Integrated Research and Action for Development

IRADe

Conference Proceedings

National Conference On "Post Paris Climate Action"

12th July, 2016 | Hotel Le Meridien, New Delhi

Organised By

Integrated Research and Action for Development

About IRADe

IRADe is an independent advanced research institute which aims to conduct research and policy analysis to engage stakeholders such as government, non-governmental organizations, corporations, academic and financial institutions. Energy, climate change, urban development, poverty, gender equity, agriculture and food security are some of the challenges faced in the 21st century. Therefore, IRADe research covers these, as well as policies that affect them. IRADe's focus is effective action through multi- disciplinary and multi-stakeholder research to arrive at implementable solutions for sustainable development and policy research that accounts for the effective governance of techno-economic and socio-cultural issues.

IRADe was established under the Society's Act, in 2002 at New Delhi. It is certified as a Research & Development Organization by the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology (MoST). It has also been selected as a Centre of Excellence by the Ministry of Urban Development (MoUD) for urban development and climate change. In addition, it provides expertise to other ministries, national and international institutions and partners with other reputed organizations.

Our Mission:

To explore new opportunities and promote paradigm shifts to provide optimum solutions in sustainable development to include vulnerable groups in decision making process.

Our Vision:

To be a leading independent policy research organization and think tank that suggests implementable policies to focus on poverty alleviation, gender equity and inclusive growth, with a focus on energy, environment and climate change using multidisciplinary, multi-stakeholder framework so as to integrate various perspectives and field-level understanding.

Our Objectives:

- Integrate multidisciplinary and multi-stakeholder perspectives concerning issues of development.
- Promote wider consensus, through research and analysis, on effective policies.
- Engage and work at local, district, state, national, South Asia regional and global levels.
- Provide research support to developing countries for development and for negotiation process for international agreements.

Carry out policy research that accounts for the political economy of the society and effectiveness of governance

Thematic Areas of IRADe

1. Energy and Power System
2. Sustainable Urban Development
3. Climate Change and Environment
4. Poverty Alleviation and Gender
5. Agriculture and Food Program

Contents

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Preface

We are happy to present the proceedings of the ***"National Conference on Post Paris Climate Action"*** held on July 12th, 2016" at New Delhi organized by IRADe. We express our sincere thanks to ***Shri Prakash Javadekar***, Hon'ble Minister for Human Resource and Development for inaugurating the event and ***Shri Suresh Prabhu***, Hon'ble Minister for Railways, Government of India for the valedictory session. We are grateful to the Senior Government officials from Ministry of Power, Ministry of Environment Forest and Climate Change, Ministry of New and Renewable Energy, Department of Science and Technology and Ministry of Finance, CMD's and Senior officials of Public and Private sector organisations for their participation and sharing their insights.

"At COP 21 in Paris, Parties to the UNFCCC reached a historic agreement to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future. The Paris Agreement requires all Parties to put forward their best efforts through "nationally determined contributions" (NDCs) and to strengthen these efforts in the years ahead." (UNFCCC).

The purpose of the conference was to discuss as how to implement the INDC's. What are the obstacles and its requirements. What are the challenges of technology and availability of finance. The representatives discussed how to meet the two promises given at Paris viz; reducing Green House Gases (GHG) intensities by 35% by 2030 from 2005 values and 40% share of non-fossil energy sources in power capacity. The focus was on power sector, transport sector, especially railways. In addition to the Inaugural session there were four sessions on the following topics.

Pre-Inaugural Session: Climate change and Development Alternatives
Session 1: Meeting India's INDC for power sector from long term perspectives 2030-2050.
Session 2: Accelerating renewable energy development and addressing integration challenges.
Session 3: High level panel discussion on Strategies and innovative financial instruments for leveraging meeting India's climate finance needs.

The expert opinions on the above topics can provide guidance in future while implementing the Paris agreement.

IRADe acknowledges the support and help it received from various organisations, departments and senior officials of the Government of India. IRADe specifically likes to thank Hon'ble Minister for Human Resource and Development, Shri Prakash Javadekar; Hon'ble Minister for Railways, Shri Suresh Prabhu for gracing two sessions individually.

We thank GAIL, NABARD, IREDA, PFC, NTPC, REC, and PTC India Limited for the support, cooperation and sponsorship of the event, without their help the conference would not be possible.

We would especially like to thank Sh.B.C.Tripathi, CMD-GAIL, Sh.Gurdeep Singh, CMD-NTPC, Dr. Harsh Kumar Bhanwala, CMD-NABARD, Sh. Rajeev Sharma, CMD-RECL, Sh.K.S.Popli, CMD-IREDA,

Sh.M.K.Goel, CMD-PFC, Sh.Deepak Amitabh, CMD-PTC India in supporting IRADe to organize the event.

Our gratitude to all our Session Panel Chairs, Sh.B.P.Pandey, Additional Secretary, Ministry of Power, Dr.Kirit Parikh, Chairman IRADe, Sh.Anil Kumar Jain, Adviser Energy, Niti Aayog and Sh.R.R.Rashmi, Additional Secretary, Ministry of Environment Forest and Climate Change for moderating the sessions.

All the panelists deserve special mention and we express our gratitude to Dr.Ajay Mathur, DG-TERI, Mr.K.Swaminathan, Min. of Railways, Mr.S.P.Garnaik, GM-EESL, Sh.V.N.Dutt, ED-Mkt Dev.-GAIL, Mr.A.K.Gupta, ED-Engg., NTPC, Mr.S.Singharoy, Director (Tech-LWR)-NPCIL, Mr. Vivek Talwar-V.P.-Sustainability, Tata Power, Mr. S.K. Soonee, CEO-POSOCO, Mr. V. Subramanian, Secy Gen. IWEA, Mr. Sanjeev K. Gupta, Dir. Tech. RECL, Mr. P.C.Maithani, Director MNRE, Mr. Charanjeet Singh, EVP, PTC India Limited, Dr. Arunish Chawla, Joint Secretary, Ministry of Finance; Mr. Ray Sudweeks, First Secretary for Energy and Economic affairs, Embassy of the United States of America; Mr. Nicholas Fornage, Regional Director for South Asia, AFD and Mr. S. K. Dora, GM, NABARD for sharing their views on very important topics.

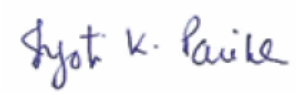
We would also like to put on record the help and co-operation received from officials of GAIL, Mr.Rupesh Kumar, Manager (CC). NABARD, Mr.R. Amalorpavanathan, Deputy Managing Director, Dr.B.G.Mukhopadhyay CGM-FSSD, Mr.M.V.Ashok, CGM-DEAR, Ms.Smita Mohanty, AGM-DEAR, and Mr.R.C.Rath. IREDA, Mr.P.Sreenivasan (GM). NTPC, Mr.Suparn Kalra (Dy Mgr-CC). PFC, Mr.S.S.Rao DGM-PR and Mr.D.P.Singh, Jm.Manager, PTC India Limited (PTC) in guiding us at all steps.

Lastly the entire IRADe staff comprising of Mr.V.K.Kharbanda, Mr.Sharad Verma, Dr.Probal Ghosh, Mr.Rajeev Panda, Mr.Vinay Saini, Mr.B.K.Sarkar, Mr.R.K. Tiwari, Mr.Rajat Puri, Mr.Anshuman Behera, Mr.Mohit Gupta, Mr.P.N.Vamadevan, Mr.Sumit Kishore, Ms.Deepanshi, Mr.Akhilesh Kumar, are duly acknowledged for providing untiring support and help in organising the conference. Ms.Shambhavi Sahai, Mr.Sharad Verma for preparing the conference proceedings and Mr.Mohit Gupta for design and art work.

We are grateful to the Ministry of Environment, Forests and Climate Change (MoEFCC) for supporting modelling work for the INDC. This support helped us to develop IRADe-CNeg50 model for INDC climate scenarios. We had nearly 2-year engagement with the earlier team at the MoEFCC viz. Shri A. Lavasa, Secretary(IAS), Shri Susheel Kumar, Additional Secretary(IAS), Shri Ravi Prasad, Joint Secretary (IAS), Shri Ajay Raghava and Dr. J. R. Bhatt, Advisor. We thank them for their suggestions and co-operations. This work was shown in a key presentation to generate the debate.

We are also grateful to the USAID for their support for South Asia Regional Integration (SARI) project in which the ANSWER-TIMES model was developed for India. That exercise gave us a great deal of insights into the options available for power system strategy, expansion plans needed for generation till 2030 and renewable energy integration.

Entire IRADe team's effort in organizing this conference is duly acknowledged.



Dr.Jyoti Parikh
Executive Director

Background

At the 21st Conference of Party (COP) meeting at Paris in late 2015, each member country presented its Intended Nationally Determined Contribution (INDC). India has given an ambitious statement of achieving 35% reduction of GHG intensity — (defined as GHG emitted per unit of GDP) and 40% share from non-fossil source of power capacity such as renewables (solar, wind, hydro power), nuclear and bio-mass by 2030. IRADE did some background modelling work for India.

India's INDCs require a discussion on how to deliver this. In this context IRADe is organizing a national conference on **"Post-Paris Climate Action:** To delve deeper into the issues surrounding future scenarios to meet INDCs.

We are happy to convey that the **Hon'ble Shri Prakash Javadekar,** Minister of Human Resource Development has agreed to inaugurate the conference and **Hon'ble Shri Suresh Prabhakar Prabhu**, Minster of Railways, Govt. of India will give the chairman's address.

Integrated Research and Action for Development (IRADe) had done modelling exercise prior to COP 21 at Paris pertaining to India's INDC till 2030 and 2050 supported by the Ministry of Environment, Forest and Climate change (MoEFCC). IRADe intends to invite senior representatives from the relevant ministries and departments, State Governments, NITI Aayog as well as from Public and Private sector and reputed experts.

The four sessions will address issues of INDCs from long term perspectives of 2030-2050 and the role of alternative policies needed such as freight corridor, transport efficiency including energy efficiency and challenges of renewable and its integration and climate finance.

Thematic Sessions

There will be four sessions in the conference

a) **Pre-Inaugural session: "Climate Change and Development Alternatives"** will focus on energy efficiency, transport and demand side management.
b) **Inaugural session** will be inaugurated and chaired by **Hon'ble Shri Prakash Javadekar,** Minister of Human Resource Development and **Hon'ble Shri Suresh Prabhakar Prabhu,** Minster of Railways, Govt. of India will give a keynote address.
c) **Session on Power Sector "Meeting India's INDC for Power Sector from long term perspectives 2030-50":** This will focus on issues pertaining to INDCs in the energy sector from long term perspectives of 2030-2050 and how power sector can play a role in meeting India's INDC targets from a long term perspective.
d) **The Session on "Renewable Energy acceleration and integration"** will focus on how to accelerate renewable energy development and addressing integration challenges.
e) **The session on "Climate finance"** will focus on Strategies and Innovative financial instruments for Leveraging finance for meeting India's Climate Finance needs from local, national and global sources.

Agenda National conference on "Post Paris Climate Action" 12th July, 2016, Hotel Le Meridien, Sovereign Hall II, Gate no. 2, New Delhi	
Time	**Session Details**
9:30 - 10.00	**Registration and welcome tea**
10.00 - 11.00	***Pre-Inaugural Session: Climate Change and Development Alternatives**
	Chair: Mr. B.P. Pandey, Additional Secretary, Energy Conservation & Energy Efficiency, Ministry of Power
10.00 -10:15 **10:15 -11:00**	Presentation on **"Long Term Perspective on Climate Change 2030-2050 Development "by IRADe** Panel discussion **Dr. Ajay Mathur,** Director General –TERI **Mr. K Swaminathan**, Ministry of Railways **Mr. S P Garnaik,** General Manager, EESL
11:00 - 11:20	**Tea Break**
11:20 -12:15	**Inaugural Session**
11:20 - 11:25 **11:25 - 11:40** **11:40 - 11:55** **12:10 - 12:20**	Welcome address by **Dr. Jyoti K Parikh**, Executive Director, IRADe Introductory address: **Prof. Dr. Kirit Parikh**, Former Member, Planning Commission Inaugural address: **Shri Prakash Javadekar**, Hon'ble Minister, Human Resource Development on "The Challenges of climate negotiations and India's Strategy" Vote of Thanks by **Shri. VK Kharbanda**, Project Director, SARI/EI Group Photograph
12:25-13:30	**Session 1: Meeting India's INDC for Power Sector from long term perspectives 2030-2050**
	Chair: **Prof. Dr. Kirit Parikh** Former Member, Planning Commission
12:25 - 12:35 **12:35 - 13:15**	Presentation on "**Power sector: its role and future scenarios to meet INDCs**" by IRADe Panel discussion on trends, future scenarios, technology, CO_2 emissions Experts from the following sectors and respective organizations **Mr. V.N. Dutt**, Executive Director, Marketing, GAIL **Mr. A.K. Gupta**, ED(Engineering), NTPC **Mr. S. Singharoy**, Director, Technical, Nuclear Power Corporation of India Limited
13:15 - 13:30	**Open Discussion**

13:30 - 14:30	**Lunch**
14:30 – 16:00	**Session-2: Accelerating Renewable Energy Development and addressing Integration challenges.**
	Chair: **Mr. Anil Kuma Jain,** NITI Aayog
	Mr. V. Subramanian, Secy. Gen. IWEA: Role of Wind Energy in Meeting INDC Targets **Mr. P.C. Maithani,** Director, MNRE on International Solar Alliance **Mr. S. K. Soonee**, POSOCO: Accelerating Renewable Energy and Addressing **Mr. Vivek Talwar**, VP Sustainability, Tata Power **Mr. Charanjeet Singh**, EVP, PTC India Limited **Mr. Sanjeev Kumar Gupta**, Director Technical, RECL Open Discussion
15:45 - 16:00	**Tea Break**
16.00 - 17.30	**Session 3: High Level Panel Discussion on "Strategies and Innovative financial instruments for Leveraging Meeting India's Climate Finance Needs"**
	Chair: **Mr. R.R. Rashmi,** Additional Secretary, MoEF&CC
	Setting the Context – Stakeholder View on Climate Finance - Panel Discussion Indicative speakers: **Mr. Arunish Chawla,** Joint Secretary, Ministry of Finance **Mr. Ray R. Sudweeks,** First Secretary for Energy Affairs Economic, Embassy of the United States of America **Mr. Nicolas Fornage**, Regional Director for South Asia, AFD **Mr. S. K. Dora, GM,** NABARD Open discussion Remarks by Chair Concluding comments
	Valedictory Session:
	Chairman's address**: Shri Suresh Prabhu**, Hon'ble Minister of Indian Railways Vote of Thanks: **Dr.Jyoti Parikh**, Executive Director, IRADe
*This session is before inaugural session because of the convenience of the Minister.	

Proceedings

This summary captures the presentations, panel discussions, and plenary sessions at the "***National Conference on Post Paris Climate Action on July 12th, 2016***" organized by IRADe.

The event brought together Ministers, senior government officials, field and industry experts, technologists, economists, stakeholders to discuss post Paris climate action needed. The representatives discussed how to meet the two promises given at Paris viz; reducing Green House Gases (GHG) intensities by 35% by 2030 from 2005 values and 40% share of non-fossil energy sources in power capacity. The discussions covered all main sources of energy including coal, hydro carbons, renewable energy, and nuclear energy as well as energy efficiency to focus on the issues of sustainability and climate action.

The conference consisted of a pre-inaugural session, an inaugural session and 3 sessions on specific topics within the framework of climate action in the Indian context. Shri Prakash Javadekar (Honorable Minister of Human Resources, the former minister of MoEF & CC) inaugurated the conference and Shri Suresh Prabhu (Honorable Minister of Indian Railways) gave the valedictory address as the Guests of Honor. Each panel consisted of experts who not only highlighted current trends and hurdles in their field, but also shared personal observations and pushed the discussion to address specific possible solutions.

With the support and cooperation of GAIL, NABARD, IREDA, PFC, NTPC, REC, and PTC India Limited, IRADe was able to organize this conference to further the discussion on the present technology, implementation bottlenecks, political, social, and economic issues regarding climate action and sustainability and implementing the CoP21 Paris agreement.

Pre-Inaugural Session: Climate change and Development Alternatives

The session comprised of a presentation on the "Long Term Perspective on Climate Change 2030-2050 Development" by IRADe, which was followed by a panel discussion on 'Climate Change and Development Alternatives' with Dr. Ajay Mathur, Mr. K. Swaminathan, Mr. S.P. Garnaik and Dr. Kirit Parikh as panelists and chaired by Mr. B.P. Pandey.

The discussions began with Dr. Probal Ghosh, IRADe, making a presentation, based on IRADe's research with an optimization model, which estimated the possible consequences of different levels of climate actions and initiatives. This model was supported by the Ministry of Environment, Forest and Climate Change(MoEFCC). The model maximizes discounted household consumption over 50 years and tries to represent the feedback effects of policy and its macro implications. The model estimated conditions for three scenarios: dynamics as usual (DAU), determined actions (DETA), and ambitious actions (AMBA), based on current trends in market costs of alternative technologies for reducing emissions and options for increasing efficiency for reducing consumptions. The results compared the three

different outcomes on the basis of how many of the INDC requirements were met with, how much each scenario will reduce emissions, and how each will impact economic growth. It basically considered wide scale implementation of existing and proven clean technologies viz, energy efficiency, renewable energy, super and ultra critical coal based power.as well as gas and hydro power with their upper limits. The conclusions of the model did reveal some unforeseen challenges. It concluded that despite major efficiency gains, there were still massive feedback effects that affected the energy usage. Though with ambitious action renewable generating capacity becomes nearly 60 % by 2050 (specifically, 345 GW of wind and 796 GW solar) with non-fossil capacity reaching 73%, coal still providing 25% of generating capacity. Coal will still remain an important power source. In terms of GHG emissions, AMBA, the most ambitious of all would reduce them by 35% by 2050 with per capita emissions of only 6 tonnes. This is lower than global average or the Chinese emissions levels in 2012. And finally, it is found that each of these scenarios will see a crowding out of investment from other sectors to renewable energy which would slow down development despite some optimistic assumptions in the progress of technology. Per capita CO2 emissions reduces from of 7.60 tonnes/person in DAU to 4.9 to 4.4 tonnes per capita in the DETA and AMBA scenarios respectively in 2050, which is far below where many developed countries are today and would be below that of what China has today. The measures in (DETA) involve additional investment of 477 billion US$ (PPP US$ 2007) over 2007 to 2030 and 2091 billion US$ over 2007 to 2050 at 2007 constant prices and in PPP US$ 2007. With (AMBA) investments required are 782 billion US$ over 2007 to 2030 and 5605 billion US$ over 2007 to 2050 at 2007 constant prices and in PPP US$ 2007. Some insights shared were that additional investment, financial sector support, technology adoption and adaptation, along with international cooperation would all be required in the future for India to meet its INDC goals.

This presentation was followed by Mr. B.P. Pandey, Additional Secretary, Ministry of Power, GoI sharing some figures and facts on the current energy efficiency initiatives in India. In line with the INDCs, the Ministry of Power has been regulating energy efficiency by first introducing standards, then labeling, and finally mandating certain standards. They have introduced LED lights to substitute current options of CFL/Sodium vapour/Mercury/tube lights. They succeeded in negotiating low and affordable prices through competitive bidding for bulk purchase. EESL has been mandated to replace existing street lights with LED lights, which will be energy efficient and provide improved illumination. The ministry has launched SEEP or the super-efficient equipment programme, with equipment like the super-

efficient fan. The PAT or "Perform, Achieve and Trade" as mentioned in the INDC, incentivizes major emitters to conform to, and even surpass, SEC reduction targets. The ECBC or Energy Conservation Building Code has been declared mandatory for all new buildings under construction, although compliance is a challenge. In addition to this, he pointed out that the ministry of Power recognizes the importance of an extensive outreach program.

Dr. Kirit Parikh, Chairman IRADe, underscored the importance of energy efficiency to reduce energy intensity and suggested that the panel discuss policy that can aid this endeavor. He suggested that policy should set up incentive structures that make compliance more achievable. Policy should be so designed that energy efficiency becomes a part of the firm's or individual's preferred option. This requires innovative financial mechanisms. Dr. Parikh also emphasized the role of transport as a major sector. with growing GHG emissions. He brought to attention that both the low carbon strategy for inclusive growth and the INDC's lay great stress on shifting freight transport off the roads and to railways, as it is a more sustainable and less energy intensive option.

Dr. Ajay Mathur, Director General, TERI, spoke about the trend in the data from the past ten years, which showed that energy intensity has decreased by roughly 2.5% every year, renewables generation has increased by 0.3% almost every year. The net effect has been for energy intensity to decrease by roughly 2.85% per annum. However, he noted, that data only relates a 2.1% decrease, which should suggest that the 0.7% increase must be from informal and household activities, like the use of biomass and trends in increasing use of air conditioners. He stressed that the three routes where India must continue reducing energy intensity are appliances, industry, and transport. He noted that road and air are viable options as opposed to railways for products with high value per kilogram of weight which is why railways need to focus on qualitative adjustments such as timelines, cost-efficiency, reliability and more accessibility. The comparative advantage of rail must be improved. Improving energy efficiency requires not only finance but also managerial time both of which are scarce with SME's. He stressed the need to develop a model that included and aligned energy efficiency goals with those of SMEs. He also brought to the table

the role of transparency and periodic reporting, collection, and analysis of data as the information function in the policymaking framework.

K. Swaminathan, Ministry of Railways continued from the point on transparency made by Dr. Mathur. He spoke that his ministry Railways, is completely transparent with information. He then focused on the challenges facing his ministry they recognize that railways are losing share of freight transport. To regain it requires significant investment in railways. Also land availability and accessibility are hurdles for railways to expand. Further, he highlighted that because railways are 12 times more energy efficient than roadways, some funding to the Rail ministry and its initiatives ought to come from the environmental funding.

Mr. S.P. Garnaik, General Manager, EESL spoke on energy efficiency initiatives of EESL and indicated that market incentives were in order, but energy efficiency needed to be reflected in designs for infrastructure and in technology. This panel closed for a short tea break, which was followed by the inaugural session.

Inaugural Session

The guest of honour of this this event was Sh.Prakash Javadekar, Hon'ble Minister of Human Resource and Development, Government of India who led the climate negotiations at Paris as the then minster of MOEFCC. India's role in meeting INDC's and playing a leading role in negotiations and even exceeding commitments were deliberated in this section.

Dr. Jyoti K. Parikh, ED, IRADe in her welcome address especially congratulated Honorable Minister Shri Javadekar on taking over the new role of HRD Minister and doing a commendable role for India on the global climate negotiations. She reminded the power sector commitments to the Paris accord, most notably the reduction in carbon intensity by 35%, and the decrease in fossil fuel share in power capacity by 40% by 2030. She recalled that during Rio Conference it was pointed out by her team that consumption pattern is a driving force for climate change. The continued stress by the minister Shri Javadekar on Common but differentiated responsibilities (CBDR) at Paris was essential given the high GHG emissions share by the developed countries.

Dr. Kirit Parikh, Chairman, IRADe in his key note speech addressed the higher cost of renewables, and the consequent slowing down of the economic growth when reducing emissions. He noted the need for long term, cheap loans from international financial organisations like the green climate fund, IMF or World Bank. He also put forth the importance of India importing hydropower from its neighbours. He mentioned that the need for finance can be reduced if the costs and efficiency of renewables are improved. The need for major R&D initiatives in solar and wind power technologies is paramount for India as it will increase energy security. We should reduce our dependence on imported energy whether it is oil or solar panels.

Shri. Prakash Javadekar, Hon'ble Minister of Human Resource and Development, Government of India in his inaugural address spoke about "Challenges of Climate Negotiations and India's Strategy". He stressed that India played important role at Paris and rather than opposing it took the approach of proposing new initiatives including International solar alliance. He addressed the role of education in building an energy efficient way of conduct and sustainable lifestyle in the generations to come. He praised the Prime Minister's leadership in up-scaling solar, wind, biomass, and hydro generation, and stressed India's pivotal role in Paris. India's INDC was a game changer, and while the targets are ambitious, they signaled

internationally that Prime Minister Shri. Modi was willing to lead from the front and that India was willing to cooperate towards a shared goal leading to the Paris Accord. He identified coal's sustained role as a source of power in the future, but did highlight the heavy taxation on both coal and petroleum that India imposes and that these funds are ear-marked for environmental actions. He spoke about active steps taken by the government in accelerating the implementation of the Bharat VI auto standards which the auto industry has accepted. He addressed the role of firewood consumption in the country, but was optimistic that LPG would be the most suitable and likely alternative, with 5000 new families gaining access to LPG every day. The government is also prioritizing afforestation, with the CAMPA program bill being voted upon in the parliament an initiative to preserve and expand the carbon sinks of the country. "Ujjala" a program to increase the accessibility of LED bulbs, where 10 crore bulbs have been distributed in the past year and a scheduled 15 crore more are expected to be distributed in the next two years. This was a case where, minister Javadekar mentioned, the government negotiated in public interest and managed to reduce the costs from Rs. 300 per unit to Rs. 75 per unit of LED bulbs. Minister Javadekar also applauded the Prime minister's strategy with the Solar Alliance, which established India's position as a leader.

Mr. V.K. Kharbanda, Project Director, SARI-EI, IRADe offered the vote of thanks to the Hon'ble Minister and Dr. Jyoti Parikh and Dr. Kirit Parikh and wished the conference success.

Session 1: Meeting India's INDC for power sector from long term perspectives 2030-2050.

Session 1 focused on 'Meeting India's INDC for Power Sector from long term perspectives 2030-2050'The session was Chaired by Dr.Kirit Parikh, IRADe and the panelists comprised of power and energy sector professionals, Mr. A.K. Gupta, NTPC; Mr. V. N. Dutt, GAIL and Mr. S.Singharoy, NPCIL.

The panel started its discussion with Mr. A.K. Gupta, ED (Engg) NTPC, speaking about coal, and how it will continue to be a major source of power in the years to come however, he mentioned the importance of refining and using coal with higher unit efficiency. This would reduce the usual level of carbon emissions from coal. He acknowledged that while NTPC mainly works in the fields of coal and thermal plants power, they have expanded to renewables, with current capacity of 300 MW, and an expected capacity of 10,000 MW by 2022. They are creating a geothermal project as well, which should expand from 100 MW to 1000 MW in 4-5 years. Solar is still to fully mature under NTPC. NTPC has a project in Dadri which is connected to their thermal project, and are also in the process of setting up floating solar panels over their reservoirs. Apart from these advancements, they also have their own R&D laboratory NETRA that does research and development in solar, solar-thermal, bio-diesel.

Mr. V. N. Dutt, ED (Mkt Dev.), GAIL brought to the table gas as a clean fuel alternative to coal and petroleum. He noted that oil consumption has increased by 6%, coal consumption has increased by 8.5%, however, gas consumption has actually decreased by 5%. He stressed that with the gas industry, capacity has increased but consumption has not, and policy must be framed to encourage consumption. He proposed a subsidy scheme to this effect. He also noted the importance of gas as a balancing factor of the grid, important when increasing the renewables portfolio in generation mix. He particularly mentioned the need to incentivize gas demand, and reiterated that the industry has the capacity and flexibility to meet the increased demand.

Mr. S.Singharoy, Director Tech (NPCIL), focused on nuclear power's role in the move toward non-fossil fuel based generation. He started by sharing the news of a reactor recently gaining criticality, which added one more nuclear reactor to the inventory of the preexisting 21. He said that an 18% contribution of nuclear to the total power supply could lead to a 2ºC reduction in temperature by 2030, which he was optimistic about and noted as an achievable target. He believed that generation capacity could be doubled by 2050 or even 2030. He reported that indigenously developed heavy-water nuclear reactors have been up scaled from the historical 220 MW capacity units to 700 MW today, and that now the nuclear industry seeks efficient and cost-effective methods of construction of the reactors. Generation 3+ reactors have been set up in coastal areas sites, with the support and technical convergence of the department of hydro-mechanical technology which will be a valuable contributor to the power sector.

"The session concluded with a presentation on 'Power Sector: Its role and future scenarios to meet INDCs' by Mr. Vinay Kumar Saini from IRADe. The model used was a technology option model that discounts the total energy system cost and presents the hourly representation of results. Some of the key questions that the model addresses include the optimal structure for the power sector and the role of hydro and gas power capacities for renewable balancing. The model used the INDCs as its target values, with 175 GW of Renewable by 2022 and 40%

non-fossil fuel capacity by 2030. Two scenarios arose from the analysis: the first one was with high flexibility in coal capacities (from 55% to 85%), the second was with medium flexibility in coal capacities (from 60% to 70%). Conclusions reached were that high integration of solar and wind capacities in the grid requires flexible generation sources such as hydro and gas, however, flexible capacities requirements may be lowered by increasing the flexibility of coal capacities."

Session 2: Accelerating renewable energy development and addressing integration challenges.

Session 2 focused on 'Accelerating renewable energy development and addressing integration challenges' The session was Chaired by Mr.Anil Jain, Niti Aayog and the panelists comprised of sector experts, Mr. Vivek Talwar-Tata Power, Mr. S.K. Soonee, POSOCO, Mr. V. Subramanian, IWEA, Mr. Sanjeev K. Gupta, RECL, Mr. P.C.Maithani, MNRE and Mr. Charanjeet Singh, PTC India Limited.

Mr. Anil Kumar Jain, Adviser Energy, Niti Aayog, opened the panel discussion with an optimistic contextual background of the prospects and use of renewables in India. He did invoke skepticism on the goal of renewables powering 175 GW by 2022. He then moved on to address some of the challenges in integrating them to the preexisting grid, and the need for accelerating development. Integration as an issue is on the periphery of policy making around renewables in the power sector. Further in the discussion Mr. Anil Jain acknowledged the growing prospects of solar energy in the future, especially in the form of solar farms. He also proposed the challenge of integration, and questioned whether solar should be decentralized-citing 50 MW as the ideal size for decentralized solar grids.

Mr. Vivek Talwar, Vice President-Sustainability, Tata Power, spoke about coal as a 'sunset industry' and how the introduction of renewables in past 10-20 years have made the demand for coal akin to a 'shark-fin curve', with a sharp spike, gradual plateauing and another sharp fall. He then gave an overview on Tata Power's involvement in the sector, mentioning that 17-18% of their capacity was credited to renewables, and Tata's target of raising this figure to 25% by 2030. Some challenges he highlighted included the need to identify and auction of waste-lands that renewables can occupy. This identification and development required greater compliance and stringent administration of regulations keeping in mind the importance of balancing (the grid) and reliability of the power sources. Further, he believed that hydro projects in the country should be developed before power is imported from India's neighbours. Lastly, he predicts a surge in rooftop solar projects. The challenge this new avenue will face, according to Mr. Talwar, is the hurdle of accepting decentralized distribution. To overcome these challenges, Mr. Talwar stressed the importance of the convergence of technology, policy, funding, and infrastructural development.

Mr. S.K. Soonee, CEO, POSOCO, addressed the skepticism surrounding integration with a vote of confidence, assuring all that the grid in India has been and will continue to accommodate all actors. He then rapidly covered twelve challenges and points of contention in the discussion around renewables and power. First, the market mechanism is a very important factor. More frequent market clearance and quicker generation of products are highly necessary. Second, the grid is challenged by the contingency and intermittency limitations of renewables as a source he believed that better forecasting and predictability was needed to deal with the variability. Third, the load profile of the grid needed to be balanced. Fourth, reserves, while plentiful as of now, needed to be accumulated systematically and faster as of now there are only reserves in thermal. Further, hydro power plants needed to be based more on reservoirs and pump storage. Additionally, hydro is undervalued the value of hydro does not peak above 41 GW. Flexibility, Mr. Soonee highlighted, should be incentivized. This requires defining it, measuring it, and then commoditizing it. Then, Mr. Soonee recommended further ancillary, reserves, and other services at state levels as well to allow for lesser central dependence and greater accessibility. He returned to the subject of pump storage, discussing India's inability to harness it due to the incentives and tariff framework. Additionally, the technology and design of hydro plants should be flexible and inclusive of renewables and pump-storage requirements. Finally, storage should be recognised and prioritised as a coalesced part of hydro projects right from the framing to the actual application and invocation of regulation. To achieve this Mr. Soonee stressed the importance of technical standards and compliance as a critical mass like renewables are connected to the grid. Distribution System Operations (DSO's) designated to renewable distribution are a method to achieve this end with the appropriate level of skilled manpower, black-belt operators, and development of human resources.

Mr. V. Subramanian, Secretary General & CEO, IWEA, followed with a brief history of climate change policy and action that India has seen since the eighties. He noticed the situation post Paris and was pleased with the government's ambition. Some of the challenges he iterated included the stance of state governments versus that of the centre. He remarked at the challenge of getting state governments on board with the mandate of climate action and the lack of policy stability, inducing a need for regulatory certainty to link the separation between what is promised and what is delivered. Mr. Subramanian expressed skepticism

about the Solar Alliance believing that the soft power India could gain from the leadership position was not enough, and that the alliance should have some economic outcomes or benefits for India. Further, he urged incentives for the finance sector to support and encourage the growth of renewables in India, giving examples of how banks across the country still wanted collaterals and were backing off from projects. He also brought to the table the discussion of waste management and the possibility of waste based power in India. He concluded with an acknowledgement of distribution challenges, and supported the idea of municipal involvement in distribution systems.

Mr. Sanjeev K. Gupta, Director Technical, RECL, spoke to the advancement and progress of the RECL. He also underlined the ostensible connection between REC and renewable energy. RECL finances ultra mega plants, transmission lines, wide rural connectivity, and renewables, while also executing government programs and directing excess power to connect remote, politically distant, and uneconomical regions to the grid. With a target of connecting 100,000 villages, RECL has achieved 96%. They have estimated 2000 remote villages, where they have/will provide renewable energy through micro grids and/or stand-alone systems. By March of 2018, all areas will have sources of power. Mr. Gupta recognized the challenge of integration, and shared that RECL had supported the integration of 1000 MW from renewables into the grid. Additionally, Mr. Gupta drew attention to the issues connecting land and the consequent hurdles for establishing plants providing examples where PPAs were not provided for years, and cases where there was no uptake by DISCOMs post construction.

Mr. P.C.Maithani, Director, MNRE, traced the timeline of India's initiatives towards introducing and adopting renewables, referring to the Nairobi Action Plan and the establishment of a solar commission. However, for want of financing, India fizzled out at that stage. Now, with the Solar alliance, Mr. Maithani commended the common voice the alliance offered, along with the R&D goals set in focus. For the success of the alliance, he identified the need for involvement, sharing and development of technology, capacity building, and cooperation in knowledge dissemination. He concluded by stressing the distinction between the solar applications for developed countries and developing ones. He identified 5 key areas,

scaling solar application for agriculture, making finance affordable, the addition of the World Bank to the Solar Trust Fund, incorporating the UNDP, and the possibility of India hosting a secretariat for 5 years.

Mr. Charanjeet Singh, EVP, PTC India Limited, concluded the panel discussion with a heartfelt discussion on the challenges in the implementation and establishment of power plants. Among other challenges, Mr. Singh mentioned that land acquisition often came with delays and lack of clarity in tenure statuses, challenges in financing, and the disruption of operation by local mafia. The overall infrastructure for business and construction was not conducive to operations, Mr. Singh noted. He was dissatisfied with the lack of a subsidy on wind energy, the wrongly imposed tariffs, and the structure of the power systems (whether kVA/kWh). He pointed out mechanical challenges in the integration of machine technology with that of plant and government requirements. He concluded with the recommendations of a wind resource assessment agency which will regulate and monitor compliance.

Session 3: High level panel discussion on Strategies and innovative financial instruments for leveraging meeting India's climate finance needs.

Session three focused on innovative financial instruments and Chaired by Mr.R.R.Rashmi, MoEFCC and Guest of Honor was Shri Suresh Prabhu, Hon'ble Minister for Railways.

The third session was Chaired by Mr.R.R.Rashmi, Additional Secretary, MoEFCC, GoI. He deliberated upon the role of climate finance as a vehicle for climate action. He addressed the role of the Government in defining a development strategy, by which private sector financial institutions can establish channels to the adaptive and mitigation sectors. Use of bonds as a source of funding was also highlighted. He mentioned that challenges remain in climate finance with funding organizations still circumspect of projects, primarily due to the lack in surety of the final output of such projects, and in a standard for measuring their efficacy-particularly when results are mixed from the developmental and climate change perspectives. He stressed that innovative finance instruments need to be devised at a national level and by the private sector to complement the preexisting instruments employed in achieving the proposed INDCs. A structured policy measure has to be in place.

Dr. Arunish Chawla, Joint Secretary, Ministry of Finance, distinguished between mitigation and adaptation environmental finance. While adaptation is integrated in most flagship programs, mitigation is costly and requires innovative finance. He spoke about deliberations of low carbon group set up under erstwhile Planning Commission and how sectoral and macro models were needed. Further, he highlighted the relationship between mitigation finance as a percentage of gross capital formation. He spoke about pigovian taxation and how it was under-utilized, the powerful role market pricing can play, and how an optimal end can be met. Capital finance too, he believed, was largely under exploited. While refinance institutions, and campaigns like Start up India have started to act like angel investors, equity participation can still be higher. He concluded by addressing Green Bonds as a path for mitigation finance to become a greater part of the fixed capital formation.

Mr. Ray Sudweeks, First Secretary for Energy and Economic affairs, Embassy of the United States of America, New Delhi, spoke about the challenges to the growth of renewable energy. Technology in renewables is both evolving and not proven, financing in this respect is conservative towards investing in renewables technology. He addressed the viability gap funding that emerges as a result of low investments, which must come from the public sector until technology is able to establish itself. He then moved to US financing in India. The US-India program 'Clean Energy Task Force' is such an initiative, that aims to standardize PPAs, create a payment security mechanism, warehousing, and securitization by bringing small projects together to get bonds. Further, the US also makes provisions for two facilities that bring $60 billion organising and easing the access small projects have to public and international funding. The 'Pace setter fund' is a smaller project for innovators to win grants and funds directly from the embassy.

Mr. Nicholas Fornage, Regional Director for South Asia, AFD, elucidated the AFD's strategy of green and inclusive growth through financing for mitigation and adaptation initiatives. In financing renewables, he assured the panel that a natural path will develop on its own contingent only perhaps to proper incentives and a sensitive framework. From a financial perspective, he recommended setting up credit lines to IREDA and PSUs like HPCL. New financial tools required innovation, with guarantee mechanisms and energy saving insurances. These credit lines, he relayed, should be duplicated on smaller scales as well. He stressed the regulatory framework and the need for a strong political impetus to synergize funds.

Mr. S. K. Dora, GM, NABARD presented the NABARD's role in adaptation financing and supporting climate action in India. He believes that the private sector had a strong role to play, as it contains the expertise and the potential for CSR initiatives. Mitigation requires encouragement, and policy needs to include incentives into its mandate. He concluded by describing NABARD's role in mainstreaming sustainable finance and microfinance in India.

Valedictory Session

The Session guest of honour was Sh.Suresh Prabhu, Hon'ble Minister for Railways, Government of India. Mr.Prabhu spoke about the railways as a major player in transportation sector in India. Railways as an entity working towards climate change mitigation and adopting renewables and energy efficiency in all activities of the ministry. He emphasized the need to switch mass goods and freight from road based transportation to railways as they are more climate friendly and cheaper per km of transport compared to roadways and airways.

The conference was compered and coordinated by Ms.Reshmi Vasudevan Co-ordinator SARI-EI and Mr.Sharad Verma, Assistant Director of IRADe.

The conference ended with a message of thanks from Dr.Jyoti Parikh, ED, IRADe. She thanked both the Hon'ble Ministers, all the Session Chairs, panelists, Sponsors NABARD, GAIL, REC, NTPC, PFC, PTC and IREDA for their wholehearted support, all the delegates and IRADe staff who were instrumental in the successful organisation of the event. This was followed by a group photograph of the event.

Group photo with Hon'ble Minister for Railways Shri Suresh Prabhu and Panelists, Delegates and IRADe Staff

Participants List		
Sl No.	**Name**	**Organisation**
	Ministers	
1	Shri Prakash Javadekar	Ministry of Human Resource and Development
2	Shri Suresh Prabhu	Ministry of Railways
	Session Chairs	
3	Mr. B.P.Pandey	Ministry of Power
4	Dr.Kirit Parikh	IRADe
5	Mr. R.R. Rashmi	MoEF&CC
6	Mr. Anil Kumar Jain	NITI Aayog
	Panelists	
7	Dr. Ajay Mathur	TERI
8	Mr. K Swaminathan	Ministry of Railways
9	Mr. S P Garnaik	EESL
10	Mr. V.N. Dutt	GAIL
11	Mr. A.K. Gupta	NTPC
12	Mr. S. Singharoy	NPCIL
13	Mr. V. Subramanian	IWEA
14	Mr. P.C. Maithani	MNRE
15	Mr. S. K. Soonee	POSOCO
16	Mr. Vivek Talwar	Tata Power
17	Mr. Charanjeet Singh	PTC India Limited
18	Mr. Arunish Chawla	Ministry of Finance
19	Mr. Ray R. Sudweeks	Embassy of the United States of America
20	Ms. Nicolas Fornage	South Asia, AFD
21	Mr.S.K. Dora	NABARD
22	Mr.S.K.Gupta	RECL
	Delegates	
23	Ms.Aeshita Mukherjee	GIZ
24	Mr.Amarjit Singh	IEF
25	Mr.Atul Kumar	TERI
26	Mr.Bhaskar Deol	NRDC
27	Dr. Arvind Kumar	India Water Foundation
28	Dr. Devendra Pandey	Forest Survey of India, GOI
29	Ms.Harshita Bisht	Oxford Policy Management
30	Mr.Irshad Khan	World Bank
31	Mr.Koshy Cherial	Energy Efficient Economy
32	Mr.Mohan Menon	Balsa consultancy
33	Ms.Nehmat Kaur	NRDC
34	Mr.Pankaj Batra	CEA
35	Mr.Pradeep Kapoor	Siemens
36	Mr.R.C Rath	NABARD
37	Ms.Monali Hazra	USAID
38	Mr.Sandip Keswani	KPMG
39	Mr.Shashikant Chopde	ACCCRN
40	Mr.Shrawan Acharya	JNU
41	Mr.Siddarthan Balasubramania	GGGI
42	Mr.Stephen Andersen	NRDC
43	Dr.T.S. Panwar	WWF India
44	Mr. Tushar Sud	Deloitte

45	Ms.Vibhuti Garg	IISd
46	Mr.Subhomoy Bhattacharjee	Business Standard
47	Mr.Vivek P. Adhia	WRI
48	Mr.V.N. Alok	Indian Institute of Public Administration
49	Mr.Chirag Gajjar	WRI India
50	Mr.Manish Singhal	EDMC
51	Kedar Sawant	AFD
52	Mr. Mihir Bhat	AIDMI
53	Mr.Arshpreet	Shakti Foundation
54	Mr.Avik Sarkar	NITI Aayog
55	Mr.Ryan Payne	Embassy of the United States of America
56	Mr.Mangal	EFILOK
57	Dr.S.C.Sharma	ONGC
58	Mr.Vaibhav Chaturvedi	CEEW
59	Mr.D.N.Dhawan	Ministry of Communication and IT
60	Mr.Kartikeya Sarabhai	CEE
61	Dr.D.K.Sharma	IIT Delhi
62	Mr.Rohit	DMRC
63	Mr.Abhishek Jain	CEEW
64	Mr.Sunil Sharma	GIZ
65	Ms.Apurva	USAID
66	Dr.Nisha Mendiratta	DST-SPLICE
67	Mr.Mann Aggarwal	CEEW
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72	Mr. B. Sengupta	IRADe
73	Mr. K.K.Govil	IRADe
74	Mr. Sharad Verma	IRADe
75	Dr. Probal Ghosh	IRADe
76	Mr. Vinay Saini	IRADe
77	Mr. Rajat Puri	IRADe
78	Mr. Anshuman Behera	IRADe
79	Ms. Reshmi Vasudevan	IRADe
80	Mr. Rajiv Ratna Panda	IRADe
81	Mr. Ramesh Kumar Tiwari	IRADe
82	Mr. B. K. Sarkar	IRADe
83	Mr. Mohit Kumar Gupta	IRADe
84	Mr. Akhilesh Kumar	IRADe
85	Ms. Deepanshi	IRADe
86	Mr.Sumit Kishor	IRADe

IRADe's outreach and partners

IRADe networks with the government, ministries/departments, international organizations, public and private sectors, academic experts, NGOs, and consultants to work on projects awarded by them. IRADe provides decision support to eleven ministries that include Ministry of Environment and Forests and Climate Change, Ministry of New and Renewable Energy, Niti Aayog (formerly Planning Commission), Ministry of Power, Ministry of External Affairs, Ministry of Earth Sciences, Ministry of Urban Development, Department of Science and Technology, Central Statistical Organization under Ministry of Statistics and Programme Implementation, Technology Information, Forecasting and Assessment Council (TIFAC), etc. for many national level projects.

At the international level, IRADe has worked with bilateral and multilateral organization like the World Bank, Asian Development Bank (ADB), U.S. Agency for International Development (USAID); United Nations Development Programme (UNDP); United States Environmental Protection Agency (USEPA), Wuppertal Institute for Climate, Environment and Energy, (WISION) Germany; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Germany; Rockfeller Foundation; International Institute for Applied Systems Analysis (IIASA), Austria; British High Commission (BHC), Centre for Clean Air Policy (CCAP), USA; International Institute for Sustainable Development (IISD), South South North Trust (SSNT) etc.

IRADe has partnered with academic, private sectors, multinational organizations, think tanks and NGOs. These include Shakti Foundation, Indian Council of Social Science Research (ICSSR), SEWA, Petroleum Federation of India, Pricewater House Coopers, ICF International, Rockefeller Foundation, Institute for Social and Environmental Transition (ISET), Center for Clean Air Policy (CCAP), Indian Council for Research on International Economic Relations (ICRIER), InsPIRE Network for environment, Stanford University and Sir Dorabji Tata Trust (SDTT) among others.

IRADe has also developed strategic partnerships and is part of global networks like the USAID's Low Emissions Asian Development (LEAD) program – ASIA-LEDS, ENERGIA-International Network for Gender and Sustainable Energy, Netherlands; Global Clean Cook Stoves Forum, UN Foundation; Asian Cities Climate Change Resilience Network (ACCCRN), Global Technology Watch Group (GTWG-DST), Climate Action Network South Asia (CANSA).

IRADe has carried out some pioneering work in the field of state level energy planning, city level climate resilience planning, other climate change studies and livelihood studies.

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