

Mapping India's Energy Subsidies 2021:

Time for renewed support
to clean energy

REPORT

INDIA'S ENERGY TRANSITION



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Mapping India's Energy Subsidies 2021: Time for renewed support to clean energy

July 2021

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Acknowledgements

The authors are indebted to previous collaboration between the International Institute for Sustainable Development (IISD) and ICF India, the Overseas Development Institute (ODI), and the Council for Energy, Environment and Water (CEEW) for establishing the subsidy database that underlies this publication. For this update, the majority of new data and revisions to previous data on energy subsidies were prepared by co-authors Balasubramanian Viswanathan, Anjali Viswamohanan, Theresia Betty Sumarno, and Siddharth Goel from IISD and Prateek Aggarwal and Danwant Narayanaswamy from CEEW. Additionally, the chapter on public sector undertakings was principally drafted by Balasubramanian Viswanathan, Theresia Betty Sumarno, and Max Schmidt from IISD, with contributions from Ria Sinha, Mani Juneja, and Souvik Bhattacharjya from The Energy and Resources Institute (TERI). The chapter on domestic manufacturing of solar photovoltaics was principally drafted by Anna Geddes and Anjali Viswamohanan from IISD and Arjun Dutt from CEEW. Christopher Beaton from IISD and Karthik Ganesan from CEEW provided editorial comments.

The authors of this update would like to thank the following individuals and institutions for the valuable comments and recommendations that they provided as peer reviewers:

- Anshul Bambra, CDP Operations India Private Limited
- Tim Buckley, Institute for Energy Economics and Financial Analysis
- Divya Datt, United Nations Environment Programme
- Lucile Dufour, Vibhuti Garg, Greg Muttit, and Peter Wooders, IISD
- Ashish Fernandes, Climate Risk Horizons
- Satpal Garg, Petroleum and Natural Gas Regulatory Board
- Abhinav Jindal, Indian Institute of Management Indore
- Abhishek Malhotra, Indian Institute of Technology Delhi
- Tyeler Matsuo, Rocky Mountain Institute
- Divyam Nagpal, International Renewable Energy Agency
- Rahul Nilakantan, Indian Institute of Management Indore
- Angela Picciariello, ODI
- Benedict Probst, Eidgenössische Technische Hochschule Zurich
- Rajnath Ram, NITI Aayog
- Partha Sarathi Bhattacharyya, Chairman (Retired), Coal India Limited
- Deepak Sethia, Indian Institute of Management Indore
- Kartikeya Singh, Center for Strategic and International Studies
- Siddharth Singh, International Energy Agency
- Elena Thomas-Kerr, U.S. Department of Energy

We would also like to thank the governments of Norway and Denmark for their generous support of this publication. The opinions expressed and the arguments employed in this update do not necessarily reflect those of peer reviewers and funders, nor should they be attributed to them.

अमिताभ कांत
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सत्यमेव जयते

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FOREWORD

Enhance supply of energy is vital to increase India's per capita energy consumption and raise the living of standards. There is global move for clean energy transition. Therefore, it is vital to pursue the right energy development pathway, so that gains over the next decade can be achieved on a comprehensive manner. NITI Aayog supports the efforts by various think tanks, knowledge partners and the key stakeholders and expert's voice towards clean energy transition, recognizing the importance of sustainability for human health and energy security.

The Indian government has played an instrumental role in guiding the development of the energy sector. This makes government support for energy an important area to monitor the quality of data and ensure good practices. This is acknowledged by various government bodies as well as international think tanks and data management agencies.

I am therefore delighted to introduce the latest IISD & CEEW report and database on energy subsidies in India, which tracks all major energy subsidy policies from FY 2014 until FY 2020, and enables a comparison between support for fossil and clean energy sources. This year, the report has additional perspectives on how COVID-19 has affected the energy sector and also highlights how subsidy policy can be used to bring efficiency in solar PV manufacturing. It also highlights the role of different stakeholders which can play a major role in energy transition. I would like to highlight the central recommendation—that support for clean energy will be needed to achieve India's ambitious target of 450 GW of renewables by 2030, which will reduce tariff of renewable energy. India can become a global leader in green hydrogen economy by utilising cheap renewable power.

NITI Aayog has provided support and feedback to IISD, CEEW and other partners in their efforts to improve data transparency on energy subsidies. Such work is critical to encourage thinking and accountability across India's many energy institutions and policies. It is commended that the underlying data, definitions and methodology are all fully transparent, enabling all energy professionals to draw on them, regardless of their own perspectives and approach to these complex questions. NITI Aayog looks forward to building on this foundation, and encourage further efforts to improve data comprehensiveness, evaluate policies and propose recommendations.

I encourage all the stakeholders to take a look at the report's findings and best utilise the data that has been made publicly available through this report to strengthen better planning and implementation of various programs

Date: 02-07-2021
Place: New Delhi

(Amitabh Kant)



एक कदम स्वच्छता की ओर



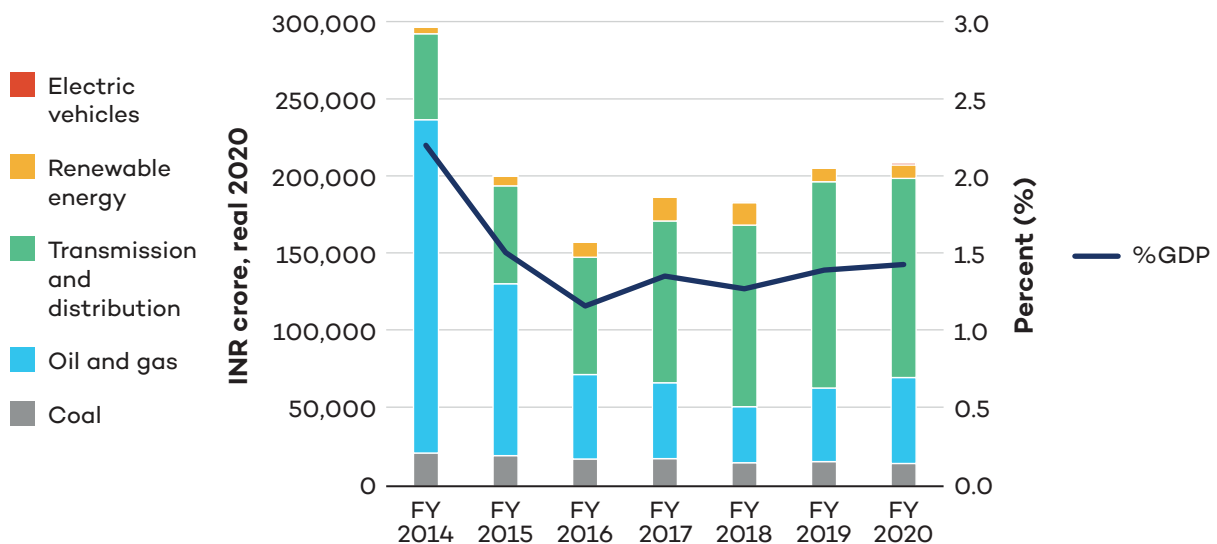
Executive Summary

Government support is more important than ever for the energy transition in the wake of COVID-19, as governments around the world take unprecedented measures to help stimulate economic recovery. Shifting government support from fossil to clean energy can ensure that every rupee of public money helps access, affordability, energy security, and the shift to a low-carbon economy.

This report examines how the Government of India has used subsidies to support different types of energy from FY 2014 until FY 2020 and draws on qualitative data to describe major shifts since the onset of COVID-19. In light of the government commitments to Aatmanirbhar Bharat (“self-reliant India”), it also includes two special thematic chapters. The first explores how subsidy policy can best promote solar photovoltaic (PV) manufacturing as part of the road to 450 GW of renewable energy by 2030. The second examines how investments by public sector undertakings (PSUs)—that is, enterprises where the government is the majority owner—are supporting clean energy.

Our data, summarized in Figure ES1, cover all subsidies from production to consumption for coal, oil and gas, electricity transmission and distribution (T&D), renewable energy, and electric vehicles (EVs). Nuclear and hydropower are not included due to a lack of adequate data availability. The underlying data are available online and have been made easier to explore with an accompanying data portal.

Figure ES1. Total quantified energy subsidies, FY 2014–FY 2020 (INR crore, real 2020)



Source: Authors' calculations. Note that a significant number of subsidy policies have been identified but cannot be quantified due to a lack of transparently available data. See subsequent discussion and accompanying [spreadsheets](#) for more details.

How Are India's Energy Subsidies Changing?

1

Support for fossil fuels is increasing again, up from 7 times more than clean energy in FY 2019 to 7.3 times more in FY 2020, with a total of 34% of quantified subsidies going to fossil fuels. Initial data suggest that this may dip temporarily in FY 2021 due to low world oil prices before increasing again as prices rise and the economy recovers from COVID-19. Reforming inefficient subsidies can generate valuable resources for recovery and clean energy.

2

Oil and gas subsidies have grown—but changes are on the horizon for kerosene and liquefied petroleum gas (LPG). Oil and gas subsidies increased 16% from FY



2019 to FY 2020, reaching INR 55,347 crore (USD 7.8 billion). Kerosene subsidies are to be removed by FY 2022, completing a successful phase-out. LPG subsidies have not yet been re-introduced since their suspension during the oil price crash in FY 2021, despite prices climbing back up, sparking concerns about impacts on clean cooking.

3

The largest bucket of subsidies continues to be electricity T&D. While overall T&D subsidies stagnated at around INR 1.3 lakh crore (USD 18.2 billion) in FY 2020, subsidies for electricity consumers increased 6% to INR 1.2 lakh crore (USD 16.9



billion). This is likely to grow from FY 2021 as the economy recovers. Reforming T&D is critical for transition, with two notable opportunities: first, better targeting of consumer subsidies; and second, the newly announced INR 3 lakh crore (USD 43.2 billion) 5-year reform-linked performance scheme, primarily focused on billing and collection, infrastructure creation, and quality and reliability.

4

Subsidies for coal have not decreased in FY 2020—and remain greater than for renewables. Concessional tax benefits continue to be the largest subsidy for the sector, at INR 13,154 crore (USD 1.9 billion), 87% of all coal support. In FY 2021, several non-



subsidy measures were implemented to incentivize domestic coal production, such as withdrawing or pushing back environmental regulations, despite health impacts for citizens.

5

Stagnation in subsidies for renewables. Subsidies for renewables saw little change from FY 2019 to FY 2020 and have fallen 45% from a high of INR 15,470 crore (USD



2.2 billion) in FY 2017. In part, this reflects the increasing competitiveness of solar PV and wind power, and in part, a slowdown in deployment levels. New support is needed to meet national targets, and entire budgeted amounts must get disbursed.

6

Increased subsidies for EVs. Since FY 2019, EV subsidies have risen more than 2.3 times, reaching INR 1,141 crore (USD 161 million) in FY 2020, driven by growing sales. Further support is needed for manufacturing capacity.



Where to From Here? A second generation of support for clean energy

India's first generation of support for clean energy has successfully brought solar and onshore wind power to market parity and placed renewables front and centre in the future energy system. Looking ahead to the target of 450 GW of renewable energy by 2030—and the large annual deployment required to achieve this goal—a strategy is needed for a second generation of support, with proportionate ambition and greater planning to meet the needs of the hour. Efforts to promote a green recovery should be aligned with this larger objective. Initiatives to identify and promote shovel-ready projects with potential investors can build capacity in clean energy while stimulating the economy and creating jobs.

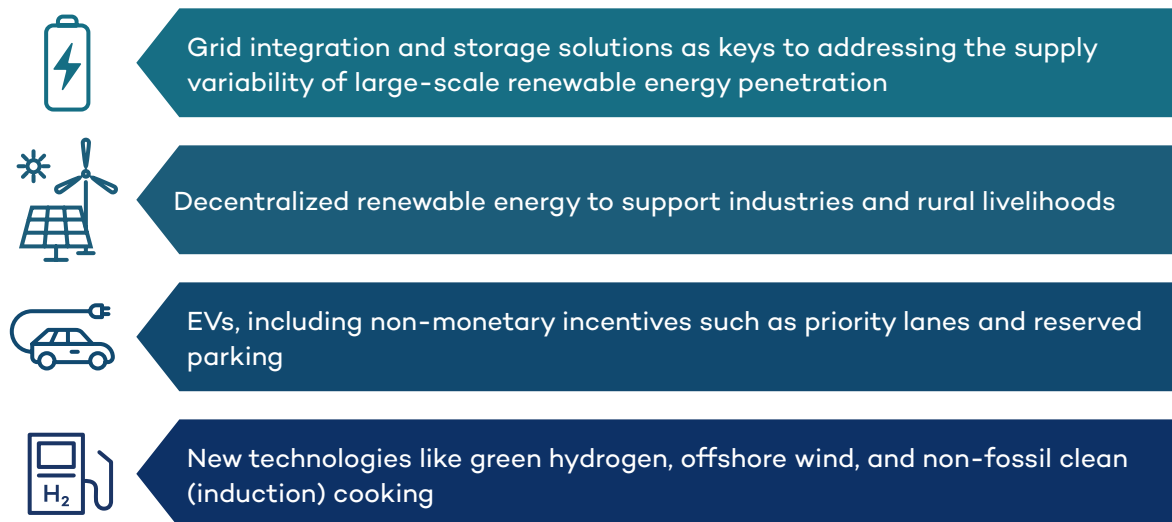
This leads us to make the following recommendations:

1

Identify, design, and implement a new generation of support measures for clean energy focused on emerging technologies required to achieve 450 GW by 2030.

This should be based on projections about the least-cost balance of energy technologies by 2030, while being consistent with India's goals on energy access and job creation, as well as a potential future net-zero target for energy. This implies a likely focus on the technologies represented in Figure ES2.

Figure ES2. Technologies requiring a new generation of support measures



2

Maximize resources available for reforming the power sector.

Greening electricity is critical for the shift to clean energy—but ongoing power sector problems, particularly insolvency among distribution companies (DISCOMs), are a pivotal roadblock. Resolving DISCOM finances is key to respecting the conditions of long-term power purchase contracts and assuring new investors. Some big schemes for DISCOMs have already been announced, including INR 3.06 lakh crore (USD 43.2 billion) over 5 years as a reform-linked performance scheme, particularly on billing and collection, and an INR 1.35 lakh crore (USD 19 billion) emergency loan facility set up in the early months of COVID-19. These existing measures must be carefully implemented to create stable, systemic changes—and not simply bail out inefficient subsidized business models. The government also needs to marshal equivalent levels of support for better targeting mechanisms so that subsidies can focus on specific eligible consumers. A joint centre–state program is required on this theme to fill knowledge gaps, establish guidelines, and provide incentives for reforms. Reducing subsidies for well-off consumers can help make policies more fiscally sustainable and enable higher support for those who are most in need.

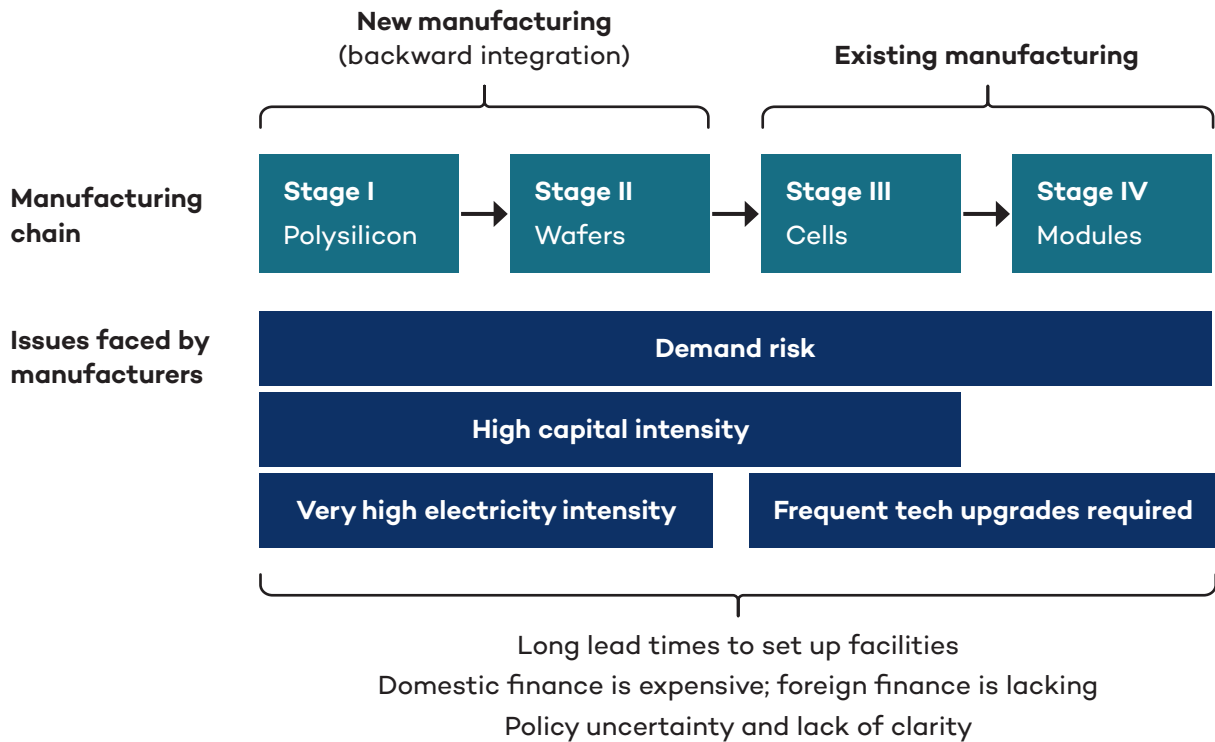
3

Expand the scope of clean energy under Aatmanirbhar Bharat.

Under the aegis of Aatmanirbhar Bharat, the government should develop more nuanced subsidies as part of a broader strategy for green industrial policy that considers both the central and state levels and prioritizes integrated solar PV manufacturing, EVs, and storage solutions. Having PSUs front this manufacturing wave could build investor confidence and prove effective in the long run.

After several years of growth, investment in India's solar PV capacity dropped in FY 2019. Part of this drop was attributed to import duties that aimed to increase the production of domestically manufactured solar PV panels. They did not have the desired effect, and manufacturing did not experience significant growth. Incentives targeted at addressing new risks brought on by the adoption of domestically manufactured products should be prioritized at this stage. An assessment of central and state-level policies identified four key recommendations that can address gaps in the government's support for solar PV manufacturing, as summarized in Figure ES3.

Figure ES3. Assessment of domestic solar PV manufacturing



- Recommendations**
1. Creating demand-side certainty is essential to trigger expansion and backward integration.
 2. Targeted fiscal and financial incentives are necessary to improve competitiveness.
 3. States should develop healthy manufacturing ecosystems.
 4. Provide research and development support all along the chain to improve price and quality.

4

Capture environmental and social costs of coal power.

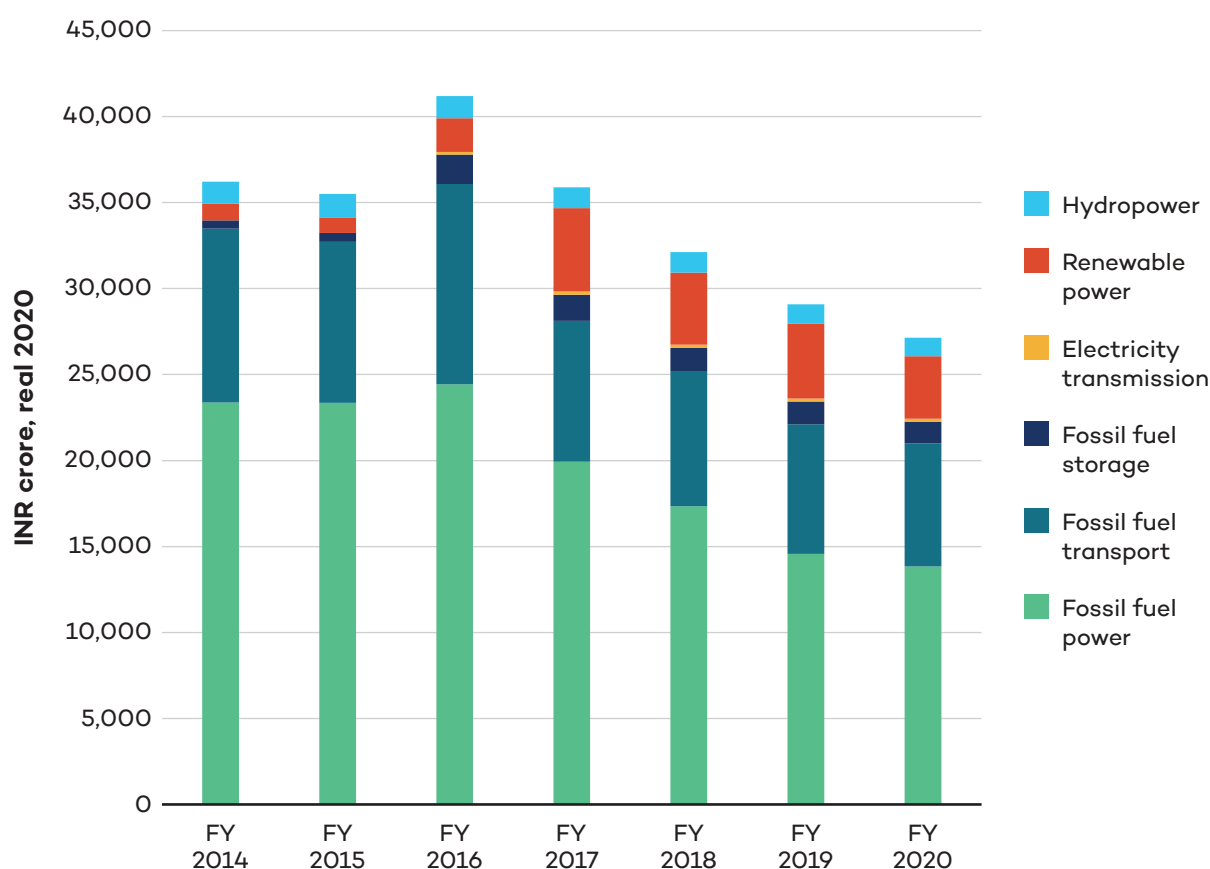
The falling prices of grid-scale solar and a drop in demand during COVID-19 have created economic challenges for coal power. And while coal makes significant contributions to government revenue and rail cross-subsidies, its full social cost is much higher than its net contributions. Despite this, a series of recent non-subsidy policy decisions have created financial benefits for coal by weakening environmental standards. This includes the rolling back of coal-washing regulations and delaying compliance with air pollution standards. Such decisions will simply exacerbate pollution-related health problems in a context where major Indian cities have already topped global charts on air pollution, pushing costs onto citizens and the health system. Low GST rates should be reformed, and green taxes such as the coal cess should continue to periodically increase so that the full social costs of coal are reflected in prices. Given increasing tax dependency on fossil fuels, it will be important to invest a share of revenue in the next generation of clean energy and just transition. Additional investment is also needed to offset economic impacts on DISCOMs, healthcare, and social protection.

5

Increase ambition from PSUs in spending their capital expenditures on clean energy.

India's PSUs make massive annual investments in the energy sector: from FY 2014 to FY 2020, the seven energy-related Maharatna-level PSUs invested INR 2.5 lakh crore (USD 35.5 billion) (in nominal terms) in 183 projects. Overall, this is still heavily skewed toward fossil fuels, which were the focus of 11 times more investment than clean energy in FY 2020, as illustrated in Figure ES4. An assessment of these seven PSUs found relatively low ambition on clean energy and no planning on how to manage the stranded asset risk of fossil-intensive asset portfolios. The government must provide a clean energy mandate to PSUs, setting ambitious targets for high levels of investment in clean energy. It has already instructed PSUs to increase capital expenditure to help stimulate economic recovery. This should be directed toward funding clean energy and establishing national capacity in manufacturing. PSUs are advised to start building key partnerships and exploring diversified business models by looking at international experience. This should include building roadmaps for decarbonization and providing transparent reporting to inform investors about the financial risks of their fossil fuel assets.

Figure ES4. Annual project-level investments made by seven major Indian PSUs, FY 2014–20



Source: Compiled from DEA, 2021.



In the Meantime, Increase Transparency On Support Measures and Reporting

Subsidy reporting can be conducted in line with formal guidelines for Sustainable Development Goal 12(c)1 and feed into India's peer review of fossil fuel subsidies as part of its G20 commitments. With fuller data and improved transparency, ministries should monitor, evaluate, and adapt their most significant subsidies to better meet policy objectives. To help this process along, it is crucial that entities in charge of allocating subsidies follow a uniform reporting format, with synchronized terminologies across various states and entities. Better reporting and transparency do not just apply to subsidies—but all the forms of support that can accelerate or hold back energy transition, including PSU investments, public finance, and regulatory measures.

Contents

1.0 Introduction	1
2.0 Context: A world in lockdown	2
2.1 Economic Recovery With Sustainable Energy	5
3.0 Approach and Scope	6
4.0 Key Trends in Energy Subsidies From FY 2014 to FY 2020	9
4.1 Highlights	10
4.2 Coal	12
4.3 Oil & Gas	14
4.4 Electricity T&D	19
4.5 Renewable Energy	23
4.6 EVs	26
5.0 Subsidies, Solar PV, and Building Indian Capacity for Manufacturing	30
5.1 Main Policy Drivers of PV Deployment and Investment	31
5.2 Solar PV Manufacturing and Investment	33
5.3 Key Takeaways	39
6.0 The Role of PSUs in India's Energy Transition	40
6.1 Investment Trends of PSUs	41
6.2 PSU Ambition for a Clean Energy Transition	43
6.3 International Experiences	50
6.4 Key Takeaways	51
7.0 Recommendations	52
References	56
Annex A. Public Sector Undertaking Project Costs	71
Annex B. Detailed Findings on Public Sector Undertakings' Ambition	72
Annex C. State Manufacturing Policies	74



List of Figures

Figure ES1. Total quantified energy subsidies, FY 2014–FY 2020 (INR crore, real 2020).....	v
Figure ES2. Technologies requiring a new generation of support measures.....	vii
Figure ES3. Assessment of domestic solar PV manufacturing.....	ix
Figure ES4. Annual project-level investments made by seven major Indian PSUs, FY 2014–20....	x
Figure 1. Power demand in the COVID-19 crisis.....	3
Figure 2. Fuel demand in the COVID-19 crisis.....	3
Figure 3. Public money committed to energy from January 20 to June 21 by the G20.....	4
Figure 4. Public money committed to energy from January 20 to June 21 by India.....	4
Figure 5. Grouping of energy subsidies.....	7
Figure 6. Total quantified energy subsidies, FY 2014–FY 2020 (INR crore, real 2020).....	10
Figure 7. Total coal subsidies in India, FY 2014 to FY 2020 (real).....	12
Figure 8. Total O&G subsidies in India, FY 2014 to FY 2020 (real).....	16
Figure 9. Energy subsidies for O&G by mechanism, FY 2014 to FY 2020 (real).....	17
Figure 10. Left—Central excise duty on fuels Right—Contributions to central and state exchequers.....	18
Figure 11. Total T&D subsidies in India, FY 2014 to FY 2020 (real).....	19
Figure 12. Price support through subsidy transfers across major state governments for FY 2020.....	20
Figure 13. Total renewable subsidies in India, FY 2014 to FY 2020 (real).....	23
Figure 14. Cumulative solar pumps installed across India until the end of 2019.....	25
Figure 15. Total subsidies to EVs in India, FY 2014 to FY 2020 (real).....	27
Figure 16. EV manufacturing and services value chain.....	28
Figure 17. Solar PV investment in India (USD billion), total and FDI.....	31
Figure 18. Solar PV manufacturing chain.....	33
Figure 19. What would a well-developed Indian domestic solar PV manufacturing sector look like?.....	34
Figure 20. Key investment barriers in different stages of solar PV manufacturing.....	35
Figure 21. Key existing policy measures to support solar PV manufacturing, central and state.....	36
Figure 22. CAPEX of PSUs by operating sector, FY 2014 to FY 2020 (real).....	41
Figure 23. CAPEX trends of seven major PSUs in India, FY 2014 to FY 2020 (real).....	42
Figure 24. Annual project-level investments made by seven major Indian PSUs, FY 2014 to FY 2020 (real).....	43
Figure 25. Leadership for IOCL's Alternate Energy & Sustainable Development group.....	48

List of Tables

Table 1. Major PSUs in the energy sector	8
Table 2. Support measures for solar PV manufacturing, stakeholder views on performance, and recommendations.....	37
Table 3. Ambition assessment framework for major energy sector PSUs	45
Table 4. Lessons from international SOEs: Ørsted and ESKOM.....	50
Table B1. The public sector undertakings ambition matrix.....	72
Table C1. State-level manufacturing policies and a breakdown of the main manufacturing incentives.....	74

List of Boxes

Box 1. A just transition in India	15
Box 2. Strategic taxation during the global oil price crash.....	18
Box 3. Targeting electricity subsidies and improving billing and collection	22
Box 4. Increasing the uptake of solar pumps	25
Box 5. EV roll out in states: Delhi and Telangana.....	29
Box 6. Institutional and social perspectives on PSUs.....	48
Box 7. New green financing mechanisms: NTPC	49



List of Abbreviations

BPCL	Bharat Petroleum Corporation Limited	MoEFCC	Ministry of Environment, Forests and Climate Change
CAPEX	capital expenditure	MoF	Ministry of Finance
CEA	Central Electricity Authority	MoP	Ministry of Power
CIL	Coal India Limited	MSME	micro, small and medium-sized enterprises
CSR	corporate social responsibility	O&G	oil and gas
DBT	Direct Benefit Transfers	ONGC	Oil and Natural Gas Corporation Limited
DBTL	Direct Benefit Transfer of LPG	PDS	Public Distribution System
DBT-P	Direct Benefit Transfer for Power	PFC	Power Finance Corporation
DCR	domestic content requirements	PLI	Production-linked incentive
DEA	Department of Economic Affairs	PM-KUSUM	Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahaabhiyan
DISCOM	distribution company	PMUY	Pradhan Mantri Ujjwala Yojana
DMF	District Mineral Foundation	PPA	power purchase agreements
EV	electric vehicles	PSU	public sector undertakings
FDi	foreign direct investment	PPAC	Petroleum Planning & Analysis Cell
FY	fiscal year	PV	photovoltaic
GAIL	Gas Authority of India Limited	R&D	research and development
GMB	Green Masala Bonds	SDG	Sustainable Development Goal
GoI	Government of India	SECI	Solar Energy Corporation of India
GST	Goods and Service Tax	SOE	state-owned enterprises
HPCL	Hindustan Petroleum Corporation Limited	SGST	State Goods and Services tax
IEA	International Energy Agency	T&D	transmission and distribution
IISD	International Institute for Sustainable Development	TERI	The Energy and Resource Institute
IOCL	Indian Oil Corporation Ltd.	UDAY	Ujjwal DISCOM Assurance Yojana
IR	Indian railways	VAT	value-added tax
ISTS	inter-state transmission system	WTO	World Trade Organization
LPG	liquefied petroleum gas		
MNRE	Ministry of New and Renewable Energy		



1.0 Introduction

Subsidies matter because they are used by governments around the world to influence energy producers and consumers. For producers, subsidies alter the relative competitiveness of different energy technologies and send a signal about national priorities to influence investment decisions and shape the energy mix. For consumers, subsidies can make different energy types more or less affordable to influence consumption decisions and target social outcomes.

Subsidies can help drive positive changes by helping consumers afford modern energy, bringing down the costs of new technologies and encouraging investors to take risks in new markets. They can also be poorly designed: running high expenses and encouraging public ills rather than public goods, despite well-intended policy outcomes. In particular, subsidies for fossil fuels increase consumption, driving up air pollution and carbon emissions while crowding out investment in renewables and energy efficiency. As part of Sustainable Development Goal (SDG) 12 on responsible consumption and production, 193 countries, including India, have committed to fossil fuel subsidy reform. For all these reasons, transparency is needed about what subsidies exist, how much they cost, and what impacts they have. Global datasets on fossil fuel subsidies can now be explored through the [Fossil Fuel Subsidy Tracker](#).

This report examines how the Government of India has used subsidies to support different types of energy. It is the latest in a series of reviews of India's energy subsidies—most recently in [Mapping India's Energy Subsidies 2020](#) (Garg et al., 2020). The underlying data have been updated to fiscal year (FY) 2020¹ and integrated into [our accompanying data portal](#). Comprehensive data are not yet available on energy subsidies for FY 2021, the FY in which the COVID-19 crisis hit the Indian economy and during which time a number of major stimulus measures were announced. To integrate these important developments, this report draws qualitatively on the data in the [Energy Policy Tracker](#), an initiative to track public money commitments in recovery packages. We seek to answer: How have India's energy subsidy policies changed, and how might they change as a result of COVID-19? What have been the most significant developments for sustainability? And is public support aligned with India's desired energy future?

This year, the update contains two special chapters. The first examines the role that subsidies have played in India's remarkable success with solar photovoltaic (PV) deployment and explores what lessons could be learned to increase the effectiveness of support for solar PV manufacturing. The second examines a different type of government support: the investments that are being made by India's public sector undertakings (PSUs). These state-owned enterprises (SOEs) dominate key parts of the energy sector. How well are their investments, projects, and future planning aligned with a clean energy transition?

As in previous editions, this report also aims to provide a useful resource for the Government of India and others as international processes go forward on energy subsidy reform. This includes the G20 peer review that India has committed to conducting with France as part of the G20 commitment to phase out subsidies and the first round of formal reporting under SDG 12.

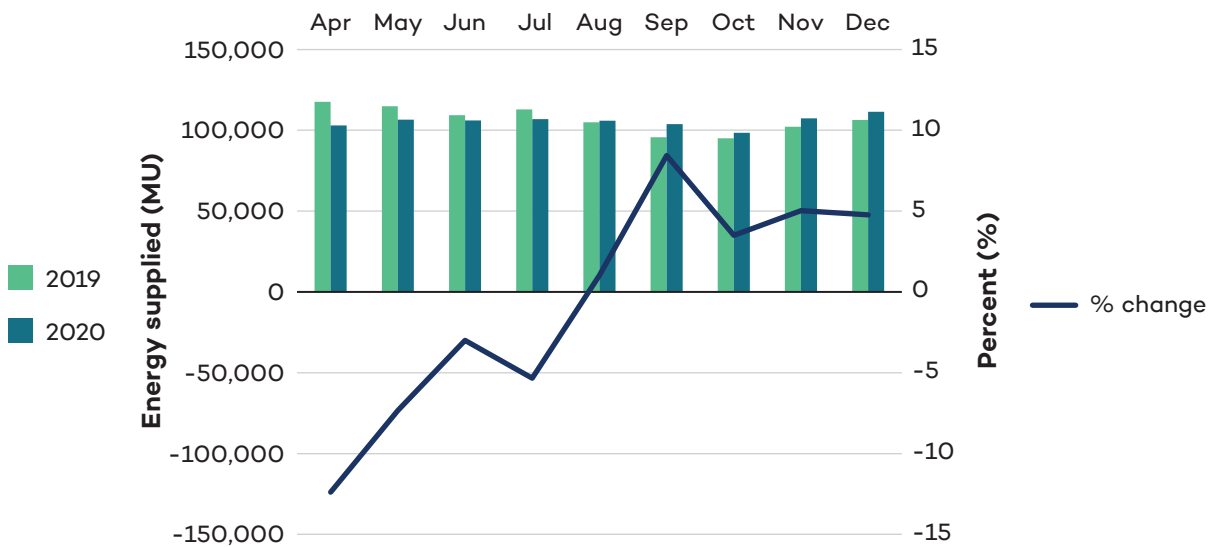
¹ FY 2020 refers to the year beginning in April 2019 and ending in March 2020, and likewise for other fiscal years.



**2.0 Context:
A world in lockdown**

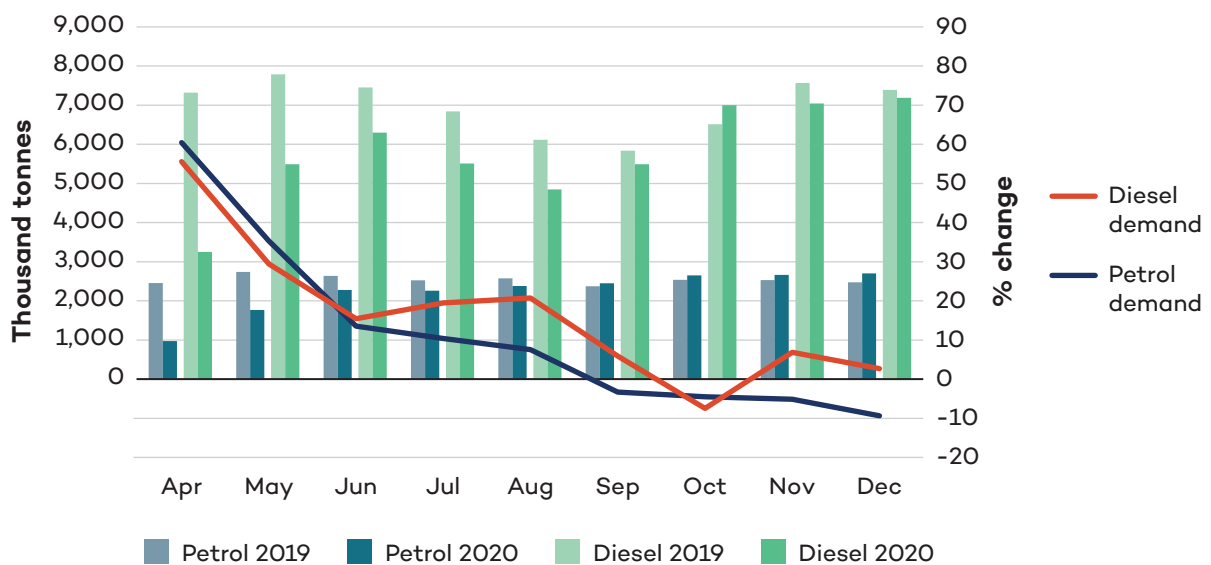
COVID-19 has resulted in an unprecedented social and economic crisis. In the energy sector, this was reflected in a dramatic fall in demand for power and transport and the fossil resources that predominantly fuel these services. As illustrated in Figures 1 and 2, electricity demand fell over 12% in April 2020, while for petrol and diesel it fell by around 60%—though by the end of the year, both had recovered. Globally, oil prices plummeted, with the Indian Crude Basket falling from an average of USD 64 per barrel in the 2019 calendar year to USD 42 per barrel over 2020 (Petroleum Planning & Analysis Cell [PPAC], 2020). Energy investment in India is estimated to have fallen by 15% (International Energy Agency [IEA], 2021a).

Figure 1. Power demand in the COVID-19 crisis



Source: PPAC, 2020.

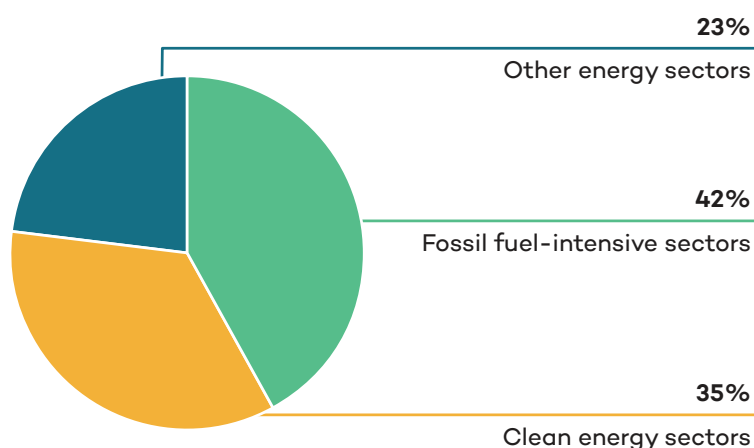
Figure 2. Fuel demand in the COVID-19 crisis



Source: PPAC, 2020.

GDP followed the same broad trajectory: a contraction of 24.4% in the first quarter (Q1), which reduced to 7.3% by Q2 and is estimated to have bounced back to 0.4% growth by Q3, though with a total estimated annual contraction of 8% (PIB, 2021d). While the economy rebounded, it is not yet clear how inclusive this has been for ordinary people. According to the Pew Research Centre, it is estimated that 32 million and 35 million people, respectively, fell out of the middle class and low-income class, while poverty increased by 75 million (Kochhar, 2021). Recovery may also not be smooth. The severe second wave of infections in the first half of 2021 has created new losses of life, economic disruptions, and associated social impacts.

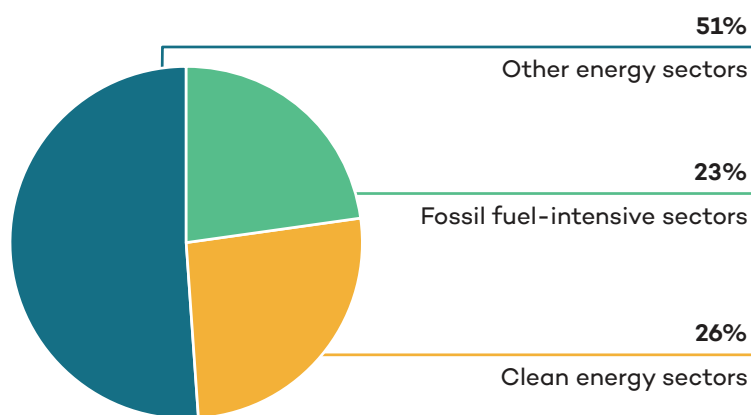
Figure 3. Public money committed to energy from January 20 to June 21 by the G20



Source: International Institute for Sustainable Development (IISD) et al., 2020.

Around the world, countries responded to the crisis with stimulus spending to support people and reinvigorate economies. A share of this has targeted energy and energy-intensive sectors. As of April 13, 2021, it is estimated that G20 countries alone committed USD 607.4 billion in public money to energy since the start of the pandemic (IISD et al., 2020). Of this, around 43% is for fossil fuels, as shown in Figure 3. While support is still skewed toward fossil-intensive activities, it is progressively shifting to favour clean energy, with countries such as EU members, China, Japan, and Canada launching plans for a clean energy transition.

Figure 4. Public money committed to energy from January 20 to June 21 by India



Source: IISD et al., 2020.



In India, as of June 13, 2021, central and state governments have committed at least INR 10 lakh crore (USD 141 billion) in energy-related support through subsidies, PSUs, and public finance. This is the largest amount committed among the G20 but one of the smallest on a per capita basis. Of this, INR 2.3 lakh crore (USD 32 billion) (23%) supported fossil energy, INR 2.6 lakh crore (USD 36.6 billion) (26%) clean energy, and INR 5.1 lakh crore (USD 71.9 billion) (51%) “other” energy (see Figure 4). Analyzing this data, Garg et al. (2021) noted that much support classified as “other”—largely for the power sector—disproportionately benefits fossil fuels, given coal’s dominant 70% share in the electricity mix (NITI Aayog, 2021). They also found that only around 20% was driven by the impacts of COVID-19, while over 50% was driven by energy security.

The focus on power reflects longstanding challenges faced by state electricity distribution companies (DISCOMs). Early in the crisis, they were supported by an INR 1.35 lakh crore (USD 19 billion) set of loans to help pay debts to generators. In the FY 2022 budget, a 5-year reform-linked performance scheme was announced, worth INR 3 lakh crore (USD 41.3 billion), with a primary focus on billing and collection efficiencies, infrastructure creation, and quality and reliability. The emphasis on energy security derives from the central role that Aatmanirbhar Bharat (“self-reliant India”) has played in India’s recovery plan. In May, October, and November 2020, respectively, the government announced three Aatmanirbhar Bharat packages, together with measures under the PM Garib Kalyan package and PMGKP Anna Yojana, worth INR 30 crore (USD 4.2 million) (M. Sharma, 2020). It also instructed central PSUs to significantly increase capital expenditure to stimulate growth, and this will likely continue in FY 2022 (Sahu, 2021).

2.1 Economic Recovery With Sustainable Energy

Like many countries, India’s challenge is to align recovery with sustainability, including (Garg et al., 2020):

- Installing 450 GW of renewables by 2030 while managing increased supply and demand variability
- Enabling universal access to affordable, modern, clean energy as part of SDG 7
- Reducing indoor and outdoor air pollution to safe levels for human health
- Phasing out inefficient fossil fuel subsidies as part of G20 and SDG 12 commitments
- Making 30% of all new vehicle sales electric by 2030
- Reducing emissions intensity by 40% from 2005 to 2030 as part of its Nationally Determined Contribution under the United Nations Framework Convention on Climate Change.

Fossil fuel subsidy reforms and taxation can help fund recovery, while recovery itself can accelerate the clean energy transition. Recovery can also lay the foundation for future commitments, given increasing urgency to ratchet up ambition on climate change. It is not yet clear if India will adopt a net-zero target, but if it does, Chaturvedi (2021) finds that this would require a 55-fold increase in non-hydro renewables, an almost complete decline in fossil fuels and the electrification of two thirds of transport and industrial energy. Such changes are for the long term but require immediate planning and support to bring new technology to market competitiveness and incubate institutional reforms.

3.0 Approach and Scope



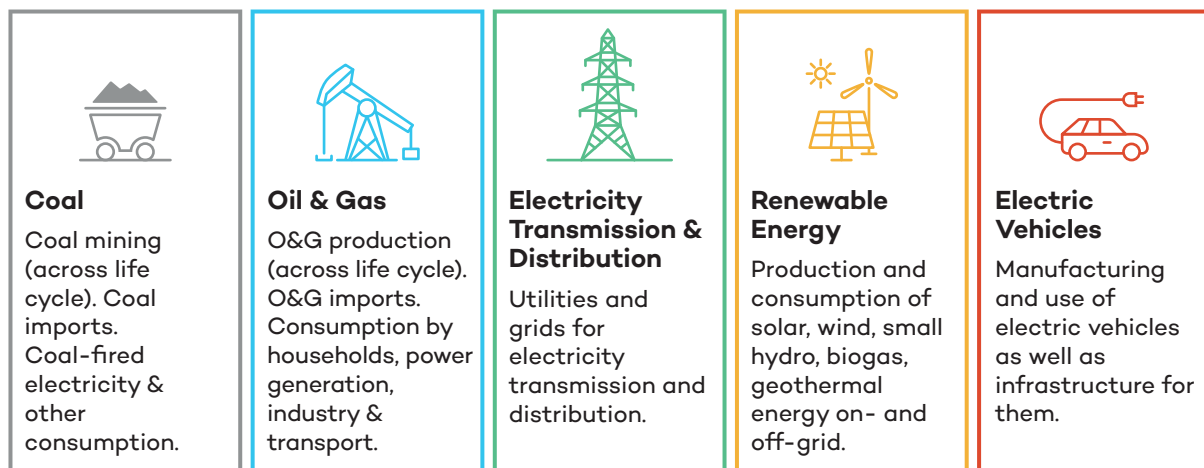
As described in detail in Garg et al. (2020), our definition of “subsidy” is taken from the Agreement on Subsidies and Countervailing Measures of the World Trade Organization (WTO), agreed by all 164 WTO members. This includes (WTO, 1994):

1. Direct and indirect transfers of funds and liabilities (budget outlays)
2. Government revenue foregone (reduced tax rates and tax exemptions)
3. Provision of goods or services below market value (such as land or water)
4. Income and price support through market regulations (including non-enforcement).

In this publication, the term “subsidy” refers to a government policy or program that creates a financial contribution to a non-government actor, while “government support” is a broader term that includes subsidies, spending by PSUs, and loans from public financial institutions. We group subsidies into five areas, as illustrated in Figure 5: coal; oil and gas (O&G); electricity transmission and distribution (T&D); renewables; and electric vehicles (EVs). Nuclear and large hydropower are excluded due to a lack of data. All categories include the full value chain of production and consumption: for example, O&G includes upstream subsidies for refineries and downstream subsidies for consumers. In most cases, estimates are based on official government data. Some are identified but “non-quantified” due to a lack of data. Our data cover FY 2014 to FY 2020. We do not yet have full data on subsidy support following COVID-19 in FY 2021, but this is reported qualitatively where possible.

The term “clean energy” includes renewable energy, EVs, and energy-efficiency measures but excludes large hydro; nuclear; palm oil; first-generation biofuels and the capture, utilization, and storage of carbon; and any fossil fuels, such as natural gas, “clean coal,” or “ethical oil.” The term “clean energy transition” is the process of switching energy systems from high-carbon fossil fuels to clean energy.

Figure 5. Grouping of energy subsidies



Most subsidies in the review are central government policies. Thus, estimates are conservative—they do not include state mechanisms. An important exception is state transfers for electricity subsidies, which exist across almost all states and are very large, so exclusion would be a serious omission. Notably, low electricity tariffs are also paid for by higher charges for other consumers

(cross-subsidies) and by DISCOM losses. It was not possible to quantify these for every year, so our estimates only capture state transfers. Another important exception is bailout packages for DISCOMs. Methodologically, these are hard to attribute as a subsidy to specific years. They are therefore excluded from T&D totals and marked separately as a standalone group, “electricity sector bailout.” For more details on the methodology, see Garg et al. (2020), as well as [accompanying spreadsheets](#) and the [supplementary annex](#) accompanying this report.

For our chapter on government support for solar PV and manufacturing, we look at foreign direct investment (FDI) into solar PV over a 5-year period from FY 2016 to FY 2020 to understand emerging risk factors for investment. To investigate the role of subsidies, we interviewed a range of developers, investors, and solar PV manufacturers. Seven interviews were conducted, the highlights of which have been included in Section 5.

For our section on PSUs, we developed two lists of major energy PSUs, based on government categories (Department of Public Enterprises [DPE], 2020). The first consists of Maharatnas—PSUs that either have particularly high levels of net profit, net worth, or annual turnover—and the second of non-Maharatnas (see Table 1). We do not examine energy PSUs that primarily operate as investors. For all 14 PSUs, audited data on capital expenditure (CAPEX) from FY 2014 to FY 2020 are taken from the Expenditure Budget provided by the Ministry of Finance, listed under Internal and Extra Budgetary Resources (Ministry of Finance [MoF], 2021a). Data on project-level infrastructure investments were collected for the Maharatna PSUs over the same period (Department of Economic Affairs [DEA], 2021). Annual totals were estimated by evenly dividing costs across the project development lifetime. Wholly owned subsidiaries of the PSUs are included, but joint ventures with states, private partners, and non-energy PSUs are not considered. Further details are provided in Annex A.

Table 1. Major PSUs in the energy sector

	Maharatnas	Non-Maharatnas
Coal	Coal India Limited (CIL)	Neyveli Lignite Corporation Limited (NLC)
		Singareni Collieries Company Limited (SCCL)
Oil and gas	Oil and Natural Gas Corporation Limited (ONGC)	Oil & Natural Gas Corporation Videsh Ltd. (ONGCV)
	Gas Authority of India Limited (GAIL)	Oil India Ltd. (OIL)
	Bharat Petroleum Corporation Limited (BPCL)	Chennai Petroleum Corporation Ltd. (CPCL)
	Hindustan Petroleum Corporation Limited (HPCL)	Mangalore Refineries and Petrochemicals Ltd. (MRPL)
	Indian Oil Corporation Ltd. (IOCL)	Numaligarh Refinery Limited (NRL)
Power and renewables	NTPC	

4.0 Key Trends in Energy Subsidies From FY 2014 to FY 2020



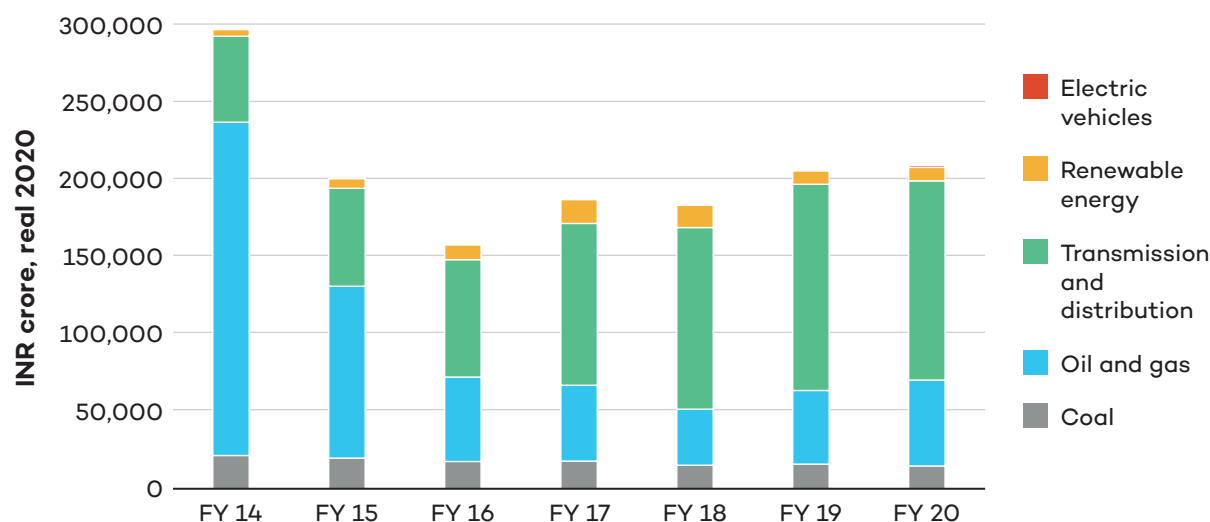
4.1 Highlights

As shown in Figure 6, the total quantified subsidies for FY 2020 in real terms have remained almost the same as the previous year, at INR 2,09,552 crore (USD 29.6 billion). This represents a plateau since FY 2016, following a significant drop from FY 2014.

For FY 2020, the notable recent trends include:

- Coal subsidies have remained stable in nominal terms, but when adjusted for inflation, have seen a steady decline of 30% over 7 years, in FY 2020 standing at INR 14,908 crore (USD 2.1 billion).
- O&G subsidies reached INR 55,347 crore (USD 7.8 billion) in FY 2020—a resurgence after the low of INR 36,465 crore (USD 5.6 billion) in real terms in FY 2018 and their highest level since FY 2015. This is due to high world oil prices in FY 2020 combined with growing household liquefied petroleum gas (LPG) consumption.
- T&D subsidies in FY 2020 were INR 1,29,256 crore (USD 18.2 billion), 60% of all subsidies. Around 90% is due to tariff subsidies from state governments to consumers. In addition to subsidies shown in Figure 6, Ujjwal DISCOM Assurance Yojana (UDAY) bailouts to DISCOMs accounted for INR 10,177 crore (USD 1.4 billion). Total bailouts from FY 2014 to FY 2020 stood at INR 2,08,749 crore (USD 36 billion) (nominal).
- Renewable energy subsidies have stagnated since peaking in FY 2017. In FY 2020, they stood at INR 8,577 crore (USD 1.2 billion). This is despite several new large subsidy programs and is largely due to a steady tapering of support to grid-scale solar and wind as they achieved market parity.
- EV subsidies have more than doubled since FY 2019, at INR 1,141 crore (USD 161 million) in FY 2020. This follows the rise in sales of electric two- and three-wheelers and the onset of the FAME II scheme.

Figure 6. Total quantified energy subsidies, FY 2014–FY 2020 (INR crore, real 2020)



Source: Authors' calculations. Note that a significant number of subsidy policies have been identified but cannot be quantified due to a lack of transparently available data. See subsequent discussion and accompanying [spreadsheets](#) for more details.



Among the quantified subsidies in FY 2020, 81% of beneficiaries were consumers, 12% were producers, and the rest were both. The largest producer support was preferential tax rates for coal and new renewable projects.

Data on subsidies during FY 2021, the year of COVID-19, are still incomplete—but available information suggests they will probably stagnate or drop slightly, particularly for fossil fuels and electricity T&D. This is due to lower-than-usual demand for petroleum products and power during lockdown. While many new energy commitments were made between January 2020 and June 2021—estimated to be worth at least INR 10 lakh crore (USD 141 billion) in the [Energy Policy Tracker](#) database—we believe it is unlikely to fully counterbalance the decline in subsidies. This is because many FY 2021 commitments will take time to disburse, be spread over multiple years, and may not be fully disbursed. Further, not all new commitments are subsidy policies.

For FY 2021, likely changes to subsidy trends include:

- Coal subsidies will temporarily decline due to lower-than-usual consumption and the decision to roll back coal-washing regulations. This latter change is notable because the removal of the environmental norm will prevent the identification of a “subsidy” when there is non-compliance but without addressing the underlying environmental externality. The uncaptured social costs of unwashed coal will still be borne by the population. Similarly, in FY 2022, the government extended deadlines for power plants to comply with air pollution norms. As with coal washing, this will prevent non-compliance from being identified as a subsidy on an ongoing basis—but the social costs will remain.
- O&G subsidies will likely remain stable or drop in FY 2021, with a sharper decrease in FY 2022. This is due to the crash in global oil prices and the resulting suspension of direct benefit transfers for domestic LPG consumers. This is likely to be a temporary fall until oil prices recover but will also depend on whether LPG subsidies are reintroduced.
- T&D subsidies are also likely to plateau, bucking the upward trend of recent years because of shocks to power demand. Going forward in FY 2022, a new reform-linked scheme will significantly increase government support for the power sector in future years.
- Renewable energy subsidies are expected to remain close to their current levels, with a potential modest fall to reflect lower-than-usual investment and consumption.
- EV subsidies will continue to increase sharply following further rollout of existing plans.

Since the previous update, some of the major changes to the database of energy subsidies are:

- Inclusion of the following new subsidy schemes: energy conservation schemes (T&D); the Phulpur Dhamra Haldia Pipeline Project and the National Seismic Program (O&G); and the provision of concessional Goods and Service Tax (GST) rates on EV buses (EVs). The waiver of inter-state transmission charges has also been calculated, though only for FY 2020.

- Retrospective revision of several renewable energy subsidies under the Jawaharlal Nehru National Solar Mission changed from data on budgeted amounts to the actually released amounts. This has resulted in an overall downward revision in renewable energy subsidies across all years.
- Retrospective revisions of estimates for T&D, based on new data from the Power Finance Corporation (PFC). The estimate of consumer subsidies for FY 2020 is taken from available state-level documents.

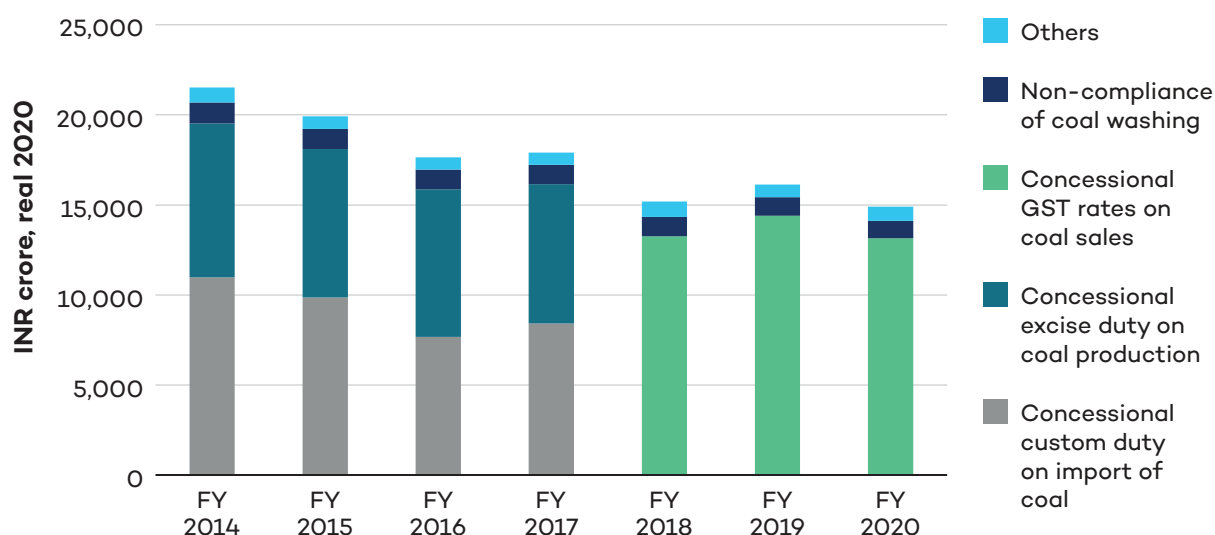
See the [supplementary annex](#) for further details of changes made to the database.

4.2 Coal

In real terms, the total quantified subsidies for coal declined steadily between FY 2014 and FY 2020, from INR 21,525 crore (USD 3 billion) to INR 14,908 crore (USD 2.1 billion). As shown in Figure 7, the major subsidies to coal in FY 2020 were:

- A concessional 5% sales tax under the GST against a benchmark of 18% for other minerals, which reduces input costs for coal-based electricity generation worth INR 13,154 crore (USD 2.0 billion).
- Non-compliance with coal-washing regulations that are intended to reduce air pollutants, conferring a financial benefit of INR 968 crore (USD 144 million) to coal producers.
- Other policies that cover a range of objectives, including conservation and safety of coal mines, exploration in difficult areas, and special benefits to employees.

Figure 7. Total coal subsidies in India, FY 2014 to FY 2020 (real)



Source: Authors' calculations; see accompanying [spreadsheets](#) for more details.



It is not yet possible to provide an estimate for government support in FY 2021, the first year of the COVID-19 pandemic, but it can be noted that the crisis will have affected coal demand, as well as triggering a range of government support measures that were extended to the coal sector.

According to the *India Energy Outlook* (IEA, 2021a), thermal coal demand fell by 7% in 2020 compared to 2019, partly due to demand shocks during the initial three-month lockdown. This affected coal disproportionately because utilities are obliged to buy power from renewable energy generators before any other source. As a result, the value of the largest quantified coal subsidy—the concessional GST rate on coal sales—will likely be lower in FY 2021, reflecting lower consumption.

The major new support in the wake of COVID-19 was a range of measures to boost domestic production and reduce reliance on imports through the privatization of coal mines for commercial purposes, as well as increased public investment in coal transport (PIB, 2020b). Before this, private firms were only allowed to mine coal for captive power plant use. The central government followed up with multiple incentives to encourage private investment, including reduced upfront payments, relaxed payment schedules, and rebates in revenue shared with the government for early production (Jai, 2021b). The government has, as of yet, not provided any estimate of the financial value of these incentives.

Further to this, a number of steps were taken to soften environmental norms affecting the costs of coal. In May 2020, the Ministry of Environment, Forests and Climate Change (MoEFCC) decided to remove the washing requirement for coal supplied to thermal power plants (MoEFCC, 2020). The Central Pollution Control Board had previously required plants located 500–749 km from mine pitheads to only combust coal with a 34% ash content or less, to reduce harmful pollutants. This required the beneficiation or “washing” of domestic coal, which typically has an ash content above 40%. The MoEFCC argued that the regulation increases costs, which has led to imported coal becoming more attractive while having a limited impact on the ash content of domestic coal. Experts have questioned this assessment, and the calculations underlying MoEFCC’s claims were not made publicly available (Centre for Science and Environment, 2020).

The following year, in April 2021, the deadline for compliance with air pollution norms was pushed by a further 3 years after the initial delay of 5 years (Varadhan, 2021). Cropper et al. (2021) estimate that 112,000 deaths annually can be attributed to current and planned coal-fired plants. These rollbacks and delays can have a severe impact on the health of the citizens as well as government expenditure on healthcare, undermining the response to COVID-19 and exacerbating health risks in a context where major Indian cities have already topped charts that record air pollution around the world.

As part of its COVID-19 recovery plan, the central government announced a commitment to spend INR 50,000 crore (USD 6.6 billion) to expand India’s coal evacuation infrastructure (Joshi, 2020). This was driven by a desire to support higher domestic production and curtail imports as part of Aatmanirbhar Bharat. At the same time, it levied a new tax on imported coal under the Agriculture Infrastructure Development Cess to raise revenue for agricultural

and rural development. The net taxes, however, remain unchanged as the customs duty was reduced proportionally (PTI, 2021a).

It is commonly observed that coal subsidies cannot be properly assessed without acknowledging the contributions that coal makes to federal and state revenues, as well as cross-subsidizing passenger transport of Indian Railways. This was reviewed in detail in the last edition of this report (Garg et al., 2020), which estimated a total coal contribution of INR 68,557 crore (USD 10.6 billion) in FY 2018. This is in line with other studies, such as Athawale et al. (2019), which find that CIL and NTPC alone contribute around 3% of total federal revenue and that coal taxes contribute over 5% of revenue in coal-rich states like Jharkhand, Chhattisgarh, and Odisha (Athawale et al., 2019). Taxes, however, must also be weighed against social costs, estimated to be at least INR 3,91,128 crore (USD 60.7 billion) per year in FY 2018 (Garg et al., 2020). This is a conservative estimate, based only on the value of mortality and morbidity from coal-related air pollution and low-range estimates of the costs of coal-related greenhouse gas (GHG) emissions. By this measure, the net costs of coal are over five times its net contributions.

The government has already shown strong leadership on fossil fuel taxation through its excise tax hike on petroleum and diesel. This approach can be extended to coal, particularly after the end of the GST compensation period in 2022, to gradually factor full social costs into prices. As the government considers whether to extend GST compensation, it should explore redirecting a share of revenue to the energy transition. Given the uncertain future for coal, it is also essential to pivot away from subsidizing production toward supporting communities, regions, and workers whose livelihoods might be affected in the coming decades by planning for a just transition (see Box 1).

4.3 Oil & Gas

In real terms, quantified O&G subsidies have fallen from INR 2,16,135 crore (USD 30.5 billion) in FY 2014 to INR 55,347 crore (USD 7.8 billion) in FY 2020. However, it is the second consecutive year it has gone up since the historically low value of INR 39,910 crore (USD 5.6 billion) in FY 2018.

The major subsidies for FY 2020 are:

- The Direct Benefit Transfer of LPG (DBTL or PAHAL), worth INR 29,628 crore (USD 4.2 billion), which transfers cash to LPG consumers after purchase to make it more affordable.
- Low GST rates for domestic LPG, worth INR 13,185 crore (USD 1.9 billion)
- LPG connection subsidies for the poor via Pradhan Mantri Ujjwala Yojana (PMUY), worth INR 3,724 crore (USD 525 million)
- Public Distribution System (PDS) kerosene, worth INR 1,833 crore (USD 259 million)
- The Phulpur Dhamra Haldia natural gas pipeline project, worth INR 1,552 crore (USD 219 million).



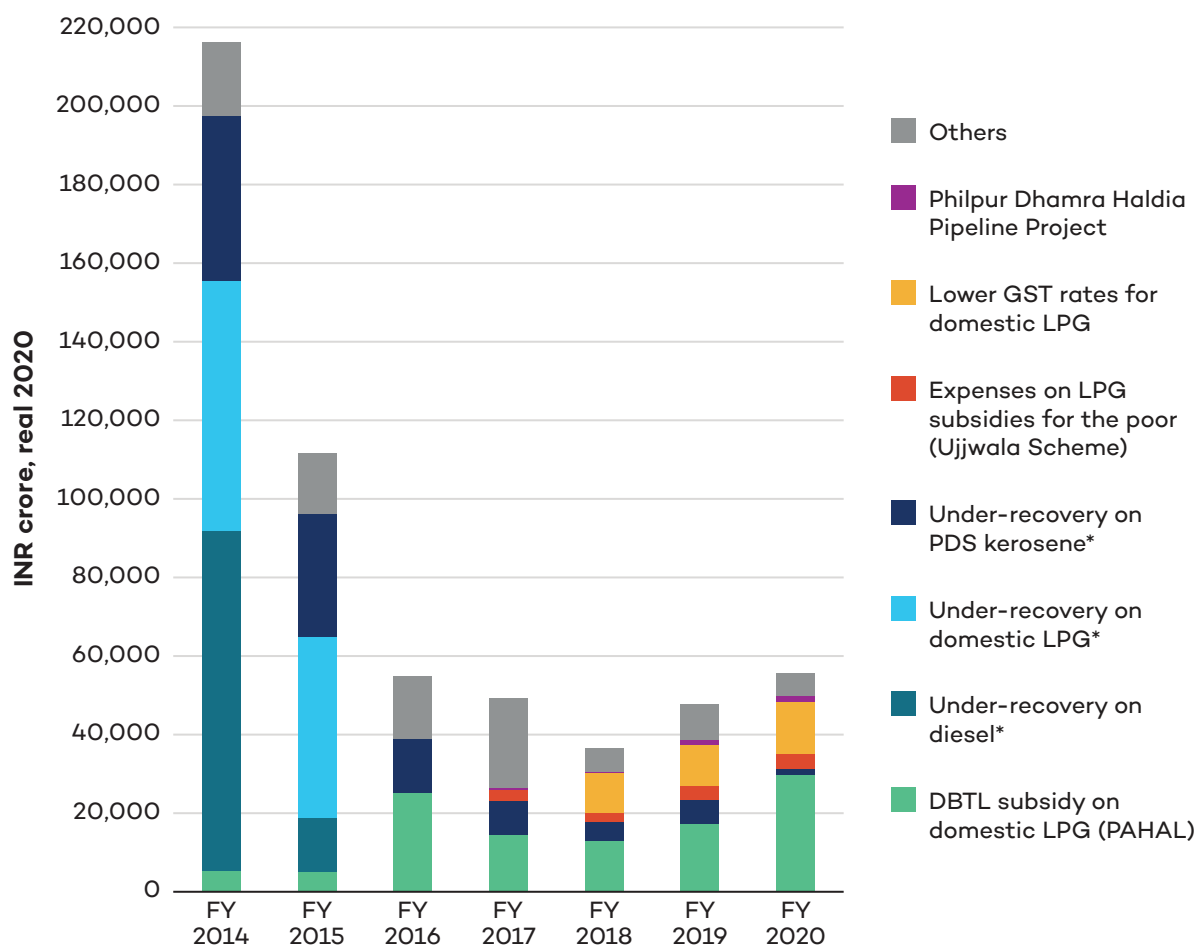
Box 1. A just transition in India

According to the IEA (2021a), currently stated policies will see coal decline from the current 70% of India's electricity mix to 30% by 2040. With further efforts to stimulate clean energy investment, solar could overtake coal a full decade earlier, seeing absolute coal demand decline 36% by 2030.

This uncertain medium-term future makes it important for central and state governments to start planning for a just transition: a negotiated vision, centred on a tripartite dialogue between governments, employers, and workers, and involving additional stakeholders, such as consumers and communities, to ensure that affected groups have a voice and a role in how change will occur.

Even in the short term, a just transition is pressing because the centre has announced that NTPC plans to shut down old polluting thermal power plants of 11 GW capacity (PTI, 2017b). And experience from other countries shows that implementing a just transition requires decades of planning, implementation, and engagement. A recent review by Pai (2021) identified a number of issues that are essential for future planning and relevant to near-term policy challenges, including:

- **Impacts on jobs and pensions.** A recent study estimated that close to 4 million people are directly or indirectly employed in coal mining and coal power (Pai, 2021). There is no national estimate of informal jobs, but research in one coal-dependent district found three times as many informal workers as formal workers (Bhushan et al., 2020). The coal industry also supports half a million pensioners, who are mainly retired workers of state-owned companies. Contributions from existing workers and companies are paid out to current retired workers, meaning that any coal contractions would have immediate consequences for pensioners.
- **Impacts on revenues.** Given the large share of government revenues derived from coal and the fact that coal contributes nearly 50% of Indian Railways' total freight revenue and helps subsidize passenger fares (Kamboj & Tongia, 2018), it is necessary to plan around diversification of the tax base.
- **The role of PSUs and public finance.** CIL alone produces 80% of coal in India, and smaller government-owned companies produce the remaining 10% (Pai & Zerriffi, 2021). Moreover, close to 50% of coal power plants are owned by federal or state companies such as NTPC. Power plants are usually two-thirds debt-financed from mainly three government-run entities: the State Bank of India, the PFC, and the Rural Electrification Corporation (Tongia et al., 2020). This exposure carries balance sheet risks for central and state governments that are already reeling under the debt impacts of COVID-19.
- **Investing District Mineral Foundation (DMF) funds in diversification.** The DMF collects funds by levying a special royalty on coal production and is intended to be used for investments in economic and social development in coal-producing districts. While it has experienced implementation challenges and funds have been diverted to support COVID-19 support measures, the DMF could be a vehicle for funding investment in just transition (Mishra, 2020)

Figure 8. Total O&G subsidies in India, FY 2014 to FY 2020 (real)

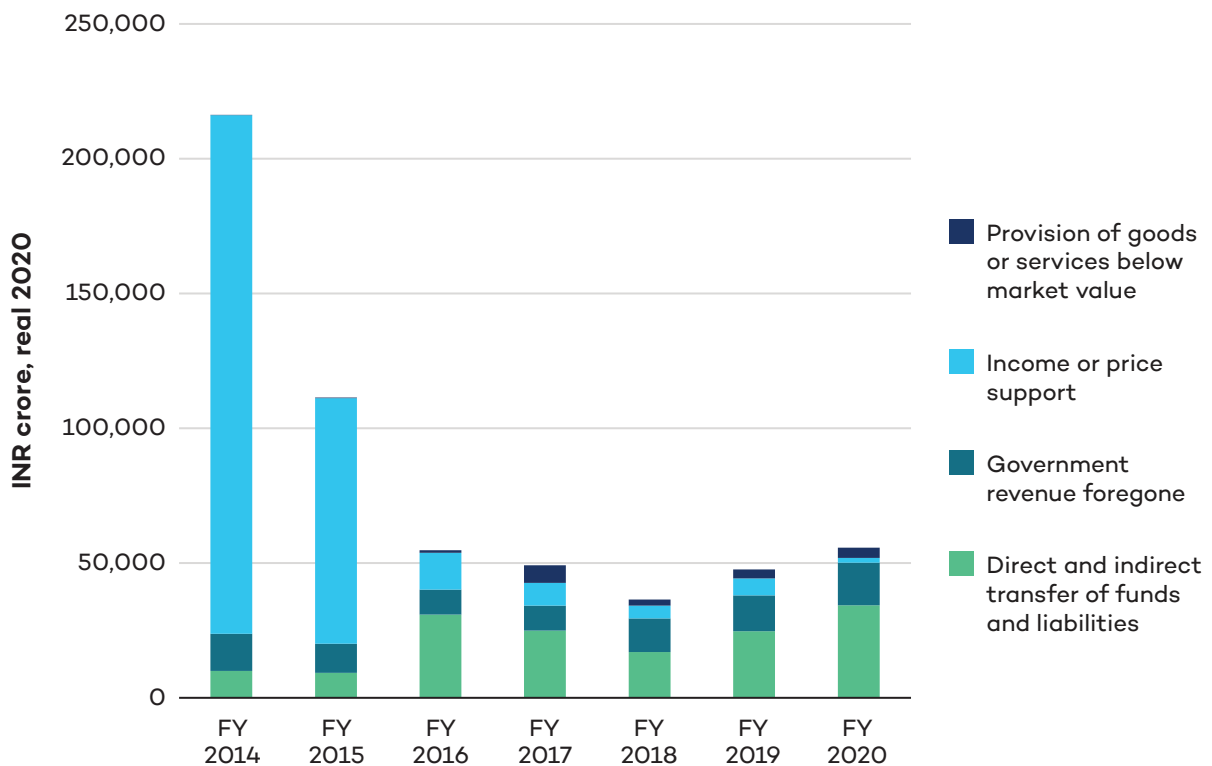
Source: Authors' calculations; see accompanying [spreadsheets](#) for more detail. Note: Policies marked with * are currently phased out. This includes under-recovery to kerosene, which has seen no budget allocation for FY 2022. A number of policies were identified but could not be quantified due to a lack of data. These policies include grants to the Oil Industrial Development Board; research and development grants under autonomous bodies; and 11 concessional rates or exemptions for O&G companies linked to research, exploration, royalties, assets, storage, supply, sales, and site restoration.

Following the crude oil price crash and the onset of COVID-19, the government has taken dramatic steps to reduce LPG subsidies by withholding direct transfers, with domestic LPG cylinders having been priced at market rates since September 2020 (IANS, 2020a, 2020b). While all PMUY beneficiaries were offered three free cylinder refills as a part of the COVID-19 relief measures, uptake has been low (Dey & Singh, 2020). The net result is expected to drive down LPG consumer subsidies as of FY 2021. This marks a significant change in support to LPG, which has grown to be the most costly focus for oil and gas subsidies. For reasons linked to the way in which expenditure is recorded, this is unlikely to result in big changes to subsidy expenditure until FY 2022, where the budget allocation for DBTL is INR 12,480 crore (USD 1.8 billion), less than half of the actuals for FY 2020. This sudden withdrawal is concerning, as it can lead to a reversal in progress on reducing indoor air pollution as LPG replaces traditional biomass. Poor households need continued support for LPG and other forms of clean cooking. The tension between scheme costs and energy access

can best be addressed through better targeting, such that subsidies are clustered on those most in need and reduced or removed for better-off consumers (Sharma et al., 2021).

The government has successfully phased out kerosene subsidies from FY 2022, and PPAC indicates no subsidy disbursement since the first quarter of FY 2021 (MoF, 2021; PPAC, 2021). This follows the phase-out of other under-recoveries, starting with petroleum in FY 2011, diesel in FY 2016, and LPG in FY 2017, making it a significant achievement in fossil fuel subsidy reform. Around 95% of the remaining subsidies are for consumption. In FY 2020, over 60% of subsidies were through direct transfers, most notably for LPG and kerosene, as shown in Figure 9.

Figure 9. Energy subsidies for O&G by mechanism, FY 2014 to FY 2020 (real)



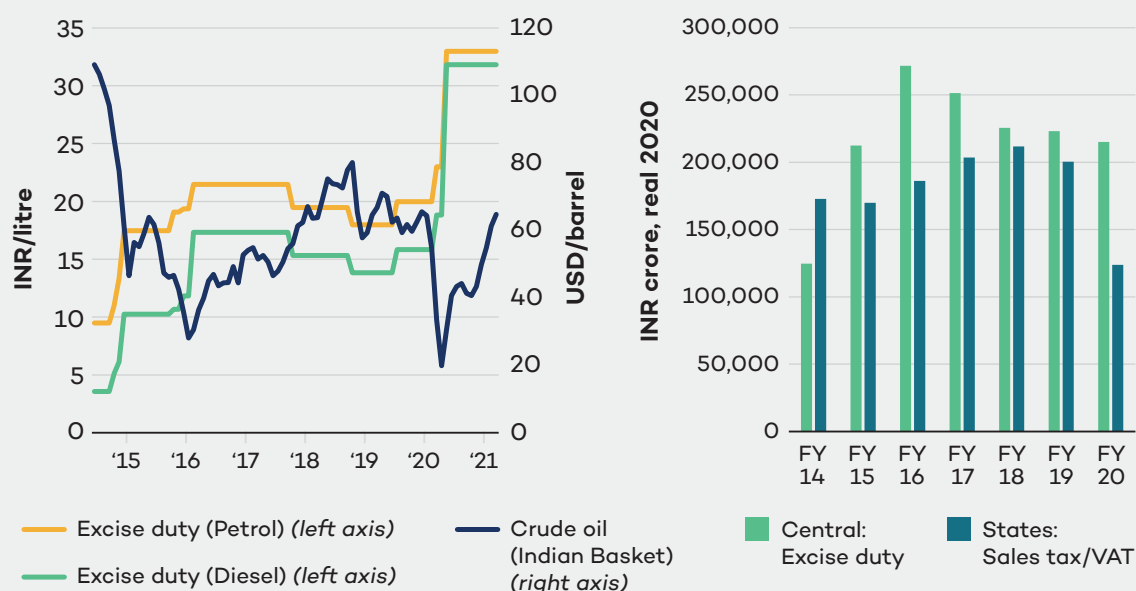
Source: Authors' calculations; see accompanying [spreadsheets](#) for more detail

As a part of COVID-19 recovery efforts, a major thrust has been gas infrastructure projects and promoting a “gas-based economy” (ANI, 2021). This includes support measures such as cuts in pipeline tariffs to boost gas use in far-flung areas; gas being put under a standard bidding route for transparent price discovery; and 100 more districts to be added to the City Gas Distribution Network (IISD et al., 2020). Given India’s growing reliance on imported LNG and the risk of these becoming stranded assets, this is undermining India’s energy security as well as the government’s decarbonization strategy (Muttitt et al., 2021). In all, 11 new O&G commitments have been identified since the onset of COVID-19, worth at least INR 15,700 crore (USD 2.2 billion) (Garg et al., 2021). In the same period, however, excise duties for petrol and diesel were significantly increased to fund crisis response and recovery (see Box 2).

Box 2. Strategic taxation during the global oil price crash

The central government has been strategically increasing fuel excise duties during moments of low crude oil prices, as shown in Figure 10. When crude prices crashed in March–April 2020, petrol and diesel duties were increased by INR 13 (USD 0.18) per litre and INR 16 (USD 0.23) per litre, or 65% and 101%, respectively (PPAC, n.d.). Strategic reserves were also filled, generating notional savings of INR 5,000 crore (USD 0.7 billion) (PIB, 2021e). As a result, tax revenues to the centre exceeded FY 2020 (in nominal terms) in the first nine months of FY 2021. While some states also increased value-added tax (VAT), net revenues did not increase in proportion to the centre, as also shown in Figure 10.

Figure 10. Left—Central excise duty on fuels
Right—Contributions to central and state exchequers



Source: Compiled from PPAC, n.d.

Globally, this is one of the best examples of taxing a polluting fossil fuel to help raise funds for recovery efforts (Sanchez et al., 2021). While this deserves due acknowledgement, there is increasing concern about impacts on the cost of living. With the right design, tax increases for fossil fuels can, in fact, result in net positive impacts for vulnerable groups. But this requires revenues to be transparently redistributed in ways that benefit the marginalized and provide mobility alternatives, such as improving public transportation and scaling up EV adoption and infrastructure.

Despite various discussions on bringing petrol and diesel under the GST, it remains politically challenging. The excise duty on petrol and diesel was 11% of all central tax revenues, and VAT is one of the few remaining levers through which states can generate additional revenue (MoF, 2021).

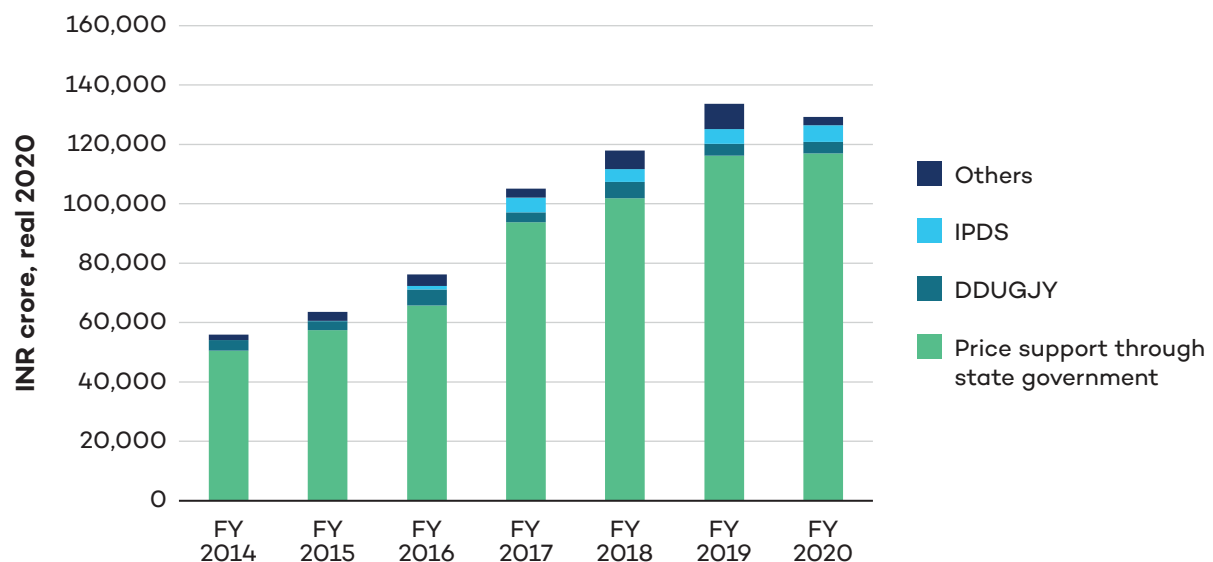
4.4 Electricity Transmission & Distribution

In the last 7 years, electricity T&D subsidies have more than doubled, from INR 55,911 crore (USD 7.9 billion) in FY 2014 to INR 1,29,256 crore (USD 18.2 billion) in FY 2020. As shown in Figure 11 the major subsidies to T&D in FY 2020 were:

- State transfers for low electricity tariffs worth INR 1,16,945 crore (USD 19.3 billion).
- The Integrated Power Development Scheme (IPDS), an urban network-strengthening scheme worth INR 5,560 crore (USD 784 million).
- Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), a rural distribution-system-strengthening scheme worth INR 3,926 crore (USD 554 million).

Low electricity tariffs play an important role in ensuring affordability, but they need to be significantly improved so they do not continue to undermine DISCOMs' financial viability. Our estimate of the value of state transfers is just one part of the full cost. Low tariffs are also paid through cross-subsidies, where some users (typically industrial and commercial) pay prices that are above-cost to compensate for other users (typically agricultural and low-end residential) paying prices that are below-cost. In FY 2019, cross-subsidies were estimated to be at least INR 75,027 crore (USD 11.2 billion) in nominal terms (Aggarwal, Viswamohan, et al., 2020). This would bring total T&D subsidies in FY 2020 to well above INR 2 lakh crore (USD 28.2 billion). Better transparency and reporting are needed for a fuller picture and to drive a lasting improvement in currently unsustainable DISCOM finances. DISCOMs, state governments, and regulators are recommended to coordinate on a standard reporting framework.

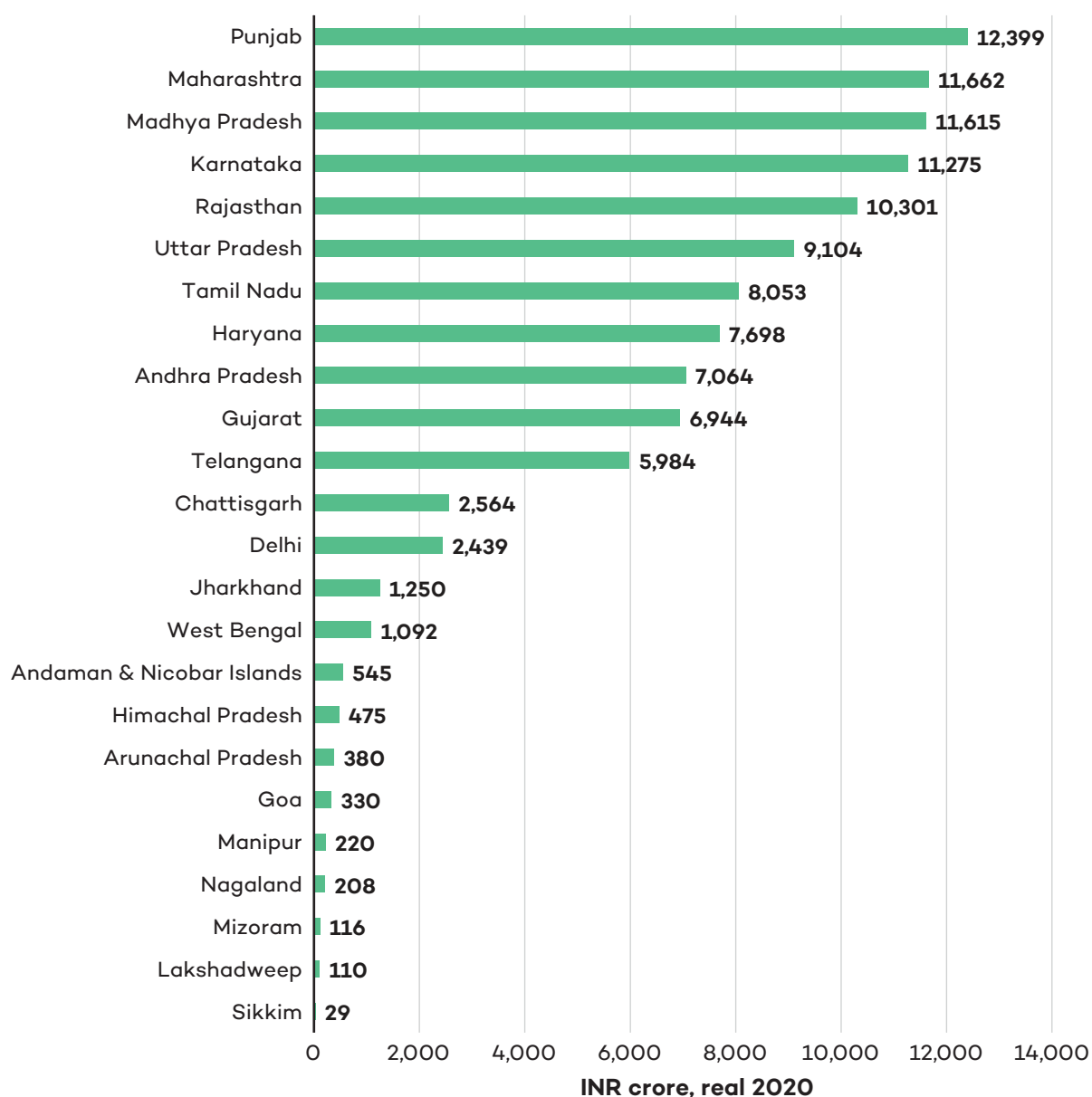
Figure 11. Total T&D subsidies in India, FY 2014 to FY 2020 (real)



Source: Authors' calculations; see accompanying [spreadsheets](#) for more details. One policy was identified but could not be quantified due to a lack of data: an excise duty rebate on T&D equipment. Price support through state governments has been taken from the PFC reports for FY 2014 to FY 2019. For FY 2020, the data have been compiled by the authors for major states from the tariff orders of various DISCOMs, PFC reports, and state government budget documents.

The state transfers to support below-cost electricity tariffs are the only state-level subsidies to be included in this database of India's energy subsidies. Figure 12 shows how they are distributed across states and Union Territories, revealing that transfers are much higher in some jurisdictions than others. It is notable that these transfers are often not paid on time, stretching DISCOMs' short-term working capital requirements and causing them to resort to high-interest, short-term borrowing that simply deepens their financial problems (Beaton et al., 2020). According to Aggarwal, Viswamohan et al. (2020), every year from FY 2016 to FY 2019, there have been at least seven states in India where DISCOMs have had to wait over 1 year to receive subsidy payments from state governments.

Figure 12. Price support through state government for FY 2020



Source: Authors' calculations; see accompanying [spreadsheets](#) for more details.



Our data on subsidies do not extend to FY 2021, the first year of COVID-19, but we expect that T&D subsidies from state governments will remain around the same level as FY 2020. This is because the fall in power demand in the initial months of the crisis can be attributed primarily to commercial and industrial consumers. This will reduce the extent to which costs are covered by cross-subsidies, increasing the expenses that need to be compensated directly by states (Aggarwal, Narayanaswamy et al., 2021).

Despite the demand recovery by late 2020, it is important to emphasize that DISCOMs' finances will considerably worsen. As of February 2021, DISCOMs across India owed INR 91,810 crore (USD 13 billion) to power producers (Ministry of Power [MoP], n.d.b). In nominal terms, the gross debts of DISCOMs to financial institutions are expected to increase from INR 4.8 lakh crore (USD 71.4 billion) in March 2019 to INR 6.0 lakh crore (USD 84.7 billion) in March 2022 (ICRA, 2021).

The major energy-related assistance measure announced in the wake of COVID-19 was the May 2020 announcement of a conditional INR 90,000 crore (USD 12.7 billion) liquidity infusion scheme to extend long-term loans to DISCOMs for clearing outstanding dues to power producers (MoP, 2020). The sanctioned loans surpassed the initially announced amount and finally stood at INR 1,35,497 crore (USD 19.1 billion) as of March 2021 (MoP, 2021b). Amid other measures, the working capital limit of 25% under UDAY, a reduction in the late payment surcharge rate, and the conditions for a letter of credit were also relaxed. Further, an option to enhance the borrowing limit of states by 2% of their gross state domestic product was also provided, subject to the implementation of certain reforms, including reducing revenue gap targets and aggregate, technical, and commercial (AT&C) losses. Direct Benefit Transfers (DBTs) of electricity subsidies were also initiated for farmers (PIB, 2021b).

Sensing the need for big reforms to turn around the sector, the Union Budget for FY 2022 stressed delicensing distribution and enabling retail competition through private sector participation. However, this would require a comprehensive consultative process with state governments, as evidenced by the resistance from DISCOMs and states so far. As part of its medium-term strategy, the MoP has also outlined an INR 3 lakh crore (USD 42.3 billion) scheme—the Revamped Reforms-Linked Results-Based Distribution Sector Scheme (MoP, 2021a). Despite these proposals, the main issues that trouble DISCOMs' finances remain unaddressed, especially mounting debt and the under-recovery of costs. Since the recent liquidity infusion was structured as loans, DISCOMs' projected debt levels will be unsustainably high and require another round of restructuring in a vicious cycle of entrapment (Aggarwal, Sharma et al., 2021).

A notable potential gap in government subsidies in the T&D sector is in preparing the electricity system for high penetration of renewable energy. If the target of 450 GW of installed renewables capacity is going to be achieved, it implies a significant degree of grid strengthening and grid integration to balance variable renewable power, massive expansions in storage capacity (to the tune of 60 GW, according to Spencer et al., 2020), and administrative investments in systems like time-of-day pricing to reflect much more volatile costs of energy at different times of the day. While a number of recent auctions have been able to bundle solar PV with storage capacity at prices that are lower than or on par with thermal coal power, it seems unlikely that a rapid transition will be feasible without some degree of support at least on par with the support levels that are still provided to mature conventional technologies in FY 2020.

Box 3. Targeting electricity subsidies and improving billing and collection

In most states, tariffs increase in “blocks” as users consume more electricity, so that you pay more for electricity if you consume more. But a review of tariff orders in FY 2020 found that 50% of states are subsidizing every single block for residential consumers—that is, tariffs increase but never reach at-cost levels or above. A further 21% of states were still providing subsidized rates for residential consumption up to 500 kWh per month, well above the level consumed by most households. This means that better-off households end up receiving much larger benefits than worse-off households, and subsidy costs are unsustainable. A recent survey of residential electricity subsidies in Jharkhand found that over 60% of benefits were captured by the top 40% of households (Sharma et al., 2020).

Tariff design could be improved through electricity subsidy targeting, that is, adjusting the pricing system so that more benefits go to those who are most in need. This can be done in numerous ways. The easiest to is to use data on consumption to adjust the existing tariff blocks so that better-off consumers get charged higher rates. More complex approaches also exist, such as varying rates according to average poverty levels in different geographic areas or creating a registry of beneficiaries based on key characteristics in order to assign subsidies according to a household's relative wealth levels. The government has made numerous commitments and efforts to establish a DBT for Power (DBT-P), which would link subsidy payments to frequent data on actual consumption. Madhya Pradesh has implemented a pilot DBT-P in one of its districts that has been running since March 2020 (PIB, 2021c). This system can and should be built in a way that better enables targeting, including an equivalent of the Give It Up campaign for LPG, where better-off households can voluntarily opt out of benefits.

Tariff design could also be improved by better reflecting DISCOMs' costs, which are made up of two parts: fixed costs and variable costs. Most DISCOMs bill consumers with a fixed charge and a variable charge, but these are not set at a level that is proportionate with costs paid to generation companies (Aggarwal, Ganesan, et al., 2020). This leaves DISCOMs heavily reliant on variable revenue. The weakness in this design was demonstrated during the COVID-19 pandemic when demand from the high-paying (effectively cross-subsidizing) commercial and industrial consumers reduced drastically. DISCOMs were also asked to waive off fixed charges of the commercial and industrial consumers that shut down their facilities. This was a “double whammy” that severely affected DISCOMs' revenues.

Subsidies can also become more affordable if DISCOMs can improve their billing and collection practices. This should include the following measures: performance-linked incentive schemes for DISCOMs' ground staff; enhancing DISCOMs' staff capacity for regular billing and collection; putting in place effective monitoring systems to monitor the performance of ground staff and to update the billing database; provisioning multiple payment options for hassle-free payment; and increased community engagement about the benefits of timely payments and various available payment modes to address nonpayment issues (Balani et al., 2020).

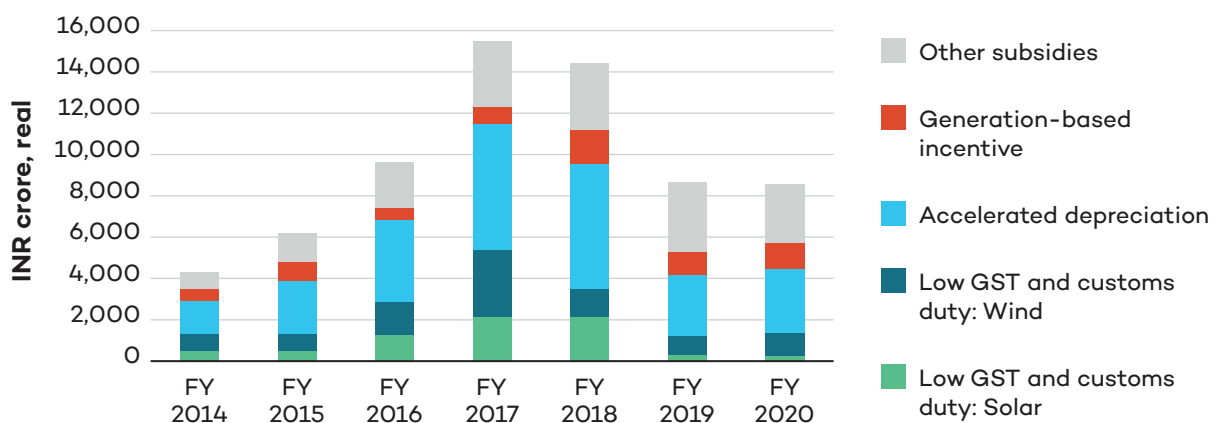
4.5 Renewable Energy

In real terms, quantified renewable energy subsidies have doubled from INR 4,292 crore (USD 606 million) in FY 2014 to INR 8,577 crore (USD 1.2 billion) in FY 2020. The year-on-year comparison, however, has stagnated across FY 2019 and FY 2020 and fell 45% from the high of INR 15,470 crore (USD 2.2 billion) in FY 2017. As shown in Figure 13, the major quantified subsidies in FY 2020 for renewable energy were:

- Accelerated depreciation for wind and solar, at INR 3,101 crore (USD 438 million)
- Lower GST and customs duty for wind, at INR 1,132 crore (USD 160 million)
- Generation-based incentives for wind power, at INR 1,126 crore (USD 159 million)
- The off-grid and decentralized solar application scheme, at INR 460 crore (USD 65 million)
- Waiver of inter-state transmission system (ISTS) charges for solar and wind power, at INR 430 crore (USD 61 million). This has been extended to apply until 2023 and can have larger implications when the share of renewable energy in the ISTS increases.²

While the overall value is similar across FY 2019 and FY 2020, there are differences in disbursements. For example, disbursements have decreased substantially for most schemes, while support increased for the Central Public Sector Undertaking Scheme and for wind projects through generation-based incentives and tax breaks. The continued sluggish trend in solar deployment and the slight uptake for wind power have contributed to these trends (Central Electricity Authority [CEA], 2020; Ministry of New and Renewable Energy [MNRE], 2020).

Figure 13. Total renewable subsidies in India, FY 2014 to FY 2020 (real)



Source: Authors' calculations; see the accompanying [spreadsheets](#) for more details. A number of policies were identified but could not be quantified due to a lack of data. These policies include resource assessments, solar charging for LED lanterns, and support for solar heat-based applications. Some estimates differ from our previous update as some subsidies are now based on actually released amounts rather than budgeted amounts.

² We have only been able to estimate the ISTS waiver value for FY 2020. Notably, this policy is often highlighted as a significant subsidy for renewable energy, but we estimate that its value is in fact modest. This is because solar and wind generation for interstate transmission for FY 2020 was only around 1.1% (6,270 million units) of the total power generated for interstate transmission (Power System Operation Corporation, 2019).

Our data do not extend to FY 2021, but we anticipate that government expenditure during the year of COVID-19 will likely have stayed fairly stable at the central government level, though perhaps with some reductions to reflect lower-than-usual levels of investment. To prevent investments in clean energy from dropping, it is also essential to identify and promote shovel-ready investment opportunities to stimulate the economy and create jobs (Federation of Indian Chambers of Commerce and Industry & EY, 2021). A number of central government announcements pertaining to domestic solar and storage manufacturing and other measures announced in COVID-19 recovery packages (details of which are available in Garg et al., 2021) will also be likely to increase expenditures in future years.

With renewable energy tariffs falling to all-time lows, the role of subsidies for the renewable energy sector needs to be reoriented. The installed capacity of renewable energy has increased to 93 GW (CEA & CEEW Centre for Energy Finance, 2021) as of February 2021, which stands at around 25% of the total installed power capacity. The projected growth in energy demand of 50% has been revised to 25–35%, owing to COVID-19 (IEA, 2021a). In these times, the need of the hour is support for both existing and future utility-scale and off-grid renewable energy capacity by making storage solutions more affordable and accessible. Spencer et al. (2020) predict that by 2030, storage capacity of around 60 GW will be required. Demand-side concerns can continue to be addressed by policy measures such as the renewable purchase obligations imposed on DISCOMs, captive power plants, and other large power consumers.

Schemes should also be prioritized that integrate renewables to meet existing power demands that are currently supplied by conventional sources. The government introduced one such scheme in 2019, Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahaabhiyan (PM-KUSUM), that aims to promote uptake of solar pumps to benefit the agricultural sector. While the objectives of this scheme are strongly aligned with the clean energy transition, it is already facing implementation challenges (see Box 4), suggesting that there is still much that can be done to increase the capacity of states, consumers, and financial institutions in this area. Current support for decentralized solar in FY 2020 stands at only 26% of the total support provided for solar energy through DBTs.

The government has been exploring other avenues to encourage the adoption of decentralized renewable energy, primarily targeting industries and rural areas. As part of the Aatmanirbhar Bharat policy push, the creation of a separate electricity distribution channel to spur the growth of industries in India was announced in November 2020 (Jai, 2020). The implementation of the separate channel is intended to bring about a reduction in the cost of power supply. Renewable power, which is a strong contender for cheap power production, would benefit enormously from policies such as this.

A draft policy is also being developed on how decentralized renewable energy can support rural livelihoods (MNRE, 2021b). The latest draft emphasizes research and development, improving access to finance, and upskilling the workforce. Successful implementation of measures such as these will serve as sustainable solutions for implementing energy transition while dealing with rising unemployment and poverty as part of the economic recovery.

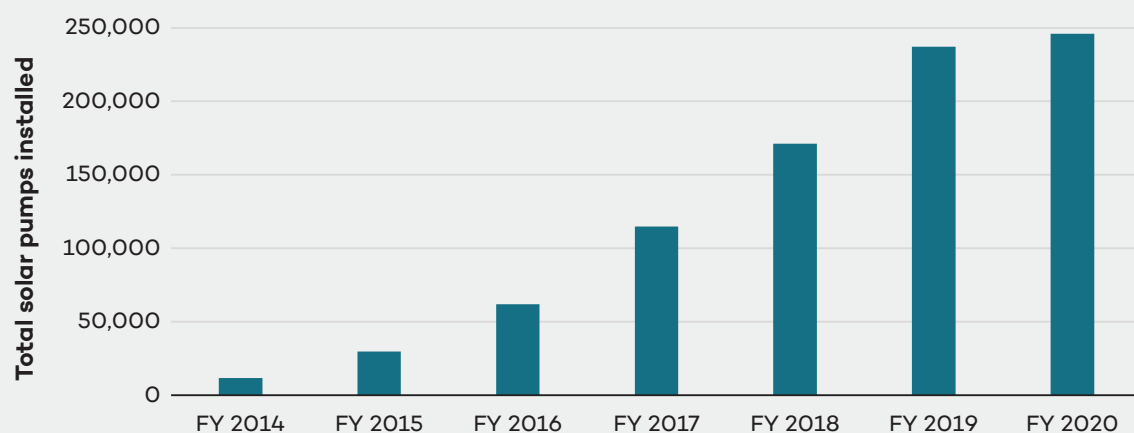
Box 4. Increasing the uptake of solar pumps

In 2019, India’s central government formally announced the launch of a major scheme to promote solar-powered irrigation, PM-KUSUM. The scheme has the potential to transform the agricultural sector, which has been beset with the structural challenges of low farm productivity, underpriced electricity that encourages the overuse of groundwater, and stagnant farmer incomes. The scheme aims to expand irrigation coverage, encourage a transition away from polluting diesel pumps, boost farmer incomes through increased agricultural productivity, and create alternate income streams by enabling farmers to become “prosumers” by selling excess solar power back to the grid. The central government announced an expanded total central financial allocation of INR 34,422 crore (USD 4.9 billion) (PIB, 2020a).

Analysis shows that less than 1% of the investment directed toward renewable projects in India during FY 2020 was geared to solar pumps (Garg, 2020). As shown in Figure 14, the installation of pumps was relatively muted between FY 2019 and FY 2020, with a total of around 9,000 installed in FY 2020. This is partly a consequence of the temporary disruption in existing state-level solar irrigation schemes following the launch of PM-KUSUM. However, it also reflects the structural challenges in scaling up the distribution of solar pumps, particularly the high capital cost that makes them hard for farmers to afford. States will need to overcome this and other challenges, such as the heavily subsidized supply of electricity to the agriculture sector, poor after-installation maintenance support, and a lack of awareness of the benefits of solar pumps, which have prevented many farmers from shifting away from less efficient, unsustainable forms of energy for irrigation (Garg, 2018).

A major challenge for the scheme is a lack of awareness among farmers on its details (Indian Infrastructure, 2021). As it stands, the scheme provides equal benefits to all farmers instead of identifying different subsidy measures to target various groups of farmers based on their income levels. Directing more financial subsidies to smaller and less well-off farmers would be key to seeing an increased uptake of solar pumps that also maximizes social benefits and improves equity.

Figure 14. Cumulative solar pumps installed across India until the end of 2019



Source: MNRE, 2020.

4.6 Electric Vehicles

Subsidies for EVs have seen a sharp increase since FY 2019, rising more than 2.3 times to reach INR 1,141 crore (USD 161 million) in FY 2020.

As shown in Figure 15, the major subsidies in FY 2020 were:

- The Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme worth INR 500 crore (USD 71 million)
- A concessional GST rate on electric two-wheelers and three-wheelers worth INR 471 crore (USD 67 million).

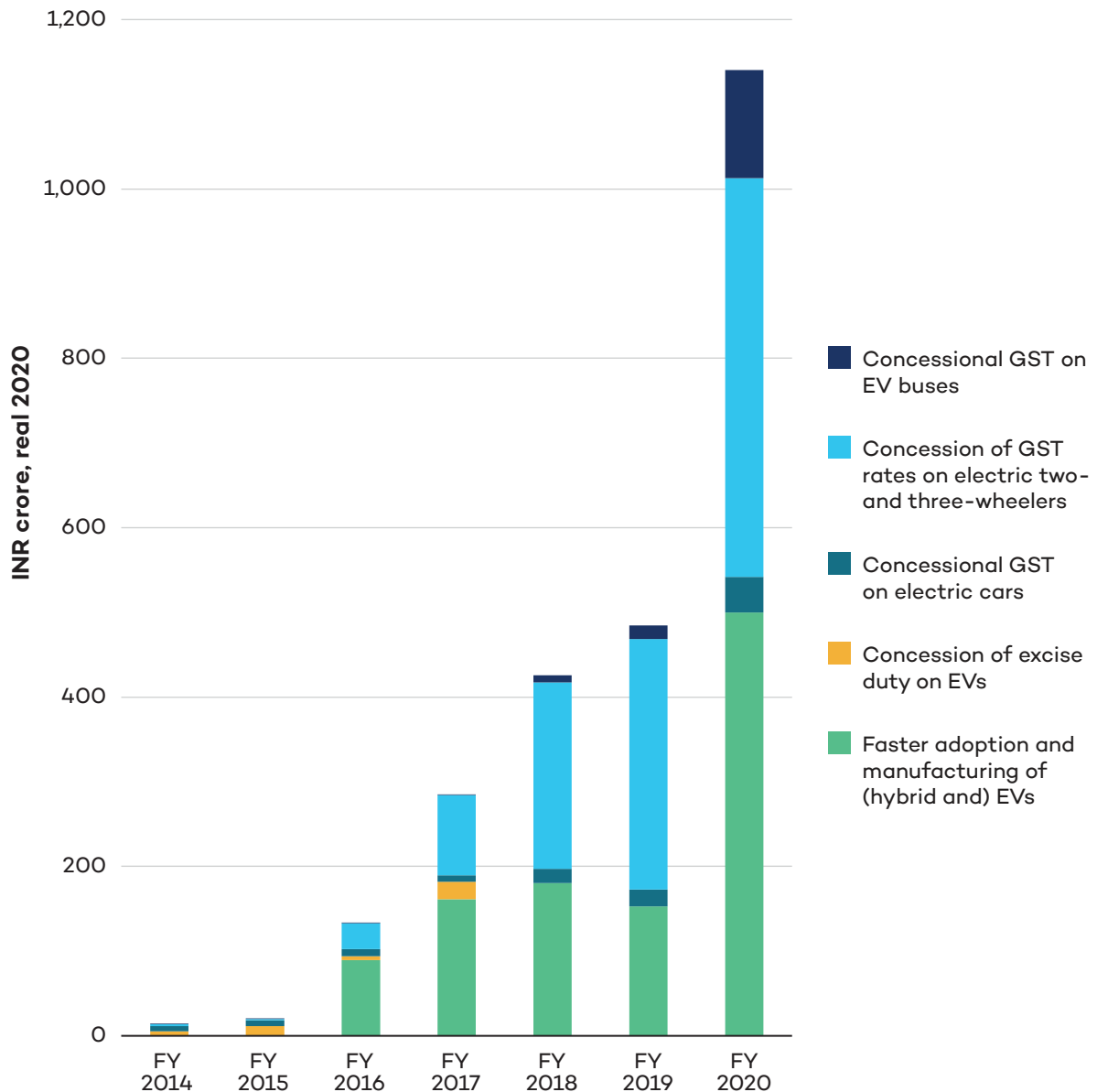
Many of the subsidies have been driven by the increase in sales of two-wheeler electric vehicles, up by around 21% from FY 2019 to FY 2020 (Society of Manufacturers of Electric Vehicles, 2021). The sale of four-wheel electric vehicles, however, dropped by 200 units (Society of Manufacturers of Electric Vehicles, 2021). Currently, there are only two companies that produce a total of 16 models of four-wheel EVs that meet the requirements of FAME II. This is a small share of the 113 EV models that have been approved in aggregate across all EV types under the FAME II scheme (Department of Heavy Industries, n.d.).

Various states and Union Territories also support the adoption of EVs through subsidies for manufacturers, consumers, and charging infrastructure or through government procurement. Our database does not cover state and territory-level subsidies for energy, but Box 5 provides details on some of the benefits and trends being seen at a state level.

The central government's target for EV penetration includes 30% of all private cars, 70% of commercial vehicles, 40% of buses, and 80% of two- and three-wheeler sales by 2030 (NITI Aayog & Rocky Mountain Institute, 2019). NITI Aayog has recommended additional support for EVs, in addition to those provided under the FAME scheme, along with interest subventions for EV purchase loans. They have also highlighted the need for non-financial incentives, such as priority lanes and reserved EV parking spaces. An estimated investment of INR 20,580 crore (USD 2.9 billion) will be required toward charging infrastructure development alone (Singh et al., 2020). The government is also actively working to support the EV manufacturing industry by framing favourable industrial policies (Sharma, 2021).

The Department of Heavy Industries had notified the imposition of a basic customs duty on various types of imported EVs (from April 2020 onwards) and lithium-ion cells and battery packs (from April 2021 onwards). This measure was implemented to enable the development of a domestic EV and battery manufacturing base. This was supplemented by the National Mission on Transformative Mobility and Battery Storage, which will focus on establishing a phased manufacturing program for large-scale integrated batteries and localizing production across the entire EV value chain at a gigawatt scale (Prime Minister's Office, 2019). COVID-19 has impacted the manufacturing capabilities of existing domestic EV manufacturers, bringing to focus the need to develop domestic supply chains in India as well.

Figure 15. Total subsidies to EVs in India, FY 2014 to FY 2020 (real)

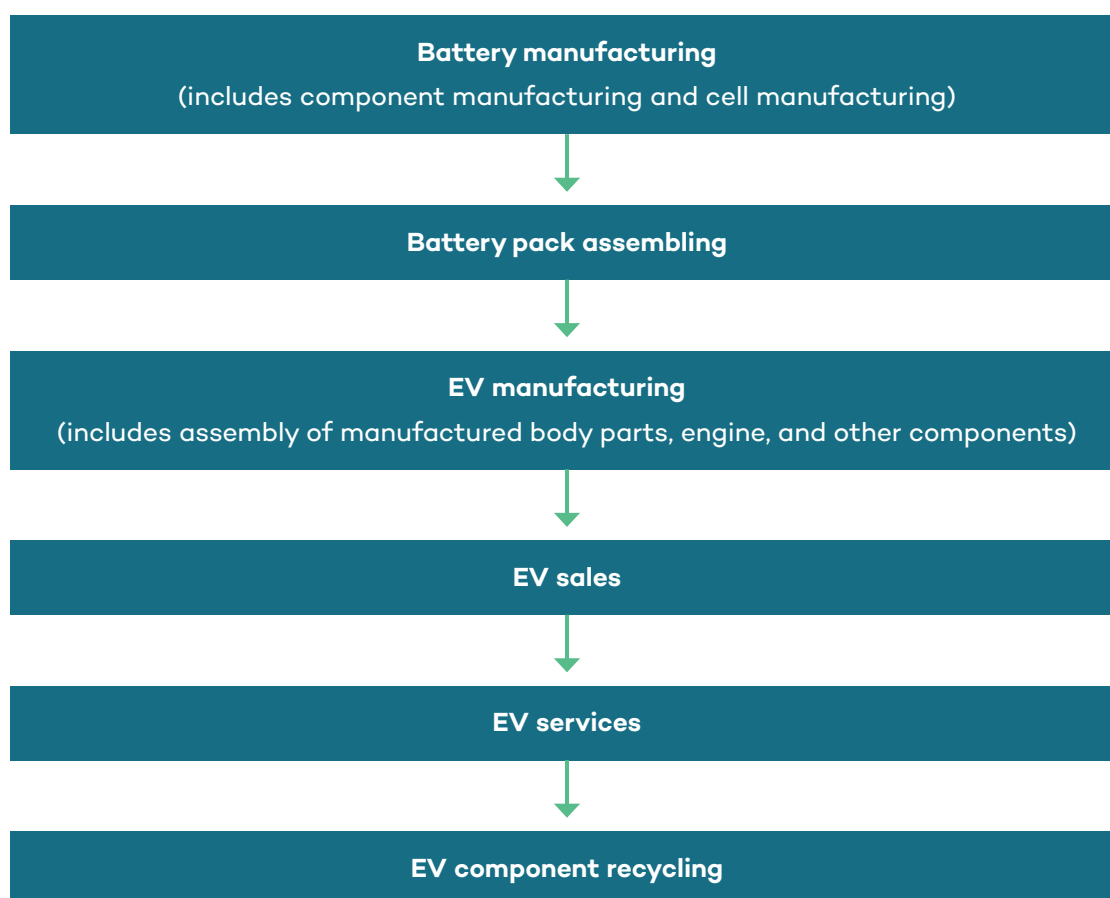


Source: Authors' calculations; see the accompanying [spreadsheets](#) for more details. A number of policies were identified but could not be quantified due to a lack of data. These policies include an exemption for customs duty on EV parts; the Modified Special Incentive Package Scheme, which provides a 20% capital subsidy in special economic zones; and a 25% subsidy outside of Special Economic Zones for companies in electronics manufacturing (Ministry of Electronics & Information Technology, n.d.).

A simple summary of the various steps in the EV manufacturing and services value chain is illustrated in Figure 16. All of this will require huge investment and meticulous planning to provide targeted incentives to various stages of the manufacturing chain based on identifying barriers and opportunities. A localization potential analysis of the EV manufacturing chain indicates that India's lowest potential is on battery cell manufacturing (GIZ GmbH & Deloitte Touche Tohmatsu India LLP, 2021). In order to remedy this, the government has implemented a production-linked incentive scheme with an outlay of INR 18,000 crore (USD 2.5 billion) to promote the manufacturing of advanced chemical cell batteries (Ranjan, 2021).

Going forward, increasing support measures to ensure the production of cheaper and more efficient EVs may be necessary to address the current low demand for EVs in India. It is interesting to see how various states in India prioritize these aspects in their EV policies. Box 5 provides a comparison of policies in Delhi and Telangana—both of which were approved in 2020 but take very different approaches. As EV subsidies grow, all efforts must be made to ensure that sustainability remains at the helm of this transition to EVs on all fronts: clean energy supply, prioritizing a sustainable supply chain for manufacturing, choosing battery components, and designing a recycling plan.

Figure 16. EV manufacturing and services value chain



Source: Authors' summary.



Box 5. EV roll out in states: Delhi and Telangana

Between the start of the COVID-19 pandemic and the time of writing this report, two Indian states have released an approved version of their EV policies: Delhi (2020) and Telangana (2020). They take very different approaches to spurring the development of EVs.

State-level EV policies are designed to meet specific state-level objectives on timelines and investments. They typically contain a combination of incentives that complement national schemes and aim to bridge the upfront price gap between EV and internal-combustion engine vehicles; support the installation of charging infrastructure; and encourage the manufacturing of EVs and their components. Purchase incentives have mainly consisted of capital subsidies and other tax-related exemptions or benefits, such as income tax credits or purchase rebates.

Only the Delhi EV policy provides a capital subsidy for the purchase of EVs. Delhi provides purchase subsidies for eligible models of two-wheelers based on vehicles' battery size and a fixed subsidy cap (Transport Department, 2020). For goods carriers and four-wheelers, there is a further limit on the number of vehicles that can avail the subsidy. However, both states provide tax exemptions, such as a road tax, that will significantly benefit commercial vehicles that are required to pay a road tax on an annual or semi-annual basis. Delhi offered a 100% road tax exemption for newly purchased EVs for varying durations of time. Telangana instead offered a road tax exemption for a fixed number of vehicles in each vehicle segment, likely to limit the overall subsidy (Government of Telangana, 2020). Both states provide a 100% exemption for vehicle registration fees.

On charging infrastructure, Delhi offers incentives for private charging equipment, with a 100% grant of up to INR 6,000 (USD 84.70) available per charging point for the first 30,000 private charging points. States have also pursued other strategies, such as the provision of concessional land for charging station developers and concessional electricity tariffs for consumers to charge their EVs (Hardman et al., 2018).

On the other hand, Telangana's EV policy provides several incentives for EV manufacturing that Delhi does not. A capital subsidy of 20% is provided for the investment of up to INR 30 crore (USD 4.2 million). It also provides an interest subvention of 5.25% over 5 years up to INR 5 crore (USD 0.7 million), stamp duty and state GST reimbursement, and an electricity duty exemption.

The priorities of the two governments in setting out these policies are vastly different. Delhi has designed its EV policy with short-term objectives in mind on environment and air pollution, targeting 25% EV adoption by 2024 (Transport Department, 2020). To meet this target, it has passed ancillary policies such as reserving 5% of commercial building parking spaces for EVs and charging points (PTI, 2021c). Telangana, on the other hand, has a relatively long-term strategy, with measures that will be valid for 10 years and are structured primarily to bring in investments and position it as one of India's top EV manufacturing hubs. This will benefit state citizens in the long run through job creation and eventual deployment of cost-competitive, domestically manufactured EVs.



**5.0 Subsidies, Solar PV,
and Building Indian Capacity
for Manufacturing**



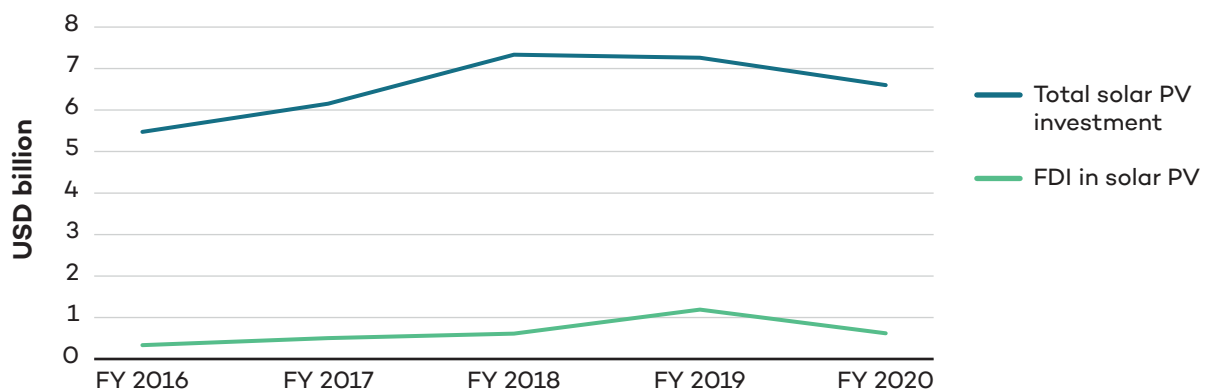
India plans to deploy 450 GW of renewable energy by 2030. According to the CEA, this would optimally include around 280 GW of solar PV—up from around 40 GW as of the end of March 2021, implying an average annual capacity addition of around 27 GW per year over the next 9 years (CEA, 2020, 2021). While India has mobilized USD 42 billion in renewables since 2014, an additional USD 500 billion³ will be needed by 2030 (Buckley & Trivedi, 2021).

Supported by interviews with investors and developers, this chapter investigates how subsidies and other forms of government support can help mobilize investments in solar PV.⁴ Given Prime Minister Modi’s call for greater FDI in the sector (S. Sharma, 2020), we give special attention to FDI as a way of boosting “technology transfer, development of strategic sectors, greater innovation, competition and employment creation” (Department for Promotion of Industry and Internal Trade, 2020). We also place a special focus on manufacturing, given the government’s focus on Aatmanirbhar Bharat as part of economic recovery and the recent allocation of INR 4,500 crore (USD 0.6 billion) to a national program on solar PV manufacturing, as part of the Production-Linked Incentive Scheme (PIB, 2021a).

5.1 Main Policy Drivers of PV Deployment and Investment

India saw a steady increase in total solar PV investment from FY 2016 to FY 2018, which then declined, as shown in Figure 17. FDI followed the same trend until FY 2019, where it increased briefly before declining in FY 2020 as well. Interviews with developers and investors emphasized the often-repeated maxim that, more than anything, policy stability was key to past success: “policy certainty equals investment certainty.” In addition to this, they highlighted two specific schemes that were integral to investment decisions: Solar Energy Corporation of India’s (SECI)⁵ reverse auctions and solar parks.

Figure 17. Solar PV investment in India (USD billion), total and FDI



Source: Total investment data from Frankfurt School et al., 2016–2020. FDI data are taken from the category “FDI equity inflows received under Reserve Bank of India’s (RBI) automatic route,” as provided in Department for Promotion of Industry and Internal Trade, 2015–2021.

³ This includes investment in grid upgrades and storage for integrating renewables (Buckley & Trivedi, 2021).

⁴ We focus on solar PV over wind because it has the largest renewable target at 280 GW by 2030. The solar PV manufacturing sector remains under-developed compared to India’s more established wind manufacturing.

⁵ Intermediation by central government entities such as the SECI mitigates offtake risk associated with DISCOMs. Besides the SECI, NTPC also commonly plays the role of an intermediary in central government-tendered renewable energy capacity.

- **SECI reverse auctions:** SECI's auctions are the preferred mode of renewable power procurement from the perspective of developers and result in the discovery of the most competitive tariffs. The “off-take” risk is seen as one of the most significant risks by developers and investors in solar PV in India, encompassing the renegotiation of contracts, intentional curtailment of power, delayed payment, and non-payment by some DISCOMs (commonly the power purchaser). Tenders underwritten by the SECI and NTPC are seen as a central government guarantee, reducing off-taker risk and driving down solar tariffs. Finally, the auctioning and tendering processes have constantly evolved, bringing in more transparency and efficiency, thereby boosting investor confidence.
- **Solar parks:** Solar parks address many of the other risks faced by solar PV developers, greatly improving the ease with which they can access land and secure transmission grid connections for projects. Even though they can be a slightly higher-cost option for the developers themselves,⁶ they make it easier and faster for developers to address many due diligence requirements, meaning they can mobilize finance quickly and more easily (Shah, 2020, p. 202). The solar parks policy aims to set up 40,000 MW of solar power by 2021, which has been subsequently extended to 2024 owing to delays in land acquisition (MNRE, 2019).

An increasing lack of policy stability was seen as having contributed to the 2019 drop-off in investment levels, largely due to increasing investor uncertainty. This uncertainty included the GST, whose impacts on solar PV were very unclear when it was introduced in 2017, and Andhra Pradesh renegotiating its power purchase agreements in 2019, which was taken as a sign that conditions might change following the finalization of investments, despite existing guarantees. Some policy changes also reduced potential returns on investment at a time when competition was high, and there were existing concerns that auction bids might be unsustainably low. Key among these was the introduction of tariff caps (now removed), applied in tandem with the 2-year safeguard duty of 25%⁷ on imported solar cells and modules. The recently announced basic customs duty of 25% on solar cells and 40% on solar modules, to be introduced from April 2022, will raise input costs for developers and could result in an increase in solar PV tariffs (Sanjay, 2021).

For foreign investors in particular, one of the bigger concerns is with regard to the emerging trend of promoting the use of domestically manufactured solar modules by imposing import duties on imported modules. Developers reported that this might cause issues for leveraging FDI in future solar PV projects. First, foreign investors are “universal procurers”: they invest in projects with technology that is “best” according to a pre-approved list of original equipment manufacturers. It will take time for Indian solar panel manufacturers to get on this list. Second, foreign investors have also indicated that they may move away from investing in projects because the overall margin on solar PV power projects is increasingly low as they strive to provide competitive tariffs: some equity providers reported that returns had fallen from 18% to 13%. Power purchasers are increasingly expecting lower tariffs and

⁶ Some of the interviewed developers stated that they could develop a project at a slightly lower cost outside of solar parks than if they developed in a solar park with its associated costs.

⁷ This duty was reduced to 20% from July 2019, then to 15% from January 2020, 14.9% from July 2020, and 14.5% from January 2021 until its end in July 2021.

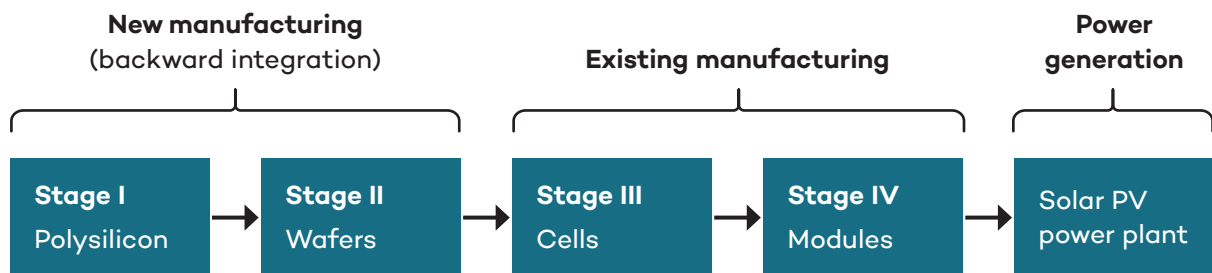
may hold off on accepting power at higher prices due to added import duties. This increases off-taker risk for project developers. Investors' concerns could result in a moderation of the growth of FDI flows.

5.2 Solar PV Manufacturing and Investment

Since the onset of COVID-19, the government has renewed its focus on solar PV manufacturing, reflecting the Aatmanirbhar Bharat initiative, disruption in global supply chains, and geo-political tensions between India and China. India's solar PV power sector relies heavily on imports, meeting 80%–90% of demand (Ghosh et al., 2020), and these factors have highlighted the risks of this dependency.

There are four stages in the manufacturing chain (see Figure 18). India's current capacity produces 3 GW per year of cells and 10 GW of modules (stages III and IV) annually, but polysilicon or wafer production capacity (stages I and II) does not yet exist (MNRE, 2021a). The government aims to incentivize firms to backward integrate and start manufacturing along the entire chain. Until full integration takes place, dependence on imports will only shift to different parts of the value chain.

Figure 18. Solar PV manufacturing chain

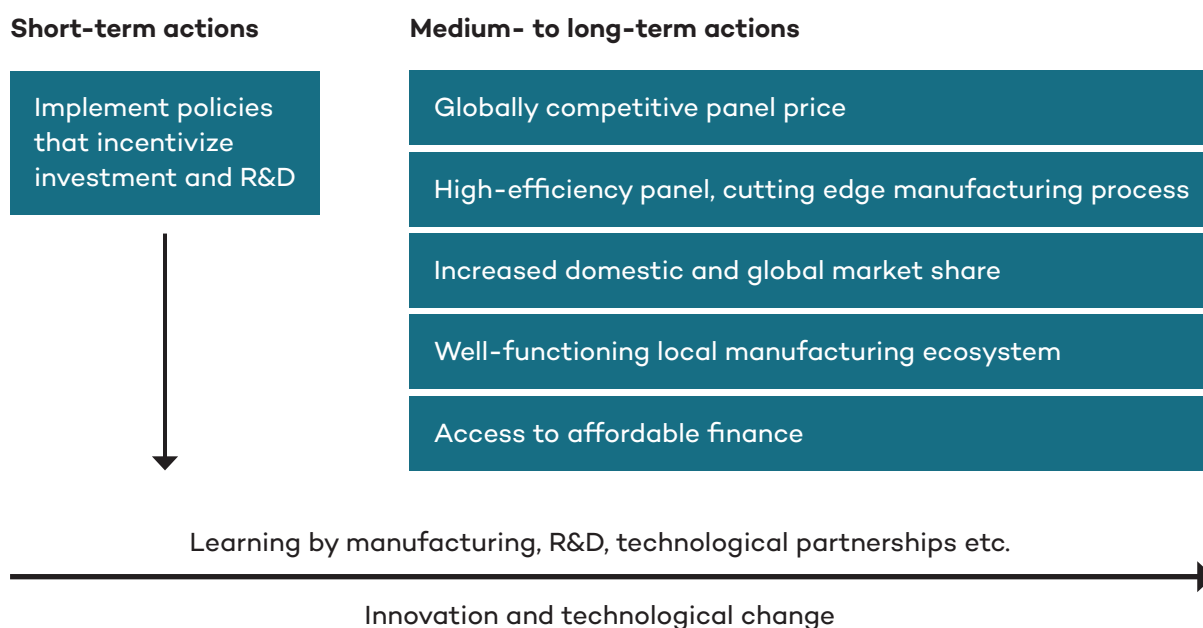


Source: Authors, adapted from Jain et al., 2020; The Energy and Resource Institute (TERI), 2018, 2019.

Panels produced in India, however, cost on average 33% more than imported Chinese panels⁸ (Jain et al., 2020). Probst et al. (2020) showed that domestic content requirements in auctions resulted in around a 6% cost increase in solar PV generation. With only 10%–20% of India's demand being met by domestic production (Ghosh et al., 2020), reducing foreign dependence en route to attaining the 2030 solar target will require significant growth in manufacturing. Figure 19 summarizes views from manufacturers and investors on what a well-developed sector would look like in the medium and long terms.

⁸ Based on existing capacity utilization levels of India's production capacity, which runs at around 50% of its estimated total operational capacity (Jain et al., 2020). If full capacity utilization is assumed, the price differential drops to around 22%.

Figure 19. What would a well-developed Indian domestic solar PV manufacturing sector look like?



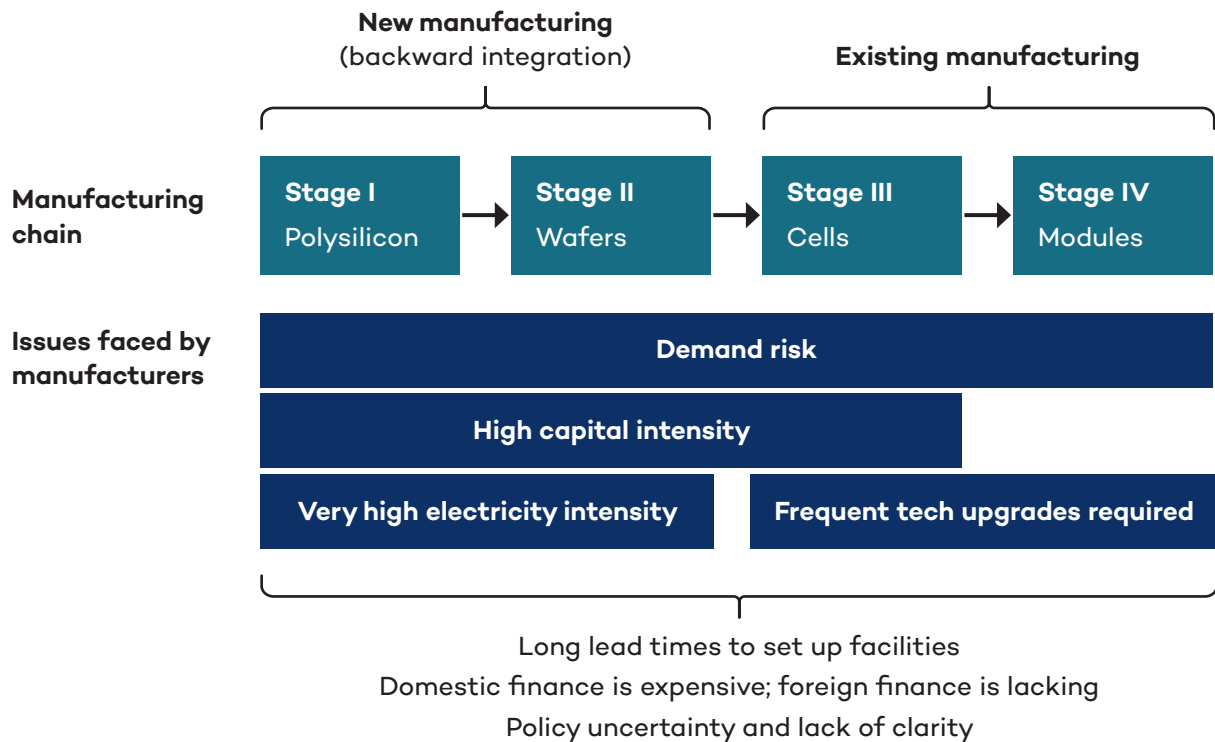
Note: R&D = research and development

Source: Authors, based on interviews with developers and investors.

In the short term, these outcomes suggest a need for policy that rapidly mobilizes investment to expand existing manufacturing; in the medium term, it suggests a need to mobilize investment to backward integrate to earlier stages. These measures should be geared toward creating demand certainty as well as improving plant-level economics through targeted fiscal or financial incentives in order to give investors the comfort to invest in scaling up capacities and integrating backward in the value chain. In addition, there is a need for investment in R&D, technological partnerships, and knowledge transfer all along the chain to ensure India's manufacturers develop the innovation capabilities to reach and remain at the cutting edge.

To identify how subsidies and other incentives can effectively promote manufacturing, we identified the major barriers to mobilizing finance at different manufacturing stages (Figure 20). By and large, the main challenge for backward integration was the step change in capital and electricity intensity, compounded by the lack of demand certainty associated with domestic solar manufacturing overall.

Figure 20. Key investment barriers in different stages of solar PV manufacturing



Source: Based on a review of Jain et al., 2020; TERI, 2018, 2019; interviews with developers and investors.

In interviews, manufacturers reported that it is challenging to source finance from domestic banks on competitive terms. This is compounded by the long gestation period for setting up facilities, which means a long wait for returns on investment. Manufacturers reported that some international companies and investors are interested in partnering with Indian manufacturers but are waiting to commit because of a lack of policy certainty and clarity.

It was commonly observed that only PSUs and established conglomerates—who can access cheaper, long-term finance—are well positioned to venture into earlier manufacturing stages. State-owned BHEL Limited recently announced plans to establish fully backward-integrated solar PV manufacturing (Jai, 2021a; Srivastava, 2020; Stoker, 2020), while CIL likewise proposed moving into solar wafer manufacturing (Mercom, 2021). This suggests there may be critical investment opportunities for major energy PSUs in FY 2022, helping them deliver on government requests to increase capital expenditure while diversifying business models to reduce risk to PSUs around a clean energy transition.

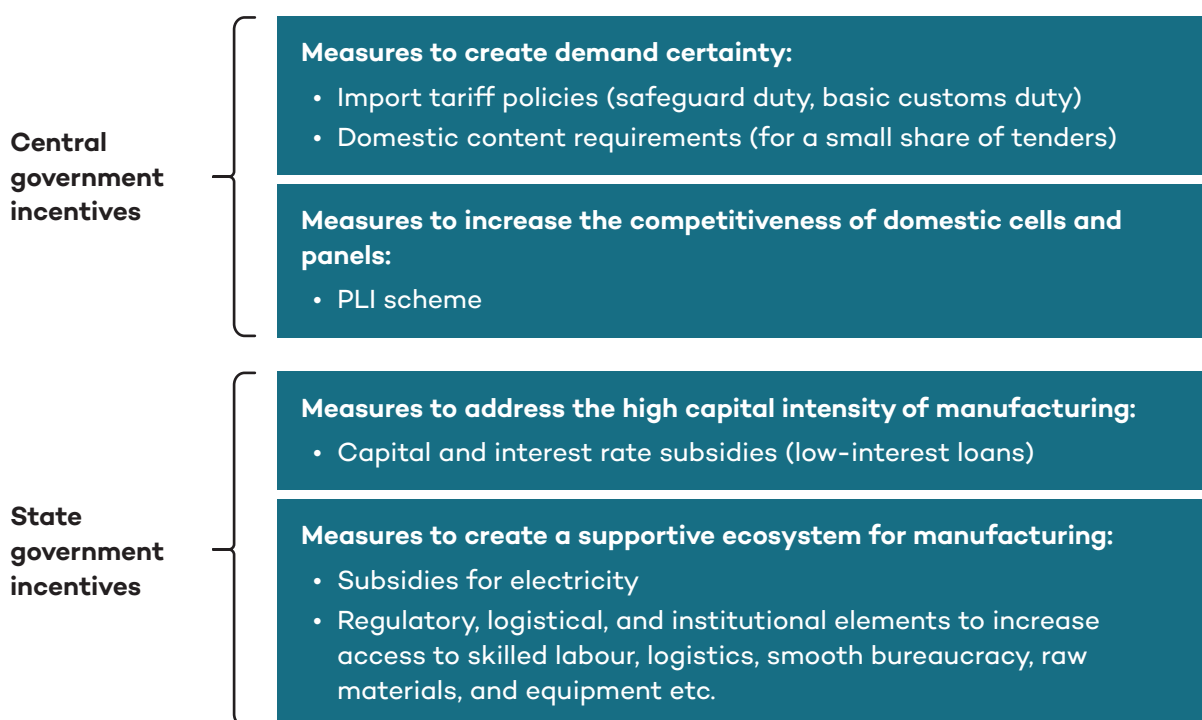
Subsequently, we looked at the major existing support measures for solar PV manufacturing at both the central and state levels (see Figure 21). We found that, at a central level, most measures were focused on stimulating demand for domestically manufactured solar PV, such as the solar safeguard duty and domestic content requirements (DCRs)⁹ (which made up a very small share of tenders). The only scheme that targeted the capital intensity of

⁹ DCRs, where the government gives preference to projects using domestically manufactured solar PV modules, have been imposed under various schemes, including parts of the Jawaharlal Nehru National Solar Mission scheme and more recently the Central Public Sector Undertaking scheme.

manufacturing specifically was the Modified Special Incentive Package Scheme (M-SIPS).¹⁰ The recently announced Production Linked Incentive (PLI)¹¹ program is designed to increase the competitiveness of domestically produced panels.

State-level measures were largely focused on addressing the high capital intensity of manufacturing and striving to create a supportive ecosystem in which manufacturing industries could flourish. This varied by state but included measures such as capital and interest rate support, investments in ecosystem capacity, and subsidies for electricity.

Figure 21. Key existing policy measures to support solar PV manufacturing, central and state



Source: Authors, based on a review of our database of central government energy subsidies and a bottom-up review of state manufacturing policies in Annex C of how policies could be tweaked, changed, or supplemented, both in order to improve impacts on manufacturing and to balance out manufacturing and deployment objectives.

¹⁰ Much of the M-SIPS subsidy support (20% for capital and operating expenditure) was not disbursed to applicants, and manufacturers report it has not been successful in growing the sector (Jyoti & Garg, 2021).

¹¹ PLI will be disbursed for 5 years post-commissioning of solar PV manufacturing plants on sales of high-efficiency solar PV modules. The PLI amount will increase with increased module efficiency and increased local value addition (Prime Minister's Office, 2021).

Table 2. Support measures for solar PV manufacturing, stakeholder views on performance, and recommendations

Policy	Stakeholder views on performance	Recommendations
1. Measures to create demand		
(a) Import duties on modules and cells to make domestic products more competitive	The safeguard duty has failed to support domestic manufacturing because its short lifetime is insufficient to influence investments. It has, however, deterred investments in solar power. A Basic Customs Duty would offer greater support. However, it could negatively impact project deployment by raising costs and increasing tariffs.	Setting the duty amount and time frame should be evidence-based, factoring in the investment timelines associated with PV manufacturing as well as the impacts of other incentives (to minimize the impacts on project deployment). ¹²
(b) Central DCRs require domestic cells and panels for certain solar PV projects.	Manufacturers report that the demand certainty created by DCRs has allowed them to ramp up operations and produce closer to maximum capacity but has not helped new manufacturers enter the market given its limited scale.	Scaling up DCR tenders can provide the demand certainty needed for new investments in scaling up capacity and backward integration. However, this must be done in a WTO-compliant manner.
2. Measures to increase the competitiveness of domestic panels		
(a) PLI to add 10 GW of manufacturing capacity of backward-integrated, high-efficiency solar PV modules.	Manufacturers report that this will help expand operations and incentivize investment in R&D. But since PLI will not be paid until post-commissioning, manufacturers may still have problems sourcing the full volume of upfront finance for backwards integration. This may be particularly problematic for new entrants.	PLI offers credible support to scale up manufacturing. However, the support amount and time frame for any extensions should be set, keeping in mind other support offered to minimize the burden on project deployment.

¹² For further reading on this, see Dutt, 2021.

Policy	Stakeholder views on performance	Recommendations
3. Measures to help address the capital-intensive nature of the early stages of manufacturing		
(a) State-level capital and interest subsidies to address large upfront capital needs and costly domestic finance.	Manufacturers report that such subsidies are not usually targeted at solar manufacturing, and the application success rate is uncertain. Interest rate subsidies are often only available to micro, small and medium-sized enterprises (MSMEs)—large firms may not qualify.	Introduce dedicated capital and interest subsidies (low-interest loans) for solar PV manufacturing, particularly to de-risk large investments in the capital-intensive upstream stages I & II.
4. Creating a supportive ecosystem for domestic manufacturing		
(a) State electricity subsidies for manufacturing stages I–III , which require large amounts of electricity.	These subsidies mostly target MSMEs—large firms do not qualify. Manufacturers are also concerned that the typical time frame for support, 3–5 years, is too short. One argued that manufacturing could only be set up near cheap hydropower, limiting possible locations.	Larger and longer-term electricity price support may be needed to support early-stage solar PV manufacturing.
(b) State support for the manufacturing ecosystem (regulatory, logistical, institutional, etc.)	Most manufacturers agreed that an ecosystem for stages I and II does not yet exist, while Gujarat and Tamil Nadu offer some support for stages III and IV. Key gaps include access to trained labour, logistical support, raw materials, equipment, and industrial R&D support.	States must create ecosystems that support stages I & II to improve access to labour, logistics, raw materials, equipment and support for R&D along the entire chain.

Source: Authors, drawing on Jyoti & Garg, 2021; interviews with manufacturers and developers.



5.3 Key Takeaways

For solar PV deployment:

1. Policy certainty is key to mobilizing finance for solar PV projects. Policies would need to address ongoing and future risks faced by developers, particularly those associated with off-take, land, and grid integration.
2. Auctions mediated by central government entities would be critical from the perspective of addressing off-take risk. However, given the scale of India's renewable energy ambitions, reforms that address the financial viability of DISCOMs would be important for scaling up capacity addition.
3. Solar parks are key business enablers, particularly for foreign investors. Central and state governments should work together to tackle issues pertaining to land acquisition to reduce delays in achieving solar park targets.
4. Finally, the next generation of policy support must focus on storage solutions and expanding evacuation infrastructure to support both grid-scale and off-grid solar.

For solar manufacturing:

1. Indian solar manufacturing lacks international competitiveness because of smaller scale, lower capacity utilization of facilities, and limited backward integration. Support policies must address these gaps. All such policies need to show clarity and long-term certainty. Policy uncertainty and short policy durations have prevented the mobilization of finance for solar manufacturing.
2. Creating demand-side certainty is essential to trigger new investments in expansion and backward integration of existing capacity. Using a combination of trade protection measures (such as import duties) and domestic procurement schemes can generate certainty. Duty amounts and timelines should be determined in an evidence-based manner, taking into consideration investment timelines associated with PV manufacturing.
3. Targeted fiscal and financial incentives to improve plant-level economics are necessary to improve competitiveness. These include solutions such as cheaper electricity for the energy-intensive upstream stages and financial incentives that reduce the capital intensity of upstream manufacturing and improve the viability of downstream stages such as the PLI scheme. The government also needs to target the creation of supporting ecosystems for enabling dedicated manufacturing zones with elements such as regulations, logistics, and institutions to address gaps such as skilled labour, logistics, smooth bureaucracy, raw materials, and equipment.
4. Incentives to increase R&D investments all along the manufacturing chain are needed so manufacturers can compete globally on technological advancements and quality.
5. Government needs to consider if there may be a critical investment opportunity for major PSUs in FY 2022 in solar manufacturing, particularly in the upstream stages, which would deliver on requests to increase capital expenditure while reducing risks around a clean energy transition.



6.0 The Role of PSUs in India's Energy Transition



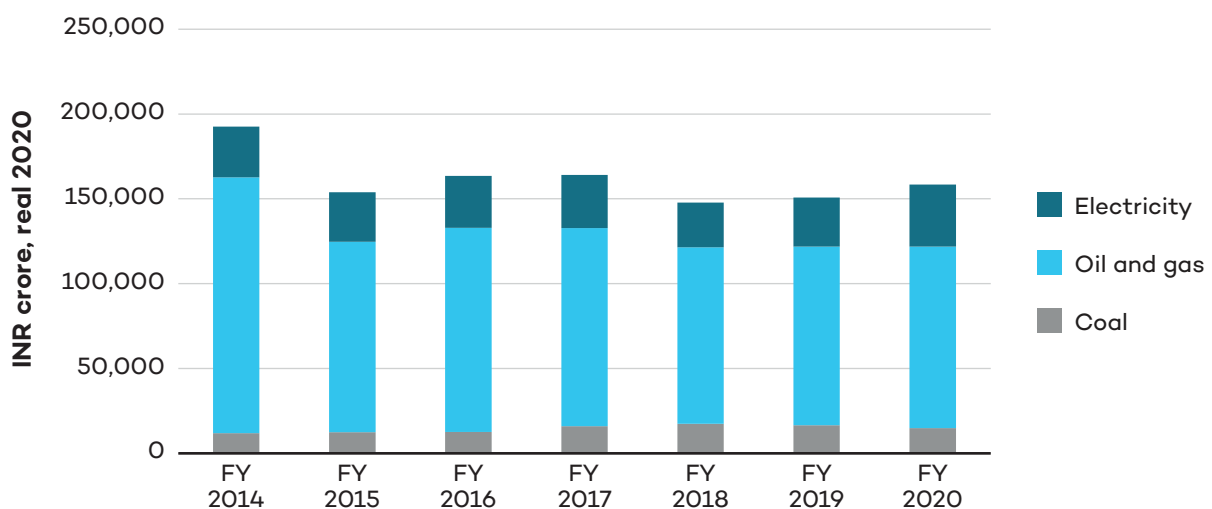
India's energy system is dominated by SOEs, known nationally as PSUs. Over 50% of power generation and 90% of electricity distribution is publicly owned (MoP, n.d.a; NITI Aayog, 2019), while around 90% of coal is produced by just two PSUs (MoC, 2020). Publicly owned oil marketing companies are responsible for 57% of refining and almost all retail distribution (Ministry of Petroleum and Natural Gas, 2020). Seven out of the 10 biggest PSUs, the Maharatnas, are energy-related (Department of Public Enterprises, 2020).

PSUs have played a critical role in economic development since independence. In the process, they have brought assistance to remote communities and become household names, as well as being some of the most sought-after employers. Today, PSUs have a strong incentive to embrace energy transition, given risks associated with fossil-intensive asset portfolios. Köberle et al. (2020), for example, estimate that in a scenario of faster renewable energy growth, NTPC, CIL, and Indian Railway's cash flows could be at least INR 63,791 crore (USD 9 billion) lower in 2030 than under current trends. We examine how PSUs invested in different kinds of energy from FY 2014 to FY 2020 and their stated future ambitions.

6.1 Investment Trends of PSUs

In FY 2020, CAPEX from the 14 most significant energy PSUs stood at INR 1.6 lakh crore (USD 22.4 billion) (MoF, 2021). This is a significant level of support from government-owned institutions, equivalent to 76% of the value of all quantified energy subsidies in FY 2020. It is challenging to classify CAPEX by energy type because this is not reported. Most PSUs, however, are largely aligned with one source of energy. If we assume that all CAPEX of each PSU is dedicated to its primary energy business model, we see a very different trend from our review of subsidy policies—as shown in Figure 22. Investments by fossil-based PSUs have barely changed since FY 2015. PSUs focused on fossil fuels accounted for 77% of total CAPEX in FY 2020, while only 34% of quantified subsidies went directly to fossil fuels. Additionally, a significant share of the electricity generation CAPEX goes to thermal power.

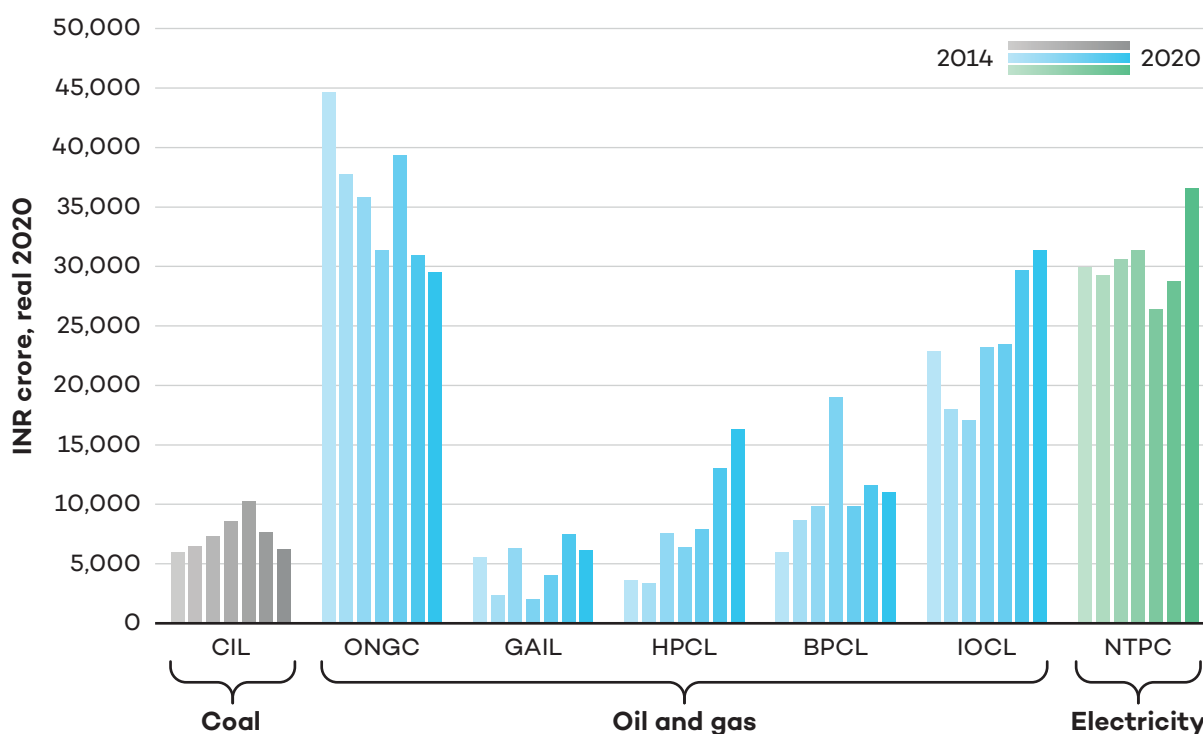
Figure 22. CAPEX of PSUs by operating sector, FY 2014 to FY 2020 (real)



Source: Compiled from MoF, 2021. Note: The classification of “electricity generation” is given to PSUs that invest in both fossil- and renewable-based electricity generation.

Among these 14 PSUs, the seven Maharatnas account for 87% of total expenditure, with NTPC, IOCL, and ONGC being the biggest. As shown in Figure 23, combined CAPEX in real terms has increased from INR 1.2 lakh crore in FY 2014 to INR 1.4 lakh crore in FY 2020 (USD 16.7 to USD 19.4 billion). There may be sharp increases in future years. For FY 2021, the government requested oil sector PSUs to double CAPEX to stimulate economic recovery, but early reports suggest that many PSUs have struggled to achieve their spending targets, so higher CAPEX may be seen in FY 2022 or later, depending on the impact of the second wave of COVID-19 in India (Sahu, 2021; Shukla, 2021).

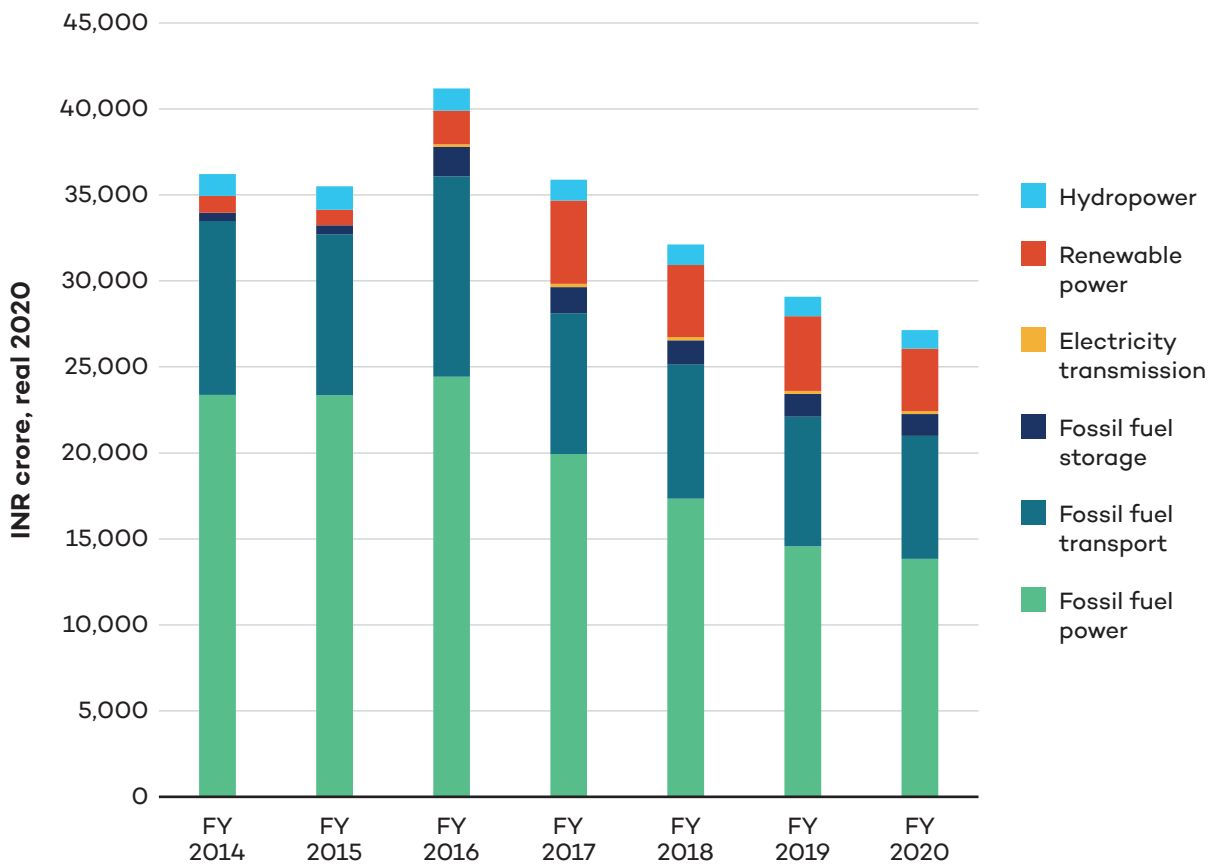
Figure 23. CAPEX trends of seven major PSUs in India, FY 2014 to FY 2020 (real)



Source: Compiled from MoF, 2021. Note: ONGC budget reporting for FY 2018 includes INR 36,915 for the acquisition of a 51.11% stake in HPCL. This has been excluded here, as the CAPEX of HPCL is captured separately.

Project-level data compiled from DEA (2021) provides a more confident picture of the energy types being supported by PSUs. In the same period, the seven major energy-related Maharatnas invested in 183 projects with a total value of INR 2.4 lakh crore (USD 33.5 billion). The annualized trend by type of project is shown in Figure 24 (see Annex A for details on the methodology). Overall, investment in fossil fuel projects was 10 times as much as renewable energy (excluding hydro). NTPC is by far the biggest operator of renewable energy projects, with INR 18,533 crore (USD 2.6 billion) in investments. While the annualized project investment in renewables has fallen since FY 2017, renewable energy investment in FY 2020 was still four times larger than in FY 2014. Oil PSUs favoured wind projects over solar.

Figure 24. Annual project-level investments made by seven major Indian PSUs, FY 2014 to FY 2020 (real)



Source: Compiled from DEA, 2021.

6.2 PSU Ambition for a Clean Energy Transition

Data on CAPEX tells us about the past—but what about PSU ambitions for the future? As PSUs push for increased CAPEX to support economic recovery, their choice of investments is critical to both their finances and India meeting its clean energy targets. This requires a roadmap to transition from fossil-dependent business models, which in turn requires ambition and planning.

Table 3 provides a simplified summary of ambitions among the seven energy-related Maharatnas (see Annex B for full details and sources). It finds:

- **Vision and mission:** All PSUs make reference to the environment in either their mission or vision—but often in the context of day-to-day operations. Many PSUs mention the need to venture into alternative energy, but this is not always unambiguously clean. Among IOCL, HPCL, BPCL, and GAIL, for example, it includes natural gas.
- **Corporate targets:** On alternative energy, NTPC has the most tangible corporate target: 60 GW of net renewable energy capacity by 2032 (PTI, 2021d). GAIL has a

GHG emission reduction target, and CIL reports it intends to make its operations “net-zero,” largely through 5 GW of solar power, but with no broader thinking around its high-carbon core business (PTI, 2020a). None of the major oil marketing companies has clear targets on diversification to clean energy. No PSU has a target of any kind around the fossil intensity of its core business model.

- **Social responsibility:** All seven PSUs spend over INR 100 crore (USD 14 million) annually for corporate social responsibility (CSR). However, the share of contribution to the environment remains low.
- **Strategic partnerships:** Partnerships seem to play a key role in helping PSUs explore new ways of working. CIL, NTPC, and IOCL have partnered to pilot clean energy projects and promote R&D. NTPC has also signed MoUs with CIL and ONGC to set up joint ventures for renewable energy (PSU Watch Bureau, 2021; PTI, 2020c). The five oil and gas PSUs are members of TERI's Council of Business Sustainability.

There are several striking “ambition gaps” for PSUs planning for an energy transition:

- Vision and targets do not address even the possibility of a net-zero target. Given global trends, India may seriously consider a net-zero commitment by 2050, at least around power and transport (Chaudhary et al., 2021; Climate Watch, n.d.). The IEA's recent roadmap for net-zero concludes that this can only be achieved by no new fossil investments (IEA, 2021b)—so PSUs could be significantly affected if they do not anticipate such changes and plan early. This would likely require a stronger mandate from ministries, given PSUs' decision-making structures, as discussed in Box 6.
- Vision and targets do not address the financial risk of climate change: stranded fossil assets and capital becoming inaccessible as lenders distance themselves from corporations with large fossil assets.
- Social responsibility for a just transition has limited planning and resources. Government guidelines on sustainability encourage PSUs to invest in this issue—but do not allow it to qualify as CSR (DPE, 2014).
- Strategic partnerships are insufficient for R&D and could feature greater collaboration among PSUs— for example, sharing lessons on PSU leadership, as discussed in Box 7.



Table 3. Ambition assessment framework for major energy sector PSUs

Vision & mission	Corporate targets	Strategic partnerships	Social responsibility
CIL			
<p>Vision: to “provide energy security... by attaining environmentally & socially sustainable growth through best practices from mine to market” (CIL, 2020a).</p>	<p>CIL plans to set up 3.4 GW in solar power projects at INR 5,650 crore (USD 797 million) by FY 2024 in a bid to become operationally net-zero. CIL has also shown interest in diversifying into non-coal mining-related areas— including solar power generation and solar wafer manufacturing (PTI, 2020a).</p>	<p>CIL has set up a joint venture with NLC India named Coal Lignite Urja Vikas Private Limited, with an objective to generate 3 GW of solar power. CIL is also in discussions with NTPC to purchase 140 MW of solar power under the centre’s Central Public Sector Enterprises Scheme and has signed a Memorandum of Understanding with SECI for 1 GW of solar power projects (PTI, 2020a).</p>	<p>CSR expenditure for FY 2020 for CIL and subsidiaries stood at INR 588 crore (USD 83 million), and it claims to be one of the highest among PSUs in the country (CIL, 2020 a).</p>
NTPC			
<p>Mission: to “provide reliable power and related solutions in an economic, efficient and environment friendly manner, driven by innovation and agility” (NTPC, 2020).</p>	<p>NTPC intends to add 60 GW of energy from renewable sources, aiming for approximately 30% of its generation capacity to be renewable in 2032 (PTI, 2021d).</p>	<p>NTPC has emerging partnerships with agencies like the National Investment and Infrastructure Fund and ONGC, focused on renewables. It is a corporate partner with the International Solar Alliance and has now been selected to implement solar projects in member countries. NTPC states that it is also “Planning to make a foray into Hydrogen Economy & Battery storage supported by R&D and collaboration with technology partners and research institutes” (NTPC, 2020).</p>	<p>In FY 2020, expenditure for CSR was the second-highest ever, at INR 305 crore (USD 43 million). According to its website, this was “benefitting over a million of our countrymen in over 500 odd villages in the neighborhood of our stations and plants” (NTPC, n.d.a).</p>

Vision & mission	Corporate targets	Strategic partnerships	Social responsibility
IOCL			
<p>The energy vision states: “presence in almost all the streams of oil, gas, petrochemicals and alternative energy source” (IOCL, n.d.a).</p>	<p>IOCL’s sustainability report generally states an ambition to “increase its renewable energy portfolio” (IOCL, 2020b). This includes expanding green alternatives like bio-diesel and hydrogen and a thrust on retail outlet solarization, but without specific, measurable targets (IOCL, 2020b).</p>	<p>IOCL has converted fuel stations (battery charging and swapping stations for EVs) with several companies. Despite no stated major clean energy partner, IOCL states it is working on “partnerships in battery manufacturing, 3G ethanol and carbon capture utilization & storage space” (IOCL, 2020b). IOCL is a member of TERI Council for Business Sustainability.</p>	<p>CSR expenditure in FY 2020 stood at INR 543 crore (USD 77 million). However, only five of 38 projects were for environmental sustainability (IOCL n.d.b).</p>
HPCL			
<p>Mission: “caring for environment protection ... attain scale... by diversifying into other energy related fields” (HPCL, 2020b).</p>	<p>HPCL aims to create awareness and respect for the environment, stressing every employee’s involvement in environmental improvement by ensuring “healthy operating practices, philosophy and training” (HPCL, n.d.a).</p>	<p>HPCL is a member of the TERI Council for Business Sustainability.</p>	<p>HPCL’s CSR spending for FY 2020 stood at INR 182 crore (USD 26 million) (HPCL, 2020a).</p>



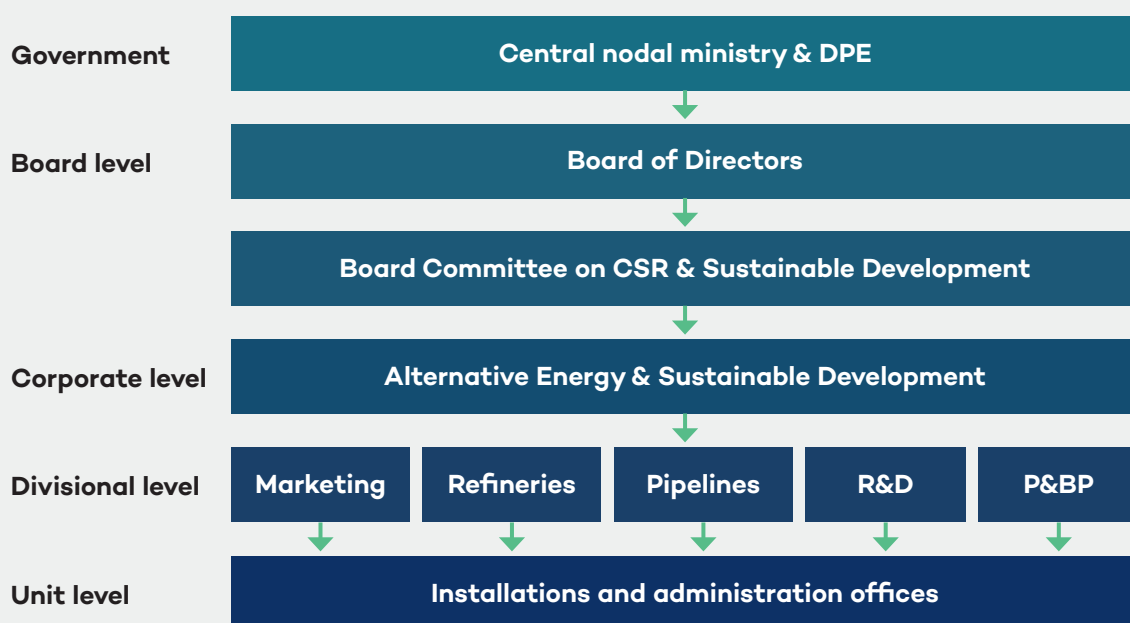
Vision & mission	Corporate targets	Strategic partnerships	Social responsibility
GAIL			
<p>Vision: to “promote use of superior, sustainable, environment friendly and efficient energy sources including Natural Gas, Renewables and other clean alternative energy” (GAIL, n.d.a).</p>	<p>GAIL Strategy 2030 and Advocacy Initiatives states that “GAIL will be making selective moves in the Renewable Energy domain given the future growth potential and also to partner [sic] with Govt. in meeting India’s INDC commitments on climate change” (GAIL, 2020b). Further, GAIL has committed to reducing GHG emission intensity by 33% and specific GHG emissions by 5% through improvements in processes (GAIL, n.d.b).</p>	<p>GAIL is a founding member of the Global Reporting Initiative (GRI) Focal Point India Sustainability & Transparency Consortium and a member of TERI Council for Business Sustainability. GAIL has worked with TERI to develop a document that outlines the Indian corporate vision on various aspects of tackling climate change and aligning the vision with government schemes in this direction (GAIL, 2020b).</p>	<p>IN FY20, GAIL spent INR 125 crore (USD 18 million) for its CSR initiatives. Environment-related activities received INR 1.9 crore (USD 261,000) out of this in FY 2020 (GAIL, 2020a).</p>
ONGC			
<p>Mission: an “abiding commitment to safety, health and environment to enrich quality of community life” (ONGC, 2020c).</p>	<p>ONGC plans to build capabilities to succeed as a solar developer in the short to medium terms, to target around 1.5 GW of solar energy capacity by 2030 (ONGC Solar) and to continue its investments in the onshore wind to target 2 GW capacity in 2030 (ONGC Wind) (ONGC, n.d.a, n.d.b).</p>	<p>ONGC is a member of TERI Council for Business Sustainability.</p>	<p>CSR expenditure for FY 2020 was INR 61 crore (USD 9 million), with two of the 32 latest projects on environmental sustainability (ONGC, 2020a).</p>

Box 6. Institutional and social perspectives on PSUs

Guest contribution: Ria Sinha, Souvik Bhattacharjya & Mani Juneja, The Energy Resources Institute

While developing a transition strategy, PSU governance structures must be considered. A relevant central ministry, like the Ministry of Petroleum and Natural Gas for O&G PSUs, is the nodal agency and sets policies, including those pertaining to clean energy. The ministry entrusts the DPE, which in turn directs the companies' board of directors. These mandates subsequently percolate from the board of directors to the corporate, divisional and unit levels, as shown in IOCL's corporate structure in Figure 25 (IOCL, 2021). Planning starts with the board, which defines the vision, mission, and targets. The corporate level creates new business cases and manages resources accordingly. Divisions do technical and financial planning and, finally, units work on implementation. Strategic interventions must be developed through such leadership structures. While central PSUs can take some independent initiative, they ultimately need a mandate from the government to significantly move towards clean energy.

Figure 25. Leadership for IOCL's Alternate Energy & Sustainable Development group



Source: Recreated from IOCL, 2021.

PSUs are likely to prioritize energy transition projects that also deliver on social mandates. IOCL, for example, has proposed setting up a second-generation ethanol plant in Haryana's Panipat district using non-food biomass (IOCL, 2020b). According to its environmental impact assessment, it will create many jobs for farmers (IOCL, 2019). Using agri-waste also reduces air pollution by providing an alternative to crop residue burning. Clean energy is generally well aligned with PSUs' social responsibilities: its often capital-intensive nature creates jobs, while it brings environmental co-benefits, like reducing air pollution or water over-extraction.



Box 7. New green financing mechanisms: NTPC

The NTPC is the energy Maharatna that has made the biggest progress in diversifying into clean energy. Which of its experiences could be useful to consider for other PSUs?

In August 2016, NTPC issued Green Masala Bonds (GMBs) for the first time, with the plan of new GMBs being issued after maturity in 5 years (Das, 2016). A Masala Bond is an Indian-rupee-denominated bond issued outside of India (Whiley, 2016). NTPC's Masala Bonds are "green" since the proceeds are intended to fund wind and solar energy projects and contribute to NTPC's renewable energy targets. The GMBs were issued with a 7.4% yield, which is lower than borrowing domestically (Das, 2016; NTPC, n.d.b). With INR 2,000 crore (USD 300 million) raised, NTPC's GMBs equal around 5% of its Medium Term Note Programme (NTPC, n.d.b). The net proceeds went into three solar energy projects (760 MW) and one wind energy project (50 MW), accounting for 2.5% of NTPC's targets (NTPC, n.d.b).

NTPC's GMB represented several firsts: the first GMB from India; NTPC's first-ever Masala Bond; the first GMB with certification from the Climate Bonds Initiative; the first 5-year Masala Bond from an Indian corporation; and the first with dual listing on the Shanghai and London stock exchanges. It was met with strong public interest, and NTPC issued twice as much as originally planned (NTPC, 2016).

Typically, NTPC finances renewable energy projects with a debt/equity ratio of 80:20. This means 80% of expenses are raised as debt through financial instruments, including bank loans (in rupee terms), debentures and foreign currency loans, and bonds (NTPC, 2020). While there are many similarities with financing conventional projects, GMBs have proven effective at facilitating diversification (PTI, 2019). NTPC's GMB has been called a "brown to green" bond deal by the Climate Bonds Initiative for using the strength of its balance sheets from thermal power to leverage funds for renewables (Whiley, 2016).

This suggests that fossil-intensive PSUs can use GMBs to fund energy diversification. Since 2016, other Indian agencies and companies have followed NTPC's lead. In late 2017, the Indian Renewable Energy Development Agency issued GMBs worth INR 1,950 crore (USD 303 million) with 5-year terms (PTI, 2017a). More recently, the first green bond by Continuum Energy, one of the largest providers of renewable power to corporations in India, was met with great interest from IFC (PTI, 2021b). This highlights the growing public and private interest in using GMBs to attract foreign investments.

While there have been some strides forward with GMBs, there is a need to strengthen existing measures by adopting a granular, standardized taxonomy for disclosure by investors and clear standards to define what is considered "green" for transparency and building confidence (Dutt et al., 2019). An example of this standardization is the "EU taxonomy for sustainable activities" being developed by the European Union as part of the European Green Deal (European Commission, 2020). An additional step from the supply side includes building a pipeline of green assets that may be refinanced through green bonds by tagging green assets on banks' balance sheets. This must further be complemented by improving awareness about the benefits of green bond issuances.

6.3 International Experiences

Internationally, there is currently no single standout SOE that can serve as a model for Indian PSUs undergoing energy transition. Where SOE visions and targets exist, they are often recent, varied in breadth and ambition, and yet to yield results. But international experience can nonetheless provide valuable insights, and elements of good practice can be drawn from a range of SOEs. Table 4 elaborates on some notable aspects of vision, targets, reporting, and planning from two international SOEs: Denmark's Ørsted and South Africa's ESKOM. Due to a lack of success stories from the Global South, Indian PSUs with strong clean energy ambitions, like NTPC, have an opportunity to emerge as global leaders in this area.

Table 4. Lessons from international SOEs: Ørsted and ESKOM

Lessons	Relevance for India
Ørsted (Denmark)	
<p>Vision and targets: The vision calls for a world that runs on green energy and acknowledges the challenge to keep the global temperature increase below 1.5°C (Ørsted, n.d.) There are separate targets for achieving carbon neutrality and building a renewable energy portfolio. Both of these are supported by forecasts and mid-term targets (Ørsted, 2020).</p>	<p>All PSUs can look to this for its clarity on objectives and joined-up thinking across fossil and clean energy—particularly ONGC and GAIL, which operate in the same segment of the energy value chain.</p>
<p>Reporting: Sustainability reporting is centred on climate change and decarbonization. This is not conflated with environmental, social, and governance performance and environmental impact assessments of projects, which are reported separately. The total carbon footprint is calculated, challenges of decarbonization are acknowledged, and management responses are identified (Ørsted, 2020).</p>	<p>Separating out reporting in elements in this way would represent a significant step forward beyond current practices among current PSUs in India.</p>
ESKOM (South Africa)	
<p>Targets: Based on a national integrated resource planning exercise, a target has been set to decommission about 12 GW of coal power plants over the next 15 years (DPE, 2019).</p>	<p>ESKOM's targets are an example of forward planning on fossil assets. Its management structures around just transition could serve as a useful model on institutional capacity building for NTPC and CIL to ensure that change is socially responsible.</p>
<p>Planning: To achieve this in a socially responsible manner, a new office for Just Energy Transition has been set up with the purpose of developing decarbonization strategies that protect vulnerable workers and communities (Creamer, 2020).</p>	

In the short-term in particular, international experience provides models on good reporting—essential for tracking trends and managing change. Today, India's energy PSUs vary strongly on data transparency about energy, sustainability, and climate change. The majority publish sustainability reports, in some cases as part of annual integrated reports, but they are difficult



to compare due to a lack of standardization and publishing delays. Online data portals are often difficult to navigate, and links to older files are broken. The Organisation for Economic Co-operation and Development's (2020) *Guidelines on Corporate Governance of SOEs* are a helpful reference point. Reporting should clearly state how PSUs are allocating financial resources and the share of CAPEX going to different types of energy and energy efficiency.

6.4 Key Takeaways

1. India's seven energy sector Maharatnas are critical to the energy transition, as well as economic recovery. In FY 2020, their CAPEX was nearly 1.4 lakh crore (USD 19.4 billion), and a review of project investments from FY 2014 to FY 2020 shows that the large majority of projects is still focused on fossil fuels. The government must provide a clean energy mandate that is in line with national targets—particularly given government instructions that PSUs should increase CAPEX significantly over the next few years to help stimulate economic recovery. As noted in Section 5, this could also align well with ambitions to increase domestic capacity in clean manufacturing.
2. Energy PSUs should develop visions and targets around decarbonization, including advance planning around existing commitments and possible future national net-zero targets. This should acknowledge and address the risks of new fossil investments getting stranded and access to capital becoming difficult due to fossil-heavy portfolios.
3. PSUs, particularly in the coal sector, should include ambitions on a just transition in their future planning. This includes early strategizing and resource allocation. International examples, such as ESKOM's office for Just Energy Transition in South Africa, can provide useful models for PSUs to consider. The government can further support PSUs by expanding the provisions of CSR so that it unambiguously includes expenditure on just transition.
4. Among the seven Maharatna energy PSUs, NTPC is the furthest along the energy transition pathway. It has set definitive targets on clean energy and built partnerships around new types of business. In part, this reflects a natural advantage over other PSUs because decarbonizing the electricity sector is economically lucrative. But this also gives NTPC an opportunity to step up as a global leader among SOEs in developing economies—if it can continue to increase ambition, innovate on planning and management structures, and demonstrate impacts.
5. PSUs operating in the O&G sector should explore new business models and clean energy technologies in which they have transferable skills and competitiveness. This may include offshore wind, as in the example of Ørsted, or decarbonizing the fuel inputs of their current customers, such as the transport and industry sectors.
6. Indian PSUs should adopt a standardized framework for sustainability reporting that draws on international best practice. This needs to address the climate change challenges at the heart of PSUs' business models.
7. GMBs are a promising avenue for raising foreign capital. PSUs can bank on the current strength of their balance sheets to bring in investments to clean energy projects—noting that the window of opportunity may not last forever, as fossil-intensive asset portfolios will be subject to increasing scrutiny and risk assessment over the next decade.

7.0 Recommendations





India's first generation of support for clean energy has successfully brought solar and onshore wind technology to market parity and placed renewables front and centre in the future energy system. Looking ahead to the target of 450 GW of renewables by 2030—and the large annual deployment required to achieve this goal—a strategy is needed for a second generation of support for clean energy, with proportionate ambition and greater planning to meet the needs of the hour. Efforts to promote a green recovery should be aligned with this larger objective. Initiatives to identify and promote shovel-ready projects with potential investors can build capacity in clean energy while stimulating the economy and creating jobs.

This leads us to make the following recommendations.

1. Identify, design, and implement a new generation of support measures for renewable energy that focuses on emerging technologies required to achieve 450 GW by 2030.

This goal should be based on projections about the least-cost balance of technologies in the energy system by 2030 but also be consistent with India's goals on energy access and job creation, as well as a potential future net-zero target for the energy sector.

This implies a likely focus on:

- Grid integration and storage solutions as keys to addressing the lull in electricity demand.
- Decentralized renewable energy to support industries and rural livelihoods.
- EVs, including non-monetary incentives such as priority lanes and reserved parking.
- New technologies like green hydrogen to help decarbonize energy-intensive industries, offshore wind to provide baseload supply, and non-fossil clean cooking to reduce reliance on LPG imports.

2. Maximize resources available for reforming the power sector.

Greening electricity is critical for the shift to clean energy—but ongoing power sector problems, particularly insolvency among DISCOMs, is a pivotal roadblock. It is key to resolve DISCOM finances so that the conditions of long-term power purchase contracts can be respected, assuring new investors. Some big schemes for DISCOMs have already been announced: INR 3.06 lakh crore (USD 43.2 billion) over 5 years as a reform-linked performance scheme, particularly on billing and collection, and an INR 1.35 lakh crore (USD 19 billion) emergency loan facility set up in the early months of COVID-19. These existing measures must be carefully implemented to create stable, systemic changes—and not simply bail out inefficient subsidized business models. The government also needs to marshal equivalent levels of support for better targeting mechanisms so that subsidies can focus on specific eligible consumers. A joint centre–state program is required on this theme to fill knowledge gaps, establish guidelines, and provide incentives for targeting reforms. Reducing subsidies for well-off consumers can help make policies more fiscally sustainable and enable a higher level of support for those who are most in need.

3. Expand the scope of clean energy under Aatmanirbhar Bharat.

Under the aegis of Aatmanirbhar Bharat, the government should develop more nuanced subsidies as part of a broader strategy for green industrial policy, considering both the central and state levels and prioritizing integrated solar PV manufacturing, EVs, and storage solutions. Having PSUs front this manufacturing wave could build investor confidence and prove effective in the long run.

After several years of growth, investment in India's solar PV capacity dropped in FY 2019. Part of this drop was attributed to import duties that aimed to increase the production of domestically manufactured solar PV panels. They did not have the desired effect, and manufacturing did not experience significant growth. Incentives targeted at addressing new risks brought on by the adoption of domestically manufactured products should be prioritized at this stage. An assessment of central and state-level policies identified four key recommendations that can address gaps in governments' support for solar PV manufacturing. First, creating demand-side certainty is essential to trigger expansion and backward integration. Second, targeted fiscal and financial incentives are necessary to improve competitiveness. Third, states should develop manufacturing ecosystems to improve access to labour and locally produced raw materials and equipment. And finally, R&D support is needed all along the manufacturing chain so that manufacturers can compete globally on factors such as panel price and quality.

4. Capture the environmental and social costs of coal power.

Falling prices of grid-scale solar and a drop in demand during COVID-19 have created economic challenges for coal power. And while coal makes significant contributions to government revenue and rail cross-subsidies, its full social cost is much higher than its net contributions. Despite this, a series of recent non-subsidy policy decisions have created financial benefits for coal by weakening environmental standards. This includes the rolling back of coal-washing regulations and delaying compliance with air pollution standards. Such decisions will simply exacerbate pollution-related health problems in a context where major Indian cities have already topped global charts on air pollution, pushing costs onto citizens and the health system. Low GST tax rates should be reformed, and green taxes such as the coal cess should continue to periodically increase so that the full social costs of coal are reflected in prices. Given increasing tax dependency on fossil fuels, it will be important to invest a share of revenue in the next generation of clean energy and a just transition. Additional investment is also needed to offset economic impacts on DISCOMs, healthcare, and social protection.

5. Increase ambition from PSUs in spending their CAPEX on clean energy.

India's PSUs make massive annual investments in the energy sector: from FY 2014 to FY 2020, the seven energy-related Maharatna-level PSUs invested in 183 projects with a total value of INR 2.5 lakh crore (USD 35.5 billion) in nominal terms. Overall, this is still heavily skewed toward fossil fuels, which were the focus of 11 times more investment than clean energy in FY 2020. An assessment of these seven PSUs found relatively low ambition on clean energy and no planning on how to manage the stranded asset risk of fossil-intensive asset portfolios. The government must provide a clean energy mandate to PSUs, setting ambitious



targets for high levels of investment in clean energy. It has already instructed PSUs to increase CAPEX to help stimulate economic recovery. This should be directed toward funding clean energy and establishing national capacity in manufacturing. PSUs are recommended to start building key partnerships and exploring diversified business models by looking at international experience. This should include building roadmaps for decarbonization and providing transparent reporting to inform investors about the financial risks of their fossil fuel assets.

6. In the meantime, increase transparency on support measures and reporting.

Subsidy reporting can be conducted in line with formal guidelines for SDG 12(c)1 and feed into India's peer review of fossil fuel subsidies as part of its G20 commitments. With fuller data and improved transparency, ministries should monitor, evaluate, and adapt their most significant subsidies to better meet policy objectives. To help this process along, it is crucial that entities in charge of allocating subsidies follow a uniform reporting format, with synchronized terminologies across various states and entities. Better reporting and transparency do not just apply to subsidies—but also to all the forms of support that can accelerate or hold back energy transition, including PSU investments, public finance, and regulatory measures

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Annex A. Public Sector Undertaking Project Costs

Using publicly available infrastructure spending, we identified projects under the Maharatna public sector undertakings (PSUs) categorized as gas pipelines, oil pipelines, electricity generation (grid), renewable energy (grid), city gas distribution, oil/gas/liquefied natural gas storage, electricity transmission, and hydropower (DEA, 2021). The data show the total project cost along with commencement completion dates. Some of the projects are still in the construction stage. Terminated projects were removed. Projects operated by wholly owned subsidiaries of the listed PSUs are included under the PSU, but joint ventures with state governments, private partners, and non-energy PSUs are not considered.

Among the categories of projects, large hydropower projects that were originally listed under renewable energy (grid) have been filtered and listed separately. Electricity generation (grid) exclusively refers to thermal power projects.

To identify annual project investments, the project costs were divided year by year along the fiscal year (FY) running from April 1 to March 31. The project cost was divided based on when the project was started, and the rest is split equally until the project was completed. For projects under construction and projects with no data on the year of award, we assumed a standard 10-year life of the project and divided the investments accordingly.

Underlying datasets have been included in the accompanying [spreadsheets](#).

Annex B. Detailed Findings on Public Sector Undertakings' Ambition

Table B1. The public sector undertakings ambition matrix

PSU	Findings
NTPC Limited	Various business and international partnerships (NTPC, 2020); 60-GW aim by 2032 and setting up own renewable energy subsidiary (PTI, 2021d); CSR policies: Initial Community Development Policy (2009), Resettlement and Rehabilitation Policy (2017), CSR & Sustainable Development Policy (2017); key areas of CSR: education, health, sanitation, water; sustainability pillars: environment, corporate citizenship, health & safety, ash utilization; Centre for Power Efficiency & Environmental Protection (NTPC, 2019).
Coal India Limited (CIL)	Set up 3-GW solar power projects at INR 5,650 crore (USD 797 million) by FY 2024 (CIL, 2020a); joint ventures with NLC India, NTPC; Memorandum of Understanding with Solar Energy Corporation of India; from 2021 onwards, diversify into non-coal mining-related areas (PTI, 2020b); NLC India Limited and CIL together plan to invest INR 1.42 lakh crore (USD 20 billion) into new business areas via 117 projects, including renewables (Ministry of Coal, 2020); thematic programs (i.e., school education and healthcare) around 60% of the total CSR expenditure (CIL, 2020b).
Oil and Natural Gas Corporation Limited (ONGC)	Succeed as a solar developer (ONGC, n.d.a); 2 GW of wind capacity by 2030 (ONGC, n.d.b); no partnerships relevant for renewable energy sources (ONGC, 2020a); tackle climate change at the group level (ONGC, 2020b).
Indian Oil Corporation Ltd (IOCL)	No fixed target to upscale renewables as of now; further expand into greener fuel alternatives, continue to augment its renewable energy capacity; stay committed to aligning its operations and products toward achieving India's targets under the Sustainable Development Goals (SDGs) and the Paris Agreement (IOCL, 2020b); limit the emission of greenhouse gases (GHGs) (IOCL, n.d.b); converted fuel stations (battery charging/swapping stations for electric vehicles) in partnership with several companies; further business partners in all countries where IOCL has subsidiaries, across the value chain (e.g., Mauritius, United States, Singapore); of all 21 joint ventures stated, not a single one on renewable energy sources specifically (IOCL, 2020a); major research and development (R&D) thrust is being put on technology upgrading in renewable energy, bio-energy, and hydrogen energy (IOCL, 2020b).
Hindustan Petroleum Corporation Limited (HPCL)	CSR focus areas: childcare, education, healthcare, skills development, sports, environment, and community development; received various awards for CSR in 2019/20 (HPCL, 2020b); as a member of the Global Compact, it adopts a precautionary approach to environmental challenges (HPCL, n.d.b).



PSU	Findings
Bharat Petroleum Corporation Limited (BPCL)	Laid down a road map for the next 5 years to solarize its retail outlets, depots, installations, and liquefied petroleum gas plants; renewable energy activities have resulted in an annual reduction of GHGs by more than 104,000 tonnes CO ₂ e (BPCL, 2020); other initiatives like transportation of product through pipelines, liquefied petroleum gas under Pradhan Mantri Ujjwala Yojana and use of biofuels has further reduced GHG emissions by 1,686,000 tonnes CO ₂ e; own carbon sink has increased to an extent of 8,000 tonnes CO ₂ e in FY 2020 (BPCL, 2019); newly launched “E-Drive” initiative (BPCL, 2020); Campaign on Climate Change – a study commissioned together with other oil and gas sector enterprises through The Energy and Resource Institute (BPCL n.d.a).
Gas Authority of India Limited (GAIL)	As per GAIL Strategy 2030 and Advocacy Initiatives, makes selective moves in the renewable energy domain; explores the feasibility of renewable and gas hybrid power generation models to utilize the existing gas-based power assets for delivering lean power (GAIL, 2020b); commitment to reduce GHG intensity by 33% and specific GHG emission by 5% through improvements in certain processes (GAIL, n.d.b).

Annex C. State Manufacturing Policies

Table C1. State-level manufacturing policies and a breakdown of the main manufacturing incentives

	Gujarat	Tamil Nadu	Telangana	Maharashtra
Name of policy	Gujarat Industrial Policy 2020	Electronics Hardware Manufacturing Policy 2020	Telangana State Industrial Development and Entrepreneur Advancement (T-IDEA) Incentive Scheme	Industrial Policy of Maharashtra 2019
Year introduced	2020	2020	2014	2019
Reason introduced	To make Gujarat a global business destination for next-generation sustainable manufacturing and a service industry driven by state-of-the-art infrastructure, employment generation, inclusive and balanced regional development, thereby contributing significantly to Aatmanirbhar Bharat (a “self-reliant India”).	To transform Tamil Nadu into an innovative and globally competitive Electronics System Design and Manufacturing (ESDM) destination.	The new Telangana State Industrial Policy strives to provide a framework that will stabilize existing industries and make them more competitive, and also attract and realize new international and national investments in the industrial sector.	To make Maharashtra the first USD 1 trillion economy in the country by augmenting the manufacturing ecosystem, complemented by ease of doing business initiatives, thereby evolving it into a preferred destination for global manufacturers and investors, resulting in the largest employment-creating state with balanced regional and inclusive growth, by 2025.



	Gujarat	Tamil Nadu	Telangana	Maharashtra
Capital subsidy	<p>For large, mega, and ultra-mega investments: varies between 6% and 12% of fixed capital investment disbursed annually over 10 years, depending on sector category.</p> <p>For micro, small, and medium-sized enterprises (MSMEs): varies between 10% and 25% of eligible term loans.</p>	<p>Varies between 15% and 30%, disbursed annually over 12–15 years, depending on the size of investment, number of employees, and district.</p>	<p>25% subsidy on specific cleaner production measures limited to INR lakh.</p>	
Interest rate subsidy	<p>For MSMEs, varies between 5% and 7% disbursed annually for between 5 and 7 years, depending on sector category.</p>	<p>5% capped at between 0.2–1 crore per annum (depending on size of investment) for 6 years.</p>	<p>MSMEs only: 15% investment subsidy on fixed capital investment subject to a maximum of INR 20 lakh.</p>	
Value-added tax (VAT)/ Goods and Service Tax (GST) exemption			<p>Reimbursement of 50%–100% net VAT/Central Sales Tax or State Goods and Services Tax (SGST) for a period of 7 years from the date of commencement of commercial production, depending on the size of the enterprise.</p>	<p>MSMEs: SGST – Investment promotion subsidy of SGST paid by unit on the first sale of eligible products billed and delivered to the same entity within Maharashtra.</p> <p>Large-scale industries: Investment promotion subsidy of SGST for the first sale within the state and billed and delivered to the same entity.</p>

	Gujarat	Tamil Nadu	Telangana	Maharashtra
Land incentive	Government-owned land is available on lease to industrial enterprises at 6% of the market rate for up to 50 years.	For eligible projects in government-owned industrial parks, land allotment will be made at 50%–100% subsidized rate for land up to 20% of investment in eligible fixed assets depending on the district. For private land, a 50% subsidy will be offered on the cost of land as per guideline value up to 50 acres and subject to land cost not exceeding 20% of eligible fixed assets and a cap of INR 2 crore.	25% rebate in land cost limited to INR 10 lakh in industrial estates/industrial parks; 25% land conversion charges for industrial use limited to INR 10 lakh only for medium-sized enterprises.	
Stamp duty exemption		Exemption of 50%–100% in government-owned parks depending on the district. For private land, the concession will be given as a 100% backend subsidy for up to 50 acres on fulfilment of investment and employment conditions.	100% reimbursement of stamp duty and transfer duty paid by the industry on purchase of land meant for industrial use; 100% reimbursement of stamp duty for the lease of land/shed/buildings and also mortgages and hypothecations.	MSMEs: 100% stamp duty exemption for acquiring land and leasing land, depending on location. Large scale: 100% stamp duty exemption within investment period for acquiring land, including assignment of lease rights, sale certificate, and term loan purposes.



	Gujarat	Tamil Nadu	Telangana	Maharashtra
Training incentive		Training subsidy of INR 4,000 per first-time employee per month up to 6 months; Training Subsidy for Women of INR 6,000 per first-time employee per month can be availed up to 6 months. Only native residents of Tamil Nadu are eligible.	50% reimbursement of the cost involved in skill upgradation and training the local manpower up to INR 2,000 per person.	
Electricity duty exemption	For MSMEs, assistance for service line and power connection charges, rent, etc., at 35% of charges paid to distribution licences for low-/ high-tension service line, maximum limit up to INR 5 lakh.	Electricity tax exemption for 5 years from the date of commercial production for power purchased from TANGEDCO or generated and consumed from captive sources.	Fixed power cost reimbursement @ INR 1.00 per unit for a period of 5 years from the date of commencement of commercial production.	MSMEs: Power subsidy for 3 years from the date of commencement of commercial production. Varies between INR 0.50 and INR 1 per unit consumed depending on unit location. Electricity duty exemption for between 7 years and the lifetime of the project, depending on location. Interest rate subsidy @ 5 % per annum up to a maximum of the value of electricity consumed and bills paid for that year. Large scale: Electricity duty exemption for between 7 years and the lifetime of the project, depending on location.
Sources	Gujarat Industrial Policy 2020 (Government of Gujarat, 2020)	Electronics Hardware Manufacturing Policy 2020 (Government of Tamil Nadu, 2020)	T-I DEA Incentive Scheme 2014 (Government of Telangana, 2014)	Maharashtra Industrial Policy 2019 (Government of Maharashtra, 2019)

