP owners in the randomly selected districts to assess the on-ground situation. Key results from this telephonic survey showed that one-third of the respondents used SIP only, while the rest of the farmers used SIP in conjunction with diesel or electric pumps. Moreover, SIP farmers did not only use groundwater for irrigation, but canal water or rainwater was also used through ponds.

Later, activities related to precision surface irrigation coupled with SIP trials were presented. Progress update was given on trials currently underway on the field site of Khwaja Fareed University of Engineering and Information Technology (KFUEIT).

At the end of the presentation, WinSRFR online training on the design of precision surface irrigation using SIP and a national webinar on the topic of 'The Potential of Solar Irrigation for Pakistan: A Critical Inquiry' was presented.

Presentation by Dr Arif Anwar:

Dr Arif Anwar presented technical details related to precision surface irrigation coupled with SIP trials at KFUEIT. This segment of the presentation included the theoretical foundation of WinSRFR software. It also explained technical inputs (i.e., soil infiltration test and longitudinal survey of field and laser grading) required to run precision surface irrigation through WinSRFR.

Discussion (Q&A)

Question-

Antone raised a point that canal irrigation replenishes groundwater to some extent, so what effect does the conjunctive use of canal water with solar irrigation pumps have on groundwater? To what time will the negative impact of groundwater pumping through SIP be nullified by recharge from canal water?

Answers-

Dr Azeem Shah replied that the share of groundwater use is far greater than surface water irrigation. Indus Basin Irrigation System (IBIS) could support 64% of cropping intensity, but cropping intensity is approximately 150%; therefore, increased cropping intensity is supported by excessive groundwater extraction. Moreover, agriculture in Barani areas is done through groundwater irrigation. Even SIP subsidies were given indiscriminately, irrespective of the level of the ground in the region. There is unchecked pumping of groundwater. Wealthy farmers can use both electric and diesel pumps to extract groundwater. All these factors make the recharge of groundwater through canal water insignificant.

Kashi Kafle commented that based on findings from the telephonic survey of SIP farmers. It is evident that SIP-only farmers are very few. But it is possible that if we can switch from farm level to plot-level study, we can circumvent the problem of a limited sample of SIP-only farmers. It will be possible to find SIP-only plots during rapid enumeration.

Dr Aditi Mukherji commented that switching from water-intensive crops (i.e., sugarcane and rice) to less water-intensive crops (pulses and vegetables) can promote sustainable use of groundwater.

Dr Arif Anwar commented that drip is being promoted to save water use in agriculture. But there are 18 million hectares under surface irrigation; it is financially unrealistic to transfer all this land to drip irrigation. Besides, any water that will be saved will find an alternative use. As far as SIP is concerned, he thinks that even without government subsidy, it will become mainstream. Surface irrigation will be present in the future, and water-saving can be achieved through precision surface irrigation as that will give a specific time for which pump should be switched on; the rest of the time, water will be saved.

YouTube link for session 2**:** https://www.youtube.com/watch?v=9K1qQhRqFUM&t=260s

Session 3 (Innovation Fund Grantees)

Dr Aditi Mukherji gave the opening remarks for the session on innovation fund grantees. She mentioned that the grantee would have worked for only 3-4 months as the grant had been approved around October 2020. This was followed by updates from grantees about the progress they made quickly, followed by closing remarks from SDC. Every grantee was given thirty minutes each, divided into fifteen minutes of presentation and fifteen minutes of Q&A.

The innovation fund grantees included the following:

Table 4: Innovation Fund Grantees

Name of grantee	Country
KHM Limited	Bangladesh
Switch On	India
Karma Power	India
Gham Power	Nepal
PARC	Pakistan

1. KHM Limited, Bangladesh

KHM Limited is a private company with a focus on profit for sustainability. It has aimed for making a meaningful contribution to the greater good of society. The project's name is Integrated Farming and

Women Empowerment (IFWE) through SIP. The presentation was given by Mr Monjur, MD, KHM Limited. Under this project, the aim has been to build a refurbished chicken farming shed and designed as weather friendly. The floor was made of concrete surrounded by a net to protect from wild birds. Solar panels were laid on the roof, the construction of the floor was complete, and the panels below had a plastic top. The main features of the project are as follows:

a) It is a small investment with optimum utilisation of the asset.
b) There has been maximum utilisation of land.
c) A small pond has been built near the shed for fish farming.
d) There is a 15X13 feet pump house with an attached toilet.
e) There are provisions wherein homeless people could stay in the pump house and work as operators in the project.
f) Women have been in the farming side, and men have been employed in the irrigation site.
g) Operational irrigation comes about 90$/month, and the wife's agricultural income comes about 90$/month.
h) The pump capacity is 22 kW, and the solar pump capacity is 46 kW. The size of the shed is 70 ft*23ft and the size of the pond is 25 ft* 70 ft. The daily water output is 2.2 million litres.

Consequently, the project timeline for chicken farming was suggested to start on 15 February 2021 as winter of 2020 was too cold. Hence, weather requirements were kept in mind.

Table 5: Q&A with KHM power

Sl no	Question	Answer
1.	What is the size of SIP and land?	The pump capacity is 22 kW, and the solar pump capacity is 46 KW. The size of the shed is 70*23 feet; the size of the pond is 25*70 feet. The daily water output is 2.2 million litres.
2.	What are the add-on activities? What could be the additional income to repay a loan from IDCOL? Will it also affect the rate of irrigation water sales to nearby farmers?	Yes, KHM will review this in the future.
3.	How much revenue will be added by these add-on activities?	There will be an estimated additional income of $2500 and $4500 that also

		involves IDCOL.
4.	Would there be any issue with heat for chicken farming as the height of the shed is lower than the standard value?	1. Insulation for chicken: heat is not an issue as the farm is located in the middle of the field. The environment is suitable for chicken farming as there is no community nearby. 2. The height of the shed should be according to the standard design in the future.
5.	In the context of the pond, is there any issue with rusting?	Solar generation should not be compromised in the long term as the project will not be sustainable. Solar modules need ventilation, the back sheet of the solar gets heated, and generation is low.

2. Switch On, West Bengal, India

The name of the project is: 'Mini Solar Pump for Women Farmers'. The presentation was given by MahaShweta, Deputy Project Manager for Switch On. The group targeted for upliftment are marginal farmers. There have been a few goals and objectives of the project, viz, reducing carbon emissions by raising diesel cost, making it difficult for the framers to irrigate the fields with diesel-based pumps. This will put a focus on the conservation of natural resources. With integrated drip irrigation, there will be a reduction in groundwater overuse. Thereafter, this will enhance the quality of life for marginalised farmers. Lastly, mitigation of climate change will be accelerated, giving farmers access to clean energy and finance.

The project also lays a focus on technical and financial innovation. The micro solar pumps have a capacity of 0.5-1 HP. There will be fixed deposits in banks with a revolving guaranteed fund. Additionally, women farmers would get loans without any collateral. The portable micro solar pumps would be integrated with processing units, and women farmers would be forming water user groups. The project also aims to target women farmers with landholding less than 1 acre.

Table 6: Project Update by Switch On

Description	Target	Achieved
Identify project sites	120	100
Installation	20	5
Revolving Guarantee Fund	1	1
Water user group formation	10	5

Activities undertaken:

1. Thirty-eight field visits were undertaken for sensitisation, wherein 400 women farmers have been sensitised.
2. There have been 14 demonstration visits on solar pumps wherein 200 women have been sensitised.
3. 5 RMU have been installed.

Plan of action:

1. There will be 15 installation units.
2. There will be 20 repayments of loans.
3. 15 RMU installation for M&E
4. 20 O&M: helpline number
5. There will be two stakeholder meetings with the banks to create awareness amongst the banks without collateral and create a financial ecosystem.

Learnings:

1. Revolving funds provide a loan without collateral
2. SIP promoted with integrated drip irrigation increased groundwater efficiency
3. WUGs regulate the selling price of water, ensuring equity.
4. WUG is trained for operation and maintenance.
5. Bring in regulations and do a case study to map the aquifers work with the government to sensitise the farmer and WUGs.
6. WUG come forward as maintenance experts providing alternative livelihood.

Table 7:Q&A with Switch On

Sl no	Question	Answer
1.	Are loans given to individuals?	Yes, loans are given to individuals, and they are engaged with WUG. They are involved with drip irrigation, and they

		come with subsidies through PM schemes. Solar irrigation comes through another plan combining two different government schemes.
2.	What happens to the loan during a climate disaster? Could you provide more details on the loan?	The average loan size is 1 lakh with an interest rate of 11-13% with two years repayment period, but that varies.
3.	Is there any intention of integrating different technologies like solar, agriculture and drip irrigation?	Switch On is an in-house branch for agriculture wherein the sister company takes care of solar. It is aimed at climate-smart agriculture with the energy-water-agriculture nexus. IIT is involved with groundwater recharge.
4.	What are the groundwater norms?	In Eastern India and West Bengal, there is a stakeholder network focusing on climate change adaptation, groundwater regulation that feed the government on regulation mandate and policies. There has also been a focus on evidence-based studies into groundwater recharge as farmers have been facing problems due to seasonal groundwater depletion. There is a possibility of SIPs exploiting groundwater, but we need strict regulatory mandates for groundwater from next year.
5.	How will the seed money be handled?	The revolving fund will go to other farmer groups, and the cycle continues.
6.	What mechanism is ensured once the	Specific MoUs with banks have been

	project is finished?	signed, and once this money is paid off, it is replicated with other WFG.
7.	To whom do these tube wells belong? How are tube wells accessed?	Groundwater is pumped through tube wells. There are no technological pumps, and farmers use diesel pumps. The farmers already have them in their plots.
8.	What is the minimum land parcel required? Is it about water selling or renting the pumps?	It is about 1 acre, wherein the service will be for one year. Neighbouring farmers are connected through pipes, so water is being sold.
9.	Is the pump rented, or is water sold?	The water is being sold in the community.

3. Karma Power, India

The name of the project is 'Mobile URJA'. A presentation was made by Saroj Nayak, who is a professor at IIT and Suraj Kumar, who is Vice President at Karma Power. Mobile URJA is a solar power project focused on irrigation. It is affordable, wherein farmers can rent the mobile URJA. It comes with a lot of entrepreneurial opportunities with a target of improving the income of BoP farmers. It is to be certified by the Ministry of New and Renewable Energy (MNRE).

Mobile URJA delivers 75K litres per day and irrigates land less than 2 acres. The pumps usually have a power of 1-2 HP. In Punjab, the pumps used are of high intensity, and as electricity is free, this has exhausted most of the groundwater.

There are customised panels for mobile URJA, and to cater to the interests, a 'farmer solar club' has also been formed.

Project updates:

1. The implementation plan can be summarised as under:
    a) Prototype Testing (Month 0-12)
    b) Field Testing (Month 6-24)
    c) Scaling Up (Month 12-24)
    d) More testing and networking (Month 18-24)
    e) Further expansion to different regions

2. There has been a partnership with MIT to develop a prototype with silicon panels. Five have been created for the farmer solar club, wherein two are working on the ground, and they have been linked to the bank.
3. The area of focus has been UP and Koraput district in Odisha. In UP, the targeted regions are close to the Nepal border, wherein plans have been devised to partner with colleagues from the neighbouring country.

Challenges:

1. There has been a massive challenge in terms of finance in the agriculture sector for the smallholder farmer.
   a) They are not able to work with private banks and cooperatives.
   b) Even to sanction a loan of amount Rs 20K, they take six months.
   c) The solar pumps cost around Rs 60K
   d) KfW provides subsidies, and farmers need Rs 20K as an upfront payment.
   e) In three months, the farmers can sell vegetables worth Rs 30 000 only.

2. It was decided to upgrade to CGIS panels from silicon panels that are being currently used by 15 March 2021.

Table 8:Q&A with Karma Power

Sl no	Question	Answer
1.	In the situation of finance, what is the experience with microfinance and agro cooperatives?	Approached MF and good working relationships with leading MF. They have done SIP policies. The interest rate is as high as 20%. The cooperative has laps (small branch). Most areas do not have a cooperative network.
2.	Great potential for bringing Solar to the farmers. Is it an invention that is worked upon worldwide? How difficult is it to build?	The invention is in-house, and panels are connected to the pump with minimal panels. Cost needs to be effective. Silicon has to be customised as the price is low. We are ready to scale up. People are also prepared to carry heavy silicon panels rather than waiting for new technology to come.
3.	When you change the system from thin	The cost of the controller and pump won't

	silicon panels to IGS panels, how will it affect the cost, and how will farmers adopt it?	change, but the cost of the panel will. Sixty SIP silicon panels, 400-500 pumps have been installed, and <1% have a challenge. With CIGS technology, the price may go up to 110k. There are tie-ups with CSR funding so that the burden can be reduced from farmers. CIGS allows you to access more farmers and larger farm areas which is difficult with Silicon. Theft is also reduced with CIGS panels, and we may deliver in June; so far, three orders have come out.
4.	What is the cost of CIGS panels?	Larger orders and sea freight will reduce costs by 30-40%. If demand increases, price decreases

4. Gham Power, Nepal

The name of the project is: 'Yield improvement in a box'. It was presented by Bhisoraj PM from Gham Power, Nepal. Precision farming increases farmer yield by up to 80%, mainly because of three factors: SIP, on-spot direct financing, and data-driven crop planning. Optimum use of the solar pump is needed to make financial sense. To adopt modern agriculture, there has to be the right amount of capacity building for farmers. With microfinance, there is a willingness to invest 100% for 2-3 years.

Project updates:

The project period is for 30 months. The project activities include:

1. WP 1: Onboarding and training stakeholder- April 2021
2. WP 2: Enhancement of personalised Agro advisory services- May 2021 and April 2022.
3. WP 3: Impact measurement and validation- March 2022.
4. WP 4: Market Activation and development- November 2020 and May 2022.

WP1- Stakeholder Training and Onboarding

1. Field trips for three branches have been completed.
2. Training programmes for 12 events and 30+ staff have been completed.
3. Development of materials for marketing in progress.

4. Development of revised android and web applications to support the improved standard operating procedure in progress.

5. Need-based operations and software refinement are in progress. Microfinance has exclusive membership of women only.

WP2- Enhancement of personalised Agro advisory services

1. Test and calibration of sensors is in progress.
2. Development and expansion of crop and advisory database in progress.
3. Integration of the sensors into the digital platform and optimisation of the algorithm in progress.
4. Preparation of a database of best practices for common crops, a matrix for data for benchmarking.

WP3- Impact measurement

1. Partnership with AEPC.
2. Obtaining ten sites to pilot and test the Yield Improvement Solution.
3. Deployment of GP solution at Yield Improvement Solution, the pilot site in progress.
4. Finalisation of KPI for partners like AEPC and MFI are in progress.
5. Development of the CIM app for farmers to start soon.

WP4- Market Activation

1. Not many activities due to the Covid-19 pandemic.
2. Needs background work to deploy a team.

Learnings and challenges:

1. Covid-19 has heavily affected the supply chain, and the MFI partners are focused on recovering the pending payments.
2. Development of partnership takes time.
3. Farmers could use immediate help as they are badly affected by Covid-19.

Way forward:

1. Implementation and replication.
2. Gathering of preliminary data.
3. Testing and integration of three new sensors.
4. Complete field demonstration.

Table 9:Q&A session with Gham Power

Sl no	Question	Answer
1.	What is the objective of GW monitoring?	First, understand the impact on GW and generate data creating a database for typical crops and integrate drip irrigation and precision irrigation. Secondly, there has to be an understanding of the seasonality of the GW table. Currently, we cannot find reliable data on the water table in Nepal.
2.	Monitoring GW, the base level information should be generated through monitoring wells through the fixed time intervals. There need to be norms; monitoring wells need to be built with regular monitoring with respect to monsoon and crop season. Your take on this?	There need to be sustainability wells concerning GW. GP monitoring the impact of SIP on GW and study wells may be cost-effective. GW aquifer is in Babar mahal in Nepal. But there is no continuous data for a long period.
3.	What is the objective to capture the baseline in GW monitoring?	Putting a few sensors may not provide a big picture on GW. Soil moisture sensor - may not provide accurate measurement on irrigation water requirement. GP wants to understand the effect of the SIP on the water table seasonally on the baseline. This is a significant concern in scaling SIPs.

5. PARC Pakistan

The project's name is 'Livelihood Improvement of Dug well dependent vulnerable communities through energy and water-efficient Responsive Drip Irrigation (RDI) systems. Dr Bashir Ahmad, Director CEWRI, presented it. RDI targets 90% of the small landholders farmers, whereby irrigation is reduced by over 60-

70%. It operates at two psi pressure and needs significantly less energy. It has been installed near the root zone and is different from drip irrigation. Through RDI, there are plans to regulate irrigation through signals, i.e., RDI pipes operated through automation. RDI needs water in the pipe for 24 hours, yet the energy requirement is low. Micro SIP does the operation of RDI. For optimisation, PARC is working on with partners. It is working with different tiers for upscaling.

Project updates:

There have been issues with fund transfer; hence, not much progress has been made. Developing micro solar pumping system and optimise the nighttime pumping with water storage and battery for 2-acre land. After one year of optimisation, there will be four sites where RDI will be implemented, and one of them would be for the women farmers group. If the effectiveness is proven, it can be recommended to the Government of Pakistan to include RDI technologies.

Currently, two setups have been installed:

- Farmer field in Islamabad
  - Comparison with the drip-irrigation system in terms of water and energy use
  - Solar PV system with backup and tank storage
- NARC setup is planned and will be implemented after the funds have been transferred.
  - 0.5 acre with Solar with battery backup
  - 0.5 acre with Storage at 8 feet height

Table 10: Q&A with PARC

Sl no	Question	Answer
1.	How much is the demand-based from the farmer?	RDI is a new technology that has been planned to introduce. The farmers' response is good, and they are happy about the automation of the system so that they can use their time in other activities.
2.	Have you optimised the tank size for the night, or have you optimised battery size?	For a more extensive system, a bigger tank size may not be adequate; maybe the use of a battery can be optimised. But the battery cost may be higher, the bigger tank can be more cost-effective then.

YouTube link for session 3: https://www.youtube.com/watch?v=AVRNp_iqHGA&t=6s

Concluding remarks from SDC

Corine:

Corine congratulated all the organisations and mentioned that every project was interesting. She focused on innovation models for financing. Participation should be closer to the farmers, and documentation should be seen on the ground. For SDC, it is helpful to raise the question if they are asking the right question.

Divya Kashyap:

This is an excellent effort to select these five grantees from a pool of 80 proposals. IGF will respond to the question and align it with the SoLAR project. The following year and a half would be critical, and the progress will be documented, which will be helpful.

Annex 1: Schedule

Day	Session timing	Session Description
Day 1 23 February 2021 Tuesday	10:30 am to 13:00 am BST 10:00 am to 12:30 pm IST 10:15 am to 12:45 pm NPT 9:30 am to 12:00 noon PST Session duration: 150 minutes/2.5 hours	Session 1: Results from year 1 and year 2 plans for Bangladesh and India - Welcome address – SDC/IWMI (10 minutes) - Brief introduction by all participants (10 minutes) - Overall project updates – Regional Project Leader, SoLAR (20 minutes) - Discussions: All (10 minutes) - Year 1 updates/results from Bangladesh Lead (30 minutes) - Discussions on Bangladesh: All (20 minutes) - Year 1 updates/results from India: India Lead (30 minutes) - Discussions on India: All (20 minutes)
Day 1 23 February 2021 Tuesday	3:30 pm to 5:30 pm BST 3:00 pm to 5:00 pm IST 3:15 pm to 5:15 pm NPT 2:30 pm to 4:30 pm PST Session duration: 120 minutes/2 hours	Session 2: Results from Year 1 and Year 2 plans for Nepal and Pakistan - Year 1 updates/results from Nepal: Nepal Lead (40 min) - Discussions on Nepal: All (20 minutes) - Year 1 updates/results from Pakistan (40 minutes) - Discussions on Pakistan: All (20 minutes)
Day 2 24 February 2021	10:30 am to 1:00 pm BST 10: 00 am to 12:30 pm IST 10:15 am to 12:45 pm NPT	Session 3: Presentations by 5 Innovations Funds Grantees (each grantee had 15 minutes to present, followed by 15 minutes of Q&A)

	9:30 am to 12:00 noon PST Session duration: 150 minutes/2.5 hours	- KHM Limited, Bangladesh - Karma Power, India - Switch On, India - Gham Power, Nepal - PARC, Pakistan - Concluding remarks: SDC

BST= Bangladesh Standard Time; IST= Indian Standard Time; NPT= Nepal Standard Time; PST= Pakistan Standard Time

Annex 2: List of Attendees from India & Bangladesh

Sl no	Name of the attendee	Organisation
1	Corinne	SDC
2	Tushaar Shah	IWMI
3	KHM Bangladesh	KHM Bangladesh
4	Shisher Shrestha	IWMI
5	Yashodha	IWMI
6	Aditi Mukherji	IWMI
7	Alok Sikka	IWMI
8	Archisman Mitra	IWMI
9	Dinesh Dulal	NMB Bank
10	Divya Kashyap	SDC
11	Dr Mohammad Ashraf	IWMI
12	Nirmal Sigtia	IWMI
13	Kazi Ahsan Uddin	IDCOL
14	Labisha	IWMI
15	Laxman Prasad Gimire	Alternative Energy Promotion Center
16	Mahasweta	Switch On
17	Marie Charlotte Buisson	IWMI
18	Mark Smith	IWMI
19	Md Ahasan Habib	NGO Forum Bangladesh
20	Mofazzal Hossain	IDCOL
21	Prakash	NDDB

22	Rajeev Gyani	ISA
23	Razi	IWMI
24	Ahsan, Kushal Gautam	Quasar Energy Consultants
25	Faiz Alam	IWMI
26	Azeem Shah	IWMI
27	Belal Siddiqui	IDCOL
28	Suraj	Kalinga Renewable Energy
29	Aditi Sanjay	IWMI
30	Zahid Osmani	NGO Forum
31	Shilp Verma	IWMI
32	Kashi Kafle	IWMI
33	Pallab Raj Nepal	IWMI
34	Ranju Pandey	IWMI

Annex 3: List of Attendees from Nepal

Sl no	**Name**	**Organisation**
1.	Mr. Sagar Gyawali	Ass. Manager - NEA
2.	Mr Prachanda Pradhan	Farmer Management System Promotion Trust
3.	Mr Kumar Raj Shahi	NuFAN- (National irrigation water user association Nepal) member
4.	Mr Anton Urfels	Cimet Nepal, Ground Water Irrigation
5.	Mr Nirman Shrestha	IWMI
6.	Dr Kashi Kafle	IWMI
7.	Ms Labisha Uprety	IWMI
8.	Ms Gitta Shrestha	IWMI
9.	Mr Shisher Shrestha	IWMI
10.	Dr Manohara Khadka	IWMI
11.	Dr Laxman P. Ghimre	AEPC
12.	Mr Sagar Gyawali	NEA