POLICY BRIEF

POWER SECTOR

ENABLING STATE LEVEL CLIMATE MITIGATION ACTIONS

20 YEARS Integrated Research and IRADe Action for Development

MacArthur Foundation

IRADe-PB-1(2022)

Policy Brief

Mobilising Power Sector to meet state-level NDC

Enabling State-Level Climate Mitigation Actions in the Power Sector

IRADe-PB-1(2022)

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Executive Director,
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Abbreviations

APDC	Assam Power Distribution Company
AERC	Assam Electricity Regulatory Commission
AT&C	Aggregate Technical and Commercial Losses
BEE	Bureau of Energy Efficiency
CCS	Carbon Capture and Storage
CEA	Central Electricity Authority of India
COP	Conference of the parties signatories to the UNFCCC
DISCOMS	Electricity Distribution Companies
GHI	Global Horizontal Irradiance
GoI	Government of India
GW	Gigawatts
IRADe	Integrated Research and Action for Development
KM	Kilometer
kWh	Kilowatt hour
MoEFCC	Ministry of Environment, Forests and Climate Change
MoP	Ministry of Power
NDC	Nationally Determined Contributions
PPA	Power Purchase Agreement
PSUs	Public Sector Undertakings
RE	Renewable Energy
RPO	Renewable Purchase Obligation
RET	Renewable Energy Technologies
SAPCC	State Action Plans for Climate Change
SECI	Solar Energy Corporation of India
SERCs	State Electricity Regulatory Commissions
TWh	Terawatt hour

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1. Introduction:

India's commitment to the Paris Agreement is reflected in its Intended Nationally Determined Contributions (NDC). (Parikh, 2018). Since India, came close to meeting them already in 2022, at the Conference of Parties, CoP-26 meeting in Glasgow, Prime Minister of India, and Shree Narendra Modi, set more ambitious targets for 2030 as follows:

NDC 4: 50% of installed capacity for power sector based on Non-Fossil Energy

- **NDC 3 goal raised to achieving carbon intensity reduction of 45% from the 2005 level**
- **Achieving Net Zero target by 2070**
- **Reducing 1 billion tonnes of projected emissions from now till 2030**

In this policy brief, we shall discuss mainly the issues relating to NDC 4, where non-fossil includes solar, wind, biogas, biomass, hydro, and nuclear energy. It uses the insights attained from the case studies we carried out for the three states viz Gujarat, Odisha and Assam, as well as related national policies announced by the Government of India (GOI) from time to time. Through the three case studies, we have tried to understand the policies needed to incentivize states to meet their NDC goals and how we can generalize for the other states, depending on specific characteristics of each state such as REN potential and the demand levels.

Currently, the Indian power sector is still dominated by coal and lignite, with an aggregate installed capacity of 210 GW out of 393 GW total installed capacity, followed by renewable with 150 GW (Including large hydro) (as of January 2022, MoP). There has been a steady growth in India's renewable-based power generation from 62 TWh in 2014-15 to 140 TWh in 2019-20 (CEA, 2019; MoP, 2020).

The power sector falls into the list of concurrent sectors between states and centre government and is India's largest source of emissions. The electricity generation for public use accounted for almost half of the total energy sector emissions in India (shown in Fig 2), and reducing the sector's carbon footprint is essential where both the central and states are responsible for the execution of the plans, mandates, etc. Sector-wise installed capacity, fossil and non-fossil installed capacity, and % share are shown in fig.1 and 2, respectively. The renewable sector has been given encouragement by the centre since the 1980s. The GoI announces schemes; it often gets done by either requesting states or large public sector enterprises by giving incentives such as funds, technical support, etc. (Parikh J and P. Dhananjayan, 2020). Thus, central and state-level policies are required to transform the sector and contribute to the NDC Goals. The critical policy intervention to promote non-renewable energy utilization is the Renewable Purchase Obligation (RPO) on distribution entities. In accordance with Section 86(1) (e) of the Electricity Act 2003 and the Tariff Policy as amended in January 2016, the RPO prescriptions required the State Electricity Regulatory Commissions (SERCs) to reserve a minimum percentage for the purchase of renewable energy to reach 8% of the total consumption of energy, excluding

Hydro Power, by March 2022 or as may be notified by the Central Government from time to time. The Government of India, in July 2018, notified the long-term growth trajectory of renewable Purchase Obligations (RPOs) for solar and non-solar, uniformly for all States/ Union Territories, to reach 21% by 2022, with 10.5% of this reserved for solar-based electricity. Renewables for this purpose include solar, wind, biomass and small hydro. Large hydropower is not included in this obligation.

In this context, it is arguable whether reserving part of the NDC for solar-based power undermines the interest in optimizing RE source choices based on the particular endowments and capacities of States. While assessing the carbon footprint of States, there is also a need to factor in the reality that while some states are significant generators of fossil-based power, its utilization is not confined to them but happens across the country. This paper aims to identify some possible directions that could be taken in the backdrop of these underlying facts.

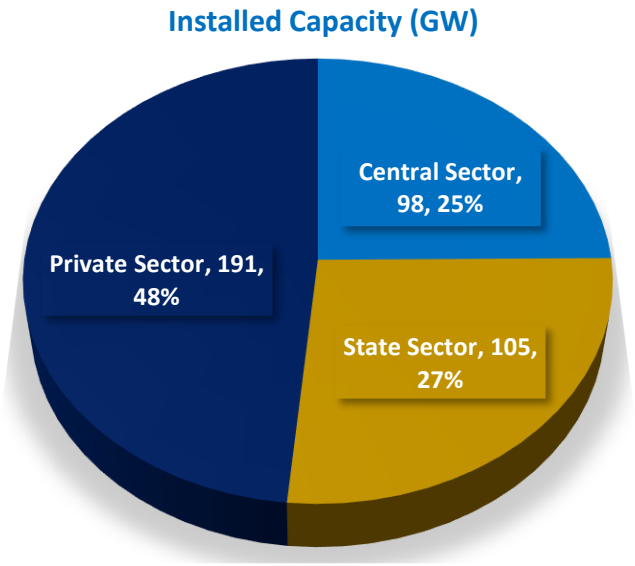

Figure 1. Sector-wise installed capacity and percentage share

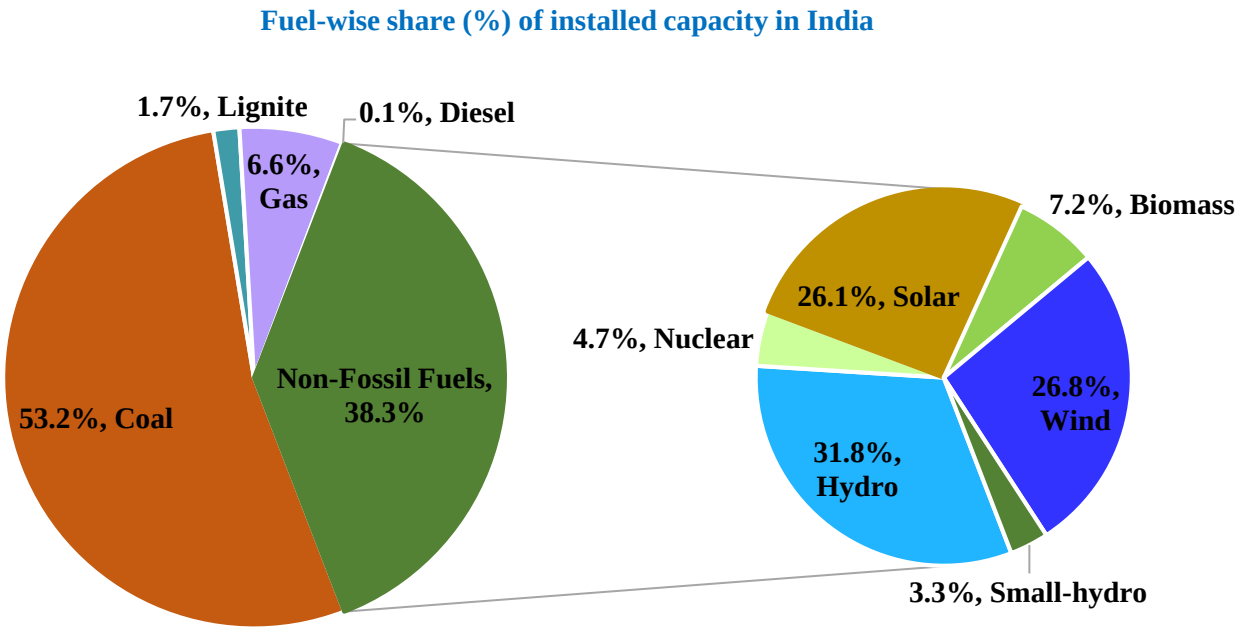

Figure 2: Fossil Fuel versus non-fossil fuel installed capacity and percentage share

Objectives

The policy brief addresses critical aspects related to the needed actions by the states in India towards renewable energy deployment target, quite connected to each other such as –

- What are the current programs at the state level that aim to increase the share of RE, viz 38% to 50% non-fossil capacity?
- What state-wide initiatives are aimed at higher RE deployment and the achievement thereof?
- What measures are needed to ensure cooperation and synergy between central and state efforts?
- What combination of renewable energy-related policies could maximize contribution to achieving India's NDC targets?

In addressing these objectives, the policy brief highlights the country and state-level progress towards the NDCs concerning the regulatory, market, operational and other interventions. It provides technical and policy recommendations for the Private and State sectors and the broader array of stakeholders for achieving the NDCs.

2. Existing and the projected scenarios of the power capacity growth

Electricity demand in the country has increased rapidly and is expected to rise further in the coming years because millions of households have had access to electricity only in the last decade. Consequently, the demand will naturally increase with the graduation from bulbs to appliances. Moreover, the overall GDP growth goal of the economy requires massive addition to the installed generating capacity. Total Generation, including from RES in the country during 2009-10 to 2021-22, ranges from 800 BU to 1200 BU. Commensurate differentials in growth rates would be required to transform from the current fuel mix to the targeted fuel mix proportion to be achieved by 2029-30, as projected by the CEA. This scenario is shown in Fig. 3.

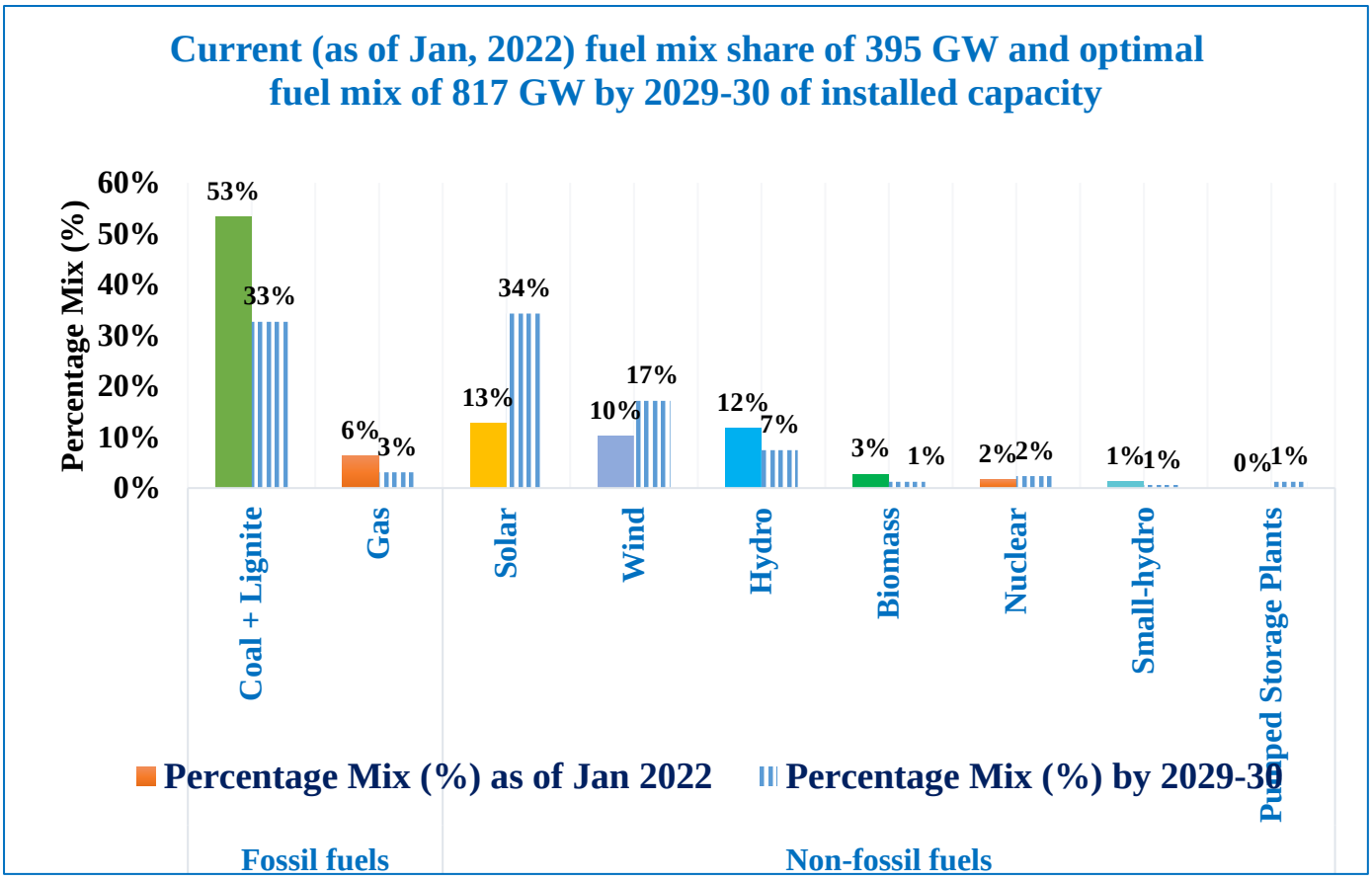

Figure 3: Fuel mix share in installed capacity of 395 GW and optimal fuel share mix of 817 GW by 2029-30 (Data Source: CEA, 2020; MoP, 2020)

3. National-level as well as state-level NDC achievements

As of Dec 2020, the country already reached a 38% share of non-fossil fuels[1] in the total installed capacity. Sixteen states have more than 38% of non-fossil fuels in their total installed capacity, as shown in figure 4; among these states- Andhra Pradesh, Gujarat, Karnataka, Rajasthan, Tamil Nadu, and Telangana are high-power capacity states (combined power capacity 164 GW). These states are performing well in renewable energy as non-fossil fuels contribute 50% of their installed capacity and comprise 70% of the country's total installed capacity at the end of 2022.

The remaining ten states- contribute more than 50% of the country's large hydro-installed capacity. These states have zero thermal power plants, and hydropower contributes more than 75% of the total installed capacity. There are 16 states- Karnataka, Tamil Nadu, Rajasthan, Telangana, Andhra Pradesh, Gujarat, Maharashtra, Punjab, Madhya Pradesh, Odisha, Uttar Pradesh, West Bengal, Haryana, Bihar, and Chhattisgarh in India that have fossil fuel installed capacity of more than 5000 MW each. Among these, the six states have a non-fossil fuel share of more than 40% of the total installed capacity, whereas Maharashtra and Punjab share 34% and 32%, respectively, as shown in figure 5. Among the remaining seven states- Madhya Pradesh, Odisha, West Bengal, and Chhattisgarh are major thermal power producers as many of India's most prominent thermal power stations (Super Thermal Power Stations) are situated in these states, and around 63% of the country's coal reserves exist in these states.

State-level non-fossil fuel share with their installed capacity is depicted in fig. 5. Maintaining this share of the mix and increasing it to 50% by 2030 will require robust policy and regulatory decisions and strong -public-private engagement. However, often the shares can change fast as the gestation periods or construction times are short for the renewables. Yet, the states like Uttar Pradesh and West Bengal have yet a long way to go.

3.1. Renewable resource distribution

Figure 5 shows the states level distribution of solar and wind resources.

[1]Non-fossil- Large hydro, Nuclear and Renewable; Renewable- Biomass, Small hydro, Solar, and Wind

State-level installed capacity non-fossil fuel share in India

Attaining 38 % national a share as per Paris agreement in every state level non fossil shares of the installed capacity

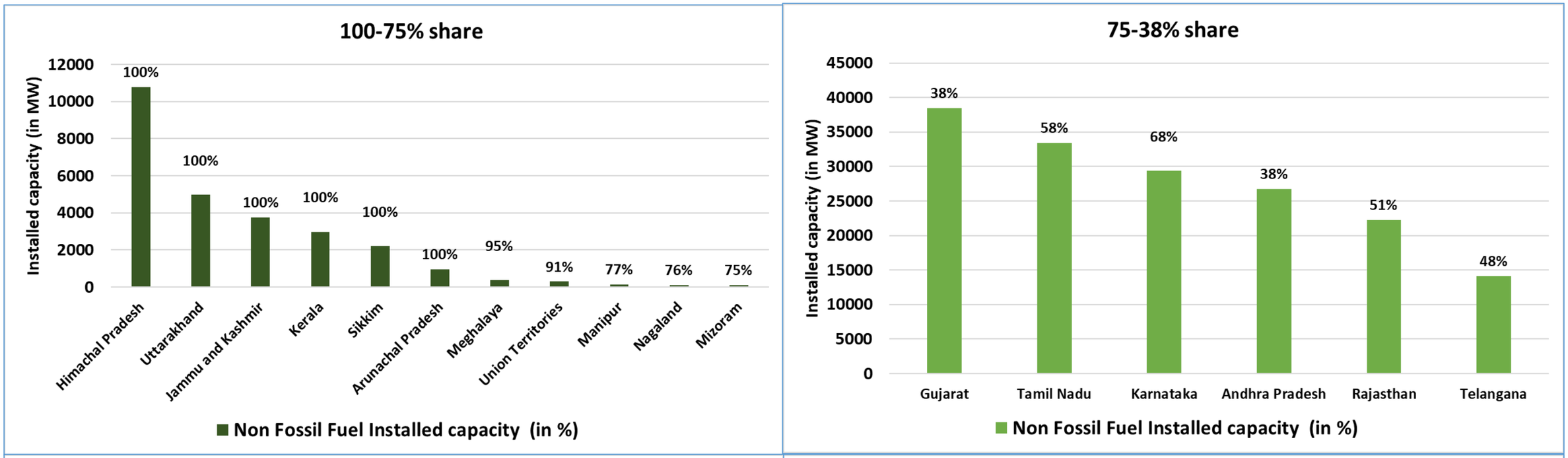

Figure 4: States with non-fossil fuel share category-wise share in India

(Data source: CEA, IRADe)

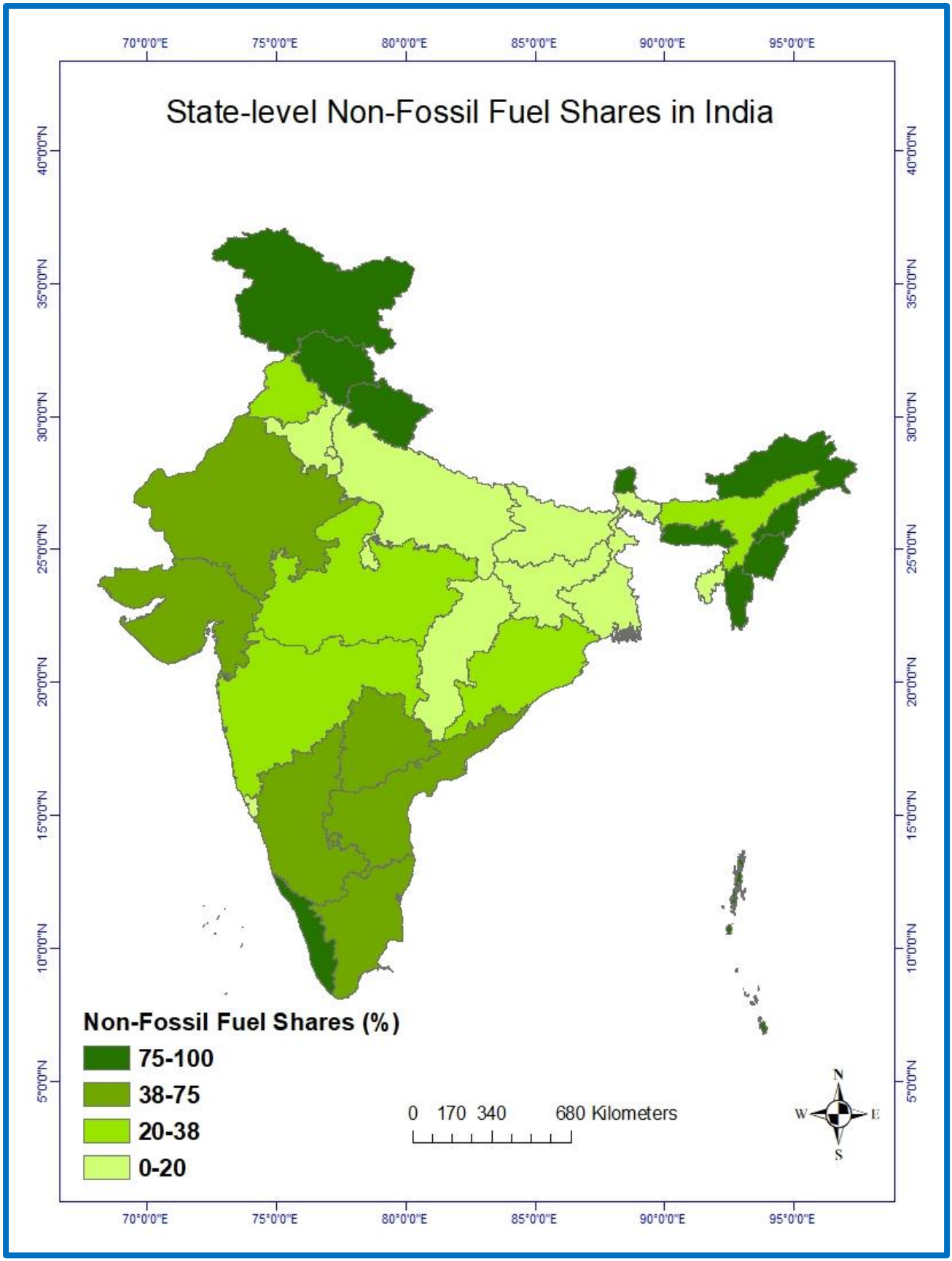

Figure 55: States level non-fossil fuel share w.r.t their installed capacity
Authors construct, Data Source: MoP, 2020)

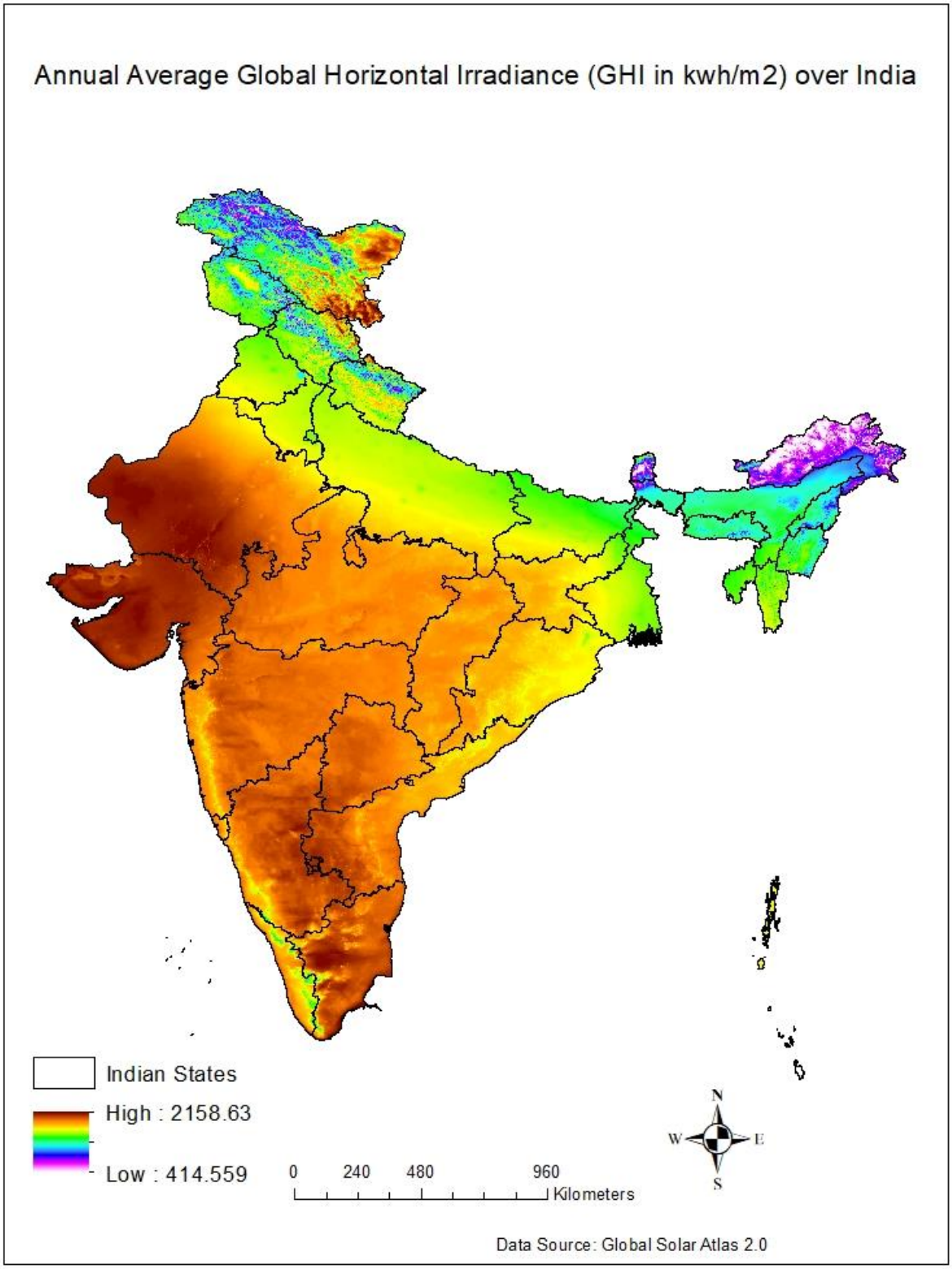

Figure 66: India's annual average Global Horizontal Irradiance (GHI) map.
Data Source: Global Solar Atlas 2.0

There is wide variation across states in their hydro and renewable energy resource endowments. The policy to attain NDC targets or Glasgow goals should consider these differences. The eastern states have less renewable resources. They have large coal resources. Thus a combination of mandate and incentives will be needed. The recent investments in transmission corridors will help as well. Availability of hydro resources corrects the differences to some extent and some also due to coastal wind power.

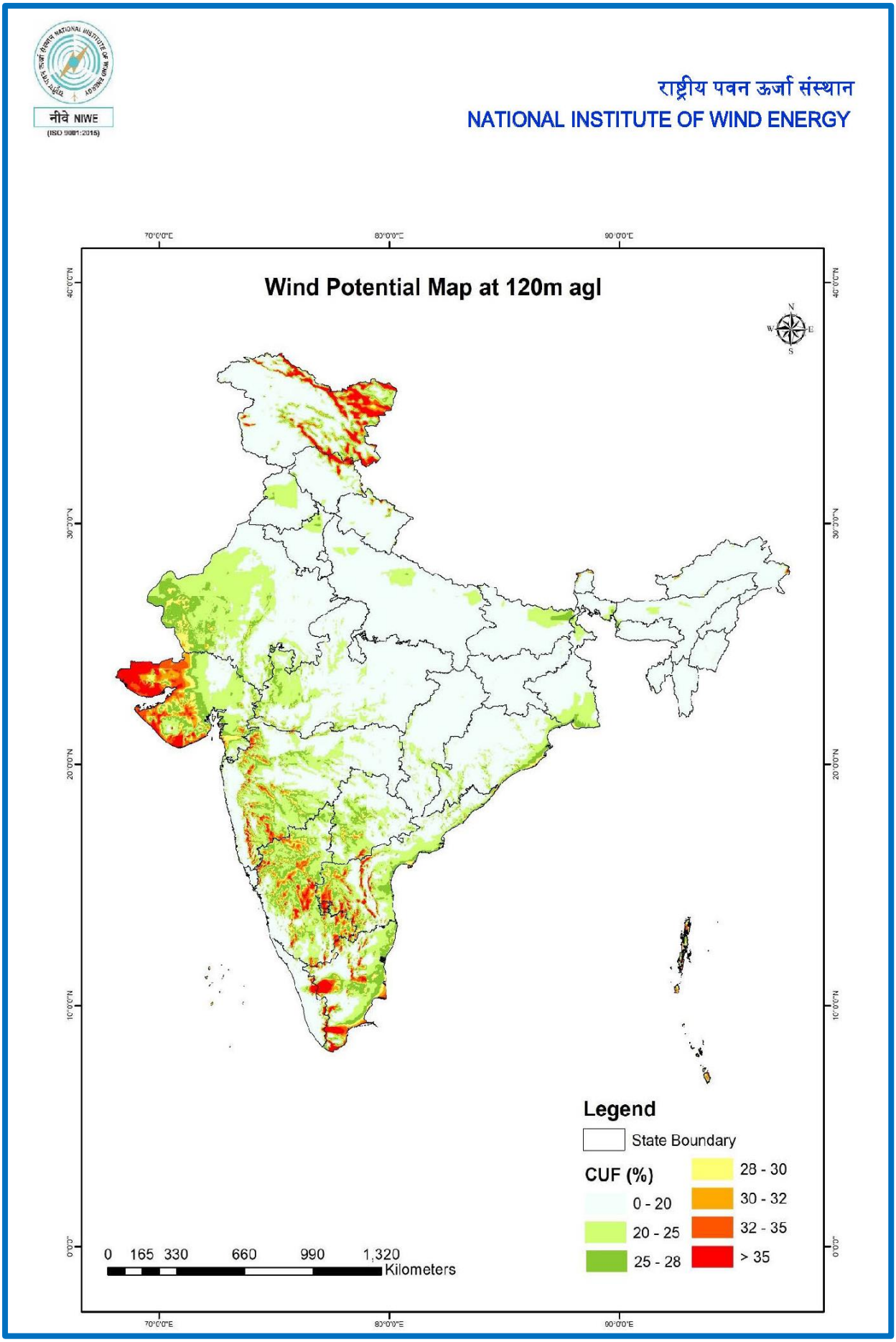

Figure 7: Wind Potential Map of India at 120m ago

4. Comparative analysis of the three chosen states

Gujarat, Odisha and Assam were chosen to study different situations. We have chosen 3 representative states - developed (Gujarat), developing (Odisha) and hilly terrain – NE location (Assam) to enable learnings to be implemented in other similarly placed states. Gujarat is well known for its capacity on account of its mature economic and commercial environment and a commensurately diversified industry profile. It could be a model for some of the other developed states in India. Odisha is one of the fastest-growing states in India, which has rapidly transformed significantly and overcome low administrative capacity and severe economic and livelihood fragility, and now represents a model for other developing states in India. It has also achieved significant industrial capacity based on its vast mineral reserves. Assam is a state representative of the uniquely socio-economic and logistical challenges, geo-climatic and from socio-economic perspective. It is in a hilly region in the North-Eastern part of India, Each state's power sector has its unique and dynamic value chain for generation and distribution. Detailed power sector studies of the selected 3 states done by IRADe are captured in the documents IRADe-PR-76(2021), IRADe-PR-77(2021) and IRADe-PR-87(2022). To achieve the national RE target of 175 GW by 2022, each region and each state was given a renewable energy deployment target.

4.1. State-level main power sector policies for achieving India's NDC target

The policies in the power sector followed by the Governments of Gujarat, Odisha and Assam are briefly described in Table 1.

Table 1: State-level power policies for achieving NDC target

State	Policies	Objectives
Gujarat	Gujarat Solar Power Policy 2015	Scale up solar power generation in a sustainable manner
	Gujarat Waste to Energy Policy 2016	Promotion of Municipal Solid Waste (MSW) utilization as a renewable resource for the Generation of electricity
	Gujarat Wind Power Policy 2016	Promotion of power generation through wind energy
	Gujarat Wind-Solar Hybrid Power Policy 2018	Promotion of large grid-connected wind-solar PV hybrid systems for effective utilization of land and transmission infrastructure
	Gujarat Small Hydel Policy 2016	Promotion, facilitation and incentivization of investments in small hydel projects
	Gujarat Repowering of Wind Projects Policy 2018	Promotion of optimum utilization of wind energy resources by creating the facilitative framework for repowering
Odisha	Odisha RE Policy 2016	To increase the total capacity of RE to 2.75 GW by 2022
	OERC Regulations 2015	To achieve 11 per cent of the total RPO target (5.5 per cent each from solar and non-solar) by 2019-20.
	OERC Regulations, 2019	Facilitate the development and management of RE generation and supply through mini-grid projects.
Assam	Small Hydropower (SHP) Development Policy, 2007	Identifies the potential sites and encourages the private players in the SHP development in the state. Focus on improving the existing SHP projects
	AERC RPO Regulations, 2010	Effective implementation by the obligated entities (OE). Upon failing RPO compliances, AERC directs OE to deposit an amount equivalent to the forbearance price of REC for target shortfall.
	AERC RE Tariff Regulation, 2012	Regulations provide norms for the determination of tariffs for RETs.

	Co-generation & Generation of Electricity from RE, 2015	Promote grid-connected RETs, determination of intra-state open access charges, and wheeling and banking charges for RETs.
	Grid-interactive Solar PV Regulations, 2015	Provide a framework for net-metering, energy generated and consumed by OE or eligible consumers by solar rooftop accounted towards RPO compliance.
	State RE Action Plan, 2017	Identify potential measures, policy, and regulatory framework to achieve the RE capacity addition target by 2022.
	Assam Solar Energy Policy, 2017	To create an enabling environment for businesses and developers to participate and invest in targeted solar power capacity expansion of 590 MW by 2019-20.
	Grid-connected Rooftop Solar Power Plant Programme, 2019	Promote the grid-connected solar rooftop power plants among the residential, community, institutional, industrial, and commercial establishments

4.2. State-level Market-based mechanisms to achieve NDC targets

A key issue with RE scale-up is resolving the technical problems emerging from significant increases in intermittent generation and doing so at the least cost and without major disruptions to electric grids. Fundamentally, a market-based power system needs to add two more components to long term fixed contracts:

(i) A power market (wholesale or spot) is needed for transactions before dispatch, say up to 30-minutes before dispatch (at which point the "gate closes"), to attain efficiencies through competition and where commitments of Generation and off-takes are binding;

(ii) Also a spot market is needed in the exchange for dealing with deviations from committed quantities after the said period.

These mechanisms may be coordinated by an entity, such as an independent power exchange or the State Load Dispatch Center, which can be responsible for all physical aspects of the grid. This market mechanism can provide a platform for fulfilling RE goals while generating consequences for imbalances. Such an arrangement can potentially simultaneously enable the following outcomes:

- Ensure that any imbalance-causing party, including exporters, bears the cost of the imbalance, as is the common practice globally.
- Elicit better response from newer technologies that are significantly more flexible, e.g. rapid ramping thermal or even battery-based or another form of storage and demand response (including via virtual power plants) and incentivize storage technologies and investment.
- Maintenance of grid discipline, compliance with market rules and putting in place a dispute resolution mechanism.

5. Mechanisms for promoting renewables for achieving NDC target for the power sector

The summary above shows that while many states have achieved the NDC target, some still need to do that. Consistent with this reality, a nuanced policy and regulatory framework with suitable flexibility for addressing inter-state variations in underlying circumstances need to be in place to develop renewables to achieve the set goals across states. The constituent elements of such a policy framework could include the following.

5.1. Market-Based policy recommendations and incentives

Currently, all states are required to achieve specific RPO targets, or they can alternatively purchase certificates linked to complying entities elsewhere if they do not comply themselves or the costs are high for them.

5.1.1. Renewable Power Purchase Obligations (RPO):

Compliance with RPO obligations by DISCOMs is a key instrument for the states to orient the power sector towards fulfilling the NDC goals. However, in many instances, DISCOMs in the states cannot fulfil their RPO obligations due to the scale of their committed power purchase agreements (PPA) from fossil fuel plants relative to current demand, which does not leave sufficient unmet demand that can be met through renewable electricity. Thus, RPOs should be set, considering these problems of DISCOMs.

- RPOs should account for the committed PPAs of each DISCOM and need to be set and phased so that a high % of new demand is met from renewables to eventually reach the overall targeted percentage.
- Thus, based on the expected growth in power demand for DISCOM, an RPO trajectory for the next five years could be prescribed.
- For captive Generation, RPOs could be separately prescribed.

To reconcile the RPOs, which are in terms of energy, with the NDCs, which are in terms of Power capacity, the latter could be converted to power generation capacity using the average load factors of solar, wind and other renewables, which are known. The CERC can aggregate the RPOs of different agencies and decide to what extent they need to be revised to meet the NDC target.

Regulators have been conservative in fixing the RPOs, and even these modest targets are often not enforced. Thus, GoI policies must incorporate incentive mechanisms to encourage states to set and fulfil higher RPO targets. This approach can incorporate a suitable trajectory to be followed with appropriate flexibility so that the RPOs keep increasing year by year and reach the required level within a compact timespan. If these provisions are placed in the Electricity Act, these issues would not depend on the regulators. Alternatively, GoI could be given the statutory right to fix the levels and their trajectory.

5.1.2. Renewable Energy Certificates (RECs):

Those unable to meet their RPO can purchase REC. A plant generating renewable electricity can sell it to anyone. Any electricity sold to DISCOM more than what it needs to meet its RPO can earn a REC for every 1 MWhr for the generating plant. The REC can be sold on the power exchange to other entities who need it to fulfil their RPOs. Due to a lack of enforcement, there is a surplus availability, and many RECs still need to be sold on the exchanges. Some states have even dishonored their signed renewables PPAs with renewable power generators, which has hit the renewable power sector hard.

If the RPO levels are transparently set and enforced, as suggested above, they can be acceptable to the states. This would enable the RECs to be more effective market-based mechanism for meeting the RPOs. A Long term view may be taken to shift to NDC obligations rather than the RPO obligations followed currently.

5.1.3. Promoting Engagement from the public and private sectors:

Various public and private sector entities in India have pledged to be a part of India's 500 GW target by 2030. Many large public and private companies have announced their ambitious clean energy goals. It will encourage small players to get involved in the supply chain as well as downstream business. Major Private Companies can promote private investment in renewable energy sources. Players among various conventional and renewable energy chains whether central, state or private producers, need to come together to develop hybrid systems with renewable resources.

5.2. Regulating and enabling mechanisms

5.2.1. Strict environmental laws and enforcement for fossil fuel-based power plants

The environmental acts prescribe emission norms for generation plants. If implemented effectively both air pollution and carbon emissions can be reduced. Thermal power companies would apply them by factoring in the negative externalities they involve Non-critical older plants would be phased out because of non-compliance with norms or merit order principles. This would be in keeping with the international practices, which strictly impose prudent emissions for fossil fuel-based power plants to reduce also carbon emissions. Recently, the Environment Minister, GoI, stated, "**We will use coal critically; non-critical (uses) would be phased down".** Older plants' efficiency is lower, emissions are higher, and they could be scaled down.

At a broader level, suitable incentives could be considered for encouraging progressively higher operational efficiency and technological progress in thermal power plants to lower carbon emissions per unit of generation.

5.2.2. Re-estimating potential:

Currently, the solar potential of the states is estimated by taking the land availability based on 3% of wasteland as area available for solar. Wasteland is classified as Forest and Non-Forest. Forest land is further classified under Reserve Forest area of Demarcated Protected Forest (PDF) and under marketed Protected Forest (UPF). The estimate of 750 GW is highly conservative and even unrealistic. For a proper solar potential assessment, a better estimate of the availability of land in India is required. Non-forest waste land belonging to Panchayat, Govt. and individuals, roadside land, railway land, urban rooftops, etc., are possible. In any case it is clear that a much more area may be available for solar generation.

5.2.3. Net Metering with time-of-day tariff:

Many DISCOMs are reluctant to promote rooftop solar plants as that would reduce the consumption of well-paying, high-end consumers who have roof tops. These consumers will need electricity at night, for which DISCOMs will have to provide capacity. To ensure commercial fairness, capacity charge and suitable time-of-day tariff could be imposed on rooftop consumers, and net metering could be at the TOD tariff rate. DISCOMs would not then see rooftop solar to be eating into their revenue but can augment their generation. This would encourage more net-metering and gross-metering solar rooftops, especially on the part of the resource deficit DISCOMs. Incentives for DISCOMs may still be needed. This may be provided based on their performance in capacity augmentation.

5.2.4. Grid Management and Grid Balancing:

Grid management needs out-of-the-box thinking and significant decisions. With the future increase in solar and wind, the renewables-rich states will experience periods when wind and solar represent the majority of generation. This may affect the system stability. As India transitions to higher renewable generation levels, improving system flexibility while ensuring electricity security and reliability would require services from a more diverse range of technologies on both the demand and supply sides as well as market based approaches, there may be resources available to purchase from to balance the grid, which need to be estimated.

5.3 Institutional mechanisms for state level climate action

Currently, there are two types of state level institutions.

5.3.1. Ministry of Environment, Forest and Climate Change of India (MoEFCC)

Ministry of Environment, Forest and Climate Change of India (MoEFCC), Government of India encouraged states to develop state action plans for climate change (SAPCC). These plans focus mainly on climate adaptation because such actions fall in the purview of the state. But the states need to set up a system for addressing climate mitigation also, and prioritise action with multiple benefits engaging with other ministries viz, energy, power, transport and industries. Much of the action required may lie with these ministries. To involve them awareness criteria need to be developed and discussion platforms may be set up.

5.3.2. State level nodal agencies

The power ministry has setup of REC and also state renewable nodal agencies in each states. For at least 3 decades these agencies are largely RE action at the state level. They need to be restructured to fulfil a much larger role.

5.4 Encouraging Technical Transformation

Significant technical changes would be required to achieve such a major transformation.

5.4.1. Storage technologies:

The government incentives could be provided for developing and installing energy storage technologies, such as batteries, hydrogen, pumped storage, etc., to create a more reliable grid system. Pumped storage sites should also include off-river sites. They need to be identified, and incentives to build pump storage plants are provided. Storage capacity will encourage the use of renewable energy and manage renewable energy variability. R&D efforts in this area need to be widened significantly.

These methods could provide coverage to unserved areas through decentralized self-contained RE-based generation systems despite of intermittent Generation addressed through such storage options to enable 24/7 supply.

5.4.2. Rooftop solar installation:

New business models are required to promote solar rooftop projects, such as utility-owned rooftop systems, RESCO (resident's society cooperative) owned rooftop systems, and payment assurance models by the utilities. The Utilities can enhance rooftop solar deployment by facilitating or by directly investing (PACE-D, 2018). Only some states participated in the solar park schemes, which required them to agree to buy 20% of the power.

Govt. establishments as well as private and public sectors need to have rooftop solar targets in a definitive timeframe. Solar rooftop provisioning should be compulsory for new buildings, schools, colleges, universities and other large public and private organizations, as also in urban areas for stadiums, hospitals, municipal buildings, large shopping complexes, parking spaces, etc. For the rural areas farms can supply solar and wind energy if a suitable micro, mini and main grid architecture is developed gradually.

5.4.3 Transmission infrastructure:

Transmitting solar can be expensive if the generating stations are at a distance, partly because the line would be used only for some hours during the day. Govt. can invest more money in transmission infrastructure to link the power plants to demand centres. However, as per MNRE, the second phase of the green energy corridor project will involve adding approximately 10,750 circuit km (km) of transmission lines and 27,500 mega volt-amperes (MVA) transformation capacity of substations. Govt. has cleared a ₹120 billion plan to set up infrastructure to transmit electricity from renewable energy projects, as it seeks to substantially boost the output from green sources by 2030.

6. Concluding comments:

The current national and state-level NDC-related scenario in the power sector in India, related to enhancing renewables use, is discussed in this paper. Three case studies viz from the relatively advanced Gujarat, developing and highly coal endowed state (Odisha) and hilly terrain state Assam. Clean energy transition can decrease fossil fuel dependence and fulfil the NDC commitments. In India, some regulatory measures are in place, but they need to be strengthened, better enforced and dynamically combined with market-based mechanisms, keeping in mind the fast-developing and changing power systems scenario across various states. Many states have substantial renewable energy potential, but this needs to be harnessed swiftly with coordination and cooperation among the central and state governments. Energy policy needs to be aligned with energy availability, energy security, climate change and environmental concerns. It needs to be recognized that:

- Generation companies will set up plants if they get a guaranteed market-based mechanism for recovering costs. The DISCOMs need a commercially sound basis to buy RE and fulfil the RPO with suitable accountability mechanisms.
- Transmission utilities (along with DISCOMS) also have a very important role; they have to set up transmission lines to exploit RE, for which financially viable mechanisms have to be implemented as a part of the policy. Govt. has a green corridor scheme for this, under which concerted efforts and adequate investment are required.
- RE-related goals can only be achieved smoothly and cost-effectively in an efficient and financially sound power sector operating at best practice normative operating standards and minimizing and recovering the supply cost. Towards this end, the high level of T&D and theft / commercial losses of the distribution utilities need to be addressed through technical solutions like fused cables and pre-paid metering, individual and institutional incentives and accountability mechanisms, and institutional change/transformation. It must be recognized that these inefficiencies and waste add to the carbon emission footprint of the power sector.
- Above all, coordinated efforts of the centre and State governments, aimed at ensuring financial viability, are required to encourage the private sector to ensure accelerated growth of RE.

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About Integrated Research and Action for Development (IRADe)

Integrated Research and Action for Development (IRADe) is an independent advanced research institute which aims to conduct research and policy analysis to engage stakeholders such as government, non-governmental organizations, and 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. Being Asia Center for Sustainable Development, we have been carrying out policy research and its implementation for enabling socio-economic growth and charting pathways for sustainable development in South-Asia.

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

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