



SoLAR

Solar Irrigation for Agricultural Resilience

Issue No 9: July - September 2022

Dear readers,

The World Water Week in Stockholm - an annual focal point for global water issues – held from 23 August to 01 September this year, was particularly crucial for water governance researchers and practitioners like us for its thematic focus on “the value of water”- an issue that goes missing when planning climate change mitigation actions, even though ninety percent of all climate disasters worldwide and sixty percent of climate change adaptation strategies are water-related. But this situation needs to change soon, given climate change's exacerbating, ominous impact on the global hydrological cycle. Water professionals must sit at climate negotiation tables to reflect on the conditions for the shift toward more responsible water consumption behavior. The deliberations at the Stockholm Water Week made this urgency more palpable than ever.



SoLAR Teams visits farmers in Bangladesh (Image Credit: Waresul Haque)

Meanwhile, South Asia has experienced two extremes of weather in rapid succession in the past six months: first, unprecedented heatwaves striking India and Pakistan in April/ May, followed by floods, first ravaging Assam and adjoining parts of Bangladesh, and now in Pakistan since an early onset of the monsoons in June. According to a news report in [Nature](#) dated 16 September 2022, “*Pakistan has received almost three times its average annual rainfall for the monsoon period so far. The southern provinces of Sindh and Baluchistan have received more than five times that average.*”

The consequences of these extreme weather events are dire for the food sector. A food security crisis is looming large in Pakistan. A recent report by the International Centre for Integrated Mountain Development (ICIMOD) on the impact of the 2022 floods estimates a loss of almost eighty percent of the expected rice production in the Sindh province, usually accounting for a fifth of the country’s total rice output. On the other hand, in India, heatwaves, followed by drought-like conditions due to the late arrival of monsoons, have impacted the two main food crops: wheat in the previous season and rice in this season. Floods followed by droughts have disrupted the crop cycle in Bangladesh. During my visit to the country in August, farmers informed us that due to the delayed monsoons, they could sow only twenty-five percent of the monsoon (aman) paddy till early August.

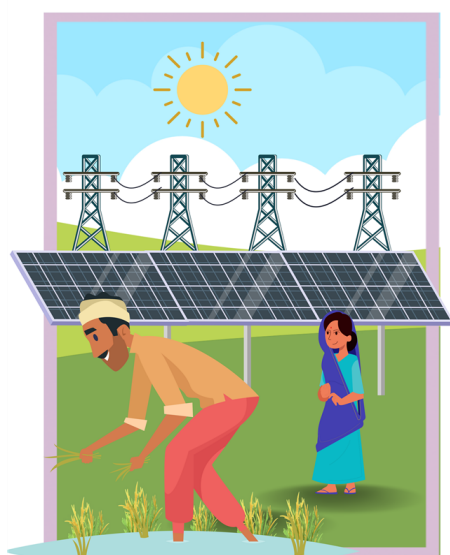
The impacts of droughts can be mitigated through access to irrigation. But the smallholder farmers in these South Asian countries lack access to affordable irrigation. They depend primarily on expensive diesel-run irrigation pumps and electricity generated from fossil fuels. The fiscal and environmental costs are massive for these economies. While replacing the fossil fuel-reliant irrigation pumps with solar irrigation pumps is one of the possible mitigation strategies, faster uptake of solar pumps would require a more rapid pace in policy changes and public financing. In this newsletter, we bring snippets of our recently produced project issue briefs, which explore the institutional modalities, financing/business models, and co-benefits of shifting to solar irrigation,

particularly in Nepal and Bangladesh. Besides, the usual news from our field offices is also there to keep you informed of our ongoing activities and engagements.

I hope you will enjoy reading about these. Please do share your thoughts with me at a.mukherji@cgiar.org.

Aditi Mukherji, Regional Project Leader, SoLAR-SA, IWMI

The SoLAR project brings out issue briefs from studies in Bangladesh and Nepal



Making renewable energy investments sustainable through grid-connected solar pumps in Bangladesh

As a nodal agency for the renewable energy transition in Bangladesh, IDCOL has installed the maximum number of off-grid solar irrigation pumps in the country and targets to scale up its activities further in line with the Bangladesh government's plans to generate 10% of its electricity from renewable sources by 2030. The high pump-to-panel capacity of the IDCOL pumps meets irrigation demands during the peak irrigation season of summer boro paddy. But irrigation demand is limited beyond the boro season. IDCOL's boro-reliant revenue generation model strains the financial viability of investments in solar irrigation pumps. While grid integration can

offer a practical solution, relevant institutional conditions must be in place. What necessary policy interventions can create an enabling scenario for grid-connected solar irrigation pumps in Bangladesh?

[Read more](#) here.

(Art Credit :Aariz Raza, IWMI Delhi)

Institutional modalities for decarbonizing irrigation in Bangladesh

Diesel-based groundwater irrigation has been crucial in expanding dry-season boro paddy cultivation in Bangladesh. But high dependence on imported diesel is a financial burden for the government. To alleviate its fiscal responsibility and help decarbonize the agricultural sector, the Bangladesh government is promoting multiple business models of solar power-operated irrigation pumps in the country. Among these, the fee-for-service model promoted by the Infrastructure Development Company Limited (IDCOL) presents a significant departure from the conventional subsidy-based financing models in the South-Asian region. IDCOL leverages private sector investments to expand solar irrigation pump services coverage. How does this model work toward affordable irrigation for smallholder farmers in the country? [Read more.](#)



(Image Credit :NGO Forum)

Mitigation and beyond: Multiple co-benefits of solar irrigation in Bangladesh

Results from a representative survey of farmers in the command areas of the solar irrigation pumps installed by IDCOL show that beyond effectively achieving the primary objective of reducing the use of diesel (mitigation), these pumps also provide other significant benefits to the farmers. The study found that these solar irrigation pumps reduce farmers' cost of irrigation by 20% to 30% compared to diesel irrigation pumps, offer them access to less labour-intensive, time-saving irrigation services, and support their needs for supplementary irrigation in case of delayed monsoons. [Read more](#). (Image Credit :IWMI)



Improving equity outcomes in solar irrigation subsidy delivery mechanism in Nepal

The Alternative Energy Promotion Centre (AEPIC) provides a 60% subsidy to install solar irrigation pumps in Nepal. Data from AEPIC shows that in the five years between 2016 and 2021, a total of 9100 farmers had applied for solar pumps, while only 21% of those farmers, mainly from Nepal's Tarai, got these pumps due to limited budget allocation. The applicant pool tended to be skewed towards male farmers from upper castes with relatively larger holdings. Yet, while choosing beneficiaries for this skewed pool of applicants, the AEPIC officials allocated a larger share of pumps to the marginal and smallholder farmers, sheerly by their discretionary powers that may vary over the years. However, as budgetary outlays for subsidies have increased over time and the subsidy delivery policy is being revised, institutionalizing transparent and inclusive criteria for beneficiary selection may help create demand from more diverse groups of farmers and ensure equity outcomes in the distribution of solar irrigation subsidies. [Read more](#) here. (Image Credit :IWMI Nepal)



Know more about the SoLAR project through our doodle videos

SDC-IWMI's SoLAR project works toward scaling up sustainable and inclusive solar power-operated groundwater irrigation in South Asia. To get an overview of the project, watch our doodle video [About SoLAR](#).

Subsidy financing is a conventional mode of solar pump financing in South Asia. While subsidies can make these investment-intensive pumps accessible to the region's smallholder farmers, these are also fraught with elite capture. How can the solar subsidy delivery mechanisms be more

transparent, inclusive, and equitable? To know more, watch our findings from Nepal: [Who gets subsidized solar irrigation pumps in Nepal?](#)

Highlights from the Quarter

SoLAR's 6th Project Steering Committee Meeting was held on September 2, 2022.



The meeting was attended by senior officials from IWMI, SDC (Swiss Development Cooperation), and senior member representatives from the International Solar Alliance (ISA) and the Ministry of National Food Security and Research, Government of Pakistan. Aditi Mukherji, Regional Project Leader, SoLAR-SA project, IWMI, presented updates on the project's research and communications outputs and plans. The committee complimented the SoLAR team and partners on their achievements in generating tangible evidence of solar irrigation's impact on income and productivity gains, groundwater use, and equity outcomes relevant to policies. They appreciated the project design that effectively created a research-policy bridge and discussed the way forward to the project's second phase. [Read more](#) here.

SoLAR- Bangladesh's 4th Country Project Management Committee Meeting on July 25, 2022, in Dhaka



The meeting was organized in a hybrid mode, with the partners and collaborators meeting in person in Dhaka and a few colleagues and partners from India and Nepal joining virtually. Besides members from IWMI and SDC, major public and private sector partners working in the renewable energy sector in Bangladesh also attended the meeting. Archisman Mitra, Country Lead, SoLAR-Bangladesh, presented the project's achievements in 2021-22 and the plans for 2022-23. Aditi Mukherji, Regional Project Leader, SoLAR-SA project, IWMI, moderated a discussion among the participants regarding the future targets and goals for the solar irrigation programs in Bangladesh, including the diverse options for making the existing solar pump financing models more attractive and profitable. Among other things, an integrated agricultural development model, competitive water tariffs for the solar pump operators, and the institutional enablers for grid-integrated

solar came up as significant policy-relevant recommendations in the discussions. [Read more](#).



SoLAR Nepal's 5th Country Project Management Committee Meeting on July 01, 2022.

The meeting was joined by representatives from the Nepal Electricity Authority (NEA), Alternative Energy Promotion Centre (APEC), Department of Water Resource and Irrigation (DWRI) and Department of Agriculture (DoA), Government of Nepal, National Association of Rural Municipalities in Nepal

(NARMIN), Municipal Association of Nepal (MuAN), and other representatives from the private sector. Capacity building of the local governments was one of the key issues discussed at the meeting. Laxman Prasad Ghimire from APEC updated the committee on APEC's moves toward incorporating SoLAR research recommendations for gender inclusiveness and equity into APEC's selection criteria for solar irrigation pump subsidy disbursement and for prioritizing community-scale projects for solar pumps for better inclusion of the marginalized farmers. [Read more](#).

Country Highlights

From the Fields

Nepal

A delegation of representatives from the Swiss Agency for Development and Cooperation (SDC), donors for the IWMI-SoLAR-SA project, and SoLAR researchers visited the solar micro-grid pilot projects in Nepal and interacted with beneficiary farmers. [Read more](#).



SoLAR Innovation Fund Grantees, Gham Power Nepal Private Limited, and MinErgy use the grant funds to strengthen the solar pump uptake of smallholder Nepalese farmers. The SoLAR team visits the grantees' sites to assess work progress. Read the blog posts on [Gham Power's digital services](#), ["Yield improvements in a Box,"](#) and MinErgy innovations [for equitable, inclusive, community-led solar irrigation projects](#) to learn more about our Innovation Fund work. (Image Credit :IWMI)

Bangladesh



SoLAR Regional Project Leader Aditi Mukherji, and Bangladesh Country Lead, Archisman Mitra, met officials at the Asian Development Bank and the Barind Multipurpose Development Authority in Dhaka to share project findings and discuss possible collaborations for strengthening the roadmaps for solarizing irrigation in Bangladesh. [Read more.](#)

The SoLAR team visited ten pilot sites of grid integration in Bangladesh to monitor the status of the grid installation process carried out by three solar sponsors, namely Gazi Renewable Energy Company Limited, Wave, and Shell. [Read more](#) here about the visits. (Image Credit: Waresul Haque)

Pakistan



SoLAR Pakistan, in collaboration with Dr. Andrew Bell from the Department of Earth and Environment, Boston University, pre-tested choice experiment questionnaires with farmers in Rahim Yar Khan. [Read more.](#)

IWMI staff troubleshoots in-situ instrumentation of the SoLAR project in Chakwal, Jhang, and Rahim in Khan districts. [Read more.](#) (Image Credit: IWMI Pakistan)

India



SoLAR-India researchers supervise the roll-out of farmers' training sessions on the Suryashakti Kisan Yojana (SKY) in Gujarat's Porbandar district. [Read more.](#)

(Image Credit: IWMI)



Dr. Deepak Varshney

Country Lead, India, SoLAR-SA Project
and Researcher – Impact Assessment,
IWMI, Delhi.

What is your role in the project?

I am the Country Lead in India for the IWMI-SDC SoLAR-SA project. I am responsible for keeping track of the project-related activities and deliverables' progress. I am also contributing to the project's impact evaluation study in Nepal, analyzing the effects of solar irrigation pumps on diesel use, groundwater usage, and agricultural outcomes.

What are the critical questions that your country team is trying to answer?

Gujarat, in India, has converted many of the existing electricity-run irrigation pumps to solar pumps and connected these to the state utility grids under its Suryashakti Kisan Yojana (SKY). Grid integration enables farmers to earn additional income by selling the surplus power, over and above their usage for irrigating their croplands, to the utility grid. Here, we are attempting to understand whether incentivizing farmers with a feed-in tariff for evacuating surplus solar power back to the grid can help them become more efficient energy (and, therefore, groundwater) users. Further, we are assessing how the scheme's capacity-building activities can improve the scheme's effectiveness.

Which aspect of the project keeps you motivated?

Our empirical research aimed toward better strategizing future policies and programs, which will benefit not only farmers but help mitigate carbon emissions, is a great motivation. The pleasure of working with the wonderful colleagues in IWMI, and especially with our regional project leader, is a bonus for this work.



Dr. Sonal Bhatt

Associate Professor and
Deputy Coordinator, UGC-Centre for Advanced Studies (CAS) Phase II,
Department of Economics, and Managing Editor, '*Artha Vikas*'- Journal
of Economic Development, Sardar Patel University Anand, Gujarat.

Which key policy-relevant research questions are you looking at in this project?

With the Suryashakti Kisan Yojana (SKY) in Gujarat, the owners of the solar irrigation pumps (SIPs) have access to 12 hours of daytime electricity supply. Since the SKY SIPs are grid-integrated, the farmers under the scheme can

evacuate the surplus power back to the national power grid to earn additional income. Thus, the scheme brings in an alternative to groundwater sales to the beneficiary farmers, affecting the structure and conduct of the groundwater markets in Gujarat. Our collaborative study of the SKY scheme with the International Water Management Institute (IWMI) looks at the scheme's impacts on the existing groundwater markets in Gujarat.

Farmers resorting to selling power instead of groundwater has a bearing on both the supply and demand for groundwater for irrigation. Therefore, the SKY affects the socio-economic inter-relationships between the water sellers and buyers parallelly with the prices and modalities of groundwater sales. How would then the water sellers find a balance between pumping sufficient groundwater for their own irrigation use, meeting social obligations of water sales, and making money by selling power to the grid? On the other hand, even as the demand for groundwater for irrigation is relatively inelastic, how would the water buyers cope with the changes in the price or supply of groundwater? These are some of the questions our study on SKY attempts to answer.

Which aspects of the project interest you the most?

It is interesting to understand the varied and often contradictory responses of water sellers and buyers to the SKY scheme. In our study area, most water sellers are simultaneously water buyers, too. Hence, personal motivations, social considerations, economic compulsions, and plain common sense determine their responses to the scheme and the changes in their behavior in the water market post-SKY. To my mind, this is the most exciting aspect of this study.

In 2020 the SDC-SoLAR project started a grant initiative under the [SoLAR Innovation Fund](#) to support innovations for wide-scale and sustainable adoption of solar irrigation pumps (SIPs) in smallholder agriculture of South Asia.

Here we bring to you how the [*SDC-IWMI SoLAR IF Grantees Pave Ways for Innovative Use of Solar in Eastern India*](#). Read more about their work [here](#), [SwitchON](#), [KARMA](#) and [CINI](#).



SoLAR in News

“Climate change is hurting India’s rice crop” – Aditi Mukherji, Regional Project Leader, SoLAR-SA, IWMI, is quoted by Aljazeera in reportage on the inclement weather events hurting South Asia’s agriculture and food systems and the emerging need for new farming methods. Read the full article on www.aljazeera.com.

“Subsidised solar irrigation pumps: Not benefitting needy farmers” – Kashi Kafle and Aditi Mukherji’s opinion piece in *The Himalayan Times* explains why despite the Nepal government’s objective to provide subsidized solar irrigation pumps to the needy farmers and encourage more affluent farmers to make the switch independently, majority of the solar pumps went to farmers who are better off both socially and economically.



Decarbonizing irrigation through privatized solar irrigation service – A case study from Bangladesh: SoLAR Bangladesh Country Lead, Archisman Mitra, presented the findings from the project’s research on the challenges and opportunities of public-private partnership in promoting solar irrigation pumps in diesel-irrigated off-grid areas in Bangladesh at the Asia Water Forum, 2022 organized by the Asian Development Bank on August 10, 2022. [Read more.](#)

On the Reading List

Kashi Kafle, Labisha Uprety, Gitta Shrestha, Vishnu Pandey, Aditi Mukherji. 2022. Are climate finance subsidies equitably distributed among farmers? Assessing socio-demographics of solar irrigation in Nepal, *Energy Research & Social Science*, Volume 91, 2022, ISSN 2214-6296, <https://doi.org/10.1016/j.erss.2022.102756>. Read the full article [here](#).

Aditi Mukherji. 2022. The “water machine” of Bengal, *Science*, 15 September 2022, Vol 377, Issue 6612, pp. 1258-1259, [DOI: 10.1126/science.ade0393](https://doi.org/10.1126/science.ade0393). Read the full article [here](#).

Mohammad Shamsudduha, Richard G. Taylor, Md Izazul Haq, Sara Nowreen, Anwar Zahid, Kazi Matin Uddin Ahmed. 2022. The Bengal Water Machine: Quantified freshwater capture in Bangladesh, *Science*, Vol 377, Issue 6612, pp.1315–1319, [DOI: 10.1126/science.abm4730](https://doi.org/10.1126/science.abm4730).

Deepak Varshney, Pramod K. Joshi, Anjani Kumar, Ashok K. Mishra, Shantanu Kumar Dubey. 2022. Examining the transfer of knowledge and training to smallholders in India: Direct and

spillover effects of agricultural advisory services in an emerging economy, *World Development*, Volume 160, 2022, ISSN 0305-750X, <https://doi.org/10.1016/j.worlddev.2022.106067>.

Deepak Varshney, Ashok K. Mishra, Pramod K. Joshi, Devesh Roy. 2022. Social networks, heterogeneity, and adoption of technologies: Evidence from India, *Food Policy*, Volume 112, 2022, ISSN 0306-9192, <https://doi.org/10.1016/j.foodpol.2022.102360>.

In partnership with



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Images courtesy: IWMI -SDC-SoLAR Project

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