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Swiss Agency for Development and Cooperation SDC

### Advancing Solar Irrigation in India: A Science Policy Forum

National Forum by IWMI-SDC-SoLAR project Venue: Jaypee Siddharth Hotel, Rajendra Place, New Delhi, India Date: 12<sup>th</sup> March 2024, Time: 9:00 am – 15:45 pm IST

#### **Background:**

The surge in carbon emissions in India, driven largely by the agriculture sector's escalating energy demands and reliance on fossil fuels, poses significant environmental challenges. Groundwater irrigation, which accounts for a substantial portion of India's carbon emissions, is heavily subsidized, with electricity provided to farmers at significantly lower rates than domestic users. This subsidy, coupled with policies promoting irrigation and high-yielding crop varieties, has led to widespread groundwater exploitation and depletion. The adoption of solar irrigation pumps (SIPs) presents a promising solution to mitigate these challenges. SIPs offer environmental benefits by reducing CO2 emissions and decreasing reliance on power subsidies. While off-grid SIPs provide energy access in remote areas, grid-connected SIPs offer the additional advantage of stabilizing groundwater withdrawals by allowing farmers to sell surplus electricity back to the grid, thereby augmenting their income. India's abundant solar potential and government schemes like PM KUSUM further underscore the importance of solar irrigation in achieving sustainability goals. However, the adoption of SIPs remains limited, highlighting the need for scaling to realize the full potential of solar irrigation in India's agricultural landscape.

The primary aim of this forum is to present and discuss recent insights into i) challenges associated with the adoption of SIPs by smallholder and women farmers, ii) their impact on livelihoods and groundwater, and iii) the need for capacity building interventions to improve the implementation effectiveness of SIP programs. Additionally, the forum will engage in an in-depth discussion about scaling strategies and policy interventions.

#### About SoLAR:

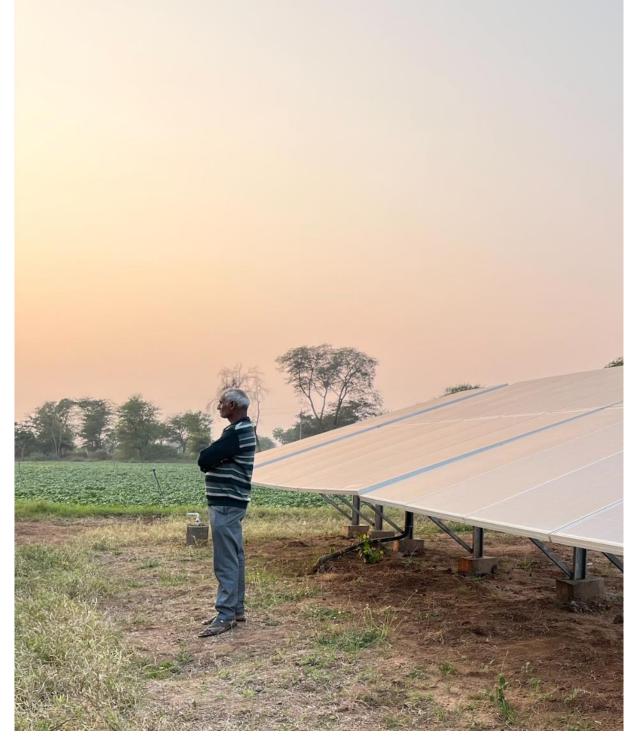
Solar Irrigation for Agricultural Resilience in South Asia (SoLAR-SA) aims to sustainably manage the water-energy and climate interlinkages in South Asia through the promotion of SIPs. The project is funded by the Swiss Agency for Development and Cooperation (SDC). The project's main goal is to contribute to climate-resilient, genderequitable, and socially inclusive agrarian livelihoods in Bangladesh, India, Nepal, and Pakistan by supporting government efforts to promote solar irrigation. In the process, the project will pave the way for sustainable and equitable groundwater governance by tackling policy distortions related to solar irrigation, such as perverse electricity subsidies that have led to negative interlinkages between the water and energy sectors in South Asia. In India, IWMI has partnered with Gujarat Urja Vikas Nigam Limited (GUVNL), the Government of Gujarat, and the Gujarat Energy Research and Management Institute (GERMI).

## Agenda:

Welcome remarks: International Water Management Institute     Alok Sitka/ Darshini Ravindnamu       9:30 - 10:15     Welcome remarks: Swiss Development Cooperation     Divya Kashyap Sharm       9:30 - 10:15     Opening remarks: Deputy Secretary, Ministry of New and Renewable Energy     Suman Chandra       Opening remarks: Deputy Secretary, Ministry of Finance     Geetu Joshi     Udham Singh Gautam       Opening remarks: Deputy Secretary, Ministry of Finance     Geetu Joshi     Udham Singh Gautam       Opening remarks: Chairman, Central Groundwater Board     Sumil Kumar Ambast       TEA BREAK (It mins) 1015-10:30     Empowering Farmers with Grid-Connected     Deepak Varshney (WMI)     15 min       01:30 - 10:45     Solar Irrigation Pumps: Evidence from Gujarat, India     Deepak Varshney (WMI)     10 min       10:45 - 10:55     Solar Irrigation Pumps: Evidence from Cujarat, Unida     Deepak Varshney (WMI)     10 min       10:45 - 10:55     Solar Irrigation and GESI     Farad Biocussion 7: Inclusive Scaling Strategies and Boiley Lessons for Solar     Irrigation in India     10 min       10:65 - 11:05     Q+A     Participants     10 min       11:05 - 12:00     Bandiffield Grid-Connected SIPS for Solar     Faiz Alam (WMI)     10 min       11:05 - 12:00     P	TIME	Presentation/panel (w	vith panelists)	
Welcome remarks: International Water Management Institute     Revindmanth       9:30 - 10:15     Welcome remarks: Swiss Development Cooperation     Divya Kashyap Sharm       0pening remarks: Deputy Secretary, Ministry of Finance     Geetu Joshi     Geetu Joshi       0pening remarks: Coputy Director General, Agriculture Research     Geetu Joshi     Udham Singh Gautam       0pening remarks: Deputy Director General, Agriculture Research     Sunil Kumar Ambast       TEA BREAK (15 mine) 1015-10:30     Starius Scalar	9:00 - 9:30	Registratio	on	Participants
9:30 - 10:15     Opening remarks: Deputy Secretary, Ministry of New and Renewable Energy     Suman Chandra       0pening remarks: Deputy Director General, Agriculture Research     Geetu Joshi     Udham Singh Gautam       0pening remarks: Chairman, Central Groundwater Board     Sumil Kumar Ambast     Udham Singh Gautam       030 - 10:45     Empowering Farmers with Grid-Connected     Session 1 - Adoption and Impact of SIPs: Inclusive Scaling Strategies and Policy Lessons     Mininget Evaluation and GESI       00:30 - 10:45     Empowering Farmers with Grid-Connected     Deepak Varshney (IWMI)     15 min       00:30 - 10:45     Empowering Farmers with Grid-Connected     Deepak Varshney (IWMI)     10 min       01:45 - 10:55     Solar irrigation Pumps: Evidence from Gujarat, India     Manohara Khadka (IVMI)     10 min       10:45 - 10:55     Q+A     Participants     10 min       10:55 - 11:05     Q+A     Participants     10 min       10:55 - 11:05     Q+A     Participants     55 min       11:05- 12:00     Zanelizit (Gri// Moderator-     Faiz Alam (WMI)     10 min       12:10 - 12:10     Impact Grid-Connected SIPs on Groundwater     Faiz Alam (WMI)     10 min       12:10 - 12:15     Q+A     Parti	9:30 - 10:15	Welcome remarks: International W	Welcome remarks: International Water Management Institute	
9:30 - 10:15 Opening remarks: Advisor, Ministry of Finance Geetu Joshi Opening remarks: Advisor, Ministry of Finance Geetu Joshi Opening remarks: Advisor, Ministry of Finance Geetu Joshi Opening remarks: Chairman, Central Groundwater Board Sunil Kumar Ambast TEA BREAK (IS mine) 10:15–10:30 SESSION 1 – Adoption and Impact of SIPs: Inclusive Scaling Strategies and Policy Lessons Impact Evaluation and GES SISSION 1 – Adoption and Impact of SIPs: Inclusive Scaling Strategies and Policy Lessons Impact Evaluation and GES Solar Irrigation Pumps: Evidence from Gujarat, India Solar Irrigation and GESI: Some insights from Nepal 10:45 – 10:55 Solar Irrigation and GESI: Some insights from Nepal 10:55 – 11:05 Q=A Participants 10 min Partel Discussion 7. Inclusive Scaling Strategies and Policy Lessons for Solar Irrigation in India Strategies and Policy Lessons for Solar Irrigation in India SIP and Groundwater Saragi (Corja) SIP and Groundwater 12:00 – 12:10 Panel Discussion 2. Potential of Grid- Connected SIPs on Groundwater Withdrawals Faiz Alam (IWHI) 10 min 12:10 – 12:15 Q=A Panel Discussion 2. Potential of Grid- Connected SIPs on Sustainable Groundwater Solutions 2. Banelist 12:10 – 12:15 Q=A Panel Discussion 2. Potential of Grid- Connected SIPs for Sustainable Groundwater Chair/Moderator-Alok Sikka (IWHI) 10 min 2. Banelist 2. Banelist 3. Banelis		Welcome remarks: Swiss Deve	lopment Cooperation	Divya Kashyap Sharma
Opening remarks: Advisor, Ministry of Finance     Geetu Joshi       Opening remarks: Deputy Director General, Agriculture Extension, Indian Council of Agriculture Research     Udham Singh Gautam       Dening remarks: Chairman, Central Groundwater Board     Sunil Kumar Ambast       SSISDN 1- Adoption and Impact of SIPs: Inclusive Scaling Strategies and Policy Lessons     Impact Evaluation and GES       10:30 - 10:45     Empowering Farmers with Grid-Connected Solar Irrigation Pumps: Evidence from Gujarat, India     Deepak Varshney (IWMI)     15 min       10:45 - 10:55     Solar Irrigation and GESI: Some insights from Nepal     Manohara Khadka (IWMI)     10 min       10:45 - 10:55     QiA     Participants     10 min       10:50 - 11:05     QiA     Participants     10 min       10:51 - 11:05     QiA     Participants     10 min       11:05 - 12:00     Data of Grid-Connected SIPs on GUZIY (Monaliz 2ga Hazra (USAID)/Amit Saragi (Orija)     Simin     Simin       SIP and Groundwater     Impact of Grid-Connected SIPs on Groundwater Withdrawals     Faiz Alam (IWMI)     10 min       12:10 - 12:15     Q+A     Participants     5 min     Simin       12:10 - 12:15     Q+A     Participants     5 min     Simin <tr< td=""><td colspan="2">Opening remarks: Deputy Secretary, Ministry of New and Renewable Energy</td><td>Suman Chandra</td></tr<>		Opening remarks: Deputy Secretary, Ministry of New and Renewable Energy		Suman Chandra
Or Agriculture Research     Utinary Sign Calutant       Opening remarks: Chairman, Central Groundwater Board     Sunil Kumar Ambast       SESSION 1 – Adoption and Impact of SIPs: Inclusive Scaling Strategies and Policy Lessons     Impact Evaluation and GES/       10:30 – 10:45     Empowering Farmers with Grid-Connected Solar Irrigation and GES: Some insights from Nepal     Deepak Varshney (IWMI)     15 min       10:45 – 10:55     9-A     Participants     10 min       10:55 – 11:05     9-A     Participants     10 min       10:55 – 11:05     9-A     Participants     10 min       11:05–12:00     Panel Discussion 7: Inclusive Scaling Strategies and Policy Lessons for Solar Irrigation in India     Chair/ModeratorTushaar Shah (IWMI)     55 min       11:05–12:00     Panel Discussion 2: Potential Cay IA:27 (JNILA)/Amit Saraogi (Oorja)     Faiz Alam (IWMI)     10 min       SIP and Groundwater     Impact of Grid-Connected SIPs on Groundwater Withdrawals     Faiz Alam (IWMI)     10 min       12:10 - 12:15     Q+A     Participantss     5 min       12:10 - 12:15     Q+A     Participantss     5 min       12:10 - 12:15     Q+A     Participantss     5 min       12:10 - 12:15     Q+A <td colspan="2"></td> <td>Geetu Joshi</td>				Geetu Joshi
TEA BREAK (Ls mins) 10:15-10:30     SESSION 1 – Adoption and Impact of SIPs: Inclusive Scaling Strategies and Policy Lessons     Impact Evaluation and GES/     10:30 – 10:45   Empowering Farmers with Grid-Connected Solar Irrigation Pumps: Evidence from Gujarat, India   Deepak Varshney (IWMI)   15 min     10:45 - 10:55   Solar Irrigation and GESI: Some insights from Nepal   Manohara Khadka (IWMI)   10 min     10:45 - 10:55   Q+A   Participants   10 min     Strategies and Policy Lessons for Solar Irrigation in India   Participants   10 min     Bane // Bickussion 7: Inclusive Scaling Strategies and Policy Lessons for Solar Irrigation in India   Chair/Moderator- Tushaar Shah (IWMI)   55 min     9:06 - 12:00   Bane // Bickussion 7: Inclusive Scaling Strategies (Gorja)   Faiz Alam (IVMI)   10 min     SIP and Groundwater   Impact of Grid-Connected SIPs on Groundwater Withdrawals   Faiz Alam (IVMI)   10 min     12:10 - 12:15   Q+A   Participants   5 min   45 min     12:10 - 12:15   Q+A   Participants   5 min     12:10 - 12:15   Q+A   Participants   5 min     12:10 - 12:16   Chair (MODCL)/Saumava Dey (ITT)/Adul Islam (ICAR)/D K Singh (ICAR)   Kiwit)   45 min     12:10 -				Udham Singh Gautam
SESSION 1 – Adoption and Impact of SIPs: Inclusive Scaling Strategies and Policy Lessons     Impact Evaluation and GES/     10:30 – 10:45   Empowering Farmers with Grid-Connected Solar trigation Pumps: Evidence from Gujarat, India   Deepak Varshney (IWMI)   15 min     10:45 – 10:55   Solar irrigation and GESI: Some insights from Nepal   Manohara Khadka (IWMI)   10 min     10:45 – 10:55   Qi A   Participants   10 min     10:55 – 11:05   Qi A   Participants   10 min     10:55 – 11:05   Qi A   Participants   10 min     11:05–12:00   Panel Discussion 7: Inclusive Scaling Strategies and Policy Lessons for Solar Irrigation in India   Chair/Moderator Tushaar Shah (IWMI)   55 min     12:00 – 12:10   Impact of Grid-Connected SIPs on Groundwater   Faiz Alam (IWMI)   10 min     12:10 – 12:15   Q+A   Participantss   5 min     12:10 – 12:15   Q+A   Participantss   5 min     12:10 – 12:15   Q+A   Participantss   5 min     12:10 – 12:16   Eanel Discussion 2: Potential of Grid- Connected SIPs for Sustainable Groundwater Solutions   5 min     12:10 – 12:17   Q+A   Participants   5 min     12:10 – 12:18   Q-A   P		Opening remarks: Chairman, Cen	tral Groundwater Board	Sunil Kumar Ambast
Impact Evaluation and GES     10:30 - 10:45   Empowering Farmers with Grid-Connected Solar Irrigation Pumps: Evidence from Gujarat, India   Deepak Varshney (IWMI)   15 min     10:45 - 10:55   Solar Irrigation and GESI: Some insights from Nepal   Manohara Khadka (IWMI)   10 min     10:55 - 11:05   Q+A   Participants   55 min     11:05 - 12:00   Panelist J V Meenakshi (IIIT)/Veena Srinivasan (WELI) Sanaogi (Oorja)   Chair/Moderator- Tushaar Shah (WMI)   55 min     SIP and Groundwater   Impact of Grid-Connected SIPs on Groundwater Withdrawals   Faiz Alam (IWMI)   10 min     12:10 - 12:15   Q+A   Participantss   5 min     12:10 - 12:15   Q+A   Participants   5 min     12:10 - 12:15   Q+A   Participants   5 min     12:10 - 12:15   Q+A   Panel Discussion 2; Potential of Grid- Connected SIPs for Sustainable Groundwate	TEA BREAK (15 n	nins) 10:15–10:30		
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Panel Discussion 1: Inclusive Scaling Strategies and Policy Lessons for Solar Irrigation in India   Chair/Moderator- Tushaar Shah (WHI)   55 min     11:05-12:00   Panelist J V Meenakshi (IIIT)/Veena Srinivasan (WELL)/ Santosh Rai (AEPC) / Nilanjan Ghose (GiZ)/ /Monali Zeya Hazra (USAID)/Amit Saraogi (Oorja)   Chair/Moderator- Tushaar Shah (WMI)   55 min     SIP and Groundwater   Impact of Grid-Connected SIPs on Groundwater Withdrawals   Faiz Alam (IWMI)   10 min     12:10 - 12:15   Q+A   Participantss   5 min     12:10 - 12:15   Q+A   Participantss   5 min     12:10 - 12:16   Q+A   Participantss   5 min     12:17 - 13:00   Discussion & Potential of Grid- Connected SIPs for Sustainable Groundwater Solutions   Chair/Moderator-Alok Sikka (IWMI)   45 min     12:17 - 13:00   Design and Implementation of Capacity Building intervention for the grid-connected solar farmers   Nikunj Usadadia (IWMI)   10 min     14:00-14:10   Design and Implementation of Capacity building intervention of the grid-connected control Trial (RCT)   Deepak Varshney (IWMI)   10 min     14:20-14:35   Capacity building intervention designed for solar farmers on solar energy generation: Evidence from the Randomized Control Trial (RCT)   Deepak Varshney (IWMI)   10 min     14:20-14:35   Capacity building intervention for grid- Connected SIP	10:45 - 10:55		Manohara Khadka (IWMI)	10 min
Strategies and Policy Lessons for Solar Irrigation in India J V Meenakshi (IIIT)/Veena Srinivasan (WELL)/ Santosh Rai (AEPC) / Nilanjan Ghose (GiZ)/ /Monali Zeya Hazra (USAID)/Amit Saraogi (Oorja)Chair/Moderator - Tushaar Shah (WMI)55 minSIP and GroundwaterSIP and GroundwaterImpact of Grid-Connected SIPs on Groundwater WithdrawalsFaiz Alam (IWMI)10 min12:10 - 12:10Impact of Grid-Connected SIPs on Groundwater WithdrawalsFaiz Alam (IWMI)10 min12:10 - 12:15Q+AParticipantss5 min12:15 - 13:00Panel Discussion 2: Potential of Grid- Connected SIPs for Sustainable Groundwater SolutionsChair/Moderator - Alok Sikka (IWMI)45 min12:15 - 13:00Panel Discussion 2: Potential of Grid- Connected SIPs for Sustainable Groundwater SolutionsChair/Moderator - Alok Sikka (IWMI)45 min12:15 - 13:00Panel Discussion 2: Potential of Grid- Connected SIPs for Sustainable Groundwater SolutionsChair/Moderator - Alok Sikka (IWMI)45 min12:15 - 13:00Design and Implementation of Capacity building intervention for the grid-connected solar farmersNikunj Usadadia (IWMI)10 min14:00-14:10Design and Implementation of Capacity generation: Evidence from the Randomized Control Trial (RCT)Nikunj Usadadia (IWMI)10 min14:20-14:20Capacity building intervention designed for solar farmers: on solar energy generation: Evidence from the Randomized connected SIP farmers: Understanding Farmers' PerspectivesEarmers: Manubhai/Kanabha/Bhikhubhai/ Deepak Varshney (IWMI)10 min14:20-14:35 <td>10:55 - 11:05</td> <td>Q+A</td> <td>Participants</td> <td>10 min</td>	10:55 - 11:05	Q+A	Participants	10 min
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12:15-13:00Connected SIPs for Sustainable Groundwater SolutionsChair/Moderator-Alok Sikka (IWMI)45 min12:15-13:00Panelist Ratan Jain (GWRDCL)/Saumava Dey (IIT)/Adlul Islam (ICAR)/D K Singh (ICAR)Chair/Moderator-Alok Sikka (IWMI)45 minLUNCH BREAK (1 hour) 13:00 - 14:00SESSION 2- Solar Empowerment: Unleashing Full Potential through Knowledge and Skills14:00-14:10Design and Implementation of Capacity building intervention for the grid-connected solar farmersNikunj Usadadia (IWMI)10 min14:10-14:20Impact of capacity building intervention designed for solar farmers on solar energy generation: Evidence from the Randomized Control Trial (RCT)Deepak Varshney (IWMI)10 min14:20-14:35Capacity building intervention for grid- connected SIP farmers: Understanding Farmers' PerspectivesFarmers: Manubhai/Kanabha/Bhikhubhai/ Deputy Engineer Hiran H Ganatra15 min14:35-OtAParticipants10 min	12:10 - 12:15	Q+A	Participantss	5 min
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14:00-14:10   building intervention for the grid-connected solar farmers   Nikunj Usadadia (IWMI)   10 min     14:10-14:20   Impact of capacity building intervention designed for solar farmers on solar energy generation: Evidence from the Randomized Control Trial (RCT)   Deepak Varshney (IWMI)   10 min     14:20-14:35   Capacity building intervention for grid-connected SIP farmers: Understanding Farmers' Perspectives   Farmers: Manubhai/Kanabha/Bhikhubhai/Deputy Engineer Hiran H Ganatra   15 min     14:35-   O+A   Participants   10 min	SESSION 2- Sola		gh Knowledge and Skills	
14:10-14:20Impact of capacity building intervention designed for solar farmers on solar energy generation: Evidence from the Randomized Control Trial (RCT)Deepak Varshney (IWMI)10 min14:20-14:35Capacity building intervention for grid- connected SIP farmers: Understanding Farmers' PerspectivesFarmers: Manubhai/Kanabha/Bhikhubhai/ Deputy Engineer Hiran H Ganatra15 min14:35-O+AParticipants10 min	14:00-14:10	building intervention for the grid-connected	Nikunj Usadadia (IWMI)	10 min
14:20-14:35 connected SIP farmers: Understanding Farmers' Perspectives Manubhai/Kanabha/Bhikhubhai/ <u>Deputy Engineer</u> Hiran H Ganatra 15 min   14:35- O+A Participants 10 min	14:10-14:20	Impact of capacity building intervention designed for solar farmers on solar energy generation: Evidence from the Randomized Control Trial (RCT)	Deepak Varshney (IWMI)	10 min
O+A Participants 10 min	14:20-14:35	connected SIP farmers: Understanding	Manubhai/Kanabha/Bhikhubhai/ <u>Deputy Engineer</u>	15 min
	14:35- 14:45	Q+A	Participants	10 min

14:45-15:30	Panel Discussion: Necessity of Awareness and Knowledge for Accessing and Optimizing Solar Irrigation Pump Usage <u>Panelist</u> R J Vala (PGVCL)/ Akash Davda (GERMI)/ Manohara Khadka (IWMI)/Shilp Verma (IWMI)/ Atul Dhir (USAID)	Chair/Moderator-Darshini Ravindranath (IWMI)	45 min
15:30-15:40	Closing Remarks	P C Sharma (ISA) Divya Kashyap Sharma (SDC)	10 min
15:40-15:45	Vote of Thanks	Darshini Ravindranath (IWMI)	5 min

# Photo: IWMI



Speakers	Designation and Organisation
Dr. Adlul Islam	Assistant Director General (S&WM), Indian Council of Agricultural Research (ICAR), New Delhi, India
Dr. Akash Davda	General Manager and Scientist, Gujarat Energy Research and Management Institute
Dr. Alok Sikka	Country Representative-India, International Water Management Institute
Mr. Amit Saraogi	CEO & Co-founder, Oorja Solutions
Mr. Atul Dhir	Objective Lead - RE, USAID South Asia Regional Energy Partnership (SAREP)
Bhikhubhai	Farmer, Paschim Gujarat Vij Company Ltd
Dr. D.K. Singh	Principal Scientist, Indian Agricultural Research Institute (IARI), New Delhi, India
Dr. Darshini Ravindranath	SoLAR Project Lead, International Water Management Institute
Dr. Deepak Varshney	Regional Researcher-Economics and Impact Assessment (ECA), International Water Management Institute
Ms. Divya Kashyap Sharma	Deputy Head of Cooperation, Swiss Agency for Development and Cooperation
Mr. Faiz Alam	Regional Researcher, International Water Management Institute
Ms. Geetu Joshi	Advisor, Ministry of Finance, Govt. of India
Mr. Hiran H Ganatra	Deputy Engineer, Paschim Gujarat Vij Company Ltd, Gujarat
Dr. J V Meenakshi	Senior Professor, Indraprastha Institute of Information Technology (IIIT), Delhi
Mr. Kanabhai	Farmer, Paschim Gujarat Vij Company Ltd
Dr. Manohara Khadka	Country Representative-Nepal, International Water Management Institute
Ms. Monali Zeya Hazra	Regional and Clean Energy Specialist, USAID
Mr. Manubhai	Farmer, Paschim Gujarat Vij Company Ltd, Gujarat
Mr. Nikunj Usadadia	Research Officer – Action Research, International Water Management Institute
Mr. Nilanjan Ghose	Senior Advisor, GIZ, New Delhi
Dr. P.C. Sharma	Joint Director, International Solar Alliance
Dr. Ratan Jain	Adviser (Groundwater), Gujarat Water Resources Development Corporation Limited, Government of Gujarat
Shri R J Vala	Chief Engineer, Paschim Gujarat Vij Company Ltd, Gujarat
Shri Santosh Rai	Senior Officer, Solar and Wind Energy, Alternative Energy Promotion Centre, Nepal
Dr. Saumava Dey	Assistant Professor, IIT-Delhi
Mr. Shilp Verma	Deputy Country Representative – India and Senior Researcher, International Water Management Institute
Ms. Suman Chandra	Deputy Secretary, Ministry of New and Renewable Energy
Dr. Sunil Kumar Ambast	Chairman, Central Groundwater Board
Dr. Tushar Shah	Scientist Emeritus, International Water Management Institute
Dr. Udham Singh Gautam	Deputy Director General, Agriculture Extension, Indian Council of Agriculture Research
Dr. Veena Srinivasan	Executive Director- WELL Labs, Bangalore