Workshop Proceedings Policy Dialogue: Enabling State Level Strategic Actions for India's NDC

Venue: Sovereign II Hall, Hotel Le Meridien, New Delhi Date:6th September 2022, Tuesday (10:00 - 17:30 IST)





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Abbreviations

APDC	Assam Power Distribution Company
AT&C	Aggregate Technical and Commercial Losses
BEE	Bureau of Energy Efficiency
BS	Bharat Stage
CCS	Carbon Capture and Storage
СОР	Conference of the parties
DISCOMS	Electricity Distribution Companies
DRE	Distributed Renewable Energy
ECBC	Energy Conservation Building Code
EV	Electric Vehicle
GHG	Green-House Gases
Gol	Government of India
GW	Gigawatts
HCV	Heavy Commercial Vehicles
ют	Internet of Things
IRADe	Integrated Research and Action for Development
КМ	Kilometer
LCVs	Light Commercial Vehicles
LED	Light-Emitting Diode
LPG	Liquefied Petroleum Gas
MCVs	Medium Commercial Vehicles
MoEFCC	Ministry of Environment, Forests and Climate Change
MRV	Measurable, Reportable and Verifiable
NABARD	National Bank For Agriculture and Rural Development
NDC	Nationally Determined Contributions
OSOG	One-Sun-One-Grid
ΡΑΤ	Perform Achieve Trade
PLI	Production-Linked Incentive
PM-KUSUM	Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyan
РРА	Power Purchase Agreement
PSUs	Public Sector Undertakings
RE	Renewable Energy
RPO	Renewable Purchase Obligation
SAPCC	State Action Plans for Climate Change
SECI	Solar Energy Corporation of India

Background

Integrated Research and Action for Development (IRADe) organized a national workshop aimed at disseminating and taking forward the learnings from the studies done by IRADe to identify strategies for timebound reduction in carbon emissions in three energy-intensive sectors power, transport, and irrigation. The deliberations happened across the following sessions conceived to discuss both sector-specific and cross-cutting issues.

Session I: Inaugural Session

Session II: Adapting Power Sector to meet NDC's Target

Session III: Moderated discussion with the representative from the Environment and Forest Ministry of the Government of India and State Environment and Forest Ministry Representatives

Session IV: Promoting Solar Water Pumps in the irrigation Sector

Session V: Energy-Efficient Transport System to Reduce Emissions

Session VI: Valedictory Session

The salient aspects of the deliberations in each session and the critical guidance and way forward generated are outlined in the succeeding sections.

Session I: Inaugural Session

The workshop brought together high-ranking State and Central government officials and a broad range of other key stakeholders. **Dr Jyoti Parikh**, Executive Director, IRADe, delivered the welcome address to flag off the workshop and set the tone for the event. The Honourable Union Power Minister, **Shri R.K. Singh** delivered the inaugural address. The Honorable Union Minister of Environment, Forests and Climate Change, Shri Bhupendra Yadav delivered the presidential address. **Shri Tarun Kapoor**, Adviser, Prime Minister's Office (PMO), delivered a Special Address. At the end of the session Dr. Kirit Parikh Chairman, IRADe presented vote of thanks to the dignitaries.

In her remarks, Dr. Jyoti Parikh highlighted the fact that India is among the few countries in the world who have promised "measurable, reportable and verifiable" (MRV) goals for addressing climate change. Today India has 161 GW of renewable energy capacity in a total installed capacity of 404 GW. She brought out the wide variation across states in NDC achievement related to non-fossil capacity creation, varying across categories ranging from 100-75%, 74- 40%, 40-20% to less than 20%, as a guide to optimally focusing further efforts, while taking state potential and circumstances into account.

Outlining the key role of the State Renewable Energy Nodal Agencies, Dr. Parikh highlighted the need them to play a more active and dynamic role in engaging with the private sector and supporting various business models for mini-grids and DRE. She suggested that State Action Plans for Climate Change (SAPCC) could incorporate mitigation plans in a more significant manner and emphasized



Dr. Jyoti Parikh Executive Director, IRADe technology support and enabling mechanisms for the following:

- Rooftop solar for schools, colleges, universities, stadia, public buildings, farms, and along the highways and railways where possible;
- Supportive / facilitating incentives and waivers;
- Mini-grids & Distributed Renewable Energy (DRE) systems with grid integration;
- Smart grids that connect buyers and sellers and maintain stability;
- Regular publishing of state-level NDC statistics and rewarding good outcomes in a variety of ways
- Regular stakeholder engagement and interaction for problem-solving.

Dr. Parikh informed the participants about the three detailed sector studies carried out by IRADe in the three representative states (Gujarat, Odisha, and Assam) aimed at identifying validated elements and best practices for framing sector-specific national policies. She concluded her remarks with the advocacy for the following broad mechanisms for achieving India's climate goals:

- 1) Market mechanisms
- 2) Technical initiatives as elaborated above
- 3) Regulatory measures incorporating appropriate checks and rewards
- 4) Institutional support from government nodal agencies and SAPCC
- 5) Policy and financial support for promoting investments

In his very informative and thought-provoking address **Shri. RK Singh** stressed that the power sector overcame several challenges during this government's term. The challenge of ensuring universal access was fully addressed. The initial goal of connecting every village and every hamlet was achieved with the first 1000 days. The subsequent target of connecting every household was completed in a record 19 months. Connections have been provided to 28.9 million households in this period.

Taking up another major challenge, the government transformed the country from a state of power deficit to power surplus, with a generation capacity of 404 GW against the peak demand of 250 GW. About two trillion rupees were spent to strengthen the distribution system over the last 5 years. About 3,000 new substations were constructed and over 4,000 upgraded. These initiatives enabled enhanced provision of electricity to households from an average of 12 hours per day in 2015 to about 22 hours today, including in rural areas.



Shri R. K . Singh Honourable Union Power Minister, Govt. of India

Talking about emissions, Shri Singh said that India's per capita emissions were one-third of the world average, with CO_2 emission amongst the lowest in the world. With about 17.7% of the world's population, India's contribution to the CO_2 load in the atmosphere today is just 3.4%.

While everybody tends to accept that the environment is in danger and action is needed to save it, India has taken concrete steps based on its belief in promoting environmental protection. This has been in the psyche of its people for ages with nature virtually worshiped in India. There is no ambiguity among the political class of the country regarding the climate action that is required. At the same time, India expects the developed world to start taking action commensurate with its obligations and capacity. Most pledges from the developed world are for net zero by 2050 but without a commitment by way of concrete intermediate plans to get there. India has shown readiness to take on the challenge of energy transition. India's nuclear capacity is 6,700 megawatts, with capacity under

construction of 48500 megawatts. India had pledged that by 2030, 40% of capacity will be non-fossil fuel based, which has been achieved 9 years in advance. It is planned that by 2030 about 62 percent of our capacity will be non-fossil fuel based. With a pledge to reduce the emissions intensity of economy by about 33-35 percent by 2030, about 30% has already been achieved. With many schemes in place to achieve this target, it would most certainly be achieved.

The anomaly in India of large hydro being excluded and only small hydro being counted as a renewable source was corrected in 2018. With electricity demand increasing significantly over the past one and a half years, an effort is being made to meet the increase in demand largely from renewable sources.

With renewable energy sources being intermittent, storage becomes very critical. Given that renewable power is expensive by almost 60 percent, which is nearly 60 percent, that's a bit expensive for our people. The government has surveyed potential pump storage sites. Many states have come forward to construct pump storage capacity to make round-the-clock renewable energy possible. For this storage price has to come down adequately. Otherwise, convincing states to accept more intermittent power would be difficult. At the current storage prices, renewable energy is more expensive than thermal. India's current electricity demand pattern is such that some states have to back down solar power generation during mid-day and some states with good wind speed have to back down wind power generation. Work is going on to find a solution to these challenges. The country also needs to create a day-ahead market for renewable power.

The whole country has been connected to a single grid through creation of massive transmission infrastructure. Work is underway on creating approximately 70 GW additional transmission network. Transmission requirement for evacuating a further 234 GW of renewable energy capacity has been planned. 11 renewable energy management centers have been set up with more are under construction. Steps are being taken to address the issue of the undermining of the viability of DISCOMs on account of political populism. A system is being put in place to ensure accountability of the States in paying the electricity subsidy due to DISCOMs on account of concessions arising from political concessions. Legacy dues of DISCOMs are also being addressed for long term financial viability and capacity growth. New revenues must first be adjusted against legacy dues and thereafter against current charges, which is beginning to show results.

With current consumption of about 1450 billion units per year likely to double by 2030, the current generation capacity of 404 gigawatts would be required to go up to 820 gigawatts. A robust payment eco-system is essential for new investment in the sector. Towards this end an automatic payment mechanism is being put in place. Energy conservation is being promoted through steps like the ECBC (Energy Conservation Building Code) for commercial buildings.

The Honorable Minister concluded his remarks by expressing confidence that the efforts being made would create an efficient and financially viable power sector oriented towards universal service provision and a rapid transition to clean energy at one of the fastest rates amongst the major economies of the world. **Shri Bhupendra Yadav** mentioned that he was looking forward to the rich contribution the discussions would bring to the table. He observed that climate change constitutes the biggest existential challenge humanity and the planet had ever faced and it was time for concerted action across the world for effective and adequate GHG mitigation.

Adaptation efforts need to be undertaken to manage the inevitable impact of warming. A multi-pronged approach that cuts across sectors needs to be adopted to realize the goal of low carbon industry transition. Prime Minster Panchamrit strategy highlights the need to decouple the development process from environmental digression. India communicated concrete climate action and adaptation policies to achieve the Paris Agreement goals, which were anchored in Mahatma Gandhi's famous saying that the earth has enough resources to meet people's needs but not to satisfy people's greed.

In August 2022 India communicated an ambitious NDC update which displays its commitment to achieving net-zero by 2070. The Paris

Agreement has also underlined the adoption of practices that are in harmony with nature. Honorable PM vision for the environment is to propagate healthy and sustainable lifestyles based on the tradition and the value of conservation, moderation, and climate justice to protect the poor and the vulnerable from the adverse impact of climate change.

It will not to be wrong to say that developed countries are progressing at the cost of the developing countries. For instance, India has contributed only 4 percent of the global accumulated emissions since the pre-industrial era and even as the fastest-growing large economy, its per capita emissions are only about one-third of the global average. It is the cumulative emissions predominantly from developed countries that have caused the overwhelming global temperature rise the world is witnessing today. Nevertheless, India has demonstrated its wisdom and has actively adopted a leadership role in the fight against climate change. Its climate action today is certainly more than its moral or legal responsibility. India's sheer size and scope for growth would indicate that its energy demand would also grow faster than any other economy. Energy demand during this decade will have to be met with low-carbon energy sources to meet the requirements of India's path to net zero.

At the 2021 Glasgow conference, India announced a target to meet 50% of its energy requirement through renewable energy. This clean energy transition is already well underway. Globally, India is ranked fourth in terms of installed renewable energy capacity. Non-fossil fuel energy increased by over 25% in the last seven years, and constitutes 40% of India's energy mix.

Subsidies for petrol and diesel have been removed, and subsidies for electric vehicles were introduced in 2019. A battery-swapping policy has also been formulated to promote electric vehicles. Honorable Prime Minister has launched the national hydrogen mission and stated the goal to make India a global hub for green hydrogen production and export. The transition to green hydrogen and green ammonia are major requirement for emissions reduction in the energy-intensive sectors. The Government of India budget 2022-23 is also indicative of a greater thrust on addressing climate action. Sovereign bonds will be issued for mobilizing resources for green infrastructure. To achieve the goal of 280 GW of installed solar power by 2030, an additional impetus has been provided through the Production-Linked Incentive (PLI) scheme for manufacturing high-efficiency solar modules. Implementing the coal cess and Perform Achieve Trade (PAT) schemes are some of the concerted efforts to reduce energy consumption in energy-intensive industries. Further, four pilot projects for coal gasification and coal conversion into syngas are being set up to achieve and demonstrate technical and financial viability. To enhance the use of renewable energy based power the Renewable Purchase Obligations (RPO) mechanism is being promoted.

Shri. Bhupender Yadav Honorable Union Minister of Environment, Forests &

Climate Change, Govt. of india



The government has notified the trajectory of renewable purchase obligations up to the year 2030. The government recognizes that renewable energy is intermittent in nature. Therefore, Renewable Energy Certificates (REC) can be purchased on national energy exchanges and allow the concerned entities to fulfill their obligation. It is important to acknowledge that the success of the RPO regime depends on strict adherence which in turn falls on state action.

Mr Yadav, emphasized that reliable, grid base power is extremely necessary to reduce air pollution caused by the use of diesel generator sets. The recently proposed amendment to the electricity right-to-consumer rule showcases the government's growing concern over the increasing local pollution levels. It mandates power distribution companies to supply 24X7 electricity in metros and large cities. Enabling a shift away from diesel generation in 5 years. The government also initiated the smart grid mission in 2015 with the primary aim of improving the reliability of the electricity network and make the grid amenable to renewable energy inputs through distributed generation.

Environmentally sustainable low-carbon initiatives have become an integral part of all key sectors of the Indian economy. The government has provided more than 90 million households with cleaner cooking fuel under the UJJWALA Yojna. The Indian Railways is moving towards complete electrification and is increasing the use of solar power to achieve the net-zero target by 2030, which will lead to the reduction of emissions by 60 million tonnes annually. Similarly, the Unnat Jyoti scheme for affordable LEDs is reducing emissions by 40 million tonnes annually. India's total forest cover has increased to more than 24 percent. Government initiatives like the green India mission and compensation and planning authority funds for forestation management will help create the additional carbon sink of 2. 5 to 3.0 Billion Tons of CO2 equivalent through additional forest cover by 2030.

The Lok Sabha recently passed the Energy Conservation Amendment Act which includes the setting up of a domestic carbon trading market. The honorable Prime Minister personally participated in COP21 and announced global initiatives such as the International Solar Alliance and the Coalition for Disaster Resilient Infrastructure.

The Central and State Governments must work together to meet India's other economy wide voluntary mitigation targets. India has the advantage of being a first mover in preparing the States Action Plans on Climate Change (SAPCCs). Other countries such as Indonesia and Kenya are now following suit. Understandably SAPCCs significantly incorporate adaptation, which comprises locally driven activity. The focus now needs to be on facilitating the implementation of these plans, and suitably incorporating an adequate mitigation emphasis.

The state-level discussion envisaged on meeting the Nationally Determined contribution (NDC) towards reducing greenhouse gas (GHG) emissions is a welcome step, which will go a long way in providing useful guidance on the way forward for the States who must necessarily be at the forefront of the grassroots action required for low carbon development in the country. Given that the broader national-level goals have been spelt out, more elaborate identification of the elements of the detailed actions required across States is required. The Honorable Minister outlined the following three points for state-level discussion

- Holistic, sustainable development which includes human, social, and economic development at the state level, critical for ensuring achievement of India's NDC targets.
- Ensuring that states cooperate and contribute to the country's climate change and development goals, conditioned by their circumstances.
- Recognizing healthy competition and comprehensive contribution across states across many activities in expanding renewable energy in the household and business and commercial sectors, promoting electric vehicles and ensuring that government and public buildings and other public infrastructure become progressively more energy efficient.

Ensuring effective and meaningful implementation of the national and sub-national climate action plan will rely on a number of approaches including tackling the political economy of climate change, addressing institutional bottlenecks, moving towards investment-ready plans, and better leveraging available resources.

He concluded his address by drawing attention to the important development of India's upcoming G-20 presidency. This is in keeping with India's willingness to host international conferences and submits for multilateral cooperation on the environment. India successfully hosted the Conference of Parties (CoP) of the United Nations Convention to Combat Desertification in Delhi in 2019, and the 13th meeting of CoP convention of migratory species in 2020. India's hosting of the G-20 summit in 2023 and related ministerial meetings, conferences, and events will be another opportunity for India to demonstrate this commitment.

Shri Tarun Kapoor mentioned that implementation action happens in the states. Hence they have a critical in achieving the NDC's. India has been a front runner in climate related actions and has achieved its commitments. The projection of a 2.7°C temperature increase by the end of the century if the world continues with the current level of emissions, as opposed to the containment goal of 1.5°C, must lead to a sense of urgency. While China alone contributes 25% of total global emissions and the developed world is also continuing to emit substantially, India's per capita emissions are quite low, notwithstanding the large poverty stricken population in India, which places poses a critical imperative.

India is among the few countries where energy demand is still growing and will continue to grow in the coming decades, meriting cognizance of our climate related commitments while planning



Shri. Tarun Kapoor Adviser, Prime Minister's Office Govt. of India

for future energy needs. With electricity generation and transport being two major energy intensive sectors, a shift from a molecule to an electron based energy supply system for both transportation and cooking would be step in the right direction. It would be convenient to integrate renewables into grid-based energy supply to monitor progress in its utilization. Talking about the world energy consumption outlook he said it is expected that fossil fuel demand will fall by 40% by 2050. By 2050, the share of renewables would be between 80 to 90%. He was hopeful that India will also follow a similar energy mix transition.

India is ranked seventh in the world as the most effective country for climate action, which underlies the importance of addressing climate change for the country. India has the largest number of the world's most polluted cities, which makes it more pertinent for us to take action on the climate front. While the Renewable Purchase Obligation (RPO) arrangements are in place, distribution of electricity is through the DISCOMs controlled by the state governments and working under the state electricity regulators, who need to declare the compliance trajectory and ensure enforcement. Some DISCOMs may be constrained by their long term PPAs (Power Purchase Agreements) with thermal power producers in excess of their immediate requirement.

He mentioned the large untapped hydro power generation potential in the northern part of the country especially in the north-eastern states. Central India also has potential for large hydro generation, while the western part of India has potential for solar and wind power generation. Efforts are being made to exploit the offshore wind power potential. Solar rooftop potential is inadequately exploited with reluctance on the part of DISCOMs for net metering, which regulators need to resolve innovatively. Facilitating impetus has to be provided to transmission through centralized initiative to make this happen. Government of India has been providing funds through the green corridor scheme on the ISTA system with free transmission of renewable energy.

Considering the intermittency in generation, storage becomes an important aspect for renewable integration in the overall energy supply system. Pump storage must be prioritized first, followed by the slightly expensive battery storage solution. Improvement in grid management to have more flexibility to accommodate intermittent sources is also important. Currently, India has approximately twenty-four percent share of renewable energy

including large hydro in grid supply. This could increase to say 35 - 40% facilitated by lower cost of storage over time. DISCOMs need to be convinced about these possibilities to enter into long term PPAs with renewable producers.

The transport sector is also a very big consumer of energy. A shift to electric mobility is an option to increase renewable energy share in the sector. This shift is happening at fast pace for 2-wheelers. India already a manufacturing hub for automobiles could become on for electric two wheelers also. For 4-wheelers the options include:1) EV which is happening at a slow pace, 2) Ethanol blended Petrol with flexi fuel vehicles and 3) strong hybrids for higher efficiencies 4) Blending of CNG with compressed biogas.

For freight, the railways are working to increase freight transport share from 18 percent currently to 35 percent. Hydrogen could be another alternative if the price of could be brought down. This could be a possibility given the volume of research and investment taking place across the world in this area.

Cooking energy is another challenge with the shift to LPG resulting in a consumption of about 36 million tons every year. Electric cooking is a viable alternative. Piped natural gas blended with biogas or green hydrogen could be another promising proposition.

Mr. Kapoor concluded by emphasizing the critical role of the States in making these outcomes possible and enabling the nation to transition to cleaner forms of energy much faster than the rest of the world.

Dr. Kirit Parikh in vote of thanks for the session, thanked the Minister of Power for his enlightening speech and appreciated his leadership which had brought new vigour to the power sector with almost 100% households getting electricity access over the last five years. The most pressing issue of the huge debt facing the Indian power sector had been addressed and the latest initiative had all promise to succeed. He stressed the importance of storage in energy transition and the need for States to have backup for at least the base load. Even though India's current contribution to global warming in per capita terms is one of the lowest, it was pertinent that warming takes place due to the stock of emissions rather than the current increment, as brought out in the latest IPCC report.

From 1990 to 2020, the stock of emissions was around 700 giga-tonnes. Even if all developing countries achieve their net zero goal this stock will



Dr. Kirit Parikh Chairman, IRADe

be doubled to 1400 giga-tonnes or more, which implies faster and more intense warming in the future than it is today. He hoped that the steps India was taking to hasten energy transition would motivate others. He concluded his vote of thanks by thanking all dignitaries and participants once again.

The inaugural session set the tone for the workshop by drawing attention to the key climate change issues related to state level actions that merited further discussion at the workshop with the aim of identifying the options and best practices available for adoption and mainstreaming across the country, and the modalities for doing the same. It brought out the critical imperative faced by India and the world for expeditiously addressing the challenges by way of sector and state specific policy suggestions. Commendable efforts of the various Government and other stakeholders related to energy intensive sectors to meet national NDC goals were identified along with the need to build on these successes.

Session II: Adapting Power Sector to meet NDC's Target

Power sector issues and strategies were discussed in the session on "Adapting Energy & Power Sector to meet India's NDC's Target", which was Chaired by former Power Secretary, Shri Sanjiv Sahai. The other very distinguished panelists comprised Shri Jishnu Barua, former Chief Secretary, Assam and the current chairperson of the state Discom, Shri Niraj Verma, Principal Secretary, Power (Electricity) Department, Government of Assam, Shri. Ravi Shankar, Director, Gujarat Urja Vikas Nigam Limited (GUNL), Shri. Sambit Parija, Financial Advisor- cum Additional Secretary, Energy Department, Government of Odisha, and Shri Rajnath Ram Adviser (Energy), NITI Aayog. The session was initiated with a theme-setting presentation delivered by Dr Kirit Parikh, Chairman, IRADe, which set the context of the discussion and posed the underlying essential questions for the speakers to deliberate.

In his opening presentation Dr Kirit Parikh talked about state actions and market-friendly policies for the power sector. He further emphasized that being market-friendly does not mean electricity has to be supplied to the consumer at market-determined prices only. It means incentive compatible policies which motivate various agents to act in a way that will fulfill India's NDC goals. India's NDC goals have three main strands: 1) increasing the share of renewable in the energy mix, 2) energy use efficiency to reduce the energy intensity of GDP, and 3) carbon sequestration.

He observed that in India power is a concurrent subject, and state actions are critical for the sector. There is significant variations in the power sector across States / DISCOMS in aspects like the fuel mix associated with power generation and AT&C losses etc. on account of variations in the underlying circumstances, area served etc. Thus, with Indian states being diverse in many ways, IRADe selected three representative states, namely Gujarat which is industrially advanced and urbanized, Odisha which is developing fast and Assam, a north-eastern state with partly undulating / hilly terrain.

RPO obligations have been a major policy plank for promoting renewable energy generation and consumption in India. However, the Central government and State governments tend to set different RPO targets, with the latter generally setting a lower target. The marginal cost of incremental power supply from coal power plants is lower than from renewables. Hence, states continue to shun renewables in the favor of dirty coal based power. Odisha has a different story; a large number of captive power plants leaves small room for DISCOMs to absorb renewables. Bringing captive generation under the RPO umbrella would merit consideration. The long rainy season and a difficult terrain make solar a not so desired choice in Assam. It was observed that commitments related to long-term power purchase agreements (PPA) do not leave enough room to absorb renewable power. Lack of demand grown over the last two Covid years has made the problem even worse. State governments are cognizant of this situation and have set lower immediate RPO targets. The central government should do the same and provide a suitable long-term RPO trajectory up to 2030 in advance. In conclusion, Dr Parikh listed the following initiatives for reducing emissions in the power sector:

- Promoting a robust and reliable grid
- Replacing / refurbishing old coal-fired power plants
- Privatization of DISCOMs Tata Power in Delhi brought down T&C losses from 50% to less than 10% in a few years.
- Promote demand side management through programs like LED promoting energy-efficient appliances; energy efficiency rating programmes etc.
- Electric cooking to reduce use of unclean fuels and de-forestation pressures.

Shri Sanjiv Nandan Sahai stated in his remarks that in 2021 India's solar power tariff was the lowest in the world. Asset-based financing has also picked up, which will further drive down the cost of debt. Talking about the risk to the sector he said that PPA counterparty risk was the highest. DISCOMs were not able to pay their dues to IPPs which makes many renewable projects economically unviable. Renegotiation of PPAs, unavailability of land, litigation etc are very important issues raised by the investors.

Intermediation by SECI (Solar Energy Corporation of India) reduces the risk. There was a clear preference by investors to enter into contracts with SECI rather than with the state DISCOMs. The increasing cost of components for solar cell manufacturing, increased freight costs, and the depreciation of the rupee have, however, added to the manufacturing cost.

Shri Jishnu Barua said that Assam is committed to renewable energy. Cabinet had taken a decision for the addition of 3 GW of solar power, which includes 1 GW through ADB support and another 2GW through joint ventures with CPSUs. However, land acquisition for these projects would be a challenge given the population density in the plains area which is higher than the all India average. Therefore, setting up a large solar park would be a challenge. In the hilly areas, large parcels of land would be available for solar parks but evacuation of electricity would be difficult.

Talking about the financial health of DISCOMs he said that in the last financial year Assam DISCOM registered a profit, AT&C losses came down, and collection efficiency improved. There have been some initiatives relating to corporate restructuring of the company, including increasing the authorized capital and paid-up capital (through conversion of loan into equity etc.). In the years to come Assam will be largely dependent on hydro power apart from the upcoming solar projects. Assam will draw power from Subansiri hydro project which is in a neighboring state and has been sourcing power from Bhutan.

Shri Niraj Verma said Assam Power distribution companies (AODC) have become debt free and profit-making. APDC pays its dues to central PSUs before the deadline. To promote energy efficiency Assam has implemented ECBC with promotion of smart meters and pursuit of a proposal for a revamped distribution support system.

Assam has signed a 2 GW PPA with a central PSU with no exit policy in preference to a scenario involving IPP suppliers. Assam does not have any wind power generation potential but has a good hydropower generation potential. With additional solar and hydro generation Assan will exceed the national RPO obligations target by 2030. Assam is also setting up a pumped storage plant for renewable storage on the Brahmaputra.



Shri Sanjiv Nandan Sahai Director, NMML & Former Power Secretary, Govt. of India



Shir Jishnu Barua Former Chief Secretary , Govt. of Assam



Shri Niraj Verma Principal Secretary, Power (Electricity) Department, Govt. of Assam

Shri. Ravi Shankar in his presentation said that the Gujarat government is fully committed to and working towards contributing to achieving the national NDC targets for 2030. Targets for the future energy basket involve 40% solar, 19% wind, 30% coal, 3% hydro, 2% nuclear, and 6% gas based power to align with the national NDC goals.

Gujarat does not have any coal or lignite reserves and is dependent on imported coal. Hydropower and perennial river sources are also not available. The state was an early adopter of RE initiatives commencing in 1993. Updated Solar Policy and Wind policies were announced in 2021 and 2016 respectively, as also a solar hybrid policy in 2018. Policies for the development of small-scale distributed solar projects and for allotment of government wasteland for wind and solar wind hybrid projects, are in place. A solar

project is being developed in the vicinity of the existing transmission network. A mechanism for competitive bidding in RE sector has been introduced. In the last 5 years, 6 GW RE has been added through competitive bidding at a rate comparable to rates discovered by SECI. The lowest discovered tariff was Rs 2.84 per unit. The state has a coastal area of 1600 KMs, which provides a huge potential for onshore and offshore wind. Offshore wind power exploration has been commenced.

Shri. Sambit Parija at stated that the government of Odisha is committed to working towards the national NDC goals. The government is taking several measures to improve its RPO compliance and has exceeded the RPO compliance target in this financial year. Odisha has many large energy-intensive industries with captive generation plants which makes it difficult to transition. He said the government is going to organize a make-in-Odisha conclave by end of this year where they would showcase the renewable energy potential of the state. Reservoirs and water bodies could be used for floating solar projects. Opportunities for the production of green hydrogen on the coastline for export are also being explored. In conclusion he mentioned some notable initiatives of the government aimed at improving energy efficiency, achieving energy transition, promoting an EV policy etc.

Shri Rajnath Ram said fossil-based energy sources dominated by coal generate 75% of the emissions from power generation in India. He said the states have a very important role to play in energy transition. Many transmission projects are stuck due to land and forest clearance. Referring to a study from the NITI Aayog he said that India's nuclear energy generation should reach 23 GW and hydro 80 GW, by 2030.

Thus, the session recognized existing long-term PPAs (Power Purchase Agreements) as a key issue requiring resolution in the quest for energy transition and increased consumption of clean power with the objective of achieving the NDC goals of the sector across States. Lack of timely payments by DISCOMs to IPPs was also an issue, which has made many renewable projects economically unviable. Renegotiation of PPAs, unavailability of land, legal



Shri Ravi Shankar Director, GUNL Govt. of Gujarat



Shri Sambit Parija Financial Advisor- cum Addl. Secretary, Energy Department, Govt of Odisha.



Shri Rajnath Ram Adviser (Energy), NITI Aayog

litigation etc. are very important issues raised by investors. Intermediation by SECI (Solar Energy Corporation of India) reduces risk and there was a clear preference by investors to enter into contracts with SECI rather than with the state DISCOMs. The increasing cost of components for solar manufacturing

increased freight costs, and the depreciation of the rupee has added to the equipment manufacturing cost and could put upward pressure on solar tariffs.

Notwithstanding these issues, it was unanimously held that meeting NDC Goal 4 would require a rapid transition to renewable energy and non-fossil sources. Work on several fronts like replacing carbonintensive sources alongside improving efficiency in the generation and consumption of electricity, and increasing usage of RE-generated power through RPO on obligated entities is required. The role of a reliable grid-based power supply is also crucial in eliminating polluting backup energy sources.

Session III: Moderated discussion with GoI and State Environment Representatives

The broad overarching national and state-level perspectives of climate change were discussed in a session that saw participation by several environment ministry officials from the Centre and the States. To set the context of the discussion, Ms Leena Nandan, Secretary, Ministry of Environment, Forest and Climate Change, Government of India, delivered a Special Address where she put forth the priorities of her ministry. The discussion, which followed, was moderated by Shri Tanmay Kumar, Additional Secretary, MOEF & CC, with Shri Anup Wadhawan former Commerce Secretary, Shri Pankaj Batra, former CEA Chairman, Shri Bipin Talati, Joint Secretary, Climate Change Department, Government of Gujarat, and Shri Jishnu Barua former CS, Assam, participating and expressing a wide range of views and perspectives.

Ms Leena Nandan said that energy transition is at the core of India's strategy to address the challenge of climate change. India's climate commitments are ambitious, which shows its intent. The country is on track to achieve all targets and, at the same time, meet the economic aspirations of the people. A clear cross-sectoral strategy and a top-down approach translating from national to subnational levels is the way to achieve climate goals. Active States participation in the discussions on increased focus on renewable energy adoption, mitigation efforts in the agriculture sector and adoption of electric vehicle are encouraging and assuring. Many actions have already been initiated, but there is a long way to go.

She suggested that states, in their spheres, formulate and implement projects and policies which address both the demand and supply side of the value chain. Many a time, focus gets confined to the supply of non-fossil



Ms. Leena Nandan Secretary, MoEFCC, Govt. of India

fuel-based sources of energy. India's grand vision of an environment friendly lifestyle promotes less consumption and shunning the wasteful use of resources, without which sustainable development cannot be achieved. Behavior change is not only required from individuals but also from organizations. She put out the following key priorities:

- Energy-efficient appliances
- Incentivizing and encouraging e-mobility
- Use of public transport systems
- Municipal waste management process
- Harnessing and mobilizing finance to mainstream innovative technologies to downstream players- medium, small and micro enterprises

She suggested that the envisaged discussion should also focus on access to finances for addressing climate change.

Shri Tanmay Kumar set the broad agenda for the discussion. He outlined the following points to start the discussion.

- Identifying climate mitigation and adaptation pathways for the states
- Recognizing respective state capabilities and national circumstances to achieve NDC goals.
- State action plans



Shri Tanmay Kumar Additional Secretary, MoEFCC, Govt. of India

Shri Anup Wadhawan suggested that the institutional mechanisms inbuilt into the various missions and programs and their implementation modalities provide a good instrument to achieve climate related objectives in an accountable manner through the efforts of all stakeholders. Imposing green taxes on fossil fuels would deter their consumption and promote the use of renewable energy sources through market-based mechanisms. CCS (carbon capture and storage) is also critical along with emissions reduction to reach net-zero status and go beyond that to address the excessive cumulative carbon load, which is the essential determinant of climate change. He also stressed suitable emphasis on adaptation given the very tangible climate change related adverse impact on lives and livelihoods visible today.

He suggested an innovative mechanism of ranking states based on performance and preparedness to address the challenge of climate change. The state ranking framework should capture the inter-states variations in endowments and other circumstances. It will promote a competitive environment across states in working towards climate related goals.

Shri Pankaj Batra outlined that policies are made for the country by the central government, whereas the implementation is at the state level. He suggested a participatory policy-making approach where policies are framed in constant consultation with state governments who are going to implement them.

Talking about the integration of renewable sources, he said storage is an important aspect given the intermittency in renewable generation. Many states are interested in creating storage capacity, especially pump storage. India has the potential for both river-based and off-river pump storage. This should be incorporated into the national electricity policy.

Apart from the advantage of reducing emissions electric vehicles have the advantage of acting as ancillary services for consuming intermittent renewable power. We need to design an incentive mechanism for electric vehicle owners

to charge their vehicles whenever we have a high supply of renewable power in the grid. It can be monitored with the use of smart meters because the ultimate idea is to match generation and demand at each point in time. Many developed countries have implemented demand response with smart meters across the countries. India's national target of connecting all consumers through smart meters will its implementation. We need to frame the rules to design incentive mechanisms for consumers and put specialized software in place. It can be implemented by all states.

Waste to energy is another very promising idea. Given the available technologies, it is expensive, therefore certain incentives need to be provided for energy generators. The technologies are evolving, and in due course, they may become competitive. He talked about a renewable plus storage project by Greenco that uses closed-loop pump storage and bid at Rs. 4.04 per unit. It would be difficult for even coal-based plants to meet this rate. He concluded by talking about the Prime Minister's vision of One-Sun-One-Grid (OSOG) and the recent declaration by the Prime Minister of India and the Prime Minister of the United Kingdom about a green-grid initiatives.

Shri Anup Wadhawan

Former Commerce Secretary Govt. of India



Shri Pankaj Batra Project Director, SARI EI- IRADe & Former CEA



Shri Bipin Talati said Gujarat is dedicated to a sustainable and climateresilient future by adopting and enabling a low-carbon pathway without compromising economic growth, equity, and inclusiveness. The state has prepared and submitted a draft SAPCC to MOEFCC comprising both adaptation and mitigation strategies with nine focus areas - water, renewable energy, energy efficiency, agriculture, green jobs, forest and biodiversity, vulnerable communities, urban development, sea level rise, coastal infrastructure, and public health. With 600 KM and good solar irradiation, Rann of Kutch has the potential for 200 GW of renewable energy generation. The state also has the potential for offshore wind generation. A wind-solar hybrid plant of 28 GW is currently under construction and is expected to start functioning by 2025. Jamnagar will be the hub for the green energy complex, with the 5,000-acre land reserved for four Giga battery factories, solar panel manufacturing, and an electrolyte manufacturing plant for the production of green hydrogen.



Shri Bipin Talati Joint Secretary, Climate Change Department, Govt. of Gujarat

These progressive renewable energy policies have created the right ecosystem for investment in renewable energy and enabled the establishment of a 1000 MW canal-top solar system. Gujarat is at the forefront of the renewable energy revolution in India and has formulated many policies, such as the solar policy, wind power policy, wind solar hybrid energy policy, waste to energy policy, and small hydel energy policy to accelerate the development of renewable energy. The total installed capacity is 17.5GW and steadily growing. 360,000 homes have opted for the solar rooftop program, and a provision of Rs. 825 Crore has been made in the current year's state budget to augment it further.

Gujarat is working to introduce a road map document to achieve the net zero target by 2070 and a 50 percent renewable energy mix by 2030. Research and development in carbon sequestration, battery storage, and green hydrogen are new pathways for the Gujarat government. Work on inviting climate finance in India by generating carbon and plastic credits for the safe collection and disposal of carbon equivalent and plastic waste is also underway. This will provide dual benefit by way of generating funds for sustaining climate initiatives and ensuring environmental protection. The state is working on improving energy efficiency in the building sector by introducing an energy conservation building code (ECBC) and is also adding components of the green building code to it.

Shri Jishnu Barua said the government of Assam has cleared the SAPCC. The plan involves 32 departments grouped into 8 clusters, and each cluster has a significant plan in place. For agriculture cluster measures have been taken to make it smart and sustainable and climate resistant. Corrective measures have also been taken for recharge of the water table. To maintain bio-diversity work is being done on enriching and restoring forest cover.

Assam has launched a massive campaign for planting saplings. The state has accessed the national adaptation fund of MoEFCC and utilized it for developing the adaptation capacity of villagers around the Kaziranga wildlife sanctuary with support from NABARD. He said there is a rapid change in weather patterns observed now. In the last 3 decades, significant decrease in rainfall and a rise in temperature has been observed. There is



Shir Jishnu Barua Former Chief Secretary, Govt. of Assam

great instability in the weather pattern over the whole year. This year intense rainfall was experienced before the monsoon set in, which caused devastation across the state by way of landslides in hilly areas, inundation and cutting off of many areas from Guwahati with disruption of the railway and roads for almost a week.

The session recognized that both adaptation and mitigation are key elements required to be addressed through a unified understanding and awareness across the government of India and the States. The states are responsible for the coordination, regulation, and enforcement of many climate policies. For example, energy efficiency on the demand side is mainly governed by the states, whereas the supply side is governed jointly by the center and the states. States are required to take measures to promote energy transition and improve energy efficiency in the energy-intensive sectors of the economy. Institutional mechanisms and accountability frameworks for addressing them across the States through synergized collective action by the government of India, the state governments, and other stakeholders are critical for achieving national climate commitments, need to be conceived.

Session IV: Promoting Solar Water Pumps in the Irrigation Sector

The session on "System of Power Supply and Finance for Solar Irrigation" discussed the following key issues 1) How to promote low carbon irrigation, which may assist in achieving India's NDC targets through the adoption of solar water pumps; 2) a viable state-level policy to incentivize both farmers and DISCOMs, and 3) a marketbased solution that would facilitate effective implementation of irrigation. Dr Chandrashekhar Singh from IRADe presented a theme-setting presentation to outline the broad areas for discussion. The session was Chaired by Dr Kirit Parikh, Chairman, IRADe. Shri Sanjeev S. J. Solanki, Director, Agriculture & Farmers' Welfare, Department, Government of Gujarat, attended the session on behalf of the Gujarat Government. Shri Sanjeev Kumar Chadha, Special Secretary, Agriculture & Farmers' Empowerment, Department, Govt of Odisha, spoke on the perspective of the Government of Odisha. Two eminent experts, Mr. Nilanjan Ghose, Senior Advisor, GIZ India and Shri Tushaar Shah, Emeritus Scientist International Water Management Institute also participated and put forth their views.

Dr. Chandrashekhar Singh in the theme-setting presentation on a system of power supply and finance for solar irrigation for the session outlined the objectives of the study carried out by IRADe on the promotion of lowcarbon irrigation through solar pumps. The study proposes a market-based solution for the effective implementation of solar irrigation. Integrating a strategy for judicious use of irrigation water is equally important as with solar power supply at almost zero operating cost excessive groundwater extraction is likely to occur.



Dr. Chandrashekhar Singh Senior Research Analyst , IRADe

He mentioned that electricity and diesel are the two primary energy sources for irrigation. Southern and Western India uses electricity, whereas Northern and Eastern regions rely more on diesel. The transition from fossil fuel-based irrigation systems to solar-based irrigation systems has the

potential of saving 163 Million MT of CO2 equivalent from saved grid electricity consumption and 5 Million MT from conversion of diesel-based pumps.

Analysis of primary survey data collected from grid-integrated solar farmers from Gujarat revealed that on average a farmer uses 40% of generated solar power for irrigation and feeds the rest to the grid, and thereby the arrangement provides electricity to the farmers for irrigation and a sustainable income from the feed-in tariff for grid-supplied electricity. DISCOMs are getting green electricity at the point of consumption and are 1) saving on transmission cost, 2) meeting RPO obligation, and 3) saving on subsidies provided to farmers. The analysis suggests a win-win solution for the three key stakeholders, namely 1) farmers, 2) DISCOMs. and 3) government-central and state who ultimately bear the subsidy burden for heavily subsidized electricity supplied to the farmers for irrigation. The effective subsidy provided to farmers for irrigation in Gujarat currently is Rs 5.40 per unit of electricity supplied, which translates to a total subsidy of Rs 28,000 per hectare per year.

The study works out three scenarios for the transition of electric irrigation pumps to grid-integrated solar irrigation pumps. Scenario 1: no capital subsidy and a low FiT, Scenario 2: 60 % capital subsidy and low FiT, and Scenario 3: 15 % capital subsidy and high FiT. In addition to capital subsidies, farmers could also avail low-interest capital from financial institutions against the mortgage of the solar system in all 3 scenarios. Scenario 1 would have limited takers given the financial condition of farmers. Scenario 2 would put a significant capital subsidy burden on the government. Scenario 3 may be the most prudent option, as it will keep the upfront subsidy burden on the government at an acceptable level while providing an incentive to farmers for judicious extraction of groundwater in the form of the opportunity cost of lost FiT income.

The study suggests additional measures to further strengthen the scheme for the speedy uptake of solar water pumps.

- Priority sector loans to farmers for solar irrigation pumps
- Regular and timely payment to the farmers for evacuated electricity
- IoT (Internet of Things) based meter system for monitoring of electricity generated from solar panel
- Comprehensive insurance scheme for panel loss and damage
- Awareness program to on-board farmers to the scheme.

Shri S. J. Solanki said the agriculture sector accounts for approximately 20-25% of the total electricity consumption and 15% of the total diesel consumption. The initial cost of a solar irrigation system is very high compared to other alternatives and financial institutions are not forthcoming in providing loans to the sector.

Central Government programs 1) Agreement Infrastructure Fund (AIF), and 2) Farmers producer organization could be of some help. There is a provision of 3% interest subsidy for solar irrigation in the AIF. He expressed

his optimism that going forward it would be possible to increase the solar irrigation base in the country.

Shri Sanjeev Kumar Chadha observed that Odisha has around 500 kilometers of coastline and is prone to natural calamities such as cyclones, super-cyclones, droughts, and floods. Odisha has around 90 % small and marginal farmers who are dependent on monsoons for their crops. The Gross irrigated area has increased to around 43.5 lakh hectares for Kharif and around 20 lakh hectares for Rabi. Diesel pump sets are the main source of irrigation.

The government has started schemes for crop diversification and moving away from paddy to reduce water consumption. The Biju Krishik Vikas Yojana to promote solar pump adoption for irrigation has been launched. Farmers are provided Rs. 36,000 from the agriculture department, and the remaining amount for the solar pump is contributed by the farmer. Interventions are also being made to provide green energy across the agriculture value chain.

Mr. Nilanjan Ghose talked about the progress India has made in terms of moving away from diesel in the agriculture sector. There has been a reduction in the consumption of diesel in the agriculture sector indicating improvement in the availability of the grid and the renewable energy infrastructure. The government of India has shown the intent to make agriculture diesel-free by 2024.

The increasing use of electricity in irrigation has contributed to the headline losses of DISCOMs reaching Rs.780 Billion, in addition to the subsidy burden which raises this amount to Rs. 2100 Billion. Thus, solarization of irrigation systems is not just a low-carbon pathway but an economic necessity. Both the Central government and State governments

have come up with schemes for on- grid and off-grid solarization of agriculture.



Shri S. J. Solanki Director, A & F W, Department, Govt. of Gujarat



Shri Sanjeev Kumar Chadha Special Secretary, A & F W, Department, Govt. of Odisha



Shri Nilanjan Ghose Senior Advisor, GIZ India

There is likely to be a potential addition of 150 GW renewable capacity if all agricultural pumps operating either on

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Diesel or electricity are converted to solar, not including canal top solar. There have been some pilots to look at solar generation potential from the top of irrigation canals. Through these initiatives one-third of India's solar ambition can be achieved through the agriculture sector. Thus, solarization offers farmers additional income, resilience to climate-induced uncertainties and (based on an assessment) a revenue saving of USD 20 Billion.

PM-KUSUM scheme has 3 components and a cumulative potential of 3.8 GW of solar energy of which approximately 1 GW has been achieved. The scheme has been extended till March 2026. The key challenge is that large players who are investing in solar parks are not interested in this particular scheme. The cost of land acquisition is running too high whereas for solar parks lands are provided to the developers. There are issues in financing terms related to: 1) the rate of interest, 2) the collateral required, and 3) the subsequent margin money. Although there has been an attempt to standardize this, bankers have not been very responsive. Making the feeders live to ensure that farmers are in a position to send the excess energy back to the grid remains a challenge for multiple feeders.

Shri Tushaar Shah said Solar pumping capacity is ramping up in the country exponentially. Five years ago India had less than 10,000 solar pumps which have increased to more than 200,000 and growing at a compound annual rate of more than 60 percent. It is an opportune time to take a strategic view on how to promote this new technology in agriculture to have the maximum advantage that it can offer to the country as well to the farmers. Many states are promoting solar pumps primarily with a view to reducing future farm power subsidies. Farmers who have applied for electricity connections are offered a solar irrigation pump in lieu of an electricity connection. This is a limited view in promoting solar pumps because solar pumps can achieve much more than just reducing the subsidy burden. Of the total installed solar pumps in the country, only 5 % (4500-4600) are grid-connected and the rest are off-grid solar pumps.

ShriTushaarShahEmeritusScientist,InternationalWaterManagement Institute

The early concern about solar pumps that when farmers getting zero variable cost (free) power during day time would tend to enhance solar energy use to

maximize benefits by expanding the area under irrigation or taking to more intensive irrigation with adverse impact on the water table. The result so far is quite the opposite. The main concern now is that a large number of solar pumps in many states are grossly underutilized. Creating expensive and capital-intensive irrigation infrastructure that is subject to a low level of capacity utilization may be a major concern.

The second major concern is that a large number of solar pumps are actually used as standby pumps. Instead of replacing existing diesel or grid electric pumps, solar pumps in such cases are net addiction to the existing pumping capacity. To achieve the best social outcomes there should be a policy that solar pumps are used only to replace existing grid-connected and diesel pumps.

India is following three approaches for solarization of irrigation system:

- Off-grid solar pumps: The major issue with this model is that a large number of such solar pumps would have low overall capacity utilization combined in many cases with excessive irrigation utilization. Overall underutilization means precious capital invested in creating solar capacity is wasted, while over-utilization for irrigation can result in excessive groundwater utilization.
- Maharashtra pilot: pumps are connected to a feeder which is powered by a tail-end solar plant substation. In this model, farmers continue to get free power during day-time. The entire infrastructure is put up and managed by private investors. The main advantage in this model is that government by offering a remunerative deal to private investors could bring them on board to ramp up solar irrigation capacity

rapidly.

• Gujarat SKY Scheme: farmers themselves manage solar pumps and they get incentives to not only generate maximum energy but also to sell as much as possible to the DISCOMs by optimizing irrigation. The fact that the scheme has grown significantly since its launch is evidence of the incentives having worked. North Gujarat where groundwater issues are severe is also solarized under this scheme. It was found that farmers are using less groundwater and selling energy. This has emerged as a significant regular income-generating alternative for farmers. There are logistical issues in expanding grid-connected solar power as many states lack grid infrastructure at the farm gate to evacuate power.

Grid-connected pumps with an incentive to farmers to sell the surplus energy would reduce future subsidy burden on the government, generate a sustainable income for the farmers, and provide green electricity to the DISCOMs to meet RPO obligations, in addition to groundwater conservation and meeting of the national NDC targets. The suggested FIT range of Rs.4.50 - 5.40 per unit in this study is very well justified given that most states are delivering power to farmers at a cost of Rs. 6.0-6.5. With certain modifications in the design features, this kind of intervention can be very attractive to farmers.

The session recognized the solarization of irrigation systems as the key to reducing carbon emissions in the irrigation sector. Solar pumps allow farmers to draw water without using energy derived from grid supply based on coal-powered plants or diesel. Once installed, solar power is largely free from any variable cost, which can exacerbate the ongoing depletion of scarce water resources, particularly in the drier northwestern and peninsular regions of India. Grid-integrated solar pump with an attractive feed-in-tariff (FiT) rate to encourage farmers to sell surplus electricity to the grid is a win-win solution. Community-level solar irrigation pumps could also be a good option for making green irrigation systems.

Session V: Energy Efficient Transport System to Reduce Emission

The session on "Energy Efficient Transport System to Reduce Emission" saw extensive discussion on reducing emissions, especially by passenger vehicles. The session was chaired by Shri Giridhar Aramane, Secretary, Ministry of Road Transport and Highway, Government of India. Dr. Probal Ghosh presented state-level studies carried out by IRADe for the transport sector. Mr. Shwetal Shah, Technical Advisor, Climate Change Department, Government of Gujarat, presented the developments in the transport sector in Gujarat. Mr Saurabh Didi, Director, Bureau of Energy Efficiency, talked about the national initiatives for energy efficiency in the transport sector. Ms. Ritu Mathur, Senior Energy Consultant, NITI Aayog and Mr. Rahul Tongia, Senior Fellow, Centre for Social and Economic Progress (CSEP) presented the civil society perspective.

Dr. Probal Ghosh delivered a theme-setting presentation on "Energy Efficient Transport System to Reduce Emission" in the session. He mentioned that the National NDC commitments require a lot of state-level decisions in many sectors including surface transport. He explained that the session would discuss effective state action plans to enable the surface transport sector to contribute to achieving the national NDC targets. The effort would be to have a market-based solution that facilitates implementation and a shared dialogue through state-level stakeholders.

State-level transportation models have been developed. Private transport vehicles dominate the total stock of vehicles. Economically better-off states have a high share of cars and low per-capita-income states have high twowheeler density. The vehicle ownership pattern is also reflected in the



Dr. Probal Pratap Ghosh Assistant Director , IRADe

commercial vehicle high income states have more HCV and low-income states have more MCVs and LCVs. The strategy for the transport sector could be to strengthen the electrification network for EV charging, improve energy efficiency, and encourage model shifts for private vehicle owners.

Electrification: 50% EV sales in total vehicle sales by 2030 would lead to a reduction of CO2 by 38% in Gujarat. 22% in Odisha and 24% in Assam. Electric vehicles cost much more than conventional vehicles therefore direct interventions through technology and policy mandates are required. DISCOMs should evolve electricity pricing policies for rolling out the EV infrastructure.

Energy efficiency: A 50% improvement in fleet fuel by 2030 would to a reduction in CO2 emissions by 20% in Gujarat, 18% in Odisha, and Assam. The suggestion here is that government may introduce a vehicle rating system and variable registration fees linked to vehicle rating, and providing an incentive for people to opt for a fuel- efficient vehicle. Promoting the retirement of old vehicles and swapping for higher fuel efficiency vehicles is also to be encouraged.

Modal shifts: a 10% shift from private transport demand to public transport would reduce CO2 emissions by 9% in Gujarat and Odisha and 13% in Assam. Public transport infrastructure should be augmented and it should focus on improving the quality of the ridership experience. Last-mile connectivity and affordability of public transport are important for improving occupancy in the public transport system. The introduction of air pollution markets and parking markets would increase the cost of private vehicle ownership and will provide an incentive to shift to public transport.

In addition to these three scenarios, there are many mixed scenarios (combining two strategies) to get a better yield in terms of CO2 emissions reduction potential. Direct measures like fiscal instruments (subsidies for EVs, metros, and public buses to make them affordable) or tax instruments like the carbon tax, parking tax, variable registration fee etc., for private vehicle ownership, would yield good results. Other measures like green vehicle rating program, alternative fuel – blended petrol or diesel etc would help to reduce the emission.

Shri Giridhar Aramane stated that the government's mission of creating an energyefficient transport systems has placed emphasis on the electrification of transport as a whole and public transport in specific. Energy independence and energy security are important for policy independence. In this volatile world, energy sources need to be under national control, affordable, and easily accessible. India's transport system is transitioning as expected for an emerging middle-income country and personal transportation share is increasing. It is not prudent to see issues in compartments and rather see transportation as an integrated whole. India has transitioned to Bharat Standard 6 (BS-VI). Work towards improving the fuel efficiency of the transport system is needed. Regulations and standards for the transport sector are world-class. Devices to measure real-time pollution are being onboarded. Reduction of the per-kilometer emissions could be achieved through the circular economy principles. Scrappage policy has got appreciation

from investors and industrialists. A biofuel policy has been formulated and a successful ethanol policy is in place. India will achieve 20% ethanol blending in petrol by 2024. Diesel engines could possibly be replaced by clean hydrogen engines directly by retrofitting and making certain modifications. As ICE engines will continue to be in service to a certain extent, these measures will reduce emissions per kilometer. The public transport CESL tender recently attracted a good response. There is a program for 50,000 more buses, which will be procured on a service model and handed over to the state transport undertakings.

The government is taking a collective view of the entire transport system which includes road infrastructure.

Multi-modality and inter-modality are other important intuitives. Dedicated freight corridors, expressways, and inland water terminals are part of the proposed efficient means of transport. People should have a choice to select the most efficient and the cheapest option for them. Combining multi-modality with an efficient road network would facilitate efficient mode change.

Mr. Shwetal Shah said that transportation energy is going to be a major aspect in India's ambition of energy independence. Gujarat has formulated an EV Policy-2021. The policy subsidizes EV purchases. The creation of EV charging infrastructure and adoption of battery technology is important. Currently high-tension lines required for fast charging are not there. Apart from energy costs, the cost of infrastructure use is required to be incorporated.

Gujarat has experienced exponential growth in vehicle ownership in the past, which is increasing further. The development of an efficient public transport system is required on priority to check vehicle ownership. Gujarat has a great experience with

a ship recycling facility. New scrappage yards are coming up. It will help resource mobilization and improve the effectiveness and efficiency of the economy in enabling resource recycling.

Mr Saurabh Didi said India has made significant progress in reducing CO2 emissions per kilometre, which have come down from 130 gm/KM in 2013-14 to 110 gm/KM CO2 emissions in 2020-21. However, with implementation of BS-6, the emission per kilometer has increased due to a reduction in fuel efficiency. A shift from diesel to petrol has also added to this number. India already have corporate average fuel efficiency standards for light, medium, and heavy-duty vehicles and by end of the year this will be possible for two-wheelers also. BEE is also launching a star-rating system for tires which will improve efficiency by

up to 20 percent.

Shri Giridhar Aramane Secretary, MoRTH, Govt. of India

Mr. Shwetal Shah, Technical Advisor, CC Dept, Govt of Gujarat



Mr. Saurabh Did Director, BEE Govt. of India Hydrogen could be one of the major areas. With hydrogen vehicles range is not an issue as they can go for 500-600 KM in a single fill and there is no issue about grid capacity requirements. However, vehicle safety would be the key issue. In the short-term hybrid vehicles could be a good choice for emission

reduction as fuel efficiency could be increased by 30-40 percent. In long run, however, EV and hydrogen vehicles have to be envisaged.

Dr. Ritu Mathur said India has set a target for net zero by 2070. Hence, keeping the longer term vision in perspective, short and medium term measures need to be adopted such that the transitions align with the national development priorities as well as the NDC commitments. The decarbonization of the grid is essential for green electrification as a whole, but more so for the decarbonization of the transport sector. Multiple options such as hydrogen and biofuels would need to play a role. Decarbonization of public transportation fleets is going to make a big impact. The Government is making great headway by successfully scaling up electrification of bus fleets through its innovative model of increasing volumes by aggregating demands and homogenization of contracting terms. Further, differentiating between ownership and ridership by incentivizing public transport over private transport could have very positive long-term implications for the decarbonization pathway.

Mr Rahul Tongia mentioned that mobility is not only about vehicles. There is power grid, local infrastructure, charging, etc. A wholistic look including vehicle type - private or public, passenger or freight, road or rail etc., fuel type, and the entire ecosystem around it need to be looked at. From the state's perspective, it should be integrated with urban planning.

Railways and waterways (low energy cost transport systems) have a small share in total freight transport. Lack of standardization and palletization is important to increase the share in freight transport. The effort should be driven by the transport ministry in coordination with the commerce ministry and industry ministry. Lack of data capturing is another area driving the growth of under- regulated, semi-legal transport providers leading to inefficiency in the system. For passenger transport intermodal and multi-modal is the way to go. The electrical energy requirements of

mobility are trivial in the short to medium term. For an electric vehicle, we need to consider the life cycle emission not only marginal emission from the vehicle. The source of electricity used for charging is also important. Coal is the swing producer of electricity in our grid, hydro is can swing output but is limited in annual output, and used as a peaker.

One needs to consider the impact of 100 % electric vehicles on grid infrastructure. Quoting his own study, he questioned why India needs 500,000 public EV charging stations whereas approximately only 75,000 petrol pumps cater to all road transport, including 2-Wheelers and Trucks, which won't be early public charging infra users (2-Wheelers can charge anywhere). A hybrid electric vehicle would actually be a good solution for some use cases and cut down local air pollution by 90%.

Transport demand in India has been growing rapidly due to economic growth and higher ownership of vehicles per 1000 persons. The session recognized several policy measures for both central and state governments to reduce the carbon imprint of the transport sector. The following elements were viewed as key elements of the prudent strategy for the way forward and reform of the current policy framework

- Promotion of the use of public transport or dis-incentivizing private transport.
- Policies to support the adoption of EVs
- Making home charging easier

Ms. Ritu Mathur Senior Energy Economist, NITI Aayog

Mr. Rahul Tongia Senior Fellow, CSEP





- Fuel efficiency policies for the transport sector system-wide view
- Reducing the cost of EV through equitable business models
- Battery standardization and potential swapping

Session VI: Valedictory Session

In the valedictory session, Dr. Kirit Parikh made the closing remarks and outlined the way forward from the workshop to enable concrete outcomes. He expressed happiness that the workshop attracted wide interest comprising an audience of over 200 persons who attended in-person and virtually, and represented diverse backgrounds ranging from government, academia, expert institutions to the broader civil society.

Key Workshop Messages and the Way Forward

The Government of India (GoI) has conveyed its climate goals for the Paris Agreement, referred to as the Nationally Determined Contributions (NDC). How do these goals translate into state-level goals for renewable energy promotion and other actions? As per the constitution, many energy related sectors are concurrent list subjects and state actions are critical for the sector. Moreover, India follows multi-level climate governance where states play an important role in climate action planning and especially in the production of renewable energies. The conversation should start at the state level and blend into the National Policy Dialogue (NPD) to enable concrete actions at all levels.

Indian states are diverse in many ways. Accordingly, for a comprehensive analysis across state level variations, IRADe carried out a multi-sectoral study for three selected representative states, Gujarat- industrially advanced and urbanized, Odisha- a fast developing state, and Assam – a significantly hilly state. The chosen power, transport, industry, and agriculture sectors are the four major energy-intensive sectors with a major share of CO2 emissions.

The studies have looked at the opportunities and barriers to rapid deployment of renewable Power by the States with suitable central government support, through market-based solutions and viable business models, to increase renewable energy share in capacity/generation and contribute towards the achievement of the NDCs. Similarly, issues like the prospects and approaches for rapid deployment of solar pumps and electric vehicles through the collective efforts of the States and the Centre have been examined through the studies.

The workshop enabled these issues to be discussed across a wide array of stakeholders and concluded with the resolve that the studies and the deliberations need to be followed up with official and civil society stakeholders to pave the way for concrete outcomes leading to concrete and coordinated action by Central and State governments for timely achievement of the NDCs with the support of the broadest array of stakeholders.

Participants

The participants included central and state government policymakers, top officials, global and regional think tanks, NGOs, academics, private sector repetitive, independent professionals, and resource persons from more than 10 countries including Australia, Denmark, Bangladesh, Germany, India, Nepal, Netherlands, Singapore, United Arab Emirates, United Kingdom, and USA.

List of organization participated in-person or in virtual mode

1	Accenture	48	International Institute for Sustainable
			Development (IISD)
2	Amphitrite Éco Services Pvt Ltd	49	IIT Bombay
3	Bangladesh Heritage Foundation	50	India Energy Forum(IEF)
4	BMUV	51	Indian Gas Exchange Ltd
5	Bihar Renewable Energy Development Agency (BREDA)	52	Indian Institute Of Sustainable Development (IISD), New Delhi
6	Cando India	53	Indian Institute of Technology, Delhi
7	Central Electricity Regulatory Commission, New Delhi	54	Indian National Trade Union Congress -INTUC
8	Centre for Air Power Studies	55	Institute for Pioneering Insightful Research & Edutech Pvt. Ltd. (InsPIRE)
9	Centre for Policy Research(CPR)	56	International Renewable Energy Agency (IRENA)
10	Centre for Science and Environment (CSE)	57	Institute of Rural Management Anand (IRMA)
11	Centre for Social and Economic Progress (CSEP)	58	James Cameron & Co.
12	Centre of Excellence (NRM & Sustainable Livelihoods), MBDA	59	JBM Renewables Private Limited
13	Centre Of Excellence For Sustainable Development	60	National Institute of Labour Economics
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25	Department of Environment, Odisha	71	S&P Global
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Session I- Inaugural Session



Session II- Achieving NDC Goal Targets



Session III- Moderated discussion with State Representatives



Session IV- System of Power Supply and Finance for Solar Irrigation



Session V-Energy Efficient Transport System to Reduce Emission





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