



INDIA
2022

GREEN RECOVERY THROUGH RENEWABLES

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AJAY MATHUR, Ph.D Director General

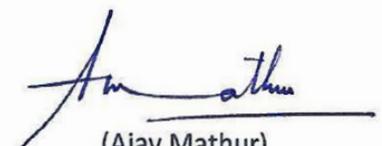
Foreword

During the past two years, as we have faced the unprecedented economic and social disruptions due to COVID 19, renewable energy has provided a strong pillar for sustained economic growth. This is because of the near-zero marginal costs of green energy, which have made them extremely competitive in markets across the world. India, and other countries who have prioritized investments in building green infrastructure have seen positive results, and they provide a unique opportunity to learn about the positive linkage between economic recovery and energy transition.

India, which has been amongst the most favourable countries in ISA's Ease of Doing Solar, committed more public money than any other economy to date to support the energy sector since the start of COVID-19, out of which a significant portion goes to renewables. The country is currently expected to be on target to meet its commitments at the Paris Agreement before 2030. Renewables and other green technologies will also play a decisive role in India's 'Net Zero' journey by 2070. India's recovery provides a unique opportunity to move towards a greener and more regenerative economy.

This report provides guidelines on the key components for the recovery package with the associated benefits and constraints. The study adopts a holistic view, examining a range of solutions across manufacturing, generation distribution and storage that complement each other. Increasing the share of renewable power in the energy mix will have a high multiplier effect on economic activity, job creation, healthcare, and overall societal well-being. Renewable technologies will also provide an opportunity to incubate new ventures and scale up domestic businesses that have a significant export potential.

I congratulate WWF on studying this critical topic in-depth and am pleased that this report sheds light on some crucial areas in the renewable power space that can simultaneously bring some quick wins on the economic and sectoral front.



(Ajay Mathur)
20th December 2021

ABSTRACT

Across the world, COVID-19 has revealed economic vulnerabilities as well as risks inherent in the conventional energy supply chain. Countries worldwide are adopting different approaches to recover from the shock of the pandemic. Many countries have chosen to adopt the energy transition pathway as a part of their recovery package. Some countries, including Germany, the UK and South Korea, have designed their entire recovery packages around green energy and sustainability.

India too, is in a position to leverage these global learnings and develop a robust strategic framework to boost the renewable power sector. While there have been financial incentives for solar module and battery manufacturing in recent times, a more comprehensive framework for renewables is required to catalyse long-term growth in this sector, achieve Nationally Determined Contributions (NDC) targets, boost economic prospects and create jobs.

The objective of this report is to make a case for a focussed impetus on clean energy, environment and sustainability to spur economic recovery of the country. For India, such a recovery package would serve many purposes, such as improve energy security, reduce dependence on fossil fuel and energy imports, improve air quality, and provide reliable energy to its citizens while creating new jobs and driving technological innovation.

Keeping in view the limitations around the scope and depth of this exercise, the report looks only at providing a boost specifically to renewable power. Broader sustainability, conservation, and power sector-specific issues like market reforms and DISCOM restructuring have been intentionally left out, given their large magnitude and complexity. The objective behind the various recommendations is to provide directional guidance to policymakers rather than detailed, precise measures. We have aimed to shed light on crucial areas that can bring some quick wins on the economic and sectoral front. We accept that each recommendation needs careful consideration and calibration to make it consistent with broader policy objectives.

EXECUTIVE SUMMARY

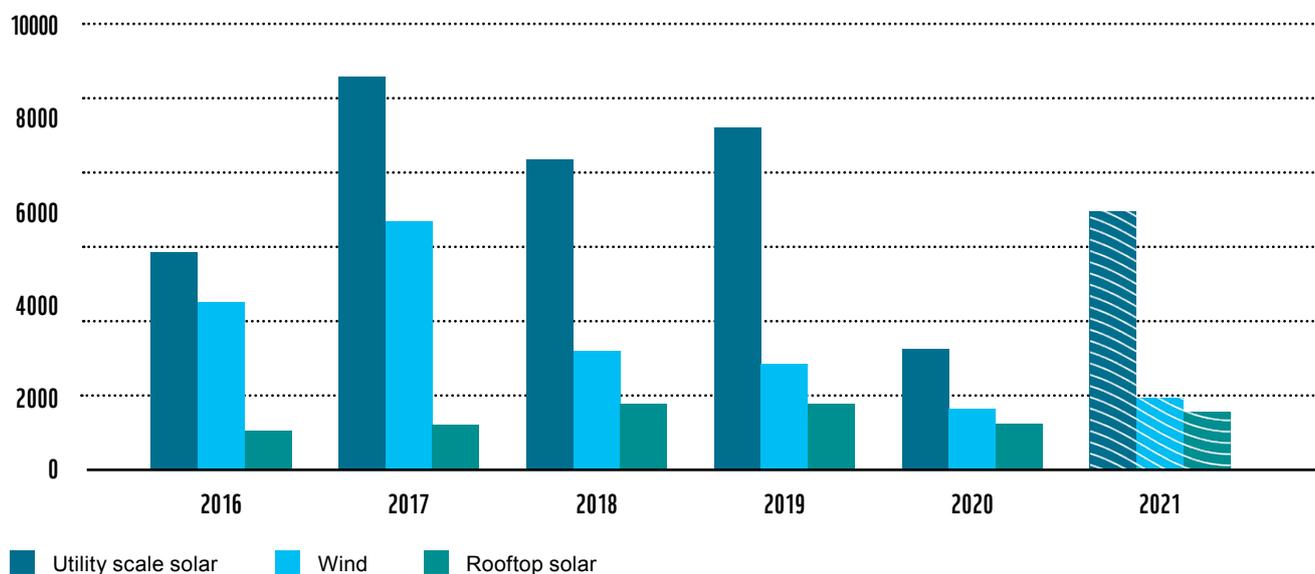
COVID-19 has sent shockwaves to countries globally, causing a historic collapse in global output. India's GDP contracted by 7.3 per cent during the financial year 2021, the first contraction of this magnitude in over four decades.

A consensus is emerging that it would take at least two-three years to recover from the crisis completely. The macro-economic impact of the crisis is feared to have caused permanent demand destruction, job losses, impairment in investment appetite and public finances. Oxford Economics forecasts India's average growth

during 2020–25 at 4.5 per cent, a downward revision from the pre-COVID-19 forecast of 6.5 per cent.¹

DISCOMs have been the worst hit with an estimated 6–8 per cent dip in annual revenues and lower payment collections from consumers within the power sector. Project construction has also been hit hard by supply chain disruption, labour shortages and restrictive work practices. The slowing down of renewable power capacity implies that India needs to significantly ramp up efforts to achieve its ambitious 2030 target of 450 GW.

Figure 1: Renewable Power Capacity Addition, MW



Source: BRIDGE TO INDIA research

Note: For 2021, estimates have been shown

¹ www.business-standard.com/article/pti-stories/oxford-economics-revises-downwards-india-growth-forecast-pegs-at-average-4-5-pc-for-2020-25-120111900972_1.html

With a stretched fiscal position, the Indian government has exercised significant fiscal restraint in total stimulus spending. Its focus has been primarily on providing liquidity, free food rations and fiscal support to agriculture

and small and medium enterprises (SMEs). However, as economic uncertainty abounds, there is pressure on the government to provide greater stimulus and undertake new measures to boost growth.

CASE FOR A GREEN RECOVERY PACKAGE

The pandemic presents a unique opportunity before the Indian government to stimulate the economy while simultaneously paving the way for faster energy transition through the growth of renewable power. Greening the energy basket can produce a sustainable and resilient recovery as the sector has a high multiplier effect on economic activity, leading to job creation, better healthcare and overall societal well-being. According to an International Renewable Energy Agency,² investment in renewable energy yields

economic savings eight times more than costs when it makes provisions for these associated social benefits.

Various studies prove that clean energy technologies such as solar are far more labour-intensive than conventional energy sources in addition to offering higher energy security. Clean energy technologies also provide an opportunity to incubate new ventures and scale up domestic businesses with significant export potential.

Table 1: Supporting Market Trends for a Green Recovery

‘Business of future’	A growing number of businesses are trimming their carbon footprint to meet regulatory mandates and to showcase sensitivity to environmental causes.
Growth of clean energy technologies	New technologies are reducing cost of clean energy at a fast pace, rendering it more competitive than conventional alternatives.
Notable shift in investment preferences	Growing environmental, social and governance considerations in the finance community are lending significant momentum to green energy transition.
Dynamic and resilient grids	Energy utilities across the world are adapting their business models and investing in new technologies to make power grid more flexible.

2 IRENA (2020), The post-COVID recovery: An agenda for resilience, development and equality

As part of the green recovery package, the government's specific priorities should be four-fold:

1	Job creation for a trickle-down effect to restore consumption	3	Enhancement of economic competitiveness for improved trade prospects
2	Injection of liquidity for financial relief and spurring demand for green fuels	4	Ensure progress towards energy transition in all of the above

For job creation in the renewable power sector, the government should prioritise distributed renewables and manufacturing. Financing support to segments such as distributed renewables, smart meters, and storage can help make the grid more resilient and cost-effective. Strong impetus for research and development (R&D), technology development,

digitalisation and local manufacturing can build new competencies and spread economic benefits across the whole value chain.

A broad package of measures has been designed, bearing in mind key sector priorities and fiscal limitations.



Table 2: Key Elements of the Proposed Green Recovery Package

TECHNOLOGY DEVELOPMENT AND MANUFACTURING	
Create strong R&D capability	<ul style="list-style-type: none"> • Harness existing domestic research resources • Set up a national renewable research agency • Provide subsidised financing and infrastructure • Tie-up with international institutions
Support domestic manufacturing	<ul style="list-style-type: none"> • Maintain consistency in policy signals • Implement a progressive subsidy structure to incentivise the adoption of advanced technologies • Ensure domestic demand
Create a circular economy for metals and minerals to meet the demand for manufacturing	<ul style="list-style-type: none"> • Focus on recycling of metals and minerals from industrial, electronic and electrical waste
Develop a hydrogen roadmap	<ul style="list-style-type: none"> • Rollout the National Hydrogen Mission in a timely manner
STORAGE	
Scale-up deployment	
Reduce cost for early adopters	
Develop pumped hydro project sites	
Formulate enabling policy and regulatory mechanisms	
POWER GENERATION	
Tap into growing renewable power demand from C&I consumers	<ul style="list-style-type: none"> • Provide minimum 5-year policy certainty • Encourage new procurement routes like green tariffs and VPPAs • Provide long-term net metering policy visibility and implementation certainty • Build consumer awareness • Develop solutions for rural consumers • Undertake site assessment studies proactively • Offer debt financing solutions to SME and residential consumers

Facilitate faster development of utility-scale renewable projects	<ul style="list-style-type: none"> • Expand and refocus renewable park scheme • Make more suitable land available for renewable projects, alongside the requisite environmental and social impact assessments. • Single window regulatory approvals • Tie-up DISCOM demand in advance • Improve transmission planning and information transparency • Award transmission projects through competitive auctions
Rationalise thermal power generation capacity	<ul style="list-style-type: none"> • Address overcapacity while balancing NDCs and RE targets • Retire old inefficient plants
DISTRIBUTION	
Aggressive smart meter rollout	<ul style="list-style-type: none"> • Assess operational and financial benefits • Provide funding aid for awareness campaigns and a nationwide rollout
Network upgradation	
CAPACITY BUILDING THROUGH SKILL DEVELOPMENT	
Capture relevant data to build assessment capability	
Utilise private sector expertise to assess skill gaps	
Set up training centres near project locations	

A crucial aspect of designing the green recovery package would be to determine the optimal scale

of each option in view of cost-benefit analysis and various operational and financial constraints.

1 | INTRODUCTION

COVID-19 has caused an unprecedented shock to the world economy. According to the International Monetary Fund (IMF), global GDP is estimated to have contracted by 3.5 per cent in 2020⁴, marking a historic collapse in global output. India's GDP contracted by 7.3 per cent⁵ during FY 2021, the first contraction of this magnitude in over four decades.

India had one of the highest caseloads globally (10.2 million as of December 2020)—casting matter of grave concern for the country's economic status. The ongoing second wave has been more severe, placing the country as one of the worse-hit in the world. A complete vaccination

drive seems likely to stretch into 2022, with consensus emerging that it would take at least two-three years or even longer to recover from the crisis completely. It is feared that the macro-economic impact of such a halt—demand destruction, job losses, depressed investment appetite, strain in public finances and banking system—may have caused permanent damage to the economy. According to Oxford Economics, India's trend growth will be substantially lower from pre-COVID levels with the “largest amount of scarring among major economies globally”. It forecasts India's average growth during 2020-25 at 4.5 per cent, a downward revision from the pre-COVID-19 forecast of 6.5 per cent.

Table 3: Monthly GST Collection (INR billion)

MONTH	FY 2020	FY 2021	% CHANGE
April	1139	322	-72
May	1003	622	-38
June	999	909	-9
July	1021	874	-14
August	982	864	-12
September	919	955	4
October	954	1052	10
November	1034	1050	1.5
December	1151	1031	12.3

**FALL IN TAX REVENUE
COLLECTION DURING THE INITIAL
MONTHS OF LOCKDOWN**

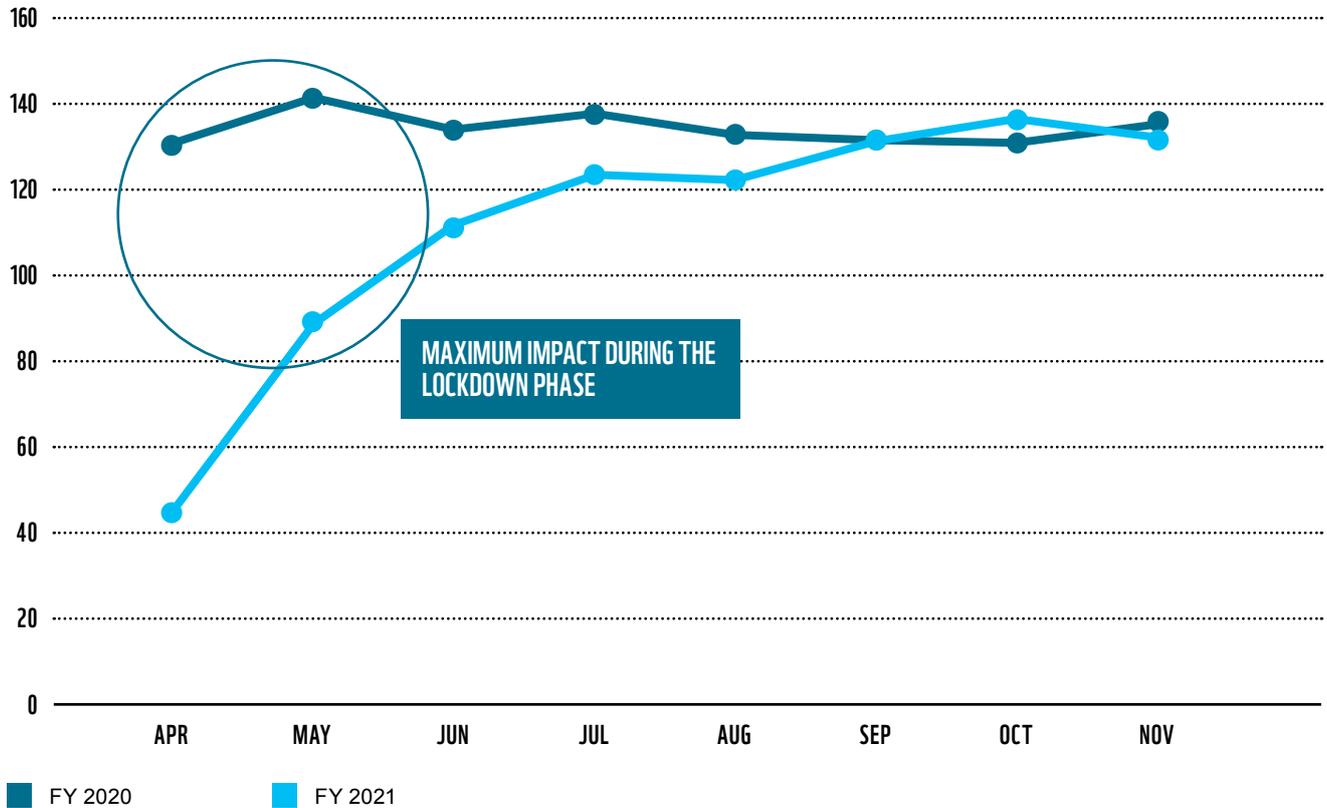
Source: Ministry of Finance

Key data: Snapshot of COVID's impact on key macroeconomic variables (tax collection, manufacturing and unemployment)

4 www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-update

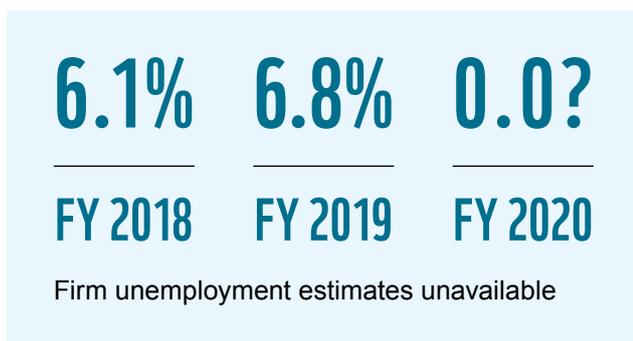
5 www.business-standard.com/article/economy-policy/india-s-gdp-growth-slows-to-1-6-in-fourth-quarter-contracts-7-3-in-fy21-121053101001_1.html

Figure 3: Renewable Power Capacity Addition, MW



Source: Ministry of Statistics and Programme Implementation

Exhibit 1: Unemployment level (%)



Source: Periodic Labour Force Survey, Ministry of Labour and Employment

Going forward, the government, regulators and private sector players need to strategise on how to manage this extreme economic downturn and plan for a resilient future.

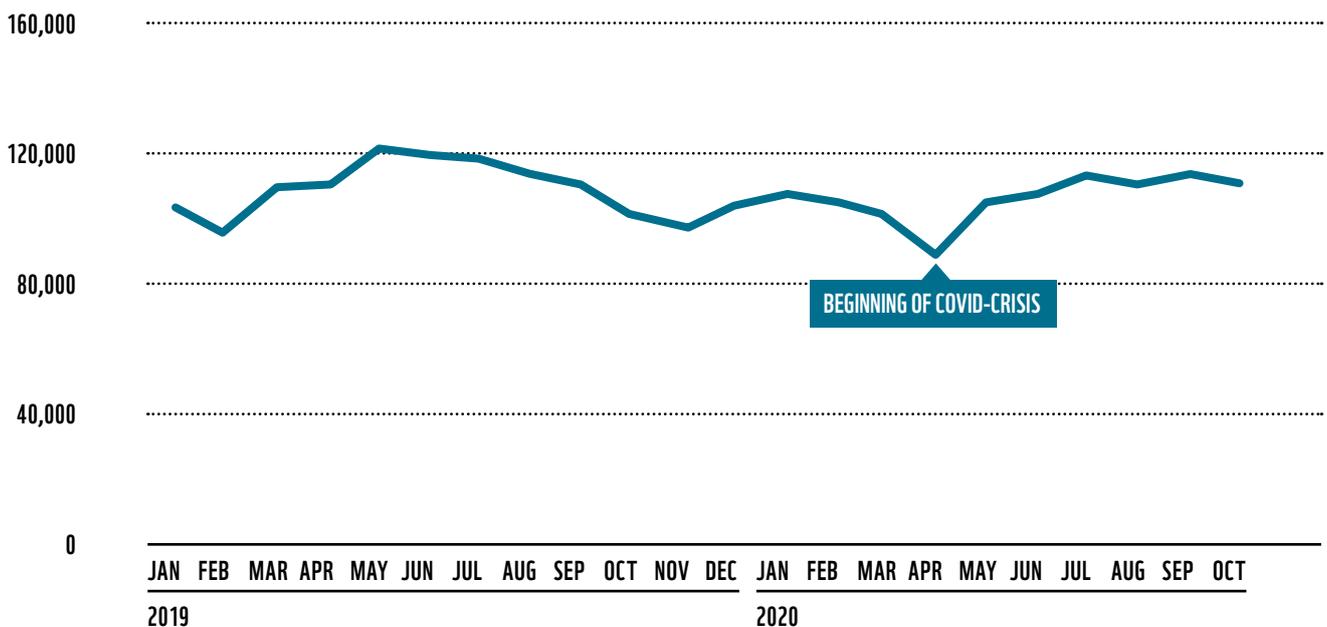
1.1 IMPACT OF COVID-19 ON THE POWER SECTOR

Within the power sector, there have been multiple repercussions due to the COVID-19 crisis. Power demand which contracted by almost 30 per cent during the early days of lockdown in 2020, has recovered to 2019 levels. But there are concerns about the impact on sustainable long-term demand. DISCOMs are already showing reluctance to sign new power purchase agreements (PPAs).⁶



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Figure 4: Reduced Power Demand, Million kWh



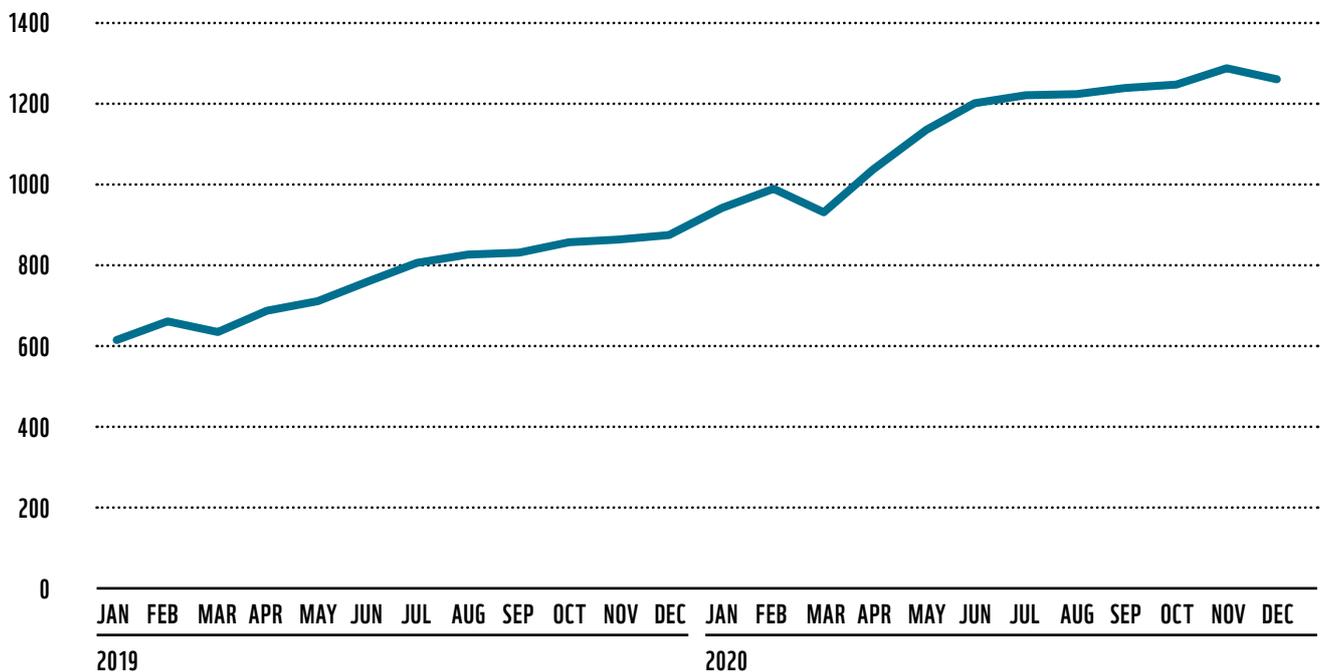
Source: CEA

DISCOMs have been the worst hit across the power sector value chain. The cash-strapped segment witnessed a dip in revenues, as many high paying commercial and industrial (C&I) units remained shut, denting average

tariff realisation. Billing and collection efficiency was also impacted, causing a spike in outstanding payments to power producers, which doubled during the period from March to December 2020.

6 www.livemint.com/news/india/discoms-leave-16-8gw-solar-and-wind-projects-in-a-bind-11597917520151.html

Figure 5: Trend in Outstanding DISCOM Dues, INR billion



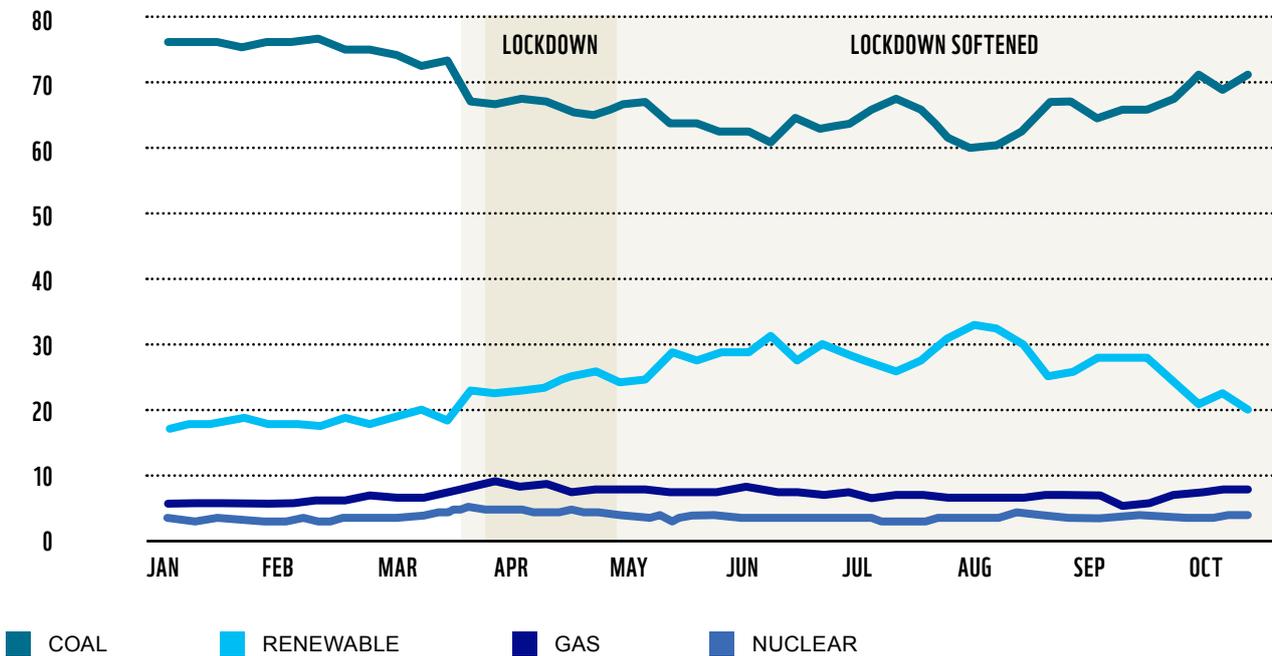
Source: PRAAPTl portal, Ministry of Power

Notes: The DISCOM dues have continued to shoot up despite INR 300 billion of debt funding by the government by October 2020 as part of the DISCOM liquidity package (see Section 7: Transmission and distribution). PRAAPTl portal data is not complete as it relies on voluntary data submission by independent power producers (IPPs). Actual DISCOM dues are believed to be significantly higher, as reported by Power Finance Corporation (PFC). PFC's latest report pegs DISCOM dues at INR 2,189 billion (USD 30 billion) as of 31 March 2019, as against INR 623 billion (USD 8.6 billion) reported by PRAAPTl portal for the same date.

Renewable projects have continued operations without any significant problems, while thermal plant load factors have fallen sharply. The 'must-run' mandate for these projects during the lockdown temporarily enhanced the share of renewable power in the generation mix from 11.5

per cent in February 2020 to 13.6 per cent during April 2020 (lockdown). Renewable power's operational simplicity and resilience is another reason why this power source should be preferred over conventional power.

Figure 6: India's Power Generation Mix in 2020



Source: CEA, IEA

Note: Renewables include power from large hydro projects.

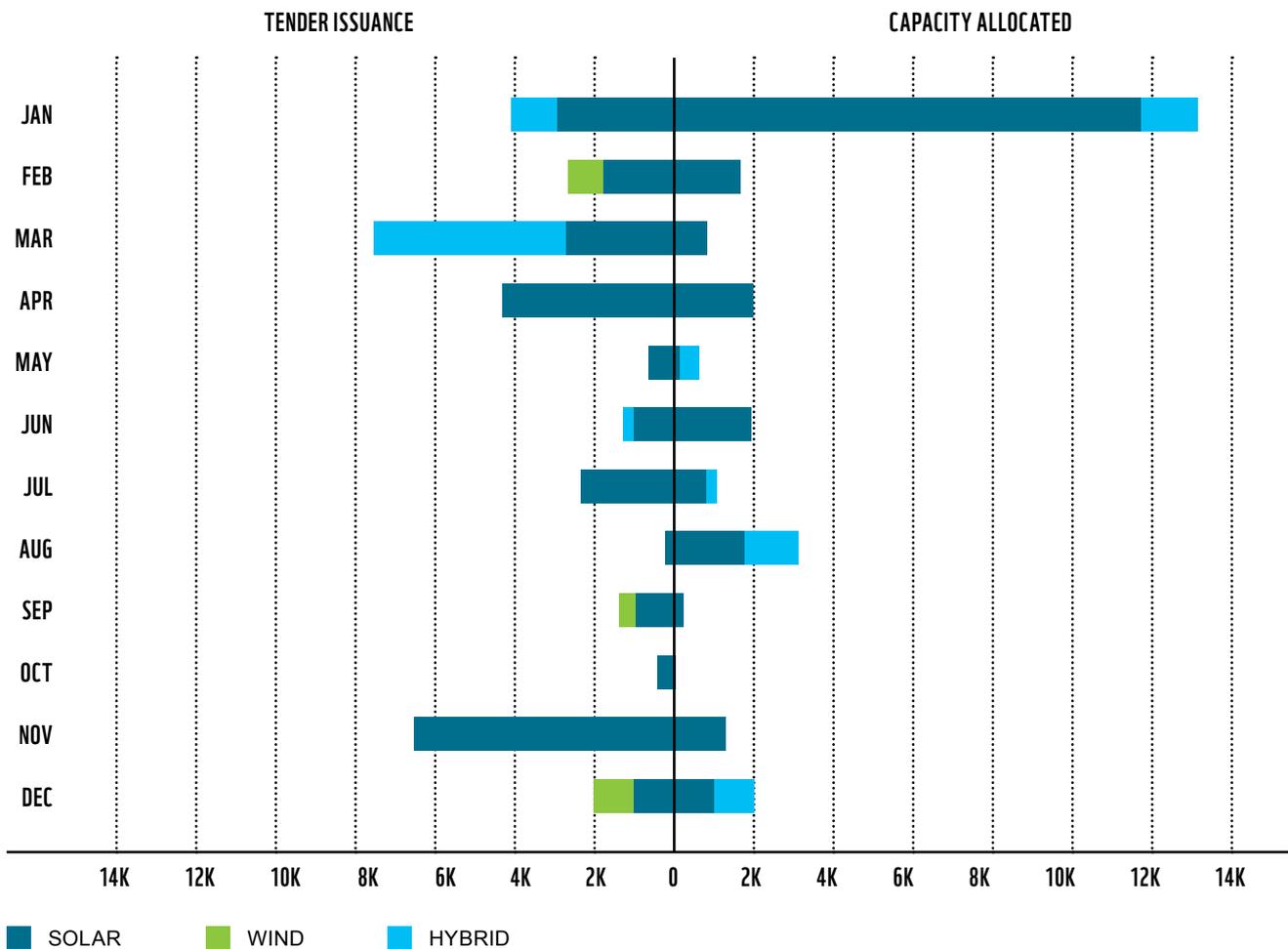
Project tender related activity became sluggish, as can be seen in the chart. In 2020, various government agencies issued 35,163 MW of new tenders, down by 20 per cent over the 2019 data. While total awarded capacity surged by 39 per

cent year-on-year to 27,873 MW, the DISCOMs have refused to sign Power Purchase Agreements (PPAs) for a staggering 18,000 MW of this capacity because of subdued demand.



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Figure 7: Trend in Renewable Energy Tender Issuance and Project Awards (2020)



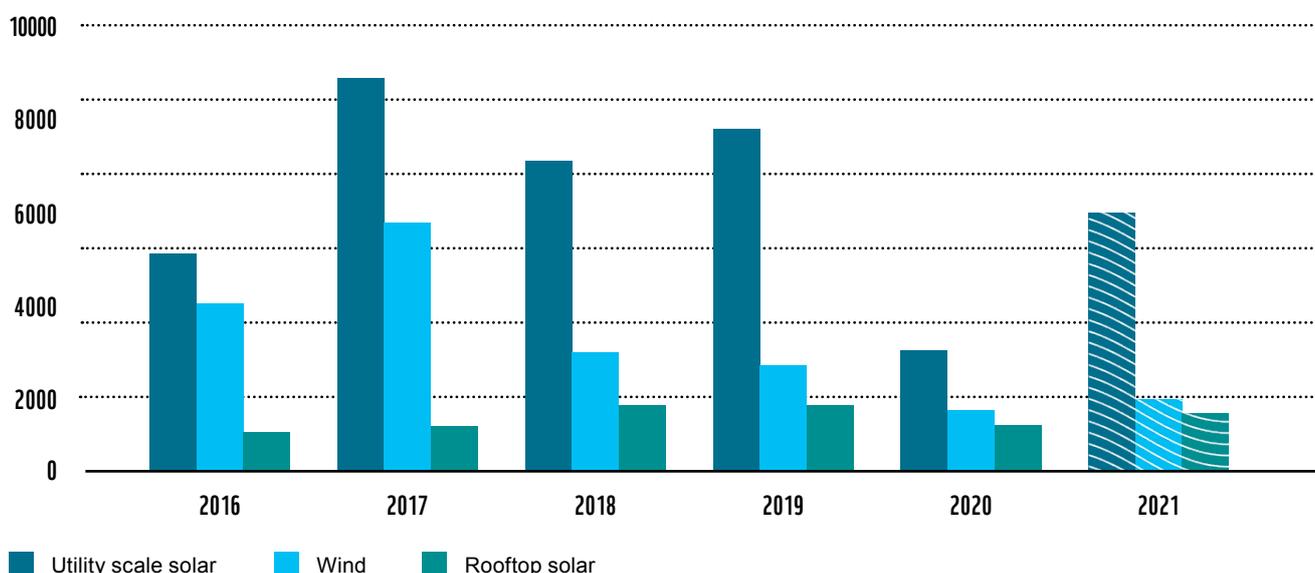
Source: BRIDGE TO INDIA research

Project construction activity has also been hit hard by supply chain disruption, labour shortages and restrictive work practices (Fig. 9). Capacity addition in 2020 is estimated at 4.2 GW, a five-year low.

More importantly, the renewable sector has been losing growth momentum since FY 2018. Land and transmission constraints have long been major barriers despite multiple government

initiatives. Imposition of safeguard duty on solar PV cells and modules, increase in Goods and Services Tax (GST), interest rates, and ancillary taxes and duties have added to project costs while stretching working capital requirements across the value chain. Debt financing constraints, particularly for smaller consumers and project developers, also continue to be a pressing issue.

Figure 8: India's Power Generation Mix in 2020



Source: BRIDGE TO INDIA research

Note: For 2021, estimates have been shown

India is not only significantly lagging behind the 2022 target of 175 GW renewable power capacity set by the government, but the pathway for longer-term growth and achieving the 2030 target of 450 GW is also looking more daunting in the post-COVID-19 scenario.

Land and transmission capacity constraints, high import dependence and deteriorating finances of DISCOMs are seen as formidable challenges going forward. The pandemic has deepened the sector's existing fault lines and risks, damaging growth prospects of renewables.

Table 4: Problem Areas and their Impact in the Renewable Power Sector

PROBLEM	COVID-19-RELATED FACTORS	IMPACT
Weak power demand	Risk of permanent demand destruction; lower C&I demand	Reduced growth prospects, higher project construction and operational costs, risk of penalties and/or disputes for delayed completion
Slowing pace of project execution	Labour and equipment shortage, social distancing at sites, unavailability of suitable land sites increase in component costs	Higher project construction and operational costs, higher dispute risk, high-risk perception for investors due to lack of policy clarity
High import dependence	Risk of trade disputes (coinciding with border tensions), import duties and other protectionist measures	More payment delays, higher offtake and project cancellation risk
Weak financial position of DISCOMs	Loss of revenue from high paying C&I consumers, adverse impact on billing and collection efficiency	

1.2 INDIA'S RESPONSE TO THE CRISIS

With a stretched fiscal position due to falling tax revenues and higher expenditure, the Indian government has exercised significant fiscal restraint, with total stimulus spending accounting for a mere 1.2 per cent of the GDP⁷. The focus has been primarily on debt financing support to businesses and households, free food rations to lower-income groups and fiscal support to agriculture and SMEs.

It is encouraging that majority of its most recent stimulus measures in the budget 2021/22 were green. The Government of India has committed at least USD 122bn to support energy since January 2020, of which USD 35bn (28.5%) supported renewable energy in particular. This includes budgetary transfers, policy support, public finance and investments by state-owned enterprises.

While there has been a focus on some of the other sectors, the opportunity, with respect to the power sector, still needs to be leveraged to achieve significant social, economic and environmental outcomes. Measures announced for the power sector primarily include a DISCOM liquidity package, financial incentives for batteries and solar modules, and investment in coal mining and allied infrastructure.

DISCOM Liquidity Package: The government has introduced an INR 1.2 trillion (USD 16.4 billion) loan scheme for DISCOMs to pay off their dues to power producers. The rationale is to

ease the liquidity position of the DISCOMs and pave the way for future reforms. Power Finance Corporation (PFC) and Rural Electrification Corporation are providing three to ten year loans to DISCOMs at rates 1–2 per cent below market rates; disbursement of loans comes with riders for instituting sector reforms including direct subsidy payments by state governments to consumers, reducing AT&C (aggregate technical and commercial) losses and installation of smart meters.

Champion Sectors: Battery Cell and Solar PV Manufacturing: The government has identified battery and solar PV module manufacturing as 'champion sectors' to pare import dependence with measures like import duties, production subsidies, cheaper debt, and single-window clearances. The government has announced a production linked incentive (PLI) scheme with an outlay of INR 226 billion (USD 3.1 billion) over five years to support domestic production of batteries and solar PV modules. The introduction of this scheme, among others has led to an increase in India's Greenness of Stimulus Index⁸.

7 www.thehindu.com/business/stimulus-to-cost-only-about-1-of-gdp/article31617629.ece

8 www.vivideconomics.com/wp-content/uploads/2021/02/Greenness-of-Stimulus-Index-5th-Edition-FINAL-VERSION-09.02.21.pdf

Table 5: PLI Scheme for Battery and Solar PV Manufacturing

PROBLEM	COVID-RELATED FACTORS	IMPACT
Battery cells	Department of Heavy Industries, NITI Aayog	181 (USD 2.5 billion)
High-efficiency solar PV modules	Ministry of New and Renewable Energy	45 (USD 608 million)

Source: Ministry of Finance

Continued Support for Thermal Power: Despite overcapacity, the coal sector continues to receive support, through measures related to commercial mining and eased regulatory regime. In June 2020, 38 coal blocks

were auctioned, of which 19 were awarded in November 2020. As a part of the stimulus package, the sector received investment support of INR 500 billion (USD 6.5 billion) for transport and allied infrastructure.



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1.3 CASE FOR 'GREEN' RECOVERY

As economic uncertainty abounds, there is pressure on the government to provide greater stimulus and undertake new measures to boost growth in renewable power sector. We believe that the government has a unique opportunity to support the economy while paving the way for faster energy transition through the growth of the renewable power sector. A recent study by Cambridge Econometrics shows that the impact of a 'non-green' stimulus package, comprising 'return to normal' through tax cuts and subsidies to revive consumption, is short-lived¹⁰.

Any beneficial effect of such a package fades as soon as the stimulus measures are withdrawn. However, if similar measures are taken to support green energy technologies and low-carbon ecosystem, the impact can be expansive and long-lasting and potentially fully offset the effects of the pandemic.

Greening the energy basket can bring sustainable and resilient recovery as the energy sector has a high multiplier effect on economic activity, job creation, healthcare and overall societal well-being. Clean energy technologies such as solar are far more labour-intensive than brown technologies like coal and hydrocarbons. Renewables hold immense potential for job creation and therefore should be a key part of a green recovery plan. Moreover, as renewable power is now cheaper, the sector proves to be attractive for promoting and advancing gender equality in the workforce.

With benefits like higher energy security, lower geopolitical risks, cleaner air and less pressure on natural resources, a green recovery package offers a lucrative opportunity for economic revival. It is also an opportunity to incubate new ventures and scale-up domestic businesses as international leaders in a sector with huge export potential.

Table 6: Job Creation Potential in Renewable versus Conventional Technologies in India

SECTOR	PERSONS PER MW
Rooftop solar	24.72
Ground-mounted solar	2.60
Wind	1.30
Coal	1.40
Gas	1.20

Source: COBENEFITS study for India, October report¹¹

¹⁰ www.camecon.com/news/green-recovery-plans-more-effective-than-return-to-normal-stimulus

¹¹ www.cobenefits.info/wp-content/uploads/2019/10/COBENEFITS-Study-India-Employment.pdf

Figure 9: Supporting Market Trends for Green Recovery

'BUSINESS OF FUTURE'

A growing number of businesses are trimming their carbon footprint to meet regulatory mandates and to showcase sensitivity to environmental causes.

FALLING COSTS OF CLEAN ENERGY TECHNOLOGIES

New technologies are reducing cost of clean energy at a fast pace, rendering it more competitive than conventional alternatives.

NOTABLE SHIFT IN INVESTMENT PREFERENCES

Growing environmental, social and governance considerations in the finance community are lending significant momentum to green energy transition.

DYNAMIC AND RESILIENT GRIDS

Energy utilities across the world are adapting their business models and investing in new technologies to make power grids more flexible.

Source: BRIDGE TO INDIA research

Investment fundamentals also support a greener energy basket—investment in renewable energy yields economic savings eight times more than costs when accounting for reduced health and environmental externalities, as per a recent

International Renewable Energy Agency¹² assessment. The agency, taking a long-term view till 2050, suggests that over time, for every USD 1 invested in clean energy there would be return benefits worth USD 3 to 8.

KEY TAKEAWAYS**01**

COVID-19 has impacted the power sector in many ways. Construction activity, which had been slowing over the last three years, has taken a major hit.

02

The government's recovery package has somehow not fully leveraged the potential of the renewable power sector. However, a greener version holds more promise in terms of a broader, long-lasting and sustainable economic revival.

03

Shift in investment preferences, the need to accelerate fight against climate change, greater potential for job creation and waning economic rationale behind fossil fuel usage—all these factors present a strong case for India to adopt a green recovery package.

¹² IRENA (2020), The post-COVID recovery: An agenda for resilience, development and equality

2 | RESPONSE OF OTHER COUNTRIES TO COVID-19

Governments worldwide have been announcing large-scale stimulus and recovery measures to recover from the economic crisis due to COVID-19. Stimulus packages announced so far amount to USD 2 trillion, representing 15 per cent of global GDP. Strong merits of ‘greening’ the recovery process have led many countries to focus on low-carbon technologies.

The European Union has become a front-runner by parking a notable share (20 per cent) of its stimulus package in decarbonisation efforts. The European Commission introduced the Net Generation EU recovery package in July 2020 to achieve carbon neutrality by 2050. Based on the initial figures planned by various member states, about a fifth of the overall spending will be geared towards green initiatives. Recovery plans of the Union are in continuation of the European Green Deal, which was proposed at the end of 2019 to decouple economic growth from resource use. In addition, the EU member states are pursuing their separate national recovery plans supporting renewable power.

The German government is cutting down renewable energy levy on power bills from EUR 0.065–0.068 per kWh to EUR 0.060 in 2022 per kWh. It is also focussing on building R&D capacity with a focus on digitalisation and coupling of power, transport and heating sectors. The country has also set aside USD 9 billion to facilitate the growth of green hydrogen—in heavy transportation and industry segments.

France plans to spend about USD 35 billion in green recovery measures. About USD 11 billion would be used for the development of the renewable energy sector, and the remaining amount will be channelled towards energy-efficiency measures. The French government has also released a National Hydrogen Strategy with an investment target of EUR 7.2 billion by 2030.

In the Nordic region, Denmark has approved the construction of two energy islands. In Norway, a dedicated fund has been created to step up investments in offshore winds.

UNITED KINGDOM’S TEN POINT PLAN

In November 2020, the United Kingdom announced its ambitious Ten Point Plan for green industrial revolution that will eliminate the country’s contribution to climate change by 2050. The plan is set to create and support 2,50,000 highly skilled jobs and is built around: offshore wind, hydrogen, nuclear power, EVs, transport systems, buildings, carbon capture, reforestation and green finance.

Key measures announced:

- GBP 1 billion to create two carbon capture clusters by mid-2020s and another two by mid-2030s
- GBP 500 million for trial of hydrogen-based heating for homes

- GBP 1 billion in 2021 towards enabling energy efficiency in buildings
- GBP 525 million towards nuclear power development including research for new advanced modular reactors
- GBP 1.3 billion for EV charging infrastructure, GBP 582 million grant for purchase of zero/low emission vehicles, GBP 500 million towards mass-production of EVs to support target of ending petrol/diesel car sales by 2030

In Australia, green initiatives vary across states. For instance, New South Wales (NSW) has recently introduced AUD 32 billion investment plan to accelerate the transition from coal to renewables in the coming decade. The NSW government plans to provide quick investment approvals for renewable energy projects and plans to close four of its five coal-fired power plants in the next 15 years. The state expects to generate 10,000 jobs while pursuing plans to

add 12 GW of wind and solar power and 2 GW of pumped storage hydro by 2030. Another state, Tasmania, plans to double its renewable production by 2040. The state also plans to develop a hydrogen-based industry¹³.

- South Korea and Italy have ramped up subsidy support for rooftop solar photovoltaic (PV) projects. The initiative would lead to the creation of 33,000 jobs in South Korea. The Italian government has increased green subsidies for households installing solar and storage systems.
- Nigeria has ear-marked USD 620 million for the installation of solar home systems across 5 million households, thereby creating 250 thousand jobs.
- In Southeast Asia, Malaysia has announced a stimulus package of USD 3.1 billion for supporting the development of rooftop solar systems and transmission lines. Singapore's stimulus plan includes developing a solar PV roadmap to potentially meet 43 per cent of the city-state's power demand by 2050.



13 www.fuelcellsworks.com/news/renewable-hydrogen-set-to-take-off-in-tasmania-with-2-6-million-investment-for-the-feasibility-of-three-large-scale-renewable-hydrogen-projects/

Table 7: Country-wise Green Stimulus Measures

COUNTRY	SIZE OF GREEN RECOVERY STIMULUS AS A RATIO OF GDP %	SIZE OF GREEN RECOVERY STIMULUS, USD BILLION	TARGET SEGMENTS
India	1.2 ¹⁴	3.10	Manufacturing of renewable energy components/equipment
European Commission	20.3	11.70	Renewable energy, hydrogen
Denmark	5.7	42.00	Renewable energy
Nigeria	0.3	0.60	Renewable energy, R&D for alternative renewable energy sources
Malaysia	0.9	0.31	Renewable energy
Tasmania	2.1	35.65	Renewable energy, hydrogen
Germany	33.0	13.28	Renewable energy, hydrogen; R&D for decarbonisation
South Korea		4.70	Renewable energy, hydrogen
Italy	3.5		Renewable energy
France	14.6	2.35	Hydrogen
Singapore	2.1	7.36	Renewable energy
Norway	5.5	0.01	Renewable energy
Morocco	3.0	0.02	Renewable energy

Source: BRIDGE TO INDIA research

*Total fiscal stimulus package

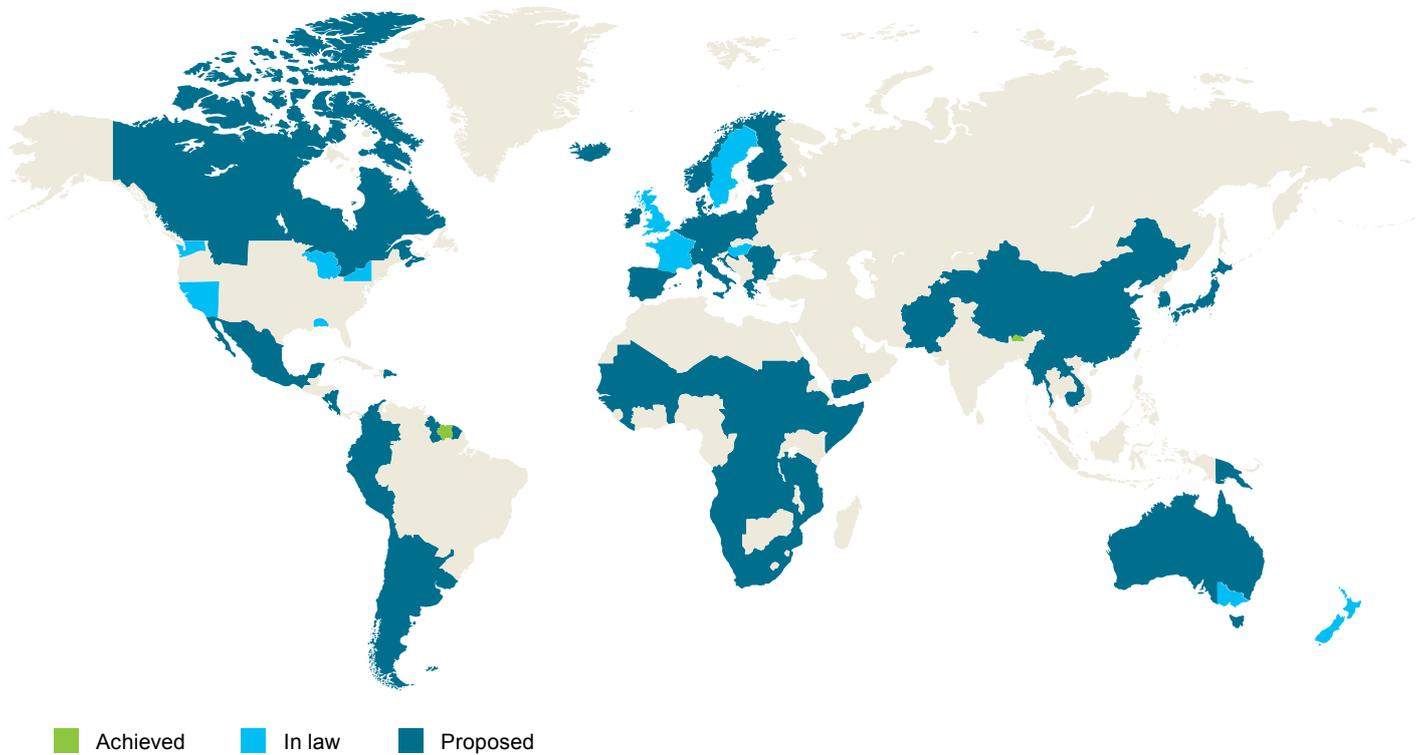
The UK, EU, Japan, South Korea, New Zealand and Denmark have pledged to become carbon neutral by 2050. China has announced tentative plans to become carbon neutral by 2060.

According to the United Nations, about half of the world's GDP and about half of the global carbon dioxide emissions are now covered by a net-zero commitment¹⁵.

¹⁴ www.thehindu.com/business/stimulus-to-cost-only-about-1-of-gdp/article31617629.ece

¹⁵ UN Secretary General press release, November 12, 2020, www.un.org/press/en/2020/sgsm20427.doc.htm

Figure 10: Global Zero Carbon Pledges



Source: PV Trends of 2020: Part 1; PV Magazine | www.pv-magazine.com/2020/12/24/pv-trends-of-2020-part-1

KEY TAKEAWAYS

01

Several countries have devised their economic recovery packages around sustainability and renewable power. Initiatives include subsidy support, investment in R&D, market reforms and liquidity infusion. New fuels like hydrogen are gaining traction.

02

Many countries have pledged to become carbon neutral by adopting time-bound targets and supporting enabling legislation.

03

Synchronised action around the world provides an opportunity for India to also to reciprocate and match these plans with its own response on climate.

3 | GREEN RECOVERY PACKAGE FOR INDIA



© Freepik / WWF-India

The Indian government can use the current opportunity to ‘build back better’ and pave the way for long-term economic revival. It is imperative to address the immediate pain points of the renewable energy sector. Towards this end, measures entailing the injection of liquidity along with other supportive measures can translate into quick wins on the economic front. Another set of measures should be designed to improve overall economic competitiveness and long-term growth prospects across the value chain.

As part of the green recovery package, the government’s specific priorities should be four-fold:

1. **Job creation:** for a trickle-down effect to restore consumption
2. **Injecting liquidity:** for financial relief and demand revival
3. **Enhanced economic competence:** for improved trade prospects
4. **Ensure energy transition:** to achieve all of the above

For job creation, distributed renewables and manufacturing are the top priorities. Financing support to segments such as distributed renewables, smart meters and storage can make the grid more resilient and bring costs down. There should also be a strong impetus for R&D, technology development, digitalisation, and local manufacturing, keeping sustainability

at priority, building new competencies, and spreading economic benefits across the whole value chain.

The package of measures given below has been designed bearing in mind key priorities and fiscal limitations of the sector. The package contains a slew of measures with little cost to the exchequer.

Table 8: Key Components of a Potential Green Recovery Plan

TECHNOLOGY DEVELOPMENT AND MANUFACTURING	STORAGE	GENERATION	DISTRIBUTION
 Create a strong R&D capability	 Scale-up deployment	 Tap into growing renewable power demand from C&I consumers	 Aggressive smart meter rollout
 Support sustainable domestic manufacturing	 Reduce cost for early adopters	 Promote distributed renewables	 Network upgradation
 Create a circular economy for metal/mineral recycling	 Develop pumped hydro project sites	 Facilitate faster development of utility scale renewable projects	
 Develop a hydrogen roadmap	 Formulate enabling policy and regulatory mechanisms	 Rationalise thermal power generation capacity	
 Capacity building through skill development			
 Job Creation	 Economic Competitiveness	 Progress in Energy Transition	

Source: BRIDGE TO INDIA research

Additionally, the government should consider setting carbon targets after a sophisticated analysis of the carbon footprint of all industrial sectors.

4 | TECHNOLOGY DEVELOPMENT AND MANUFACTURING

India has made substantive progress in manufacturing some clean energy products (for example, wind turbines), but it still remains largely dependent on international technology and imports. There is little domestic R&D or technology competence in poly silicon, PV cells, chemical batteries, hydrogen, or other technologies of the future. India invests only 0.7 per cent of GDP annually in R&D, dwarfed

in comparison to 2–4 per cent investment by leading industrialised nations like the US, China, Europe, and South Korea. As per the Department of Science and Technology estimates, the share of the energy sector in the country's overall R&D expenditure is only about 6 per cent. Even the low budgetary allocation often goes underutilised, as shown by the data in the table below.

Table 9: Shrinking Ministry of New and Renewable Energy (MNRE) Budget Outlay for R&D (INR million)

YEAR	BUDGET ESTIMATE	REVISED ESTIMATE	ACTUAL EXPENDITURE	UTILISATION (%)
FY 2017	900	600	454	76
FY 2018	1,440	810	530	65
FY 2019	940	430	254	59

Source: Demand for Grants Report, MNRE (March 2020)

Domestic manufacturing of key renewable project components that ensure minimum environmental impacts and maximum social benefits is crucial to make the RE value-chains more resilient and create more jobs. Currently, manufacturing costs are high due to poor economies of scale and obsolete technology

besides expensive and inadequate infrastructure. The cost and technology deficit need to be bridged with sustained policy support for R&D, skill development and demand enhancement. Strong local demand with a visible trajectory over a long period can be a pillar for sustainable domestic manufacturing.

Figure 11: Import Dependence across Low Carbon Technologies

	SOLAR	WIND	EMISSION CONTROL TECHNOLOGY	STORAGE (BATTERY)
				
IMPORT DEPENDENCE	>70-80%	UPTO 15%	70-80%	NEARLY 100% FOR BATTERY CELLS
TYPE OF EQUIPMENT/ COMPONENT IMPORTED	Cells, modules, inverters	Special bearings, gear box, yaw components, wind turbine controllers, and other sub-parts	Flue gas desuperheating systems, electrostatic precipitators	Cell and package

Source: BRIDGE TO INDIA research

India needs to develop strong expertise in technology development and manufacturing to reap the full economic benefits of clean energy adoption and develop economically effective solutions. A robust multi-pronged and multi-sectoral approach combining education and skill

development, R&D, infrastructure and other supporting policies is required. Steps in this direction also align well with the government's vision of being self-reliant or 'atma nirbhar' and emerging as a global manufacturing and export hub.

4.1 CREATE STRONG R&D CAPABILITY

Given the fast-paced advancements in technology and aggressive targets like the deployment of 450 GW of renewables by 2030, the government should determine clear R&D priorities through multi-stakeholder consultation. Government agencies and research institutions need to work in close collaboration with the private sector and academic institutions.

HARNESS EXISTING DOMESTIC RESEARCH RESOURCES

There is a need to prioritise research from credible domestic institutions like the Indian

Space Research Organisation (ISRO) and Indian Institutes of Technology (IITs). Active collaboration mechanisms for research partnerships between research institutions and private industry should be developed to leverage domestic research capability. While such collaborations do exist, further momentum is required.

SET UP A NATIONAL RENEWABLE RESEARCH AGENCY

The government should establish a specialised national institute as a centre of excellence for new

technology development in clean energy. Global (tried and tested) examples such as National Renewable Energy Laboratory (NREL) in the US and Singapore (SERIS) should be borrowed from.

PROVIDE SUBSIDISED FINANCING AND INFRASTRUCTURE

The government would need to bear the bulk of the financing burden as the private sector is wary of investing in early-stage R&D initiatives. The central government can extend support through learning-curve subsidies, patient R&D capital, tax rebates or grants. State governments should provide operational assistance through concessional land, rebates on local taxes

4.2 SUPPORT DOMESTIC MANUFACTURING

India heavily depends on imports from countries like China, South Korea, and ASEAN member states to meet its requirement of key components like smart meters, solar modules and battery packs. The government has made several attempts to create domestic manufacturing capacity, but insufficient progress is reflected in increasing import volumes.

To develop a strong manufacturing base, each value-chain segment requires careful evaluation of policy options and a temporal policy vision.

MAINTAIN CONSISTENCY IN POLICY SIGNALS

As a capital-intensive heavy business, manufacturing requires long-term policy with sufficient clarity and visibility. Conversely, taking the example of solar manufacturing, frequent changes in policy with multiple measures, including financial incentives, trade duties, and domestic content requirement (DCR) being tried out over the last eight years, have yielded

and development of technology incubators, dedicated parks and local infrastructure while ensuring sustainability in their planning, designing and operations.

TIE-UP WITH INTERNATIONAL INSTITUTIONS

Strategic government-to-government engagement to promote technology and knowledge transfer hold enormous promise. This route can be tapped for availing attractive credit lines, soft loans, learning from international best practices—countries like Germany, France, UK, and Denmark have been keen on developing renewables-focussed R&D relations with India.

little success. Often, policy announcements are not backed with commensurate implementation support.

Similarly, India's wind energy sector has been struggling. India's wind energy sector is led by indigenous wind power industry and has shown consistent progress. The expansion of the wind industry has resulted in a strong ecosystem, project operation capabilities and manufacturing base of about 10,000 MW per annum. However, the annual addition of wind capacity has fallen well short of these targets. In addition to ensuring long term policy stability in India which will increase annual capacity addition, the manufacturing capacity of India can also be promoted through exports. There are a number of policies that could incentivise this like increasing the discount available for companies on export duty of wind turbines. A new green line of credit can push wind turbine exports up significantly. Further, increasing

the duty drawback and incentivising the freight charges will boost shipment of wind turbines and related equipment to other countries. Inconsistent policy landscape deters sincere players from entering the manufacturing business. Avoiding policy reversals and crafting a dedicated, long-term manufacturing policy (with a span of at least 8–10 years) would prove helpful in attaining self-reliance in the short run and export competitiveness in the medium to long run.

IMPLEMENT A PROGRESSIVE SUBSIDY STRUCTURE TO INCENTIVISE ADOPTION OF ADVANCED TECHNOLOGIES

Manufacturing technologically advanced equipment and components require a progressive

subsidy structure, wherein the amount of subsidy increases on the basis of the novelty and relevance of the technology and its economic value-added potential. Equal importance should be attached to devising fair and expedient disbursement mechanisms.

ENSURE DOMESTIC DEMAND

The government should identify sectors that absorb domestically produced output to help achieve critical mass. For example, this is already being done for smart meters by nodal agencies such as Energy Efficiency Services Limited (EESL). However, sufficient measures are still lacking in critical sectors like battery storage, hydrogen and offshore wind.

4.3 FOCUS ON A CIRCULAR APPROACH TO MINERAL USE

Instead of subsidising and promoting a linear economy to obtain raw material for manufacturing purposes, which generally converts natural resources into wastes via production and ultimately leads to environmental degradation¹⁶, an integrated and comprehensive circular economy policy should be designed to meet demand for strategic minerals and metals through recycling and sustainable use of solar modules, batteries, electronic gadgets and electric vehicles¹⁷. The focus should be on recovering

products with high value. For instance, a mobile phone can contain more than 40 elements, including base metals, special metals like cobalt, indium and precious and platinum group metals like silver, gold, tungsten, and palladium¹⁸. The announcement of vehicle scrappage policy in the 2021 budget is a positive step in this direction as automotive parts contain a large number of metals that can be recycled and brought back into use through circular economy.

16 UN Secretary General press release, November 12, 2020, www.un.org/press/en/2020/sgsm20427.doc.htm

17 www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF-Analysis-Steel-and-aluminium-Boom-in-raw-materials-between-profits-and-losses.pdf

18 Metal Recycling—Opportunity, Limits and Infrastructure | www.wrforum.org/wp-content/uploads/2015/03/Metal-Recycling-Opportunities-Limits-Infrastructure-2013Metal_recycling.pdf



4.4 DEVELOP A HYDROGEN ROADMAP

Clean fuels like hydrogen are likely to form an increasingly important part of the clean energy transition. Rapid technology improvements have boosted the feasibility of hydrogen generation, transportation and usage. For the power sector specifically, hydrogen's capacity to act as a long-term storage and flexible generation resource is a significant opportunity to integrate a high share of variable renewable energy into the grid. Countries like Australia, Japan, South Korea and EU member states have aggressive national-level plans to develop a dedicated hydrogen ecosystem. But in India, progress has been slow as the imminent 'National Hydrogen Mission' is still under preparation. Taking cues from global models and International Renewable Energy Agency IRENA's guide¹⁹ to policymaking for green hydrogen, we recommend the following:

ROLLOUT THE NATIONAL HYDROGEN MISSION IN A TIMELY MANNER

Define a clear strategy with a detailed roadmap, time-bound targets and incentives for investment in R&D and demonstration

projects. The strategy and roadmap must be inherently nimble to evolve with improving technologies.

CREATE DEMAND

The use of green hydrogen in the power sector is only one of the many end-use cases. To enable a sustainable, cost-effective hydrogen economy, the strategy must identify various best potential use cases for the fuel. Emission-intensive and hard-to-abate applications (transportation, heating and cooling, oil refining, metal production, manufacturing) should be prioritised and incentivised to use green hydrogen to create sustained demand.

Simultaneously, the government should remove fossil fuel subsidies and examine the introduction of carbon pricing or emissions trading to create market value for hydrogen. Improving demand is expected to provide impetus to the supply side, including electrolyser manufacturing, transportation and storage infrastructure.

KEY TAKEAWAYS

01

Local R&D technology development and manufacturing capability are crucial to ensure a lasting and sustainable economic recovery and set up a strong foundation for the renewable sector.

02

A progressive taxation and incentive structure, long-term policy visibility and robust domestic demand are essential pillars for domestic manufacturing.

03

Manufacturing of key components like smart meters, solar modules and electrolysers would generate stable employment opportunities and improve India's export competitiveness.

19 Green Hydrogen. A guide to Policy Making. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Nov/IRENA_Green_hydrogen_policy_2020.pdf

5 | STORAGE

Storage is an essential technology for maintaining grid stability and absorbing variability and intermittency associated with renewable power. Other countries are racing ahead to build manufacturing and project capacity, but India has not achieved its potential in this area so far, with minimal presence across the value chain. In 2019, a National Mission on Transformative Mobility and Battery Storage was announced to build an e-mobility ecosystem including a phased manufacturing plan for battery storage. The Energy Storage System (ESS) Roadmap of India prepared by the India Smart Grid Forum (ISGF) estimates an energy storage potential of over 200 GWh by 2032 for grid support services to integrate renewable power sources. However, concrete progress has been slow. Lack of access to

in-house technology or domestic supply and unwillingness to bear high prices have been the major inhibitors. Strong 'market making' intervention is therefore required on both demand and supply sides together with a national policy roadmap to accelerate progress in this critical area.

So far, grid-scale storage has been promoted mainly through a few project auctions, but the DISCOMs remain reluctant in purchasing expensive power. Similarly, the behind-the-meter C&I market holds enormous potential with applications such as backup power, smoothing of renewable power output, peak load shaving and power factor correction, but a paucity of cost-effective options has hindered the market growth. Therefore, this report recommends the below



SCALING UP DEPLOYMENT

Rapid deployment is essential for building the industry ecosystem and creating a sufficient demand base for domestic manufacturing capacity. The government should outline at least a 10-year deployment roadmap for grid-scale storage in order to complement the growing renewable power capacity. A key instrument in achieving these targets would be to mandate specified storage capacity deployment with all large-scale renewable projects. The government has successfully used several financial incentives, including capital subsidies (viability gap funding, VGF), accelerated depreciation and top-up tariffs (generation-based allowance, GBI), to accelerate solar and wind deployment when these technologies were relatively expensive. Similar financial incentives would immensely help in early-stage storage deployment.

OVERHAULING OF POLICY AND REGULATORY MECHANISMS

The entire power sector regulatory framework requires overhauling to provide different storage applications for co-located and stand-alone storage systems.

- A. Addition of storage in grid code to allow use as both a generation and demand resource^{20,21};
- B. Creation of market instruments through which storage can participate in capacity, balancing and ancillary services markets;
- C. Introduction of systems to value various grid services, including fast frequency response, transmission upgrade deferral, transmission congestion prevention and demand reduction provided by storage and enable value stacking to make it more financially attractive²²

KEY TAKEAWAYS

01

Future growth of renewable power crucially rests on greater deployment of storage capacity.

02

The segment warrants targeted focus through aligned capacity deployment targets and design of supportive regulatory and fiscal mechanisms.

20 Energy Storage News, 2020. UK regulator Ofgem elects to classify energy storage as subset of generation. www.energy-storage.news/news/uk-regulator-ofgem-elects-to-classify-energy-storage-as-subset-of-generatio

21 Current News UK, 2020. Ofgem approves changes ending double charging of storage. www.current-news.co.uk/news/ofgem-approves-changes-to-end-double-charging-of-storage

22 NYSERDA, 2020. Value stack calculators. www.nyserda.ny.gov/All-Programs/Programs/Energy-Storage/Developers-Contractors-and-Vendors/Technical-Assistance

6 | GENERATION

Specific measures need to be taken for both distributed and utility scale projects to address respective barriers and accelerate market growth.

6.1 TAP INTO GROWING RENEWABLE POWER DEMAND FROM C&I CONSUMERS

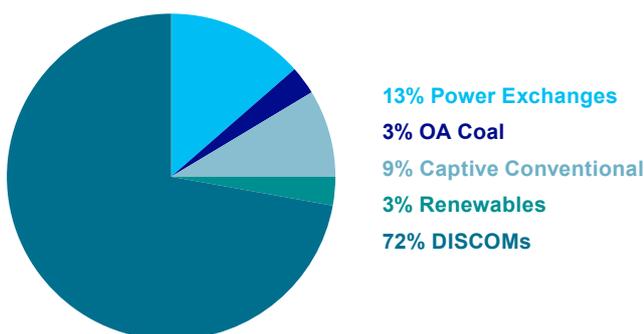
Companies across the globe are adopting mandates to reduce their carbon footprint and even pledging to 100 per cent renewable energy targets. The demand from C&I consumers will continue to grow on the back of consumers seeking independence from the grid, lower power costs, and more ambitious carbon goals. High growth prospects of C&I renewables are evident from the massive investment appetite

shown by leading institutional investors, private equity firms, and oil and gas companies.

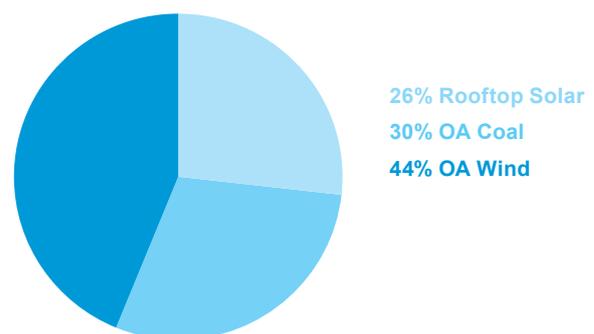
C&I consumers use nearly 50 per cent of the total power consumption in India. But their procurement efforts for renewable power are held back by restrictive state policies and resistance from DISCOMs. Policy reversals and lack of long-term visibility have inhibited capacity addition.

Figure 12: Dominance of Conventional Power in C&I Consumption Mix

Energy Mix for C&I Consumers (2019–20)

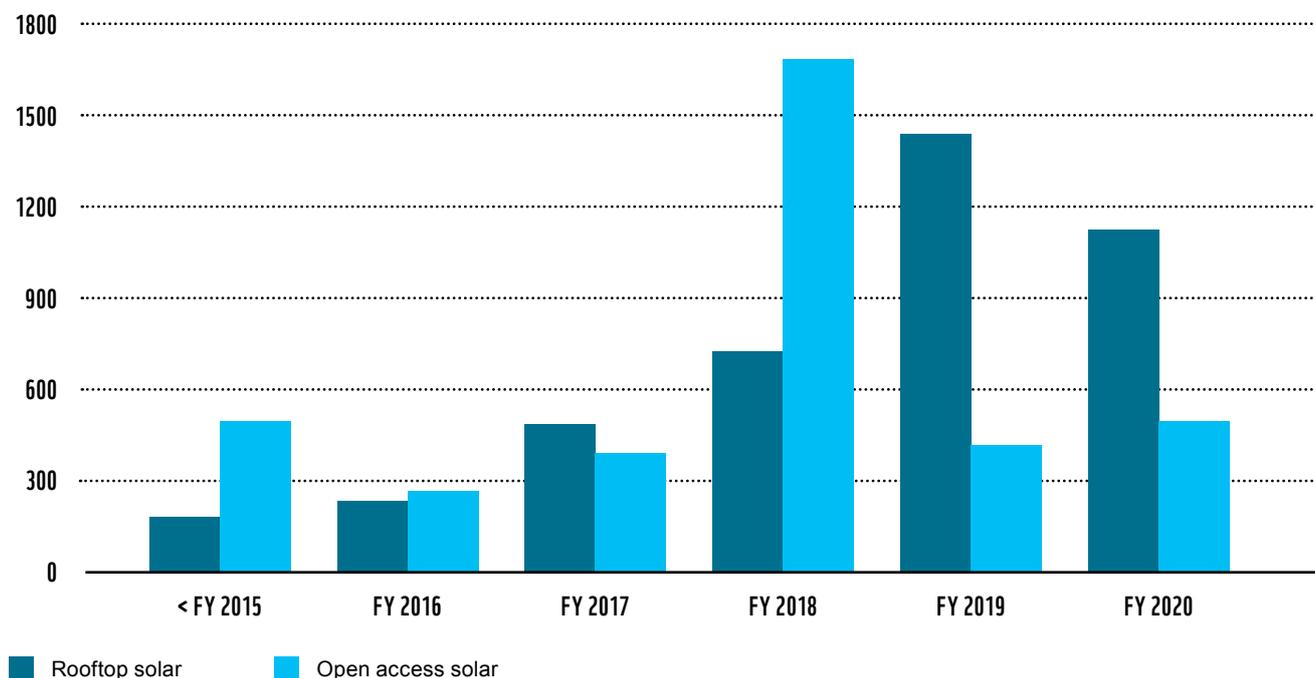


Energy Consumption from Renewable Sources (2019–20)



Source: CEA

Figure 13: C&I Renewables Capacity (MW)



Source: CEA

Meeting growing C&I demand through a more favourable policy design can provide a major boost to the renewable sector.

PROVIDE MINIMUM FIVE-YEAR POLICY CERTAINTY

Both investors and consumers require long-term policy visibility. Ad hoc changes hurt investor sentiment and render transition to renewable power risky. States should design policies and regulations with clearly laid-out targets and incentives to provide at least a five-year horizon to the market. Simultaneously, the government should ensure that all necessary project approvals, including land availability, grid connectivity and regulatory clearances are provided in a transparent, time-bound manner subject to robust environmental and social impact assessments.

ENCOURAGE NEW PROCUREMENT ROUTES LIKE 'GREEN' TARIFFS AND VIRTUAL POWER PURCHASE AGREEMENTS (VPPAS)

DISCOMs should be encouraged to introduce 'green tariffs' as a convenient means for consumers to opt for renewable power. Green tariffs offer a lucrative option to source renewable power, especially for SMEs. These tariffs are easy to implement within the existing regulatory and policy framework with the additional advantage that DISCOMs can retain their consumers. Besides, transaction costs are potentially lower for DISCOMs, who can procure renewable power in larger quantities at a lower cost.

As consumers are unwilling to pay a premium for green power, 'green tariffs' should be introduced at a small discount to grid tariffs and be aligned with state or national industrial policies to promote specific industries, greenfield

investments, or export-oriented units. India has recently announced the introduction of a ‘Green Tariff Policy’, which is expected to allow consumers to procure power at costs lower than conventional power. This is an encouraging sign about the government’s receptivity to recommendations.

VPPAs are another promising green power procurement option for C&I consumers. They can help C&I consumers overcome the lack of inter-state scheduling of open access renewable power. For adoption of VPPAs, we recommend the following:

- A. Establish regulatory sandboxes to execute demonstrative pilots
- B. Take steps to deepen exchange trading of renewable power, in particular, by encouraging policy (land and transmission capacity, see Section 6.3) and financing support for merchant projects.
- C. Regular updates on intra-state transmission network availability should be issued by respective State Load Dispatch Centres (SLDCs) to allow generators and consumers to plan project capacities. Greater transparency is also needed in open access policy implementation, particularly on the process of granting approvals and determination of charges.
- D. The central government, together with Regional Load Dispatch Centres (RLDCs), should monitor power curtailment data regularly and undertake strict measures to combat this risk.



6.2 PROMOTE DISTRIBUTED RENEWABLES

Despite its many benefits—low T&D losses, no land or transmission infrastructure requirements and high job creation prospects—the distributed renewable sector has enjoyed limited policy support and consequently registered suppressed growth. Main challenges include policy uncertainty and lack of tailor-made solutions, consumer awareness and suitable financing.

The reluctance of DISCOMs to support rooftop solar has led to frequent changes in net metering policy across states—causing a high degree of uncertainty. Many states have prematurely withdrawn net metering provision from some or all consumers. Besides, restrictive and ad hoc caps on system size have also hurt prospects. Where subsidies are available, the access mechanisms have the power to be overly complex and opaque.

Another constraint in the growth of this market is the lack of home-grown products to meet specific requirements of consumers in rural and remote parts of the country without access to reliable

grid power. Examples include devices like water purifiers, refrigerators, chillers, agricultural implements and food processors powered with renewable power. Industrial off-grid solar agency GOGLA has issued research highlighting USD 21 billion potential for solar-powered refrigeration in the healthcare and food sectors in India²³ alone.

Distributed renewable installation decisions are typically made by end-consumers, households and small businesses. Lack of awareness about the benefits of rooftop solar and other solutions like mini-grids, technical and operational requirements, business models, contracting and financing structures etc., holds many consumers back. Helping consumers discern good quality systems with suitable configuration is important as such systems are not available as standard, off-the-shelf products. As consumers tend to be suspicious of marketing material available from solar vendors and installers, there is a critical need for independent, reliable sources of information for consumers.



23 www.pv-magazine.com/2021/01/21/the-indian-market-for-off-grid-solar-refrigeration

Various measures for boosting growth in the distributed renewable market are:

PROVIDE LONG-TERM POLICY VISIBILITY FOR ROOFTOP SOLAR

States should be encouraged to provide a consistent net metering policy framework with stability over at least five years. All caps on system sizes should be removed. To address DISCOM concerns, a graduated fee structure could be introduced over time (for example, deferred imposition of additional fees on systems larger than 10 kW until cumulative rooftop solar capacity reaches a pre-determined threshold), and banking benefit could be limited to, for example, a few months or specific times of the day. The crucial part is to provide policy certainty to installers and consumers and back it up with effective time-bound implementation.

BUILD CONSUMER AWARENESS

The government, in partnership with development institutions and think-tanks, should undertake mass consumer awareness initiatives to educate consumers on technical, operational and financial aspects of rooftop solar systems. The initiatives should include educational materials, online aids as well as standard templates for various contract types.

DEVELOP SOLUTIONS FOR RURAL CONSUMERS

Domestic research institutions, non-government organisations (NGOs) and consumer goods

companies should be encouraged to collaborate to develop products and services for meeting unfulfilled domestic and commercial energy needs of rural consumers.

UNDERTAKE SITE ASSESSMENT STUDIES PROACTIVELY

Many government tenders and schemes have failed in the past because of difficulties in identifying suitable sites within tight timeframes. Madhya Pradesh and Kerala issued tenders last year (2020) after completing preliminary site assessment in a break from the norm. The industry response was extremely encouraging as this information saved precious time and effort for installers. Using advanced drone and spatial technologies to undertake large-scale studies for identifying optimal installation areas and offering such data to the industry for a fee would be a win-win proposition.

OFFER DEBT FINANCING SOLUTIONS TO SMES AND RESIDENTIAL CONSUMERS

Indian banks and financial institutions still remain reluctant to finance distributed renewable systems because of small ticket sizes and the lack of standard products. The problem extends across the entire market but is more acute for SME businesses and residential consumers.

The government needs to take the initiative by tying up funding from development agencies and impact investors to provide affordable financing solutions to SMEs and residential consumers.



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6.3 FACILITATE FASTER, BUT RESPONSIBLE DEVELOPMENT OF UTILITY SCALE PROJECTS

Utility scale project construction has been mired in delays in acquiring land, seeking transmission connectivity and securing requisite government clearances. There have been many instances of nearly fully constructed wind projects awaiting transmission connectivity and cases where the developers have abandoned projects up to two years after the completion of auctions because they were unable to secure suitable sites. The challenge arises partly from the fact that transmission infrastructure build-out takes as long as four-five years, while renewable projects can be built in less than two years.

Multiple schemes have been designed for the development of solar parks, green energy corridors and renewable energy zones to address these challenges. However, all such schemes are beset with extensive delays. The government has recently embarked on developing 60 GW

of renewable park capacity with ready land and transmission capacity for project developers.²⁴ But past experience raises concerns about the successful implementation of the scheme due to delays and/or unsuitable site selection. Therefore, government intervention is majorly required in proactively working for land availability and transmission infrastructure at least four-five years in advance of renewable project development with requisite environmental and social impact assessments. A move away from mega parks with capacities upwards of 1,000 MW to more distributed development would also help in reducing infrastructure requirement. Some more recommendations that this report wishes to make are:

EXPAND AND REFOCUS RENEWABLE PARK SCHEME

MNRE should seek to expand the renewable park

24 www.pib.gov.in/PressReleasePage.aspx?PRID=1598948

scheme to cover anticipated capacity addition over at least next five years. There needs to be a greater focus on securing suitable sites for wind power (more challenging than for solar power) with requisite environmental and social impact assessments, and developing smaller, distributed parks to ease infrastructure burden. A monitoring cell with participation from state governments and private developers would be helpful in ensuring timely deployment.

MAKE MORE LAND AVAILABLE FOR RENEWABLE PROJECTS

States should digitise land records to facilitate allotment of land parcels and provide single-window clearance to developers with requisite approvals. The central and state governments should jointly identify land parcels and create land banks for smoother approvals and site allocation.

GRANT SINGLE-WINDOW REGULATORY APPROVALS

A single regulatory body should be made responsible for granting all necessary project approvals, including tariff adoption and extension of commissioning date. In case of regulatory delays, requisite measures, should be incorporated in tendering process.

TIE-UP DISCOM DEMAND IN ADVANCE

MNRE and tendering agencies should work with DISCOMs to accurately estimate medium-

and long-term power demand. Demand estimates must be firmed up before issuing new tenders to avoid the risk of delay in Power Purchase Agreement (PPA) execution.

IMPROVE TRANSMISSION PLANNING AND INFORMATION TRANSPARENCY

Transmission infrastructure upgradation and expansion programme should be dovetailed with renewable project development to ensure smooth implementation, ensuring requisite Environmental Impact Assessment (EIA) is undertaken. Moreover, greater information transparency to renewable project developers about transmission capacity availability and status of projects under construction would be beneficial to them for more efficient project development process.

AWARD TRANSMISSION PROJECTS THROUGH COMPETITIVE AUCTIONS

Competitive auctions procurement process has significantly brought down implementation time and cost of inter-state transmission projects. The average tariff of transmission projects auctioned between 2012 and 2019 was 31 per cent lower than the regulated tariff.²⁵ Using the same approach for awarding intra-state transmission projects would help attract more private capital, speed up construction time, and reduce tariffs across the board.

6.4 RATIONALISE THERMAL POWER GENERATION CAPACITY

Thermal power remains the mainstay of the Indian power system, with about 75 per cent share in the total power supply. Fall in share to 67 per cent in the last few months is considered temporary due

to COVID related demand reduction and must-run status enjoyed by renewable power. India added 114 GW of new coal-fired capacity in the last decade (2010-2019), resulting in an enormous

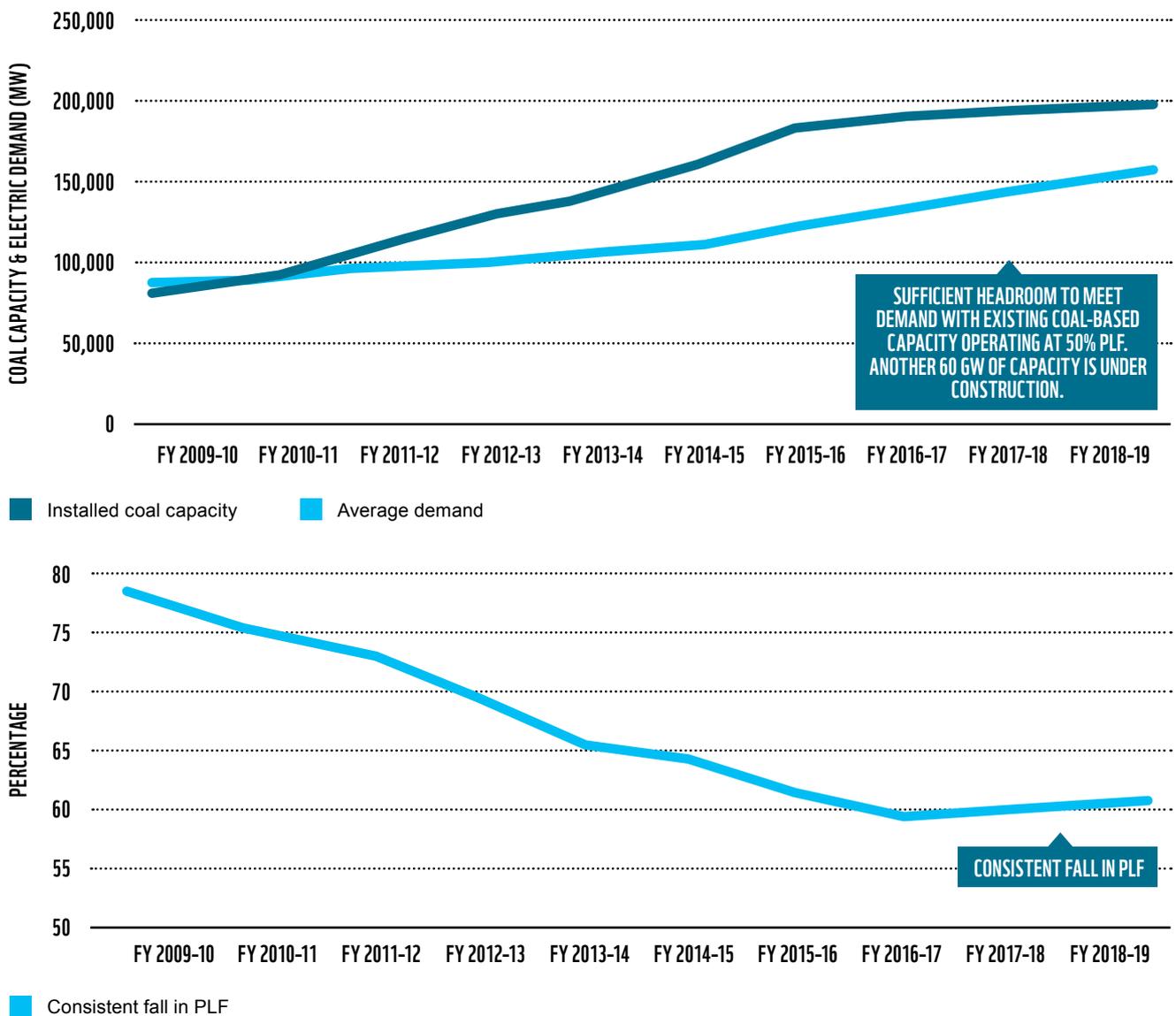
25 www.ieefa.org/wp-content/uploads/2020/02/Increasing-Competition-in-India-Transmission-Sector_February-2020.pdf

capacity overhang—a total generation capacity of 380 GW, against peak power demand of about 185 GW. Thermal plant load factors (PLFs) have been falling since the start of the decade –78 per cent in FY 2010 to about 52 per cent in FY 2020.

Tighter emission control standards, higher cost in comparison to renewable power and the

unwillingness of DISCOMs to enter long-term PPAs challenge the economic viability of thermal power projects. This has led to significant overcapacity of thermal generation, and so it is important for India to review its long-term strategy on fossil-fuel generation so that it not just meets its INDCs, but also showcases its leadership with ambitious RE targets.

Figure 14: Total Coal-fired Generation Capacity, Power Demand and PLFs



Source: CEA



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Retiring old thermal plants and suspension of green-field project development would boost demand for renewable power.

RETIRE OLD, INEFFICIENT PLANTS

The fleet of existing thermal plants should be carefully examined to carve out a retirement plan for the least competitive units. Over 35 GW of thermal power capacity is more than 20 years

old, of which flue-gas desulphurisation (FGD) contracts have been awarded for only about 15 GW capacity owned by NTPC. The remaining 20 GW capacity should be considered for retirement to avoid damage to the environment. The creation of a special fund to compensate the workforce, developers and off-takers would ease resistance to such a step.

KEY TAKEAWAYS

01

Realise the full potential of distributed renewable power to improve grid resilience, ease infrastructure requirements and improve energy access for consumers.

02

Provision needs to be made for more renewable power for C&I consumers to improve their competitiveness and to attract international capital into the sector.

03

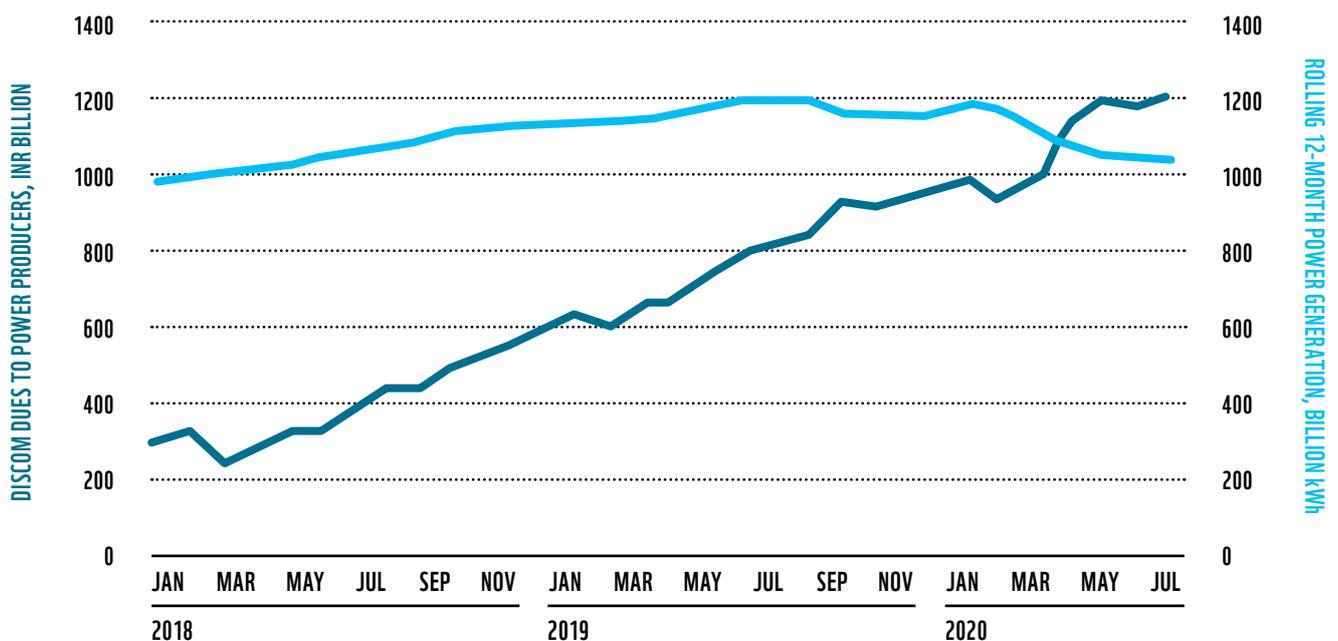
Gearing up construction of utility scale renewable power projects and adopting a conservative approach towards thermal power would be crucial in accelerating sector growth.

7 | DISTRIBUTION

The poor financial condition of DISCOMs has often been described as the most important hurdle in the Indian power sector. COVID-19 has aggravated the situation with DISCOMs facing mounting losses due to disruption in billing and collection activities as well as inadequate tariff rises. Payment dues to power producers have

shot up to 6–12 months in many states. As of November 2020, the government had disbursed INR 31.1 billion (USD 0.4 billion) in debt funding as part of the INR 1,200 billion (USD 16 billion) liquidity package for DISCOMs, but their outstanding exposure to power producers continues to worsen, as shown in the figure below.

Figure 15: Power Consumption and DISCOM Dues



Source: CEA, PRAAPTI portal, BRIDGE TO INDIA research

Note: The DISCOM dues data on PRAAPTI Portal is not complete. Actual overdue amount as per other data sources, including the Ministry of Power's Report on Performance of State Power Utilities 2018-19 is higher by about two-three times.

It is feared that solvency issues in the distribution sector would suppress power demand, investor appetite and overall growth prospects for renewable power. A comprehensive set of reforms (tariff rationalisation, direct benefits transfer, reduction in AT&C losses and privatisation, amongst other measures), proposed for many years, is yet to be implemented.

Moreover, increasing the share of variable solar and wind power along with distributed generation would place severe stress on the distribution network. Additional measures such as smart meter rollout, network upgradation and digitalisation are needed to decentralise operations and maintain grid stability.

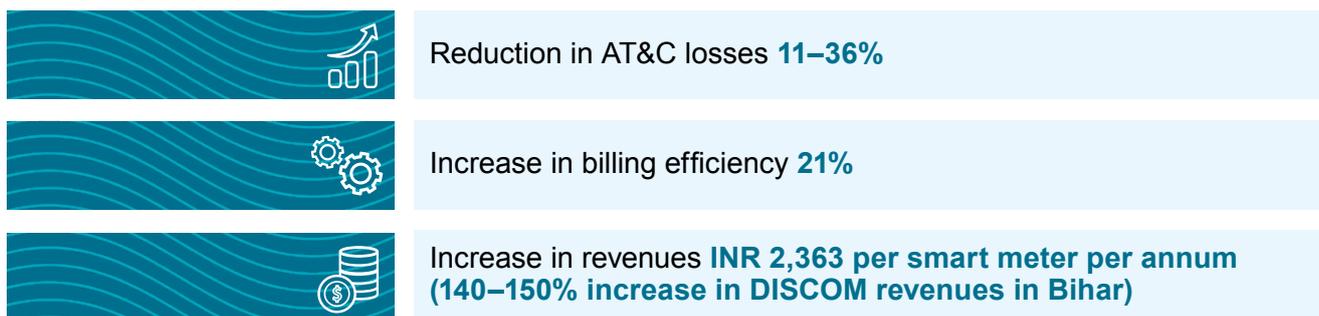
7.1 AGGRESSIVE SMART METER ROLLOUT

The central government has made various attempts to facilitate the uptake of smart meters through the Integrated Power Development Scheme, Ujwal Discom Assurance Yojana and the Smart Meter National Programme. However, smart meters still account for only about 1 per cent of the market (3 million units installed against 270 million connections).

The smart meter market potential is estimated at around INR 520 billion (USD 7 billion). EESL is

taking the lead in a joint venture with National Investment and Infrastructure Fund (NIIF), to deploy smart meters under a BOOT basis with no upfront investment burden on DISCOMs or consumers. The DISCOMs, however, remain hesitant to undertake large-scale installation due to lack of training, experience with smart meter infrastructure and cost concerns. Initial studies show significant financial benefits but a more detailed analysis is required to ascertain long-term benefits.

Figure 16: Benefits of Smart Meters



Source: National Smart Meter Programme Dashboard (20 November 2020)

Universal adoption of smart meters would help in mitigating AT&C losses and improving metering and billing practices. Moreover, smart meters would allow DISCOMs to monitor power demand at a more granular level enabling smarter approach to demand forecasting and load management. A few suggestions in this regard are:

ASSESS OPERATIONAL AND FINANCIAL BENEFITS

More detailed studies should be undertaken to assess the true operational and financial

benefits of smart meters, particularly in view of the long-term dynamic grid management issues.

PROVIDE FUNDING AID FOR AWARENESS CAMPAIGNS AND A NATIONWIDE ROLLOUT

The government should consider providing 30–50 per cent financial aid to DISCOMs (estimated cost of USD 3 billion) to address their cost concerns and speed up programme rollout.

7.2 NETWORK UPGRADATION

Smart meter rollout should be leveraged to expand the use of digital technologies, data management, performance analytics, artificial intelligence (AI) and machine learning (ML). These new technologies can improve demand and supply forecasting accuracy and network stability through enhanced asset monitoring and predictive maintenance.

Utilities in developed markets with experience in implementing AI solutions have reported significant savings in asset management. US-based Duke Energy reported savings of over USD 130 million in maintenance costs over three years using an AI-based early warning solution for its power-generation assets.²⁶

Researchers at the University of Luxembourg and the University of Quebec reported that a Brazilian distribution utility could detect cases of electricity theft with 65 per cent better accuracy than conventional methods.²⁷

In December 2020, Andhra Pradesh Transmission Corporation became the first utility in India to develop a day-ahead electricity forecasting model using AI and ML to plan power and optimise power purchase costs.²⁸

The government should issue binding mandates to DISCOMs to implement digital technology solutions.

KEY TAKEAWAYS

01

The power distribution sector needs an urgent operational overhaul of processes to improve efficiency and overall performance.

02

Aggressive drive for smart meter rollout, network upgradation and use of digital technologies would help in improving distribution system resilience and increasing renewable power penetration.

²⁶ www.utilitydive.com/news/the-biggest-numbers-game-in-the-power-sector-data-analytics-and-the-utility/550660/

²⁷ www.firstpost.com/tech/news-analysis/researchers-develop-artificial-intelligence-system-that-can-detect-electricity-theft-and-meter-misreadings-4082421.html

²⁸ www.newindianexpress.com/states/andhra-pradesh/2020/dec/28/forecast-of-energy-use-made-easy-in-andhra-with-the-help-of-artificial-intelligence-2242100.html



8 | CAPACITY BUILDING THROUGH SKILL DEVELOPMENT

India's power sector has perennially faced acute shortage of skilled personnel. This shortage is compounded in the context of energy transition as clean energy technologies and business models are evolving quickly, posing requirements for a

more technologically advanced skill set. The skill deficit extends not only to the private sector but also to DISCOMs, grid management companies, regulators and policymakers.

Table 10: Skills Required for Renewable Power Sector

ACTIVITY	KEY TASKS	SKILL REQUIREMENT	EMPLOYMENT POTENTIAL
Technology Development, R&D	Solar, storage, hydrogen, AI, ML	High	High
DISCOMs and Grid Managers	Power demand and supply forecasting and scheduling	High	Medium
Policymakers and Regulators	Policy & regulatory design, implementation	Medium-high	Low
Manufacturing	Solar cells and modules, storage	Medium-high	Low
Business Development	Research, market intelligence, project bidding, site selection, securing finance	Medium-high	Low
Design and Engineering	Project design, engineering equipment sourcing, project scheduling and management	Medium-high	Medium
Construction and Commissioning	Site preparation, Engineering Procurement Construction (EPC) work, equipment installation and testing	Low-medium	Medium
Operations and Maintenance	Day-to-day operations, preventive and reactive maintenance, performance analytics and optimisation	Low-high	High

Source: BRIDGE TO INDIA research

Despite the high job-creation potential of renewable technologies (as discussed in Section 3), skilling and training programmes have failed to keep pace with the industry's needs. Therefore, training programmes should be made an integral part of the green stimulus package. The number of personnel trained every year is dwarfed by

increasing industry requirements. In the last five years, only 52,000 personnel have been formally trained in the renewable power sector while the industry needs over 175,000 personnel every year in installation and operational jobs alone to meet the 2030 target of 450 GW renewable power capacity.

Table 11: Number of Personnel Trained

YEAR	SOLAR	WIND
FY 2016	2,606	970
FY 2017	8,407	791
FY 2018	8,167	1,605
FY 2019	11,912	1,505
FY 2020	16,074	NA
Total	47,166	4,871

Source: BRIDGE TO INDIA research



Experience from other countries like Germany suggests that an early-stage, well-planned education and training programme is a critical factor in the successful deployment of green technologies. An effective skilling strategy can benefit hard-hit areas of the country in remote locations with few alternative employment opportunities. New jobs can help mitigate livelihood concerns as land, and other resources are diverted towards renewables.

Going forward, we suggest the following measures for the industry to upskill its personnel and be at par with global standards.

CAPTURE RELEVANT DATA TO BUILD ASSESSMENT CAPABILITY

Capturing detailed employment data is essential for correctly assessing the performance of various policies and initiatives. Such a database

would facilitate skill mapping and timely adaptation of skilling plans.

UTILISE PRIVATE SECTOR EXPERTISE TO ASSESS SKILL GAPS

The private sector can play a crucial role in identifying and bridging skill gaps and develop curriculum to match on-the-ground requirements.

SET UP TRAINING CENTRES ACROSS THE COUNTRY

Training and skilling initiatives should be localised—the creation of vocational training clusters near major renewable clusters would prove highly beneficial in training the local population. Ideally, with assistance from development agencies, the central government should fund the bulk of the cost towards setting up and operating such centres to accelerate implementation.

KEY TAKEAWAYS

01

Initiatives to build a pool of skilled workforce will lead to a very high cost-benefit impact and would help in spreading economic benefits of the sector across the country.

9 | CONCLUSION



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The COVID-19 crisis presents a unique opportunity for India to pivot its growth strategy on a sustainable pathway. Globally, many countries have designed their entire recovery packages around green energy and sustainability. However, India's response to the crisis should focus more on the 'green component'. The country's unique economic, social and environmental considerations present a strong case for pursuing a green recovery pathway—one that will ensure robust, sustainable and equitable growth in the future.

A strong case for green recovery stems from numerous benefits from a robust growth trajectory of the renewable power sector—resilience showcased by the sector during the lockdown, improved energy security, better economic competitiveness, reduced energy import dependence, better air quality, availability of affordable and reliable green power to citizens while creating fresh jobs and

ensuring progress on technological innovation. Given that the fiscal space is constrained, the government can embark on the green recovery pathway by adopting the following recommendations through a multi-pronged approach because immediate action is required on all facets of the renewable energy sector. The government can undertake crucial initiatives such as introducing some low-cost options that ensure policy certainty, simplify and hasten regulatory approval procedures, introduce the National Hydrogen Mission and emerging green power procurement routes like green tariffs and VPPAs, build public awareness, capture relevant data points, among others, without undertaking significant fiscal pressure. Having said that, prompt and timely action will hold the key to success. With the ongoing second wave (and a third one feared), timely steps to recover from the COVID-19 crisis will set the stage for India's power sector to transform into a low-carbon using, sustainable sector.

Table 12: Key Elements of the Proposed Green Recovery Package

TECHNOLOGY DEVELOPMENT AND MANUFACTURING		
		Feasibility
Create a strong R&D capability	<ul style="list-style-type: none"> • Harness existing domestic research resources • Set up a national renewable research agency • Provide subsidised financing and infrastructure • Tie-up with international institutions 	
Support domestic manufacturing	<ul style="list-style-type: none"> • Maintain consistency in policy signals • Implement a progressive subsidy structure to incentivise adoption of advanced technologies • Ensure domestic demand 	
Create a circular economy for metals and minerals to meet the demand for manufacturing	<ul style="list-style-type: none"> • Focus on recycling of metals and minerals from industrial, electronic and electrical waste 	
Develop a hydrogen roadmap	<ul style="list-style-type: none"> • Rollout the National Hydrogen Mission in a timely manner 	
STORAGE		
		Feasibility
Scale-up deployment		
Reduce cost for early adopters		
Develop pumped hydro project sites		
Formulate enabling policy and regulatory mechanisms		

POWER GENERATION		Feasibility
Tap into growing renewable power demand from C&I consumers	<ul style="list-style-type: none"> • Provide minimum 5-year policy certainty • Encourage new procurement routes like green tariffs and VPPAs • Provide long-term net metering policy visibility and implementation certainty • Build consumer awareness • Develop solutions for rural consumers • Undertake site assessment studies proactively • Offer debt financing solutions to SME and residential consumers 	
Promote distributed renewables	<ul style="list-style-type: none"> • Provide long-term net metering policy visibility and implementation certainty • Build consumer awareness • Develop solutions for rural consumers • Offer debt financing solutions to SME and residential consumers 	
Facilitate faster development of utility-scale renewable projects	<ul style="list-style-type: none"> • Expand and refocus renewable park scheme • Make more suitable land available for renewable projects, alongside the requisite environmental and social impact assessments. • Single window regulatory approvals • Tie-up DISCOM demand in advance • Improve transmission planning and information transparency • Award transmission projects through competitive auctions 	
Rationalise thermal power generation capacity	<ul style="list-style-type: none"> • Address overcapacity while balancing NDCs and RE targets • Retire old inefficient plants 	
DISTRIBUTION		Feasibility
Aggressive smart meter rollout	<ul style="list-style-type: none"> • Assess operational and financial benefits • Provide funding aid for awareness campaigns and a nationwide rollout 	
Network upgradation		

CAPACITY BUILDING THROUGH SKILL DEVELOPMENT

Feasibility

Capture relevant data to build assessment capability



Utilise private sector expertise to assess skill gaps



Set up training centres near project locations



FEASIBILITY:



LOW



HIGH

ACRONYMS

AI	Artificial Intelligence
AT&C	Aggregate Technical and Commercial
C&I	Commercial and Industrial
CEA	Central Electricity Authority
DISCOM	Distribution Company
EESL	Energy Efficiency Services Limited
EV	Electric Vehicle
FGD	Flue Gas Desulfurization
GBI	Generation Based Incentive
GDP	Gross Domestic Product
GSI	Geological Survey of India
GST	Goods & Service Tax
GW	Giga Watt
GWh	Gigawatt Hour
HT	High Tension
IEA	International Energy Agency
IMF	International Monetary Fund
IRENA	International Renewable Energy Agency
KABIL	Khanij Bindesh India Limited
LT	Low Tension
MNRE	Ministry of New and Renewable Energy
MSME	Micro, Small, Medium Enterprises
MU	Mega Unit
MW	Mega Watt
NIIF	National Investment and Infrastructure Fund
NISE	National Institute of Solar Energy
NIWE	National Institute of Wind Energy
NREL	National Renewable Energy Laboratory
NSW	New South Wales
OFGEM	Office of Gas and Electricity Markets
PLF	Plant Load Factor
PLI	Production Linked Incentive
PPA	Power Purchase Agreements
PV	Photovoltaic
R&D	Research and Development
SERIS	Solar Energy Research Institute of Singapore
SME	Small, Medium Enterprises
VGF	Viability Gap Funding

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15%
of global GDP
Green stimulus packages
announced worldwide

24.72
persons/MW
Job creation potential
in solar rooftop segment
in India

Every USD invested in
clean energy would return
benefits worth

USD 3–8
over time

1.2%
India's size of green
recovery stimulus as a
ratio of GDP



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