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Inception Meeting
Solar Energy for Agricultural Resilience (SoLAR) Phase II

November 28, 2025 | New Delhi, India

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Solar Energy for Agricultural Resilience (SoLAR) Phase II

Partners

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MINISTRY OF AGRICULTURE

HARAMBEE

National Irrigation Authority

प्रदान Pradan
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Ms. Divya Kashyap Sharma

Deputy Head of Cooperation, SDC

Divya Kashyap Sharma is the Deputy Head of Cooperation with the Embassy of Switzerland in India. She has more than 25 years of experience in development cooperation and programme management spanning across climate resilience, environmental management and financial inclusion. Supported by academic training at the University of Oxford, the University of St. Gallen, and the School of Planning and Architecture, New Delhi, she is managing the Swiss supported SoLAR project.

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Ms. Maya Tissafi

Ambassador Extraordinary and Plenipotentiary, Swiss Confederation to India and Bhutan

Ambassador Maya Tissafi holds the distinction of being the first female Ambassador of Switzerland to India and Bhutan. She brings over three decades of experience in diplomacy, peacebuilding, and development, having held senior roles within the Switzerland's Federal Department of Foreign Affairs (FDFA), where she has served as Ambassador since 2011. Before her posting to India, she was Assistant Secretary of State for the Middle East and North Africa Division. She previously served as Ambassador to the United Arab Emirates and Bahrain, and as a Permanent Representative to International Renewable Energy Agency.

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Ms. Suman Chandra

Director, Ministry of New and Renewable Energy, Government of India

Ms. Suman Chandra is a Director at the Ministry of New and Renewable Energy (MNRE), Government of India. An IAS officer of the 2010 batch, she has played a key role in shaping India's renewable energy policies and leading major national programmes in solar deployment, including work on PM-KUSUM and sustainability frameworks. Her experience spans policy design, implementation, and international engagement, contributing to India's efforts to expand clean energy and strengthen long-term energy security.

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Dr. Alok Sikka

Country Representative – India & Bangladesh/ Senior Fellow, IWMI

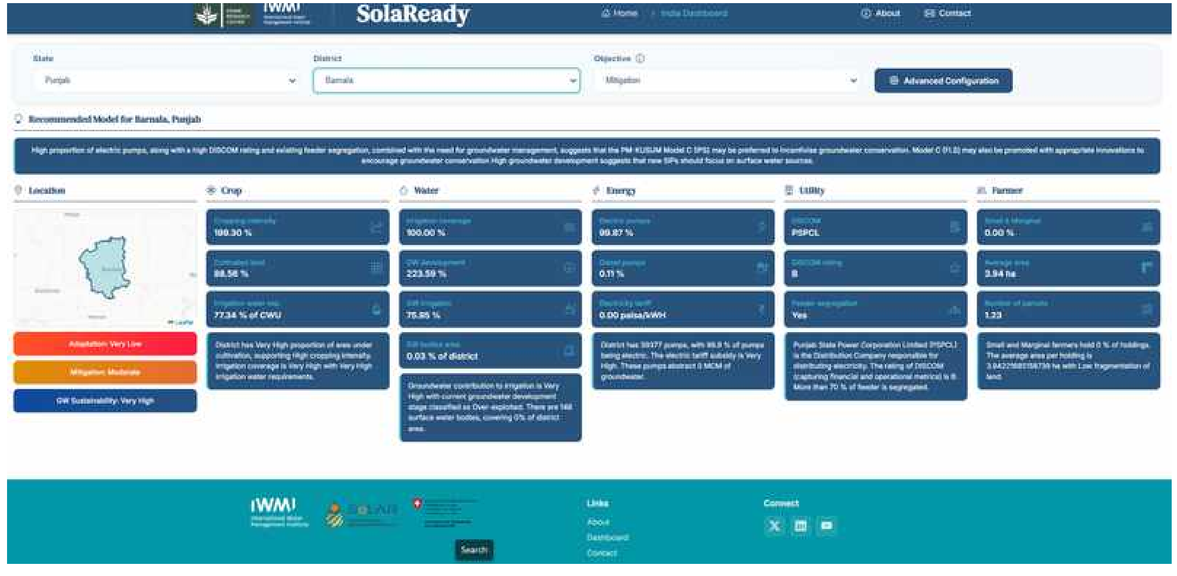
A seasoned leader in agricultural research and natural resource management, with previous roles including Deputy Director General (Natural Resource Management) at the Indian Council of Agricultural Research (ICAR) and Technical Expert (Watershed Development) at the National Rainfed Area Authority (NRAA), Planning Commission, in the rank of Additional Secretary to the Government of India. Experience spans research leadership as Director of the ICAR Research Complex for the Eastern Region in Patna and earlier as Basin Coordinator for the Indo-Gangetic Basin under the CGIAR Challenge Program on Water and Food (CPWF) from 2002 to 2007.

SolaReady: Climate-Responsive and Sustainable Solar Irrigation Upscaling

Solar irrigation for reducing GHG emissions, strengthening climate resilience, and enhancing energy security

Co-benefits: Higher farm incomes, adaptation, and lower subsidy burdens

Large investments demand **context-specific** solar irrigation models/strategies.



https://solaready.iwmi.org/

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Partnership for SoLAR Phase 2 in Bangladesh [2026-2028]

Partner name: Bangladesh Agricultural Development Corporation (BADC)
Type: Letter of Agreement (LOA)
Duration: **2026-2028** (3 Years)
Location: **Bangladesh**

Objective/output:

Strengthening solar energy policies and practices is strengthened through knowledge, capacity building and Piloting bundled AWD solutions for SIPs using groundwater with alternative incentive mechanisms and policy brief

Activities:

Training module developed for implementing inclusive community managed SIP systems
2 Training event (50 participants) Govt. officials including farmers and local technicians
- Specific training for knowledge sharing and capacity building

Piloting bundled AWD solutions for SIPs using groundwater with alternative incentive mechanisms and policy brief
- Track adoption of water-efficient practices among solar irrigation users
- Measure the number of new farmers gaining access to SIP services

Multi-stakeholder forums and other platforms held to disseminate findings across all target countries

MoU: Kenya Ministry of Water Sanitation & Irrigation x IWMI

Objective: Strengthen **policy**, **institutional**, and **technical capacities** for improved irrigation development and management

Key Activities / Deliverables

- 🟦 **Capacity Building:** Quality management, water-energy efficiency, scheme governance, water accounting, and decision-support tools.
- 🏛️ **Policy & Governance Support:** Co-develop irrigation policies, governance reforms, and inclusive approaches.
- 💰 **Financing Models:** Design blended-finance facilities and develop bankable business models for irrigation investments.
- 🌞 **Scaling Sustainable Irrigation (incl. Solar Irrigation):** Ecosystem analysis, enabling-environment support, and piloting innovative business models for solar irrigation.

- *Expected signing: Second week of December*

Sub-Agreement: Strathmore University

Objective: Strengthen institutional and human capacities to scale solar energy applications in agriculture

Key Activities / Deliverables

- **Training Needs Assessment:** Comprehensive assessment of capacity gaps and training needs in Kenya and Ethiopia.
- **Curriculum co-design and customization:** Co-develop a customized curriculum with stakeholders in Kenya and Ethiopia.
- **Training:** Training of Trainers (ToT) and the subsequent delivery of training session to stakeholders.
- **South-South Learning:** Facilitate South-South and cross-country learning through exchange workshops.

Partnership for SoLAR Phase 2 in India [2026-2028]

Partner name: Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA)
Type: MEMORANDUM OF UNDERSTANDING (MOU)
Duration: 2026-2028 (3 Year)
Location: India

Objective/output:

IWMI and UPNEDA will jointly strengthen the rollout of PM KUSUM C1 in Uttar Pradesh by training agricultural extension agents on solar irrigation and the scheme's technical and financial features, enabling them to effectively support farmers.

Activities:

1. IWMI will conduct Training/Awareness of Farmers and Capacity Building of Energy Extension Agents : Build extension agents' capacity and deliver in-person/video campaigns to educate farmers on SIP technology, PM-KUSUM C1 processes, financing, applications, and O&M, in collaboration with KVKs and Jan Seva Kendras.
2. Village-Level Implementation: Engage 96 villages (48 treatment, 48 control) to roll out and assess extension activities, facilitate SIP applications, and support farmers through local service centers.

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Sh. Ramesh Chand

Member National Institution for Transforming India (NITI Aayog)

Sh. Ramesh Chand is a Member of NITI Aayog and one of India's foremost agricultural economists, with over three decades of contributions to research, policy design, and institutional development. He has previously served as Director of the National Institute of Agricultural Economics and Policy Research and has held academic positions at leading universities and research centres in India and overseas. His work spans agricultural markets, food security, trade, productivity, and rural transformation, supported by extensive publications and advisory roles with international organisations. At NITI Aayog, he provides strategic leadership on agricultural reforms, farmer welfare, and sustainable development, guiding evidence-based policymaking at the national level.

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Dr. Vidhisha Samarasekara

Program Director- Water-Climate Change and Resilience, IWMI

Dr. Vidhisha Samarasekara is the Program Director for Water, Climate Change and Resilience at the International Water Management Institute (IWMI). An ecologist with over two decades of experience, she has worked across Asia and Africa on water resource management, climate adaptation, ecosystem restoration, and sustainable agriculture. Before joining IWMI, she held senior roles at organizations such as IUCN, KPMG, and the Asian Development Bank, where she led major climate finance and resilience initiatives. At IWMI, she oversees research and country programs focused on climate-resilient water governance, digital modeling and forecasting, disaster risk reduction, and integrated adaptation strategies for vulnerable communities.

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Mirjam Macchi Howell

Head of Climate, Disaster Risk Reduction (DRR), and Environment (CDE), SDC

Mirjam Macchi Howell is the Head of the Climate, Disaster Risk Reduction (DRR), and Environment (CDE) division at the Swiss Agency for Development and Cooperation (SDC). She has extensive experience in climate resilience, adaptation planning, and environmental governance, with a career spanning work in mountain regions, fragile contexts, and climate-vulnerable ecosystems. Prior to her current role, she contributed to climate risk management, ecosystem-based adaptation, and sustainable development across Swiss Administration and partner institutions. As the Head of the CDE Division, she guides investments, policy engagement, and international cooperation to strengthen resilience and environmental sustainability in partner countries.

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Dr. Darshini Ravindranath

Project Lead, SoLAR, Senior Researcher and Research Group Leader - Climate Policies, Finance and Processes (CPFP), IWMI

Darshini has over 15 years' experience with diverse organisations including government, research institutes, multilateral development agencies, private sector consulting and NGOs. Prior to joining IWMI, Darshini was a Principal Policy Advisor and Program Lead – International Climate Finance – at the UK Government, where she led teams overseeing UK Aid programs in Asia, Africa and Latin America. Darshini\'s previous posts have enabled her to provide expert research advice, technical assistance, and support to agencies and governments transitioning to low carbon and resilient strategies. These bodies include ADB, UNDP, UNEP, Grantham Research Centre, IIED, and Water Aid. Darshini holds a PhD in Sustainable Resources from University College London and an MSc in Environment and Development from the London School of Economics and Political Science.

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Dr. Muluken Adamseged

Deputy Project Lead, SoLAR, Deputy Country Representative, IWMI- Ethiopia

Dr. Muluken Adamseged is the Deputy Country Representative for IWMI Ethiopia and a researcher specializing in resource and agricultural economics, with a strong focus on innovation scaling, private-sector engagement, and sustainable irrigation systems. He leads work on solar irrigation, public–private partnerships, and co-design approaches, advancing scalable models that strengthen climate-resilient agricultural systems across East Africa.

His portfolio includes coordinating strategic partnerships with government, donors, and private actors, and leading applied research on the intersection of technical and social innovations to better understand, scale, and institutionalize transformative solutions in agricultural water management.

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Learnings and Prospects in Solarizing Energy towards Sustainable Agriculture

Dr. Darshini Ravindranath
Project Lead

Dr. Muluken Adamseged
Deputy Project Lead

26 November 2025

solar.iwmi.org

Agriculture, Livelihoods & Climate Change

Agriculture, which much of the Global South population depends, is particularly vulnerable and exposed to climate impacts

This has a direct impact on livelihoods of some of the most vulnerable populations.

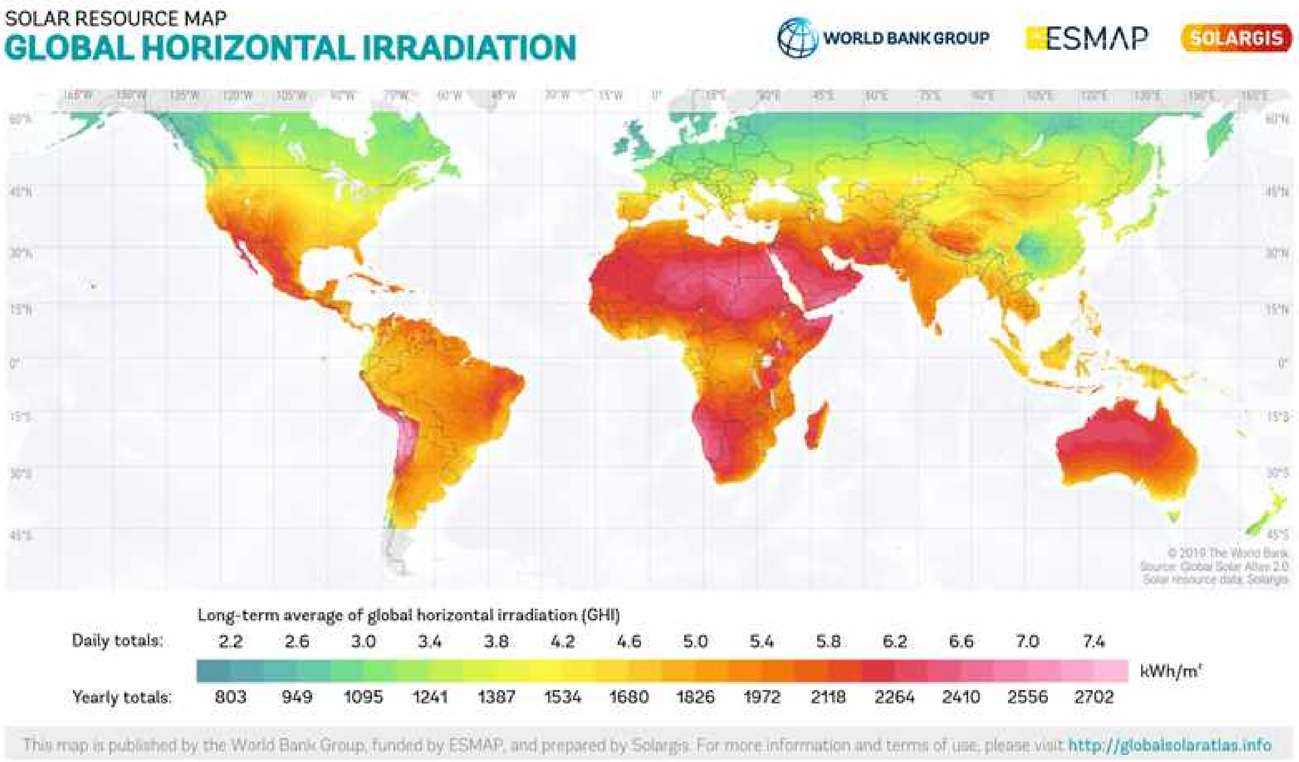
Emissions from agriculture are on the rise, e.g.

- In South Asia, 8-11% of emissions of the regions total carbon emissions are from groundwater pumping for irrigation.
- 45.2-62.3 MMT of carbon emissions can be reduced by converting India's existing 20.5 million pumps to Solar Irrigation Pumps (SIPs)

Transitioning to solar-powered irrigation offers a dual benefit: improving water-/food-security and reducing fossil-fuel dependence.

Solar energy provides several co-benefits, including reduction in foreign exchange spent in fuel imports, cleaner air, meeting of NDCs of countries

Issues of scaling solar for agriculture remain



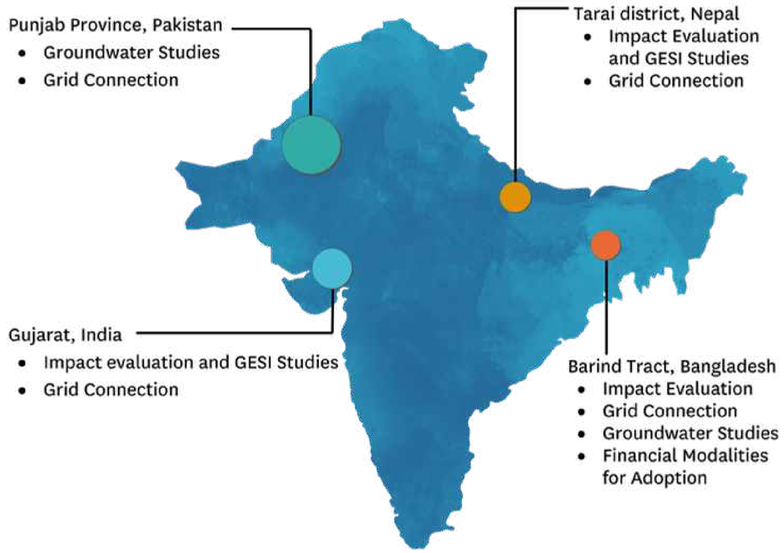
Many regions in the Global South receive high levels of solar irradiation (e.g., over ~1 400–1 800 kWh/m²/year in many parts) making them technically favourable for solar-based agriculture.

Solar-PV potential is not only technically high but increasingly cost-competitive globally.

For irrigation applications, this means: Solar pumps can run many hours, reduce reliance on diesel, and in some cases even feed excess electricity back to mini-grids, enhancing the value proposition.

High solar potential alone doesn't guarantee sustainable outcomes — infrastructure, financing, governance (especially around groundwater and water rights) must also align.

Solar Irrigation for Agricultural Resilience in South Asia



Goal

Producing robust **empirical evidence** to inform the creation of climate-resilient, gender-equitable, socially inclusive, and groundwater-responsive solar irrigation policies.

Testing and **validating innovative strategies** and interventions that advance sustainable and inclusive scaling of solar irrigation.

Enhancing **national and global knowledge and capacity** to design and implement solar irrigation policies and practices.

Key impacts

Gender-Inclusive Solar Irrigation

Advocated for gender-sensitive policies and piloted financial models to ensure equitable access to SIPs for women farmers and marginalized groups.

Innovative Financing Models

Introduced micro-financing, grant-based investments, and First Loan Default Guarantee to enhance SIP accessibility, reducing financial barriers for smallholder farmers.

Sustainable, Climate-Resilient Agriculture

Advocated for solar-powered irrigation to replace diesel systems, leading to lower CO_2 emissions, groundwater conservation, and high-value crop adoption through region-specific irrigation strategies.

Grid-Connected Solar Irrigation

Piloted first of its kind grid connected SIPs and net metering and surplus electricity sales, enabling farmers to generate additional income while encouraging responsible groundwater use.

Capacity Building & Knowledge Sharing

Strengthened technical skills and system maintenance through GERMI training programs, field visits, and collaborative learning, ensuring the long-term sustainability of SIP adoption across regions.

Driving Policy Changes in South Asia

In **India**, our findings have been shared with MNRE and are expected to influence the design of PM-KUSUM 2.0 in 2027.

In **Nepal**, AEPC will revise its subsidy disbursement criteria in favour of women and small farmers and first grid-connected solar irrigation pilot was established via a net-metering agreement.

In **Bangladesh**, using evidence from our pilots, IDCOL have approved 56 new SIPs, of which 39 sites will be connected to the grid.

In **Pakistan**, web-based modules for solar suitability mapping and a solar irrigation pump sizing tool have been developed and extended to three provinces.

Key Learning

1. SIPs support **climate mitigation and adaptation by reducing diesel use** and helping farmers cope with rainfall variability—without notably increasing groundwater use.
2. Diverse business models, including **grid integration pilots and innovation funds,** offer scalable solutions across different agro-economic contexts.
3. Policy advocacy has made **solar programs more inclusive** and effective.
4. Community involvement and **targeted capacity building, especially for women**, have strengthened technical ownership and advanced gender and social inclusion (GESI).

Partners

Beyond Project Countries: South-South Learning

The team was approached by the BTF to assist in implementing two solar lift irrigation systems in Bhutan, which was successfully completed with additional support from SDC.

Achievements

Farmer Income

• In India (Rajasthan, Gujarat) 27% rise in farm income and USD 125/year saved on diesel costs as a result of SKY
• ~25% higher Boro profits in Bangladesh (USD BDT/acre) following introduction of SIPs

Water Saving

• In India-600 mm/year less water pumped by grid-SIP users. 14% energy use reduction reported by SKY farmers
• Lower groundwater abstraction in Pakistan due to SIP capacity limits

GHG Mitigation & Energy Efficiency

• ~2.8 tCO_2/year avoided per SIP (India)
• 61% (rice) & 44% (wheat) reduction in use of diesel for pumping (Nepal)

Capacity Building & Outreach

• Project outreach to around 36,000 people
• Around 5000 benefitted from pilot studies and GESI-focused awareness activities.
• More than 20 trainings conducted including ~3500 farmers, ~300 technicians (~30% women) and policymakers

Having access to these portable micro-solar irrigation pumps has freed up some of our time. For example, I used to take my cattle to the river to bathe, but now I can use pumped water. This means women like me can shift more of our time from domestic work to economic activities.

Mariam Bibi (30)

Agricultural worker, Kayumer Char, Fulchari, Gaibandha District, Bangladesh

Photo: Tanmoy Bhaduri/IWMI

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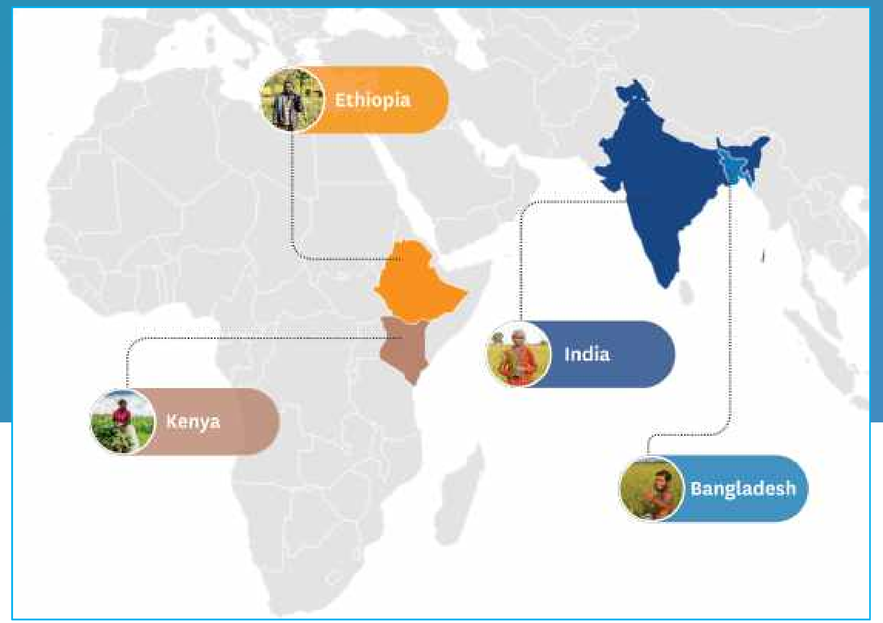
SoLAR Program Innovations

- Strong partnerships with agencies on the ground to support in strategy and capacity building activities
- Regular consultation with government through CPMC meetings, national and regional forums
- Scalable, data-informed decisions and policy linkages
- Capacity building
- Build national systems for long-term data and tool ownership.
- South-South knowledge exchange

Expanding Impact through South-South Collaboration

Building on key learnings from Phase 1, the goal of Phase 2 (July 2025- Dec 2028**)** is to **strengthen the enabling environment for promoting socially inclusive and climate-resilient solar energy systems in agricultural settings across South Asia and East Africa.**

Phase 2 will directly benefit vulnerable populations in India, Bangladesh, Ethiopia and Kenya by enhancing energy and water security, supporting agricultural emissions mitigation, and boosting adaptive capacities and climate resilience.



Proposed SoLAR project locations in South Asia and East Africa.

Outcome 1

Evidence-Based Policy Design
Policymakers embed water energy food interlinkages in a socially inclusive manner, to enhance effectiveness of solar agri-tech programs

Outcome 2

Accelerating Finance
Climate-smart and socially inclusive financing solutions for scaling solar agri-tech are co-developed and launched

Outcome 3

Capacity Building
Strengthened knowledge, capacities and south-south collaboration leads to greater uptake of solar agri-tech applications. .

Outcome 4

Solar Scaling through Living Labs
Existing platforms and living labs are assessed and optimized for scaling solar agri-tech bundles. .

Maurice Owino, a smallholder farmer in Siaya County, Kenya, in his land. His solar-powered irrigation pump has boosted yields and increased resilience to drought. Photo: SunCulture

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Theory of Change: SoLAR Phase 2 (July 2025 - Dec 2028)

Level and Target of Intervention

1 **Macro Level**
Influence policies and institutional practices of government organizations—our direct beneficiaries—in India, Bangladesh, Ethiopia, and Kenya.

2 **Meso Level**
Collaborate with partner-led projects to validate and adapt approaches at the regional or district level.

3 **Micro Level**
Implement research, demonstration, and capacity-building activities with farmers, solar technicians, and local businesses.

4 **Target Groups**
Government organizations (primary), with indirect benefits extending to farmers, service providers, and the private sector through improved implementation and outreach.

Workshop Objectives

- Introduce SoLAR Phase II objectives, outcomes, and approach.
- Share key findings and lessons from Phase I in South Asia
- Highlight country-level plans for SoLAR Phase 2
- Introduce partners, key stakeholders and gather inputs to build country/regional implementation strategies
- Identify synergies for South-South Collaboration
- Facilitate field visits to promote cross-learning and work towards inclusive, climate-resilient scaling of solar energy for agriculture.

Thank you.

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Solar Energy for Agricultural Resilience (SoLAR) is a global project implemented by the International Water Management Institute (IWMI) and supported by the Swiss Agency for Development and Cooperation (SDC).

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Eng. Mohammad Sarwar Hossain

Additional Chief Engineer, Bangladesh Agricultural Development Corporation

Dr. Mohammad Sarwar Hossain is the Additional Chief Engineer at the Bangladesh Agricultural Development Corporation (BADC). He brings extensive experience in agricultural engineering, with a focus on irrigation, water management, and the development of infrastructure to support Bangladesh's agricultural productivity. In his role, he leads key technical and operational initiatives that strengthen irrigation services and promote sustainable agricultural practices across the country.

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Er. Vincent Kabuti

Irrigation Secretary, State Department for Irrigation, Kenya

Eng. Vincent Kabuti has 20 years' experience in irrigation project development and formulation, irrigation projects identification, scoping, evaluation, irrigation planning and design, project management and construction supervision, implementing participatory irrigation management, farmers training and community mobilization. He oversaw the formulation of the National Irrigation Sector Investment Plan (NISIP) 2025-35 to coordinate investments for high performing irrigation sector in Kenya.

He also has experience in strategy formulation, resource mobilization, budgeting, performance contracting, monitoring and evaluation of irrigation schemes performance as well as implementing of QMS system in ISO environment.

Eng. Kabuti was appointed is the Irrigation Secretary in the State Department for Irrigation in the Ministry of Water, Sanitation and Irrigation. He holds a MSc. Water Science and Engineering, Hydraulic Engineering, Land and Water Development with distinction from UNESCO-IHE, Delft, Netherlands and BSc Civil Engineering, Jomo Kenyatta University of Agriculture and Technology, Kenya.

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P C SHARMA

Distributed Solar Specialist, International Solar Alliance

Mr. P. C. Sharma works with governments around the world to improve energy access and security, promoting solar power as a sustainable pathway toward a carbon-neutral future. His mission is to contribute to unlocking US$1 trillion of investment in solar by 2030 while driving down the cost of solar technology and its financing.

He advocates for the adoption of solar energy across key sectors, including Agriculture, Health, Transport, and Power Generation. Mr. Sharma supports countries in driving meaningful change by helping them enact effective policies and regulations, share best practices, align on common standards, and mobilize investments that strengthen the global transition to clean energy.

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Ms. Tripti Agarwal

Project Coordinator, SDC-SoLAR, IWMI

Tripti Agarwal is a development sector professional with over 13 years of experience in managing large-scale projects across agriculture and public health. At International Water Management Institute (IWMI), she is working as Project Coordinator for SDC Solar Project - a multi-country initiative in Asia and Africa. Her expertise spans project strategy, proposal development, budgeting, partnerships, capacity building, event coordination. Tripti has previously worked with The Union, Solidaridad, and CIMMYT, fostering strong government, corporate, and donor partnerships. She is passionate about gender and social inclusion and has authored several research articles s in this field.

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Terms of Reference

Project Steering Committee of SDC SoLAR Phase 2

TERMS OF REFERENCE

This TOR establishes the purpose and responsibilities of the Project Steering Committee (henceforth called “PSC”) of Swiss Development Cooperation - (henceforth called “SDC”) funded and the International Water Management Institute - (henceforth called “IWMI”) implemented project titled “Solar Energy for Agricultural Resilience (SoLAR) Phase 2”

The PSC is the key body within the project governance structure that is responsible for high level inputs and guidance to the Project Leader and the extended project team, so that the project meets its objectives as stated in the Proposal Document (henceforth called Pro-Doc) submitted to SDC by IWMI and as per the Project Agreement document.

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PURPOSE

The overall purpose of the Project Steering Committee (PSC) is to review and approve annualwork plans, monitorprogress in projectexecution, provide strategic and policy guidance, and to support communication and dissemination of project outcomes. The Project Steering Committee will have decision-making authority to review the overall project development over the project life time.

ROLE AND RESPONSIBILITIES OF THE PSC

- Support the project team in convening and guiding the development of partnerships with researchers, practitioners, and policy makers.

- Provide advice to the ProjectLeader on projectoutcomes, activities and deliverables;

- Address any issuesthat can have major implications for the project;

- Provide advice and assist in the communication and promotion of the project and its related outcomes to the sector;

- Actively participate in meetings through attendance, discussion, and review of minutes, papers and other PSC papers;

- Make recommendations for the development of related projectmaterials and documentation;

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MEMBERSHIP

Ms. Mirjam Macchi Howell
Head of the Climate, Disaster Risk Reduction and Environment, SDC

Mark Smith
Director General, SDC
Sri Lanka
Co-Chair

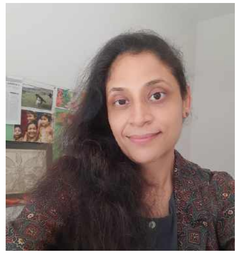
P C Sharma
Joint Director
International Solar Alliance

Eng. Vincent Kabuti
Irrigation Secretary - State Department for Irrigation, Kenya

Suman Chandra (IAS)
Director, Ministry of New and Renewable Energy, Government of India

Md. Sarwar Hossain
Additional Chief Engineer, Bangladesh Agricultural Development Corporation

Elias Awol
CEO-Smallholder Irrigation Development, Ministry of Agriculture, Ethiopia



Divya Kashyap
Deputy Head of Cooperation, Swiss Agency for Development and Cooperation (SDC)

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Project Lead, SoLAR & Senior Researcher, IWMI

S. M. Monirul Islam
Deputy CEO and CFO, Infrastructure Development Company Limited (IDCOL), Bangladesh

Eng. Vincent Kabuti
Irrigation Secretary - State Department for Irrigation, Kenya

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THE CO-OPTED MEMBERS OF PSC WILL BE

Vidhisha Samarasekara

Program Director-
Water-Climate Change
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Alok Sikka

Country Representative-
India and Bangladesh/
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Muluken Adamsegad

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Dr. Jayanta Bhattacharya

Country Lead - SoLAR in Bangladesh, IWMI

Dr. Jayanta Bhattacharya is an Associate Scientist at the International Water Management Institute (IWMI), specializing in agronomy, irrigation, and soil fertility. He has a PhD in Agronomy and has carried out research on water management, community-based farming systems, and climate resilience.

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Solar Irrigation for Agriculture Resilience (SoLAR) Phase II in Bangladesh

Dr. Jayanta Bhattacharya
Country Lead

28 November 2025

solar.iwmi.org

Achievements in SoLAR Phase I in Bangladesh

Bangladesh

Groundwater Sustainability

- The results show no significant difference in water use between solar and diesel irrigation (intensive margin), with 4.2 percentage point increase in dry season paddy area (extensive margin).
- Hydrological modeling suggests minimal regional groundwater impact under these assumptions.
- Results proved to be important technical support to IDCOL in their GCF proposal for SIPs in Bangladesh.

Grid Connected SIP

- Seven grid-integrated SIPs were piloted with IDCOL—the first of its kind in the country—to enhance the financial sustainability of SIPs.
- These pilots resulted in substantial energy exports to the national grid and savings in government subsidies.
- The lessons from these pilots have been instrumental in shaping the design of future investments, with the majority of upcoming SIP investments approved for grid integration.

Capacity Building

- In collaboration with IDCOL and DAE, training modules were developed on solar pump usage, crop scheduling, and water-efficient irrigation to promote sustainable practices among SIP farmers in Bangladesh. Four pilot training sessions were conducted, benefiting around 120 farmers.
- The Country Coordination and CPMC, comprising key implementing departments for SIPs such as IDCOL, BARC, BADC, DAE, BREB, BMDA, and SREDA, established a platform for regular stakeholder engagement and policy discussions.
- Exchange visits to India and Nepal facilitated knowledge transfer and learnings.

GESI-Responsive and Groundwater-Aware Financial Models

Study to identify barriers to SIP adoption among women and marginal farmers in remote regions of Bangladesh, including Char land, Chittagong Hill Tracts, and Sylhet.

Vision of Bangladesh in SoLAR Phase II

Key components of SoLAR Phase II

Outcome 1: Evidence-based Policy Design

- Developed **WEF-SS Composite Maps** and Building **Digital Tools** wider use and application
- Conducted capacity building training with implementing officials including women participants

Outcome 2: Accelerating Finance

- **Promising financial market and non-market-based instruments/business** models for increasing access and use of solar for different stakeholders.
- Co-design **bespoke climate-smart financial instruments/business models**

Outcome 3: Capacity Building & Knowledge Sharing

- Uptake of solar energy policies and practices is strengthened through knowledge, capacity building and south-south collaboration and exchange

Outcome 4: Solar Scaling through Living Labs

- Piloting SIP financial model in 2 sites; Agrivoltaics and bundling solar solutions
- AWD bundling with SIPs piloting in IDCOL commanding areas

Partners and Programs and Collaboration Pathways

Key Implementing Partners

IDCOL
TOGETHER FOR TOMORROW

- Renewable Energy Promotion
- Capacity Building & Technical Support
- Partnerships with Private Sector
- Grant & Subsidy Support
- Blended Finance Approach
- Focus on sustainable renewable energy

বাংলাদেশ কৃষি উন্নয়ন কর্পোরেশন

- Government agency supply quality agricultural inputs
- Irrigation & Infrastructure Support
- Promotion of Solar powered Irrigation
- Capacity Building & Financing Support

Partnership Focused

- Piloting SIP financial model
- Agrivoltaics and bundling solar solutions
- Capacity building and gender inclusive knowledge sharing
- AWD solutions for SESA using groundwater with alternative incentive mechanisms
- Pathways for Carbon Financing through bundling AWD with SIP

Country Implementation Activties

Outcome 1: Evidence-based Policy Design

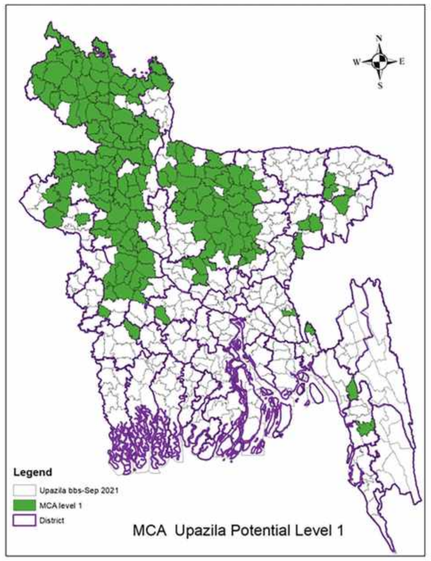
WEF responsive digital tools and methodologies developed to enhance efficiency and effectiveness of policies and programs for solar energy promotion

Output 1.1: Design WEF-responsive solar suitability ‘principles’ for effective and efficient solar energy applications in agriculture

Develop **Solar Suitability Mapping** using WEF-SS Maps, Generate field evidence on **diverse solar irrigation models**, **Policy briefs on WEF-responsive solar suitability tool** and ‘principles’ for uptake for prioritizing policy development and investment decisions.

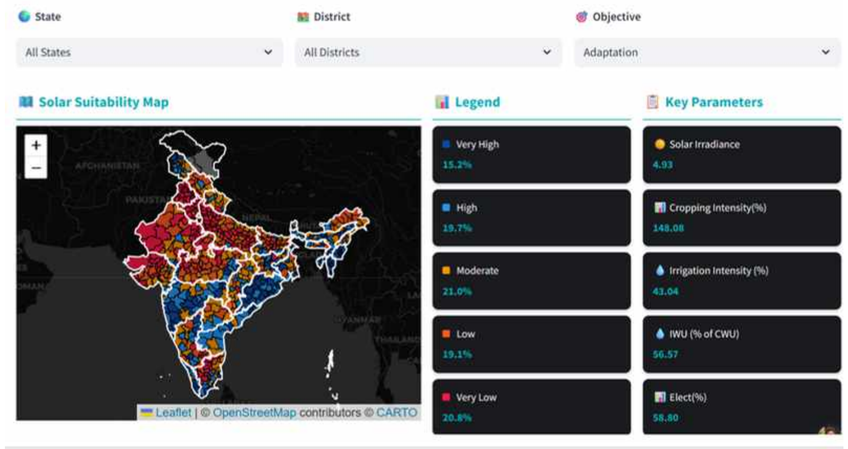
S.no	Datasets
1	Solar radiance
2	Cultivated land (as % of total land)
3	Cropping Intensity (%)
4	Irrigation Coverage (%)
5	GW irrigation share (%)
6	Irrigation Water Requirement
7	Pump energy source (Diesel)
8	Water level trend
9	Surface Water Body (ha)
10	Small and marginal holdings (%)
11	Water table depth (meter)
12	Farmers' average land-holding (ha)
13	Share of farm-holdings in total holdings (%)

Figure 10: *Upazilas* Where Groundwater Solar Irrigation Pumps Are Feasible with No Major Constraints



Output 1.2: Decision-support tools are developed to support efficacy of solar schemes for policymakers and practioners.

A **jointly developed digital platform, SIP Sizing tool and ‘User Manual’** for wider use and application
At least **1 training** with implementing officials including women and participants from different implementing agencies on the use of SIP sizing tool



https://www.iwmi.cgiar.org/blogs/solar-irrigation-pump-sip-sizing-tool/

Outcome 2: Accelerating Finance

Climate-smart and socially inclusive financing solutions are recommended for scaling of solar energy systems for agriculture

Output 2.1: Identify and validate financial instruments and incentives to improve equitable access to technology, finance, and markets in Bangladesh, including:

Activities:

- **Analyzing effectiveness and scalability** of selected solar business models
- Feasibility study on various **market-based models** [pay-as-you-go model, earn first-pay later model, revolving fund for loans, credit facilities, mobile SIPs]
- Technical and economic **feasibility of alternative approaches** for increasing return on solar investments through alternative uses of energy; and identifying necessary policy actions

Photo: IRRI/Bangladesh

Outcome 3: Capacity Building & Knowledge Sharing

The uptake of solar energy policies and practices is strengthened through knowledge, capacity building and south-south collaboration and exchange

Output 3.1: Training of targeted groups, including women, on tools created including

Activities:

Training module developed for implementing inclusive community managed SIP systems

- Need assessment to **identify required training modules**
- Site selection and prepare training module with **DAE and BADC**

2 Training event (50 participants) by **DAE and BADC** officials including farmers and local technicians

- Selection of participants form **DAE and BADC**
- Specific training for knowledge sharing and capacity building

Output 3.2: Multi-stakeholder forums and other platforms to disseminate findings across all countries.

- National and Global forums
- **Policy Hackathons**, where necessary, for small conceptual policy brainstorming
- **South-South knowledge exchange**/key partner meet-ups

Photo: NGO Forum for Public Health

Outcome 4: Piloting and Validating

Solar energy innovations are validated and optimized through existing platforms and living labs

Output 4.1: Validating and testing of new tools and services and products in a real-life context.

Activities:

Assessment report on policy issues hindering SIPs scaling in Bangladesh

- Current policies related to scaling SIPs (**Grid and solar expansion, ground water use regulations**)
- Sorting inclusion of ideas for scaling SIPs

Output 4.2: Scaling Readiness and Scaling Pathways

Activities:

1. **Piloting SIP financial model** in 2 locations with IDCOL
   - Prepare **research note** on pilot experience, improvement for **scaling and policy support**

2. **Agrivoltaics** and bundling solar solutions
   - Site selection for **Agrivoltaics systems**, partnering with IDCOL, NGO support (Wave Foundation)
   - **Feasibility study**, investment opportunity and sustainable grid-connection

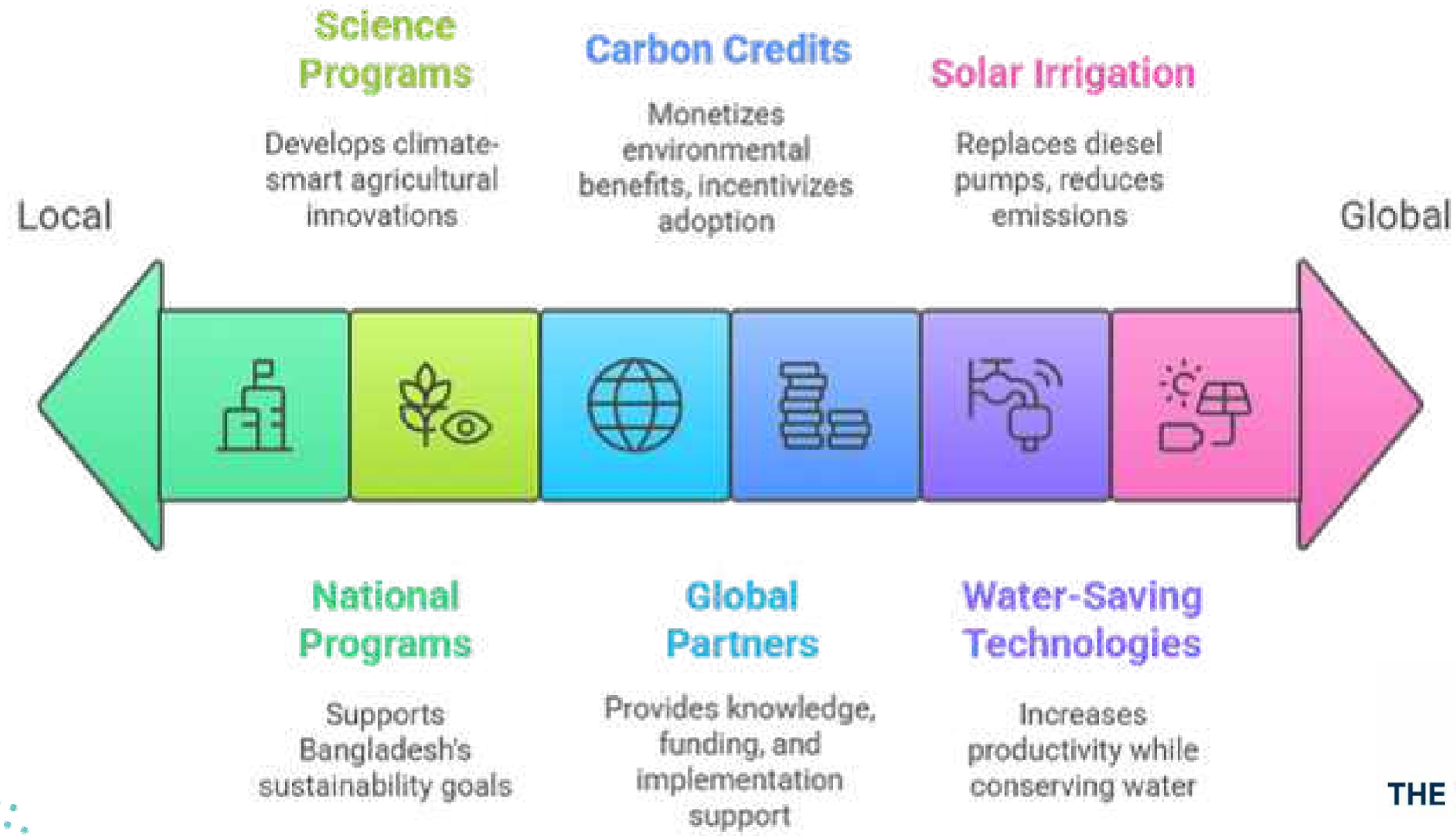
3. **AWD solutions** for SESA using groundwater with alternative incentive mechanisms
   - **AWD bundling with SIPs piloting** in IDCOL commanding areas, policy brief, recommendations

4. **Pathways for Carbon Financing** through bundling AWD with SIP
   - Policy note on **carbon credit for AWD adoption** in IDCOL SIP command areas

Country Implementation Activities Timeline

Activities/Plan	2025-2026	2027	2028	Expected Results
Design WEF-responsive solar suitability ‘principles’; decision support tool for policymakers	Report on WEF index to assess the impact of different solar interventions; training on SIP sizing tool	WEF-SS maps using by partners, develop user manual, WEF principles using by ministry or implementing organization	Evaluate trade-off using WEF on solar irrigation models & policies Training on decision support tool	At least 2 partners and 5,000 people using WEF-SS map; Research paper/Policy brief on WEF-SS composite maps & integration WEF solar mapping
Accelerating finance through financial instrument and co-developed access to technology, finance & Market	Analyse scalability of solar business models on access for women, smallholder & marginal farmers	Feasibility study on market-based models with recommendation for scaling of SESA	Report on choice experiment on institutional & financial models for SIPs; alternative approaches for increasing return on solar investments and identifying policy actions	1 financial instrument adopted for implementation 40% target group benefitted including women, smallholder & marginal farmer & increasing farm income
Targeted groups, including women, are trained on tools created; Multi-stakeholder forums and other platforms to disseminate findings	Develop training module for scaling solar energy & inclusive community managed SIP systems	1 Trainings by DAE officials, extension agents Organize national and regional policy forums for disseminate findings	Scaling brief and roadmap from reginal and global events	At least 50 officials trained One events trained 100 participants for govt. Officials & extension agents
Scaling SIPs through bundling innovations and validated through existing platforms and living labs	Piloting bundled AWD solutions for SIPs using groundwater with alternative incentive mechanisms	Piloting SIP financial model at least 2 locations with appropriate stakeholders, policy brief on pathways for carbon financing	Assessment of bundling SIPs with AWD effect on irrigation behaviour, ground water use & productivity	1000 farmer adopt AWD practice bundling with SIPs, 10% farmer reduction ground water use and increase productivity by 15%

Alignment with National Program and Global Partners



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Transforming Agrifood Systems in South Asia

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giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

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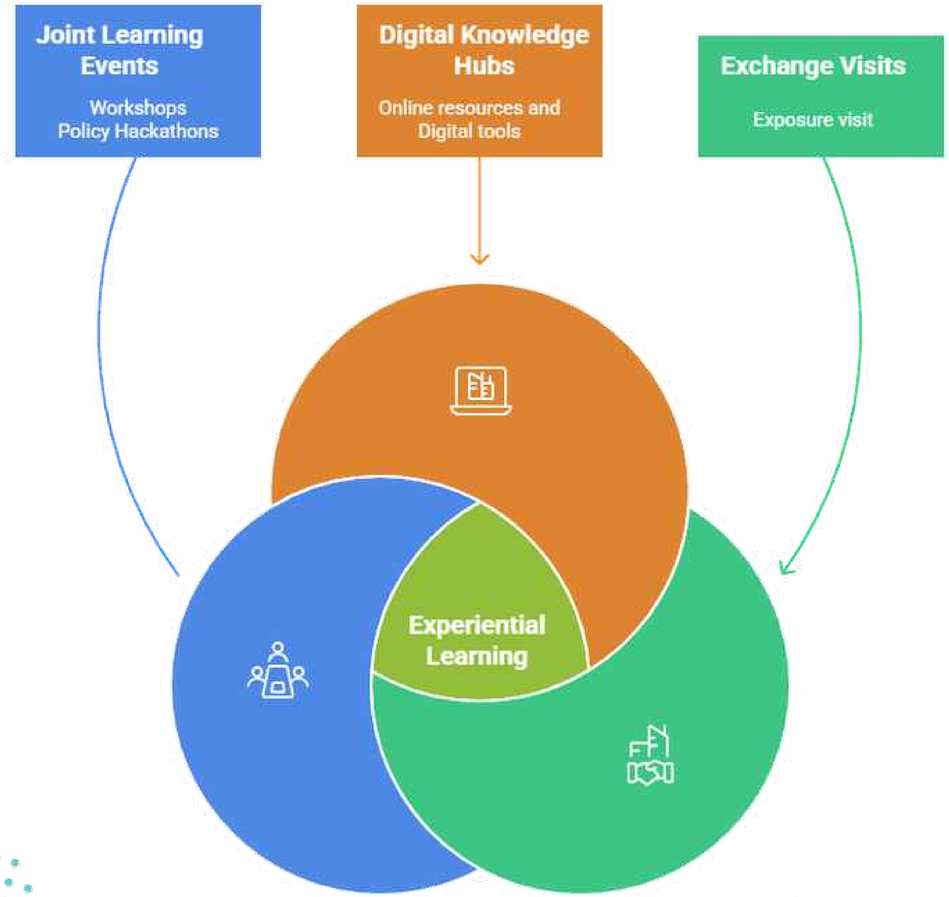
SoLAR Solar Energy for Agricultural Resilience

Roadmap and Country Implementation Approach and Outputs

Outputs

- Policy brief
- Publications
- Capacity building report
- Case studies
- Digital Tool platforms
- Assessment report

South-South Knowledge Exchange Framework



Mechanism for knowledge Sharing

Thematic Areas for Exchange

Monitoring, Data & Impact Evaluation

Utilizing data to assess and improve the effectiveness

Co-design Business Models

Exploring innovative financial Models and co-design sustainable business models

GESI Approaches

Promoting gender equality and social inclusion in development initiatives

Solar Agriculture Integration

Integrating solar energy for Irrigation

Thank you.

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Solar Energy for Agricultural Resilience (SoLAR) is a global project implemented by the International Water Management Institute (IWMI) and supported by the Swiss Agency for Development and Cooperation (SDC).

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International Water Management Institute

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Swiss Agency for Development and Cooperation SDC

Mr. Yidnekachew Zewde

Country Lead - SoLAR in Ethiopia, IWMI

Yidnekachew Zewde is an economist with over 17 years of experience in the fields of economics, development research, innovation scaling, policy advocacy, impact assessment, capacity development, partnership, knowledge management and monitoring, evaluation and learning (MEL). Prior to joining IWMI he worked as a Senior Socioeconomic Researcher at the World Vegetable Center (WorldVeg) and ICRISAT, Addis Ababa, Ethiopia. He holds an MSc. in International Development from the Ghent University, Belgium.

Currently, he is the SoLAR-II project country co-lead based in Addis Ababa, Ethiopia.

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Country Presentation-Ethiopia

Yidnekachew Zewde
Muluken Elias
Amare Haileslassie

New Delhi
November 2025

solar.iwmi.org

Country specific need and vision

- High reliance on rainfed agriculture
- Huge potential for solar-powered irrigation
- Access to finance is limiting adoption
- Capacity & policy gaps exist

Key components prioritised for Ethiopia in each outcomes

Evidence-based Policy

1. Solar Suitability Mapping (SSM)
2. Solar Sizing Tool
3. Wider use & impact at scale

Accelerating Finance

1. Financial Landscape assessment
2. Investment Solutions
3. Market Segmentation
4. Demand & Supply side Assessment

Capacity Development

1. Training Module Development
2. Training programs for frontline extension workers

Scaling via Living Labs

1. Engagement with key programs: PACT & FSRP
2. Facilitation of demand & supply side linkages

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Key Implementing and Knowledge Partners

Ministry of Agriculture

Initiates and Implements of key agricultural policies.

Ethiopian Solar Development Association (ESEDA)

An association works to enhance the enabling environment for private sector.

Institute of Ethiopian Standards

Develops and monitors standard for solar products/technologies.

Alignment with
Ethiopian 10 Years Development Policy, Development partners, CGIAR

Climate-Resilient Green Economy Strategy

Home-Grown Economic Reform Agenda

Irrigation Development Strategy

Scaling for Impact (S4I):
PPP, bundling & Scaling pathway

SoLAR-II

Productive Use of Solar

PACT

FSRP

ACC

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Timeline of key activities: Progress, Implementation and Plan

Inception Activities
- Innovation System Analysis
- Stakeholder Mapping
- Consultative Workshop

Solar Suitability Mapping
- Global & local indicators
- Data gathering & quality check
- Methodological development
- Zooming into target regions

Develop Solar Sizing Tool
- App Development
- Dashboard Development
- Validation & use

Scaling via Living Labs
- Demand & supply linkage workshop
- Facilitate system change to scale SPIS.
- Awareness creation & increasing outreach
- Technical support & backstopping

Use, Evaluation & Update the suitability maps & Sizing tools

Year-1 (Q1 & Q2)

- MoU & ToR Development
- Joint Activity Planning
- Onboarding consultant

Year-1 (Q3 &Q4)

- Market Segmentation (DD & SS)
- Financial Landscape Study
- Investment Solutions
- Field data collection
- Engagement with key programs

Year-2

Progress tracking, Joint learning, Knowledge sharing, documentation (MEAL)

Capacity Dev & support policy
- Review the **curricula**
- Develop training modules
- Engage with TEVTs
- Backstop **Solar Standard** dev.
- Capacity Development
- National policy forums

Year-3 & 4

- Capacity building
- Scaling through Living Labs
- Partnership & policy engagement
- Sustainability & exit strategy
- **South-south exchange**

***Cap dev**: Emphasis will be given to women & youth.*

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Events Tracking: Participation in workshops & key events

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This week, IWMI, together with partners, hosted a stakeholder consultation workshop on inclusive innovation bundling and scaling pathways for smallholder solar irrigation.

Building on lessons from solar pump living labs in the Hawassa Sub-Basin and Central Rift Valley, the workshop brought together experts, policymakers and practitioners to explore how decentralized, climate-smart energy and irrigation technologies can be scaled to benefit more smallholder farmers.

Key discussions focused on:
➡️ Insights and opportunities from the field
➡️ Policy directions for clean energy transition in

This collaborative exchange, made possible by the Nature-based Solution for Inclusive and Sustainable Development project and the CGIAR Scaling for Impact Science program, is a step toward practical strategies that make solar irrigation more accessible, inclusive, and sustainable

Amare Haileslassie | Wolde Mekuria | Inga Jacobs-Mata | MAHA Al-ZU'BI, Ph.D. | Abdulkarim-H. Seid PhD) | Muluken Elias Adamseged | Yidnekachew Mondimu Zewde | Desalegn Tegegne | Elias Awol | Ministry of Agriculture, Ethiopia | Ministry of rrigation and Lowlands (MILLs) | Awash Bank S.C.

#SolarIrrigation #ClimateSmartAgriculture #CleanEnergy #FoodSystems

Roadmap and Country Implementation Approach

Implementation Approach

- Understanding the context
- Leveraging & building on existing initiatives
- Local Capacity Development
- Max synergy & compounding effects
- Scaling using living labs

The Roadmap

1. Foundations Phase

- Stakeholder platform & coordination
- Policy & regulatory review
- Market assessment & business model design
- Capacity building & demonstrations

2. Scaling & Deepening

- Unlock investment
- Accelerate finance
- After-sales network
- Bundle solar pumps with...
- Strengthen PPPs & partnerships

3. Sustain & Mainstream Impact

- Institutionalize SPI in national plans.
- Promote local manufacturing / assembly.
- Scale PPP / private-sector led deployment
- Build national knowledge hubs / centers of excellence

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Key Challenges

- The sector is mainly project or donor-driven: sustainability?
- Information asymmetry about the solar products.
- The lack of standard for solar-powered pumps.
- Availability & lack of diversity: a need for market segmentation.
- Awareness & skill issues: *Operation, Maintenance & Management*….
- Weak linkage among financial institutions-suppliers-end users.
- Lack of local data on key indicators for Solar Suitability Mapping.

- The need for investment for demonstration/ joint learning avenues:
  - *Promotes learning by doing*.
  - *Acts as a platform to bring key actors on-board*.
  - *Enhances participation & adoption*.

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Dr. Deepak Varshney

Country Lead - SoLAR in India, Regional Researcher, IWMI

Dr. Deepak Varshney is a Regional Researcher in the Economics and Impact Assessment team at the International Water Management Institute (IWMI). He specializes in applied economic research with a focus on technology adoption, rural livelihoods, and the impacts of renewable energy interventions. His work at IWMI includes leading and contributing to impact evaluations on solar irrigation, understanding farmer decision-making, and assessing how innovations in water and energy management influence productivity, incomes, and resource sustainability. Dr. Varshney holds a PhD in Economics and has published widely on rural development, labour markets, and agricultural transformation.

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Strengthening Solar Irrigation Pathways: Country Strategies, Partnerships, and South-South Exchange

Dr Deepak Varshney
Country lead-India
International Water Management Institute (IWMI)

November 28, 2025

solar.iwmi.org

Key Achievements

Groundwater Sustainability

- The deployment of SIPs often raises concerns about groundwater sustainability.
- Our findings suggest that grid-connected SIPs reduces energy used for groundwater extraction by 14%, without compromising yield.

GESI Impact

- Women-led community-based solar business models were piloted to build the entrepreneurial capacity of women farmers, enhance irrigation access, and improve agricultural productivity and income with SHGs in Madhya Pradesh.
- Two models were implemented with the objective: one following the "Earn First, Pay Later" approach and another requiring a 10% upfront cost.
- Community-based solar initiatives like CinI and KARMA created local jobs and strengthened rural economies.
- Specialized training was conducted for male and female enumerators to better incorporate GESI into data collection.

Impact Evaluation

Grid-Connected SIPs

- Adoption is hindered by risk aversion and capital constraints.
- Farmers earn an average of INR 21,917 annually from selling power—about 43% of their crop income.
- Strong cost recovery: 25–28% of investment recouped in two years.

Off-Grid SIPs

- Farmers shift toward high-value crops like wheat and Isabgol post adoption.
- Significant reduction in diesel consumption.

Capacity Building

- IWMI conducted a day-long training for 2000 farmers on the technical and financial aspects of the grid-connected SIP scheme.
- Farmers participating in the SKY scheme experienced a 23% increase in net energy evacuation and an average income boost of INR 14,000.

Key Challenges from SoLAR Phase I implementation

Equity & Inclusion Gaps

- Low awareness and information asymmetry
- Gendered barriers in extension and outreach

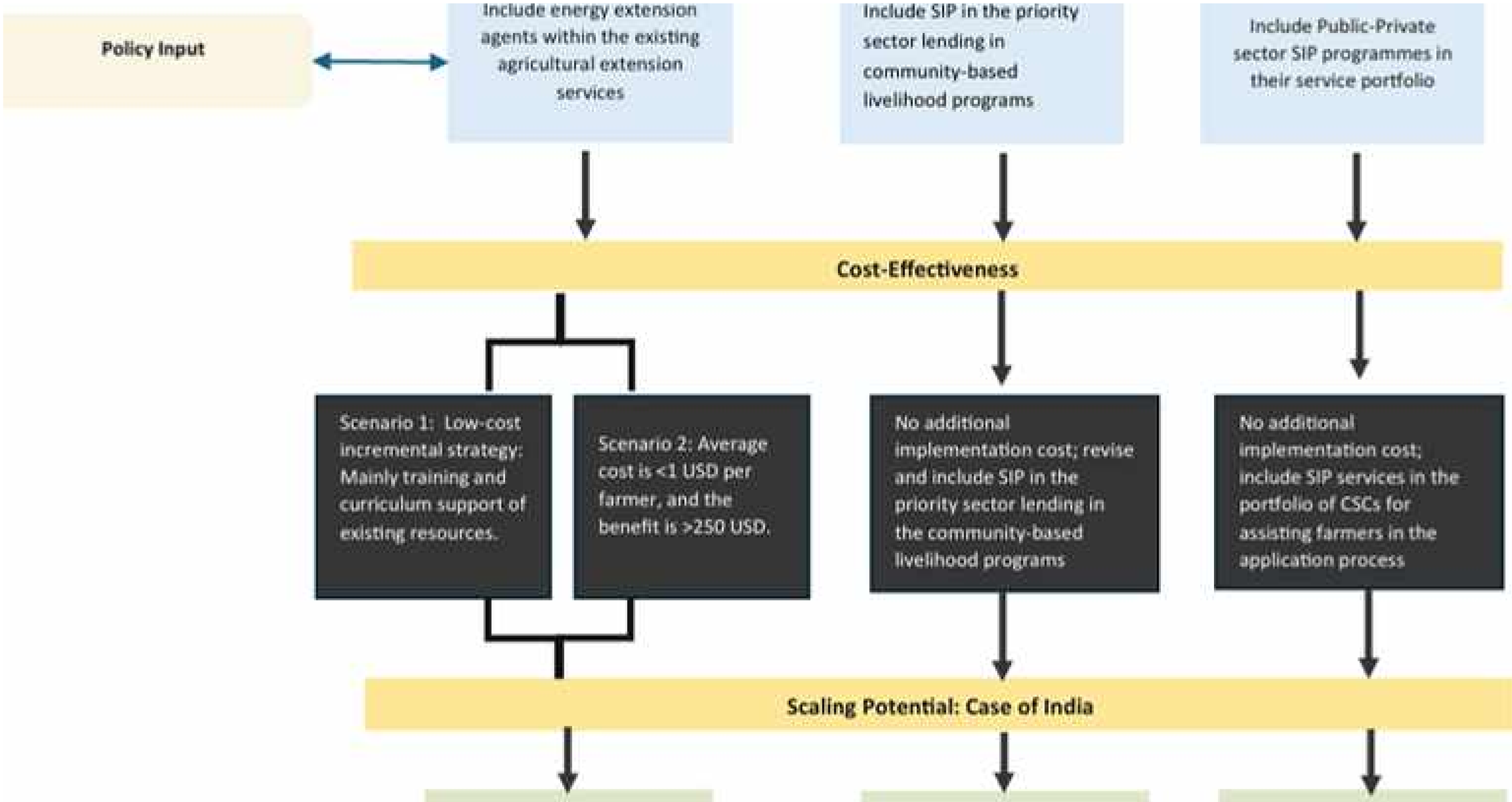
Financial Sustainability & Underutilization: Perceived financial risks and Unsuitable for marginal farmers

- High upfront investment and limited access to affordable credit
- Underutilization of installed SIPs

Institutional & Policy Bottlenecks

- Weak coordination across energy, agriculture, and water departments
- Complex and time-consuming administrative processes.
- Lack of institutionalised extension mechanisms

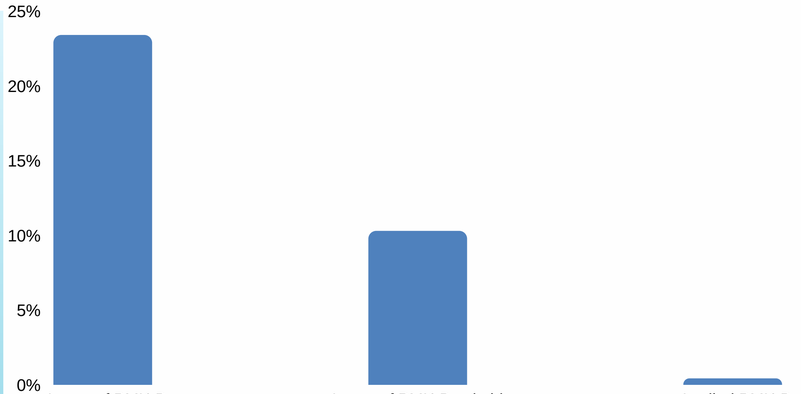
Pathways to Overcome Barriers

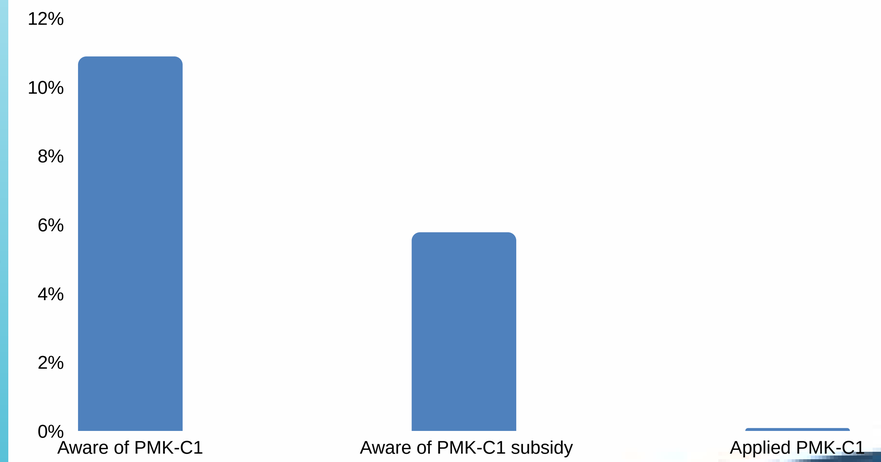


Piloting Energy Extension Agents (EEAs) and Citizen Service Centres (CSCs) to Scale Solar Irrigation Adoption in Uttar Pradesh

Region : Uttar Pradesh — home to 25 million farmers.
Baseline: Around 19,200 households across 24 districts covering 96 villages have been covered in Uttar Pradesh to map ground realities

- ***Overall awareness of the PM-KUSUM Scheme is low; process, benefits, and financing are not well understood.***
- ***Under PM-KUSUM, only 10% of farmers know the subsidy levels for Off-Grid SIPs, and 5% for On-Grid SIPs.***
- **Intervention Plan** : Collaborate with key institutions to pilot these interventions in a RCT framework, quantifying impacts to build the case for institutionalising EEAs and CSCs in promoting solar irrigation.
  - For EEAs, Department of agriculture extension, Indian Council of Agriculture Research, Government of India
  - For CSCs, Department of Electronics and IT, Government of Uttar Pradesh
  - State nodal agencies: Uttar Pradesh New and Renewable Energy Department (UPNEDA) for on-grid SIPs, Department of Agriculture, Government of Uttar Pradesh for off-grid SIPs
- **Capacity Building for EEAs and CSCs:** Drafting training materials for extension officers and CSC operators
- **Farmers Outreach** : EEAs will deliver extension services, and CSC operators will organise camps across 96 villages in Uttar Pradesh.
- **Impact Targets :** Reaching 19,200 Farmers to Drive SIP Awareness and Adoption





Piloting Energy Extension Agents (EEAs) and Citizen Service Centres (CSCs) to Scale Solar Irrigation Adoption in Uttar Pradesh

Publications

- Training Material on Extension agent and CSC workers- for publication
- Scaling Solar Irrigation through Grassroot Institutions: Meta-Analytic Evidence and Pathways for Inclusive Delivery – Submitted to Energy policy

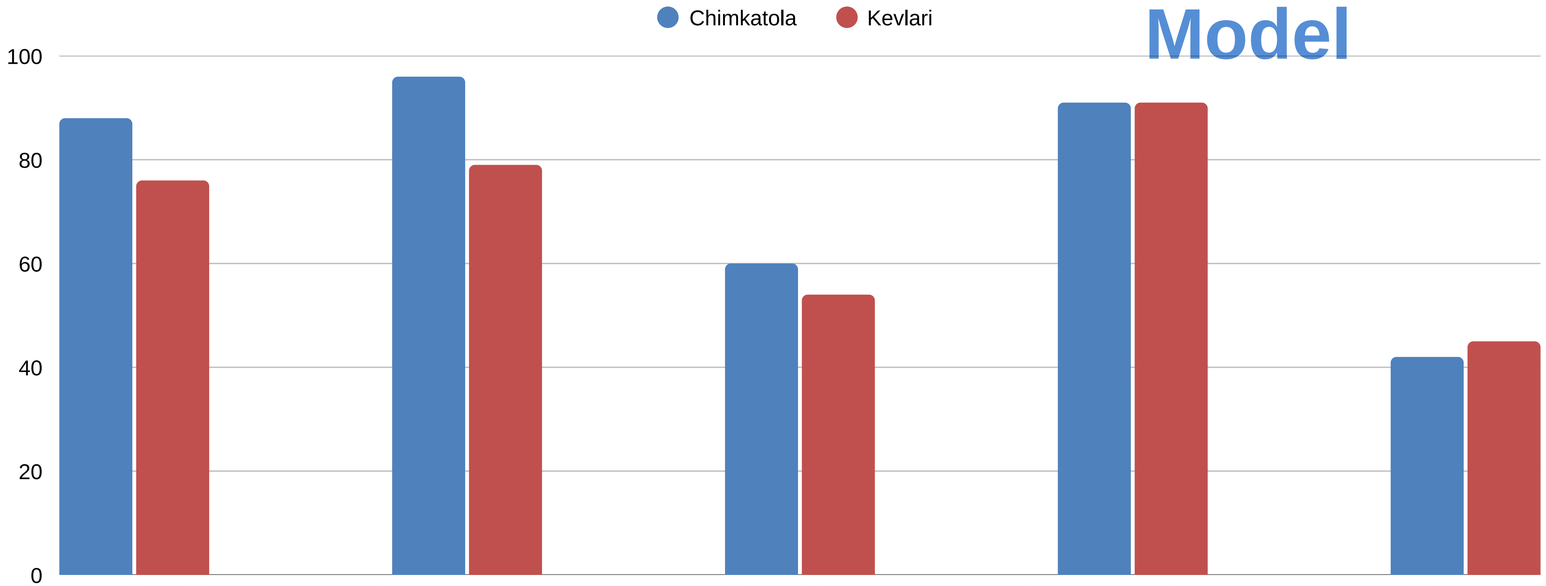
Capacity Building for EEAs for Inclusive Solar Irrigation Adoption under PM-KUSUM'

On 23-24 September, workshop organized at ICAR-IISR, Lucknow that brought together 30 EEAs from 26 districts – 19 men and 11 women

Training session for 26 JSKs organized on 13 November – focus on PM Kusum and filing of application forms

Organized JSK camps in treatment villages for PM Kusum application

Pilotting a Community-Based Solar Lift Irrigation: A Women-Led SHG Model



- **Context :** The intervention targeted two tribal-dominated villages (Kevlari and Chimkatola, MP), where over 75% of farmers—economically poor and reliant on rainfed agriculture—lacked access to reliable irrigation, limiting crop diversification and productivity.
- **Business models tested**: *Earn First, Pay Later and10% Upfront Cost*, with recovery through water sales
- **Institutional structure**: Water User Associations with women farmers was formed. 15 members in Kevlari and 13 members in Chimkatola
- **Preliminary impact**: Each WUA saved over INR 10,000 from water sales. Farmers shifted cropping patterns toward more profitable crops like wheat and vegetables
- **Behavioral Change:** Initially hesitant to invest or take loans, the women farmers are now leading efforts to install a solar-powered mini-rice mill for off-season income. This marks a shift toward greater confidence in renewable energy and collective enterprise.

Key outcomes/components : Phase 2

Outcomes	Key prioritised components/activites
Evidence-based policy design	Water-Energy-Food-Solar Suitability (WEF-SS) composite maps to assess and recommend spatially differentiated SIP models for different regions.
	A fully functional online solar sizing tool and user manual tailored to the specific country contexts, and usable by end users, implementors and policymakers.
	A live digital database of key indicators for PM-KUSUM implementation
Accelerating finance	Strategy document outlining potential funding partnerships with SRLMs and FPOs, including a financial framework that addresses barriers to financing solar irrigation pumps A report presenting results of the choice experiment on institutional and financial models for SIPs
Capacity building	Training module for energy extension agents (KUSUM-Mitra) Outreach to farmers for providing extension services on SIPs Produce a final impact assessment journal article detailing the causal effects of the energy extension agent model on solar demands
Solar Scaling through Living Labs	Report on assessment of how bundling SIPs with water-efficient technologies affects farmers' irrigation behavior, groundwater use, and crop productivity

Partners and collaboration pathways

Organization	Objectives
Indian Council of Agriculture Research (ICAR)	Develop and institutionalise an energy-extension pathway within ICAR's existing extension systems (KVKs) to promote widespread and sustained adoption of Solar Irrigation Pumps (SIPs).
National Bank for Agriculture and Rural Development (NABARD)	Design financial models and mechanisms that enable SRLM funds to be channelled efficiently for group-based SIP adoption, reducing upfront costs and improving access for smallholders and women farmers.
Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA)	Provide technical and policy support to strengthen the design and implementation of PM-KUSUM in Uttar Pradesh, ensuring higher uptake and more equitable access to SIPs.
Common Services Centre, Uttar Pradesh (Ministry of IT & Electronics)	Integrate PM-KUSUM services into the CSC service portfolio to simplify and digitise the application process, expanding farmer access and reducing procedural barriers.

Cross-Regional Learnings & South-South Cooperation

Intra-Regional Transfer:

Learnings from grid-connected SIPs (SKY/PM-KUSUM) highlight how water-saving incentives work when aligned with hydrogeology. India's SKY experience informs Nepal's net-metering pilots, while Bangladesh's fee-for-service model is being adapted to address equity concerns, together offering replicable pathways for Africa's emerging solar irrigation programs.

Knowledge Platforms:

Solar literacy innovation-Energy Extension Agents, position SoLAR-SA as a global reference for policy, training and planning, offering transferable models for Africa and other South Asian regions.

South-South Finance:

- Subsidy-driven adoption limited by fiscal space: carbon finance and Water-as-a-Service emerging as scalable options
- SHG-led models empower women and diversify livelihoods. Fee-for-service model attracts private capital but risks excluding small/remote farmers, micro-SIPs and mobile units are needed.
- Article 6 carbon markets offer new collaboration channels linking Asia/Africa in climate-smart irrigation.

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Feedback and suggestions?

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Dr. Josey Kamanda

Researcher - Innovation Scaling and Agribusiness Acceleration, IWMI

Josey supports the innovation scaling and agribusiness acceleration portfolio at the International Water Management Institute (IWMI). His work puts innovation systems and science of scaling concepts into practice. He leads the "Future Food Systems Lab", an Area of Work focusing on joint innovation and learning under the CGIAR Food Frontiers and Security Program. He also serves as the Kenya Country Lead for the Swiss Agency for Development and Cooperation (SDC)-funded Solar Energy for Agricultural Resilience (SoLAR) Phase II project.

Josey has work experience in over 20 countries across Africa and Asia. He served as Food Security and Livelihoods Technical Advisor for East and Southern Africa at Save the Children International. Prior to that, he managed the High Iron Bean Compact of the AfDB-funded Technologies for African Agricultural Transformation (TAAT) program based at the Alliance of Bioversity International and CIAT. His earlier roles include research positions with Africa Rice, ICRISAT, the Knowledge, Technology and Innovation (KTI) group of Wageningen University as well as private companies in the financial and water sectors.
Josey holds a PhD in Agricultural Sciences from the Division of Social and Institutional Change in Agricultural Development at the University of Hohenheim (Germany). He obtained Msc. in Technology Management from the University of Surrey (UK), and Bsc. in Agricultural Engineering (First Class Honors) from the Jomo Kenyatta University of Agriculture and Technology (JKUAT - Kenya).

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SoLAR II: Kenya Implementation Approaches and Partnerships

Josey Kamanda, PhD

Innovation Scaling Researcher Kenya Country

Lead, SoLAR II

International Water Management Institute (IWMI)

November 28, 2025

SoLAR II Inception Meeting, New Delhi

solar.iwmi.org

Background

- Climate variability, unreliable rainfall, limited energyaccessconstrainagriculturalproductivity in Kenya
- Only 21% of Kenya's irrigation potential is developed
  - –Kenya - regional leader in solar technology (65% of SSA solar water pump sales; emerging markets in cold storage, solar dryers, milling, e-mobility, etc.)
  - –5-7 hours peak sunshine hours per day
  - –Growing momentumtoscalesolar solutions
- Solar-powered technologies can improve climate resilience and productivity

Overview of Solar Appliances in Agriculture - Kenya

PRODUCT	APPLICATION	PROVIDERS
Solar water pumps	Enhance irrigation and enable production during dry seasons	SunCulture, Lorentz, Ennos, Grundfos, Ecozen, Dayliff
Solar refrigeration	Preserve produce and beverages	Biolite, Koolbox, Dayliff
Solar inverter	Provide 24/7energy, allowsolar appliances to connect in weak-grid areas	Dayliff, Chloride Exide, Huawei, SunKing
Solar cold rooms	Off-grid cold-storage for preservation of dairy, fish, meat, fruits, vegetables	Ecozen, Baridi, SokoFresh
Agro- processing	Electric milling machines, solar dryers	Agsol, GrainPro

Agro-solar Stakeholder E cosys tem

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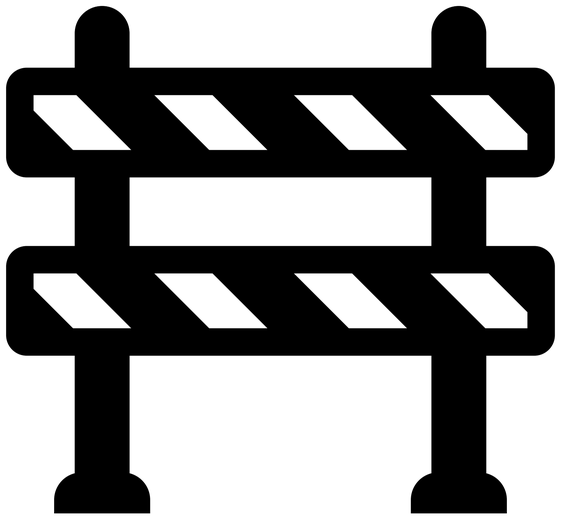
Key Barriers

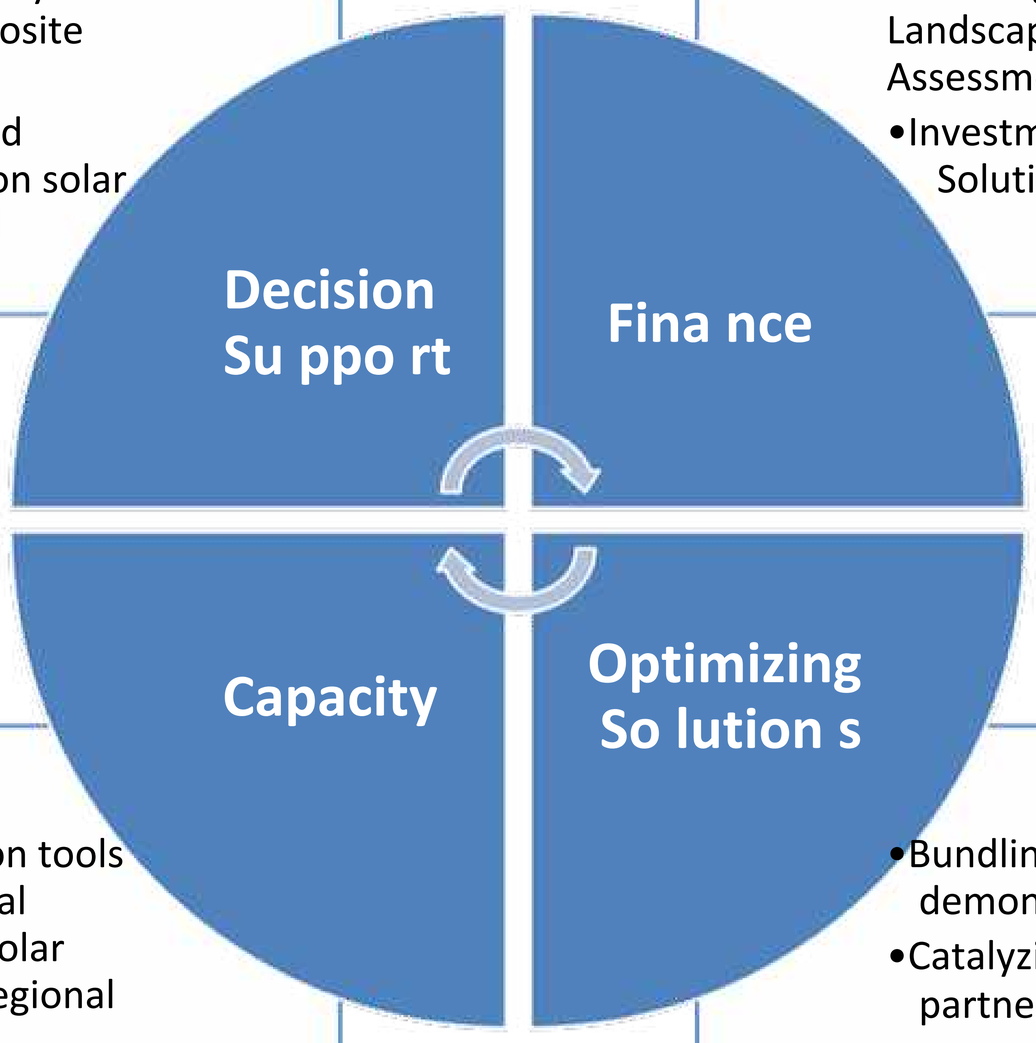


- 📊 **Dataanddecision-support tools:** Insufficient reliable, integrateddataonwater,energy,food,climate,toguidesolar program design.
- 🌐 **Policy fragmentation:** inconsistent incentives, in-effective coordination.
- 💰 **High upfront costs & limited finance:** farmers lack affordable loans; banks risk-averse.
- 🛠️ **Capacity gaps:** technicians; low farmer awareness of technologies.
- 👬 **Inclusivity challenges:** women, youth, and marginalized groups face adoption barriersduetoaffordability,tenure insecurity, and limited outreach.
- ♻️ **Sustainability issues:** weak consumer protection, influx of low-quality products, e-waste,risksofover-abstraction.

Key Activities - Kenya

- WEF-SS analysis and composite maps
- Manual and trainings on solar sizing tool

- Financing Landscape Assessment
- Investment Solution Analysis



- Trainings on tools and technical aspects of solar
- National regional forums

- Bundling and demonstration
- Catalyzing partnerships

Complementary Program

Flagship 1.2: Scaling Private-sector-led Solar-Powered Irrigation Systems (SPIS) for Climate-Resilient Smallholder Farming in Sub-Saharan Africa

Partners - Kenya

MINISTRY OF WATER, SANITATION AND IRRIGATION
STATE DEPARTMENT FOR IRRIGATION

NISIP

National Irrigation Authority

Strathmore UNIVERSITY

GOGLA
Global Off-Grid Lighting Association

SunCulture

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Solar Energy for Agricultural Resilience (SoLAR) is a global project implemented by the International Water Management Institute (IWMI)andsupportedbytheSwiss AgencyforDevelopmentand Cooperation (SDC).

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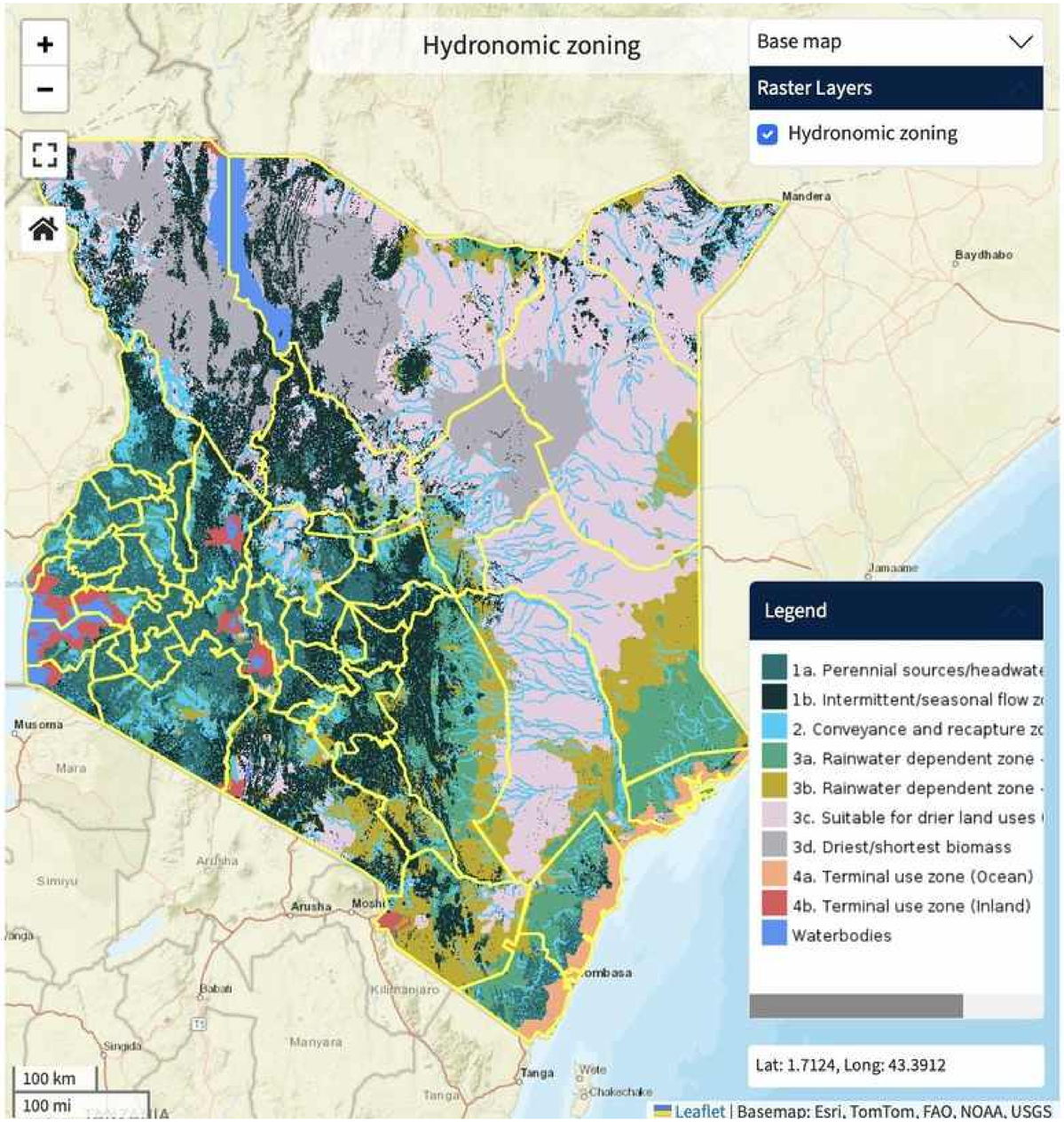

Name (and area c ove red)		Description	Example Agricultural Land Uses and interventions
Water Source Zone - Headwaters			
1.a. Perennial	9.6%	Generates runoff most of the year	Large and medium scale dams, small scale hill side irrigation, agroforestry
1.b. Seasonal	18.9%	Generates runoff intermittently	Reservoirs, water harvesting, supplementalirrigation,flood-based irrigat ion
2. Conveyance and Recapture	11.9%	River valleys, flows return to river system	Irrigation, cities and industrial supplies, surface and groundwater, reuse, competing need
Rainwater dependent - Rainfallisprimary source			
3.a. Reliable Rainfed	8.7%	Can support rainfed ag	Rainfed agriculture, watershed management treatments, agroforestry
3.b. Risky Rainfed	9.1%	Rainfed agriculture is risky	Limited rainfed agriculture, supplemental irrigation, water harvesting, efficient irrigation systems soil moisture management
3.c. Semi-arid	25.8%	Some biomass, too dry for crops	Livestock andpastoralsystems, localized water harvesting for pasture
3.d. Desert	11.0%	Limited biomass	Bringing river and groundwater for agriculture **(irrigation not best intervention)**
Terminal Use - Water drains into terminal water bodies (oceans, terminal lakes, wetlands)			
4.a. Drainage to seas	1%	Water drains intooceans or seas.	Largescaleirrigation,water productivity is not key
4.b. Drainage to inland water bodies	1%	Water drains into inland lakes or wetlands.	Large scale irrigation, water productivity is not key

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Moderator

Dr. Darshini Ravindranath
Project Lead, SoLAR, IWMI

Panelists

Mr. Elias Awol
CEO-Smallholder Irrigation Development, Ministry of Agriculture, Ethiopia

Mr. Monirul Islam
Deputy CEO and CFO Infrastructure Development Company Limited (IDCOL), Bangladesh

Mr. Frankline Kiptoo
Research Associate Strathmore University (Virtual)

Mr. Bart Minsaer
Vice Chairman, Ethiopian Solar Energy Development Association (ESEDA)

Dr. R K Singh
Assistant Director General (Coordination, Crops & Forestry)` at ICAR

Shikha Anand
Senior Program Associate in the Energy Access Team at WRI India

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Dr. Faiz Alam

Senior Regional Researcher

Faiz Alam completed his Bachelor of technology in civil engineering from the Indian Institute of Technology, India (2009-2013) and Master of science in environmental engineering from KTH Royal Institute of Technology, Sweden (2014-2016). After completing the master's degree, he joined IWMI and is now based at the Institute's Delhi office in India.

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SolaReady: Climate-Responsive and Sustainable Solar Irrigation Upscaling

November 28, 2025
New Delhi, India

solar.iwmi.org

Solar irrigation: WEF nexus

Food <> Adaptation

Water <> Sustainability

Water requirement and use

Cropping pattern, Yield

Type of solar model, uptake

Cropping pattern, inputs

Water availability, depth

Impact on water use

Changing cost/economics, accessibility
Differ among solar models

Energy <> Mitigation

India: Datasets used

Water

- Groundwater use
- Groundwater level
- Irrigation water needs
- Aquifer Type
- Surface water bodies

Energy

- Number of pumps
- Electric and diesel pumps
- Electricity Tariff

Utility

- DISCOM Name
- Integrated rating
- Feeder segregation

Food

- Cultivated land (%)
- Cropping intensity (%)
- Irrigation coverage (%)
- Source of irrigation

Farmer

- Small& Marginal Holdings
- Avg. area holding
- Land fragmentation

Objectives

Adaptation

Districts where the priority is irrigation expansion to manage weather extremes and climate change. These are characterized by low cropping intensity and irrigation coverage with underdeveloped groundwater and shallow water tables. High use of diesel pumps that increases cost of irrigation.

Mitigation

Districts where pumping emissions are high due to high irrigation water requirements coupled with significant share of groundwater irrigation and diesel pumps with higher preference for districts where groundwater is safe so that standalone SIPs doesn't lead to groundwater risk

Groundwater Sustainability

Districts where incentive for upscaling solar is to manage groundwater depletion, caused by high irrigation requirement and high subsidies for pumping, through introducing incentive mechanisms via SIPs

Reclassification and Composite Index

Goal: Adaptation | Sum of Weights: 0.9999

Adaptation
Mitigation
GW Sustainability
Community SIP

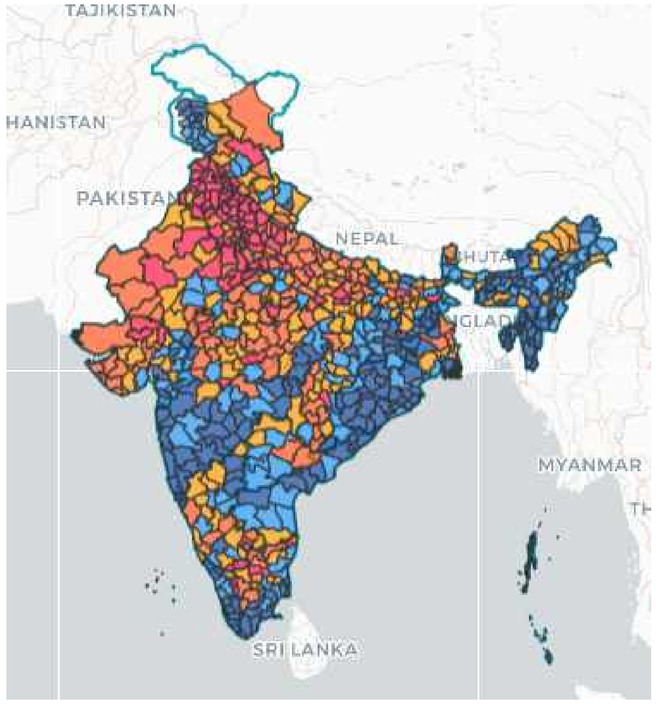
S.No	D	Weight	Unit	Less Suitable (1)	Moderately Suitable (2)	Highly Suitable (3)	Very Highly Suitable (4)
1	S	0.0909	kWh/m²/day	< 3.75	3.75 - 4.5	4.5 - 5.25	> 5.25
2	Cropping Intensity (%)	0.0909	%	> 220	220 - 180	180 - 140	< 140
3	Irrigation Intensity (%)	0.0909	%	> 75	75 - 50	50 - 25	< 25
4	IWU (% of CWU)	0.0909	%	< 28.5	28.5 - 48	48 - 67.5	> 67.5
5	Electric pumps (%)	0.0000	%	> 75	75 - 50	50 - 25	< 25
6	GW development stage (%)	0.0909	%	> 100	100 - 70	70 - 50	< 50
7	Surface water area (%)	0.0909	%	< 1	1 - 3	3 - 5	> 5
8	Cultivated land (%)	0.0909	%	< 25	25 - 50	50 - 75	> 75
9	Electricity tariff	0.0909	Rs/unit	< 70	70 - 150	150 - 300	> 300
10	Water level depth (m)	0.0909	m	> 20	20 - 10	10 - 5	< 5
11	GW Share (% of IWU)	0.0909	%	> 75	75 - 50	50 - 25	< 25

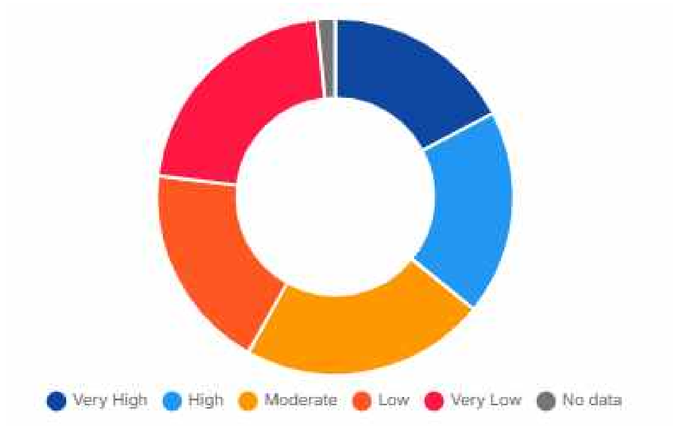
Reset to Defaults | Cancel | Apply & Recalculate

National

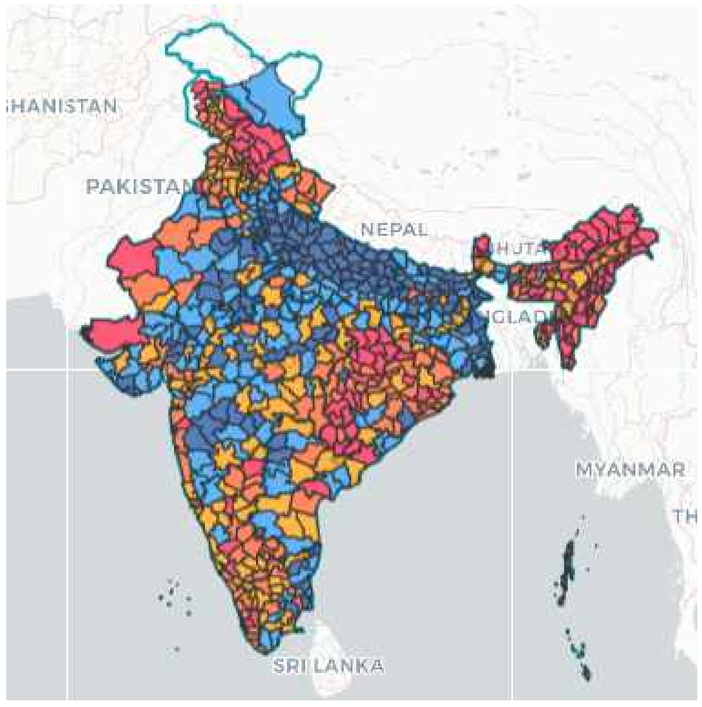

SolaReady
Home
About
Contact
State
All States
District
All Districts
Objective
Adaptation
Advanced Configuration
Suitability
Distribution
Key Parameters
4.93 kWh/m²/day
151.24 %
48.59 %
58.05 %
62.53 %
57.02 %
6.31 %
58.34 %
131.31
51.87 %
8.33 m
78.34 %
1.40 ha
2.09
Summary
666

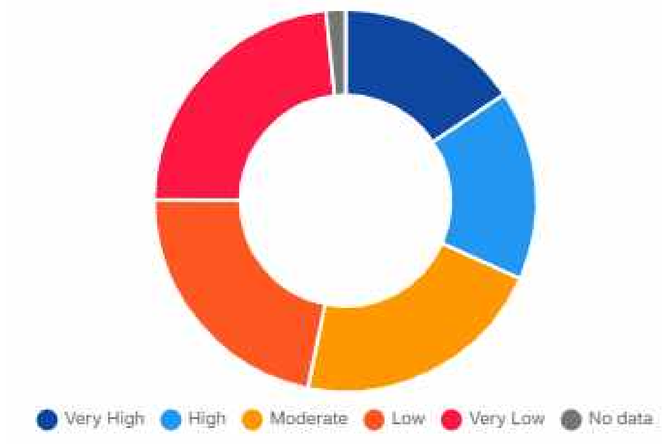
Adaptation



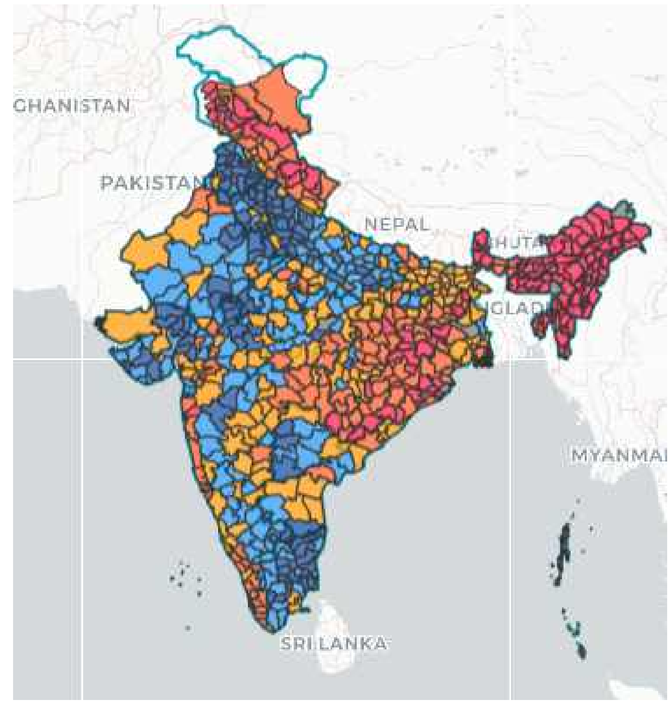


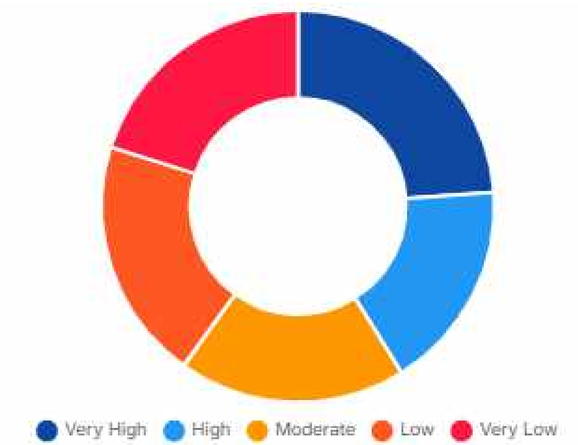
Mitigation



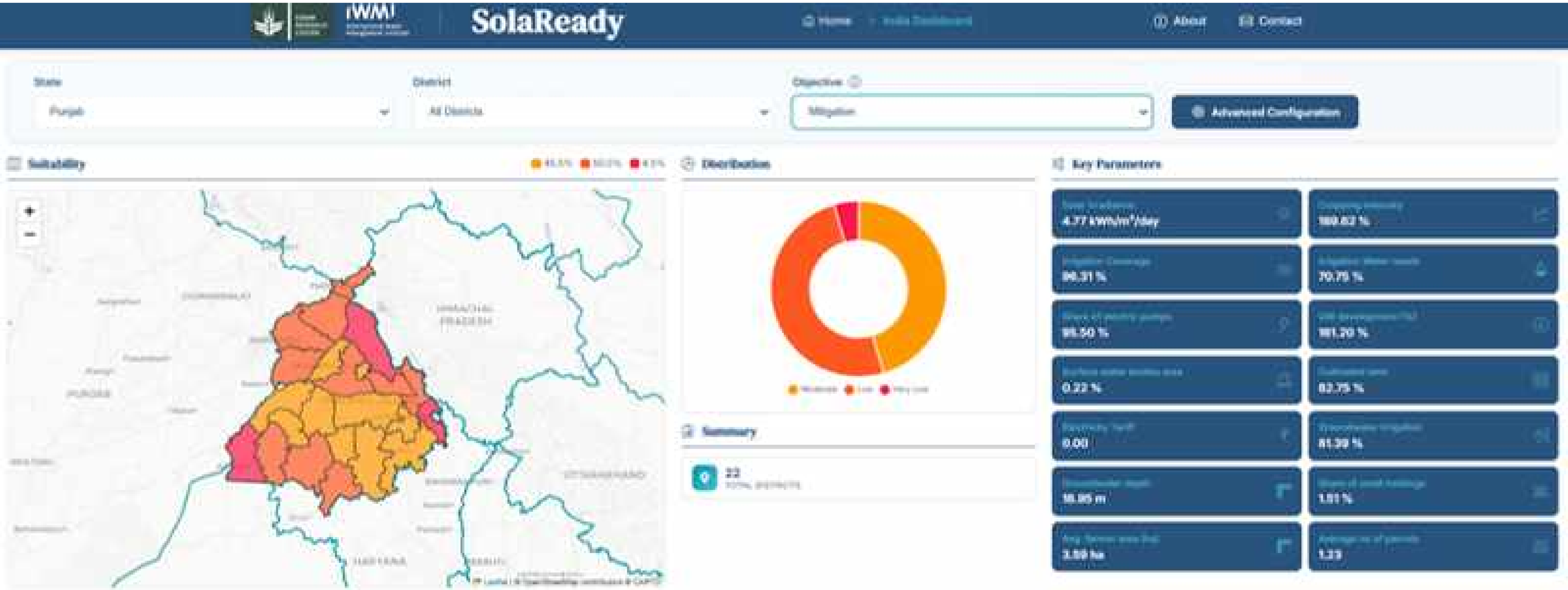


GW Sustainability

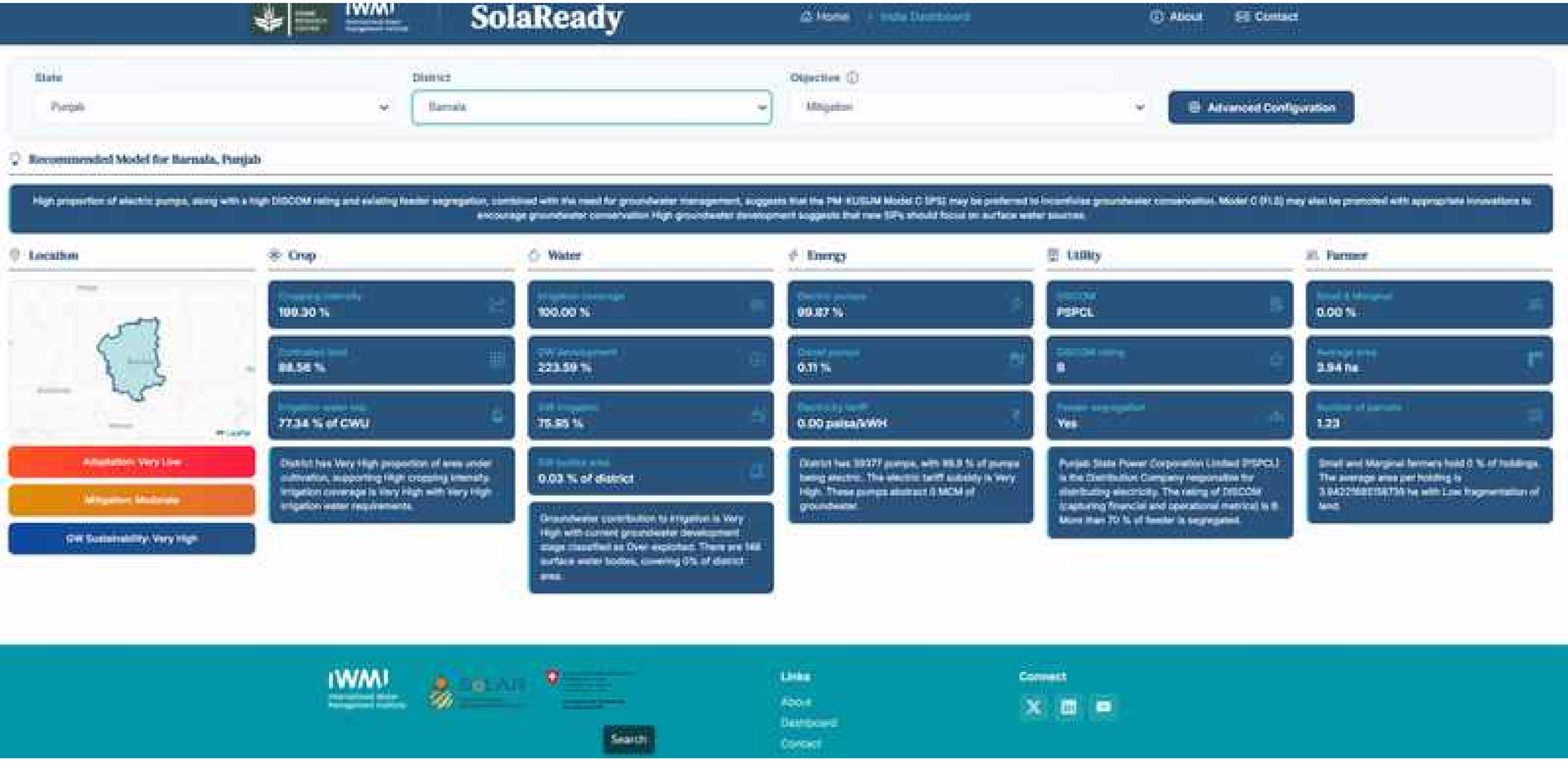




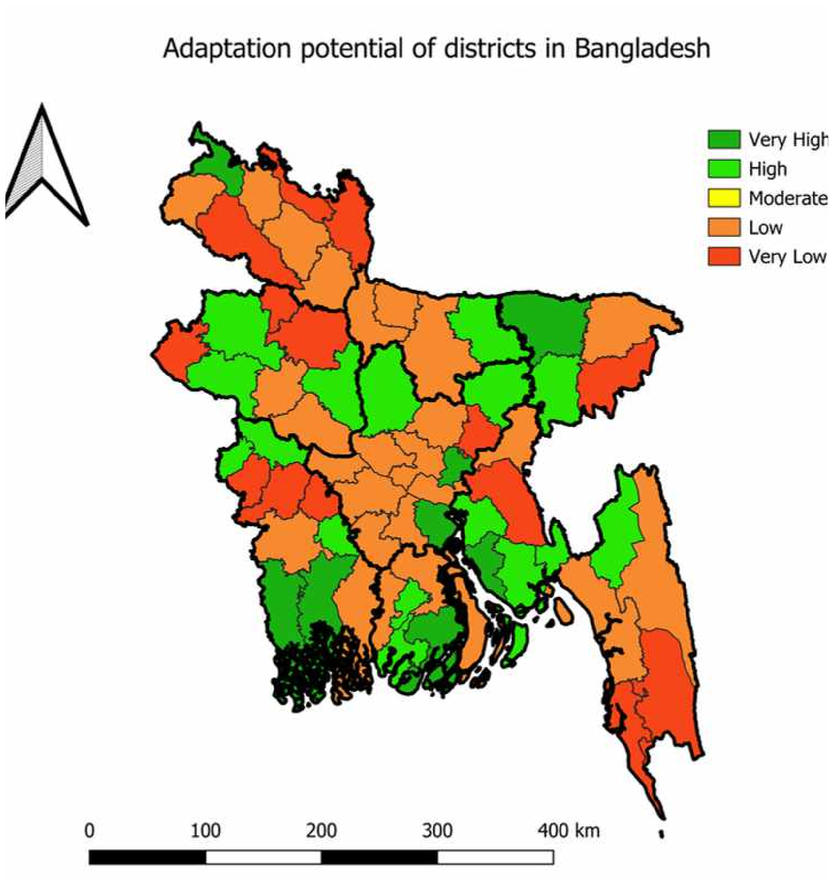
State

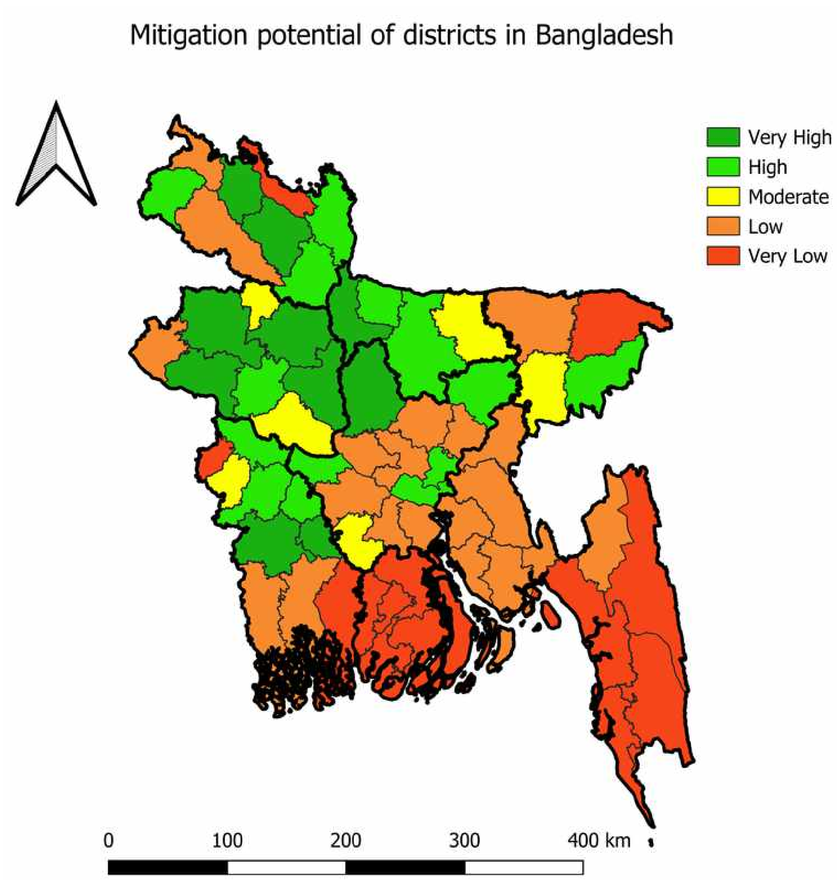

SolaReady
Home
About
Contact
State
Punjab
District
All Districts
Objective
Mitigation
Advanced Configuration
Suitability
Distribution
Key Parameters
4.77 kWh/m²/day
98.31 %
95.50 %
0.22 %
0.00
16.95 m
3.59 ha
169.62 %
70.75 %
181.20 %
82.75 %
81.39 %
1.51 %
1.23
Summary
33
TOTAL DISTRICTS
PUNJAB
HARYANA
HIMACHAL PRADESH
UTTARAKHAND

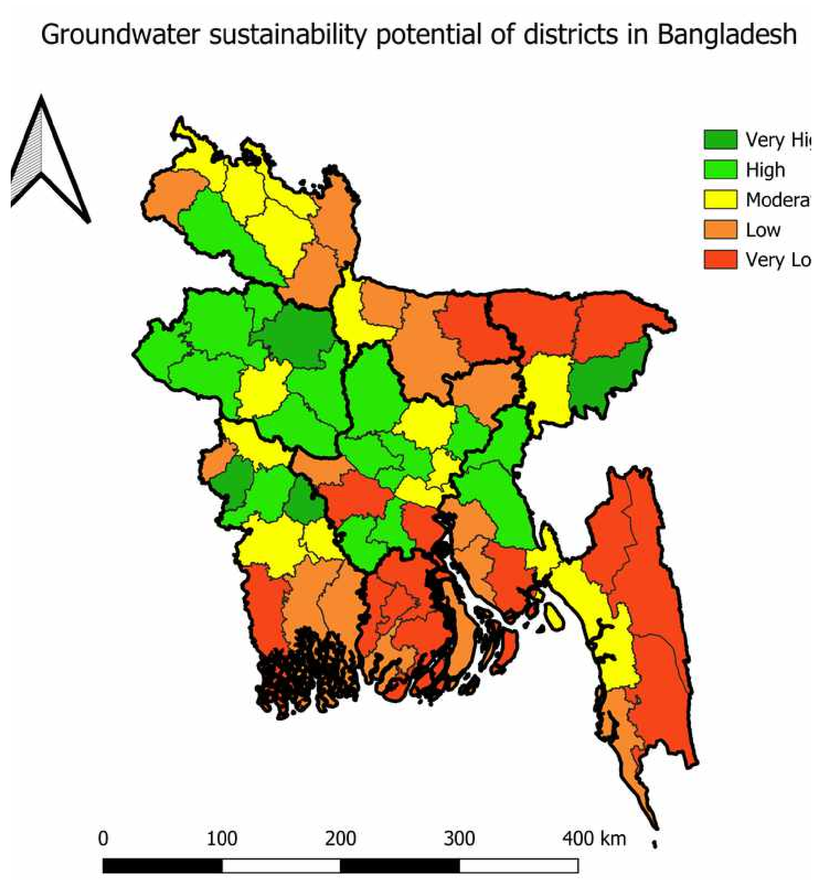
District


SolaReady
Home
About
Contact
State
Punjab
District
Barnala
Objective
Mitigation
Advanced Configuration
Recommended Model for Barnala, Punjab
Location
Crop
Water
Energy
Utility
Farmer
100.30 %
100.00 %
99.87 %
PSPCL
0.00 %
88.58 %
223.59 %
0.11 %
B
3.94 ha
77.34 % of CWU
75.85 %
0.33
1.23
0.03 % of district
0.00 paisa/kWH
Yes
Adaptation: Very Low
Mitigation: Moderate
GW Sustainability: Very High
Search
Links
About
Dashboard
Contact
Connect

Bangladesh (Preliminary)







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Food-Climate-Growth

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Dr. Abdulkarim Seid

Country Representative- Ethiopia, IWMI

Before his appointment to IWMI, Dr. Seid was Deputy Executive Director of the Nile Basin Initiative (NBI) Secretariat and Head of the Basin-Wide Program, and led the NBI Strategic Water Resources Assessment. He has played a lead role in the preparation of NBI flagship knowledge products including the first ever State of the Nile River Basin report. He also led the preparation of the Nile Basin Water Resources Atlas. Prior to joining NBI he was Assistant Professor at Addis Ababa University, Civil Engineering Department, and taught courses in water resources management, hydrology, and water supply engineering and hydraulic structures design.

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Mr. Elias Awol

CEO-Smallholder Irrigation Development, Ministry of Agriculture, Ethiopia

Mr. Elias Awol is a PSC member of the SoLAR-II project based in Ethiopia. He is the chief executive officer (CEO) of the smallholder irrigation directorate within Ethiopian Ministry of Agriculture. Mr. Elias has served the ministry in different capacities: technical, managerial, strategic, and policy levels. He is an engineer by training and enriched it with practical experience and impactful engagements as a part of different national programs, including PASIDP, PACT, GTP, MDG, SDG, SHIDEP etc. He has commendable understanding and exposure to smallholder irrigation systems. His leadership and guidance helped the ministry to scale and outreach many agricultural technologies.

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Mr. Monirul Islam

Deputy CEO and CFO
Infrastructure Development Company Limited (IDCOL), Bangladesh

S. M. Monirul Islam serves as Deputy Chief Executive Officer & Chief Financial Officer at Infrastructure Development Company Limited (IDCOL) in Bangladesh. He joined IDCOL in 1998 and has since played a key role in managing the organisation's financial operations, including the mobilisation and administration of more than USD 1 billion in development funds from entities such as the World Bank, Asian Development Bank and other bilateral and multilateral cooperation agencies. He is widely recognised for his expertise in negotiating and structuring finance for infrastructure and renewable energy initiatives, and under his leadership IDCOL has received national recognition for good governance and tax compliance

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Dr. R K Singh

ADG Extension, ICAR

Dr. R. K. Singh serves as the Assistant Director General (Agricultural Extension) at the Indian Council of Agricultural Research (ICAR), New Delhi. In this role, he leads efforts to strengthen agricultural extension services across India by improving technology transfer to farmers, guiding Krishi Vigyan Kendras (KVKs), and promoting climate-resilient practices and capacity-building initiatives for extension personnel. He is focused on ensuring that innovations developed within the ICAR system effectively reach farming communities to enhance productivity and livelihoods.

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Mr. Frankline Kiptoo

Research Associate
Strathmore University (Virtual)

Frankline Kiptoo is a dedicated Renewable Energy professional with expertise in Renewable Energy Technologies and clean cooking projects. He currently serves as a Test Engineer and a researcher at Strathmore Energy Research Centre, where he conducts solar PV and stove tests, research work, and leads solar PV training sessions.

Mr. Bart Minsaer

Vice Chairman, Ethiopian Solar Energy Development Association (ESEDA)

Bart Minsaer currently serves as the Vice-Chairman of the Ethiopian Solar Energy Development Association (ESEDA) in Addis Ababa, Ethiopia. In parallel, he is the Founder and CEO of HelloSolar, a company specialising in pay-as-you-go solar solutions for off-grid and under-served communities. He brings more than two decades of leadership and operational experience across Africa and Europe in renewable energy and fintech sectors. In his ESEDA role, Bart is focused on enabling market-friendly policies, forging public-private collaboration and accelerating the uptake of small-scale solar systems to expand access and drive the solar economy in Ethiopia.

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