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SoLAR: Solar Irrigation for Agriculture Resilience

INDIA CONSULTATION REPORT

December 2018

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As farmers struggle to cope with increasing climate uncertainty, they must increasingly rely on irrigation. In much of South Asia, the only reliable source of irrigation that offers on-demand water control is groundwater. The last half-century has seen a rapid expansion of groundwater irrigated area in South Asia. With an annual withdrawal of nearly 300 km³, more than 60% of irrigation in South Asia is today dependent on groundwater. Some argue that this expansion has helped the region achieve food security and banish recurring famines. At the same time, over-dependence on scarce groundwater resources for irrigation has also led to unsustainable farm power subsidies and pockets of severe groundwater depletion – causing much farm distress, affecting poor and marginal farmers; and making electricity utilities financially unviable. The recent decline in unit costs and resultant popularity of solar irrigation in the region promises an opportunity to resolve some of these challenges but also poses a threat to the sustainability of groundwater irrigation.

In September 2018, the Swiss Agency for Development and Cooperation (SDC) and the International Water Management Institute (IWMI) came together to form a regional partnership with the objective of addressing some of these challenges. By adopting a ‘Water-Energy-Climate’ Nexus approach, the partnership – Solar Irrigation for Agriculture Resilience (SoLAR) – will identify, field test and aim to mainstream climate-smart solar irrigation promotion strategies across South Asia. This report presents an overview of early project activities carried out between 1 September and 15 December 2018.

1. SoLAR: Regional Consultation

As part of the IWMI-Tata Partners’ Meet on 4-6 December 2018, IWMI organized the SoLAR regional consultation. The partners’ meet brought together more than 200 participants from around South Asia and the rest of the world. The 3-day event presented and discussed more than 100 new pieces of research in 15 thematic sessions. Those gathered included scientists, researchers, experts, policy makers and donors from India, Pakistan, Nepal and Bangladesh.

Spread over three two-hour sessions, the consultation was organized at the Dr. Kurien Auditorium (National Dairy Development Board Campus, Anand) on 5 December and comprised of more than 15 presentations and expert panel discussions.¹ The consultation also included a visit to IWMI’s solar field pilots in Dhundi and Mujkuva.²

1.1 Session 8A: Prospects of SoLAR in Water-Scarce South Asia

| 5 December 2018 | 11:00 – 13:00 |

Solar Irrigation Pumps: Perfect Antidote to South Asia’s Perverse Energy-Irrigation Nexus

¹ see Annex 1 for the full agenda and Annex 4 for list of invitees to the SoLAR Regional Consultation

² see Annexes 2 and 3 for a list of participants who visited the field pilots.

Alternate Solarization Pathways for Water-scarce South Asia

ITP Custodian: Neha Durga

Session Chair: Mohinder Gulati

| Venue: Dr. Kurien Auditorium |

Mohinder Gulati (Ex-COO, UN Sustainable Energy for All) opened the first session, emphasizing that the consultation would follow an open discussion format where invited speakers, panel members, and participants can exchange ideas and perspectives. He then invited all participants to spell out issues and concerns regarding solarisation of agriculture that they would like the session to discuss. These issues and concerns included:

- *What will be the effects of solar power on property rights over groundwater and equity/access issues?*
- *What will be the impact of solar pumps on groundwater depletion and over-exploitation?*
- *If solar irrigation pumps (SIPs) make selling excess power becomes more lucrative than farming, what are the implications for food production?*
- *Rigorous cost-benefit analyses of different power sources for agriculture are lacking;*
- *Because the high levels of capital subsidy offered for solar pumps are unsustainable, what are other business models that might succeed?*
- *As solar pumps might change the business model for electricity utilities (DISCOMs), what planning and investments are necessary?*

Neha Durga (IWMI) followed the introduction, providing an overview of the evolution of solar irrigation in South Asia and outlining competing models for solarizing agriculture. Her presentation was followed by a panel discussion. Rajeev Gyani (ISA) emphasized the need to enhance farmers' capacities to understand SIP technology and generate sufficient demand. This capacity building with farmers, he argued, would generate a promising and sustainable market for solar irrigation systems. He argued that the viability of solar-powered irrigation systems without government subsidies would depend on the mind-set of people. Thus, Gyani stressed, solarizing agriculture is more a 'behaviour change' issue than a technological one. By offering the option of selling surplus power, grid-connected solar irrigation systems incentivize such behavioural change while saving groundwater. However, there is still a need to devise better mechanisms to establish the per unit cost of electricity being sold or the feed-in-tariff offered to farmers.



Akhilesh Magal (GERMI) added that the tariff of ₹3.50 currently offered to farmers under Gujarat's SKY (*Suryashakti Kisan Yojana*) program has some constraints. Without

the subsidy offered by the government, the model would face sustainability challenges. He also argued that rather than calculating on the basis of feed-in-tariff alone, life cycle costs must be considered and solar promotion policies should allow direct and open sale of surplus power by surpassing DISCOMs to prevent their monopoly. The surplus power can be pooled at the feeder level, allowing better returns to farmers. Such a mechanism, Magal said, if facilitated by the government, will have significant implications for the existing electricity supply mechanisms of DISCOMs.

Tushaar Shah (IWMI) added that under such a scenario, vigilance will become farmers' responsibility and any losses incurred will have to be borne by farmers, not DISCOMs – as is the situation at present. Furthermore, the solar PV panels currently being installed are not in accordance with the irrigation pumps operated by farmers. Abhishek Jain (CEEW) agreed with this point and added that since farmers have limited capacity to replace existing pumps with higher capacity pumps, dysfunctional solar pumps might be a bigger concern for the future, rather than groundwater depletion. Jain suggested that the field needs more efficient, lower capacity pumps as opposed to high capacity, less efficient pumps.

Karan Dangayach (Shashwat Cleantech) argued that while developers might be interested in supporting farmers, contractors have few incentives to work with farmers since the time and effort required is significantly higher compared to other business opportunities. Dangayach also argued that to promote community-based selling of surplus solar power to the grid, the selection criteria for “feeders” should be clearly laid out and communicated to farmers.

In his concluding remarks, Gulati emphasized the need to trust the intellect of farmers and to facilitate a process through which they can freely choose and act. Neither government nor any other organization should threaten their right to choose and efforts to enhance their capacities in all aspects must be made. He noted that existing solar promotion schemes are looking at the energy generation aspect of agriculture solarisation in isolation. Instead, there is a need for integrated solutions that consider the water-energy nexus. He argued that there is a need for a synergy of experts working together with a common goal and vision to facilitate the shift from ‘*farming*’ to ‘*solar farming*’. Instead of practitioners working in sectoral silos, farmers should be made party to the planning and implementation mechanisms of programs. He argued for participatory planning that incorporates the interests of all stakeholders through an combination of bottom-up and top-down planning.

1.2 Session 8B: SoLAR Opportunities and Challenges in GBM Basin

| 5 December 2018 | 14:00 – 16:00 |

Can Solar Irrigation Pumps Break the Agrarian Impasse in Ganga-Brahmaputra-Meghna Basin?

ITP Custodian: Gyan P. Rai

Session Chair: Apoorva Oza

| Venue: Dr. Kurien Auditorium |

The second SoLAR session began with a new ITP video on “*Catalyzing Solar Irrigation Entrepreneurs in Chakhaji*”. The video explained the rationale behind IWMI’s field pilot in Chakhaji village in the Samastipur district, Bihar. The video was followed by a presentation by Gyan P. Rai (IWMI-Tata Program) on the prospects of solar irrigation entrepreneurs in the Ganga-Brahmaputra-Meghna (GBM) basin. Based on recent fieldwork, Geetika Varshney (Development Management Institute, Patna) made a presentation on the gender-related impacts of IWMI’s experiment in Chakhaji. She noted that although the official records showed male ownership of land, unofficially, many women were the primary water buyers in Chakhaji. She noted, with some satisfaction, that women appeared to be benefiting as much as men in the field of solar irrigation entrepreneurship. She argued that it was the economics of water selling that was driving the inclusivity, reaffirming the value monetary incentives to drive social change.



Aditi Mukherji (ICIMOD) shared her experiences promoting SIP in the Nepal *Terai*, where sustainable financing options are being offered to facilitate adoption of the technology. While discussing the pros and cons of the initiative, Mukerji argued that NGO-based models should be preferred over market-driven models to better protect the interests of farmers. Neha Durga (IWMI-Tata Program) presented a comparison of community-run solar irrigation systems with those run by solar entrepreneurs. Based on field studies of both types, Neha argued that community-led models should also encourage individual participation as it would give people a sense of ownership and affinity towards the technology: leading to better adoption, operation and maintenance. She concluded that for promoting citizen-centric programs and policies, a better understanding of drivers and motivating factors will be required.

During the panel discussion, Apoorva Oza (AKRSP) pointed out that generalizations leading to preference for either individual entrepreneur or group schemes may not be useful. While economics will always be a key driver, equity must be a central concern. Based on AKRSP's experience, he argued that if enough resources are available for saturation at the village-level, solar entrepreneurs should be preferred over group schemes. On the other hand, if resources are limited, group schemes may be preferred so that a large section of the community can benefit from the intervention. Oza argued that the existing policy framework gives preference to individual access to solar pumps over community access. Policy makers have been sceptical that group-based schemes might promote exclusion of certain sections of the community, hampering their right to access the shared groundwater resource. Further, he argued that farmers themselves prefer individual access over group ownership as group schemes are effort and resource intensive and require elaborate coordination mechanisms.



Nilanjan Ghose (GIZ) argued that while policies do support individual ownership, equity concerns are better addressed in group schemes, even though they pose greater challenges in terms of establishment and operations. He noted that group schemes require additional effort in understanding group dynamics and facilitating their formation and management. For both group and individual schemes, investments in capacity building are a key factor. He noted that the entrepreneur model, is much less resource intensive as compared to community-driven models and requires less follow-up, and fewer transactions and loan formalities. Based on GIZ's experience in eastern GBM basin, Ghose concluded that the 'Service Provider' model might be an answer to several of these issues. Other models discussed included the NABARD-supported groups and Claro's model of using solar energy for selling irrigation service. Aditi Mukherji argued that to promote community-based solar irrigation, success would depend on how to [a] enhance community's awareness for demand-driven initiatives; [b] facilitate mechanisms to aid group formation; and [c] provide hand-holding support in initial years. Once the community starts experiencing the full benefits of the intervention, they will be motivated to carry the work forward.

1.3 Session 8C: Scaling-up SoLAR in South Asia

| 5 December 2018 | 16:30 – 18:30 |

SoLAR (Solar Irrigation for Agriculture Resilience)

A new SDC-IWMI Regional Partnership

ITP Custodian: Shilp Verma

Session Chair: Marylaure Crettaz

| Venue: Dr. Kurien Auditorium |

The final SoLAR Regional Consultation session started with a speech from Shilp Verma (IWMI-Tata Program) in which he introduced the theme of the session. Explaining the significance of the water-energy-climate nexus, Shilp argued for the need to develop climate-compatible energy and water management models that support sustainable economic growth in South Asia. He spoke about the new regional partnership between SDC and IWMI to map, analyse and field test, as well as explore varied roles that solar irrigation systems can play in the domain of the water-energy-climate Nexus and beyond.

The keynote was followed by a presentation on the experience of solar irrigation in Sub-Saharan Africa by Petra Schmitter (IWMI). Although geo-physically Asia and Africa are quite different, Petra noted the two continents shared commonalities in terms of climate vulnerabilities and limited climate adaptation capabilities. She therefore argued for promoting a South-South exchange of knowledge and best practices, particularly in the domains of water management, renewable energy, and smallholder agriculture. Neha Durga presented the FAO-supported country study on emerging solar opportunities and challenges in Bangladesh. The discussion that followed focussed on the diversity of physical and economic conditions in different parts of Bangladesh with respect to promotion of solar irrigation.

Aditi Mukherji (ICIMOD) and Soumya Balasubramanya (IWMI) pointed to the need to factor in the presence of arsenic in parts of Bangladesh as excessive groundwater pumping and the resulting groundwater depletion can accentuate arsenic contamination. It was also noted that in parts of Bangladesh – such as the Barind tract – affordable solar irrigation can play an important role in catalysing pro-poor agrarian growth. Devesh Shah (SEWA) and women members of the Agariya (salt-pan workers) and farming communities in Little Rann of Kutch (Gujarat) spoke about their positive experience with solar pumps. Solar pumps have enabled significant cost savings for salt-pan workers and provided year-round irrigation access for farmers to engage in intensive cultivation and dairy. The final presentation of the session by Mohinder Gulati discussed on-going and upcoming SPaRC (Solar Power as Remunerative Crop) pilots in Haryana and Rajasthan. Describing four alternate business models for solarizing agriculture through grid-connected solar pumps, Mohinder argued that solar irrigation has the potential of not just being a green energy generation mechanism but also to offer an additional, counter-climatic source of income for farmers while incentivizing them to become efficient energy and groundwater users.

Moderating the discussion, Shilp Verma posed a question each to the three panel members. Aditi Mukherji was asked to weigh-in on the prospects of solar irrigation in GBM basin. Paresh Shirsath (CCAFS) was asked to talk about the prospects of initiating solar irrigation pilots in the Nepal Terai. And Divya Kashyap (SDC) was asked to comment on lessons from the session presentations and discussions for the new SDC-IWMI regional partnership.

Aditi Mukherji noted that compared to India, grid-power in Nepal is significantly less fossil-fuel based. Thus, promoting solar irrigation purely for replacing dirty fuel might not make a lot of sense. She argued that the phenomenal results observed in

Chakhaji might not be

available everywhere in the GBM basin, as experience from Nepal suggests that even with solar pumps, the potential to expand irrigation areas and intensity might not be significant. Shilp Verma pointed out that the experience in Chakhaji and Nepal may not be directly comparable as bulk of SIPs promoted in Nepal are small horsepower. That said, Verma said it remains to be seen how well other parts of the GBM basin will respond to smartly promoted solar irrigation programs. Paresh suggested that combining solar irrigation schemes with decentralized water harvesting initiatives and micro-irrigation promotion might offer a window of opportunity for climate smart agriculture. Divya Kashyap noted that the unique selling point (USP) of pilot projects is their ability to adapt to local contexts and that when scaling up from successful pilots, local context must be taken into consideration.

The session chair, Marylaure Crettaz (SDC), concluded by thanking all the participants for their contributions and inputs. She noted that the issue of replicating and scaling-up solar irrigation is a complex one and she hopes that the new SDC-IWMI partnership will draw useful lessons from the plethora of solar irrigation experiments across South Asia and develop models that are replicable and context specific.

1.4 Track Summary and Feedback Session

On 6 December, a team of prominent experts, which included Mohinder Gulati (Ex-COO, UN Sustainable Energy for All), Marylaure Crettaz (SDC) and Regassa Namara (World Bank), were asked to summarize the discussions under the 'Water-Energy-Climate Nexus' track and provide feedback and suggestions to the IWMI-Tata Program for future research directions. The trio offered the following observations:

- The water-energy-climate Nexus is very complex and the issue of promoting solar irrigation needs to be evaluated within a 'Nexus' approach. It would be very useful for the IWMI-Tata Program to consider publishing a regular or annual report on the status of solar irrigation in South Asia.



- It might also be useful to collaborate with donors, state governments, the Ministry of New and Renewable Energy (MNRE), NITI Aayog, and the Ministry of Power to convene a small expert group on the water-energy-climate Nexus.
- Despite a lot of good work, uncertainty remains regarding the impact of SIPs on water and groundwater. It also remains to be seen if millions of farmers will become net energy producers, who will buy that energy, and at what tariff? Will solar power be attractive enough for farmers to use for agriculture, or will it be so attractive that it will lead them away from agriculture?
- Rising temperatures and incomes are going to increase energy demand, especially during daytime hours for domestic uses, such as air-conditioning. Integrating solar into the power grid should take such future demands into account.
- Inspired by IWMI's Dhundi experiment, the Government of Gujarat's SKY (*Suryashakti Kisan Yojana*) scheme might require new governance mechanisms and institutions at the feeder-level. Solar cooperatives are one option, but there might be others. The new SDC-IWMI partnership should explore these options in detail.
- The government perspective was somewhat under-represented at the meeting. Future IWMI-Tata meetings should also invite government officials and politicians so they can respond to ITP's research and recommendations. If it is difficult to get them to Anand for 3 days, perhaps the last day can be specifically designed with government officials in mind.
- Given India's expertise in information technology, ITP should incorporate smart metering and smart grid designs into some of its solar field pilots and experiments.
- India has a lot of useful experience that it can share with Sub-Saharan Africa (SSA) as that area prepares to develop its water, and, its groundwater resources. ITP should consider extending some of its solar pilots to Africa with IWMI to oversee in both locations (S. Asia and Africa). IWMI can play a critical role in promoting South-South exchange with the help of institutions like the World Bank.
- The proceedings of the workshop should be published and circulated quickly, including (draft) track summaries.



2. SoLAR: Next Steps

The IWMI and SDC teams took time aside from the meeting to discuss next steps in the SoLAR project. This separate meet provided a good opportunity for IWMI researchers from Colombo (Sri Lanka), Delhi (India), Kathmandu (Nepal), and Yangon (Myanmar) to interact with the SDC team. The following key points emerged from this meeting:

- IWMI is already in discussion with several key players for building national and regional partnerships. At the regional level, IWMI is pursuing a partnership with the International Solar Alliance (ISA) and the International Renewable Energy Agency (IRENA). In India, IWMI is working closely with the World Business Council for Sustainable Development (WBCSD). In Bangladesh, IWMI is working with World Fish and exploring partnership opportunities with IDCOL. And in Nepal, IWMI is in touch with FAO and ICIMOD.
- There was some discussion about co-organizing the Nepal National Consultation jointly with FAO. However, FAO's timeframe has changed, and they have postponed their workshop until May 2019.
- With the conclusion of the regional consultation in Anand, IWMI will plan to organize national stakeholder consultations around SoLAR in Nepal, Bangladesh and Pakistan. IWMI will target January for planning the national consultation in Nepal and February for similar events in Bangladesh and Pakistan.
- IWMI will study IDCOL's solar promotion models in Bangladesh and ICIMOD's experience in Nepal when comparing alternate models of solarizing agriculture and scoping opportunities for scale-pilots. In Bangladesh, IWMI will use some of its past work on arsenic and coastal management to develop a more nuanced solar irrigation suitability map for each of the four project countries.

The following project activities are planned for the coming months:

National Stakeholder Consultations: The national stakeholder consultation in Nepal is planned for late January 2019 and in February and March for Bangladesh and Pakistan, respectively.

Review of Solar Policies: IWMI will build on its past work in India and Nepal to undertake new exploration in Bangladesh and Pakistan and prepare a comprehensive review of national and sub-national solar policies, particularly related to solar irrigation. IWMI expects to complete this work by March 2019.

Review of Solar Promotion Models: An early version of such a comparative assessment was discussed at the IWMI-Tata Partners' Meet. IWMI will build on that by incorporating suggestions and inputs received during the SoLAR sessions. A first-cut draft of this assessment is expected by April 2019.

Planning Scale Pilots: IWMI has already started exploring new partnerships in India, Nepal and Bangladesh for planning scale pilots. During the IWMI-Tata Partners' Meet, the participants agreed that it may

not be feasible, or even advisable, to undertake detailed project reports (DPRs) for all proposed scale pilots in the entry phase, but the broad contours of the pilots should be finalized.

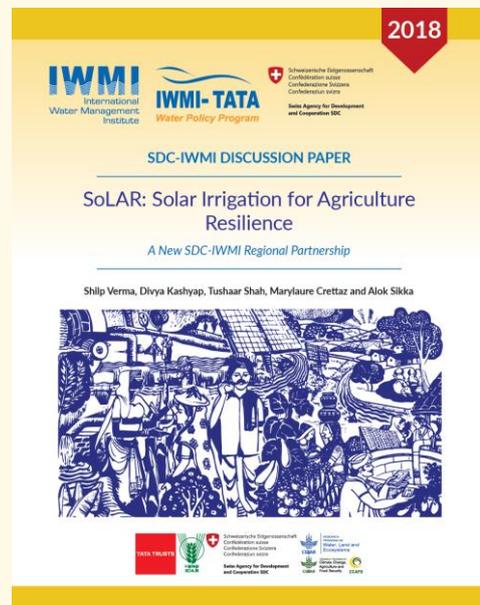
Detailed Project Design:

All the above activities will contribute toward the detailed project design document below.

	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19
1. Stakeholder Consultations									
1.1 Regional Consultation, Anand									
1.2 National Consultation, Kathmandu									
1.3 National Consultation, Dhaka									
1.4 National Consultation, Lahore									
2. Reviews and Studies									
2.1 Solar Promotion Policies									
2.2 Solar Promotion Models									
3. Planning Scale-Pilots									
3.1 Identifying Partners and Locations									
3.2 Conceptualizing 'Innovation Fund'									
3.3 DPRs for Scale Pilots									
4. Detailed Project Design									

3. SoLAR: Some Early Outputs

- For circulation at the IWMI-Tata Partners’ Meet, a SDC-IWMI Discussion Paper was prepared based on the SoLAR entry proposal document. The paper provides an overview of the water-energy-climate Nexus context in South Asia and the rationale, goals, and broad objectives of the SoLAR partnership.
- The IWMI-Tata Program showcased two new ITP Videos that explain ITP’s “solar entrepreneur” model as demonstrated in the Chakhaji solar pilot.
- The IWMI-Tata Program is preparing a comprehensive workshop report. All workshop presentations and videos from parallel and plenary sessions will be shared online in early 2019.



Annex 1: SoLAR Regional Consultation – Agenda

| 5 December 2018 | 11:00 – 13:00 |

S-08A: Solar Irrigation Pumps: Perfect Antidote to South Asia's Perverse Energy-Irrigation Nexus?

Alternate Solarization Pathways for Water-scarce South Asia

Solar irrigation pumps (SIPs) appeal to different stakeholders for different reasons. For grid farmers harangued by nightly and/or poor-quality power supply by DISCOMs, solar pumps are a boon because they offer convenient, high quality, daytime power throughout the year. For diesel pump irrigators, solar pumps offer massive cost savings. For DISCOMs, solar pumps offer the promise of liberation from the dead weight of farm power subsidies. And for those worried about global warming and carbon footprints, SIPs present a green irrigation solution. For ITP, however, the biggest promise of solar pumps is in transforming a perverse energy-irrigation nexus that has left aquifers depleted, farmers unsatisfied, and DISCOMs bankrupted.

This session presents work under ITP's SPaRC (Solar Power as Remunerative Crop) theme, making a case for viewing solar irrigation not just as a 'green pumping' solution but as a composite 'water-energy-agriculture-climate-livelihood' solution. Besides sharing insights from field studies and action pilots from Gujarat, Maharashtra, Karnataka, Haryana and Rajasthan, this session will synthesize the national debate around solar irrigation and discuss its potential to be the next big thing to energize agriculture while presenting alternative models of solarization of agriculture.

Venue: Dr. Kurien Auditorium, NDDB

Time: 11:00 – 13:00

ITP Custodian: Neha Durga

Session Chair: Mohinder Gulati

From	To	Title	People
11:00	11:10	Session overview and plan	Neha Durga
MODERATED DISCUSSION			
11:10	11:50	<i>Moderators: Tushaar Shah; Neha Durga</i> Comparing Alternate Viewpoints on Solarization of Agriculture	
11:50	12:00	Summing up the discussion	M. Gulati / N. Durga
12:00	12:15	ITP Keynote: Relevance of feeder-level solar cooperatives for SKY	Tushaar Shah

[30 – 40 minutes]

PANEL DISCUSSION

Kick-starting 'Suryashakti Kisan Yojana' (SKY)

Panel: Rajiv Gyani; R.B. Patel; Akhilesh Magal; Omkar Jani; Dinesh Patidar; Karan Dangayach

| 5 Decembers 2018 | 14:00 – 16:00 |

S-08B: Can Solar Irrigation Pumps break the Agrarian Impasse in Ganga-Brahmaputra-Meghna Basin?

The floodplains of Ganga-Brahmaputra-Meghna basin spread across eastern India, the Nepal Terai, and much of Bangladesh. These plains are home to one of the largest concentrations of rural poverty in the world. Despite having fertile soils and an abundant natural water endowment, the region's agriculture suffers for a lack of agri-infrastructure.

While the density of irrigation wells and pumps has been rising in recent years, the near-absence of rural electricity grids and high cost of diesel have been among the key factors explaining low agricultural productivity. Solar irrigation pumps can play a significant role in lifting millions of smallholder farmers out of poverty in the region, provided they are promoted smartly. This session explores the potential of solar irrigation in the region; discusses alternate growth trajectories for solar pumps; and presents results from ITP's experiences of promoting solar irrigation entrepreneurs in Chakhaji village, Bihar.

Venue: Dr. Kurien Auditorium, NDDB

Time: 14:00 – 16:00

ITP Custodian: Gyan P. Rai

Session Chair: Apoorva Oza

From	To	Title	People
14:00	14:15	ITP Video: Catalyzing solar irrigation entrepreneurs in Chakhaji	-
14:15	14:30	ITP Keynote: Cranking up the Ganges water machine through solar irrigation entrepreneurs	Gyan Prakash Rai
14:30	14:40	Solar-irrigated <i>Chakhaji</i> , with a special focus on gender issues	Geetika Varshneya / Dhiraj Kumar
14:40	14:50	Community solar irrigation systems vs solar entrepreneurs	Neha Durga
14:50	15:00	Can solar pumps help West Bengal's water buyers?	Manisha Shah
15:00	15:10	Solar irrigation promotion experiences in Nepal	A. Mukherji / Vishnu Pandey / Manita Raut
15:10	15:20	IDCOL's experience of promoting solar irrigation in Bangladesh	Md. Rasel Ahmed

[30 – 40 minutes]

PANEL DISCUSSION

Can Solar Pumps Deliver Affordable and Reliable Irrigation for Smallholders in GBM Basin?

Panel: Apoorva Oza; Aditi Mukherji; Nilanjan Ghose; Md. Rasel Ahmed

Rapporteur: Sakshi Saini

S-08C: SoLAR (Solar Irrigation for Agriculture Resilience)

A new SDC-IWMI Regional Partnership

The South Asian region's 25-30 million pumps lift approximately 330-350 km³ of groundwater each year to support agriculture-based livelihoods of nearly 700 million smallholder farmers, while also ensuring drinking water security for nearly a billion people and contributing to more than half the industrial output of the area. Roughly, 70-80 percent of the pumped groundwater is used for irrigation and this accounts for more than a fifth of the total electricity consumption and 6-8 percent of the CO₂ emissions. While many countries make intensive use of groundwater, the governance challenge in South Asia is unique because nowhere else does the groundwater economy sustain such a large proportion of the population and nowhere else are the stakeholders so poor and the resolution of these issues so politically sensitive and complex. While elsewhere in the world, hydrogeology, cropping systems, and natural water endowments explain the extent and spread of groundwater irrigation, in South Asia, demographic pressures, energy tariffs, and supply regimes are the key drivers.

In 2018, SDC and IWMI began a new partnership to map, analyse, and field test the different roles that solar irrigation can play in different energy-groundwater interaction scenarios across South Asia. The collaboration aims to support climate-compatible development of energy and water systems in rural South Asia for resilient livelihoods. The research will support the mainstreaming of context-specific, financially, and institutionally viable models for solar-powered irrigation systems to reduce the carbon footprint of irrigation while promoting efficient use of groundwater resources under climate-induced uncertainties in South Asia. This session marks the first regional consultation in this collaborative initiative.

Venue: Dr. Kurien Auditorium, NDDB

Time: 16:30 – 18:30

ITP Custodian: Shilp Verma

Session Chair: Marylaure Crettaz

From	To	Title	People
16:30	16:45	ITP Keynote: SoLAR: Solar Irrigation for Agriculture Resilience	Shilp Verma
16:45	17:00	Solar irrigation experiences from Sub-Saharan Africa	Petra Schmitter
17:00	17:10	Potential and risks of solar-powered irrigation systems: FAO-supported country studies in Pakistan	Shilp Verma (on behalf of FAO)
17:10	17:20	Potential and risks of solar-powered irrigation systems: FAO-supported country studies in Bangladesh	Neha Durga (on behalf of FAO)
17:20	17:30	SEWA's work with Aghariyas in Kutch	Devesh Shah
17:30	17:45	Upcoming SPaRC experiments in Haryana and Rajasthan	Mohinder Gulati

[30 – 45 minutes]

PANEL DISCUSSION

Smart Promotion of Solar Irrigation: Lessons and Ideas

Panel: Divya Kashyap; Aditi Mukherji; Paresh Shirsath; Chaitanya Chaudhary; Md. Rasel Ahmed

Rapporteur: Sakshi Saini

Annex 2: Visitors to ITP's Field Pilot in Dhundi [3-6 Dec.]

Name	Affiliation
Alicia Harley	<i>John F. Kennedy School of Government, Harvard University</i>
Alok Rajouria	<i>International Water Management Institute (IWMI), Nepal</i>
Alok Sikka	<i>International Water Management Institute (IWMI), New Delhi</i>
Aniruddha Dey	<i>Consultant, Kolkata</i>
Archisman Mitra	<i>International Water Management Institute (IWMI), New Delhi</i>
Ashok Kumar	<i>Transforming Rural India (TRI) Foundation</i>
Athar Parvaiz	<i>Journalist / Researcher</i>
Avinash Krishnamurthy	<i>Biome Environmental Solutions, Bangalore</i>
Christopher Scott	<i>Udall Center for Studies in Public Policy, University of Arizona</i>
Claudia Sadoff	<i>International Water Management Institute (IWMI), Colombo</i>
Dinesh Chadha	<i>Consultant, Dharmaj</i>
Dinesh J. Kagathi	<i>Power Research & Development Consultants Private Limited, Bangalore</i>
Dipendra Bhattarai	<i>International Centre for Integrated Mountain Development (ICIMOD), Nepal</i>
Edoardo Borgomeo	<i>International Water Management Institute (IWMI), Colombo</i>
Farah Ahmed	<i>International Water Management Institute (IWMI), New Delhi</i>
Farhet Shaheen	<i>Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu</i>
Geetika Varshneya	<i>Development Management Institute, Patna</i>
Himanshu Kulkarni	<i>ACWADAM, Pune</i>
Himanshu Thakkar	<i>South Asia Network on Dams, River and People (SANDRP)</i>
Julie van der Blik	<i>International Water Management Institute (IWMI), Colombo</i>
Kashi Metya	<i>Transforming Rural India (TRI) Foundation</i>
Madar Samad	<i>Consultant, IWMI, Colombo</i>
Mohammad Faiz Alam	<i>International Water Management Institute (IWMI), New Delhi</i>
Mohinder Gulati	<i>UN Sustainable Energy for All</i>
Nivedita Khandekar	<i>Journalist</i>
Petra Schmitter	<i>International Water Management Institute (IWMI), Myanmar</i>
Rajeev Gyani	<i>International Solar Alliance (ISA), Gurugram</i>
Ram Fishman	<i>Tel Aviv University</i>
Ramaswamy Sakthivadivel	<i>Consultant, IWMI-Tata Program, Chennai</i>
Rasel Ahmed	<i>Infrastructure Development Company Limited (IDCOL), Bangladesh</i>
Regassa Namara	<i>World Bank, Washington</i>
S.K. Swaroop	<i>Central Groundwater Board (CGWB)</i>
S. Vishwanath	<i>Biome Environmental Trust, Bangalore</i>
Shreyas Somashekar	<i>Consultant, Bangalore</i>
Soumya Balasubramanya	<i>International Water Management Institute (IWMI), Colombo</i>
Sukhpal Singh	<i>Indian Institute of Management, Ahmedabad</i>
Surbhi Arul	<i>Arghyam, Bangalore</i>
Tinni Sawhney	<i>Aga Khan Foundation</i>
U.N. Ravi Kumar	<i>Centre for Appropriate Rural Technology (CART), Mysore</i>
Uzra Sultana	<i>Arghyam, Bangalore</i>
Veena Srinivasan	<i>Center for Environment and Development, ATREE</i>
Vijay Shankar	<i>Samaj Pragati Sahayog, Dewas</i>
Vishnu Pandey	<i>International Water Management Institute (IWMI), Nepal</i>
Vivek Warade	<i>Consultant, IWMI-Tata Program, Buldhana</i>



Annex 3: Visitors to ITP's Field Pilot in Mujkuva [3rd – 6th Dec.]

Name	Affiliation
A. Gurunathan	<i>Dhan Foundation</i>
Abhishek Jain	<i>Council on Energy, Environment and Water (CEEW), New Delhi</i>
Akshay Anand	<i>Venus School of Architecture, Gandhinagar</i>
Alok Rajouria	<i>International Water Management Institute (IWMI), Nepal</i>
Alok Sikka	<i>International Water Management Institute (IWMI), New Delhi</i>
Amit Mishra	<i>Piramal Sarvajal</i>
Aniruddha Dey	<i>Consultant, Kolkata</i>
Anjali Parasnis	<i>World Bank, New Delhi</i>
Athar Parvez	<i>Journalist</i>
Avinash Krishnamurthy	<i>Biome Environmental Trust, Bangalore</i>
Claudia Sadoff	<i>International Water Management Institute (IWMI), Colombo</i>
Dalsukh Vaghasiya	<i>Ambuja Cement Foundation</i>
Deepa Maggo	<i>World Business Council for Sustainable Development (WBCSD)</i>
Dheeraj Kumar Gupta	<i>Aga Khan Rural Support Program (India), Samastipur</i>
Dinesh Chadha	<i>Consultant, Dharmaj</i>
Dinesh J. Kagathi	<i>Power Research & Development Consultants Private Limited,</i>
Edoardo Borgomeo	<i>International Water Management Institute (IWMI), Colombo</i>
Eshwar Kale	<i>Watershed Organisation Trust (WOTR), Pune</i>
Farah Ahmed	<i>International Water Management Institute (IWMI), New Delhi</i>
Geetika Varshneya	<i>Development Management Institute, Patna</i>
Harish Pathak	<i>Bharatiya Jain Sanghatana (BJS), Pune</i>
Himanshu Thakkar	<i>South Asia Network on Dams, River and People (SANDRP)</i>
Hossein Nazaboland	<i>Smart Water Metering Inc., Iran</i>
J.V.R. Murty	<i>World Bank, New Delhi</i>
Julie van der Blik	<i>International Water Management Institute (IWMI), Colombo</i>
Kezia Fernandes	<i>Sattva Consulting</i>
Kian Alibakshian	<i>Smart Water Metering Inc., Canada</i>
Kiran Kumar Sen	<i>WIPRO, Bangalore</i>
Madar Samad	<i>Consultant, IWMI, Colombo</i>
Mansee Bal Bhargava	<i>Nirma University, Ahmedabad</i>
Nehaal Mayur	<i>United Nations Development Program (UNDP), India</i>
Nilanjan Ghose	<i>Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH</i>
Nivedita Khandekar	<i>Journalist</i>
Pankaj Fole	<i>Shakti Pumps (India) Limited</i>
Paresh Shirasath	<i>Climate Change, Agriculture and Food Security (CCAFS)</i>
Petra Schmitter	<i>International Water Management Institute (IWMI), Myanmar</i>
Prodyut Mukherji	<i>En-genuity Advisory, New Delhi</i>
Rajeev Gyani	<i>International Solar Alliance (ISA), Gurugram</i>
Rasel Ahmed	<i>Infrastructure Development Company Limited (IDCOL), Bangladesh</i>
Rashmi Kiran Shrestha	<i>Consultant, ICIMOD, Nepal</i>
Ravinder Pal Singh Malik	<i>Consultant, IWMI, New Delhi</i>
Rishabh Sood	<i>Rabobank India</i>
S.K. Swaroop	<i>Central Groundwater Board (CGWB)</i>
Shreyas Somashekar	<i>Consultant, Bangalore</i>
Shubhoshree Banerjee	<i>INREM Foundation, Anand</i>
Soumya Balasubramanya	<i>International Water Management Institute (IWMI), Colombo</i>
Suddatta Ray	<i>Stanford University</i>
Surbhi Arul	<i>Arghyam, Bangalore</i>
Tinni Sawhney	<i>Aga Khan Foundation</i>
Unnikrishnan Nair	<i>Global Green Growth Institute (GGGI)</i>
Uzra Sultana	<i>Arghyam, Bangalore</i>
Vijay Shankar	<i>Samaj Pragati Sahayog, Dewas</i>
Vishnu Pandey	<i>International Water Management Institute (IWMI), Nepal</i>
Vivek Warade	<i>Consultant, IWMI-Tata Program, Buldhana</i>



Annex 4: Invitees for the SoLAR Regional Consultation

Name	Affiliation
Abhishek Jain	<i>Council on Energy, Environment and Water (CEEW), New Delhi</i>
Aditi Mukherji	<i>International Centre for Integrated Mountain Development (ICIMOD), Nepal</i>
Ahmed Rasel	<i>Infrastructure Development Company (IDCOL), Bangladesh</i>
Akhilesh Magal	<i>Gujarat Energy Research and Management Institute (GERMI), Gandhinagar</i>
Alok Rajouria	<i>International Water Management Institute (IWMI), Nepal</i>
Alok Sikka	<i>International Water Management Institute (IWMI), New Delhi</i>
Apoorva Oza	<i>Aga Khan Rural Support Program (India), Ahmedabad</i>
Archisman Mitra	<i>International Water Management Institute (IWMI), New Delhi</i>
Claudia Sadoff	<i>International Water Management Institute (IWMI), Colombo</i>
Devesh Shah	<i>Self-Employed Women's Association (SEWA)</i>
Dheeraj Kumar Gupta	<i>Aga Khan Rural Support Program (India), Samastipur</i>
Dinesh Patidar	<i>Shakti Pumps (India) Limited</i>
Divya Kashyap	<i>Swiss Agency for Development and Cooperation (SDC)</i>
Edoardo Borgomeo	<i>International Water Management Institute (IWMI), Colombo</i>
Farah Ahmed	<i>International Water Management Institute (IWMI), New Delhi</i>
Geetika Varshney	<i>Development Management Institute, Patna</i>
Julie van der Bliet	<i>International Water Management Institute (IWMI), Colombo</i>
Karan Dangayach	<i>Shashwat Cleantech Limited</i>
Manita Raut	<i>International Water Management Institute (IWMI), Nepal</i>
Marylaure Crettaz	<i>Swiss Agency for Development and Cooperation (SDC)</i>
Mohammad Faiz Alam	<i>International Water Management Institute (IWMI), New Delhi</i>
Mohinder Gulati	<i>Ex-COO, UN Sustainable Energy for All</i>
Nilanjan Ghose	<i>Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)</i>
Paresh Shirsath	<i>Climate Change, Agriculture and Food Security (CCAFS)</i>
Petra Schmitter	<i>International Water Management Institute (IWMI), Myanmar</i>
Rajeev Gyani	<i>International Solar Alliance (ISA), Gurugram</i>
Soumya Balasubramanya	<i>International Water Management Institute (IWMI), Colombo</i>
Vishnu Pandey	<i>International Water Management Institute (IWMI), Nepal</i>

SOLAR: SOLAR IRRIGATION FOR AGRICULTURE RESILIENCE

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