



# Nepal Science-Policy Dialogue on Solar Irrigation Empowering Agriculture with Renewable Energy for Sustainable Irrigation and Inclusive Policies



April 22, 2024  
ICIMOD, Nepal

**Authors:** Amrita Rauniyar (Consultant, IWMI Nepal), Anuj Mishra (Research Officer - Socio-Technical Innovation, IWMI Nepal), Shisher Shrestha (National Researcher - Renewable Energy Water and Climate Change, IWMI-Nepal).

**Citation:**

Rauniyar, A.; Mishra, A.; Shrestha, S. 2025. *Empowering agriculture with renewable energy for sustainable irrigation and inclusive policies*. Nepal Science-Policy Dialogue on Solar Irrigation, Kathmandu, Nepal, 22 April 2024. Colombo, Sri Lanka: International Water Management Institute (IWMI). 44p. doi: <https://doi.org/10.5337/2025.231>

**About SoLAR:** The Solar Irrigation for Agricultural Resilience (SoLAR) in South Asia project aims to sustainably manage the water-energy and climate interlinkages in South Asia through the promotion of solar irrigation pumps (SIPs). The main goal of the project is 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. This project responds to government commitments to transition to clean energy pathways in agriculture. All countries in this project have Nationally Determined Contribution (NDC) commitments to reduce greenhouse gas (GHG) emissions and SIPs can play a significant role in reducing emissions in agriculture.

The project is supported by the Swiss Agency for Development and Cooperation (SDC).

Read more: [solar.iwmi.org](http://solar.iwmi.org)

Copyright © 2025, by IWMI. All rights reserved. IWMI encourages the use of its material provided that the organization is acknowledged and kept informed in all such instances.

**Disclaimer:** This publication has not been independently peer reviewed. Responsibility for editing, proofreading, and layout, opinions expressed, and any possible errors lies with the authors and not the institutions involved. The boundaries and names shown and the designations used on maps do not imply official endorsement or acceptance by IWMI, CGIAR, our partner institutions, or donors.

Photographs used in this report were provided by the communications team in the IWMI Nepal office.

**Design:** Tanmoy Bhaduri, Communications Consultant, IWMI

## Contents

<b>Executive Summary</b> .....	3
<b>Acknowledgement</b> .....	4
<b>Introduction</b> .....	5
Overview .....	5
Objectives .....	5
Theme 1 - Scaling Solar Irrigation in Nepal .....	5
Theme 2 - Social Inclusion in Solar Irrigation .....	6
Theme 3 - Making Solar Irrigation Programs More Sustainable.....	6
Expected Outcomes.....	6
Knowledge Partners .....	6
<b>Session Summaries</b> .....	7
Opening Session: .....	7
Session 1: Scaling Solar Irrigation in Nepal .....	13
Session 2: Social Inclusion in Solar Irrigation .....	20
Session 3: Making Solar Irrigation Programs More Sustainable .....	27
Plenary Closing Session: .....	33
<b>Conclusion</b> .....	36
<b>Appendices</b> .....	37
Networking Events .....	37
Agenda .....	39
Participants .....	41
Further Reading: Brochure Links.....	42

## Executive Summary

A one-day workshop, jointly organized by the Alternative Energy Promotion Center (AEPIC), International Water Management Institute (IWMI), and International Center for Integrated Mountain Development (ICIMOD), aimed to bring together policymakers, researchers, the private sector, development partners, civil society, and other key stakeholders. This workshop showcased evidence and research findings from the Swiss Agency for Development and Cooperation (SDC) funded Solar Irrigation for Agriculture Resilience in South Asia (SoLAR-SA) and the Green Energy Management for Mountain Economy (GEM) Nepal project funded by the Royal Norwegian Embassy. The workshop focused on engaging participants in a science-policy dialogue to scale renewable energy programs, particularly solar irrigation. This highlighted research findings from several studies, highlighting the importance of inclusivity and sustainability in solar irrigation programs. The expected outcomes of the workshop were to exchange knowledge about solar irrigation practices, improve policy dialogues to advance government initiatives, and identify critical research gaps and opportunities for future work in solar irrigation research in Nepal.

The National Science-Policy Dialogue on Solar Irrigation in Nepal addressed crucial themes like Scaling Solar Irrigation, Social Inclusion, and Sustainability. The conference highlighted key takeaways such as the benefits of solar irrigation, the need for greater scalability and inclusivity in solar systems, and the challenges and opportunities in promoting sustainable solar irrigation practices. The event emphasized the importance of collaboration between various stakeholders to drive inclusive growth and sustainability in the irrigation sector.

Additionally, the forum discussions revolved around critical areas for improvement and development in the country's irrigation and agricultural sectors. These discussions underscored the importance of modernizing irrigation systems through renewable energy, particularly solar power, to enhance resilience against climate change and improve food security.

The discussions revealed that scaling up requires moving beyond technical solutions to address deeper systemic issues. Key challenges include:

- **Policy & Coordination:** Unclear policies for grid-connected systems, misaligned subsidies, and a lack of coordination between energy, water, and agricultural ministries.
- **Financial Barriers:** High upfront costs and a lack of innovative, inclusive financing models that reach marginalized farmers and women.
- **Technical & Maintenance Issues:** A severe shortage of local technicians for maintenance and repair, leading to a high rate of defunct systems, especially in the mid-hills.
- **Social Inclusion:** Well-intentioned subsidies often benefit wealthier, male landowners, while women and marginalized communities face barriers to access and ownership.
- **Sustainability Concerns:** Questions about long-term economic viability beyond subsidies, the risk of groundwater depletion, and the need for a holistic "soil-to-market" approach.
- **Future pathways:** Future success depends on a multi-stakeholder approach involving all levels of government, the private sector, development partners, and local communities. Priorities include developing clear policies (especially for net metering), building local capacity for maintenance, designing targeted and inclusive business models, and ensuring that research directly informs policy and practice.

## Acknowledgement

We extend our heartfelt gratitude to everyone who contributed to the success of the National Science-Policy Dialogue on Solar Irrigation.

Our sincere thanks to our co-organizers, the Alternative Energy Promotion Center (AEPC) and the International Centre for Integrated Mountain Development (ICIMOD), for their partnership and joint effort.

This event was made possible through the generous support and collaboration of our esteemed partners: the Swiss Agency for Development and Cooperation (SDC), the Royal Norwegian Embassy, and the International Solar Alliance (ISA).

We are deeply grateful to our distinguished guests for their insightful contributions: Mr. Keshab Kumar Sharma, Secretary of WECS; Mr. Nawa Raj Dhakal, Executive Director of AEPC; Dr. Laxman Ghimire (AEPC); Ms. Divya Sharma (SDC); and Dr. Pema Gyamtsho, Director-General of ICIMOD.

Special thanks are due to the organizing teams at ICIMOD (Mr. Avishek Malla, Dr. Mewang Gyeltshen, Mr. Pugazenthi Dhananjayan, and Ms. Kaweri Bhandari), GIZ POSTED (Mr. Kushal Gautam), and AEPC (Mr. Prasis Paudel), as well as colleagues from IWMI (Dr. Darshan Karki, Ms. Sumitra KC, and Ms. Shivani Chemjong), for their invaluable support.

We also acknowledge the active participation of representatives from local and provincial governments, our speakers, panelists, moderators, development partners, researchers, the private sector, and civil society. Your diverse perspectives were crucial to the dialogue's richness.

Finally, we commend the technical and logistical teams, including all rapporteurs and volunteers, whose tireless work behind the scenes ensured the workshop ran seamlessly. To all participants, your enthusiastic engagement and constructive input were essential to achieving our shared goals for sustainable and inclusive solar irrigation in Nepal.

# Introduction

## Overview

The irrigation system covers only 40% of Nepal's agricultural land, and only 19% of the irrigated land in Nepal receives year-round irrigation (YRI)<sup>1</sup>. With many farmers relying on rain-fed cultivation, the escalating challenges posed by shifting weather patterns exacerbate difficulties in sustaining food production and livelihoods dependent on farming. Moreover, Nepal's diverse physiographic zones lead to unequal distribution of, and access to, irrigation technologies. This necessitates tailored solutions. Major policy changes are required to reimagine Nepal's modern irrigation programs to ensure YRI through Renewable Energy irrigation and expedite this energy transition in the agriculture sector, making them more inclusive, sustainable, and scalable.

Renewable energy solutions like Solar irrigation have gained traction as a climate-resilient technology among Nepali farmers over the last decade. Recent data shows that Nepal is gradually moving away from fossil fuel-based irrigation to more sustainable renewable energy sources such as solar. The ICIMOD PURE platform also shows that the area with unmet irrigation in Nepal requires an additional estimated power capacity of 1300 MW for lift irrigation.

The one-day workshop, jointly organized by the Alternative Energy Promotion Center (AEPC), International Water Management Institute (IWMI), and International Centre for Integrated Mountain Development (ICIMOD), aims to bring policymakers, researchers, the private sector, development partners, civil society, and other key stakeholders together to engage in a science-policy dialogue on scaling renewable energy programs. The workshop showcased evidence and research findings from the Swiss Agency for Development and Cooperation (SDC) funded Solar Irrigation for Agriculture Resilience in South Asia (SoLAR-SA) project and the GEM Nepal project funded by the Royal Norwegian Embassy. The workshop primarily focused on scaling solar irrigation programs, prioritizing inclusivity and sustainability by harnessing evidence and collective insights to overcome challenges and promote effective solutions.

## Objectives

The key objectives of the National level Science-Policy Dialogue on Solar Irrigation are:

1. Provide a platform to exchange knowledge on solar irrigation in Nepal.
2. Facilitate policy dialogues with policymakers, development partners, and stakeholders to improve the government's solar irrigation initiatives and make them more socially inclusive, scalable, and sustainable.
3. Identify key gaps in research and opportunities for future work in Nepal's solar irrigation sector.

The workshop focused on three thematic areas.

## Theme 1 - Scaling Solar Irrigation in Nepal

Solar irrigation has been widely adopted in Nepal for over a decade. The government of Nepal has actively promoted solar irrigation pumps (SIPs) in areas with limited grid electricity access as a climate-friendly alternative to diesel pumps. However, because of the significant upfront capital investment, the adoption of solar irrigation programs in Nepal heavily relies on subsidies. As a result, the market size for solar irrigation is often determined by the available budget for subsidizing pumps rather than actual demand. This session focused on strategies for scaling up solar irrigation in Nepal with an innovative business model, including exploring opportunities for off-grid solar irrigation systems and investigating the possibility of grid integration of SIPs.

This session explored the following:

- Identifying the potential renewable energy demand (on/off-grid) for irrigation in Nepal.
- Benefits of integrating Solar Irrigation Pumps (SIPs) with the grid and their role in enhancing the scalability of solar irrigation.
- Cost optimization of solar irrigation system for hills
- Building a scalable business model for solar irrigation with subsidies and financing options.

---

<sup>1</sup> National Irrigation Management Plan, 2019, Department of Water Resources and Irrigation, Ministry of Energy, Water Resources and Irrigation, Government of Nepal

## Theme 2 - Social Inclusion in Solar Irrigation

The success of SIP in Nepal hinges on the ownership and adoption of the technology. However, the disproportionate focus on the electro-mechanical and technical fixes is a critical shortcoming. This neglects the vital socio-political and economic context within which these programs operate. Failing to account for societal realities as an integral part of planning, design, and implementation hinders the effective transfer of solar irrigation technologies. This session was designed to dive into this challenge, exploring the need to integrate social inclusion into solar programs.

to understand the following:

- The importance of gender and social inclusion for sustainable solar irrigation programs.
- Practitioners' experiences, both successes and challenges.
- Strategies to build ownership of solar irrigation programs, ensuring their adoption and long-term success.

## Theme 3 - Making Solar Irrigation Programs More Sustainable

AEPC has installed more than 3000 SIPS in Nepal, a significant number has also been installed by sectorial organizations, provincial and local governments. However, various reports have highlighted the sustainability issues of the systems. Some of the sustainability issues are related to poor construction standards and poor operation and maintenance (O&M) services. Furthermore, frequent issues result in farmers not trusting the technology, limiting its adoption.

Without ensuring challenges related to the sustainability of solar irrigation programs, the government's investment is wasted, and farmers cannot maximize the benefits of solar irrigation systems.

This session explored the following:

- While poor O&M services have been widely reported, what practical challenges limit timely and effective O&M services?
- Beyond the technical issues, what issues (social aspects, groundwater sustainability, etc.) limit the sustainability of solar irrigation programs?
- What initiatives are being taken by solar irrigation programs, installer companies, and supplier companies to overcome the challenges?

## Expected Outcomes

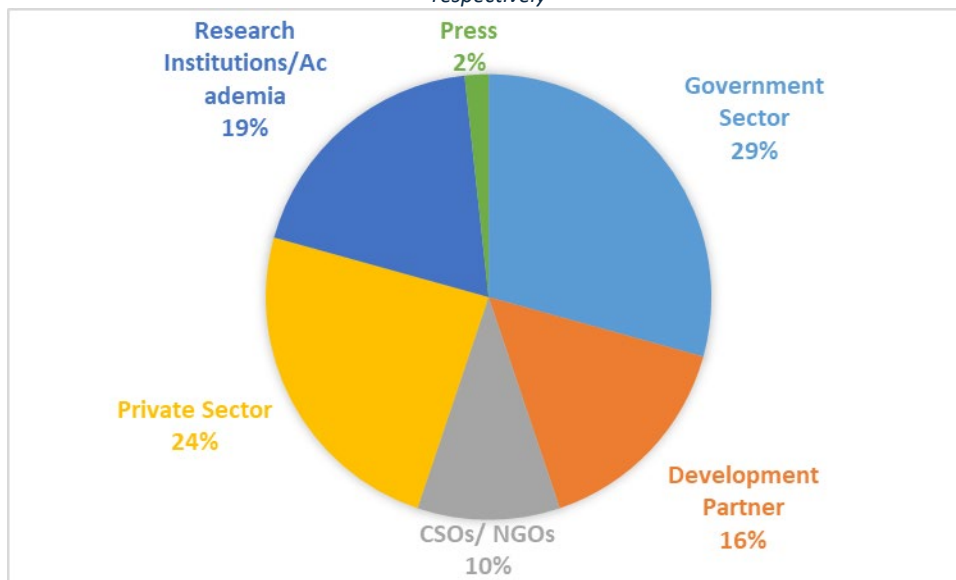
1. Increased understanding and knowledge exchange among participants about solar irrigation practices in Nepal.
2. Enhanced policy dialogues may improve the government's solar irrigation initiatives.
3. Identify critical research gaps and opportunities for future work in Nepal's solar irrigation sector.

## Knowledge Partners



## Session Summaries

A total of 154 participants attended this one-day event, with male and female attendees comprising 64% and 36% of the attendees respectively



Organization categories (In percentage)

## Opening Session:

**National Anthem:**



Participants stand for the national anthem during the national forum.

**Welcome Remarks by Dr. Manohara Khadka, Country Representative, IWMI-Nepal**

Dr. Khadka welcomed participants to the National Science-Policy Dialogue on Solar Irrigation, thanking partners AEPC, SDC, ISA, the Royal Norwegian Embassy, and ICIMOD for their collaboration. She highlighted the growing adoption of solar irrigation for climate resilience, mentioning the over 3,300 solar pumps installed since the enactment of the Renewable Energy Subsidy Policy (2016). Dr. Khadka emphasized benefits like higher crop yields and reduced workloads for women while acknowledging the need for greater scalability, inclusivity, and affordability. She stressed addressing climate change's impacts on smallholder farmers, advocating for renewable solutions to ensure food security and economic benefits. She wished for the success of this dialogue to foster knowledge sharing and policy advancement in three areas: Scaling Solar Irrigation, Social Inclusion, and Sustainability.



*Dr. Manohara Khadka delivering her welcome remarks.*

### ***Opening Remarks by Dr. Pema Gyamtsho, Director-General, ICIMOD***

In his opening remarks, Dr. Gyamtsho stressed the crucial importance of water, advocating for it to be a central focus in discussions due to its interconnectedness with food, energy, and security. He highlighted the need to address future challenges, such as extreme weather and uncertain monsoon patterns affecting rainfed agriculture in regions like the Hindu-Kush Himalaya and Southeast Asia. Dr. Gyamtsho questioned why Nepal, despite its abundant water resources, hasn't fully utilized its hydroelectric, wind, and solar energy potential, calling for improved policies and coordination between government bodies. He emphasized the promise of solar pumping technology, urging donors to invest in solar irrigation to enhance agricultural resilience and sustainability.



*Dr. Pema Gyamtsho delivering his opening remarks during the opening session.*

### ***Opening Remarks by Ms. Divya Sharma, Deputy Head of Cooperation at SDC***

Ms. Sharma addressed the forum virtually. In her opening remarks, she emphasized the paradox of Nepal's food insecurity despite its large agricultural population, underscoring the need for better water management to boost productivity. She noted progress in adopting solar pumps over diesel pumps through collaboration between the Government of Nepal and development partners but acknowledged challenges in reaching marginalized farmers. Highlighting the financial feasibility of solar pumps for women and marginalized farmers. She highlighted the importance of the recent agreement between the user community and the local Nepal Electricity Authority (NEA) office for net metering, which is a key highlight of the SOLAR Project.

In addition, she expressed optimism about the transformative journey of solar irrigation adoption in Nepal while recognizing ongoing challenges.



*Ms. Divya Sharma delivering her opening remarks (virtually)*

**Keynote Presentation on the Status of Solar irrigation in Nepal by Dr. Laxman Prasad Ghimire, AEPC**

In his keynote presentation on solar irrigation in Nepal, Dr. Ghimire outlined AEPC's establishment in 1996 and its policies like the Renewable Energy Subsidy Policy (2022) aimed at promoting renewable energy. He shed light on the subsidy for solar irrigation and drinking water systems and the process of solar irrigation, focusing on prioritizing marginalized groups and women landowners. Findings from an IWMI study showed reduced diesel use and benefits for small landowners, despite challenges in monitoring, technical manpower, and post-installation support. Dr. Ghimire emphasized the need for continued efforts and exploring grid-connected solar irrigation to maximize solar irrigation potential in Nepal.



*Dr. Laxman Ghimire during his keynote address.*

**Special remarks from the Chief Guest – Mr. Keshab Kumar Sharma – Secretary, WECS**

As the Chief Guest, Mr. Sharma, Secretary of the Water and Energy Commission Secretariat (WECS), provided special remarks and discussed several critical issues on solar irrigation in Nepal.

Mr. Sharma highlighted the issue of food insecurity, with 6 million people in the country facing this challenge, particularly marginalized and small landowner farmers. He emphasized the country's targets to increase food production and decrease food imports by 30%, aiming to lift one-fourth of the population out of poverty by improving the agricultural sector, particularly through better irrigation practices. Mr. Sharma stressed that water is an instrumental factor in improving agriculture, especially given that only one-third of irrigable land in Nepal receives year-round irrigation. He underscored the significance of solar irrigation as an alternative to diesel pumping, citing its affordability, environmental friendliness, and technical feasibility. He noted the government's commitment to expanding irrigation infrastructure and improving resilience in the face of climate change. He emphasized Nepal's commitment to achieving net-zero emissions by 2050 and generating 15,000 MW of clean energy in the next decade, leveraging the country's immense solar and hydro potential. He noted the challenges faced in promoting solar pumps, particularly in the mid-hills region, and highlighted the need for innovative business models involving the private sector. He also emphasized the importance of green thinking and coordination at national, regional, and global levels, along with the need for more studies and empirical evidence. Lastly, he stressed the importance of gender and social inclusion in renewable energy initiatives, particularly in achieving success with solar irrigation.

In conclusion, Mr. Sharma highlighted the significance of dialogues like the solar forum in enhancing cooperation and bridging the gap between science and practice, emphasizing that solar energy should be viewed not as an option but as a necessity to achieve food security in the face of climate change.

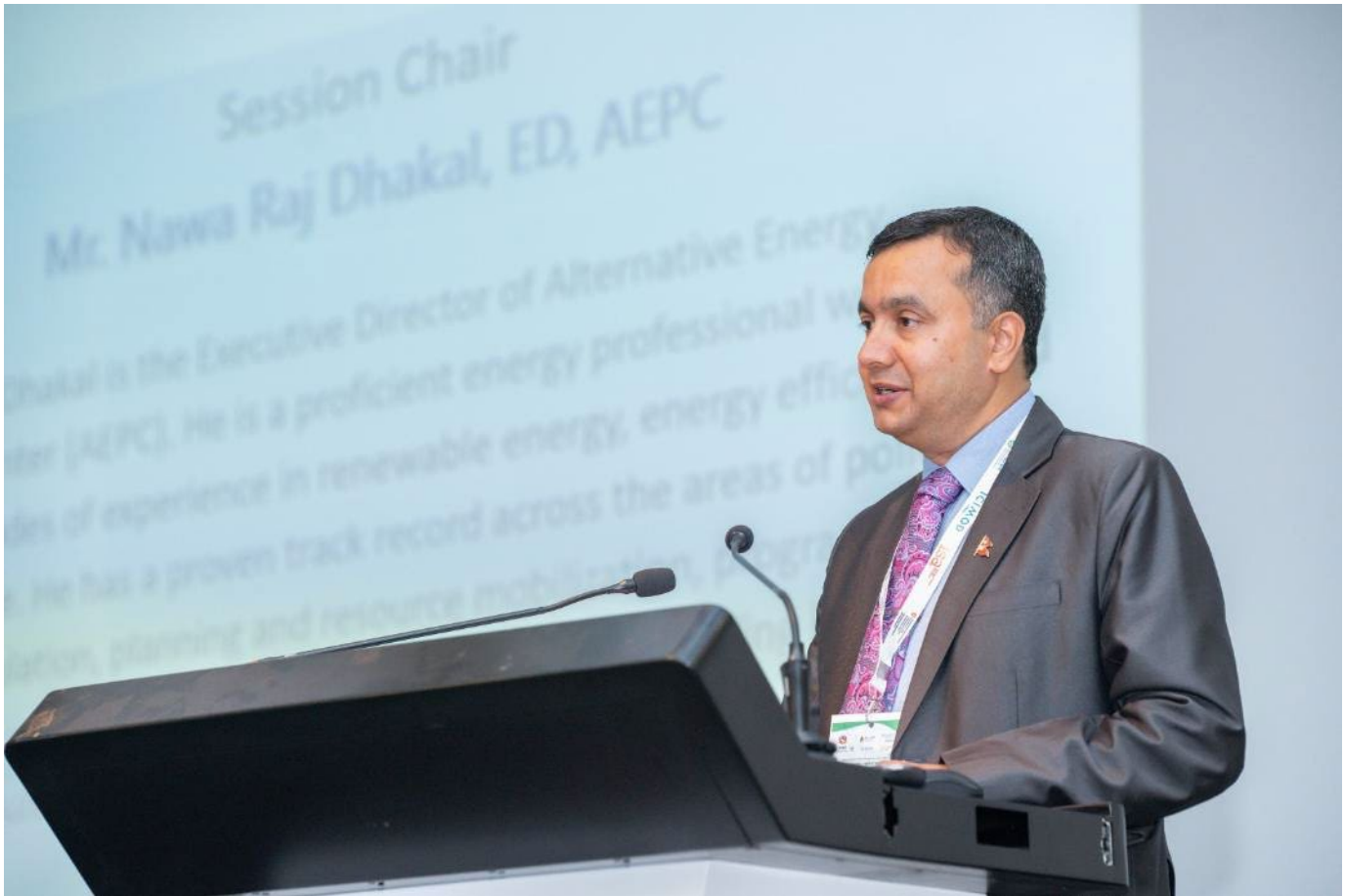


*Chief Guest, Mr. Keshab Kumar Sharma addressing the forum.*

**Remarks by Session Chair – Mr. Nawa Raj Dhakal – Executive Director, AEPC**

In his remarks as the Session Chair, Mr. Nawa Raj Dhakal began by emphasizing the significant reliance of global communities on agriculture for livelihood, with recent studies indicating that close to 2.5 billion people are involved in agricultural activities in Asia. Mr. Dhakal underscored Nepal's heavy dependence on agriculture, with approximately one-third of the country's GDP coming from this sector. He noted that the majority of farmers in Nepal are smallholders engaged in subsistence agriculture, often relying on rain-fed irrigation. He highlighted the limited availability of irrigable land in Nepal, with only 69% of arable land being suitable for irrigation, mainly concentrated in the Terai region. Additionally, he pointed out the vulnerability of Nepal's agricultural sector to climate change and emphasized the viability of solar irrigation as an alternative to diesel pumping, particularly in areas where grid access is limited. He noted the gradual reduction in diesel pump usage due to the adoption of solar irrigation systems. He discussed the relatively recent inclusion of Solar Irrigation Pumps (SIPs) in Nepal's renewable energy policy in 2016, indicating a growing momentum in their adoption since then. He also acknowledged the support and encouragement from development partners in promoting solar irrigation, highlighting the importance of strong partnerships in this endeavor. Furthermore, he emphasized the significance of collaboration with local governments, particularly in the context of federalization, and encouraged development partners to engage more actively with local authorities.

In conclusion, Mr. Dhakal expressed his optimism that the discussions and collaborations during the program would contribute to mainstreaming renewable energy reflecting the dedication of stakeholders to this cause.



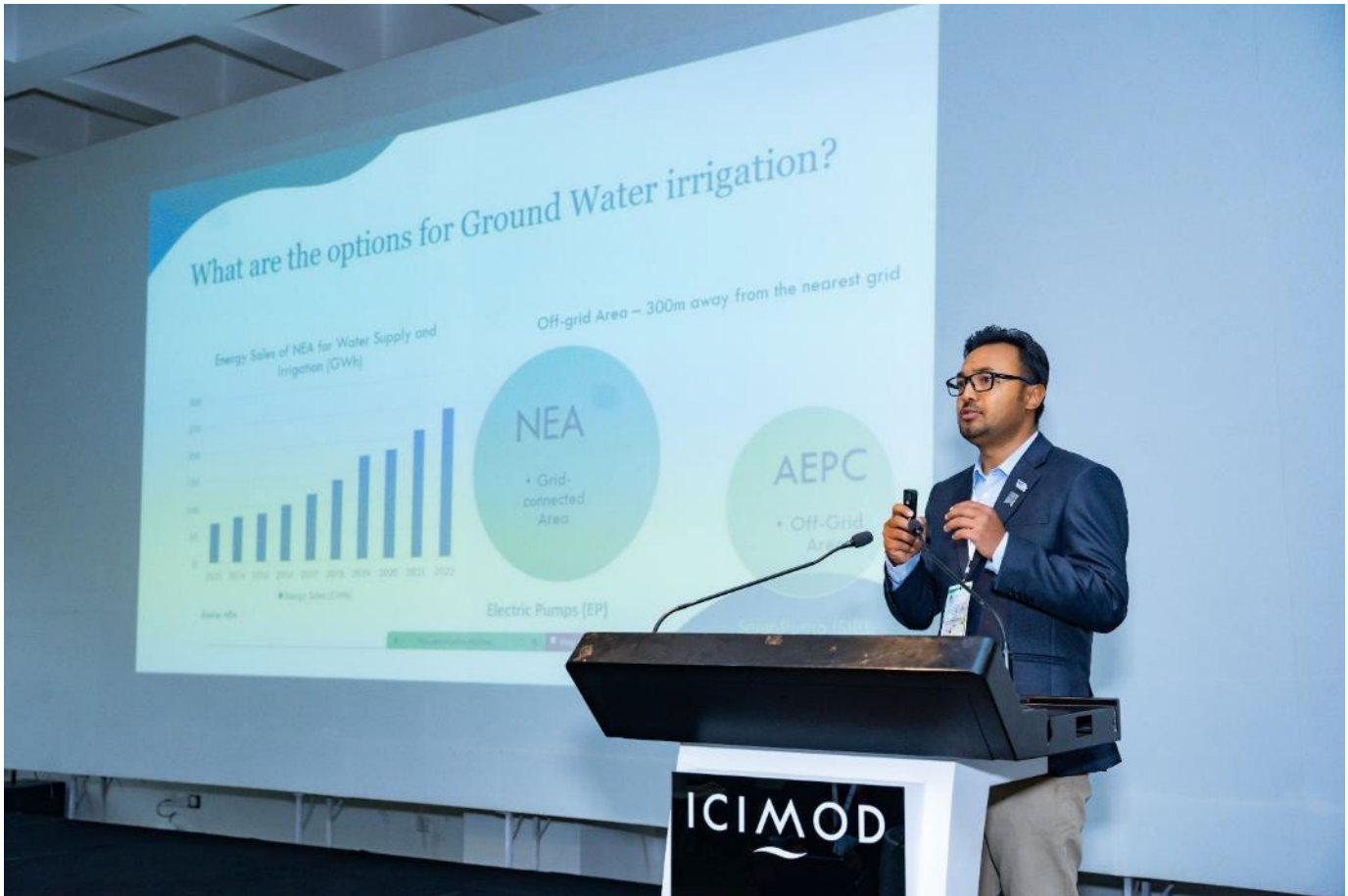
*Session Chair Mr. Nawa Raj Dhakal delivered his concluding remarks.*

## Session 1: Scaling Solar Irrigation in Nepal

### ***Presentation 3.1 – Lessons from the Grid-connected Solar Irrigation Pilot in Parsa by Mr. Shisher Shrestha, IWMI***

In his presentation on “Lessons from the Grid-connected Solar Irrigation Pilot in Parsa”, Mr. Shrestha from IWMI outlined a collaborative effort of AEPC, NEA, Chhipaharmai Rural Municipality, Saurya Urja Krishak Samuha, and the SDC funded SoLAR project.

The presentation explored different typologies for grid-connected SIP systems and shared preliminary findings from the grid-connected solar irrigation pilot. He emphasized the importance of establishing clearer implementation systems, guiding policies, and capacity-building measures for promoting grid-connected solar irrigation in Nepal. The signing of the net-metering agreement between the local NEA office and the Farmer user group was a key highlight of the project. The farmers involved in the pilot project have zero diesel use for irrigation and are able to sell water to their neighbors at cheaper rates, providing them with an additional income source. Future work will focus on cost optimization, assessing socio-economic impacts, and implementing net metering for these projects.



*Presentation on Lessons from the Grid-connected Solar Irrigation Pilot in Parsa by Mr. Shisher Shrestha, IWMI.*

***Presentation 3.2 – Opportunity for renewable energy for irrigation in the mountains by Mr. Avishek Malla, ICIMOD***

Mr. Avishek Malla’s presentation on “Opportunity for Renewable Energy for Irrigation in the Mountains”, presents major findings after thorough investigation of possible renewable energy (RE) demand for irrigation via the PURE platform which included features such as sustainability analysis, measurement of crop water requirement, power requirement assessment, and cost estimation. Findings indicated that 87% of cultivable land lacks year-round irrigation, with only 13% availing continuous access. The potential demand for irrigation stands at 1000 MW capacity. However, challenges persist, including high infrastructure capital costs, limited investments, natural disaster risks, capacity constraints, technical and logistical hurdles, insufficient subsidiary programs, and unification system limitations, with only 60 % of systems in place, merely 50% operational.



*Presentation on Opportunity for renewable energy for irrigation in the mountains by Mr. Avishek Malla, ICIMOD.*

***Experience from the field: (a) User of grid-connected Solar Irrigation Project in Parsa by Mr. Amin Miya***

Mr. Amin Miya, with 30 to 35 years of agricultural experience, has directly benefitted from the grid-connected solar irrigation pilot, along with 7 other farmers. These SIPs have significantly lowered operational costs, generating an income of 15 to 20 thousand per Katha. The system is user-friendly, allowing all family members to operate it smoothly. However, ensuring functionality during grid power outages would be beneficial. Additionally, inverter issues at grid centers require proper attention for optimal performance.



*Mr. Amin Miya, a user of grid connected Solar Irrigation Pilot Project in Parsa, sharing his Experience from the field.*

***Experience from the field: b) User of Solar Water Pumping System in Rautahat by Mrs. Januka Devi Upreti and Mr. Mahesh Upreti***

Mrs. Januka Devi Upreti has significantly reduced her irrigation costs by switching from a diesel pump to a solar water pumping system for her 6.5 bigha<sup>2</sup> of land. Previously, she spent between 1500 to 2000 Nepalese Rupees per day on diesel. With the capacity of 1.35 kWp SIP, she now incurs no water expenses, demonstrating the cost-effectiveness and sustainability of solar power.

---

<sup>2</sup> 1 Bigha = 0.251 Hectare



*Mrs. Januka Devi Upreti User of Solar Water Pumping System in Rautahat, sharing her experience.*

**Panel Discussion on Scaling Solar Irrigation in Nepal**

*Panelists: Ms. Bimala Rai Tilung, Mayor [Halesi Tuwaching Municipality], Mr. Kiran Timilsina [Ghampower], Mr. Madhab Neupane [Mero Microfinance], Mr. Sagar Gyawali [NEA]*

*Moderator: Mr. Badri Nath Baral [NREP]*



*Panelists: Mr. Sagar Gyawali [NEA], Mr. Kiran Timilsina [Ghampower], Ms. Bimala Rai Tilung, Mayor [Halesi Tuwaching Municipality], Mr. Madhab Neupane [Mero Microfinance], and Moderator: Mr. Badri Nath Baral [NREP] from left to right.*

## PANEL DISCUSSION

**Q: Scaling comes up with additional monetary value, being a private enterprise what are your experiences from the field and what are your plans and business models to upscale SIPs?**

**A:** Ghampower has been working in the solar sector since 2015. Farmers are completely aware of SIP coming this long. As the upfront cost is high, in the initial days Ghampower used to finance SIPs, being a private enterprise which became a challenge. So, they started collaborating with commercial banks to finance upfront costs. As commercial banks are based in city areas and SIPs are needed in rural areas, people need to travel 2 to 3 hours per day just to pay EMI. This strategy also did not seem good, so they started collaborating with microfinances with the model of 60% by microfinances and 40% by Ghampower. Farmers need to pay, both: microfinance and Ghampower (without interest). It seems to be tedious to farmers. So, Ghampower tapped microfinances and signed MOUs, and they became ready to pay 100% upfront costs. The company also provides training to farmers which would help farmers in generating more revenue by high-value crops [Mr. Kiran Timilsina].

**Q: Private sector collaborates with local governments and provincial governments to uplift SIPs, are there any such business models, what are your experiences and plans for the future?**

**A:** Regarding collaboration with the government to uplift SIPs, the Government commits but difficult to implement. There is a need for coordination with lots of government bodies just to implement a single SIP. The government needs to work on how effective collaboration with private enterprises can be done [Mr. Kiran Timilsina].

**Q: How are microfinances helping and supporting farmers?**

**A:** There are altogether 149 branches of Mero Microfinance all over Nepal. Irrigation facility lacked in the hilly and terai parts of Nepal. The demand for SIP loans is high but there are hurdles. However, they are in the way to provide suitability to farmers. They are getting support from NRB for this initiative/action. To provide easy access to the farmers they are opening centers and branches in most of the places. They have hired JTA too to provide advice and disseminate information regarding agriculture to the farmers [Mr. Madhab Neupane].

**Q: Is it interesting for microfinance to provide loans to SIPs, is there any base to continue after the end of the projects?**

**A:** After the SIP tie-up, 10 million loans have been distributed so far. Microfinance is also providing subsidies to SIPs by decreasing interest rates from 15% to 9 or 10% [Mr. Madhab Neupane].

**Q: How is NEA playing a role in making quick procedures for grid connection to SIPs and promotion of SIPs?**

**A:** The grid connection idea is generated from NEA itself. As irrigation requirements are seasonal, this concept is the ultimate solution to help farmers. However, the policy of grid connection set is becoming a challenge for them, as for irrigation, the electric charge is Rs.2.30 and the electricity cost from solar is Rs. 5.94, which is quite unattractive and is causing delays in the process. The policy needs to be revised to help both parties. He also addressed that NEA should not take immense pride in electric connection (reaching out to people for lighting houses) but should focus on grid extension to meet irrigation requirements area [Mr. Sagar Mani Gyawali].

**Q: How does NEA play a role in addressing the challenge of grid interconnection with SIPs?**

**A:** NEA is supporting with line extension and 11KVA transformer to electrify the area for grid interconnection. He expressed that collaborative work is needed in this field, like area identification, pumping support by AEPC, line extension, and whole area electrification (not only focusing on the single farmer but the whole area potential for lift irrigation) by NEA [Mr. Sagar Mani Gyawali].

**Q: How do local governments play a role in upscaling SIPs?**

**A:** The policy demands number of Households and population. The population of Halesi Tuwaching Municipality is around 32,000, as it is a religious place, more than 300,000 devotees visit the place every year. The policy needs to be revised and should address such things.

People are migrating due to inaccessibility to water, even the perennial rivers flow below the houses. The irrigation scheme from AEPC is mainly focused on Terai region, as Halesi Tuwaching Municipality is considered dry, this area also needs focus from those parties. She is optimistic about the possibility of such programs with the assistance of local government. She also addresses the localization of policy as a must [Ms. Bimala Rai Tilung].

**Q: How can local governments move forward in SIPs?**

**A:** The PPP model act has already been formulated to work in the PPP approach. She expressed that they are ready to participate with AEPC and other such institutions to scale SIPs and uplift the area [Ms. Bimala Rai Tilung].

**Remarks by Session Chair-Dr. Laxman Prasad Ghimire, Alternative Energy Promotion Center (AEPC)**

Dr. Ghimire underscored the increasing importance of off grid SIPs and grid connected solar irrigation, not only presenting opportunities for both users and NEA but also demanding attention from policymakers. The discussion highlighted the necessity for intervention in mountain regions to facilitate cultivation and emphasized the need for technical improvements in the pilot projects. Limited support from NEA was noted, indicating untapped market potential. Suggestions were made for a transition from subsidy-driven to market-driven approaches, promoting a reconsideration of business modalities. A collaborative, integrated approach along the value chain was advocated for, alongside efforts to enhance promotion and awareness of technology.



*Concluding Remarks by Session Chair, Dr. Laxman Prasad Ghimire.*

## Session 2: Social Inclusion in Solar Irrigation

### ***Presentation 3.1 – Making solar irrigation equitable and inclusive: Some insights from Nepal by Ms. Sumitra KC, IWMI***

Ms. Sumitra KC from IWMI presented insights on making solar irrigation equitable and inclusive in Nepal, based on Gender Equality and Social Inclusion (GESI) assessments in water-energy-food policies and solar irrigation projects. The research aimed to address gender and social inequalities embedded in South Asia’s socio-cultural and decision-making systems, filling the knowledge gap on promoting GESI. Findings revealed that subsidies intended for women and underprivileged groups often benefit richer, privileged men, and there is a lack of GESI-specific subsidy policies and financing mechanisms. Despite commendable efforts by AEPC, with 22% of recipients being women, community ownership of solar programs remains limited, and policies inadequately address social norms and differentiation, focusing mainly on physical, economic, and technological aspects. Recommendations included allocating dedicated budgets, human resources, and leadership for GESI integration, developing financial and business models that promote gender equality and social inclusion, and expanding solar irrigation programs to consider social economic factors. Ms. KC emphasized the need for stakeholders to prioritize GESI integration for sustainable and effective solar irrigation programs.



*Presentation on Making solar irrigation equitable and inclusive: Some insights from Nepal by Ms. Sumitra KC.*

***Presentation 3.2 – Enabling GESI in the Renewable Energy Powered Decentralized Lift Irrigation Systems by Dr. Shiba Satyal Banskota & Ms. Simran Silpakar, ICIMOD***

Ms. Simra Silpakar from ICIMOD presented insights on enabling GESI in RE Powered Decentralized Lift Irrigation Systems, focusing on the Women’s Empowerment through Renewable Energy Powered Decentralised Lift Irrigation Systems in Bhutan (WERELIS – Bhutan) Project. In Bhutan, where agriculture employs 60% of the population with 53% being women, the project implemented RE-powered lift irrigation systems at two pilot sites to empower women and create economic opportunities through GESI-responsive implementation. Strategies included ensuring equitable opportunities for women’s participation, enhancing stakeholders’ capacities, conducting comprehensive GESI analysis, and aligning activities with findings. The presentation emphasized the importance of enabling GESI in renewable energy, citing job growth projections in the energy sector by 2030 and the need to address gender gaps. It highlighted that the absence of GESI exacerbates inequalities, challenges project effectiveness and sustainability, and results in missed opportunities. Ms. Silpakar concluded by underscoring the importance of integrating GESI considerations into renewable energy projects to promote equality, effectiveness, and sustainability.



*Presentation on Enabling GESI in the Renewable Energy Powered Decentralized Lift Irrigation Systems by Ms. Simran Silpakar, ICIMOD.*

***Experience from the field by Ms. Sabita Maharjan, Chairperson, Chhahari Krishi Ekal Mahila Firm***

Ms. Sabita Maharjan, Chairperson of Chhahari Krishi Ekal Mahila [Single Women] Firm, shared her experiences from the field, highlighting the benefits and challenges of using Solar irrigation. The firm, situated on communal land (*guthi*<sup>3</sup> land), aims to empower single and widowed women through agricultural activities, and has become a model for income generation. While Solar irrigation has brought significant benefits, it has also posed challenges, particularly in maintenance and upkeep, such as the changing of GI pipes. Initial subsidies lacked adequate follow-up from developers, leading to maintenance issues. Ms. Maharjan emphasized the need for continuous training in agricultural skills and called for support from organizations like ICIMOD and IWMI to ensure the sustainability of such initiatives. Her insights stressed the practical realities of utilizing solar irrigation in agriculture, highlighting the critical need for ongoing support and training.

---

<sup>3</sup> Guthi is a trust established by donors with religious, charitable, or philanthropic activities.



*Ms. Sabita Maharjan talking about Chhahari Krishi Ekal Mahila Firm [the firm managed and lead by single women group]*

**Panel Discussion on Gender and Social Inclusion in Solar Irrigation**

*Panelists: Dr. Indira Sthapit Shakya [Independent Consultant], Mr. Ishwari Tiwari [BCIRMP], Ms. Pratima KC [AEPC], Mr. Krishna Prasad Parajuli [SEMAN], Ms. Usha Maskey Manandhar [MinErgy Nepal]*

*Moderator: Dr. Darshan Karki [IWMI]*



*Panelists: Mr. Krishna Prasad Parajuli [SEMAN], Mr. Ishwari Tiwari [BCIRMP], Ms. Pratima KC [AEPC], Ms. Usha Maskey Manandhar [MinErgy Nepal] and Moderator: Dr. Darshan Karki [IWMI] from left to right.*

## PANEL DISCUSSION

### Round 1:

**Q: Are there any ongoing challenges in achieving social inclusion within solar irrigation programs that require further discussion or collaboration?**

**A:** Mr. Tiwari highlighted the inception of solar irrigation since 2013, initially focusing on areas impacted by the Bheri Diversion Project. He noted challenges during installation, operation, and maintenance, including limited land availability, operational unreliability during cloudy and rainy periods, and vandalism by disgruntled users. Lack of community ownership and the high installation cost compared to electrical systems were also cited as significant hurdles [Mr. Ishwari Tiwari].

**Q: What strategies have you found most effective in building a sense of ownership for solar irrigation initiatives [ownership by the federal, provincial, local govt, private sector, communities]?**

**A:** Ms. K.C. discussed strategies employed by AEPC, emphasizing the importance of collaborative efforts involving private and public sectors, civil society, and local communities. She highlighted the Renewable Energy Subsidy Policy and the prioritization of marginalized groups and women in the selection process. Additionally, she stressed the crucial role of local government recommendations and their financial support in fostering ownership. Planning and integration across all project phases were deemed essential for addressing ownership issues effectively [Ms. Pratima K.C.].

**Q: What challenges have you encountered in solar irrigation projects, in relation to training human resources? Do you have any suggestions to address these issues?**

**A:** Mr. Parajuli discussed challenges faced by SEMAN, particularly in training human resources. He emphasized the need to focus on technical skills, including civil, mechanical, and plumbing aspects, to address the out-migration issue effectively. Training programs tailored to the specific needs of solar irrigation projects were proposed as a solution *[Mr. Krishna Prasad Parajuli]*.

**Q: *How can we bridge the gap between the technical focus and the social considerations in solar irrigation programs?***

**A:** Ms. Manandhar emphasized the empowerment of women and marginalized groups through solar irrigation in Nepal but there are raised concerns about the high rate of defunct systems, particularly in the mid-hills. She questioned whether detailed feasibility studies adequately assess social feasibility alongside financial and technical aspects. Ms. Manandhar stressed the importance of considering the social and political implications to ensure the sustainability and success of scaling up solar irrigation initiatives as the first round of panel discussion revolved around the multifaceted challenges faced by the major stakeholders in social inclusion in solar irrigation programs *[Ms. Usha Maskey Manandhar]*.

**Round 2: [Question by moderator to all panelists]**

**Q: *Why does the Detailed Feasibility Study (DFS) fail to consider socio-political issues?***

**A:** Maintenance of solar irrigation systems pose difficulties due to limited community resources. Full reliance on subsidies can lead to reduced ownership and accountability. While solar irrigation increases crop yield, without the cultivation of cash crops or economically valuable crops, farmers may struggle to generate sufficient income for system maintenance. Prior to scaling up SLI, local technicians and grid-connected solar systems are necessary. Improved communication and coordination between energy-related bodies and the Department of Water Resources and Irrigation (DWRI) is essential *[Mr. Ishwari Tiwari]*.

**A:** While installation technicians may be insufficient, local communities and users require basic technical knowledge for solar irrigation operation and maintenance. There is a shortage of technicians trained in technologies like solar irrigation that utilize DC power. Establishing service centers for solar irrigation systems in areas with a high concentration of systems is crucial. Implementing net-metering, as done in India, can be beneficial for Nepal. Local-level prioritization is essential for effective implementation *[Mr. Krishna Prasad Parajuli]*.

**A:** Grassroots organizations should be included in DFS processes, and local communities should also be consulted. Consideration should be given to post-sales support beyond the initial two-year period to ensure sustained community assistance *[Ms. Pratima K.C.]*.

**Round 3: [Question by moderator to all panelists]**

**Q: *How can a research for development organization like IWMI help you [farming communities, NGO, private sector, the government] with regards to ensuring social inclusion in solar irrigation?***

**A:** Ms. Usha Maskey Manandhar emphasized the need for applied research that translates into practical solutions rather than theoretical studies. She acknowledged IWMI's research efforts in solar irrigation and highlighted the importance of integrating social aspects into Detailed Feasibility Studies (DFS) to support the private sector *[Ms. Usha Maskey Manandhar]*.

**A:** Ms. Pratima K.C. advocated for more detailed studies focusing on inclusion and power dynamics, beyond mere monitoring of yield and income generation *[Ms. Pratima K.C.]*.

**A:** Mr. Ishwari Tiwari highlighted IWMI's role in conducting impact studies to evaluate the sustainability and effectiveness of solar irrigation systems. Raised questions about the sustainability of solar irrigation systems and suggested that IWMI's research could help identify gaps and assess the impact of increasing competition among solar irrigation developers *[Mr. Ishwari Tiwari]*.

**A:** Mr. Krishna Prasad Parajuli expressed the need for data regarding water availability, which could be addressed through IWMI's research efforts *[Mr. Krishna Prasad Parajuli]*.

**Q&A [Open Floor]**

**Question from the advisor of the National Association of Rural Municipalities in Nepal (NARMIN) to Pratima K.C., AEPC:**

**Q:** Why are the subsidized solar irrigation projects from AEPC mostly centered on similar areas in the Terai region?

**Question/remarks to Krishna Prasad Parajuli, SEMAN and Pratima KC, AEPC:**

**Q:** Technician availability is mostly considered regarding installation only, and there seems to be a gap in technician availability post-warranty period. Can AEPC support technician training projects as well? Additionally, is Nepal being utilized (by donor agencies) for pilot solar irrigation projects only?

**Question/Remarks to all:**

- Need more emphasis on the importance of involving local government more in solar irrigation projects.
- Need for investment in Operation and Maintenance (O&M) of solar irrigation systems.

**Remarks from Session Chair: Mr. Nabin Chandra Adhikari, Secretary – Ministry of Water Resources and Energy Development, Karnali Province**

In his closing remarks, the session chair reflected on the significant benefits of solar irrigation projects while highlighting a notable gap between inclusive policies and their practical implementation. He posed a pivotal question regarding the necessity of more inclusive policies, suggesting that further research by IWMI could shed light on this aspect. Emphasizing the crucial role of local technicians in solar irrigation maintenance, he stressed the importance of prioritizing accessibility and availability over centralized approaches. Moreover, he underscored Nepal's heavy reliance on technology for solar irrigation projects, advocating for a shift towards prioritizing social development with a central focus on inclusion. Expressing concerns about Nepal's financial constraints, he questioned the investment in defunct solar irrigation systems and proposed a reflection on the availability of financial resources. Lastly, he advocated for a departure from blind subsidy policies, suggesting that subsidies should only be encouraged if they support the entire value chain, fostering a more sustainable approach to Solar irrigation initiatives.



*Concluding Remarks from Session Chair, Mr. Nabin Chandra Adhikari, Secretary, Ministry of Water Resources and Irrigation Development, Karnali Province, Nepal.*

## Session 3: Making Solar Irrigation Programs More Sustainable

### **Presentation 3.1 – Groundwater (GW) dashboard and Impact of GW-based pumped irrigation on GW table by Pratik Bhaju, CIMMYT**

In his presentation on the groundwater dashboard and the impact of groundwater-based pumping irrigation, Mr. Bhaju from CIMMYT highlighted the development of a comprehensive monitoring system. The initiative began with the collection of groundwater data from 60-70 wells per Terai district and expanded to over 20 districts in March, transitioning from paper-based methods to digital collection due to issues of inaccuracy, redundancy, data loss, and lack of real-time monitoring. A collaboration with GWRDB in 2020 led to the development of an Android-based data collection method, which proved cost-effective and efficient without requiring an internet connection to fill forms, synchronizing data when connected to the internet. Training facilitated by GIZ in Eastern Nepal and the creation of the groundwater website<sup>4</sup> enabled access to historical data and digital libraries. A case study in Bardiya district revealed a significant increase in shallow tubewells since 2007, optimal groundwater levels for irrigation, and substantial recharge during the monsoon. The rising demand for groundwater underscored the necessity for sustainable management, with further data collection across other districts being crucial for comprehensive impact assessment.



*Presentation on Groundwater (GW) dashboard and Impact of GW-based pumped irrigation on GW table by Pratik Bhaju, CIMMYT.*

### **Presentation 3.2 – Needs and instruments available for capacity building in the irrigation sector by Kushal Gautam, GIZ POSTED**

In his presentation on capacity building in the irrigation sector, Mr. Gautam from GIZ POSTED highlighted the program's focus on mini grids, water pumps, and rooftop solar systems, targeting policy and regulation, training, and digital monitoring in the

---

<sup>4</sup> <https://gw-nepal.com/>

Koshi and Far Western regions. Key challenges include poor system quality, lack of training access for the private sector, insufficient expertise in local and provincial governments, lack of standardized training programs, and program discontinuity. The program's journey involved need assessments, identifying training needs, and rolling out training. For solar water pumps, guidelines and budget planning tools were developed, and a service network pilot in East Nepal was launched. Coordination with AEPC, IWMI, and ICIMOD was crucial. To ensure sustainability, training is driven by market demand, integrates with the Technical and Vocational Education and Training (TVET) system, and fosters local ownership by matching interest and need, with training fees supporting ownership. Training offers cover feasibility studies, project implementation, and solar electric technician skills, provided by organizations such as SPRATA, Center for Energy Studies, and Don Bosco.



*Presentation on Needs and instruments available for capacity building in the irrigation sector by Kushal Gautam, GIZ POSTED.*

### **Presentation 3.3 – DFS Framework for pump irrigation by Mewang Gyeltshen, ICIMOD**

Mr. Gyeltshen from ICIMOD presented on the DFS Framework for Pump Irrigation, emphasizing the critical need for a government-endorsed framework in Nepal, involving stakeholders at central, provincial, and local levels to avoid oversight by outsourced teams. The framework, developed in collaboration with AEPC, follows a multidisciplinary approach, integrating expertise from renewable energy, agriculture, irrigation, and environmental and social safeguarding. Scheduled for completion by September 2023, the framework adhered to guiding principles like systematic assessment, multistakeholder engagement, contextualized project evaluation, proactive risk mitigation, and use of best available technology. The four-step process included inception, site survey, analysis and design, and finalization of the DFS study, with initial inception involving consultations, background studies, site surveys, and engagement with stakeholders to ensure comprehensive and inclusive project planning and execution.



*Presentation on DFS Framework for pump irrigation by Mewang Gyeltshen, ICIMOD.*

***Panel Discussion on Sustainability: Quality of System Design, Operation and Maintenance, Capacity Development Issues, and Groundwater Depletion***

*Panelists: Mr. Asit Saha [Aqua Flow Technologies], Dr. Anusuya Joshi [AEPC/DKTI], Mr. Jeevan Baidya [Sunbridge Nepal], Ms. Kalpana Kumari Katuwal, Mayor [Barahathwa Municipality], Mr. Santosh Rai [AEPC], Ms. Sadikshya Neupane [GIZ]*

*Moderator: Dr. Bharat Poudel [GIZ POSTED]*



*Panelists: Mr. Jeevan Baidya [Sunbridge Nepal], Ms. Sadikshya Neupane [GIZ], Mr. Asit Saha [Aqua Flow Technologies], Mr. Santosh Rai [AEPC], Dr. Anusuya Joshi [AEPC/DKTI], Ms. Kalpana Kumari Katuwal, Mayor [Barahathwa Municipality], and Moderator: Dr. Bharat Poudel [GIZ POSTED] from left to right.*

## PANEL DISCUSSION

**Q: How can SIPs help in solving gender issues, social issues, and environmental issues?**

**A:** The implementation of small solar irrigation pumps, particularly community-type irrigation systems, offers significant environmental and social benefits. The DKTI targets installing 200 small SIPs and 34 community SIPs in rural and semi-urban regions. By replacing diesel pumps with photovoltaic (PV) pumps, there is a notable reduction in carbon emissions, addressing the high emissions from the agricultural sector and enhancing energy efficiency. These systems promote responsible water and groundwater management, targeting areas without groundwater issues. During the first field visit to Madhesh Pradesh in the Rautahat district, the social impact was evident as local communities embraced sustainable practices, highlighting the program's potential for widespread positive change [Dr. Anusuya Joshi].

**Q: Which is better either promoting individual SIPs or community SIPs?**

**A:** Individual SIPs are considered more favorable due to their ease of adoption by farmers. Economic (Income) analysis indicates that regions with irrigation facilities tend to have higher income levels, whereas areas lacking such facilities often experience lower income levels. Therefore, promoting individual SIPs provides farmers with reliable irrigation solutions and can boost their income levels, aligning with the socioeconomic benefits associated with improved irrigation access [Dr. Anusuya Joshi].

**Q: What are the social and economic benefits of subsidizing solar pumps by the Government of Nepal?**

**A:** The initial cost of adopting new technology can be prohibitive for many farmers. By providing subsidies, governments can provide quality assurance through the establishment of technical standards, making the technology more accessible and

affordable for farmers. This not only promotes sustainability by encouraging widespread adoption but also enhances the socioeconomic well-being of farmers by reducing their financial burden [Mr. Santosh Rai].

**Q: How to make SIP sustainable, are there any plans?**

**A:** Achieving sustainability for SIPs involves various dimensions, including technical, managerial, economic, environmental, and social aspects. While sustainability is a challenging goal, it is not impossible. It requires a holistic approach that considers the multi-dynamic nature of agriculture, such as soil quality, seed quality, and the soil-to-market approach. Currently, efforts are focused on an isolated approach, but there is a growing recognition of the need for an integrated approach that involves collaboration with other agricultural institutions. Policy intervention is also crucial for ensuring sustainability, and there is a call for inclusive policies recommended to the Nepal Government through research conducted by organizations like IWMI and ICIMOD. Key areas for research include comparisons between grid vs. standalone systems, isolated vs. community-based SIPs, and the effectiveness of subsidies vs. credit financing in promoting sustainable adoption [Mr. Santosh Rai].

**Q: What is your company's experience, and what are the problems and challenges it faces?**

**A:** Mr. Baidya, representing his company, highlighted his vast experience with over 1000 solar irrigation projects, employing a business model focusing on revenue generation. Despite guaranteed revenue, the company faces challenges with a notable 30% usage and 70% wastage rate. Project monitoring involves scheduled visits every six months, irrespective of problem detection, alongside unscheduled visits triggered by identified issues, notably 90% of pump damage in Nepal occurs due to operation without water. Addressing such challenges, the company emphasizes the need for proper knowledge and skill transfer to mitigate operational issues and ensure the longevity of their projects [Mr. Jeevan Baidya].

**Q: What are AC pumps and DC pumps? What are their pros and cons?**

**A:** AC and DC pumps differ significantly in their operation and characteristics. DC pumps utilize direct current generated by solar panels, resulting in less energy loss and consistent performance. Conversely, AC pumps require conversion from DC to AC, leading to fluctuating performance. In terms of sustainability, DC pumps tend to be more expensive initially but require fewer solar panels compared to AC pumps. However, DC pump repair and parts replacement are costly. However, AC pumps are cheaper and easier to repair, with local technicians available for maintenance. While AC pumps historically required more solar panels, recent cost reductions have narrowed this gap. Overall, due to lower maintenance requirements and easier reparability, AC pumps are generally preferred over DC pumps [Mr. Jeevan Baidya].

**Q: Based on your field experience, what are the problems and challenges of solar water pump and irrigation?**

**A:** Based on her extensive experience conducting over 60 surveys on solar water pumps, Ms. Neupane identified several challenges and issues prevalent in solar water pumps and irrigation systems. Her surveys focused on sites where systems had been installed for over five years, primarily clustered on the municipal level in regions like Madhesh Province. Despite a high level of satisfaction among locals, with 90% reporting contentment, challenges persist. These include a lack of ownership in Madhesh, insufficient information on installation processes, and technical difficulties such as improper operation and limited functionality. For instance, farmers don't even know the warranty period and the company that installed the system, so it takes more than 2 years to rehab the system. Also, the currently installed system has more product failures than those installed in 2075 and 2076. Overall, Ms. Neupane emphasized the need for more training, transparency in installation processes, and solutions to common technical issues like loose parts and MCB tripping problems to enhance the long-term sustainability and effectiveness of solar water pump systems [Ms. Sadikshya Neupane].

**Q: Based on your field survey, what are 2-3 aspects to focus on sustainability?**

**A:** Ms. Neupane emphasized several key aspects for sustainability based on her field survey. Firstly, she underscored the importance of providing training at the municipal level to ensure that local communities are equipped with the knowledge and skills necessary to effectively operate and maintain solar irrigation systems. Secondly, she highlighted the critical need for installation transparency to build trust and accountability among stakeholders, ensuring that the installation process is clear and well-documented. Finally, she advocated for the grid integration of PV systems, emphasizing the importance of net metering and integrating solar irrigation technology into existing infrastructure to maximize its long-term viability and impact [Ms. Sadikshya Neupane].

**Q: Many PV system parts imported, from where are they imported, what is the process and how is the quality assurance done?**

**A:** Many PV system parts are imported for solar irrigation pumps in Nepal, with a shift from previously installed AC pumps to more recent installations of DC pumps. While local technicians have the expertise to repair AC pumps, the complexity of DC pump inverters, with their multiple settings, poses challenges. This lack of proper equipment and training leads to an increase in technical problems rather than product failures. Regular maintenance is necessary to address issues with the control system, although major problems with imported products have not been commonly observed. While failures in electromechanical items are common, significant failure rates of 10-20% are observed based on personal experience [Mr. Asit Saha].

**Q: Do you like to add anything?**

**A:** DC performance is high, but oil-filled motors are not available in Nepal (need to be full replaced if damaged). Similarly, the repair cost of oil-filled motors is near to new AC pumps or diesel pumps, thereby encouraging farmers to use diesel pumps. Mr. Saha, hence, suggested that a shift from oil-filled motors to water-filled motors are necessary for improved efficiency and sustainability in pump irrigation systems. This change would mitigate environmental risks associated with oil leakage while enhancing the overall performance and longevity of the equipment [Mr. Asit Saha].

**Q: Are Solar pumps used in your municipality? What is your view on this technology? How can this technology be implemented at a local level?**

**A:** When asked about the usage of solar pumps in her municipality and her views on the technology, Ms. Katuwal expressed a lack of sufficient information regarding their implementation despite its most potential lying in Madhesh Province. However, she emphasized the importance of local government involvement in policymaking to integrate this technology effectively. Highlighting recent implementations of solar irrigation pumps, she noted positive outcomes such as improved irrigation efficiency even in areas with limited sunlight. Ms. Katuwal underscored the significance of PV technology in reducing reliance on costly fossil fuel-based oil imports and transitioning from traditional irrigation methods. Despite acknowledging the initial high cost as a barrier, she suggested that local government support could alleviate these financial challenges and facilitate wider adoption of solar pump technology at the local level [Ms. Kalpana Kumari Katuwal].

**Q: How can this discussion help in fostering this technology?**

**A:** This discussion serves as a catalyst in fostering the adoption and development of SIP technology by emphasizing the pivotal role of local governments. Ms. Katuwal highlighted the crucial connection between local governments and citizens, underscoring the importance of leveraging this bond to promote awareness and training programs at the grassroots level. By empowering local authorities and engaging communities through targeted initiatives, such as training and awareness programs, the groundwork can be laid for widespread acceptance and utilization of solar irrigation pumps, ultimately driving sustainable agricultural practices and economic growth [Ms. Kalpana Kumari Katuwal].

**Remarks by Session Chair; Prof. Dr. Shree Raj Shakya, CES**

Session Chair, Prof. Dr. Shakya underscored the main aims of promoting the country's economic development and sustainable development and sustainable agricultural practices. While acknowledging the expense of solar technology, he emphasized the importance of thorough study and implementation to maximize its benefits. He suggests utilizing expensive PV technology in irrigation projects aimed at higher economic value crop production to yield greater economic benefits. Additionally, he highlighted the multipurpose nature of water and the necessity for comprehensive studies on its usage areas. Prof. Dr. Shakya advocates for conducting similar studies across other districts like in Bardiya district to address the potential diverse outcomes resulting from rapid urbanization. He emphasized the role of local governments in addressing technical issues and stressed the need for technicians for operation and maintenance, not just engineers and designers, to ensure sustainable farming practices. Finally, he underscores the significance of artificial intelligence (AI) in decision-making for crop selection and asserts that sustainable farming involves not only agriculture but also energy practices.



*Concluding Remarks by Session Chair, Prof. Dr. Shree Raj Shakya, Center for Energy Studies, Institute of Engineering.*

## Plenary Closing Session:

### **Plenary Panel Discussion on the Future of Solar Irrigation and Research**

*Panelists: Prof. Netra Chhetri [Arizona State University], Mr. Niraj Subedi, [KfW<sup>5</sup>], Dr. Ram Prasad Dhital [ADB Consultant], Ms. Resha Piya [British Embassy Nepal]*

*Moderator: Dr. Darshini Ravindranath [IWMI]*

<sup>5</sup> KfW: Kreditanstalt für Wiederaufbau



*Panelists: Dr. Ram Prasad Dhital [ADB Consultant], Mr. Niraj Subedi, [KfW], Ms. Resha Piya [British Embassy Nepal], Prof. Netra Chhetri [Arizona State University], and Moderator: Dr. Darshini Ravindranath [IWM] from left to right.*

## PANEL DISCUSSION

**Q: How can Provincial and local governments contribute to scaling solar irrigation within the context of Federal Nepal?**

**A:** The Provincial and Local government has been actively addressing various policy-related issues throughout the day, emphasizing the need to build a robust financial mechanism and conduct feasibility studies for proposed initiatives. Efforts include promoting small energy reforms, such as hydro and solar projects, and ensuring the synchronization of the grid system. However, challenges persist due to a lack of capacity to implement these ideas effectively. To overcome this, the government is focusing on demonstrating practical models rather than merely providing technical training. Additionally, they are working on preparing legislative frameworks and advocating for a federal act to support the development of an integrated energy system. Aiming for a data-driven approach, the government is also developing transparent solutions and remote monitoring models to enhance efficiency and oversee these initiatives [Dr. Ram Prasad Dhital].

**Q: What are the primary funding sources for the subsidies that drive solar irrigation initiatives? How can we make these subsidies more inclusive?**

**A:** Irrigation as a primary source of financial support in various countries is multidimensional and not area-specific, necessitating a justification for its need. While it may seem contradictory, promoting irrigation as a means of climate change adaptation, rather than mitigation, is crucial. To address this challenge, introducing business models is essential. For instance, hydropower in Nepal appeared to be a significant investment challenge a decade ago, yet it has progressed significantly. Similarly, promoting business in irrigation can drive inclusive growth and sustainability. [Mr. Niraj Subedi]

**Q: What role do you foresee development partners (for e.g., KfW) playing in scaling solar irrigation in Nepal? (Follow up question)**

**A:** KfW supports the financial aspects of irrigation by providing subsidies and partnering with various organizations. They allocate 60% of the fund directly to farmers to aid in their irrigation needs. Additionally, if the government requests guarantee forms, KfW is prepared to address and comply with these requirements. *[Mr. Niraj Subedi]*

**Q:** *The British embassy has partnered with the private sector in Nepal Renewable Energy Programme (NREP) to innovate business models. What are the main lessons learned from these scalable models? What strategies can be implemented to build the capacity of the private sector to lead the expansion of solar irrigation?*

**A:** The main challenge initially faced was significant, but several lessons have been learned. Firstly, farmers don't necessarily need advanced irrigation technology; they simply need access to water. They already possess the knowledge to plant and grow crops and do not need to become solar technicians. Promoting private sectors that provide water services is crucial. Collaboration with organizations like IWMI and GIZ POSTED is beneficial. Farmers should be given flexible payment options rather than paying all at once to ensure affordability. Efforts should focus on maximizing water use, and solar companies are not only interested in selling products but also establishing local plants. Developing mechanisms to reduce costs further supports these initiatives. *[Ms. Resha Piya]*

**Q:** *Considering the current data gaps, what research opportunities exist for solar irrigation in Nepal? How can research findings be more effectively incorporated into policy-making processes?*

**A:** The research gap is intricately connected to several critical factors in the agricultural sector. There is a substantial financial opportunity, with 65 million rupees dollars available in the global farmers market, which someone needs to capitalize on. Understanding the implications of groundwater depletion is crucial, especially in Kuleni, Nawalparasi, where water levels are dropping by 11 inches annually. Unfortunately, subsidies are often misplaced, and there is a dire need for investment to generate and utilize data effectively. Currently, 30% of the generated data has not even come to use with probably 7% being applied. This underutilization contributes to Nepal's energy paradox, where energy poverty persists despite available resources. The current subsidy delivery mechanism is flawed, applying a one-size-fits-all approach across diverse regions like the hills and the Terai, necessitating policy revisions based on lessons learned. Moreover, increasing insurance for farmers and enhancing pump efficiency are essential steps forward. Technology, while captivating, often exacerbates existing inequalities, as seen with solar lift irrigation systems. A holistic approach to the energy ecosystem is needed, involving both technical experts and promoting social inclusion. Balancing optimism with concerns about solar energy sustainability is essential to prevent the premature failure of solar irrigation systems. *[Prof. Netra Chhetri]*.

**Closing Remarks: Mr. Manoj Pantha - Ministry of Energy, Water Resources and Irrigation**

During the 71<sup>st</sup> Irrigation Day Panel discussion, the program focused on the potential of solar lift irrigation, highlighting the possibility of implementing 400,000 lift irrigation systems in hilly and mountainous regions. Emphasizing the need for meticulous planning, discussion, and policymaking, this panel stressed that lift irrigation systems are more reliable than groundwater sources in these areas. Additionally, the importance of promoting organic products through SIPs was emphasized. However, a significant challenge identified was the inability to effectively distinguish between farmers genuinely in need of subsidies and those who are not. Thereafter, he stressed the importance of defining 'real farmers' to clarify subsidy allocation criteria. Finally, he highlighted the necessity for research on managing renewable energy effectively, emphasizing its crucial role in sustainable development.



*Closing Remarks by Mr. Manoj Pantha, undersecretary Ministry of Energy, Water Resources and Irrigation, Kathmandu.*

## Conclusion

The workshop on solar irrigation in Nepal illuminated the pressing need for modernizing the country's irrigation systems through renewable energy, particularly solar power, to reinforce resilience against climate change and improve food security. Despite the significant role agriculture plays in Nepal's economy, only a fraction of its agricultural land benefits from year-round irrigation, leaving many farmers vulnerable to erratic weather patterns. The event emphasized the importance of comprehensive policy frameworks that support inclusive and sustainable irrigation practices. The discussions highlighted the necessity of a holistic approach addressing technical, economic, social, and environmental aspects for the sustainability of solar irrigation systems. Therefore, collaborative efforts among policymakers, researchers, the private sector, and civil society are crucial to scaling solar irrigation technologies, enhancing their inclusivity and affordability, and addressing the critical research gaps identified. Moving forward, there is need for transparent installation processes, training programs, and grid integration to ensure the long-term viability and effectiveness of solar pump technology. By fostering such multi-stakeholder engagement and focusing on tailored solutions for Nepal's diverse physiographic zones, the country can better leverage renewable energy solutions to ensure sustainable agricultural growth and climate resilience.

## Appendices

### Networking Events



*Volunteers at Registration Desk.*



*Mrs. Januka Devi Upreti, Mr. Mahesh Upreti, Mr. Asit Saha and Mr. Madhab Neupane (from left to right) talking with each other during Tea Break.*



*Dr. Darshini Ravindranath and Dr. Manohara Khadka (from left to right) in front of the photo displays outside the conference hall.*



*Stalls set by different entrepreneurs selling authentic local products.*



*Group photograph of participants attended the National Forum.*

## Agenda

### Agenda (Emcee Ms. Shivani Chemjong, IWMI Nepal)

Time	Agenda
08:00 – 09:00	Registration
<b>OPENING SESSION</b>	
<b>Session Chair: Mr. Nawa Raj Dhakal – ED, AEPC</b>	
09:00 – 09:10	Welcoming the Dignitaries National Anthem
09:10 – 09:20	<b>Welcome Remark</b> – Dr. Manohara Khadka – CR, IWMI Nepal
09:20 – 09:30	<b>Opening Remark</b> – Dr. Pema Gyamtsho – DG, ICIMOD
09:30 – 09:40	<b>Opening Remark</b> (virtual) – Ms. Divya Sharma – Deputy Head of Cooperation, SDC
09:40 – 09:55	<b>Keynote Presentation</b> – Status of Solar Irrigation in Nepal Dr. Laxman Ghimire, AEPC
09:55 – 10:05	<b>Special remarks</b> from the Chief Guest – Mr. Keshab Kumar Sharma – Secretary, WECS
10:05 – 10:15	<b>Remarks</b> by Session Chair – Mr. Nawa Raj Dhakal – ED, AEPC
10:15 – 10:45	<b>Group Photo and Tea/Coffee Break</b>
<b>SESSION 1 – SCALING SOLAR IRRIGATION IN NEPAL</b>	
<b>Session Chair – Dr. Laxman Prasad Ghimire, AEPC</b>	
10:45 – 11:00	<b>Presentation 1.1</b> – Lessons from the Grid-connected Solar Irrigation Pilot in Parsa – Mr. Shisher Shrestha, IWMI
11:00 – 11:15	<b>Presentation 1.2</b> – Opportunity for renewable energy for irrigation in the mountains – Mr. Avishek Malla, ICIMOD
11:15 – 11:25	<b>Experience from the field</b> <ul style="list-style-type: none"> <li>User of grid-connected Solar Irrigation Project in Parsa – Amin Miya</li> <li>User of solar water pumping system in Rautahat – Januka Devi Upreti and Mahesh Upreti</li> </ul>
11:25 – 12:15	<b>Panel discussion</b> Scaling solar irrigation in Nepal. (40 mins)  <b>Moderator:</b> Mr. Badri Nath Baral, NREP  <b>Panelists</b> <ol style="list-style-type: none"> <li>Ms. Bimala Rai Tilung, Mayor, Halesi Tuwachung Municipality</li> <li>Mr. Kiran Timilsina, Ghampower</li> <li>Mr. Madhab Neupane, Mero Microfinance</li> <li>Mr. Sagar Gyawali, NEA</li> </ol> Q&A (10 mins)
12:15 – 12:45	<b>Lunch</b>

<b>SESSION 2 – SOCIAL INCLUSION IN SOLAR IRRIGATION</b>	
<b>Session Chair: Mr. Nabin Chandra Adhikari, Secretary – Ministry of Water Resources and Energy Development, Karnali Province</b>	
12:45 – 12:55	<b>Presentation 2.1</b> - Making Solar irrigation equitable and inclusive: Some insights from Nepal – Ms. Sumitra KC, IWMI
12:55 – 13:05	<b>Presentation 2.2</b> - Enabling GESI in the Renewable Energy Powered Decentralized Lift Irrigation Systems – Dr. Shiba Satyal Banskota & Ms. Simran Silpakar, ICIMOD
13:05 – 13:15	<b>Experience from the field</b> – Ms. Sabita Maharjan, Chairperson, Chhahari Krishi Ekal Mahila Farm
13:15 – 14:15	<p><b>Panel discussion</b> on gender and social inclusion in solar irrigation. (45 mins)</p> <p><b>Moderator:</b> Dr. Darshan Karki, IWMI</p> <p><b>Panelists</b></p> <ol style="list-style-type: none"> <li>1. Dr. Indira Sthapit Shakya, Independent Consultant</li> <li>2. Mr. Ishwari Tiwari, BCIRMP</li> <li>3. Ms. Pratima K.C, AEPC</li> <li>4. Mr. Krishna Prasad Parajuli, SEMAN</li> <li>5. Ms. Usha Maskey Manandhar, MinErgy Nepal</li> </ol> <p>Q&amp;A (15 mins)</p>
<b>SESSION 3 – MAKING SOLAR IRRIGATION PROGRAMS MORE SUSTAINABLE</b>	
<b>Session Chair – Prof. Dr. Shree Raj Shakya, CES</b>	
14:15 – 14:25	<b>Presentation 3.1</b> – Groundwater dashboard and Impact of GW-based pumped irrigation on GW table – Pratik Bhujju, CIMMYT
14:25 – 14:35	<b>Presentation 3.2</b> – Needs and instruments available for capacity building in the Irrigation sector – Kushal Gautam, GIZ POSTED
14:35 – 14:45	<b>Presentation 3.3</b> – DFS Framework for pump irrigation – Mewang Gyeltshen, ICIMOD
14:45 – 15:45	<p><b>Panel discussion</b> on Sustainability: Quality of system design, Operation and maintenance, capacity development issues, and groundwater depletion. (45 mins)</p> <p><b>Moderator:</b> Dr. Bharat Poudel, GIZ POSTED</p> <p><b>Panelists</b></p> <ol style="list-style-type: none"> <li>1. Mr. Asit Saha, Aqua Flow Technologies</li> <li>2. Dr. Anusuya Joshi, AEPC/DKTI</li> <li>3. Mr. Jeevan Baidya, Sunbridge Nepal</li> <li>4. Ms. Kalpana Kumari Katuwal, Mayor, Barahathwa Municipality</li> <li>5. Mr. Santosh Rai, AEPC</li> <li>6. Ms. Sadikshya Neupane, GIZ</li> </ol> <p>Q&amp;A (15 mins)</p>
15:45 -16:00	<b>Tea/Coffee Break</b>

<b>PLENARY CLOSING SESSION</b>	
16:00 – 17:00	<p><b>Plenary Panel discussion</b> on the Future of Solar Irrigation and Research(45 mins)</p> <p><b>Moderator:</b> Dr. Darshini Ravindranath, IWMI</p> <p><b>Panelists</b></p> <ol style="list-style-type: none"> <li>1. Prof. Netra Chhetri, Arizona State University</li> <li>2. Mr. Niraj Subedi, KfW</li> <li>3. Dr. Ram Prasad Dhital, ADB Consultant</li> <li>4. Ms. Resha Piya, British Embassy Nepal</li> </ol> <p>Q&amp;A (15 mins)</p>
17:00 – 17:15	Closing Remarks – Mr. Manoj Pantha, Ministry of Energy, Water Resources and Irrigation

## Participants

Altogether 154 participants from various organizations attended this one-day event.

<b>S.N.</b>	<b>Organization</b>	<b>Number of Participants</b>
1	Aegis Technologies Pvt. Ltd.	1
2	Alternative Energy Promotion Centre (AEPCC)	8
3	Aquaflow Technologies	1
4	Arizona State University, USA	1
5	Barahathwa Municipality, Sarlahi	1
6	Bheri Corridor Irrigation and River Management Project, Surkhet	1
7	British Embassy Nepal	1
8	Center for Energy Studies (CES), Institute of Engineering (IOE)	2
9	Center of Research for Environment, Energy and Water (CREEW)	1
10	Centre for Rural Technology (CRT) Nepal	1
11	Chhipaharmai Rural Municipality	2
12	Department of Agriculture (DoA)	2
13	Department of Hydrology and Meteorology (DHM)	1
14	Department of Water Resources and Irrigation (DWRI)	2
15	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	5
16	Ghampower Nepal	3
17	Gurvakot Municipality	1
18	Halesi Tuwachung Municipality	1
19	Indrawati Rural Municipality, Sindhupalchowk	1
20	Institute of Engineering (IOE), Pulchowk Campus	2
21	International Centre for Integrated Mountain Development (ICIMOD)	18
22	International Forestry Students' Association	1
23	International Maize and Wheat Improvement Center (CIMMYT)	1
24	International Rice Research Institute (IRRI)	1
25	International Solar Alliance (ISA)	1
26	International Water Management Institute (IWMI)	19
27	Kreditanstalt für Wiederaufbau (KfW)	2
28	Krishi Ekal Mahila Firm	2

29	Melamchi Water Supply Development Board	1
30	Mero MicroFinance	1
31	MinErgy Pvt. Ltd.	3
32	Ministry of Energy, Water Resources, and Irrigation (MoEWRI)	1
33	National Association of Rural Municipalities in Nepal (NARMIN)	1
34	National Federation of Irrigation Water User's Association, Nepal (NFIWUAN)	1
35	Nepal Agricultural Research Council (NARC)	1
36	Nepal Electricity Authority (NEA)	1
37	Nepal Renewable Energy Programme (NREP)	6
38	Ohm Energy Pvt. Ltd.	1
39	OMLAS-One Million Leaders Asia	2
40	Pixel Studio	2
41	Population Council	1
42	Shikhar Insurance	1
43	Solar Electric Manufacturers Association Nepal (SEMAN)	1
44	Southasia Institute of Advanced Studies (SIAS)	1
45	Students	7
46	Sunbridge Solar Nepal	2
47	Sunfarmer Nepal	1
48	Suryodaya Urja Pvt. Ltd.	1
49	United Nations World Food Programme (UNWFP)	1
50	Urja Khabar	2
51	Water and Energy Commission Secretariat (WECS)	2
52	Wind Power Nepal	2
53	World Bank	1
54	Other single-participant organizations	28

## Further Reading: Brochure Links

### **From IWMI: Issue Briefs**

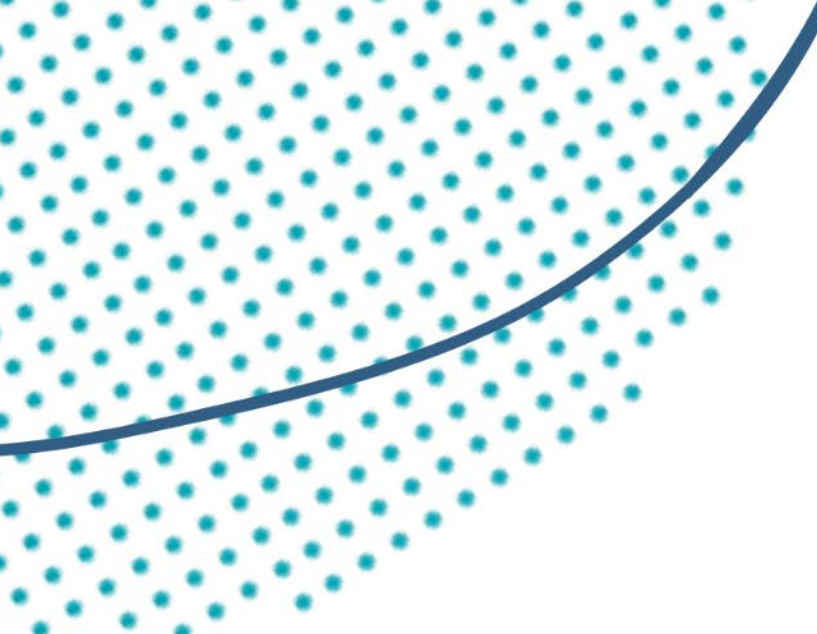
<https://solar.iwmi.org/issue-briefs/issue-brief-4/>

[https://solar.iwmi.org/?page\\_id=2077&preview=true](https://solar.iwmi.org/?page_id=2077&preview=true)

### **From IWMI: Journal Articles**

[https://solar.iwmi.org/?page\\_id=2234&preview=true](https://solar.iwmi.org/?page_id=2234&preview=true)

<https://solar.iwmi.org/are-climate-finance-subsidies-equitably-distributed-among-farmers-assessing-socio-demographics-of-solar-irrigation-in-nepal-energy-research-social-science/>



## Contacts

### Nepal office

Manbhawan Road 5,  
Lalitpur, 44600, Nepal

Tel: +977 15443141  
[iwmi-nepal@cgiar.org](mailto:iwmi-nepal@cgiar.org)

### Delhi office

2nd Floor, CG Block C, NASC Complex,  
DPS Marg, New Delhi 110 012, India

Tel: +91 11 25840811  
[iwmi-delhi@cgiar.org](mailto:iwmi-delhi@cgiar.org)

### Global headquarters

127 Sunil Mawatha,  
Pelawatta Battaramulla, Sri Lanka  
Mailing address: P. O. Box 2075,  
Colombo, Sri Lanka

Tel: +94 11 2880000  
Fax: +94 11 2786854  
[iwmi@cgiar.org](mailto:iwmi@cgiar.org)  
[www.iwmi.org](http://www.iwmi.org)



The International Water Management Institute (IWMI) is an international, research-for-development organization that works with governments, civil society and the private sector to solve water problems in developing countries and scale up solutions. Through partnership, IWMI combines research on the sustainable use of water and land resources, knowledge services and products with capacity strengthening, dialogue and policy analysis to support implementation of water management solutions for agriculture, ecosystems, climate change and inclusive economic growth. Headquartered in Colombo, Sri Lanka, IWMI is a CGIAR Research Center with offices in 15 countries and a global network of scientists operating in more than 55 countries.

International Water  
Management Institute (IWMI)

**Headquarters**  
127 Sunil Mawatha, Pelawatta,  
Battaramulla, Sri Lanka

Mailing address:  
P. O. Box 2075, Colombo, Sri Lanka  
Tel: +94 11 2880000  
Fax: +94 11 2786854  
Email: [iwmi@cgiar.org](mailto:iwmi@cgiar.org)  
[www.iwmi.org](http://www.iwmi.org)