



**THE WORLD BANK**  
IBRD • IDA | WORLD BANK GROUP



**NITI Aayog**

# Energy-Water-Agriculture Nexus: Grow Solar, Save Water, Double the Farm Income

New Delhi

December 18, 2019



In partnership with



## **Organizing Teams**

### **NITI Aayog**

Mr. R. P. Gupta, Special Secretary

Mr. Rajnath Ram, Advisor

Mr. Manoj Upadhyay, Deputy Advisor

Ms. Saumya Pandey, Young Professional

### **The World Bank**

Mr. Mohinder Gulati, Former Advisor (Energy)

Ms. Kavita Saraswat, Senior Power Engineer

Mr. Gaurav Upadhyay, Consultant

Ms. Neetu Sharda, Program Assistant

Ms. Hena Kanungo, Support Staff

## Introduction

NITI Aayog and the World Bank organized a one-day workshop on “Energy-Water-Agriculture Nexus: Grow Solar, Save Water, Double the Farm Income” on 18<sup>th</sup> December 2019 in New Delhi. This workshop is a part of the Lighthouse India initiative<sup>1</sup> of the World Bank. The workshop was attended by approximately 90 participants including policy makers from energy, water resources and agriculture from central ministries and different states along with representatives of multilateral organizations, bilateral organizations, DISCOMs, farmers collectives, CSOs and the academia.

The Workshop was opened by the CEO NITI Aayog, Mr. Amitabh Kant, and the World Bank Country Director, Dr. Junaid Ahmad. Dr. Ramesh Chand, Member (Agriculture) NITI Aayog gave a key note address and Dr. N. S. Bains, Director (Research), Punjab Agriculture University gave the concluding remarks and closing address. The workshop included seven panel discussions focused on the experience of different states on energy-water-agriculture nexus, critical evaluation & sustainability of the KUSUM scheme, institutional arrangement and financing of the farmers and state’s share of capital cost buy-down in the KUSUM scheme.

Annexure 1, 2, 3 and 4 provides the photographs, agenda, list of the participants and list of the speakers of the workshop respectively.

## Objectives of the Workshop

The perverse energy-water-agriculture nexus into which India has been trapped for more than fifty years is well known. The complexity of political economy has been a major impediment to finding financially and economically viable and politically acceptable solutions. Many Indian states have tried to address the challenge through various initiatives such as Direct Benefit Transfer for Electricity. Advancements in technology and falling prices, particularly of solar panels, have opened enormous opportunities of not only shifting the nexus into a virtuous cycle but also transforming rural livelihoods. By focusing only on energy and/or water dimension of the solar energy, India may be missing a huge opportunity of increasing farm income, making agriculture climate resilient, and reducing agro-dependence of rural India. Experience of states in implementing off-grid solar for irrigation, solar cooperatives (Dhundi and Majkuva in Gujarat), sub-station level solar generation (Maharashtra), feeder-level solarization of irrigation (SKY scheme of Gujarat), though in early stages and often being recalibrated, provide useful

---

<sup>1</sup> Lighthouse India is an initiative of the World Bank Group to support systematic efforts to create and curate knowledge and know-how generated within India and disseminate it across the country as well as to the outside world.

lessons to be shared to improve the business models for accelerating use of solar in agriculture. The workshop was organized to bring together states, policy and technical experts, farmer representatives, and private sector to share their experiences and explore the possibilities of leveraging the full potential of the recently announced KUSUM scheme of Government of India.

### Summary of the workshop

The Workshop concluded that grid-connected solar irrigation for agriculture and rural electricity supply holds immense potential to achieve the trifecta of saving water, doubling farmer income, and saving electricity. Some speakers argued that solar energy, particularly off-grid solar, could lead to increase in groundwater extraction, while others argued that off-grid and grid-connected solar are not the same and offer very different incentives to farmers on use of electricity and water. Even off-grid solar irrigation may be a good solution where groundwater is shallow such as in eastern Uttar Pradesh, and parts of Bihar, Assam, and West Bengal. An attractive feed-in-tariff can help set the trade-off in favor of water productivity and conservation. The World Bank report titled “Grow Solar, Save Water, Double Farmer Income - An innovative approach to addressing Water-Energy-Agriculture nexus in Rajasthan” was presented at the Workshop. Two interesting concepts: (i) “value of water in agriculture” and (ii) “Drought Premium in case of grid-connected solar irrigation” demonstrate how pricing policies for surplus electricity generated by grid-connected solar could encourage water conservation. One of the sessions was devoted to institutional models for implementation.

It became clear during the deliberations that there is lack of clarity in many stakeholders’ minds about Kisan Urja Surakhsha evam Utthan Mahabhiyan (KUSUM) scheme which has three distinct components, each of which is a self-standing scheme: (A) sub-station level solar power plant between 0.5 MW to 2.0 MW to be installed through private sector, power utility, or farmers collective, (B) off-grid solar irrigation, and (C) grid-connected solar that could convert the existing electric tube-wells to farmer-led solar pumps. The Government of India has set separate target for each of these schemes. It was also argued that efficient agriculture practices and use of crop residue for energy generation should be encouraged. Establishing monitoring wells at Gram Panchayats would help provide timely information to the communities on resource depletion. Crop diversification and promoting dry land crops such as millets to focus on nutrition requires a shift in the government policies and farmer incentive. To deal effectively with the nexus, it is important to move from schemes to systems.

Grid-connected solar irrigation is a major positive disruption waiting to happen in India. The opportunity is real; what it would take is to strengthen institutional capacity and mitigate payment risk for surplus electricity generated by solar.

## Opening Session

Mr. Gailius Draugelis, Lead Energy Specialist from the World Bank welcomed the participants and speakers of the workshop. He invited Mr. Amitabh Kant, CEO, NITI Aayog and Dr. Junaid Ahmad, Country Director, World Bank to deliver key note addresses.

Mr. Kant stated that ground water depletion is a serious issue for India and the current trends of water guzzling crops like paddy and sugarcane are threatening the water security in many states; he suggested that crop diversification is one of the solutions that can help to reduce the stress on water resources. Less water intensive crops such as millets and pulses are suitable for the dry lands of India. These crops also provide high nutritional value and can be included in the child nutrition scheme to increase the nutritional standards of the children in the country. Such a move can change the procurement to millets and pulses. He emphasized that KUSUM scheme is one of the opportunities which can promote sustainable use of water in agriculture as well as generate climate resilient income to the farmers. This scheme has the potential to double the farm income by harvesting solar energy.

Dr. Junaid Ahmed emphasized in his key note address that it is essential to put value to water and electricity to discourage wastage of resources in agriculture, but policy alignment between the center and the states is necessary to achieve this objective. He also emphasized that to improve this nexus a significant shift in approach is needed - from schemes to a systems. An incentive program between the states and the center is needed where states are given the power to implement the system and the center rewards them accordingly.

## Session 1: Key objectives of the energy-water-agriculture nexus interventions

This panel discussion chaired by Mr. Mohinder Gulati, former Adviser, World Bank was focused on the key objectives of the interventions to address the adverse nexus of the energy-water-agriculture nexus. Dr. Tushaar Shah, Scientist Emeritus, IWMI stated that Solar Irrigation Pumps (SIP) offer an innovative and promising solution for irrigation as well as the energy-water-agriculture nexus. It provides access to uninterrupted free solar power for irrigation during the day time for farmers. Energy pricing and supply conditions are the most important drivers of agricultural ground water demand in South Asia. Free electricity is to be blamed for the over exploitation of ground water from Punjab down to Tamil Nadu, though its negative impacts are limited by restricted hours, unreliable and often night time supply. Solar irrigation pumps offer reliable free solar power during the daytime which can be more lethal, causing overexploitation of ground water resources. So, the design of a promotional policy for solar pumps should also take account water related issues.

Mr. Gulati presented the linkage between financial losses of the DISCOMs, agriculture power subsidy and fiscal deficit of some large states. In most of the states a large part of fiscal deficit is because of the agriculture power subsidy. He also presented that despite this large amount of subsidy, farm household incomes are stagnant and, barring two states, are around Rs. 10,000 per month, only half of which comes from agriculture. Given the small share of agriculture in GDP, if the current low long-term growth rates (less than 2%) continue and more than two-thirds of the Indian population remains dependent on agriculture, the rural-urban income disparity would grow even further and is likely to affect political and fiscal space for growth.

### [Session 2: Sharing of experience of states on the nexus](#)

The session was chaired by Ms Kavita Saraswat, Senior Power Engineer, World Bank. Ms. Ravneet Kaur, Additional Chief Secretary Power, Government of Punjab, presented the design, and implementation status of the scheme 'Paani Bachao, Paisa Kamao' an initiative of the Government of Punjab. Farmers who enroll in the scheme are given monetary benefit for conserving and using electricity and water efficiently in agriculture. She emphasized that learnings from the initial six-feeder pilot supported by the World Bank and JPAL were incorporated to recalibrate the scheme for scale up in phase-2 to 250 feeders. Dr. Pritpal Singh Kalra, Project Coordinator, Rajasthan Agriculture Competitiveness Project (RACP), presented experience of RACP project in Rajasthan which resulted in the improvement of productivity and income of farmers in selected locations covered by the project. The project also encouraged crop diversification which has helped in reduction of water use in agriculture. Farm-ponds under the project have helped to increase agriculture productivity by 70%. These farm-ponds are piloted at large scale in many areas of Rajasthan.

Mr. Shilp Verma from IWMI presented their experience of promoting a solar cooperative (Dhundi) in Gujarat. This initiative (Solar Power as a Remunerative Crop- SPaRC) focused on creating a farmer's cooperative that invested in solar irrigation and sells surplus power to the DISCOM as per a power purchase agreement. He emphasized that solar power directly available on farm land for farmers can even worsen the situation of ground water resources exploitation but if the solar is grid-connected and farmers can sell power, it can change the incentive to water conservation. Mr. R. J. Vala from GUVNL presented Gujarat's experience of SKY scheme that is offered to individual farmers for installation of solar irrigation system on selected feeders if more than 70% farmers on a feeder opt for the scheme. The Discom borrows on behalf of the farmer and farmers' debt is serviced out of payment due for surplus electricity sold by the farmer (a sort of on-bill financing). Mr. Ashwin Gambhir from Prayas presented a different scheme of feeder level grid connected solar installation which can provide reliable day time electricity to the farmers and cut down losses of the DISCOMs. Two major benefits of this model (KUSUM-A) are improved quality of power supply to the farmers and reduction in upstream network losses. However, the farmers do not have any incentive to improve efficiency of electricity and water use.

### [Session 3: KUSUM scheme: Achieving the trifecta of saving water and electricity, and doubling farmer income](#)

This panel discussion focused on the KUSUM scheme and critical evaluation of the objectives in terms of addressing the trifecta of saving water and electricity and doubling farmers income. The panel was chaired by Mr. Akhil Kumar, Joint Secretary, Ministry of Jal Shakti. Dr. Tushaar Shah and Mr. Bhimashankar Shetkar explained the model of the SKY scheme. It is mandatory in the scheme that more than 70% of the farmers in the feeder need to opt for solarization of pump sets. Farmer's cooperatives, water conservation and income generation are the focus of the SKY scheme in Gujarat. Mr. Karan Dangayach, Managing Director, Shashwat Cleantech shared his experience of SKY scheme. While supporting arguments made by Dr. Shah and Mr. Shetkar, he further suggested that network stability is an important factor to be considered as both KUSUM A and C components include grid connected solar powered pump sets. He also suggested that social engineering and communication with farmers are crucial aspects for the success of KUSUM scheme.

### [Session 4: Business Models for KUSUM-C \(Report of SAWI-funded analytical work in Rajasthan\)](#)

This session chaired by Mr. Gailius Draugelis, Lead Energy Specialist, the World Bank, focused on the South Asia Water Initiative (SAWI) funded study conducted by the World Bank in Rajasthan in collaboration with World Bank-financed Rajasthan Agriculture Competitiveness Project (RACP). Mr. Gulati, Dr. Om Prakash, Project Director, RACP and Mr. Suresh Chauhan, Director (Technical), Jaipur Vidyut Vitran Nigam Limited, participated as panel members. The discussions were focused on the business models for KUSUM-C components. The report has analyzed three institutional models: (i) public private partnership, (ii) individual farmer, and (iii) farmer-led, farmer-enterprise-aggregated model. The panel agreed that the Farmer Enterprise (FPO/cooperative/FPC) model at the feeder level is most effective for the success of KUSUM-C. It was suggested that the scheme should be linked with various water conservation techniques like micro irrigation and pond development. The panel also agreed that the institutional capacity for implementation, inter-agency coordination and mitigating payment risk of DISCOMs will play a major role in the successful implementation of the KUSUM-C scheme.

### [Session 5: Sustainability of Grid-Connected Solar Irrigation](#)

This panel discussion was focused on sustainability of grid connected solar irrigation and was chaired by Ms. Namita Priyadarshie, Joint Secretary, Ministry of Agriculture. Mr. R. L. Dhurandhar presented various ground water related initiatives undertaken by the Government of Chhattisgarh which also led to increased income for the farmers. Mr. Chandra Bhushan, CEO,

iFOREST stated that previous studies have suggested that adopting solar irrigation leads to more water extraction by the farmers. He also emphasized that grid connected solar is more efficient in economic terms as it provides incentives for using water and electricity efficiently. Mr. Rahul Kapur from Grant Thornton also expressed this concern related to over exploitation of ground water resources. It was agreed by the panel that from the sustainability point of view grid connected solar is appropriate as the scheme has inherent incentives for the farmers to use water and electricity efficiently in order to maximize power evacuation.

### [Session 6: Institutional arrangements for implementation of KUSUM scheme: Perspectives of key stakeholders \(a\) Farmers, \(b\) State, \(c\) National](#)

The session focused on the institutional arrangements required for successful implementation of KUSUM scheme. The panel suggested that first a pilot of the scheme should be implemented and design changes carried out based on field implementation experience - that is, adopt a learning-by-doing approach. KUSUM-C can be implemented both with an individual farmer model and farmer's cooperative model. Farmer-led model can be rolled out more quickly but some of the benefits such as improved operation and management of feeder, reducing free-rider problem and potential malfeasance since any leakage is to the account of the Discom cannot be achieved through this model. Farmer Enterprise model not only addresses all these issues satisfactorily but also creates capacity for local governance. Both models should be tried, and pilot should be implemented before scaling up.

### [Session 7: State \(Government\) Financial Assistance for KUSUM Investments](#)

The financing structure of KUSUM B and C component envisages capital cost buy-down of 30% each by the Government of India and the respective State Governments. The remaining 40% is the farmer's contribution (of which 30% can be in the form of loan). This session focused on identifying avenues for the financing of the state and the farmer's share. The session was chaired by Mr. Shantanu Gotmare, Country Representative, GGGI. He suggested that combining climate financing with the normal financing instrument will bring down the overall cost of the program. The main area to focus on is 'how to reduce capital investment', and address the payment risk of DISCOMs. Intime loan repayment would be critical to the success of the program. Mr. Amol Gupta from the World Bank presented that the present fiscal burden of state governments limits their capacity to invest at scale in the program. He suggested that since there is a burden on farmers to pay for cost of solar pumps, there is a need to create bankable structures and financing options that also include subsidy from the State. An illustrative financing structure, that was used in the UDAY scheme was presented.

Mr. Rajesh Miglani from IFC indicated that local commercial financing is possible for the program. Organizations like IFC may be amenable to consider financing the program if key



commercial risks can be brought down to manageable levels. Mr. K. P. Baiju, Deputy General Manager, State Bank of India also expressed that KUSUM is a program which can contribute to increasing the income of farmers. If the payment risk is reduced, banks would be willing to lend for the project. Mr. A. R. Khan, General Manager, NABARD stated that scheme is attractive to farmer community particularly small and marginal farmers who less concerned about the macro impact of scheme and more about farm level income. The investments can be collectivized in the form of society/cooperative and community level borrowing should be possible (as in Gujarat) as farmer credit is already provided by the banks for various areas. For either category of farmers, some risk-fund should be available so that commercial banks are encouraged to finance farmers in the scheme. Area development program should be implemented (to target clusters) and banks may participate so that credit flow can be monitored proactively and corrective actions taken. He also stated that unless banks are involved at a large scale, viability of the program is at risk.

### Closing session

#### **Role of agriculture in energy-water-agriculture nexus:**

Dr. Ramesh Chand, Member Agriculture, NITI Aayog stated that agriculture is the deciding factor in the nexus as water and electricity is utilized for the agriculture production. By giving free power, the agriculture distress will be passed on to next generations because of the over extraction of the ground water. To ensure positive growth in agriculture, it is important to formulate and implement right set of policies and analyse the impact of policies and magnitude of outcomes. As an example, he cited, recycling urban waste water to utilize in agriculture sector is a good step but will meet a miniscule fraction of the irrigation requirements in the country. He suggested that it is important that efficient agriculture practices should be brought in for water and energy conservation issues. Adopting modern techniques like drip and sprinkler irrigation systems can help significantly in conserving water in irrigation. Incentives at community level will also have impact on ground water saving. He also expressed that interventions to address the nexus should not be limited to solar powered pump sets but need to be expanded to other energy sources too.

#### **Conclusion and recommendation for way forward:**

Dr. N. S. Bains, Director Research, Punjab Agriculture University, gave concluding remarks and suggested that a scheme should also be made for better utilization of surface water to release some pressure on the ground water resources. He also suggested that it is important to involve ground level functionaries such as state agriculture universities as they are more familiar with ground level conditions, challenges and solutions. In order to achieve crop diversification, it is critical that farmers are linked with right markets. Farmer should be made aware that the efficient irrigation and agriculture interventions practiced by him can lead to water resource

replenishment. He expressed that some flexibility in scheme design and implementation should be provided to the states to help them adapt the interventions as necessary. The risk of non-target group getting the funding from the scheme needs to be eliminated. He concluded by stating that farmers are in the process of learning, and one intervention will become a stepping stone for other interventions.

Annexure 1: Photographs











## Annexure 2: Agenda

<b>Timing</b>	<b>Sessions</b>	<b>Panelists</b>
<b>9:30 AM to 10:00 AM</b>	<b>Registration (light breakfast will be served)</b>	
<b>Session 1 10:00 AM to 10:30 AM</b>	<b>Key objectives of the energy-water-agriculture nexus interventions</b> (a) Contextualizing solutions to energy-groundwater interaction settings (b) Potential and opportunities to achieve the trifecta of saving water, doubling farm income and increasing renewables	<b>Mr. Mohinder Gulati</b> (former COO, UN Sustainable Energy for All) <b>Dr. Tushaar Shah</b> (Scientist Emeritus, International Water Management Institute)
<b>Opening Session 10:30 AM to 11:00 AM</b>	<b>Welcome and Introduction</b>	<b>Mr. Amitabh Kant</b> (CEO, NITI Aayog) <b>Mr. Junaid Ahmad</b> (Country Director, The World Bank)
<b>11:00 AM to 11:15 AM</b>	<b>Tea Break</b>	
<b>Session 2 11:15 AM to 12:30 PM</b>	<b>Sharing of experience of states on the nexus</b>  (a) Punjab - Pani Bachao, Paisa Kamao scheme (b) Rajasthan Off-grid solar irrigation (c) IWMI – Solar Power as a Remunerative Crop (SPaRC) (d) Gujrat - Jyotigram and SKY (e) Maharashtra - Sub-station level solar energy plant	<b>Chair - Mr. R. P. Gupta (Special Secretary, NITI Aayog)</b> Panelists – 1. Ms. Ravneet Kaur (Addl Chief Secretary (Power) Punjab) 2. Dr. Pritpal Singh Kalra, Project Coordinator, Rajasthan Agriculture Competitiveness Project (RACP), Rajasthan 3. Mr. Shilp Verma, IWMI-TATA Program 4. Mr. R. J. Vala, Executive Engineer (Solar) (GUVNL) 5. Mr. Ashwin Gambhir, Prayas 6. Mr. Ganesh Neelam, Tata Trusts
<b>Session 3 12:30 PM to 01:15 PM</b>	<b>KUSUM scheme: Achieving the trifecta of saving water and electricity, and doubling farmer income.</b> (Evaluation of three components against key objectives presented in Session 1)	<b>Chair – Mr. Akhil Kumar, Joint Secretary, Ministry of Jal Shakti</b> Panelists – 1. Dr. Tushar Shah (Scientist Emeritus, International Water Management Institute) 2. Mr. Bhimashankar Shetkar, NDDB 3. Mr. Karan Dangayach, Managing Director, Shashwat Cleantech
<b>1:15 PM to 1:45 PM</b>	<b>Lunch</b>	
<b>Session 4 01:45 PM to 2:30 PM</b>	<b>Business Models for KUSUM-C (Report of SAWI-funded analytical work in Rajasthan): Technical and financial viability of grid-</b>	<b>Chair – Mr. Gailius Draugelis, Lead Energy Specialist, World Bank</b> Panelists –

	<i>connected solar irrigation with sale of surplus electricity.</i>	<ol style="list-style-type: none"> <li>1. Mr. Mahendra Jain, ACS (Energy) Govt of Karnataka</li> <li>2. Mr. Mohinder Gulati (Former COO, UN Sustainable Energy for all and Adviser WB)</li> <li>3. Dr. Om Prakash, Project Director (RACP)</li> <li>4. Mr. A. K. Gupta, MD Jaipur DISCOM (TBC)</li> </ol>
<b>Session 5</b> <b>2:30 PM to 3:15 PM</b>	<b>Sustainability of grid-connected solar irrigation: Technology and practices (Such as – Micro Irrigation), Impact on groundwater, agriculture, and rural livelihood</b>	<b>Chair – Ms. Namita Priyadarshie, Joint Secretary, Agriculture</b> <b>Panelists –</b> <ol style="list-style-type: none"> <li>1. Mr. Chandra Bhushan, President &amp; CEO, iFOREST</li> <li>2. Mr. R. L. Dhurandhar, Deputy Director, Farmers Training Centre, Durg, Chhattisgarh</li> <li>3. Mr. Rahul Kapur, Partner, Grant Thornton</li> </ol>
<b>Session 6</b> <b>3:15 PM to 4:00 PM</b>	<b>Institutional arrangements for implementation of KUSUM scheme: Perspectives of key stakeholders (a) Farmers, (b) State, (c) National</b>	<b>Chair – Dr. Tushaar Shah, Scientist Emeritus, IWMI</b> <b>Panelists –</b> <ol style="list-style-type: none"> <li>1. Mr. R. J. Vala, Executive Engineer (Solar) (GUVNL)</li> <li>2. Mr. Ved Arya, Founder Srijan, Delhi</li> <li>3. Mr. Mohinder Gulati, World Bank</li> </ol>
<b>4:00 PM to 4:30 PM</b>	<b>Role of agriculture in electricity-water-agriculture nexus</b>	<b>Mr. Ramesh Chand (Member Agriculture, NITI Aayog)</b>
<b>Session 7</b> <b>4:30 PM to 5:00 PM</b>	<b>State Government Financial Assistance for KUSUM investments: Innovations and Instruments of Financing</b>	<b>Chair – Mr. Shantanu Gotmare, Country Director, GGGI</b> <b>Panelists –</b> <ol style="list-style-type: none"> <li>1. Amol Gupta, World Bank</li> <li>2. IFC representative</li> <li>3. Mr. K. P. Baiju, DGM, State Bank of India, Credit Policy &amp; Procedures Department</li> </ol>
<b>Closing Session</b> <b>5:00 PM to 5:20 PM</b>	<b>Conclusion and Recommendations for Way Forward</b>	<b>Ms. Bhavna Bhatia</b> <b>Program Leader, World Bank</b> <b>Dr. N. S. Bains, Director of Research, Punjab Agriculture University</b>
<b>5:20 PM to 5:30 PM</b>	<b>Vote of Thanks</b>	<b>Mr. Rajnath Ram (Adviser, NITI Aayog)</b>

### Annexure 3: List of Participants

S.No	Name	Designation	Organization	E-Mail ID
1	Mr. T.V.N.A.R. Kumar	Chief Engineer, Hydrology	Andhra Pradesh Water Resources Department (APWRD)	<a href="mailto:ce_hydrology@ap.gov.in">ce_hydrology@ap.gov.in</a>
2	Mr. Kishlaya Misra	Investment Specialist	Asian Infrastructure Investment Bank (AIIB)	<a href="mailto:kishlaya.misra@aiib.org">kishlaya.misra@aiib.org</a>
3	Mr. Arijit Sengupta	Director	Bureau of Energy Efficiency (BEE)	<a href="mailto:asengupta@beenet.in">asengupta@beenet.in</a>
4	Mr. Abhishek Jain	Program Lead	Bureau of Energy Efficiency (BEE)	<a href="mailto:abhishek.jain@ceew.in">abhishek.jain@ceew.in</a>
5	Mr. Sumit Mudgal	Project Engineer	Bureau of Energy Efficiency (BEE)	<a href="mailto:sumit.mudgal@beenet.in">sumit.mudgal@beenet.in</a>
6	Dr. Sardana Prasanns Das	Senior Researcher	Centre for Policy Research (CPR)	<a href="mailto:sardana@cprindia.org">sardana@cprindia.org</a>
7	Mr. Ashwini K. Swain	Fellow	Centre for Policy Research (CPR)	<a href="mailto:ashwini@cprindia.org">ashwini@cprindia.org</a>
8	Mr. Srinivasa Rao Gandham	Advisor	Consortium of Indian Farmers Associations	<a href="mailto:gandham76@gmail.com">gandham76@gmail.com</a>
9	Mr. Sunil Sharma	Vice President	Darashaw	<a href="mailto:sunil-sharma@darashaw.com">sunil-sharma@darashaw.com</a>
10	Dr. Shilpy Gupta	Assistant Vice President	Darashaw	<a href="mailto:shilpy-gupta@darashaw.com">shilpy-gupta@darashaw.com</a>
11	Mr. Pravin Parmar	Secretary	Dhundi Solar Energy Producers' Cooperative Society (DSEPCS)	<a href="mailto:dhundisolar@gmail.com">dhundisolar@gmail.com</a>
12	Mr. Dipak Koktate	State Head, Mumbai	Energy Efficiency Services Limited (EESL)	<a href="mailto:dhkokate@eesl.co.in">dhkokate@eesl.co.in</a>
13	Mr. Vaibhav Chowdry	Associate Director	EPIC India	
14	Professor Cham Athwal	Associate Dean – Research and Enterprise	Faculty of Computing, Engineering and the Built Environment, Birmingham City University, Birmingham, UK	<a href="mailto:Cham.Athwal@bcu.ac.uk">Cham.Athwal@bcu.ac.uk</a>
15	Mr. Divakara M.S.	Additional Director, Agriculture	Government of Karnataka	<a href="mailto:agriadhrd@gmail.com">agriadhrd@gmail.com</a>
16	Mr. Shubhendu Dash	Manager	Grant Thrompton	<a href="mailto:shubhendu.dash@in.gt.com">shubhendu.dash@in.gt.com</a>
17	Mr. Yashwant Sethi	Consultant	Grant Thrompton	<a href="mailto:yashwant.sethi@in.gt.com">yashwant.sethi@in.gt.com</a>
18	Mr. S. J. Solanki	Director	Gujarat State Seed Certification Agency	<a href="mailto:solankisj@gmail.com">solankisj@gmail.com</a>
19	Dr. Pradeep Deswal	Manager	Indian Renewable Energy Development Agency Limited (IREDA)	<a href="mailto:pradeepdeswal@ireda.in">pradeepdeswal@ireda.in</a>
20	Mr. Shalabh Tandon	Regional Head of Operations	International Finance Corporation (IFC)	<a href="mailto:standon@ifc.org">standon@ifc.org</a>
21	Ms. Anjali Garg	Operations Officer	International Finance Corporation (IFC)	<a href="mailto:agarg1@ifc.org">agarg1@ifc.org</a>
22	Mr. Rajeev Gyani	Additional Director	International Solar Alliance	<a href="mailto:rajeevgyani@isolaralliance.org">rajeevgyani@isolaralliance.org</a>
23	Mr P. C. Sharma	Joint Director	International Solar Alliance	<a href="mailto:pcsharma@isolaralliance.org">pcsharma@isolaralliance.org</a>
24	Mr. Alok Sikka	IWMI Representative - India	International Water Management Institute (IWMI)	<a href="mailto:asikka@cgiar.org">asikka@cgiar.org</a>
25	Ms. Aditi Mukherji	Principal Researcher	International Water Management Institute (IWMI)	<a href="mailto:.Mukherji@cgiar.org">.Mukherji@cgiar.org</a>
26	Mr. Gyan Rai	Consultant	International Water Management Institute (IWMI)	<a href="mailto:gprai1985@gmail.com">gprai1985@gmail.com</a>
27	Mr. F. K. Meshram	Chief General Manager	M.P. Power Management Company Limited (MPPMCL)	<a href="mailto:firoj.meshram@mppmcl.com">firoj.meshram@mppmcl.com</a>
28	Mr. Anil Kumar Alung	Additional General Manager	M.P. Power Management Company Limited (MPPMCL)	<a href="mailto:anil.alung@mppmcl.com">anil.alung@mppmcl.com</a>



29	Mr. Pankaj T.	Director	Ministry of agriculture, Government of India	
30	Mr. Vijay	Chief Engineer	Ministry of Power (MoP), Government of India	
31	Ms. Sonali Datta	Under Secretary	Ministry of Rural Development (MoRD), Government of India	<a href="mailto:sonali.datta@nic.in">sonali.datta@nic.in</a>
32	Mr. Kiran Charan Padhey	Program officer	Ministry of Rural Development (MoRD), Government of India	<a href="mailto:kiran.padhey@rediffmail.com">kiran.padhey@rediffmail.com</a>
33	Ms. Sukhgeet Kaur	Director	NITI Aayog	<a href="mailto:sk220@cam.ac.uk">sk220@cam.ac.uk</a>
34	Ms. Rajeshwari Sahay	Young Professional (YP)	NITI Aayog	<a href="mailto:rajeshwari.sahay@nic.in">rajeshwari.sahay@nic.in</a>
35	Mr. Kowtham Raj	Young Professional (YP)	NITI Aayog	<a href="mailto:kowtham@nic.in">kowtham@nic.in</a>
36	Ms. Saumya Pandey	Young Professional (YP)	NITI Aayog	<a href="mailto:pandey.saumya@nic.in">pandey.saumya@nic.in</a>
37	Mr. K. P. Koner	Deputy Director	Odisha Renewable Energy Development Agency (OREDA)	<a href="mailto:ceoreda@oredaorissa.com">ceoreda@oredaorissa.com</a>
38	Ms. Sara Constantino	Post-grad Researcher	Princeton University	<a href="mailto:saraconstantino@princeton.edu">saraconstantino@princeton.edu</a>
39	Ms. Alica Cooperman	Post-grad Researcher	Princeton University	<a href="mailto:alicacooperman@princeton.edu">alicacooperman@princeton.edu</a>
40	Dr. Rajan Aggarwal	Sr. Research Engineer	Punjab Agriculture University (PAU)	<a href="mailto:rajanaggarwal1@pau.edu">rajanaggarwal1@pau.edu</a>
41	Mr. Ayan Deb	Manager	Tata Trust	<a href="mailto:adeb@tatatrust.org">adeb@tatatrust.org</a>
42	Professor Arun Kansal	Dean (Research)	The Energy and Resources Institute (TERI)	<a href="mailto:akansal@terisas.ac.in">akansal@terisas.ac.in</a>
43	Ms. Vidhu Kaupur	Associate fellow	The Energy and Resources Institute (TERI)	<a href="mailto:vidhu.kapur@teri.res.in">vidhu.kapur@teri.res.in</a>
44	Mr. Prajnasish Swain	Project Associate	The Energy and Resources Institute (TERI)	<a href="mailto:Pswain@teri.res.in">Pswain@teri.res.in</a>
45	Ms. Apoorva Bamal	Project Associate	The Energy and Resources Institute (TERI)	<a href="mailto:apoorva.bamal@teri.res.in">apoorva.bamal@teri.res.in</a>
46	Dr. Vishwanak sharma		The Energy and Resources Institute (TERI)	<a href="mailto:._sharma@teri.res.in">._sharma@teri.res.in</a>
47	Mr. N. Balaji	Chief Engineer, planning & RC	The Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)	<a href="mailto:ceplg@tnebnet.org">ceplg@tnebnet.org</a>
48	Ms. Bhavna Bhatia	Program Leader	The World Bank	<a href="mailto:bbhatia@worldbank.org">bbhatia@worldbank.org</a>
49	Ms. Kavita Sharaswat	Senior Power Engineer	The World Bank	<a href="mailto:ksaraswat@worldbank.org">ksaraswat@worldbank.org</a>
50	Ms. Sona Thakur	Senior External Affairs Officer	The World Bank	<a href="mailto:sthakur1@worldbank.org">sthakur1@worldbank.org</a>
51	Mr. Rohit Mittal	Senior Energy Specialist	The World Bank	<a href="mailto:rmittal@worldbank.org">rmittal@worldbank.org</a>
52	Ms. Mani Khurana	Senior Energy Specialist	The World Bank	<a href="mailto:mkhurana@worldbank.org">mkhurana@worldbank.org</a>
53	Mr. Arvind Jhamb	Consultant	The World Bank	<a href="mailto:arvind_jhamb@hotmail.com">arvind_jhamb@hotmail.com</a>
54	Mr. Gaurav Upadhyay	Consultant	The World Bank	<a href="mailto:gupadhyay1@worldbank.org">gupadhyay1@worldbank.org</a>
55	Ms. Neetu Sharda	Program Assistant	The World Bank	<a href="mailto:nsharda@worldbank.org">nsharda@worldbank.org</a>
56	Ms. Hena Kanungo	Support Staff	The World Bank	<a href="mailto:hkanungo@gmail.com">hkanungo@gmail.com</a>
57	Mr. Ram Kumar		Uttar Pradesh non-conventional energy development agency (UPNEDA)	<a href="mailto:ho_rak@reddiffmail.com">ho_rak@reddiffmail.com</a>
58	Mr. Bhawani Singh	Director	Uttar Pradesh non-conventional energy development agency (UPNEDA)	<a href="mailto:dirupenda@gmail.com">dirupenda@gmail.com</a>
59	Mr. N. kalra	Senior Project officer	Uttar Pradesh non-conventional energy development agency (UPNEDA)	<a href="mailto:ho_nmk@reddiffmail.com">ho_nmk@reddiffmail.com</a>
60	Mr. Padma Kant Jha	superintendent Engineer	Water Resource Deptt, Govt of Bihar	<a href="mailto:erpjkha@yahoo.com">erpjkha@yahoo.com</a>
61	Mr. Prafula Pathak	ED		<a href="mailto:resendnd@gmail.com">resendnd@gmail.com</a>

## Annexure 4: List of Speakers

S.No	Name	Designation	Organization	E-Mail ID
1	Mr. Amitabh Kant	CEO	NITI Aayog	<a href="mailto:ceo-niti@gov.in">ceo-niti@gov.in</a>
2	Mr. Ramesh Chand	Member, Agriculture	NITI Aayog	<a href="mailto:rc.niti@gov.in">rc.niti@gov.in</a>
3	Mrs. Ravneet Kaur	Additional Chief Secretary (Power)	Government of Punjab	<a href="mailto:secy.power@punjab.gov.in">secy.power@punjab.gov.in</a>
4	Mr. Akhil Kumar	Joint Secretary	Ministry of Jal Shakti, Government of India	<a href="mailto:j-s-mowr@nic.in">j-s-mowr@nic.in</a>
5	Ms. Namita Priyadarshiee	Joint Secretary	Ministry of Agriculture, Government of India	<a href="mailto:.namita14@gov.in">.namita14@gov.in</a>
6	Dr. N. S. Bains	Director of Research	Punjab Agriculture University (PAU)	<a href="mailto:drpau@pau.edu">drpau@pau.edu</a>
7	Mr. Shantanu Gotmare	Country Representative	Global Green Growth Institute (GGGI)	<a href="mailto:shantanu.gotmare@gggi.org">shantanu.gotmare@gggi.org</a>
8	Dr. Om Prakash	Project Director	Rajasthan Agriculture Competitiveness Project (RACP)	<a href="mailto:pd@racpmis.com">pd@racpmis.com</a>
9	Dr. Pritpal Singh Kalra	Project Coordinator	Rajasthan Agriculture Competitiveness Project (RACP)	<a href="mailto:kalraps@gmail.com">kalraps@gmail.com</a>
10	Mr. Suresh Chauhan	Director (Technical)	Jaipur Vidyut Vitran Nigam Limited (JVNL)	<a href="mailto:dirtechnical@juvnl.org">dirtechnical@juvnl.org</a>
11	Mr. R. J. Vala	Executive Engineer (Solar)	Gujarat Urja Vikas Nigam Ltd. (GUVNL)	<a href="mailto:eesolar.guvnl@gebmil.com">eesolar.guvnl@gebmil.com</a>
12	Mr. R. L. Dhurandhar	Deputy Director	Deptt of Agriculture, Government of Chhattisgarh	<a href="mailto:rdhurandher07@gmail.com">rdhurandher07@gmail.com</a> <a href="mailto:diagricg.cg@gov.in">diagricg.cg@gov.in</a>
13	Mr. Junaid Ahmad	Country Director	The World Bank	<a href="mailto:jahmad@worldbank.org">jahmad@worldbank.org</a>
14	Mr. Gailius Draugelis	Lead Energy Specialist	The World Bank	<a href="mailto:gdraugelis@worldbank.org">gdraugelis@worldbank.org</a>
15	Mr. Mohinder Gulati	Former advisor	The World Bank	<a href="mailto:mgulati@worldbank.org">mgulati@worldbank.org</a>
16	Mr. Amol Gupta	Energy Specialist	The World Bank	<a href="mailto:amolgupta@worldbank.org">amolgupta@worldbank.org</a>
17	Mr. Rajesh Kumar Miglani	Senior Climate Change Specialist	International Finance Corporation (IFC)	<a href="mailto:rmiglani@ifc.org">rmiglani@ifc.org</a>
18	Mr. A. R. Khan	General Manager (GM)	National Bank for Agriculture and Rural Development (NABARD)	<a href="mailto:ar.khan@nabard.org">ar.khan@nabard.org</a>
19	Mr. K. P. Baiju	Deputy General Manager (DGM)	State Bank of India (SBI)	<a href="mailto:dgml.cppd@sbi.co.in">dgml.cppd@sbi.co.in</a>
20	Dr. Tushaar Shah	Scientist Emeritus	International Water Management Institute (IWMI)	<a href="mailto:tushaar.shah@gmail.com">tushaar.shah@gmail.com</a>
21	Mr. Shilp Verma	Researcher, Water-Energy-Food Policies	IWMI-TATA Program	<a href="mailto:shilp.verma@cgiar.org">shilp.verma@cgiar.org</a>
22	Mr. Bhimashankar Shetkar	Manager	National Dairy Development Board (NDDB)	<a href="mailto:bshetkar@nddb.coop">bshetkar@nddb.coop</a>
23	Mr. Ganesh Neelam	Head, Innovation and Technology	Tata Trusts	<a href="mailto:gneelam@tatatrust.org">gneelam@tatatrust.org</a>
24	Mr. Ashwin Gambhir	Fellow, Energy	Prayas	<a href="mailto:ashwin@prayaspune.org">ashwin@prayaspune.org</a>
25	Mr. Chandra Bhushan	President and CEO	International Forum for Environment, Sustainability & Technology (iFOREST)	<a href="mailto:bhushan.chandra123@gmail.com">bhushan.chandra123@gmail.com</a>
26	Mr. Rahul Kapur	Partner	Grant Thrompton	<a href="mailto:rahul.kapur@in.gt.com">rahul.kapur@in.gt.com</a>
27	Mr. Karan Dangayach	Managing Director	Shashwat Cleantech	<a href="mailto:karan@shashwatcleantech.com">karan@shashwatcleantech.com</a>