

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

9<sup>th</sup> Project Steering Committee (PSC) Meeting | 21 March 2024

15:30 to 17:00 (IST)

Venue: Hybrid/IWMI Delhi Office, NASC Complex, New Delhi-110012

### Agenda:

Time	Agenda Item	Speaker
15.30-15.35	Welcome Remarks	Alok Sikka
15.35-15.45	Opening Remarks	Jonathan Demenge and Mark Smith
15.45-16.20	Annual Project Progress (2023) and Global Forum Update (April 2024)	Darshini Ravindranath
16.20-16.45	Discussion	PSC members
16.45-16.55	Remarks on progress and global forum	Divya Sharma
16.55-17.00	Closing Remarks	Jonathan Demenge and Mark Smith

### Attendees:

Name and Designation	Designation at PSC	Attended
Jonathan Demenge, Head of SDC, New Delhi	Chair	Yes
Mark Smith, Director General, IWMI	Co-Chair	Yes
Divya Kashyap Sharma, Deputy Head and Project Manager, SDC	Member	Yes
Vidhisha Samarasekara, Strategic Program Director, Water, Climate Change and Resilience, IWMI	Invited	Yes
Alok Sikka, Country Representative, India, IWMI	Member	Yes
Darshini Ravindranath, Senior Researcher, Solar Energy and Climate Resilience, IWMI and SoLAR-SA Project Lead	Member	Yes
P.C. Sharma, Joint Director, International Solar Alliance (ISA)	Co-opted Member	Yes
Tushar Shah, IWMI, Anand	Invited	Yes
S.M. Monirul Islam, Deputy CEO & CFO, IDCOL	Member	Yes
Cornelia Hett, Programme Officer, SDC	Invited	Yes
Amanul Hak Ansari, Engineer, Alternative Energy Promotion Center, Nepal	Invited	Yes
Shibani Chattopadhyay, Communications, IWMI	Invited	Yes
Swati Jain, Finance & Admin, IWMI	Invited	Yes

**Abbreviations:** IDCOL: Infrastructure Development Company Limited; ISA: International Solar Alliance; IWMI: International Water Management Institute; SDC: Swiss Agency for Development and Cooperation

## Remarks

**Dr Alok Sikka** welcomed all the attendees to the PSC meeting and welcomed Dr Jonathan Demenge, the chair of the meeting and the head of the cooperation. He mentioned that for the last 6 months, after the joining of Darshini Ravindranath, the project lead, things have been moving fast and based on the past evaluation by the third party, and some of their suggestions have been internalized. He mentioned that IWMI had a great presence at the COP28 in Dubai, where a session was devoted solely to solar which was well received, there were impact studies and capacity building programmes going on. There was good traction from the policy makers with a lot of discussion on impact assessment of the SKY scheme done with the Indian Ministry of New and Renewable Energy. He then passed it on to the chair and co-chair to take it forward.

**Dr Jonathan Demenge** started off by welcoming everyone to the solar project Steering Committee meeting. He said that the year 2023 had been very impactful with many big developments that reflect the impact of the solar project. First, the government of Pakistan announced the scheme to solarize 100,000 tube wells with an early allocation of 1.14 billion Swiss francs. The World Bank funded project was launched in the Punjab province. Bangladesh announced plans to replace all these diesel pumps with solar irrigation pumps and these are only some of the of the successes. It was important for SDC to note that the research reports and briefs generated by the solar project with multiple exchanges with key national stakeholders played such an instrumental role in sensitizing the solar policy environment in the partner countries. SDC was very happy that solar project had been able to contribute towards important country level developments, it's important for the project to provide further support to the partner countries and outline a pragmatic and effective strategy to roll out these ambitious programs. The year 2023 also saw the successful conclusion of the review of the solar project. He expressed his gratitude to everyone for integrating the recommendations into the implementation plan and the report. The reviewers have noted that the solar project has achieved good understanding of policy drivers for the SIP program adoption, especially diesel, fossil fuel substitution in the countries in the region and the project strategy and approach are highly relevant to solarization policies in Nepal and Pakistan, in Bangladesh and in Gujarat India. In their view, the outcomes and outputs achieved by this sort of project to date are highly satisfactory overall and the project has generated significant achievements and impacts.

He mentioned that the solar project's greatest impact has been through training especially of the SIP implementation agencies of respective governments. Additionally, the project has provided crucial research and knowledge support, aligning SIP programs with local and national policies, socio-economic contexts, and environmental conditions. Notably, the project's efforts to assess groundwater sustainability regionally have been commendable, reflecting a consistent modelling and data framework despite differences in monitoring data across countries. These achievements owe much to the concerted efforts of stakeholders and partners, demonstrating a collective commitment to sustainable development. The Solar Project Steering Committee acknowledges and appreciates the intensive efforts of all involved parties.

In conclusion, the Solar Project has made significant strides in advancing solarization efforts across partner countries. Through training, research, and strategic partnerships, it has not only sensitized policy environments but also contributed to the implementation of ambitious solar programs. Moving forward, there's a shared commitment to further support partner countries and enhance the project's impact on sustainable development.

**Dr Mark Smith**, Director General, IWMI, and Co-Chair of SoLAR-SA offered reflections on the progress of the solar project, focusing on its inception in 2019 and its journey since then. He acknowledged his engagement primarily through the Project Steering Committee (PSC), which has provided him with a broader perspective on the project's evolution. The overarching goal of the project has been to utilize knowledge and research to drive implementation and bring about significant change, including policy reforms. Smith emphasized the importance of effectively bridging the gap between generating knowledge and its practical application in policymaking and on-the-ground implementation, a topic consistently deliberated within the PSC.

He acknowledged the learning curve experienced throughout the project's duration, particularly in ensuring that efforts remain aligned with the project's objectives and facilitating the transition of generated knowledge into actionable policies. He highlighted the pivotal role of dialogues within the PSC in fostering these learnings. The recent period has seen increased focus on enhancing this process, with notable attention drawn during COP 28. He recalled his participation in a session during COP 28, where discussions centered on the potential of technological advancements and appropriate policy frameworks to effect transformative change. He underscored the collaborative efforts required among stakeholders to achieve this.

Amidst these discussions, Smith pointed to tangible outcomes of the project, such as impact assessment studies and insights into groundwater sustainability in regions utilizing solar pumps. He cited examples of knowledge uptake, including the integration of gender considerations into subsidy allocation criteria in Nepal, aligning with the project's objectives. Additionally, he mentioned IWMI's recent intensive work on a new strategy spanning from the current year to 2030. This strategy emphasizes the power of collective action in advancing water system transformation. He mentioned the solar project as a valuable learning opportunity for IWMI and its stakeholders in leveraging partnerships and collective action to maximize impact. He emphasized the significance of internal learning from the solar project and other initiatives within IWMI's portfolio. He sees these experiences as instrumental in shaping IWMI's strategic direction towards more effective collaboration and impact creation. Looking ahead, Smith expressed anticipation for the upcoming global forum, viewing it as a pivotal moment to weave together the threads of progress from the solar project and other initiatives. He underscores the importance of leveraging the project's outcomes to further the collective ambition of creating lasting impact.

## **Progress and Workplan**

**Dr Darshini Ravindranath** mentioned that we were able to keep a majority of activities on track this year and since the current phase will be the last year of the project, we are keen to push through and deliver impact. There have been some excellent results in 2023 coming through from some of the pilots and other studies. This is creating a strong narrative on the key opportunities and barriers for scaling and implementing solar irrigation under different contexts.

The 2023 program highlights include – a) Successfully providing support to governments on implementation of SIP programs in project countries, including improvements in GESI outcomes b) capacity-building interventions under the project have had a positive impact on the effectiveness of ongoing SIP programs c) cross-country/learning from the project has been instrumental; the project is fostering regional knowledge integration effectively d) strong impact driven research findings on groundwater and adaptation co-benefits that contribute to global discourses on solar irrigation.

Her presentation focused on the three key project outcomes and upcoming initiatives. She commenced by acknowledging the importance of project outcomes, which she intended to discuss based on the findings outlined in the annual report. Under Output 1.1: impact of solar irrigation adoption on livelihoods (women and men farmers), agriculture and climate resilience documented and shared with policymakers – under this, evaluation of farmers utilizing grid-connected solar irrigation pumps, generating evidence on adaptation and mitigation benefits to support country's SIP expansion. In Bangladesh, compared three distinct SIP implementation modalities: assessing their appropriateness for scaling SIPs in Bangladesh. A policy brief on scaling SIPs shared with CPMC members and IDCOL. The fee for service model involving a market-based approach and public private partnership has emerged as the most promising one. The financial sustainability of SIPs is threatened by significant project cost settings so it's important to expedite the integration of SIPs with the national power grid in supporting government policies. Some important adaptation benefits for farmers that go beyond the mitigation potential offered by solar has been identified and diesel use was reduced by 87 to 89%, which speaks directly to the Prime Minister's announcement.

In India, a number of impact assessments, the evaluation of feeder level solarization of the Sky scheme assessed the impacts on farmers and groundwater. The findings indicated enhanced voltage quality during daytime power supply under the scheme effectively helps meet farmers irrigation requirements. Recommendations for expediting the scheme included adopting sort of a lease model for land procurement, tariff adjustments among others. And it also some of the findings from our studies also showed that farmers generated an annual income of round ₹17,000 Indian Rupees, which is equivalent to 34% of their crop income, by selling electricity back to the grid. So, those are really strong findings. All the findings provided valuable insights into region specific complexities underscoring the need for context specific strategies when implementing solar irrigation pumps in India. The study recommended transitioning to crops that not only maximize profit but also reduce water requirements. Questions remain around adoption and what the implications are for women and small and marginal farmers. The team visited Jaipur in Rajasthan to discuss the pilot for broader adoption of solar irrigation pumps and how we solve it and eliminate some of the barriers. One of the ideas is to have a KUSUM Mitra which is an energy extension agent and also, a gender-specific pilot in Mandla in Madhya Pradesh is being tried out.

In Nepal, a study investigated how state and non-state actors have implemented 3 solar irrigation pump programs in Saptari District which focus on women and marginal farmers. There was also a desk assessment carried out to determine the emission factors due to the use of solar radiation pumps to demonstrate the mitigation potential that's offered, and one of the things that was nice to see was that the traditional irrigation policies haven't been great for equity considerations. Additional review of 19 water, energy and food policies showed that the energy sector needed a lot more embeddedness of gender and inclusion. The phone survey conducted showed that there was a significant reduction of up to 70% in diesel use by SIP adopters.

Also, looked at the impact of large-scale SIP adoption on groundwater sustainability, groundwater studies related to the design and scaling of on grid solar IRRIGATION programs have been done in India Pakistan, Nepal, and Bangladesh. The groundwater question has become quite controversial and whether solar irrigation pumps increase groundwater use. In Bangladesh, based on two years of groundwater data, the key findings shared with government officials and donors was that there's no significant difference between irrigation water application for Boro between solar and diesel farmers and under these assumptions, SIP upscaling scenarios show no significant changes in the groundwater levels. We

are in the process of actually designing a solar suitability mapping exercise to sort of address some of these wider questions. Similarly in India, the findings didn't demonstrate a significant statistical difference in groundwater utilization between solar and non-solar farmers, but the analysis relies on three years of secondary data and sort of monitoring millions of, I think generally monitoring millions of pumps owned by small holders can be extremely challenging. So, an energy-based approach which is more cost-effective will be explored.

In Pakistan, behavioral response to groundwater extraction was looked at; looking at SIP and non-SIP farmers and 64% of SIP farmers, that diesel pumps as a prior source of energy and SIP and non-SIP farmers had sort of similar cropping patterns, a different type of study but shows similar results. Data analysis of in-situ instrumentation for 2023 is conducted, comparing SIP and diesel site in Chakwal district.

A lot of capacity building workshops aimed at optimizing the use of grid connected solar irrigation systems were done. In Bangladesh, impact of SIP introduction on local GW markets and comparing across different business models to understand that the SIP benefits are pro-poor. To avoid risk of local monopolies, policy intervention was needed to promote competition in the GW market and rationalize the TW permit system. These have been shared through CPMC meetings and other interactions and meetings and is also, part of the policy brief being developed. In India, community-based solar business models with women SHGs were experimented with in Madhya Pradesh. Implementation of two SIPs is planned, one from the SDC-SoLAR project and another one from One-CG Agroecology initiative at two different sites.

In Pakistan, with the choice, experiments with more than 200 farmers in three different districts, the study addressed farmers willingness towards the sale of surplus electricity to the grid and exchange for a feed in tariff, and a policy brief with partners in Pakistan is being prepared.

Four innovation fund grantees submitted their completion reports in 2023: SwitchOn, Gham Power, URMUL and CINI. Case studies of for six out of seven will be presented at the Global forum. A synthesis report is being prepared.

In Bangladesh there were two farmer trainings in coordination with IDCOL and DAE for a total of 60 farmers with the primary aim of educating farmers about solar pumps and on crop scheduling and water saving practices and attend and a 10-member delegation of government officials from Bangladesh came to India for an exposure visit in 2023 and had meetings with farmers in collaboration with GERMI and GUVNL.

Training to 637 farmers with the objective of empowering them to enhance their income through grid connected solar pumps and regular maintenance of solar PV systems as well in India. In Nepal, 132, technicians were trained, 83 men and 49 women and fifty percent of 54 participants in 2023, of which 50% were female. In Pakistan, there were separate trainings for men and women where 40 females were trained, and 25 male farmers was conducted at a farm site in Punjab. Also, a two-day training of 25 water professionals where government and private sector partners on standardization and selection of solar equipment and subsequent maintenance was conducted in Islamabad.

National forums were held in Nepal and Pakistan during their respective water weeks in April and December 2023. Bangladesh National Forum and the India National Forum was held in March. Nepal will be alongside the Global Forum in April 2024.

A successful collaboration between IWMI and International Solar Alliance (ISA) led to a series of events that brought together diverse partners, global experts, and leaders to share their thoughts. There were two events – Accelerating Solar Irrigation for Agricultural Resilience: Lessons from South Asia shared findings from the SoLAR project and Solar Energy for Agriculture and Rural Livelihoods: Opportunities for South-South Learning and Collaboration.

In terms of lessons learnt – a) SIP programs remain dependent on large financial subsidies b) SIPs have important adaptation co-benefits c) Evidence from the project shows that SIP adopters are seeing visible improvements in their livelihoods d) Off-grid SIPs provide an opportunity to scale-up with appropriate business models e) Low-capacity utilization in off-grid models is a challenge requiring alternative uses of energy especially grid-integration f) The effect on groundwater extraction needs to be studied in more contexts and with different lenses g) Need for large-scale capacity-building initiatives to educate farmers about the benefits of grid-connected (SIPs) and mitigating risk-aversion factors.

The way forward would be – a) greater focus on work that supports policy development and impact b) mainstream GESI into all regional work and provide innovative implementation platforms to better promote solar irrigation among women and marginal farmers c) better understand suitability of solar within different contexts d) enhance south to south learnings (e.g. Africa) e) improve science communication to policy makers, local governments, and end users.

Also, an update on the Global Science Policy Forum to be held in Kathmandu in April 24-26<sup>th</sup> was shared.

## **Discussion**

### **Jonathan Demenge**

He appreciated the impressive results and also, impressive in terms of granularity. Also, a lot of it is context specific so it's difficult to generalize from one country to the other and from 1 context to the other. He also mentioned the power of narratives and would be useful to know how we could sum up, is it possible to simplify the narrative to a few determinants that would allow us to explain when it is successful in terms of adoption, in terms of increase in income and in terms of reduced CO2 emissions. We need some key messages that can be flashed around, and if at some point it's possible to do that, it would be greatly useful. The second is in terms of figures, a lot of the figures are so country specific so if there was a common metric, it would help to figure out how large, or significant, the results are. Also, wanted the presentation slides to be shared with the Swiss Cooperation office in Nepal before the Global Forum. Also, the high capital cost which makes it subsidy dependent so any recommendations on that would be quite useful.

### **Divya Sharma**

Divya Sharma from SDC India, highlighted several key points regarding the impact of solar irrigation projects on farmers' incomes, as well as broader policy implications. The focus should be on percentages rather than absolute numbers, particularly emphasizing the additional income farmers in Gujarat experienced, which amounted to a 34% increase after paying off the loan component associated with the project. This indicates a significant economic benefit for farmers participating in solar irrigation initiatives. Sharma mentioned the importance of considering upfront investments made by farmers, with 40% of their income being allocated towards loan repayment. After deducting this loan component, the

remaining income represents the tangible benefit gained from the project, demonstrating its effectiveness in generating surplus income for farmers. Furthermore, Sharma discussed the nuances involved in benchmarking solar irrigation pricing against electric pumps, highlighting the complexities in determining accurate cost comparisons. Despite these challenges, she emphasized the importance of understanding such details, particularly in the context of presenting project results to a global forum.

Sharma also reflected on the initial policy questions posed at the inception of the project, which varied across different countries involved, including Bangladesh, India, Nepal, and Pakistan. These questions encompassed issues such as subsidy allocation, social and gender inclusiveness, and groundwater sustainability. She noted the evolution of these questions over time and suggested revisiting them to assess how project outcomes address these policy concerns. Moreover, Sharma underscored the significance of stakeholder consultations in shaping project objectives and outcomes. She proposed summarizing the project's responses to these policy questions in a concise manner, highlighting the alignment between project activities and overarching policy objectives. In terms of feedback, Sharma expressed a desire to receive inputs from project partners, particularly governmental bodies regarding the relevance and effectiveness of the project's findings. This feedback is crucial for evaluating the project's impact and informing future initiatives.

Overall, Sharma's remarks underscored the multifaceted nature of solar irrigation projects, emphasizing their potential to not only enhance farmers' incomes but also address broader policy objectives related to sustainability, inclusiveness, and economic development. The discussion highlighted the importance of considering various factors, such as loan repayment structures and policy frameworks, in assessing the success and impact of such initiatives.

### **Cornelia Hett**

Cornelia Hett expressed gratitude towards Darshini and the team for their exceptional efforts throughout the year, acknowledging their leadership's significant impact on project outcomes. She highlighted the crucial role of solar energy in facilitating just energy transitions, citing examples such as reducing reliance on oil and diesel, which contributes to more stable energy prices. Hett emphasized the importance of framing the project's contributions within the context of these broader goals, advocating for strong messaging to convey the project's impact effectively.

She expressed anticipation for results from initiatives focused on women's empowerment within self-help groups and the Innovation Fund projects, noting their potential to further enhance the project's outcomes. Hett discussed the project's transition into its second phase, emphasizing the importance of identifying central topics and geographic focuses. She also expressed a desire for more regular project updates, expressing difficulty in accessing information through the project's newsletter. She highlighted the nexus between food security, water, and energy, noting the potential for collaboration across thematic sections within SDC. She mentioned efforts to engage regional offices beyond South Asia to explore opportunities for collaboration on solar-related topics. However, she acknowledged challenges in justifying continued support for solar irrigation projects, despite their ongoing relevance and impact, and stressed the need for clear messaging and briefs to address skepticism among stakeholders.

She underscored the importance of finding entry points to engage stakeholders effectively, particularly those who perceive solar irrigation as a well-covered topic. Hett concluded by expressing appreciation

for the discussion and emphasized the importance of continuing efforts to advocate for solar irrigation projects effectively.

Overall, Hett's remarks highlighted the project's achievements, challenges, and future directions, emphasizing the need for clear communication and strategic engagement to ensure continued support and impact in the field of solar irrigation.

### **Darshini Ravindranath**

She acknowledged the importance of simplifying the project narrative and framing the results effectively. She acknowledged the complexity of the data and the need to present it in a more accessible format, particularly for wider audiences. Ravindranath mentioned ongoing efforts to develop concise summaries of project outcomes, starting with a three-page note focusing on India's progress over the last four years, which will serve as a template for other countries and the project as a whole.

There was recognition of the oversight in not presenting common metrics, with a suggestion to potentially convert numbers into US dollars for better comprehension, especially in anticipation of the upcoming global forum. Ravindranath expressed readiness to refine the presentation further to align with SDC's requirements, indicating responsiveness to feedback and a commitment to effective communication.

The discussion also touched upon revisiting policy questions to assess the project's achievements over the years, particularly in terms of policy impact and gender-related initiatives. There was enthusiasm about the progress made in gender-focused projects, with plans to replicate successful strategies in other countries and contribute recommendations for the region as a whole. The conversation addressed the question of why solar irrigation merits support, emphasizing the need for further research on its full benefits and impacts on equity and inclusion.

Ravindranath also assured Hett of being added to the newsletter distribution list, addressing concerns about accessibility to project updates. Overall, the exchange reflected a collaborative approach towards refining project communication and addressing stakeholders' questions and concerns effectively. In conclusion, the dialogue highlighted efforts to streamline project messaging, enhance accessibility of information, and demonstrate the project's impact on policy and gender inclusion. The exchange underscored a commitment to continuous improvement and collaboration to ensure the project's effectiveness and relevance in addressing key development challenges.

### **Divya Sharma**

Sharma provided insights into why the organization supports solar irrigation projects, emphasizing the focus on addressing challenges in wider technology adoption rather than furthering technological development, as the technology itself is well-established. The decision to concentrate efforts in South Asia was driven by the region's substantial adoption rates, with a keen awareness of the region's potential impact on global trends. Engaging with policymakers revealed two significant challenges hindering broader adoption: financial viability and capacity constraints. Financial viability emerged as a primary concern, underscored during discussions at the Bangladesh National Forum. Additionally, capacity issues related to maintenance and operations at the local level were identified, along with the need for appropriate equipment in various departments, as observed in Pakistan. Sharma highlighted



these challenges as not only relevant to South Asia but also applicable to other regions considering solar irrigation adoption. Recognizing the importance of addressing these gaps, Sharma endorsed the idea of developing a concise one-pager outlining SDC's support for solar irrigation projects. She expressed willingness to collaborate with Ravindranath and the IWMI team to create this document, indicating its potential utility in advocating for continued support and understanding the rationale behind SDC's involvement in such initiatives.

Overall, Sharma's remarks underscored the strategic approach of SDC India towards supporting solar irrigation projects, focusing on addressing key barriers to adoption rather than duplicating efforts in technological innovation. By identifying and targeting these challenges, SDC aims to facilitate wider uptake of solar irrigation technologies, not only in South Asia but also in other regions where similar obstacles exist.

### **Cornelia Hett**

Cornelia Hett expressed gratitude to Mark Smith for providing insights on the COP event focused on solar, noting the challenges of navigating numerous side events alongside the main negotiations. Despite reservations about the value of such events, Hett acknowledged the significant impact of the solar event and appreciated the positive feedback. She highlighted a missed opportunity in the annual report, noting the absence of information on how the solar project aligns with or contributes to other environmental activities or programs. Given that solar projects receive co-funding and have broader implications, Hett expressed interest in understanding the project's benefits beyond its participation in COP events, suggesting that this information would enrich the understanding of the project's overall impact. Hett encouraged Ravindranath to consider incorporating such insights into the annual report, seeking clarification on whether the presented version was final or still in draft form. This request reflects a desire for a more comprehensive overview of the project's contributions, both within and beyond the scope of specific events like COP.

Overall, Hett's remarks underscored the importance of understanding the broader implications and synergies of solar projects within the context of institutional activities, emphasizing the need for comprehensive reporting to capture the full extent of their impact.

### **Darshini Ravindranath**

Ravindranath acknowledged the suggestion to include information on how the solar project aligns with other environmental activities in the annual report. She affirmed her ability to incorporate this into the report, recognizing the value of highlighting synergies between solar initiatives and broader institutional programs. Ravindranath cited the example of the Bangladesh National Forum, co-organized with the "TAFSSA" initiative, which focuses on electrification and intersects with plans for solarization. She emphasized the potential for interesting overlaps between solar projects and other initiatives in both Asia and Africa, indicating her intent to include a section addressing these connections in the annual report.

### **Mark Smith**

Mark Smith discussed several key points regarding the solar irrigation project and its broader implications. Firstly, he emphasized the significance of upcoming events like the Global Forum and highlighted the need for effective media engagement around such initiatives. He referenced a recent

article by Fred Pierce that underscored existing controversies surrounding solar irrigation but noted that actual usage data contradicts concerns about excessive water consumption. Secondly, Smith recounted his experience in Uganda, where he encountered a company called Nexus Green showcasing solar-powered pumps. Despite widespread assumptions that solar irrigation technology has reached maturity, Smith discovered that donor support still plays a crucial role in funding such projects, raising questions about their long-term sustainability and business viability. Thirdly, Smith addressed the impact of solar irrigation within IWMI's broader strategies. He mentioned the organization's renewed focus on climate change mitigation and decarbonizing water systems, positioning solar irrigation as one component of these efforts. This highlights the project's resonance within IWMI's overarching goals and its potential contribution to addressing climate challenges. Lastly, Smith discussed IWMI's approach to collaborative action, emphasizing the importance of partnerships with diverse organizations to drive meaningful change. He highlighted the solar irrigation project as an example of effective collaboration, illustrating how it informs policy changes and investment strategies. Overall, Smith's insights underscored the ongoing relevance and complexity of solar irrigation initiatives, highlighting the need for continued research, strategic planning, and collaborative action to maximize their impact within the broader context of climate change and agricultural development.

### **Divya Sharma**

Sharma reflected on the recent article by Fred Pearce, noting that it had been brought to her attention by the Deputy Secretary of the Ministry of New and Renewable Energy, India, who also happens to be a Yale graduate. This official expressed interest in the solar project's perspective on the article and requested further information. In response, Sharma shared a brief prepared by her team, which was well-received, sparking discussions about potential joint publications. Sharma acknowledged the limitations of the research, which focused primarily on the Bangladesh and India cases. However, she highlighted the growing interest from government entities in understanding the project's outcomes, citing engagement at both the national level in India and through forums like the National Forum in Bangladesh. She emphasized that various departments, including agriculture, showed keen interest, indicating a broader recognition of the project's importance. Despite the current research's regional focus, Sharma suggested that deeper exploration of the topic might be warranted in the project's next phase. She expressed gratitude for the mention of the article and its relevance, indicating that it served as a catalyst for engaging with government stakeholders and potentially shaping future research directions. In summary, Sharma's remarks underscore the project's growing recognition and interest from government bodies, fuelled in part by external articles like Pearce's.

### **Darshini Ravindranath**

Ravindranath addressed a couple of queries, noting plans to involve the media in an upcoming event but emphasized the need to consult with SDC beforehand. She mentioned the recent development of a communication strategy that includes a list of potential media contacts and expressed willingness to discuss how this aligns with the objectives of the global forum. Regarding the groundwater question, Ravindranath suggested deferring to Dr Sikka, who has cautioned against becoming overly enthusiastic about certain results. She invited Dr Sikka to provide insights on the matter.

## **Alok Sikka**

Dr Sikka provided insights on the variability and location-specific nature of the impact of solar irrigation. He emphasized the importance of avoiding overgeneralization, noting that the effectiveness of solar irrigation schemes is highly contingent upon hydrogeological conditions, crop types, and land use patterns. Sikka discussed two case studies to illustrate this point. In Gujarat's Sky scheme, farmers are incentivized for water conservation by being paid for feeding surplus energy back into the grid. This model results in a balance in pumping behavior, with little to no increase observed. Conversely, in Bangladesh, where diesel pumps were previously used, the adoption of solar pumps has led to cost savings for farmers and reduced groundwater extraction. However, during drought-like conditions, there was increased extraction to protect crops, highlighting the seasonal variability of groundwater use. Sikka stressed the need to avoid broad generalizations based on limited data or anecdotal evidence. He cautioned against sensationalizing stories without empirical support, emphasizing the importance of assessing solar irrigation projects across various typologies to draw more accurate conclusions about their impact. He referenced the challenges faced when colleagues present research findings, as some statements lack data support and rely on anecdotal evidence, complicating efforts to provide accurate justifications.

Sikka highlighted the importance of recognizing the location-specific nature of solar irrigation's impact, cautioning against generalizations. He noted that in areas like Punjab, where 99% of the land is already irrigated, even if free energy were provided, farmers might not increase pumping due to limited land availability. To address this, Sikka mentioned the use of modeling and simulation approaches to predict the potential impact of solar irrigation under various scenarios. He emphasized the need for caution when assessing the wider impact of solar irrigation, pointing out that only a small percentage of pumps may currently be solar powered in many areas. By employing modeling and simulation techniques, researchers aim to forecast the consequences of broader adoption more accurately. Sikka briefly mentioned how solar irrigation initiatives intersect with other IWMI projects, such as an agroecology initiative in Mandla district. This integration aims to align agricultural practices with sustainable principles by replacing diesel-powered pumps with solar alternatives. In response to Divya's comment on addressing high-level policy questions, Sikka acknowledged the importance of this aspect and indicated that IWMI had covered some of these topics in earlier presentations. He committed to refining the narrative for the upcoming global forum to ensure comprehensive coverage of policy-related issues, including subsidies, inclusiveness, and sustainability. In conclusion, Sikka expressed gratitude for the discussion and acknowledged time constraints. He deferred further elaboration on additional topics and handed over the floor to Demenge and Smith.

## **Closing**

### **Jonathan Demenge**

In his closing remarks, Jonathan Demenge expressed gratitude for the fruitful discussion and emphasized the need to simplify and provide a powerful narrative despite the inherent challenges and limitations in the data analysis process. He underscored the importance of translating scientific findings into impactful policy actions, a goal that the project has excelled in. Demenge also commended the efforts made to reinforce gender inclusion and stressed the significance of investment in the Innovation Fund for future endeavors. Looking forward to the Global Forum, Demenge expressed anticipation for the presentations and emphasized its importance in attracting potential partners for the project's next phase. He thanked

Hett for initiating the discussion and highlighted the alignment between IWMI's new strategy of transforming water systems through collective action and the project's objectives.

Demenge concluded by acknowledging the project's contribution to the green energy and sustainability transition, particularly in addressing the water-energy-food Nexus. He praised the project for symbolizing the poetic synergy between sunlight and water, essential for sustaining life. Demenge's remarks reflected appreciation for the project's achievements and optimism for its future endeavors, highlighting the significance of collaborative efforts in advancing sustainable development goals.

### **Mark Smith**

In his brief statement, Mark Smith reflected on the common concerns raised about solar irrigation, drawing from his experience in the conservation field. He acknowledged the legitimacy of these concerns but emphasized that solar irrigation is already in use and thus the focus should shift towards optimizing its usage sustainably rather than debating its existence. Smith highlighted the importance of understanding how to utilize solar irrigation effectively, considering its prevalence. He referenced an article by Fred Pearce, suggesting that the challenge lies in harnessing solar irrigation in the best possible manner. He commended the project for addressing this challenge effectively, indicating its relevance to the broader discourse on sustainability.

Looking ahead to the global forum, Smith anticipated further exploration of these key questions and collaboration within diverse networks to advance sustainable irrigation practices. He concluded by expressing gratitude for the opportunity to engage in this discussion and the project's efforts in tackling the pertinent issues surrounding solar irrigation. Smith's remarks underscored the project's commitment to finding practical solutions to enhance the sustainability of solar irrigation systems.

### **Dr Alok Sikka**

Dr Sikka concluded the session by saying that he looked forward to seeing the participation of all in the next month for the Global Forum.

### **SM Monirul Islam**

S.M. Monirul Islam reflected on the learning experience of the session, expressing gratitude for the opportunity to learn rather than comment. He indicated a willingness to contribute to the future discussions based on his experiences. Islam emphasized the importance of political will at the highest government levels, suggesting that it could pressure stakeholders to hasten their actions. However, he cautioned that this pressure might lead to problems in the market if not managed properly. He highlighted the potential for distortion and setbacks if stakeholders do not adhere to a structured business model. Drawing from past experiences, Islam expressed concerns about the consequences of such distortions and the lack of coordination resulting from the absence of clear business models among stakeholders.

# 9<sup>th</sup> PSC Meeting

## SDC-SoLAR Project

21<sup>st</sup> March 2024



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## Introduction

- A summary of activities and results from 1 Jan 2023 until 31 December 2023.
- 2023 was the fourth year of the project and overall implementation has accelerated and progress is on track to deliver outcomes set out in the original project plan.



# Welcome and Program Highlights

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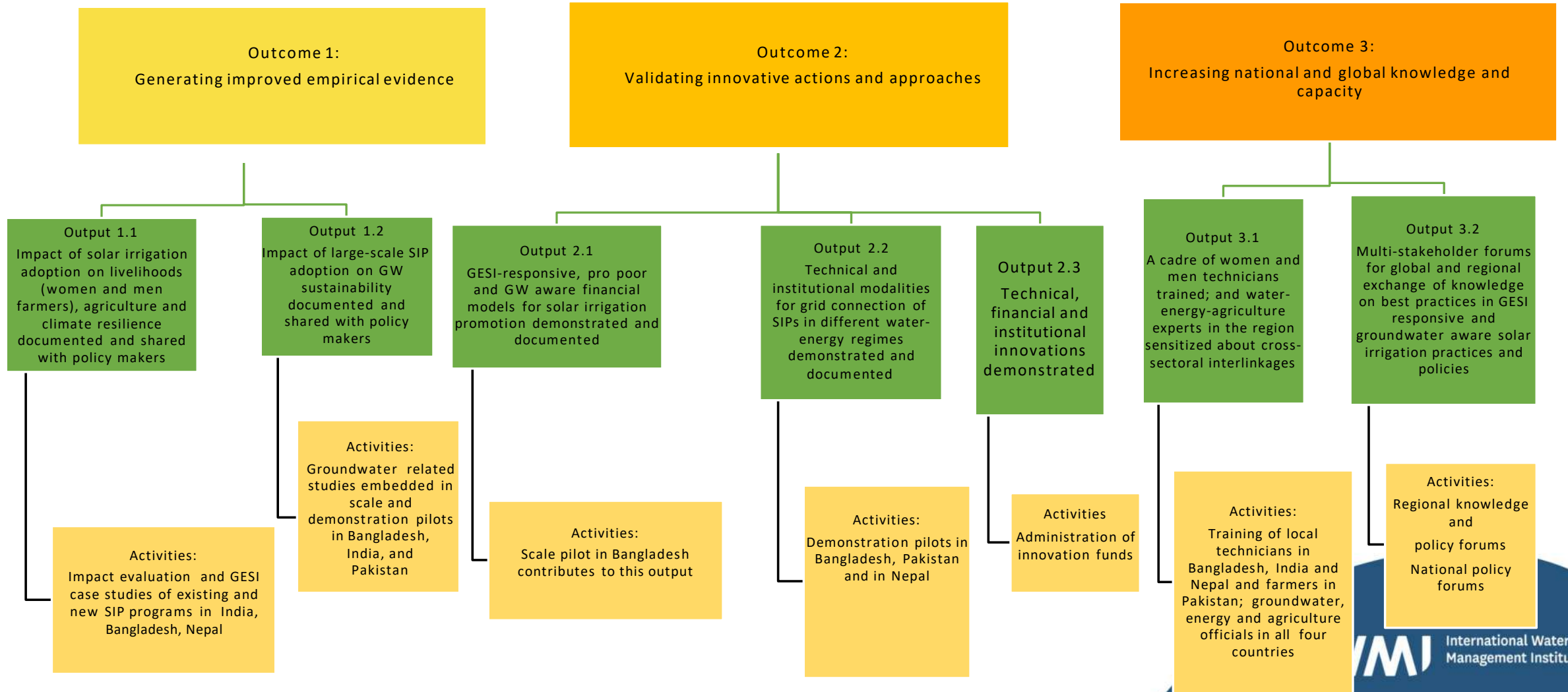


## 2023 Program Highlights

- Successfully **providing support to governments on implementation** of SIP programs in project countries, including improvements in GESI outcomes.
- **Capacity-building interventions** under the project have had a positive impact on the effectiveness of ongoing SIP programs.
- Cross-country learning from the project has been instrumental; the project is **fostering regional knowledge integration** effectively
- **Strong impact driven research findings on groundwater and adaptation co-benefits** that contribute to global discourses on solar irrigation.

## Goal

To contribute to climate-resilient, gender-equitable, and socially-inclusive agrarian livelihoods in Bangladesh, India, Nepal, and Pakistan by supporting government efforts to promote solar irrigation



# Project Outcomes

**Outcome 1** Improved empirical evidence leading to mainstreaming of climate resilient, GESI responsive and groundwater-aware solar irrigation promotion policies

**Outcome 2** Innovative actions and approaches for gender and socially inclusive and groundwater aware solar irrigation are validated

**Outcome 3** Increased national/global knowledge and capacity for GESI responsive and groundwater aware solar irrigation policies and practices

# Overview of Outcome-based findings

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# Outcome 1

**Improved empirical evidence leading to mainstreaming of climate resilient, GESI responsive and groundwater-aware solar irrigation promotion policies**

## Output 1.1: Impact of solar irrigation adoption on livelihoods (women and men farmers), agriculture and climate resilience documented and shared with policymakers.

- Evaluation of farmers utilizing grid-connected solar irrigation pumps
- Generating evidence on adaptation and mitigation benefits to support country's SIP expansion and secure finance
- Compare alternative off-grid business models, empirically estimate and show the adaptation co-benefits of SIPs for farmers
- Farmers' responses to solar irrigation pumps and evaluation of the feeder-level solarization
- Impact of SKY on women farmers
- Publications from Nepal with a focus on women and marginal farmers
- Policy review for Nepal and Bangladesh were all completed.
- GESI case studies will be undertaken in 2024 to complement the impact evaluation studies.

# Bangladesh

Compared three distinct SIP implementation modalities: assessing their appropriateness for scaling SIPs in BD.

1. Community-managed SIP model,
2. Individual ownership model,
3. Fee-for-service model

Policy brief on scaling SIPs shared with CPMC members and IDCOL

# Bangladesh

## SIPs have important adaptation benefits for farmers beyond mitigation

- Diesel use reduced by 89% within SIP command area, **~2.8 metric tonnes/year**
- **SIP buyers pay 20-30% lower charges compared to diesel pumps**
- IDCOL SIPs very convenient for buyers ==> **Times savings (lost wages) in irrigation management + Underground pipes lead to savings in land and labor**
- Positive effect of SIP access on food security and profitability from dry-season paddy (6400-6900 BDT/Acre gain)
- ~6% increase in boro coverage in cultivated area

## Drudgery of operating diesel machines



Strengthens argument for investing in SIPs ==> engagement with donors (KfW) and other officials, IDCOL got investments from KfW,

GCF proposal submitted inputs from our research

Policy brief on scaling SIPs shared with CPMC members from our results



# India

- Evaluation of farmers utilizing grid-connected solar irrigation pumps
- Farmers' responses to solar irrigation pumps and evaluation of the feeder-level solarization
- Impact of SKY on women farmers
- GESI case studies will be undertaken in 2024 to complement impact evaluation studies.



# Nepal

- A study investigated how state and non-state actors have implemented three solar irrigation pump (SIP) programs in Saptari district, with a focus on women and marginal farmers.
- Desk assessment carried out to determine emission factors due to the use of diesel pumps for irrigation shows that the diesel pump uses **13,870 m<sup>3</sup> (kL)** of fuel annually, emitting **34,549 tons of CO<sub>2</sub>** and **49.24 tons of CH<sub>4</sub>**.

# Summary of GESI work in Nepal

- *(Shrestha et al., 2023)* summarizes the following impact of SIP
  - Women Friendly – YES
  - Change in Gender Stereotypes – NO
  - Change in Gender Relations – NO
- *(Khadka et al., 2024)* conducted GESI Policy review shows sectoral policies show variability in the understanding and embeddedness of gender and inclusion
  - **Agriculture policies** show greater GESI responsiveness
  - **Energy policies** show much lower GESI awareness, seeing energy as gender-neutral



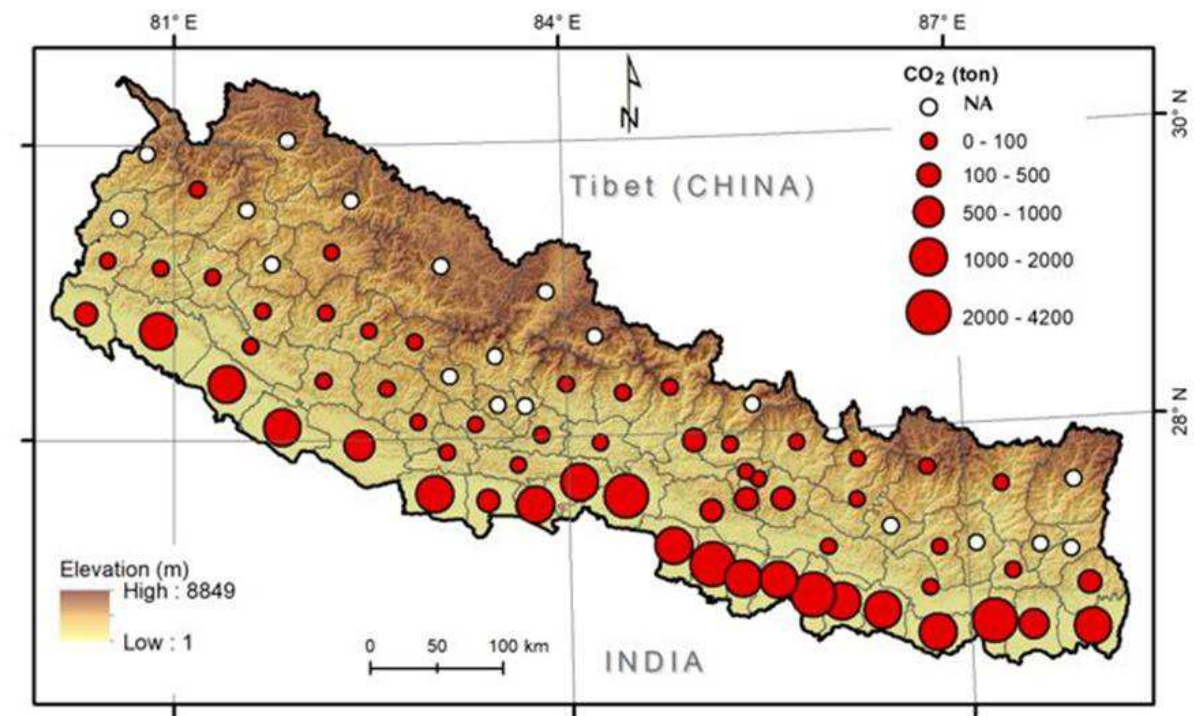
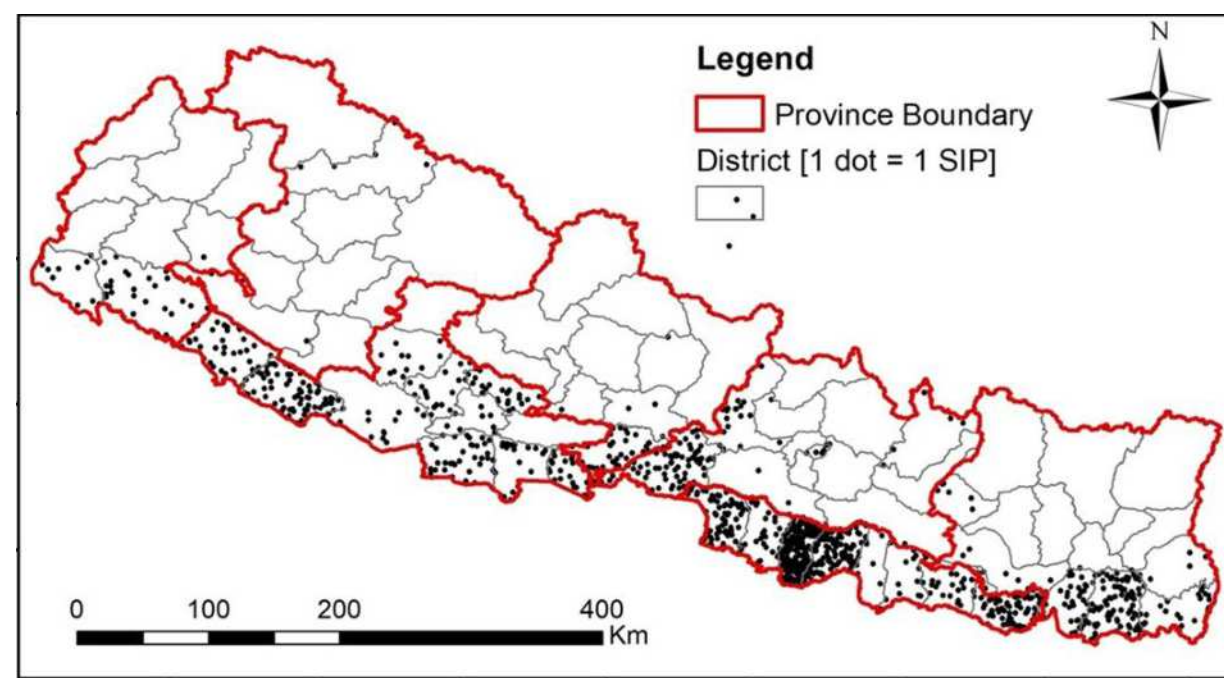
# Summary of HH and Phone Survey

## SIPs reduce diesel use

- Strong reduction in the use of diesel pumps for SIP farmers compared to non-SIP farmers (*Phone Survey, 2021*)
- SIP farmers reduced diesel pump use by 64 and 33 percent for monsoon paddy and wheat, respectively (*HH Survey, 2021*)

## SIP Farmer has more revenue (*Phone Survey, 2021*)

- SIP Farmers earned 10% more crop revenue than non-SIP Farmers
- SIP farmers from the Disadvantaged group reported higher benefits
- *SIP owners tend to devote more land to vegetables*



## Output 1.2: Impact of large-scale SIP adoption on groundwater sustainability documented and shared with policymakers

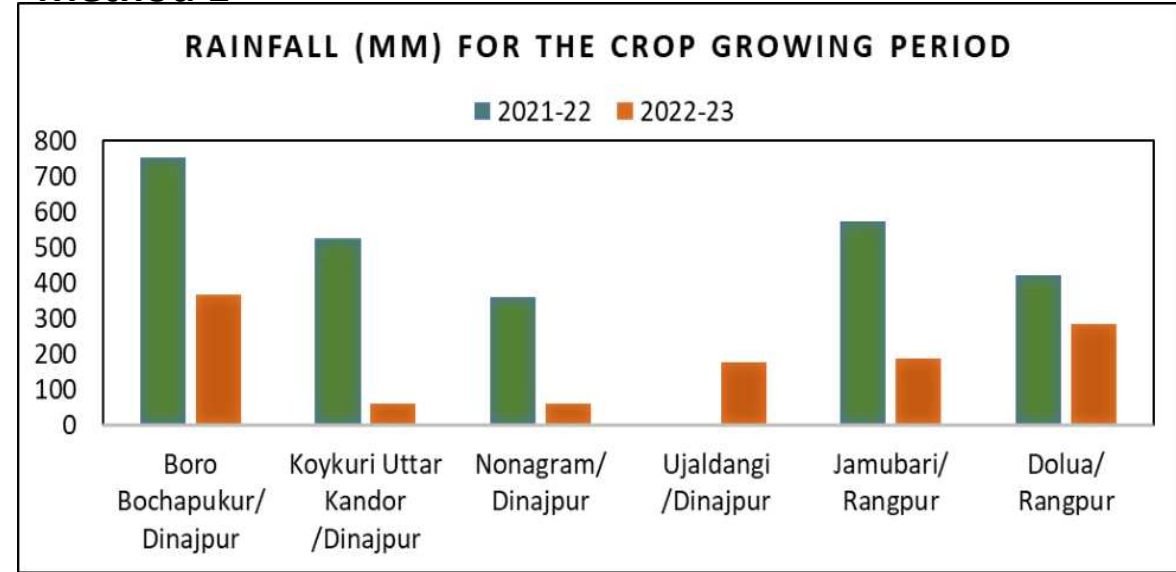
- Groundwater studies related to the design and scaling of on-grid solar irrigation programs in water-stressed areas
- Estimating groundwater abstraction in irrigation using energy consumption
- Generating empirical evidence using groundwater tubewells; groundwater management practices.

# Bangladesh

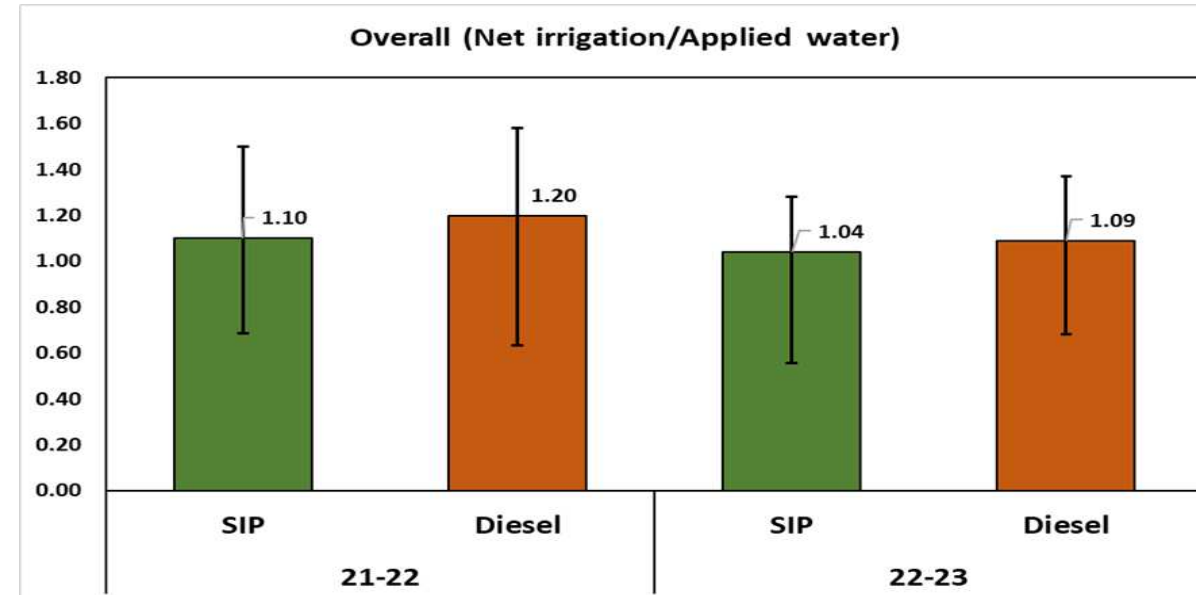
- Based on 2 years of groundwater data, key findings shared with government officials, IDCOL, donors
  - Currently no significant difference (overall) between irrigation water application for Boro between solar and diesel farmers (using 2 different methods)
  - Under these assumptions, SIP upscaling scenario show no significant changes in GW level in the region
  - If cropping pattern changes in regions with low irrigation usage, then implications would be different
  - Solar suitability mapping (ongoing) to address the likely threat of GW over-exploitation risks

## Comparing SIP and diesel water use

### Method 1



### Method 2



# India

**"Comparing groundwater pumping behavior of solar and non-solar irrigation farmers in Gujarat, India"** assessed impact of the SKY program on farmers' groundwater pumping behavior.

- Average water use for solar and non-solar irrigation farmers was 533 mm/year and 608 mm/year, respectively.

**"Does incentivizing grid-connected solar farmers influence the pumping behavior of farmers,"** assessed increase in pumping time (minutes) for SKY consumers compared to Non-SKY consumers post-scheme implementation.

- Suggestive evidence that groundwater extraction has not increased for SKY farmers when compared to non-SKY farmers.

**"Energy Consumption as a Proxy to Estimate Groundwater Abstraction in Irrigation"** proposed an innovative approach that utilizes energy consumption as a proxy for estimating groundwater abstraction in irrigation.

# Pakistan

- “Assessing the behavioral response to groundwater extraction: A move towards solar irrigation in Pakistan” assessed results of behavioral survey. Survey was conducted with 604 farmers (300 SIP farmers and 304 Non-SIP farmers) was conducted in three districts of Punjab province
  - 64% of SIP farmers had ***diesel pumps as prior source of energy***
  - SIP & non-SIP farmers had similar cropping patterns
  - Diesel pump farmers had highest usage of pump as measured in hp-hours per acre
- Data analysis of in-situ instrumentation for year 2023 is conducted, comparing SIP and diesel site in Chakwal district.
  - For 2023, diesel pump is operated for greater number of days as compared to SIP i.e., 340 days for diesel pump and 277 days for SIP (disclaimer: SIP farmer has water storage pond)
  - On average SIP is operated for 6.5 hours and diesel pump is operated for 3.5 hours per day.
  - For 2023, total water extracted by diesel pump is 1.9 times greater than water extracted by SIP. Water extracted by diesel pump is 56187.24 m<sup>3</sup> and water extracted by SIP is 29718.51 m<sup>3</sup>.
  - In-situ instrumentation data is being analyzed.



# Outcome 2

**Innovative actions and approaches for gender and socially inclusive and groundwater aware solar irrigation are validated**

## **Output 2.1: GESI-responsive, pro poor and GW aware financial models for solar irrigation promotion demonstrated and documented**

- Capacity-building workshops aimed at optimizing the use of grid-connected solar irrigation systems
- Assessing the impact of SIP adoption on groundwater markets in Bangladesh.
- Studies in the pipeline to ensure a balanced policy framework.

# Bangladesh

- Impact of SIP introduction on local GW markets and comparing across different business models to understand that the SIP benefits are pro-poor
- The study “Exploring the Implications of SIP Access on Groundwater Markets in Bangladesh” finds that the co-adaptation benefits of lower irrigation price depend crucially on competitiveness of groundwater markets.
- To avoid risk of local monopolies, policy intervention needed to promote competition in the GW market, rationalize the TW permit system
- These have been shared through CPMC meetings and other interactions and meetings. Also, part of the policy brief that is begin developed.

# India

- **Community-based Solar Business Model with Women SHGs (Madhya Pradesh)**
- **Objective:** To experiment with a community-based solar business model involving women SHGs and to disseminate the learning to policymakers
- The implementation of two SIPs is planned, one from the SDC-SoLAR project and one from the One-CG Agroecology initiative, at two different sites



## **Output 2.2: Technical and institutional modalities for grid connection of SIPs in different water-energy regimes demonstrated and documented**

- Several initiatives are underway, including working with energy extension agents ('Kusum Mitra')
- Implementing a community based solar business model
- Conducting a choice experiment study for feed-in-tariff, and exploring potential business models.

# Bangladesh

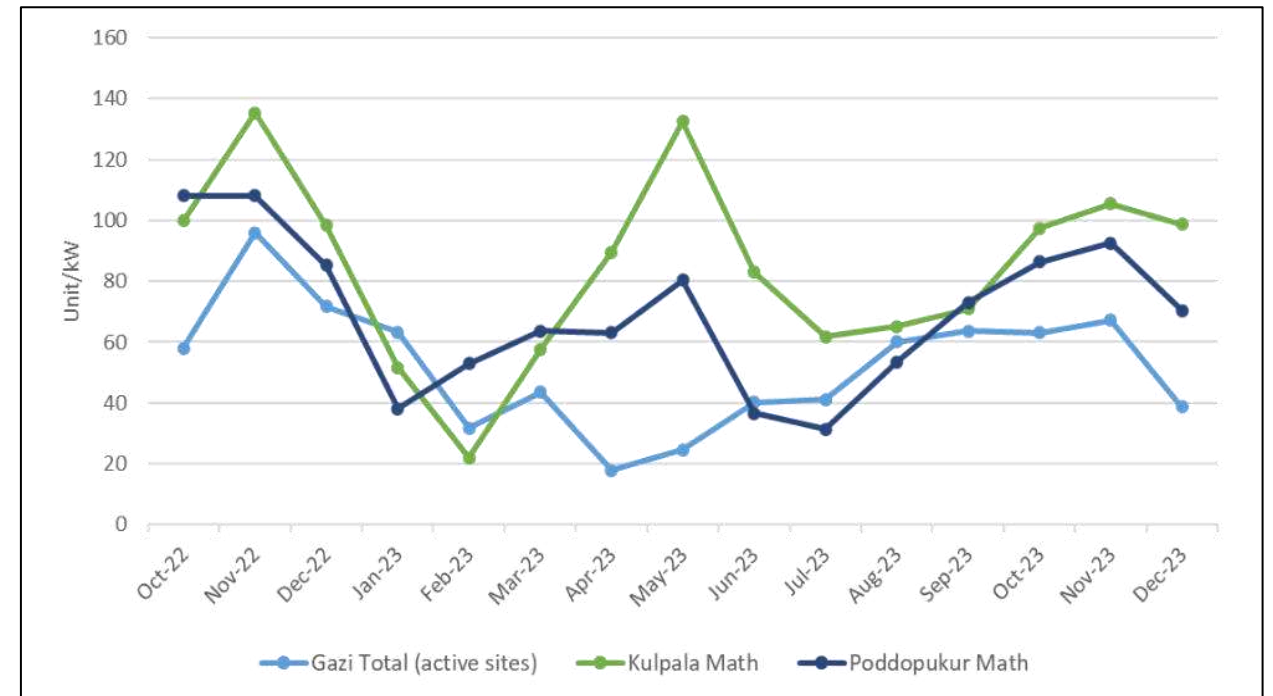
- **Low capitalization is a challenge – 6 SIPs grid-connected in end 2022**

within 15 months total 138000 units exported to the national grid. Sponsors earned ~7.4 lakhs BDT and the estimated savings on electricity subsidy is calculated to be close to 7 lakh BDT.

- **Two recommendations -**

- Future investment in SoLAR should prioritize grid-integrated systems
- Grid-integration of existing off-grid systems should be incentivized through higher tariff and net-metering options.

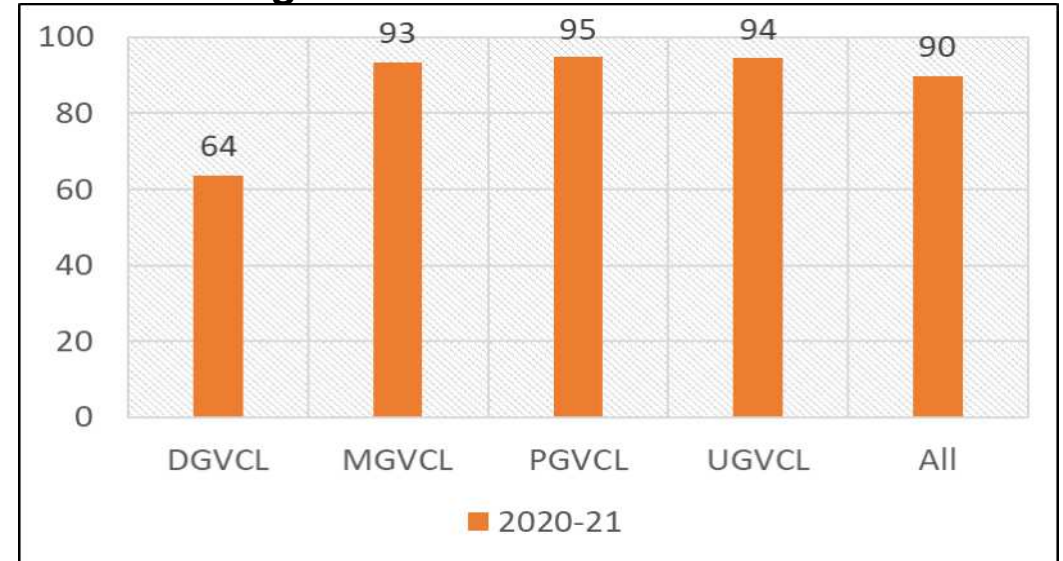
- **Results and recommendations shared with KfW, implementing departments, SREDA**
- **Theft is a major challenge (GTI, Transformer etc.)**



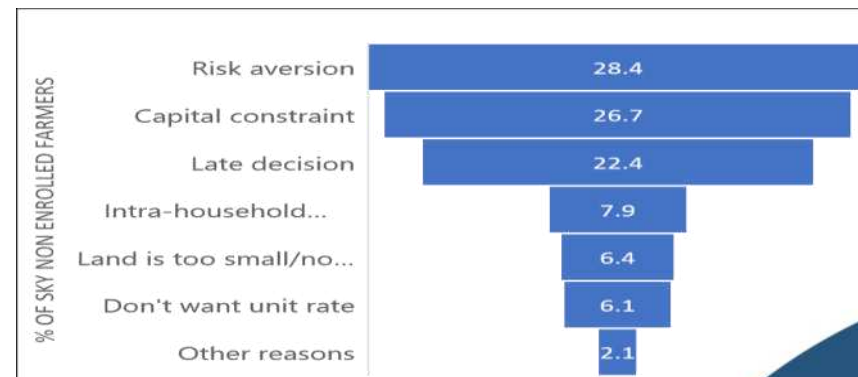
# India

- **Financial aspects** : The study assessing the impact of SKY on farmers revealed that farmers earned INR 17,461 through the sale of electricity back to the grid.
- **Technical aspects** : 90% of the farmers participated in scheme evacuating electricity to the grid.
- **Non-adoption reasons** : Financial constraints and perceived risks were frequently cited as reasons by non-enrolling farmers for not participating in the scheme.

**% of SKY beneficiaries who evacuated energy back to the grid**



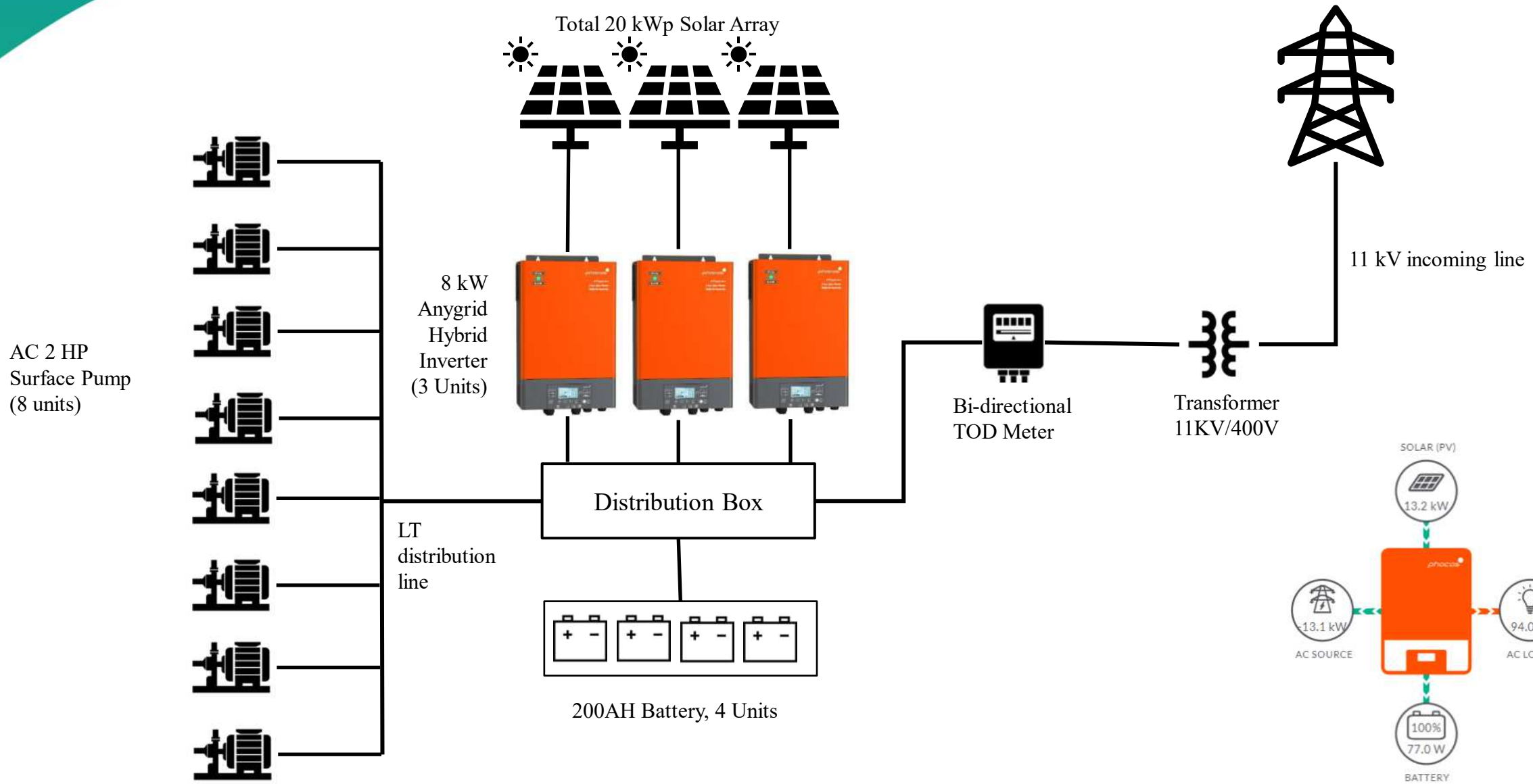
**Reason for non-enrolment**



# Nepal

- Due to low utilization, In partnership with AEPC, NEA, Local Government and Farmer's user community, one of Nepal's first grid-connected Solar Irrigation project was **commissioned in January 2023**.
- Early findings indicate **reduction in diesel use** and **increase in irrigated area**.
- The pilot farmers made **additional income** from selling water to their neighbors.
- **46 farmers** took part in a two-day capacity-building workshop in Parsa that was focused on maximizing the use of grid-connected solar irrigation systems.





Schematic diagram of Grid-connected Solar Irrigation Pilot

# Capacity building of Farmers



# Pakistan

Choice experiments were conducted with more than 200 farmers in three different districts Chakwal, Jhang, and Rahim Yar Khan. Study assessed the farmer's willingness towards the sale of surplus electricity to the grid, in exchange for a feed-in-tariff.

- Choice experiment suggested that at a tariff of 20 Rs. / kWh for electricity, farmers would see ~30% greater utility in solar-irrigated farm area
- During kharif season, vegetable, sugarcane, cotton, and wheat farmers sold less electricity than maize, rice, and orchard farmers.

## **Output 2.3: Technical, financial and institutional innovations demonstrated**

# Innovation Fund Grantees

Four Innovation Fund Grantees submitted their completion reports in 2023: SwitchOn, Gham Power, URMUL, CINI

Case studies of IF grantees are being prepared

A summary report detailing the work of the Innovation Fund Grantees is currently being prepared and will be submitted in 2024.

# Innovation Funds

## Switch on

Switch ON implemented a project installing 20 SIPs for micro-irrigation, benefiting 200 women farmers.

To promote micro solar pump adoption through awareness and capacity building, they have established an ecosystem of technological and financial innovation and created a Revolving Guarantee Fund (RGF) for micro solar pump lending to women farmers for sustainability. The result suggests :

- Improved economic conditions and asset creation for women farmers
- Enhanced awareness, knowledge, capacity, and skills among women farmers
- Development of a financial ecosystem supporting the scaling up of solar-powered irrigation



# Innovation Funds- Posters

## SoLAR IF GRANTEE

Case study series



### Switch On

Mini Solar Pumps for Women Farmers\* or MSP4WF under IWMI SDC SoLAR

#### Project objectives

- Empowerment of small and marginal women farmers in the districts of West Bengal by creating solar assets in their name while enhancing income generation through crop and livelihood diversification.
- To replace diesel/grid powered irrigation pumps with solar powered irrigation solutions through the provision of clean and cost-effective water solutions.
- To develop replication potential by engaging stakeholders - financial institutions, policy makers and end-users.



#### Project Impact:

- Availability of timely and affordable water helped farmers to diversify crop patterns throughout the year. Increased economic independence of women farmers and asset creation for them.
- Reduction of CO<sub>2</sub> emissions through replacement of diesel and electric pump sets.
- Development of a financial ecosystem support mechanism for scaling up of solar powered irrigation. First Loan Default Guarantee (FLDG) Model: A support during challenging times for women farmers-

#### Solution implemented:

- Identified 30 women farmers, by carrying out detailed study and baseline survey of 11 districts in the 5 identified agro-climate zones.
- Arrangement with bank for the loan component and use of IF grant as a collateral security. Water Users Group formation and creation of innovative solar water pumps financing solution (FLDG Model).
- Training and capacity building to manage projects locally.



#### Major lessons/ Key learnings/Reflections from the project:

- Women led water user associations as platforms of change. Promotes community water management system and knowledge sharing to help other farmers.
- Need to identify and integrate livelihoods avenues for women farmers in next phases.
- IF grant was instrumental to create a financial ecosystem, which is the backbone for success of the project.



## SoLAR IF GRANTEE

Case study series



### CInI

Excess Energy Accumulation and Redistribution Network (EARN)

#### Project objectives

- To setup network which will allow aggregation and transfer of excess energy of selected 3 solar pumps installed in selected location in Khunti district, Jharkhand.
- To use excess energy generated from 3 Nos of 5 hp solar irrigation system in Khunti district to run productive equipment's such as flour mills/chaff cutters/paddy threshers, etc.
- Connecting solar systems, monetizing excess solar energy in real time.



#### Project Impact:

- An integrated innovative approach to deploy solutions and services in rural areas.
- Job creation in the village. Villagers are now able to get facility within the village, saves time and money for them.
- CO<sub>2</sub> savings by use of DRE.

#### Stages of Implementation



#### Solution implemented:

- Developed a solution design (technologies, business models, operation models, funding models and implementation roadmap) to tap excess energy.
- Three irrigation pumps in different locations were tapped and a single cable brought to a facility center to operate rice mill, flour mill and oil expeller.
- Trained operator manages the facility center and center has created avenue for income generation in the village.



Scenario	Revenue	Cost	Net Profit
Scenario 1	10000	5000	5000
Scenario 2	15000	7500	7500
Scenario 3	20000	10000	10000



#### Major lessons/ Key learnings/Reflections from the project:

- Onboarding Gram Sabha and local institutions is critical.
- Identifying and capacity building of local entrepreneur ensuring adequate market linkages are present.
- IF grant helped to prove the concept on ground to create large scale replication.



## SoLAR IF GRANTEE

Case study series



### KARMA

Mobile URJA- Scalable Solar Power with Innovations beyond Silicon Technology

#### Project objectives

- To develop mobile solar power (mobile URJA) units that will deliver affordable and sustainable energy for irrigation with universal charging option resulting in a simplified rental model having multiple uses.
- Field testing of mobile URJA using flexible and fixed solar panels for irrigation with IoT devices
- Use of mobile URJA in other activities such as rice mill, flour mill, aerator for fish farming.



#### Solution implemented:

- KARMA has developed mobile pumping solution using two types of solar panels: a) Copper Indium Gallium Selenide (CIGS) based light-weight and flexible solar panels and b) Poly crystalline panels.
- Mostly farmers use 2 or 3HP water pumps but often they are oversized. To tackle optimum use of energy and water, KARMA, introduced the first solar micro-pump of below 1HP in India that is certified by the Ministry of New and Renewable Energy (MNRE).
- The Mobile Urja will not only be used for irrigation by multiple farmers but will also power other electrical loads.



#### Project Impact:

- Mobile Urja has created opportunity for farmers to irrigate remote areas also where access to water was a problem.
- Easy to move from place to place, Plug-and-play system and theft proof.
- Multiple farmers can use one system and easy to maintain



#### Major lessons/ Key learnings/Reflections from the project:

- The IF grant enabled the first integration of lightweight and flexible solar panels with solar pumping in the world.
- The high price of solar flexible panels and the challenge in collecting user fees in the rental model were the biggest challenges for scaling up. Digital payment system will be useful.
- KARMA is trying to create a culture of sharing model (read as uberization of irrigation) and/or an entrepreneur model.



## SoLAR IF GRANTEE

Case study series



### URMUL

Solar Powered Hydroponic Fodder Station

#### Project objectives

- To provide a consistent and nutritious source of green fodder for livestock in the Thar Desert, Rajasthan.
- To reduce the environmental impact of fodder production through water-efficient hydroponic systems.
- To enhance livestock health, productivity, and overall farm profitability



#### Solution implemented:

- Given the low probabilities of ground-based agriculture in the region, low-cost customized hydroponics proved to be a viable solution.
- DRE based innovations to promote better availability of green fodder throughout the year in the desert landscape.
- Grow high quality green fodder without soil and maximize space utilization with vertical farming techniques.



#### Project Impact:

- Project has demonstrated a functional net-zero dairy model. More than 1,000 farmers are impacted positively.
- Improved access to nutrition fodder positively impacted the health and well-being of livestock, helped community and enhanced income of farmers.
- Adaptation of hydroponic fodder solution has helped in reduction of water usage and reduction in carbon footprints

#### WHAT DO WE DO?



#### Major lessons/ Key learnings/Reflections from the project:

- Rapid growth: fodder cultivated hydroponically exhibits remarkable growth rates compared to traditional soil-based methods.
- Water Efficiency and nutrient rich fodder. Quality Control is crucial for faster growth.
- IF Grant was a great enabling instrument to showcase a successful model and this will help to replicate the model elsewhere.



# Outcome 3

**Increasing national and global knowledge and capacity**



Output 3.1: A cadre of women and men technicians trained; and water-energy-agriculture experts in the region sensitized about cross-sectoral interlinkages

A number of capacity building interventions organized for stakeholders at different levels and the training modules are duly developed.

# Bangladesh



- Two farmers' trainings in co-ordination with IDCOL and DAE for a total of 60 farmers, with the primary aim of educating farmers about solar pumps and on crop-scheduling and water saving irrigation practices.
- A 10-member delegation of government officials (IDCOL, BARC, BADC, DAE, and BREB) from Bangladesh for an exposure visit to Gujarat, India in Feb 2023 and had meetings with farmers, GERMI, and GUVNL officials.

# India

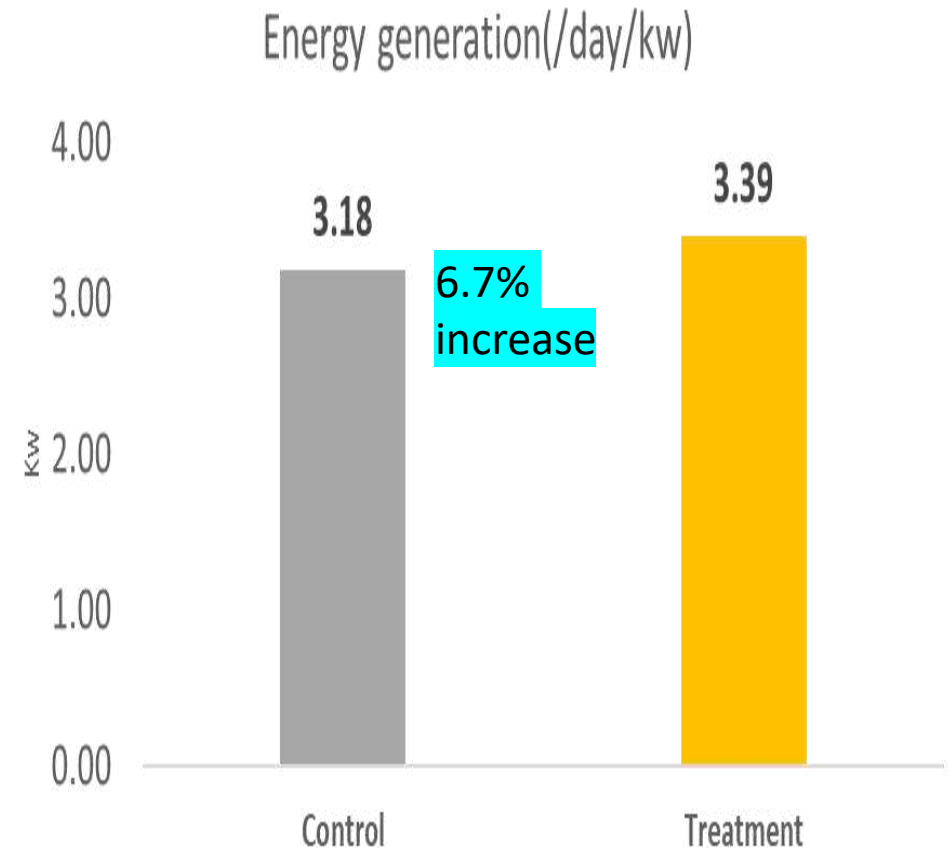
**Training Partners:** IWMI, in collaboration with GERMI and GUVNL

**Participants:** In 2023, we have provided training to 637 farmers

**Objectives:**

- Empowering farmers to enhance their income through grid-connected Solar Irrigation Pumps (SIP),
- Promoting optimal water use,
- Educating farmers on regular maintenance of the Solar Photovoltaic (SPV) system.

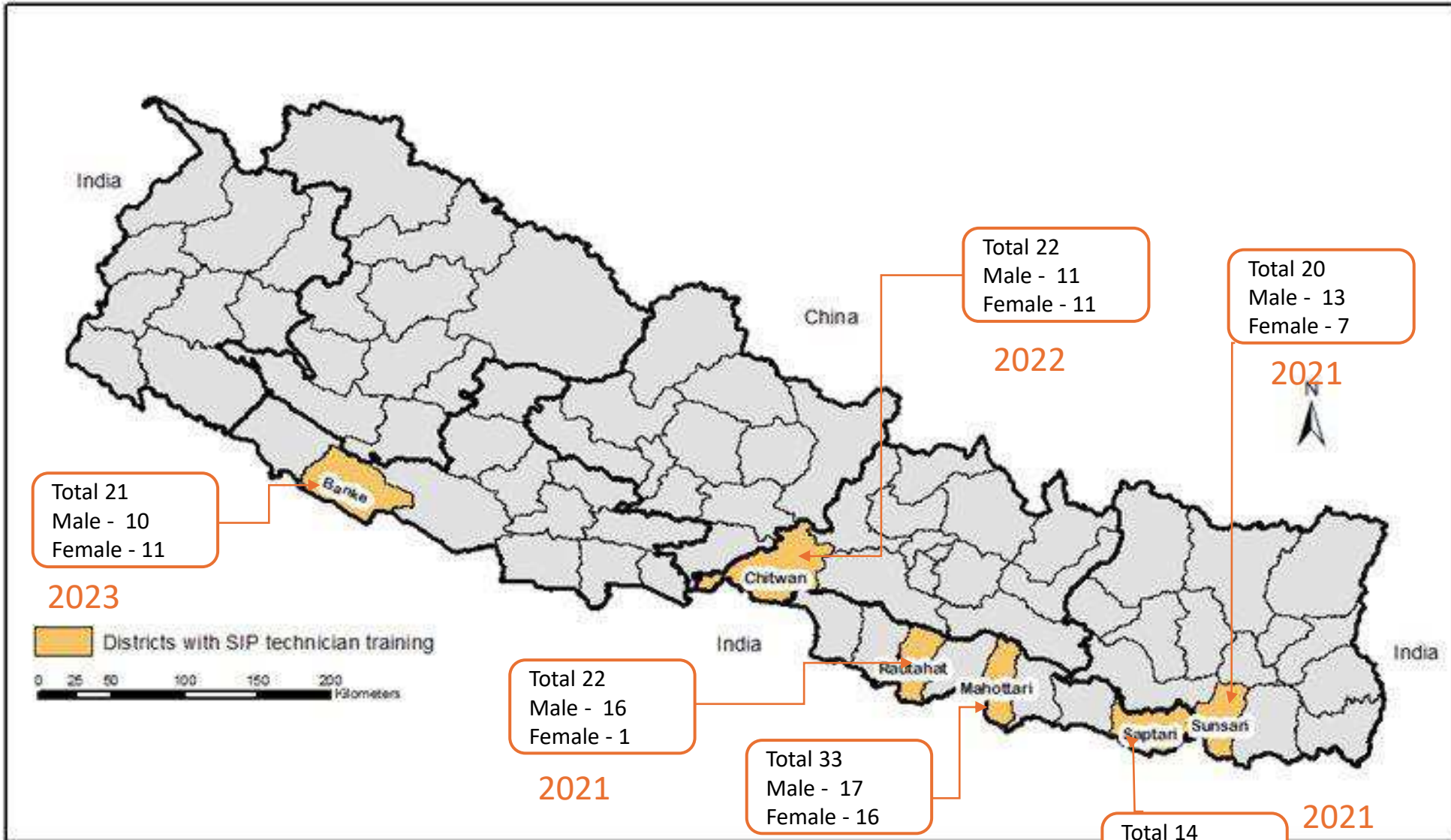
**Significant difference b/w treatment and control group, with treatment group showcasing better performance overtime**



# Nepal – Capacity Building

- **Total Persons Trained – 132**
  - (Male 83; Female 49)
- **2023 – 54 Participants** (50% female)





# Pakistan

- In collaboration with PARC, training of 40 female and 25 male farmers, was conducted on a farm site in Punjab.
  - Farmer's training encompassed topics like effective utilization of solar pumps for precision surface irrigation, drip irrigation, tunnel farming, and alternative uses of solar installed equipment.
  - 2 day training of 25 water professionals, government and private sector partners, on the standardization and selection of solar equipment and subsequent maintenance was conducted in Islamabad.

Female farmers group photo



Male farmers group photo



Output 3.2: Multi-stakeholder forums for global and regional exchange of knowledge on best practices in GESI responsive and groundwater aware solar irrigation practices and policies

# Regional Forum (2023)

➤ Organized Regional Knowledge Forum (IWMI, in collaboration with partner organizations) titled "Energizing Agriculture and Enabling Just Energy Transition in South Asia: A Regional Knowledge Forum," at IIT Gandhinagar

➤ **Date:** February 6th to 8<sup>th</sup>, 2023.

➤ **Participants:** Over 170 attendees, including regional researchers, policymakers, and practitioners from the Renewable Energy (RE) sector .

➤ **Key Takeaways:**

- Importance of hydrological surveys for feasibility assessment.
- Financial considerations, innovative models, value chain strengthening, technical challenges and maintenance, and private sector involvement.
- Maximizing capacity utilization, grid integration, and promoting technology and innovation.
- Integrating gender perspectives into policy design.
- Prioritizing capacity building, market linkages, and gender-inclusive approaches.
- Need for proactive policy formulation and capacity building at all levels.





# National Forums

- National forums were held in Nepal and Pakistan during their respective Water Weeks in April and December 2023.
- Bangladesh National Forum held in February 2024
- India National Forum held in March 2024
- Nepal will be in April 2024



# COP28

A collaboration between IWMI and International Solar Alliance (ISA) led to a series of events that brought together diverse partners, global experts and leaders to share their thoughts.

- Accelerating Solar Irrigation for Agricultural Resilience: Lessons from South Asia shared findings from the SoLAR project
- Solar Energy for Agriculture and Rural Livelihoods: Opportunities for South-South Learning and Cooperation



# Key Lessons Learnt and Way Forward

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# Lessons Learnt

- SIP programs remain dependent on large financial subsidies
- SIPs have important adaptation co-benefits
- Evidence from the project shows that SIP adopters are seeing visible improvements in their livelihoods
- Off-grid SIPs provide an opportunity to scale up with appropriate business models
- Low-capacity utilization in off-grid models is a challenge requiring alternative uses of energy especially grid-integration
- The effect on groundwater extraction needs to be studied in more contexts and with different lenses
- Need for large-scale capacity-building initiatives to educate farmers about the benefits of grid-connected (SIPs) and mitigating risk-aversion factors.

## Way forward

- Greater focus on work that supports policy development and impact.
- Mainstream GESI into all regional work and provide innovative implementation platforms to better promote solar irrigation among women and marginal farmers.
- Better understand suitability of solar within different contexts
- Enhance south to south learnings (e.g., Africa)
- Improve science communication to policy makers, local governments, and end users

# Communications and Other Activities

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# SoLAR Newsletter Analytics reports



## Click Rate

Highest ever Click-to-open-rate  
**55.50%**

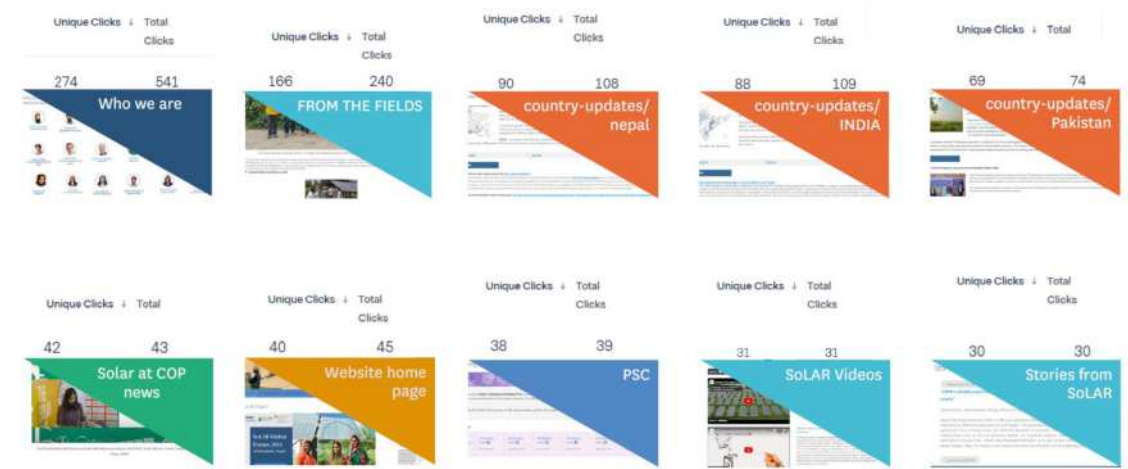
**313**  
CONTACTS  
CLICKED

**55.50%**  
CLICK-TO-OPEN  
RATE

Link	Unique Clicks	Total Clicks
Who we are	274	541
FROM THE FIELDS	166	240
country-updates/nepal	90	108
country-updates/INDIA	88	109
country-updates/Pakistan	69	74
Solar at COP news	42	43
Website home page	40	45
PSC	38	39
SoLAR Videos	31	31
Stories from SoLAR	30	30

## Oct- Dec 2023 Edition clicks

## What are they clicking?



March 2024      September 2023      November 2023



[Access full reports here >>](#)



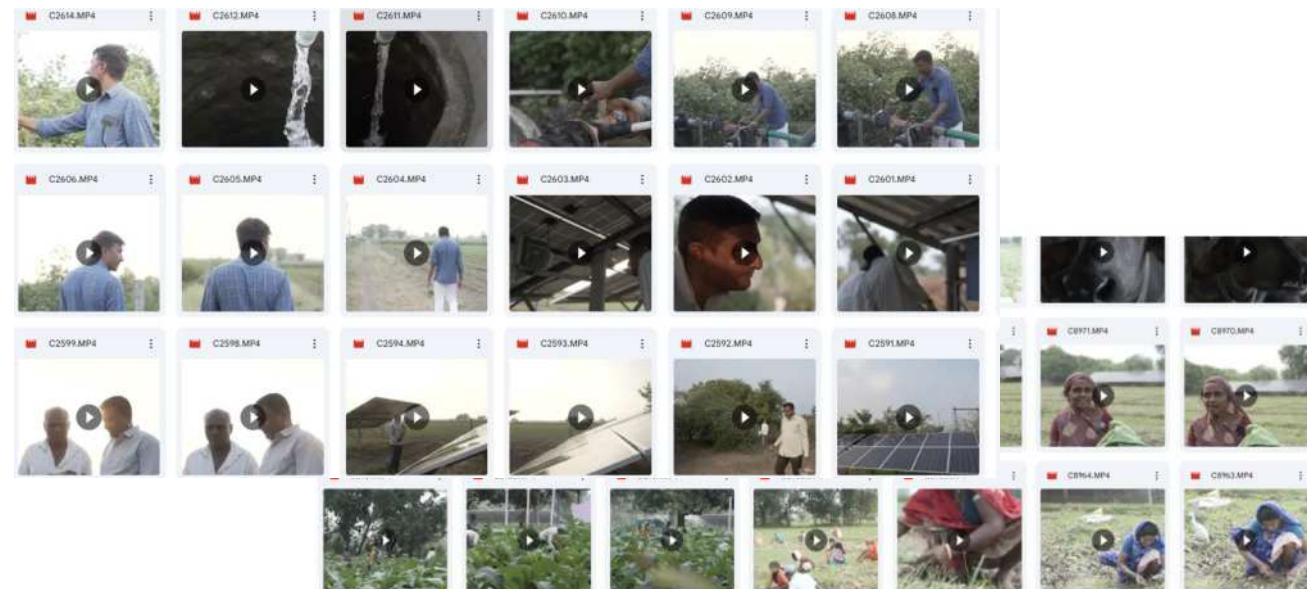
# Gujarat AV

## Game Changer for Sustainable Agriculture: The Promise of Solar Irrigated Pumps

### Campaign objectives-

- Promote the adoption of solar irrigation pumps among small-scale farmers.
- Showcase the success and benefits of the Suryashakti Kisan Yojana (SKY) scheme.
- Advocate for policy support and investment in renewable energy for agriculture.
- Highlight the positive impact of the SKY scheme on farmers' livelihoods, energy access, and environmental sustainability.
- Encourage stakeholders to support and replicate similar initiatives in other regions or countries.
- Provide evidence-based insights into the economic, social, and environmental advantages of solar-powered irrigation.

**Call to action:** Encourage viewers to explore opportunities for solar irrigation and advocate for supportive policies and incentives.



## Recent Events

National forum  
Bangladesh  
54 People attended



[Access all events here >>](#)

National forum  
India

67 People attended



# Snapshots



# Global Forum 2024

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# Global Science-Policy Forum: Socially Inclusive Solar Irrigation Systems

To be held in Kathmandu, Nepal (April 24 – April 26<sup>th</sup>)

Key themes:

1. Groundwater sustainability, adaptation and mitigation
2. Business models of SIPs and scaling up of solar irrigation
3. The role of communities: Capacity building and Gender, Equity and Social Inclusion
4. Designing effective and inclusive policies for solar energy transitions



# Draft agenda



**Global Science-Policy Forum: Socially Inclusive Solar Irrigation Systems**  
 Venue: Hotel Himalaya, Kathmandu, Nepal  
 Date: 24-26 April 2024

**Overview**

Climate change is a major challenge globally, and countries in the Global South are facing large-scale climate variability and are exposed to high risk due to low levels of climate readiness and high levels of fragility. Agriculture, as a sector, is particularly vulnerable due to its dependence on weather and climatic conditions. Climate change affects crop yields, livestock, soil and water resources and in turn impacts food and livelihood security. Simultaneously, agriculture is a major source of Greenhouse Gas Emissions (GHG) emissions both directly (through on-farm emissions linked to production e.g. diesel irrigation) and indirectly (through land use change due to agricultural expansion).

Irrigation is a proven strategy to build resilience in many parts of the Global South, particularly in South Asia; it has reduced exposure to changing rainfall patterns, helped improve yields, and enabled diversification of livelihoods. However, access to irrigation particularly for women and marginalized farmers is constrained by several factors. In parts of East/West Africa and MENA, there is lack of accessible, clean and affordable energy for irrigation. In South Asia, irrigation is becoming increasingly energy-intensive; the proliferation of groundwater irrigation is responsible for 11-12% of the regions' agricultural emissions.

Solar energy, particularly the use of solar irrigation pumps (SIPs), offers a reliable alternative to erratic power supply and costly and high emitting diesel pumps. There is emerging evidence to show the transformational potential of SIPs for livelihoods, agri-food systems and recognizing the agency of women and marginalized groups in climate resilient irrigation for harnessing livelihood opportunities. Communities that have adopted these systems report higher crop yields, extended growing seasons, and increased income generation. With consistent water supply, farmers can diversify their crops, improve food security, and enhance their economic well-being.

However, the optimism is often truncated by questions around the actual impacts on mitigation and adaptation, issues of equity and inclusion in access to and control over SIPs remain a systemic challenge to tackle, given the high cost and capacity needed to install and operate SIPs and limited understanding of SIPs from techno-social, institutional and political perspectives. Critically, concerns around the potential for over-extraction of groundwater in vulnerable areas remain high. Replicability and scalability of solar irrigation has therefore not achieved its full potential.

International Water Management Institute (IWM) and its partners are organizing a three-day Global Forum as a part of its Swiss Agency for Development and Cooperation (SDC) funded project titled Solar Irrigation for Agricultural Resilience in South Asia (SoLAR). This forum will bring together around 150 key stakeholders from across the world to discuss the growing body of work and evidence in South Asia on solar applications in agriculture, particularly bringing together key experiences, insights and promotion of south-south collaboration and scaling up of global ambitions around effective and sustainable use of solar energy in agriculture.

Using learnings from South Asia, this forum will present unique insights on the effectiveness of solar irrigation as a strategy to sustainably manage water, energy, food and climate (mitigation and adaptation) interlinkages. It will highlight how governments are using evidence from the field to develop and deploy ambitious policies and programs on solar irrigation to address nationally determined contributions (NDC) commitments while supporting climate-resilient, gender-equitable, and socially inclusive agrarian livelihoods.

**Scope and Objectives**

The key objectives of the forum are to:

1. Demonstrate key lessons learned from South Asia on the effectiveness of solar irrigation as a viable strategy for sustainable agri-food systems.
2. Provide a platform for policymakers, public and private sector partners, and scientists to exchange ideas and experiences on key barriers and opportunities in the uptake of solar irrigation taking gender and social inclusion into consideration.
3. Share innovative ideas and strategies for supporting south-south collaboration to suitably scale equitable and inclusive solar irrigation globally, including ideas for future research.

The forum will be organized as a three-day conference covering plenary and parallel sessions with presentations and diverse panels under four key thematic areas.

1. Groundwater sustainability, adaptation and mitigation
2. Business models of SIPs and scaling up of solar irrigation

1. The role of communities: Capacity building and Gender, Equity and Social Inclusion
2. Designing effective and inclusive policies for solar energy transitions

Each parallel session will have 2-3 presentations and a 45-minute panel.

## High-Level Draft Agenda

(Detailed agenda will be subject to change and will be shared closer to the date)

TIME	Presentation/Panel	
<b>DAY 1 (24 April)</b>		
08:30 – 09:30	Registration	
09:30 – 09:40	Welcome remarks	
09:40 – 10:20	Opening remarks [x4]	
10:20 - 10:30	Special remarks from the Chief Guest – (Minister/Secretary, Nepal)	
10:30 - 10:45	Special remarks [TBC]	
10:45 - 11:00	Group photo followed by Networking Tea/Coffee Break	
11:00 - 12:30	Panel Discussion 1: SoLAR & the Global Strategic Landscape	
12:30 - 13.30	Lunch	
<b>Theme 1: Groundwater sustainability, adaptation and mitigation</b>		
13.30-15.00	Parallel Session 1 <i>Cross-country learnings – Solar and groundwater</i>	Parallel Session 2 <i>Solar – Climate Adaptation and Mitigation</i>
15.00-15.30	Networking Break	
<b>Theme 2: Business models and scaling up (grid and off-grid)</b>		
15.30-17.00	Parallel Session 3 <i>Effective SIP grid integration models for on-grid and off-grid areas</i>	Parallel Session 4 <i>Establishing sustainable business models</i>
17.00-17.30	Final Plenary	
19.00-21.00	Special Dinner	
<b>DAY 2 (25 April)</b>		
09.00 - 09.30	Opening Plenary	
09.30 - 10.40	Panel Discussion 2 [TBD]	
10.40-11.00	Networking Tea/Coffee Break	
<b>Theme 3: The role of communities: Capacity building and GESI compatible strategies</b>		
11.00-12.30	Parallel Session 5 <i>Designing effective capacity building</i>	Parallel Session 6 <i>Solar and GESI</i>
12.45-13.30	Lunch	
<b>Theme 4: Designing effective and inclusive policies for solar energy transitions</b>		
13.30-15.00	Session 7: <i>Policy presentations and panel discussion</i>	
15.00-15.30	Networking Tea/Coffee Break	
15.30-17:00	Panel Discussion 3: South-South Collaboration	
17.00-17.30	Final Plenary	
<b>Day 3 (26 April)</b>		
09.00-09.30	Opening Plenary	
09.30-11.00	Final Panel discussion: <b>Sector outlook - The future of SOLAR irrigation</b>	
11.00-11.30	Closing remarks	
12.30-17.30	Half day Field Visit (including lunch) <i>ICIMOD, Godavari Centre (TBD) + Community solar pump (TBD)</i>	



Thank You