

The lowest hanging fruit on the coconut tree: India's climate transition through the price system in the power sector

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Abstract

The heavy lifting in the climate transition is done in the electricity sector. Decarbonisation of the economy requires a large-scale rearrangement of technology and business models, in supply and demand, in the electricity sector. The Indian electricity sector is ill-suited to perform this role and this constitutes the major roadblock for the climate transition in India. The solution lies in electricity reform, that addresses the long-standing fundamental problems of the electricity sector, that places this sector on the foundation of the price system. Once electricity works through the price system, an escalating schedule of a carbon tax will deliver the cost-minimising climate transition through myriad actions of self-interested actors spread all over the country, without requiring central planning. Many elements are coming together, through which this reform is feasible today while it was not in the past 30 years.

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1 Introduction

The world is projected to emit about 50GT of CO₂ per year by 2055. Climate scientists say (net) emissions need to be ended by 2055, in order to avoid catastrophic events with reasonable probability. At present, India is emitting 2.5GT per year with a long term trend growth rate of about 5%. India is the 4th largest source of CO₂ in the world, accounting for 7% of emissions, with emissions that are roughly as large as those of the European Union. In this paper, we engage in strategic thinking about India's decarbonisation.

Decarbonising any economy is a large and complex problem. The electricity sector is a key site of the carbon transition, as it directly makes CO₂ (e.g. by burning coal and gas), and because decarbonisation in other areas (e.g. cooking) involves switching away from fossil fuels to electricity. The sector is formally organised, which makes it more susceptible to policy intervention. Thus, in every country, decarbonisation calls for a large modification of the resource allocation in the electricity sector. Technical and business model decisions are required at each location in an economy about the optimal mix of renewables, storage and demand-side adjustment for the zero emissions world.

The Indian electricity sector is poorly placed to perform the required modification of this resource allocation. At present, it is a centrally planned system that is under growing financial stress. The process of private investment in electricity has lost momentum. Resource allocation is inefficient owing to multiple prices and a command-and-control system, rather than one based on producers and users that respond to prices. The command-and-control system works poorly in steady state, and particularly poorly when large changes in the resource allocation are required. By imposing enlarged costs upon the economy, a centrally planned decarbonisation runs the risk of greater political difficulties. The electricity sector is thus the critical choke point in India's climate transition.

Looking forward, the problems of the electricity sector are likely to deepen. Rising Indian emissions in coming years will sit uneasily alongside a decarbonising world. Regardless of the speed at which Indian policy makers might desire a change in course, there are forces reshaping the behaviour of Indian firms which are narrowing the options. Indian firms now operate under international asset pricing, and ESG investment has changed the incentives of Indian firms to favour buying and selling renewables. Some large economies could, in coming years, introduce trade taxes upon the carbon content of Indian exports. This would additionally induce Indian firms to desire reducing emissions in their supply chain. The cross-subsidy system within the electricity sector will come under increasing stress when buyers see renewables inducing some combination of a lower cost of capital, a lower

operating cost and reduced trade barriers.

For 30 years now, political and fiscal resources have been expended in periodic incremental reforms of the electricity sector. These have not delivered the desired results. It is unlikely that similar efforts will work in coming years. In the meantime, 2021 is likely to be a turning point in the demands made upon the electricity sector owing to the carbon transition.

The climate transition is one of the most complex problems in Indian public policy and will now be subject to the new commitments made at COP26. A coherent strategy needs to be established and articulated, which can reshape the behaviour of a billion private persons across space and time.

This involves going with the grain of the price system, i.e. stepping away from the command-and-control system. All firms in the electricity sector need to be creatures of the market economy, which constantly reshape technology and business models in response to prices. Such firms have the incentive and the ability to look at the changing landscape of technology, financing and carbon taxation, and solve local maximisations that yield the correct engineering and business solutions all across the country. This distributed intelligence, this self-organising system, processes information better, values profit over conservatism and populism, engages in a process of search with risk-taking where some win and some lose, and avoids the state capacity constraints that hamper the central planning system. It will achieve the required Indian climate transition at a lower cost to the economy when compared with a centrally planned path.

Under an electricity sector that is grounded in the price system, there is a clear pathway to the climate transition: the single instrument of the carbon tax. Following a 5-10 year reform process of the electricity sector, the Indian state would announce levels of carbon taxation for the next 25 years, based on international commitments towards decarbonisation and net zero. Private persons would respond to these numerical values with business and technological strategies that are optimal at every location in the country. Every five years, policy makers would review the emissions, and modify the trajectory of taxes for the coming 20 years. Policy makers would control this one lever – the carbon tax – and the decarbonisation of the economy would be achieved through private decisions on the demand side, in generation and in storage.

Without a carbon tax, the union government lacks instruments for carbon policy, and intricate regulatory activities will induce enhanced costs upon the economy. Without an electricity sector that is organised around the price system, the resource allocation will be distorted thus enhancing the economic cost of decarbonisation. The optimal way forward is a combination of electricity regulation at state governments, a carbon tax led by

the union government, and a private electricity sector organised around the price system.

While this appears to be an attractive vision, it is also a difficult policy project. Immense effort has been put into electricity reform in the past, by insightful policy makers. These leaders of Indian electricity reform, of the last 30 years, stayed within the strategy of a centrally planned electricity system. Why do we believe that things could work differently today?

There are six aspects in which the present situation is different, which creates a pathway to the fundamental reform that was elusive for the last 30 years: (1) There is greater understanding of the political economy landscape, and it is possible to design bargains where the losers from the reform are compensated. (2) State capacity in regulation is essential for the operation of an electricity sector organised around the price system, and there is now a greater understanding in India of how to establish the objectives and methods of regulation. (3) There is a path to electricity reform, one state at a time, which is more tractable and feasible when compared with grand schemes led by the union government which apply to the entire country. (4) The materiality of climate policy in the international discourse has shifted the political salience of domestic electricity reforms. Alongside this, the domestic policy envelope on establishing more market-led solutions has improved. (5) It is possible to fund the transition. (6) The fiscal cost of upholding the status quo in the electricity sector is likely to rise.

2 Reviewing the Indian climate transition

This paper is located in the field of big picture analyses of Indian climate and energy policy (Ahluwalia and Patel, 2021; IEA, 2021; K. S. Parikh, J. K. Parikh and Ghosh, 2018). So far, the main milestone in India’s climate transition has been the ‘Nationally Determined Contributions’ (“NDC”) under the Paris Accords, to achieve 40% electricity installed capacity from non-fossil-fuel sources by 2030.¹ The total installed capacity of renewables in India was at 101.53GW as on 30 September 2021, and almost 40% of the total installed capacity is non-fossil-fuels (renewables, nuclear and hydel) (*All India Installed Capacity of Power Stations 2021*). In this measure, India is in compliance with the promises made in 2015.

This accomplishment is, however, based on a narrow metric: the share of renewables in capacity. In a larger assessment of the carbon transition, the situation is more daunting. Renewables generation is at 11% of total generation. On a flow basis, India’s annual CO₂ emissions rose from about

¹These commitments will be modified by the commitments made on behalf of India by Prime Minister Narendra Modi at COP26 in Glasgow in November 2020; detail of how the NDCs change remains to be seen.

1GT per year in 2001 to 2.6GT per year today, with a compound growth rate of about 5% per year. The share of Indian emissions in the world went up from about 4% in 2000 to about 7% today. While there is ample sunlight in India, the carbon intensity of energy production has actually grown in recent decades (from 0.24kg/Kwh in 1970 to 0.28kg/Kwh today). Many countries have fared better in this period, e.g. China dropped from 0.33kg/Kwh to 0.26kg/Kwh, and the UK dropped from 0.26kg/Kwh to 0.17kg/Kwh. This does not bode well for another one of India's NDCs, which is an emissions-intensity target of 33% to 35% below 2005 levels by 2030.

At COP26 in Glasgow, the Prime Minister placed India on a more concrete climate transition path. He made five key commitments, saying that India will: (1) increase its non-fossil energy capacity to 500GW by 2030; (2) fulfil 50% of its energy (electricity) requirements from renewable energy sources by 2030; (3) reduce its total projected carbon emissions by 1 billion tonnes by 2030; (4) reduce the emissions intensity of the economy by 45% by 2030 and (5) achieve net-zero by 2070.

While the precise meaning of the Prime Minister's announcements is still being debated, these are significant commitments and have been widely welcomed. At the same time, the path to achieving net-zero by 2070 is far from straightforward. This paper is part of the thought process on going from here to there.

3 How climate policy influences the economy

As the world begins to emerge from the worst of the COVID-19 pandemic, the global climate transition has re-emerged as the major issue shaping policy thinking across the world. Decarbonisation is a complex process that impacts upon a large number of economic agents in every country. A large number of changes in the structure of production are required (K. S. Parikh, J. K. Parikh and Ghosh, 2018). Every country requires a strategy through which the required carbon transition is achieved on the required time horizons, at the lowest possible cost to society. This requires establishing *instruments* of climate policy, through which climate policy makers can make decisions from time to time, which have an impact upon the carbon-intensity of the economy over a period of time, and achieve economic efficiency (i.e. minimum cost to society). These instruments include tools such as a carbon tax or regulations that restrict carbon emissions.

The most important site of the climate transition is the electricity sector. Electricity is important because fossil fuels are a major input for electricity generation, and because decarbonisation of other aspects of the economy (e.g. transportation) requires shifting from fossil fuels to electricity. On both aspects, the magnitude of the change that is required is quite considerable; it

is not just small changes on the margin. Every country requires the climate policy tools which achieve the carbon transition by influencing the electricity sector.

The difficulties of the Indian electricity sector hamper this process.

3.1 The Indian electricity sector is hamstrung

Across many decades of attempts at reform, the main fault lines of the Indian electricity sector can be summarised as follows:

3.1.1 The difficulties of DISCOMs

State-owned DISCOMs are in chronically bad financial health. Total DISCOM losses in FY 2021 were estimated at Rs.0.9 trillion and accumulated losses stand at about Rs.5 trillion (Kadam, Majumdar and Vikram, 2021; Chitnis, Dharmadhikary et al., 2018). In March 2021 overdue payments from DISCOMs to power generators were at about Rs.0.68 trillion.²

DISCOMs have been used as a redistributive tool, where state control has gone with explicitly free electricity to certain persons or the lack of enforcement against theft of electricity by others. This theft, and the lack of incentives in government organisations to achieve operational efficiency, has generated high AT&C losses in most states. Government owned DISCOMs are at AT&C losses of about 22% while private DISCOMs are at about 10%.³

There is a periodic ritual of ‘panic, package and neglect’,⁴ where fiscal resources go into public sector DISCOMs accompanied by a ‘package’ of reforms that is supposed to put an end to the problem.⁵ There have been at least 4 such bailouts of the DISCOMs in the past 20 years, i.e. roughly one every five years. There was the UDAY scheme in 2015. About five years later, the next package of reforms and money appeared: in May 2020, the Government of India announced a liquidity infusion in the form of cheaper loans from public sector financial institutions of Rs.0.9 trillion to DISCOMs to cushion the impact of the COVID-19 pandemic. A further package of reforms, with an allocation of Rs.3.05 trillion, was announced in the February 2021 Budget.

The problems of the electricity sector hinder the carbon transition. As an example, consider the enlargement of renewables generation. The Indian

²Payment Ratification And Analysis in Power Procurement for Bringing Transparency in Invoicing of Generators (PRAAPTI), Ministry of Power, PFC Consulting (2020), at www.praapti.in/.

³Ministry of Power, UDAY Dashboard on AT&C losses, at https://www.uday.gov.in/atc_india.php.

⁴‘Panic, package and neglect’ is the phrase from Harsh Vardhan, Chapter 4 in Kelkar and Shah (2019).

⁵For an excellent history of these reforms, see Chitnis, Dharmadhikary et al. (2018).

state, particularly after COP21, was keen to accelerate renewables generation. Absent a price-based mechanism that can reshape the incentives of private generators away from fossil fuels, renewables capacity had to be procured through the centrally planned system. Private persons are nervous about selling to public sector DISCOMs given their poor credit ratings and record of payment defaults. A solution was to set up a buffer, a new Union Government state-owned enterprise – the Solar Energy Corporation of India (“SECI”) – which would buy solar electricity from private persons and sell this to state DISCOMs. This solution works until the working capital inside SECI is exhausted, and highlights the fragile economic foundations of renewable energy in India.

SECI notwithstanding, state DISCOMs remain the main locus of the problem. They are unable to understand how the private sector assesses and responds to incentives and risk. This has created problems in the sector, such as:

- Bidding conditions that allowed private power producers to not price the escalation of coal prices into their tariff bids, leading to power producers defaulting on their supply commitments when coal prices went up as it was no longer rational for them to continue to produce power at the bid tariffs.⁶
- State procurement agencies and DISCOMs passing on the risks relating to obtaining permits and consents and acquiring land to power producers, when state-owned power procurers were much better placed to take these risks.
- PPAs, particularly those for renewables, failing to provide adequate security for delayed payments, early termination, change in law and force majeure. This arises from the inability of power procurers to take on actual and contingent financial commitments that would be considered legitimate in any rational business environment.
- Inadequate compensation to power producers when requiring them to back down, particularly in the absence of grid emergencies. Recently, the courts have shown some inclination to provide relief here but this should be an essential feature of a contractual long-term power purchase relationship.⁷
- Failing to sign PPAs or issuing letters of award after bids have been opened and/or requiring winning bidders to reduce their bid prices after bids have been legitimately won.
- Attempting to force reduction in power tariffs in signed and operational PPAs when no right to do so existed in the PPA or in regulation.⁸
- DISCOMs in various states, including Andhra Pradesh, Jharkhand, Karnataka and Uttar Pradesh, renegeing on signed PPAs, with regulators failing to step in

⁶*Power Tribunal’s Compensatory order time to take a fresh look at competitive bidding*, Akshay Jaitly and Anuja Tiwari, The Wire, May 2016 at <https://thewire.in/business/aptels-compensatory-tariff-decision-time-to-take-a-fresh-look-at-competitive-bidding>.

⁷See, *National Solar Energy Federation of India v. Tamil Nadu Electricity Commission and Others*, APTEL, Appeal No. 197 of 2019.

⁸See Chapter 4 of Kapur and Khosla (2019).

to prevent these breaches of contract, despite warnings issued by the Ministry of New and Renewable Energy of the Union government.⁹

- Refusing to grant open access when required to do so by the provisions of the Electricity Act and then persisting with litigation to oppose open access, even when it apparent that it is in a losing cause.
- Failing to honour change in law, force majeure and other provisions in PPAs, for both thermal and renewable energy projects.

The presence of these risks implies that the sector is attractive mainly to investors who are able to absorb high levels of risk and manage the political and bureaucratic environment, which means that many foreign firms find it hard to make direct investments.¹⁰

A recent episode illustrates the direct conflicts between protecting the legacy electricity sector arrangements and the objective of decarbonisation. India has ample sunshine, and in a rational world, many private persons should be putting up rooftop solar panels. Apart from generating renewable energy and directly assisting the climate transition, rooftop solar eliminates transmission and distribution losses and reduces investment required for grid infrastructure. However, this creates problems in the state-DISCOM driven electricity system which relies on cross-subsidies and overcharging commercial and industrial users. Hence, we had a remarkable moment in 2020 – the Electricity (Rights of Consumers) Rules 2020 issued by the union government – which blocked net metering for loads above 10kW.¹¹ In June 2021, responding to demands to raise this limit, the Ministry of Power amended these rules to allow net metering up to 500kW, but some state governments continue to use a much lower limit. This makes India one of the few countries where state power is being used to impede the growth of rooftop solar (Garg and Gulia, 2020).¹²

⁹ *Ibid.*

¹⁰ Options to solve some of these problems within the current structure of the electricity sector exist. For an interesting discussion of options for payment security and currency risk, see Shrimali (2021).

¹¹ For the negative impact this has had, for example, in Punjab, see *Rooftop Solar and Discoms: A Case of Putting the Cart Before the Horse?* M Rajshekhhar, Carbon Copy, June 2021, at <https://carboncopy.info/rooftop-solar-and-discoms-a-case-of-putting-the-cart-before-the-horse/>.

¹² Another unique feature of India is the 40% basic customs duty on solar panels, which increases the capital cost of new renewables capacity. See also, the tensions between DISCOMS and captive power producers on the draft amendments to the Electricity Rules 2005 at <https://economictimes.indiatimes.com/industry/energy/power/rules-for-captive-power-plants-to-be-amended/articleshow/70121180.cms?from=mdr>

3.1.2 The pipeline of investment has difficulties

Governments fare poorly in designing power purchase agreements. There are weaknesses in the government contracting process which translate into business risk for private persons. It is difficult for smaller and medium sized players and international firms unfamiliar with the Indian environment to find pockets of acceptable and predictable risk in which they can survive and flourish.

The CMIE Capex database reports the stock of ‘under implementation’ investment in generation. This stock of private projects in generation, summing across all technologies, peaked at Rs.14.7 trillion in September 2011 and has steadily retreated to the value of Rs.3.6 trillion in September 2021. For some time, after 2011, policy makers tried to overcome this problem using increased public investments in generation. However, this strategy is limited by the constraints of fiscal space and management capacity in government (Shah, 2017). The stock of public sector ‘under implementation’ projects peaked at Rs.16.1 trillion in December 2015 and has retreated to Rs.14.8 trillion in September 2021. All values here are nominal; the declines are greater when expressed in real terms.

The relative disenchantment of private investment has been shaped by the experiences of investors who began projects. In March 2018, the Standing Committee on Energy (Standing Committee on Energy, 2018) identified approximately 40GW of stranded and stressed thermal power assets.¹³ The reasons for these include: lack of appropriate coal linkages in some cases and gas supply in others; increases in the cost of coal in the international market, lack of power purchase agreements; cost overruns due to delays in acquiring land and securing approvals and obtaining environmental clearances; and, in some cases, optimistic demand projections. Of this 40GW, almost 25GW represented fully commissioned assets. It is not clear if these plants will be revived or who will pay for this revival, especially in the context of the falling cost of renewables. There was a time when there was a global market for fossil fuel generation equipment, and some value could be obtained by selling this equipment into the world market, but this is now less feasible.¹⁴ The investment risk made manifestly visible by the continuing existence of these stranded assets,¹⁵ and the fact that international financing for coal

¹³ *There is no Way Out for India’s Stranded Thermal Power Units*, Kashish Shah, IEEFA, March 2021, at <https://ieefa.org/ieefa-theres-no-way-out-for-indias-stranded-thermal-power-assets/>.

¹⁴ As an example, in July 2021, Bangladesh scrapped plans to build 10 coal thermal plants. See *Bangladesh scraps plans for 10 coal-fired power plants* by Syful Islam, NikkeiAsia, 8 July 2021, at <https://asia.nikkei.com/Politics/International-relations/Bangladesh-scraps-plans-for-10-coal-fired-power-plants>.

¹⁵ *India Faces Stranded Coal Assets as Financing Dries Up*, Power Engineering International, Pamela Largue, 4 June 2021, at <https://www.powerengineeringint.com/>

projects comes at a high cost of capital, implies that little fresh capital will be committed to adding new thermal capacity in India.¹⁶

3.1.3 Multiple prices

In the market economy, the price of (say) nickel must be the same everywhere, with price heterogeneity only grounded in the frictions of transportation that impede arbitrage. This ‘law of one price’ creates the correct incentives for producers and consumers everywhere. In the Indian electricity sector, however, there are multiple prices, enforced by the government. This results in a first order distortion of the resource allocation. As an example, in Tamil Nadu the table of tariffs has 36 rows and 2 columns.¹⁷ For the cost-minimising carbon transition, done through the price system, the multiple prices (controlled by the central planner) have to be replaced by a unified price at each place at each timepoint, that is determined by the market.

3.1.4 A mandate-based policy environment

Lacking a price system, most business decisions in the electricity sector are government-mandate driven. Governments, state or central, acting through DISCOMS and agencies such as SECI determine largely by fiat what new capacity is required, and where. The overwhelming prevalence of the long-term, fixed-price, non-negotiable PPA model provides limited stability but hampers the every day response of market participants to price signals. The share of transactions on the short-term electricity markets, in the overall electricity generated, has been stuck at between 10 and 11% for the best part of a decade (Garg, 2020; CERC, 2020), to which renewable energy contributes 1 percentage point.¹⁸

India is geographically vast, is highly diverse with great heterogeneity within the country, and is now a complex technology-intensive market economy. Central planning approaches fare poorly at grappling with the complexity and emerging with the correct answer at each location and at each point in time. This is true in the static case, and even more when faced with the vast

[coal-fired/india-faces-stranded-coal-assets-as-financing-dries-up/](https://www.bloomberquint.com/business/coal-fired/india-faces-stranded-coal-assets-as-financing-dries-up/).

¹⁶*Climate Coal and India - Capitals and Capital are Calling Time on Fossil Fuel*, Akshay Jaitly, BloombergQuint 11 June 2021 at <https://www.bloomberquint.com/business/climate-coal-and-india-capital-and-capitals-are-calling-time-on-fossil-fuel>.

¹⁷https://www.tangedco.gov.in/linkpdf/ONE_PAGE_STATEMENT.pdf has the table, and features prices ranging from 0 (e.g. for ‘huts in village panchayats’) to Rs.12 (e.g. for ‘lavish illuminations’).

¹⁸Of interest is the proposal of the Ministry of Power to implement the day-ahead Market Based Economic Despatch system, aimed at despatching the cheapest generating resources nationally to meet overall demand. This is a good step in principle; we will wait to see the extent to which the states decide to implement it. Press release by Ministry of Power, 8 October 2021.

scale of changes in (post-tax) relative prices and changes in technology that characterise the climate transition. There is also the problem of the gap between the ideal omniscient and benevolent central planner vs. the reality of limitations of the Indian state.

3.2 The problems will deepen

Looking forward, these difficulties are likely to deepen, for five reasons.

1. *Under business-as-usual, Indian emissions could rise significantly.* India went from 4% of global emissions in 2000 to 7% in 2021. While the growth of electricity generation and emissions averaged 5% over the last 20 years, the growth of electricity generation in the recent period (2016-17 to 2020-21) was lower at 2.8% reflecting the difficulties of the economy in this period. This low growth of emissions may not obtain in the future. The elasticity of electricity generation in GDP growth could be higher in the future, given the incipient shift from fossil fuels to electricity in areas such as mobility and cooking. A large class of Indian households are within range of the income levels to add energy-intensive home durables such as air conditioners, a process that is assisted by global warming.¹⁹

Electricity consumption in the future could thus grow faster than the recent growth rates of 2.8%, through higher GDP growth and Engel curves. Given the carbon intensity of the electricity sector, if a phase of high growth in electricity production arises in coming years, this could induce a sharp increase in emissions, in the event that it is not possible to meet this demand through renewables and storage.

2. *Global concerns about Indian action on emissions.* Rapid growth of Indian emissions would sit uneasily in a decarbonising world.

In 2020, the Climate Action Tracker rated India's NDC target as '2°C compatible'. However, in 2021, the Climate Action Tracker revised its methodology and has now placed India in the "Highly Insufficient" Category.²⁰ This indicates that India's policies and commitments (pre-COP26) are inconsistent with the Paris Agreement's 1.5°C target.

The hands of leaders in the developed world are increasingly tied by courts all over Europe requiring greater action from governments on climate change.²¹

¹⁹At present, 7% of households in India have an air conditioner and 25% have a washing machine, see, Goyal, Sane and Shah (2021).

²⁰The Climate Action Tracker states that 'for India to improve its rating, it needs to increase its unconditional NDC target to significantly reduce the speed of emissions growth. With international support, India also needs to set an ambitious conditional target to curb its expected growth in emissions from its dependency on fossil fuels, and begin the shift to a net zero economy.' at <https://climateactiontracker.org/countries/india/>.

²¹*Climate Coal and India - Capitals and Capital are Calling Time on Fossil Fuel*, Akshay Jaitly, BloombergQuint, 11 June 2021, at <https://www.bloombergquint.com/business/climate-coal-and-india-capital-and-capitals-are-calling-time-on-fossil-fuel>.

In elections in most developed countries, climate change is a key issue.²² These domestic pressures will reshape diplomacy: it will not be tenable for governments of advanced economies to be soft on climate matters in their engagement with countries like India.

Through 2021 and 2022, it is likely that international activity on climate change will gather momentum. Coordination on climate change between the European Union and a post-Trump United States is improving. Despite Xi Jinping's absence from COP26 and public statements on historical responsibility and climate equity, China is well on the way to building its own climate transition. It has a strategy for net zero, has launched a domestic emissions trading scheme earlier this year, and has pledged to peak emissions by 2030 and become carbon neutral by 2060.²³

Greater pressure may come together, upon India, COP26 announcements notwithstanding, to make progress on the long game of decarbonisation. Lacking effective instruments of climate policy, it will be difficult for Indian policy makers to respond in a way that does not impose large costs upon the economy.

3. *International asset pricing is reshaping the investment strategy of Indian firms in this sector.*

Private firms face an ESG - inflected investment environment where access to debt and equity capital requires decarbonisation in the firm and its supply chain. The cost of capital for debt or equity finance for carbon-intensive investments is higher. Even if Indian policy makers desire a carbon-heavy energy strategy, the firms respond to the incentives associated with international asset pricing. ESG investment has created a new problem for the legacy electricity system: buyers who are not content to accept carbon-intensive power from the grid, as they need to demonstrate that they have shifted to renewables.

4. *International trade competitiveness concerns could reshape the incentives of Indian actors.*

Constrained optimisations always yield inferior outcomes when compared with unconstrained ones. Countries that are at an advanced stage in the carbon transition fear that their contribution to a global public good comes at the cost of competitiveness when pitted against production in more polluting countries. This can amount to a reverse Pigouvian subsidy to the polluter. This has led to the idea of carbon border taxes.

²²A Pew Research Centre survey in 17 advanced economies, published in September 2021, found that 72% felt global climate change would personally harm the respondent, and 80% were willing to make changes in life and work in response. About 52% were not confident that the international community was doing enough to solve the problem. These strong majorities have reshaped the views of first world politicians who face democratic accountability and have to follow the shifting views of the median voter. This will feed into the various elements of economic statecraft.

²³Given the difficulties of the China-India relationship, and the importance of advanced economies in India's way forward on international relations, it will be a handicap for India if China is a full participant in the climate transition and if India is weak on this first order concern for the advanced economies. See Bambawale et al. (2021).

In July 2021, the European Commission adopted a proposal for a new Carbon Border Adjustment Mechanism (“CBAM”), which will put a carbon price or tariff on imports of a targeted selection of products (Commission, 2021). The main objective of the CBAM, which is proposed to commence in 2026, is to ensure that European emissions reduction efforts contribute to a decline in global emissions, instead of merely moving carbon-intensive production outside Europe. In the initial phase of the plan, the industries covered include iron and steel, cement, fertiliser, aluminium and electricity generation.

The EU believes that the CBAM will be WTO compliant and enforceable. The United States and even China could head in the same direction. If some version of these moves do materialise in coming years, Indian exporters will see direct links between international competitiveness and the extent of decarbonisation within their firm and supply chain,²⁴ and within the electricity system of the states in which they operate. This will change decisions of domestic and international firms which export, on the question of where production within India takes place: they will avoid states which have low economic freedom in purchasing renewables and where renewables make up a lower fraction of DISCOM supply.

5. *Internal stress in the electricity sector which renewables will exacerbate.*

The difficulties of investment in electricity have not generated electricity shortages on a large scale, as demand growth slowed down in recent years. When GDP growth and electricity demand growth resumes, significant electricity shortages could arise.

Grid electricity in most places in India is over-priced, carbon-intensive, and unreliable. Good customers are keen to exit through various means, including captive or ‘third-party’ corporate PPAs. They are only held in through state coercion.²⁵ Some corporations face pressure from their investors to control emissions and an increasing number are making voluntary formal commitments towards achieving net zero emissions by deadlines such as 2040.²⁶

There are strong incentives for generators and buyers to arrive at market transactions that bypass the cross-subsidy system and its associated use of state coercion to interfere with voluntary transactions.²⁷ As an example, if state power is used to interfere with the ability of a renewables generator to sell to a third-party customer, it can rearrange the transaction as converting electricity into hydrogen and sending this over a pipe into a fuel cell at the other side. This is feasible today as the transportation of hydrogen in India is not restricted by state coercion in the way that the transportation

²⁴For an account of the choices before two quite differently placed Indian steel exporters in the context of a decarbonising world, see *What Tata Steel’s attempts to decarbonise tell us*, M Rajashekar, Carbon Copy, October 2021 at <https://carboncopy.info/what-tata-steels-attempts-to-decarbonise-tell-us/>.

²⁵For a detailed analysis of the corporate PPA market in India and the various tensions it creates, see *Corporate Renewable PPAs in India: Market and Policy Update* (2021).

²⁶See, for example, the signatories to the Climate Pledge and the 24/7 Carbon Free Energy Compact at <https://www.theclimatepledge.com/us/en/Signatories>; https://www.un.org/sites/un2.un.org/files/24-7cfe_compact_-_v2_updated.pdf.

²⁷To paraphrase Manish Sabharwal’s observation about the Indian bond market, ‘*The Indian electricity grid does not have customers, it has hostages*’.

of electricity is.²⁸ The shrinking base of customers who can be charged high prices will result in escalating fiscal stress in the electricity sector.

Ironically, the rise of renewables is directly intruding upon the existing electricity system, for three reasons. (1) Most renewables generation is sold under long-term power purchase agreements. In the absence of a sizable spot market, this provides stability to producers and makes financing easier. On the other hand, as renewables generation is intermittent, the sale of this electricity actually works best in spot or short-term markets. Markets are being encouraged for renewables²⁹ but market-based sales of low cost renewable energy will impose greater pressure on the grid. (2) Existing electricity systems equipment, transformers, switching equipment, transmission etc., is unprepared for the large capacities of renewable energy along with more decentralised generation envisaged by India's plans for massive renewables growth. Huge investments are required here. (3) Transition to renewable energy for transport and household purposes, could bring a significant increase in electricity demand, over and above the increase in such demand that will be brought about by faster rates of GDP growth. This will also induce demands for investments in transmission and distribution. Financially stressed public sector firms will find it hard to muster these investments.

4 The case for fundamental reform

For 30 years now, a variety of short-term policy reform projects have been attempted in the power sector. A brief chronology reveals: the opening up of different aspects of the sector to private investment, initially generation and subsequently transmission and to a limited extent distribution; the unbundling of vertically integrated state-owned power utilities into separate entities executing generation, transmission, distribution, trading and regulatory functions; the introduction of limited areas of market-based competition including the creation of power exchanges; attempts at privatisation of DISCOMs and transmission assets; some improvement in regulatory capacity, particularly at the central level and; finally, multiple rounds of efforts by the central government to bail out and restructure DISCOM finances.

India's electrical power sector was built for an economy that was much smaller than it is today. The system was built around public sector ownership of generation, transmission and distribution and the problems of this

²⁸We recognise that these steps (electrolysis and fuel cells) have inefficiencies, but these losses can add up to a smaller friction when compared with the elevated prices paid by commercial and industrial users of electricity, when faced with outright bans on private transactions. This friction is also worth bearing for firms that need to decarbonise in order to qualify for ESG investment and (in the future) to avoid trade taxes, where coercion of the Indian state hinders direct purchases from renewables generators.

²⁹*IEX to commence trading on green term ahead market from August 21*, ET Energy World, 19 August 2020 at <https://energy.economictimes.indiatimes.com/news/renewable/iex-to-commence-trading-on-green-term-ahead-market-from-aug-21/77634040>.

public sector system remained internal to this system. Risk assessment and mitigation was not required. Delayed payments or poor fiscal performance had implications only for the owner of this public system, the government.

The Electricity Act, 2003 was brought into force when there was almost no private participation in the sector. The unbundling it brought into place was a necessary first step towards wider sectoral reform prompted by the financial stress in state electricity boards, which culminated in their Rs.400 billion bail out through state government bonds in 2001. But it was only a first step. The reform brought about by the Electricity Act 2003 took the existing public sector system and grafted privately owned independent power projects (IPPs) onto it. A mere decade later, in 2012, a second bailout of the power sector was required, shortly after the IPPs permitted by the Electricity Act 2003 started commercial operations and invoicing DISCOMs for power sales. This cost the taxpayer Rs 1.9 trillion. This was followed by UDAY in 2015, the 2020 bailout package and the allocation announced in the 2021 budget, referred to in Section 3.1. Alongside this, no solution has been found to the 40GW of stranded assets which have lingered for a decade.

This suggests that the nature and extent of reform attempted thus far are not solving the fundamental problems of the sector.

In some places, like Delhi, where deeper reform has been attempted through privatisation of distribution companies, significant gains have been obtained, and the state of electricity today is better when compared with the situation 30 years ago. But in large parts of India, electricity as viewed by most paying customers is much like it was 30 years ago, with unreliable supply, technical failures on frequency and/or voltage, usurious prices, expenditures on diesel generators, batteries, inverters and UPSes, and unreasonable restrictions on rational transactions between private persons. There is no market that discovers a price and sends signals to producers and buyers to change their behaviour.

Why has considerable policy activism, and investments of significant political and financial capital, not delivered the desired results? The problem is at the core: a government-controlled centrally planned system. Government control transmits the limitations of state capacity into the working of the industry. The growing complexity of the Indian economy requires subtle judgments, that vary by space and time, on the production and consumption of electricity. Centrally planned systems lack nuance, and single national solutions fare poorly at many places and times.

After 30 years of policy work of this genre, it is unlikely that another decade of such incremental work will now solve the problems at their root cause. The sector will continue to make resource demands from the exchequer as before. When high economic growth recommences, there is the possibility

of significant electricity shortages. In the meantime, while there is an increasing requirement of decarbonisation, the Indian carbon transition will be feeble owing to the bottleneck of the electricity sector.

There is a need to step back from the tactical detail of the electricity sector and its everyday policy activities, into a more coherent policy strategy, aligned with international commitments to 2030 and beyond. The term ‘strategy’ denotes thinking on large scales of resources, time and space. The problem of climate change, and the problem of electricity policy, both demand a large number of actions by numerous actors across long periods of time. Practical problem solving on a day to day basis is inducing policy incoherence, to the point where in many situations there are different government policy initiatives that are undermining each other.³⁰

Policy influences society by reshaping the incentives of private persons. Absent a coherent strategy, the private sector will be subjected to confusing signals, and will respond less. The private sector will also interpret policy incoherence as heightened policy risk, as it is apparent to private persons that parts of the present policy arrangement will have to be jettisoned at a future date. This will encourage a wait-and-see attitude for private persons.

The most recent consolidated reform effort, in the shape of the Electricity Amendment Bill 2021, has positive elements but is incomplete. The attempt to introduce competition in distribution and provide more customer options is significant but does not adequately take into account the market and political economy power of legacy state DISCOMs. While purporting to remove the need for distribution licenses, the bill still envisages approval from State Commissions. The proposed payment security mechanism is accompanied by the option that this can be waived by the parties. A realistic reading of the bargaining power on the ground would suggest that DISCOMs would pressurise private power producers to accept this waiver. These amendments reflect the conflicting forces acting on policy makers owing to the presence of the large public sector.

Scholars such as (Dubash, Kale and Bharvirkar, 2018) argue that the main flaw in the various reform efforts undertaken so far has been the failure of the reform processes to engage meaningfully with the political economy of the power sector in India (Dubash, Kale and Bharvirkar, 2018). Power is a critical input for every sector of the economy and is directly consumed by households. Given the starting condition of a state dominated system, there are ready temptations for it to be used for redistribution. Mature ecosystems of vested interests have formed, in each state, around the existing

³⁰Earlier, we had described the rule from 2020 where net metering was blocked for rooftop solar above 10kW. This is an example of a situation where some parts of the Indian state are promoting rooftop solar, and even have targets for it, while other parts of the Indian state are trying to block its expansion.

power sector.

While there is much merit in these arguments, a fuller picture of the Indian journey of economic modernisation reveals greater possibilities. While many sectors in India have graduated out of state control into full economic freedom, this was not attempted with electricity. There was a lack of state capacity in conceiving and executing fundamental reform. Elements of reforms have been executed piecemeal, without the required level of policy coherence and articulation of strategy that would coordinate the behaviour of the large number of state and non-state actors.³¹

In the foreword to a recent important report on the reform of the distribution sector prepared for NITI Aayog, Amitabh Kant acknowledges that India will not be able to achieve a high-growth, low carbon economy unless the distribution sector achieves profitability (Fitzgerald et al., 2021). The report highlights some key reforms considered necessary for the power distribution sector. These include: the need to separate utilities from the state; increase private participation in the sector; autonomy for State Electricity Regulatory Commissions, direct benefit transfers instead of routing subsidies through DISCOMS; viability gap funding to extend service to commercially unremunerative areas and more. There is much to commend in the findings of the report and we consider many of these measures necessary. However, the approach of the report remains rooted in a centrally planned, state-dominated electricity sector.³² In this paper, we see the essence of the reform as placing the electricity sector on the foundation of the price system, which would create the incentive arrangements for solving these and numerous other problems.

5 A desirable steady state

5.1 Principle 1: Organise the electricity sector through the price system

We in India are so steeped in the command and control mores of the state-dominated electricity sector that it is sometimes hard to recall how the simple methods of the price system solve these problems. When a factory buys metals and sells ball bearings, there is no complexity of state organisations contracting on either side. The price of ball bearings fluctuates from

³¹*The Strategy and the Tactics*, Ajay Shah, Business Standard, 3 June 2019 at https://www.mayin.org/ajayshah/MEDIA/2019/strategy_tactics.html.

³²A new generation of reforms are already being attempted. Some contemplate exploiting technology to increase DISCOM viability such as solar water pumps for agriculture, see <https://www.prayaspune.org/peg/resources/solar-feeder.html> and net metering for public bodies, see <https://www.prayaspune.org/peg/resources/power-perspective-portal/291>. These are welcome steps.

moment to moment based on shifting supply and demand. Depending on the nature of the industry, firms buy/sell through long-term contracts and through the spot market. The price system sends signals to all buyers and sellers – through the information contained in prices – to change their behaviour. Firms constantly respond to opportunities, modifying production and technology based on the everyday process of technical change and the changing requirements of the customers.

Such firms are denizens of the genuine market economy. They face risk every day. The senior management has no locked-in ROE that is underwritten by the state. The management team works every day to obtain a situational awareness, and thinks about how to change course in a way that maximises profit. Profit is not something that comes about easily; it is the reward for creativity, energy, reinvention and risk taking. Risk and reward are ever-present, and constantly shape operational decisions, real investments and financial structure. There is no fixed debt:equity financing structure for a sector or even for any one firm: the financial structure is constantly refined through the judgement of the leadership team and the views in the financial sector about the nature of risk faced by the firm. Profit is not assured in the market economy, it fluctuates every day. Some firms fail every year, and go into the bankruptcy process.

None of this is unusual in the market economy. This is a description of the bulk of the Indian economy. It is all absent in the Indian electricity sector. The Indian electricity sector remains largely the domain of central planning, where technology and investment choices are made by the electricity bureaucracy. This bureaucratic control induces misallocation of resources in steady state, and it will be particularly problematic in the carbon transition where the costs imposed upon society of a centrally planned transition will be greater than those that emerge from the intelligence, flexibility and local control of adaptation led by self interest and the price system.

Nobody today knows how the Indian electricity sector should best be organised in the coming decade. How should renewables and storage be combined? How should the demand side be re-organised so as to best fit into the intermittent renewables generation? What is the role for decentralised (“micro-grid”) solutions in the future, as opposed to the 20th century model of large generators and large distribution companies? (Shah, 2015). How will technological change on renewable generation, batteries, electric vehicles, etc. play out, and how will the electricity system constantly reshape itself, with profits and losses being made by firms based on the correctness of their bets? What is the true cost of renewable energy given the existence of implicit subsidies like having must-run status and a waiver of transmission charges? What price should be paid to DISCOMs as the providers of standby, adequacy and network services?(Singh, 2017; Chitnis, Dixit et al., 2018).

The Indian electricity sector today is on a trajectory where officials and politicians, who are the central planners, are being asked to make all these decisions. This is an unreasonable demand to place upon any shoulders. The detailed design of how production should take place is best performed through the self-organising system of the market economy, where all decisions about technology and business models are made by self-interested actors that interact through markets and respond to prices.

Is the electricity sector unique in the large magnitudes of capital involved, which might then create a justification for a centrally planned system? This argument was prevalent in 1944 with the Bombay Plan. But in India today, the largest fixed capital stock of the country, the Jamnagar refinery belonging to Reliance Industries, has no PPA with a state organisation on either inputs or outputs. It is a creature of the price system and inhabits the price system.

As with any other widgets in the market economy, the default state in the electricity sector must be freedom for buyers and sellers to pursue self-interest and arrive at attractive business arrangements, without having to be guaranteed fixed ROEs on their investment. State intervention must be narrowly designed to address market failure. The key subsystem that is missing in the Indian climate transition is an electricity sector that operates in the price system, with supply and demand that make prices, and prices that reshape decisions of all firms and all users.

5.2 Principle 2: This will require complete privatisation

In conventional public economics, there is a focus upon state coercion: upon the laws and associated enforcement machinery which limit economic freedom. However, a central feature of the Indian electricity sector is government ownership. State intervention is implemented not just through laws that authorise coercion of private people, but through instructions to business entities controlled by the state. The centrally planned electricity system was built through a combination of law, regulation and public sector ownership. Conversely, graduating to the ceaseless intelligence and adaptation of the price system will require a fully private electricity sector.

Of particular importance is government ownership of DISCOMs. While private distribution has worked quite well in Bombay, Calcutta and Delhi, public sector DISCOMs dominate at the level of the overall country. These have numerous difficulties:

- DISCOMs and the state procurement agencies or electricity departments that manage them are the central point at which contracts are written with private generation companies. In some cases, ‘model contracts’ are handed down by union government organisations such as SECI. In the Indian state, there is

generally low state capacity in government contracting.³³ This results in bad incentives for private firms, bad contracts and adverse events in the life of a contract. DISCOMs understand risk poorly, and allocate risk inefficiently in contracts. As is common in government contracting, their unequal bargaining power coupled with weak judicial contract enforcement creates *ex ante* risk for private persons.³⁴

- The DISCOMs regularly fight legitimate requests of private sector power producers (for example compensation for *force majeure* and change in law), including through unjustified litigation. This reduces confidence in the sector and the Indian market. DISCOMs are not unique in this: these problems afflict the Indian state more broadly, as is seen with the difficulties of Enron, Vodafone and Cairn Energy. But in the narrow context of the electricity sector, there is a need to recognise that contracts between a private person and a state organisation are particularly problematic due to their unequal bargaining power and because the IPPs feel that they cannot risk antagonising the state entity with which they need to have a long-term contractual relationship.
- DISCOMs have low incentives for performance and face government vigilance processes which also feature difficulties relating to the rule of law. The incentives of officials diverge from decisions that have economic rationality. As an example, losing legal causes are litigated so as to avoid the vigilance process.
- The occasionally ambiguous and sometimes partisan treatment of state-owned DISCOMs by the regulatory authorities and perhaps even the courts, particularly those at the state level, enables policy mistakes. For private persons, the sense of a monolithic ‘electricity bureaucracy’ that mans regulators, DISCOMs electricity departments and other electricity PSUs, that controls the levers of policy and protects itself even if this infringes on the rule of law, creates policy risk.
- DISCOMs are ultimately controlled by the political administration and tend to respond to political objectives including redistribution and selective enforcement against theft.

Making progress in India requires a pragmatic assessment of the ground reality, as opposed to the pursuit of ideology. There are countries where the public sector plays a significant role in grid operations or distribution, and does this well.³⁵ However, these countries have a broad level of state capacity, and the rule of law, which makes such public sector activism more

³³ *The bottleneck of government contracting*, Ajay Shah, Business Standard, January 2021 at <https://xkdr.org/publicprocurement.html>.

³⁴ As an example, when more balanced contracts were drafted with the assistance of the International Finance Corporation in the Rewa Ultra Mega Solar Power Plant in Madhya Pradesh, this resulted in a more positive response from bidders.

³⁵ The California electricity crisis of 2000-01 and the recent problems in the deregulated UK electricity distribution sector show that privatised systems can have problems. These can be addressed by appropriate tools such as regulatory standards for fuel stock buffers. Concerns about the quality of service, associated with private systems, should be judged against the quality of service that prevails in India today, rather than an idealised state.

likely to induce favourable results. Recognition of a broad-based weakness of state capacity in India – as seen across all fields ranging from the police or courts or tax system to monetary policy and financial regulation – suggests that these infirmities in the field of electricity are not grounded in isolated mistakes in electricity policy (Kelkar and Shah, 2019).

Decarbonisation requires tough decisions of closing down fossil fuel activities and initiating new pathways emphasising renewables and storage. This also involves fundamental business model changes, as the fossil fuel world was based on large generation factories while the natural rhythm of renewables will emphasise decentralised generation. Change is always wrenching, and these large changes will not come easily to the employees of government departments or PSUs, who combine low accountability, no threat of bankruptcy, and the levers of coercive power. Only private persons will be able to make the tough decisions required in decarbonisation, and rethink business models for the new world.³⁶

For 30 years, the main plank of policy thinking in electricity was that the electricity sector would be primarily centrally planned, substantial public ownership would remain, some private activity would commence on the side, and that the working of the system would be gradually improved. With the benefit of hindsight, we see that this process of incremental improvement has been feeble. An optimist might think that now, for the first time, there is the possibility of a twenty-year journey where the public system will be pulled into shape. But with the climate change problem upon us with consequent international commitments, such time horizons are no longer available.

Hence, the way forward for Indian electricity reform requires complete privatisation of all government organisations, assets and activities that concern the operations of the industry. This includes generation, distribution, transmission, land assets, state entities, etc.³⁷ In each state, the public sector should shrink down to an electricity regulator and a Ministry of Power that performs appointments for the regulator.

³⁶For an analogy, Kingfisher Airlines and Jet Airways were forced to exit through the pressures of the market economy, firms like Indigo invented new business models, while Air India neither adapted nor exited.

³⁷Clearly, better functioning PSUs such as NTPC and Powergrid are not a priority for privatisation. However, they should ultimately be placed into private ownership due to the dominant market position they have, which could distort the responses of regulators and other market participants in an otherwise largely privatised system.

6 India's climate transition through the price system

Once the electricity sector works through the price system, there is a welfare maximising path to the climate transition, shaped and controlled by one instrument, the carbon tax. The government would announce a 20-year trajectory for the carbon tax. Private persons would see these values and make decisions about alternative technologies on the supply and on the demand side. Private persons would start new investment projects, close down certain unviable facilities, etc. A course correction is required every five years, where distance from the desired carbon trajectory is re-assessed, and the next 20 year trajectory for carbon taxes is incrementally determined.

In this journey, private self-interested persons would make the decisions about decarbonisation at all locations and time points in the economy. There would be no central planner to choose what renewable or storage facilities should be built when and where. Instead of renewables coming about owing to state mandates, they would arise through self-interested private players. The path of carbon transition would vary across each state, based on heterogeneity in local conditions including the level of theft, renewable vs. fossil fuel costs, the ability to buy/sell electricity at the state or national border, and the extent to which exporting firms are present. This would reflect the decisions of private persons, in response to local prices and technical opportunities, and not a central planning system operated by officials or politicians.

An efficient transition also requires significant changes by users of energy in favour of lower energy consumption. If de-carbonisation is achieved through centrally planned state coercion, applied purely at the production of electricity, the demand side would not adjust. This is a less efficient arrangement.

The present unfavourable investment environment has an important implication: India receives only a fraction of global clean energy transition investment. According to BloombergNEF, in 2020, worldwide investment in renewable energy capacity hit \$303.5 billion, the second-highest annual figure ever. Of this, Europe accounted for \$81.8 billion, up 52%, its highest since 2012, and China was at \$83.6 billion, down 12%. The U.S. fell 20% to \$49.3 billion and India slipped 36% to \$6.2 billion.³⁸

The investing environment is less than optimal, reflecting a combination of sector-specific difficulties and other more general difficulties. If the electricity sector is organised through the price system, the concerns of private

³⁸*Energy Transition Investment Hit \$500 Billion in 2020 For First Time*, BloombergNEF, January 2021, available at: <https://about.bnef.com/blog/energy-transition-investment-hit-500-billion-in-2020-for-first-time/>.

investors would be significantly addressed. Investment in the sector would rise when policy risk and the risk of the state as a counterparty is replaced by business risk.

At present, the union government does not have the levers to achieve a cost-minimising decarbonisation, particularly because electricity policy decisions are made at the state level, and many state governments and/or DISCOMS could be unresponsive. The carbon tax is a single lever that would impact upon the entire economy, thus giving the union government the required simple instrument for climate policy.

It is possible to envision two alternative possibilities:

- What if a carbon tax were put into place, but the electricity sector remained the world of central planning? The problem here is that the public sector DISCOMS and other firms would not respond rationally to the carbon tax. Sometimes, the carbon tax may even merely end up driving up the deficit of a state government and not induce the required decarbonisation. The desired change in the resource allocation, at the demand and supply side, would only come about when self-interested private persons are presented with an escalating carbon tax.
- What if the electricity sector graduated to the price system, but decarbonisation was controlled by officials at each state electricity regulator writing detailed rules that prescribed technical changes that would induce decarbonisation? This would be inefficient as the self-organising system knows more than any central planner. It would also deny the union government a simple mechanism for climate policy.

7 From here to there

In the previous section, we have argued that if the electricity sector is organised around the price system, this addresses the long-standing problems of the electricity sector, and creates the possibility of a cost-minimising climate transition through a pre-announced escalating carbon tax. Climate policy would then be able to influence the electricity sector by establishing a set of values for the carbon tax for the coming 20 years, which are revised every five years based on the actual emissions. The establishment of present and future tax levels would induce the most efficient set of technical choices all across the economy, with an electricity sector that is coordinated through the price system, to get the required transformation of the electricity sector. It would avoid the incomplete decarbonisation and the excessive costs for society associated with central planning.

While this appears to be an attractive vision, it also appears infeasible. Many well meaning and competent policy makers have tried to solve the electricity sector for the last 30 years. Why might this difficult reform be

feasible today, while it was not in the last 30 years? How might one make progress today, drawing on a practical understanding of what impedes the reform? How might one draw upon the experiences of the last 30 years, and do things differently?

We believe there is a path to implementation today, in a way that was not possible in previous years, for six reasons:

1. There is greater understanding of the political economy landscape, and it is possible to design bargains where the losers from the reform are compensated.
2. State capacity in regulation is essential for the operation of an electricity sector organised around the price system, and there is now a greater understanding in India of how to establish the objectives and methods of regulation.
3. There is a path to electricity reform, one state at a time, which is more tractable and feasible when compared with grand schemes led by the union government which apply to the entire country.
4. The materiality of climate policy in the international discourse has shifted the political salience of domestic electricity reforms. Alongside this, the domestic policy envelope on establishing more market-led solutions has improved.
5. There is a pathway to finding the resources to funding the transition.
6. The financial stress faced by the present electricity system is mounting.

We now discuss each of these six elements in more detail.

7.1 Addressing the political economy

The principal impediment to implementing a wide and deep reform process in the power sector is that many vested interests benefit from the status quo. If the reform process does not have value for them, they are likely to mobilise politically against it. Many reform efforts of the past have been compromised by a failure to take the political economy into account.

The reform process must identify and compensate the vested interests who will lose current benefits as a consequence of the privatisation. In each state which embarks on this journey, an assessment is required of the groups who will potentially lose out in the reform process. Special interests will differ by state, and compensation solutions will commensurately have to be crafted on a per-state basis.

Compensation should cover all potential losers and reach the lowest possible rupee value at which the reform is widely accepted. There are vested interests that are legitimate (for example, recipients of subsidies or free

power) and there are those that are illegitimate (e.g. people stealing electricity alongside the persons in the state who support/enable this theft in exchange for gratification): both require attention in sound policy design.³⁹

Persons or entities with purely financial interests in the power sector do not require designed compensation. The shareholder of a thermal generation company today is a speculator who is long Indian carbon, who will make money if India fails to decarbonise, and requires no compensation if decarbonisation does proceed. Equity and bond holders and institutional lenders will have the time and resources to deal with the effect of the reform; they know that the carbon transition is coming, and must therefore accept the profits and losses that flow from their present positions. Many existing investors have negotiated and accepted contractual rights under debt documentation and power purchase agreements that will protect them.

The coal industry has a large number of workers in mines and thermal power plants. They will require support for rehabilitation and resettlement. Resources will be required to convert degraded land into forests or agricultural land. The employees of government organisations in the electricity sector do not require compensation, other than through voluntary retirement schemes implemented as part of the privatisation process, as they will become employees of the new private organisations. There are ample precedents of this combination of transfer of employees and VRS, in the privatisation transactions of the past. The public sector workforce in electricity will shrink to a few hundred regulatory staff per state.

Much work will have to be done to identify appropriate methods and levels of compensation for each group and the mechanics of resource transfers. In some cases, compensation will be a one-off payment or cost, such as a VRS scheme for state employees or regularising an illegal connection, but in other cases such as subsidies or free power, compensation may have to be a stream of payments.

Welfare gains can be obtained, while addressing redistributive considerations, through on-budget vouchers that empower poor people to buy a certain amount of electricity a month. This is similar to the methods that have been applied in the field of drinking water where there is a market-based water utility industry, where all water in the taps is tolled, but redistributive considerations are met by funding the purchase of a certain minimum amount of water by poor people. From the viewpoint of the consolidated balance sheet of the state, whether power is sold by a state-run PSU at a price of 0, or vouchers are given to certain classes of consumers to enable the purchase of electricity, there is no fiscal difference. But from the view-

³⁹As an example, slum dwellers in Bombay are illegally squatting on land, but the wise design of policy involves compensating them for leaving

point of a sound electricity sector, and therefore the climate transition, this difference is remarkably important.

To help understand the magnitudes involved, we examine the CMIE household survey database. In this, the average monthly household expenditure on electricity in the bottom three income deciles is Rs.215, Rs.243 and Rs.269. These are the expenditures of households, over and beyond the stolen or free power. This suggests a ballpark calculation for the cost of a voucher program for the bottom 30% of households. An on-budget payment to the poorest 30% households of Rs.250 per month works out to Rs.0.27 trillion a year if applied all over the country. This is a feasible cost, on a flow basis, in order to achieve fundamental reform. We emphasise, of course, that this is only a ballpark estimate that pertains to an overall average for the vast country. Electricity reforms are played out one state at a time, and the states are highly heterogeneous.

State governments such as Madhya Pradesh are implementing direct benefit transfers for the purchase of electricity.⁴⁰ Information systems in government have improved, through the UIDAI system, and it is more feasible to identify poor people and deliver vouchers to them. The Electricity (Amendment) Bill 2020 also contemplates that subsidies will be paid directly by the states to consumers as direct benefit transfers. Such proposals are more likely to be adopted if they are tailored to the specific political economy of a state, and part of a full reform of the electricity sector.

Devising feasible reform strategies is the task of each state government. Addressing the political economy is not the problem of private firms, and these resource flows should not pass through private firms. The strategy for reforms will, however, greatly influence the possibilities on privatisation and investment in the electricity sector. For example, private interest in a DISCOM privatisation transaction in a given state will be greatly shaped by the extent to which there is an expectation that the privatisation decision will be durable, that the political economy has indeed been addressed, and that the criminal justice system will actually enforce against theft.

7.2 Building regulatory capacity

At one extreme, we have a state-dominated centrally-planned mandate-driven electricity sector, where a few private vendors are service providers to the state, where responses to changes in prices and technology are feeble and often incorrect. This is a world of political considerations, defence of the status quo, mistakes in resource allocation, and lack of response to the

⁴⁰ *Madhya Pradesh takes the lead in undertaking Power Sector reforms - Starts Direct Benefit Transfer (DBT) of Electricity Subsidy to Farmers*, Press release by Ministry of Finance, at <https://pib.gov.in/PressReleasePage.aspx?PRID=1689996>.

changing world.

At the other extreme, we have a purely private electricity system, in which the price system generates incentives and tireless striving, where all technical choices are made by firms i.e. there is no central planning, where all firms face genuine business risk and are continuously reinventing themselves so as to earn profits, where state power is used to coerce firms on the narrow zone of addressing market failure. In this purely private system, there is a problem of market failure: mere laissez faire would deliver poor results. The role of the state in the electricity sector lies only in using the coercive power of the state to address market failure. These market failures require recognition and commensurate regulatory strategy. The present state of electricity regulation in India is not ready, in terms of clarity of purpose and state capacity, for coping with an electricity sector organised around the price system.

Analytical clarity on the nature of market failure induces a coherent philosophy of regulation, and sets the stage for sound drafting of the laws that authorise state coercion. Alongside this lies the state capacity problem in regulation. India has a large number of regulators and many of them have shown substantial difficulties in their operations and activities. While the CERC is an experienced and relatively well-regarded regulator, this is not the case for the majority of the State Electricity Regulatory Commissions. Business as usual on the working of regulators, either in the Indian electricity sector or more broadly, will not deliver the required regulatory performance, and can derail the entire reform.

Building regulators requires (a) A high level of clarity on the purpose of regulation, so that regulators work towards addressing market failure and not central planning or redistribution, and (b) The public administration foundations are laid for high state capacity, where forces of accountability steer regulatory organisations towards high performance, instead of the private benefits for state personnel of the fruits of arbitrary power. These two streams of thinking determine the drafting of the laws that create regulators, authorise their use of coercive power, while establishing the checks and balances that uphold Constitutionalism and the rule of law, protect private persons against arbitrary power, and create feedback loops that foster high performance.

7.2.1 The objectives of regulation

There are four market failures in the field of electricity:

Market power. In many situations, sellers of electricity and owners of transmission lines can be monopolistic or form cartels. This constitutes market failure.

Some part of this problem is addressed by the generic sector-neutral Competition Act. In addition, addressing market power should be one objective of electricity regulation as enshrined in electricity law.

Negative externalities. Fossil-fuel based generation emits CO₂, SPM, SO_x, and NO_x, all of which are important problems for India. The first pathway through which society fights atmospheric pollution is through regulation that is aimed at air quality. The second pathway through which India will fight CO₂ pollution will be the carbon tax. Alongside these two main pathways (fiscal policy, and regulation of air quality), there is a case for placing some responsibilities for pollution reduction into the objective of electricity regulation and enshrined in electricity law.

Asymmetric information. Customers of electricity are not in a position to judge quality of service and when competition is lacking, do not have the choice of moving to a better vendor. As with telecom, there is a problem of achieving adequate quality of service in the form of electricity that reaches the customer with technical standards of frequency, voltage and uptime. This is also a market failure that motivates regulation, and must be enshrined in electricity law as the objective of regulation. In this problem, there is a certain overlap with consumer protection law.

Public goods. Grid management is a complex network service that is non-rival to the interconnected persons. The design of technical standards results in a public good that is non-rival and non-excludable. Grid management across state and national boundaries requires both centralised and decentralised action and is a complex problem for a purely private system. State ownership of the grid is not a useful answer, as this would readily slip into central planning and state control. One pathway involves non-profit cooperatives or trust structures, with ownership by all wholesale electricity companies, that perform grid operations. Similarly, technical standards can be designed through open consortiums of engineers and companies such as ITU or IEEE.

Electricity law, including the Electricity Act, 2003, needs to be modified so as to establish these four problems as the purpose of electricity regulation. In three areas, the sensible co-existence between electricity laws and regulators with adjacent state agencies (Competition law, pollution control and consumer protection) will need to be designed.

There is a distinction between the redistributive objective (which would be controlled by the state government in its conduct of redistributive policies, where a voucher system is run to get money out to poor people for the purpose of buying electricity) vs. addressing market failure (which would be the work of state electricity regulators). At present, the redistributive objective clouds the thinking of electricity regulators and has hampered regulatory performance.

7.2.2 The working of regulators

Alongside this there is the problem of state capacity in regulation. Numerous regulators have been created in India, and considerable experience has built up over the 1991-2021 period. This has created new knowledge on the problems of state capacity in regulation.

Regulators worldwide are unusual in fusing legislative and executive functions. This concentration of power creates special concerns about ‘the administrative state’, the rule of unaccountable officials. Some regulators in India are remarkable in also possessing judicial powers. By fusing all the three branches of the state into a single organisation, some regulators in India achieve complete power, in a way that diverges from the separation of powers doctrine which is in the basic structure of the Constitution. When all three branches of the state come together in the Indian-style regulator, a unique level of care is required in establishing commensurate checks and balances. This requires reducing the coercive power wielded by regulators, in regulation-making, investigations and penalties. As an example, an electricity regulator should not be able to block a voluntary transaction between consenting parties.

A significant Indian literature has emerged, which has analysed concerns about the rule of law and the arbitrary power of many regulators in India, identified the close links between arbitrary power and low state capacity, and developed strategic thinking on the elements of design that are conducive to a high performance regulator. Mature draft law is now available in India, with about 140 sections of law that set a regulator in motion with the requisite array of checks and balances.⁴¹

Large scale private investment in electricity in India is essential for achieving the climate transition. From the viewpoint of creating a healthy investment climate, where the Indian state earns the confidence of domestic and foreign investors, these two pillars of regulatory reform – the objectives of regulation and the regulatory process – are essential. Regulatory organisations do not operate in a vacuum. It takes three hands to clap: (a) formal processes in regulators, (b) energy and assertiveness in private firms, and (c) a vibrant intellectual ecosystem which analyses data, thinks about the public interest and participates in public debates. Capabilities in each of these three elements of a modern market economy induce positive feedback loops upon the other two. All three elements need to be put into place in the reforms

⁴¹The working of a regulator was designed by Financial Sector Legislative Reforms Commission (FSLRC), chaired by B. N. Srikrishna, Ministry of Finance, 2015, and has been followed by a substantial literature with new thinking on regulation in India. They drafted the requisite sections of law that govern the working of a regulator, in the form of the draft Indian Financial Code, Version 1.1, 2015. Also see the papers in Kapur and Khosla (2019).

process.

The journey towards state capacity in regulation, as has been taking place in many parts of India, runs in three stages. The first stage lies in documents (which are typically committee reports) that flesh out the two wings of the reform: the objectives of regulation and the working of regulators. The second stage lies in translating these documents into draft law and carrying these through legislatures. The third stage lies in organisation building for regulatory organisations which are able to discharge the objectives of these clean laws.

This is necessarily a process that will require time, effort and money. In modern India, we are used to the idea that building a bridge or a transmission line is a multi-year project. In similar fashion, building a high quality regulatory organisation (the third stage of the regulatory reform) is a multi-year project and needs to be managed as such. All too often, we have experienced state capacity collapses because coercive power is casually handed to officials through poorly drafted law, hasty execution is demanded of fragile organisations, and the private sector retreats into subservience and flattery, thus denying the regulator adequate feedback loops. This induces ‘organisational rout’⁴² with organisations consumed by fire-fighting, incapable of strategic thinking, and unable to establish the long journey of gaining capability over time through the operation of feedback loops. At the same time, there is now ample experience with these problems under Indian conditions, and a body of knowledge and people that can help avoid these pitfalls.

The magnitudes of money required for regulatory reform are small when compared with the magnitudes involved in the electricity sector as a whole. This entire process is unlikely to cost more than Rs.10 billion per state, which suggests an upper bound of Rs.0.3 trillion for 30 states. This is a one-time cost to establish regulatory capacity, and after this the flow of annual expenses will be smaller. These are small values when compared with periodic bailouts in the range of multi-trillion rupees.

India’s climate transition runs through the electricity sector, and the electricity sector requires to level up from a government-controlled system into a market based on private persons that respond to incentives through the price system. Regulatory capacity is a critical roadblock in this transformation. The knowledge and capabilities available in India, on the problem of regulatory capacity, are now commensurate with the task. This reform is feasible today while it was not in earlier reform projects.

⁴²The phrase ‘organisational rout’ is from Andrews, Pritchett and Woolcock (2017).

7.3 Making progress, one state at a time

In the Indian policy elite, the focus of policy tends to be the union government. The union government has tried to play a leadership role in the attempts at electricity reform across the country in the last 30 years.

The Constitution of India envisions electricity as a concurrent subject. The main legislation in the sector, the Electricity Act 2003, is at the level of the union, as are the National Electricity Policy and Plan and the National Tariff Policy. This legislation and the associated regulations and guidelines are implemented largely at the state level, by state governments. Transactions in electricity across state and international borders involve the union government. In this legal architecture, much of the real action is at the state level, particularly in the area of electricity distribution. The bulk of the discussions of this paper impact upon policy thinking at the state level.

The ground realities – of renewable energy generation opportunities, vested interests, extent of theft, state capacity in regulation, extent of renewable energy resources, legacy fossil fuel assets, extent of export orientation of the economy – vary sharply across the states.⁴³ Therefore, any one solution created in the Union government will be inappropriate in most states. The Constitutional scheme, of a federal architecture with state governments having primacy in electricity, is a wise one.

From the viewpoint of the complexity of change management, it is better for India to navigate 30 distinct reform processes, in 30 states, as opposed to a single large problem at the Union government level. The chances of a smaller problem being solved, using a solution that is tailored for local conditions, is higher. The intellectual capacity in the best states exceeds that found in the union government; innovations in reform can commence at these states and percolate to others through ‘regional role models’.⁴⁴ The Kerala experience is more relevant for Tamil Nadu, and the Bihar experience is more relevant for Jharkhand. There are greater feedback loops of accountability for local policy makers as opposed to the politicians and officials of the union government.

The international dimension will influence the thinking of firms, investment project decisions, consumers and local politicians. When a state makes better progress on electricity reform, audited reports about the carbon-intensity of production in that state will improve, which would impact on (1) Access to ESG capital and climate finance, (2) Competitiveness in a world where

⁴³States may also have varying ambitions for the climate transition - Maharashtra, which has significant international investment and is more dependent on export led industry, may choose to have a net zero target of, say, 2050.

⁴⁴The phrase ‘regional role models’ is from ‘The East Asian Miracle: Economic Growth and Public Policy’, World Bank, 1993.

carbon border taxes are present, and thus (3) Decisions by firms in placing investment. Firms will prefer to be in states where the electricity sector more rapidly achieves the carbon transition, and this will change the incentives of politicians, particularly in the economically advanced states who are competing for investment and customers on a global scale.

The overall carbon trajectory for the country will be shaped by the carbon tax, established at the level of the union. Some states which host exporting firms will want to decarbonise at a faster pace, while states with a greater presence of fossil fuel production will want a slower pace. Given the powers of the union government in tax policy, the union government will have to play its constitutional role of negotiating a middle ground between the interests of different states.⁴⁵

If India has a centrally planned electricity sector, the divergence of desired time lines across states would be a significant problem, as the optimal carbon transition for Bihar diverges from that of Tamil Nadu, and any middle road is unsatisfactory to both. Under the ideas of this paper, however, the carbon transition in each state is shaped by the optimisations of private persons and not the state. Internationalised firms everywhere will desire decarbonisation. They will arrive at private contracts that solve their private problems. Sophisticated firms that operate in Bihar will be able to contract with renewables generators and low-carbon suppliers anywhere in the country, and work out their optimal production locations. The carbon transition would arise through local decisions by firms all across the country, and would not require an omniscient and benevolent central planner.

The path to the Indian climate transition, then, lies in the Indian electricity reform, which will be played out one state at a time. What we require is a policy thinking and expert community in one state at a time, rather than grand schemes that operate at the level of the entire country.⁴⁶ The electricity reform described in this paper appears impossible if we think of this as a grand strategy led by the union. If, instead, we think of making progress one state at a time, it is much more feasible.

For the global climate policy community, this implies reshaping attention and engagement, away from the union government, in favour of directly

⁴⁵There is no provision in the State List of the Constitution for a carbon tax at the state level. The only excise permissible is on alcohol. Differential carbon taxation by different states would require an amendment to the Constitution. Such constraints hamper state-led adjustment at a pace that varies across states. Market-based adjustment faces no such difficulties.

⁴⁶In some cases, the ideal locus for problem-solving in the electricity sector may be at a level below a state but this is made difficult by the current constitutional scheme. In a privatised scenario however, it is possible to envisage distribution being organised more efficiently at a district or state level, or indeed distribution companies covering customers in contiguous regions that form more logical single markets across state borders.

working with the state governments with greater interest and greater intellectual capacity on these fundamental problems.

7.4 The envelope of reform possibilities has shifted

The reformers of previous decades faced a certain conjunction of political forces which acted against fundamental reform of the command-and-control electricity system. The present moment, however, offers a unique opportunity to attempt a comprehensive, market-oriented reform effort for the Indian power sector.

1. *The fiscal situation:* At the union and at the states, debt levels have risen. The consolidated liabilities of the union and states dropped below 90% of GDP in 2006-07. From 2019-20 to 2020-21, in one year, this jumped from 76.6% to 91.72% of GDP. Prior to this, there have been only four years where the consolidated debt/GDP ratio was above 90%: from 2002-03 to 2005-06. This enhanced debt level drives up the minimum primary surplus required for a stable debt/GDP ratio and makes it more difficult to sustain malfunctioning sectors such as electricity with regular fiscal resources.
2. *The triumph of experience over hope:* The next wave of bailouts for the electricity sector – of fiscal transfers without the sector graduating to the price system – will be treated with greater skepticism. There is now a full consensus that incremental policy work induces regular large-scale fiscal transfer into a hamstrung sector. As with Air India or banking, it is hard to claim that this bailout will be the last.
3. *The Overton window on privatisation has shifted:* In previous decades, privatisation was often beyond the pale, when viewed through the prevailing political philosophy. The climate of opinion has now shifted considerably. Air India has been sold, and there is movement on privatisation of banks: Both these were eminently sensible pathways that were long blocked in India on account of ideological problems. The winds are shifting in the field of electricity also. The gains from DISCOM privatisation in Delhi are now well established. The union government has started a programme of privatising DISCOMs in Union Territories and has encouraged the states to do the same. The recent announcement of the National Asset Monetisation Pipeline is another path to placing erstwhile public assets under private control. This broad-based political acceptability of privatisation-based solutions was not present prior to 2020, and helps shift the envelope on what is feasible in electricity policy reform today.
4. *The global climate problem is reshaping international relations:* India faces a challenging international environment. China has signed on to the global climate transition. India will need to reshape domestic policy strategies (in this case, electricity policy) in response to international relations considerations (in this case, global concerns about climate change) and its own commitments to decarbonise. The validity of various climate equity issues (J. Parikh and K. Parikh, 2021) notwithstanding, the first world electorate will create pressures upon their governments to demand progress by India, the fourth largest

emitter in the world. Global climate policy has moved forward from the early debates to concrete action, and in the mature phase, there will be an emphasis on facts and outcomes, as opposed to grandstanding about the past and unenforceable promises about the deep future. India has vulnerabilities both to the impacts of climate change and to the costs of inaction that might be imposed on it by the international community.⁴⁷

5. *The global financial environment has reshaped the incentives of the Indian private sector:* It is now difficult for Indian private firms to undertake fossil fuel based investment projects, as these cannot be easily funded in the modern climate finance and ESG -influenced investment environment. Financing opportunities from first world countries, including concessional financing through ESG investment, has strongly reshaped the priorities of Indian firms. These developments imply that expansion of the energy system in a fossil fuel intensive path, with financing based only on the capabilities of the domestic financial system, is largely infeasible.
6. *The Indian private sector now has the requisite capabilities:* In earlier years, it was difficult to think of Indian private companies that could be the major players of a modern Indian electricity sector. Now the Indian private sector has many large firms and business groups; organisational and financial capability in domestic and foreign firms is no longer the bottleneck.⁴⁸
7. *Competitiveness is at stake:* Indian exporting firms, and the states that host exporting firms, need to show they have graduated to renewables and low emissions. This cannot be achieved without solving the overall logjam of the electricity sector in the export-oriented states.

7.5 Resourcing the transition is feasible

The climate transition involves three large groups of resource flows that involve the government. The first is the direct costs experienced in implementing the reform. The second is the group of sources of finance that are in play. The third is the positive impacts upon GDP, which are welfare-improving and also generate enhanced tax revenues holding tax/GDP ratios intact.

There are four areas where public money will have to be spent:

⁴⁷*Sensing An Opportunity: Why India Should Accept, Not Resist, Decarbonisation*, M Rajshekhar, Carbon Copy, August 2021 at <https://carboncopy.info/sensing-an-opportunity-why-indias-should-accept-not-resist-decarbonisation/>.

⁴⁸As an example, a firm with a balance sheet size of over 0.1% of GDP is considered a large firm. At an Indian GDP of \$3 trillion, this corresponds to a balance sheet size of \$3 billion or Rs. 0.22 trillion. For the year ended 31 March 2000, there were 54 private firms with a balance sheet size above 0.1% of GDP. Twenty year later, there were 113 such firms. This shows substantial broad-based capability in the private sector to finance and operate large complex firms. The shift from fossil fuels to renewables may, however, favour a large number of small firms with a more decentralised electricity system, as opposed to large factories with (say) 3000mW of thermal generation. As a thumb rule, 5 acres of land yield a peak output in India of 1mW.

1. DISCOMS seek to change the terms of PPAs with fossil-fuel generation firms as a consequence of the operation of a carbon tax, they will have to pay liquidated damages or termination costs. They will need to make VRS payments to some employees upon privatisation.
2. Fiscal resources will be required to pay the households and small firms who are losers of the reform, i.e. the people who are getting subsidised or stolen electricity today.
3. Employees in mining and generation companies, that are presently based on fossil fuels, will require rehabilitation and resettlement. Degraded land will require resources to convert it back into forest or farm land.
4. Small amounts of money will be required to build regulatory capacity.

In terms of the sources of capital for this reform:

1. If India embarks on a credible reform, backed by intellectual clarity and auditable facts, official flows under the US\$100 billion per annum to be provided to developing countries under the Paris Agreement can help pay for transition costs in one state at a time.
2. Privatisation of state assets in transmission, distribution and generation will generate proceeds.
3. The periodic injections of fiscal resources into the electricity sector would come to an end.

While carbon taxation is sometimes seen as a revenue source, it is best to organise this as a revenue-neutral arrangement where (say) the GST rate is cut alongside the carbon tax in a way that yields no additional tax resources. Through this, the carbon tax would reshape the resource allocation but not constitute an additional tax, over and above the existing taxes.

There are four pathways through which there will be a positive impact upon Indian growth:

1. Regardless of the climate problem, Indian GDP growth would go up if the electricity sector were placed into a price system. Consumers would then achieve grid reliability, and end expenditures on diesel generators and batteries.
2. Fossil fuels emit pollutants that adversely impact on the health of the people of India. This is particularly important in North India.
3. The Indian economy will benefit from the Indian geo-political gains from fully participating in the global climate transition.
4. When Indian engineering firms (whether hardware or software) are engaged with trying to serve the Indian market for the climate transition, in the face of global competition, they will gain better skills and exports from India would likely improve. Conversely, if Indian engineering firms remain carbon-oriented, these skills are a wasting asset.

The conventional average tax/GDP ratio would apply on this increased GDP as an enhanced flow of resourcing into the Indian state.

The reasoning above has emphasised the flow of resources in the public sector. Alongside this, the main resource flows would happen in the private sector. New capital will be required to build a decarbonised energy system including large investments in the grid. These would come from the private sector. The global ESG system is a vast investment mechanism through which (at times) concessional financing is available for new investment projects that are consistent with decarbonisation. At a conceptual level, first world pensioners are accepting lower rates of returns as their pension funds are constrained to only invest in certain kinds of assets; this constitutes a transfer from them to the buyers of electricity in India, one that is not intermediated through the Indian state.

7.6 Stress in the electricity sector

The sixth factor which works in favour of fundamental reform of the electricity sector is the fact that the long-standing chronic stress of the electricity is likely to get worse. India's carbon transition faces a choke point in the legacy electricity sector, and at the same time, decarbonisation is creating heightened stress for the legacy electricity sector.

When the grid provided expensive, unreliable and pollution-intensive electricity, and the only option was diesel generators, the best paying customers did little but grumble. But with the rise of renewables, the best customers are exiting the grid.

The complexities of distributed generation, and the absolute increase in the size of the electricity sector, demand substantial investments in distribution and transmission, which are unlikely to come about in the public system. The demands on the exchequer will become larger through time. As with Air India or PSU banks, at some point, the cost-benefit calculations of politicians will change.

8 Conclusion

Given the size of India's economy and the fact that it is the fourth largest emitter worldwide, the path to the global climate transition involves India.⁴⁹

The path to the Indian climate transition lies through electricity policy. The heart of the problem of India's climate transition is that the site of the reform – the electricity sector – is malfunctioning. The Indian electricity

⁴⁹For a discussion of India's salience to the global climate transition, see Sivaram (2017).

sector today is a realm of central planning and state control. It is unresponsive and produces largely expensive-dirty-unreliable electricity. If the carbon transition is implemented through command-and-control tools, the costs faced by society will be high. In contrast, the price system would create incentives every day, for consumers and producers to reshape their technology and behaviour, in ways that deliver the required decarbonisation, at the lowest possible cost.

Fundamental reform in the power sector, and in particular the DISCOMs is one of the more intractable problems of the Indian economy. The impediments include the political economy and embedded vested interests, divergent perceptions of the interests of the union government and the states, India's federal structure etc. The best of the Indian intellectual community has worked on various aspects of power sector reform for decades. These experiences have taught us that more tinkering at the edges will not deliver. Men and nations will do the right thing after trying every reasonable alternative. We stand at the end of 30 years of many reasonable alternatives. The forces that shape Indian electricity policy are changing, and it is now possible to pull together a feasible reforms strategy.

Under the present arrangement, the union government lacks the levers that can induce decarbonisation, and the use of regulatory instruments will induce high costs upon the economy, particularly given the unpredictable responses in any one state. The combination of a private electricity sector and a carbon tax gives the union government the lever through which decarbonisation can be achieved, while imposing the minimum economic costs.

What we are describing here is not easy. Any other strategy – that genuinely solves the problem – is harder. As an example, if we envision the central planning system attempting a carbon transition, this imposes excessive costs upon society, and risks a political blowback. In this case, India could become isolated as an important global emitter.

For researchers and practitioners steeped in the electricity sector, graduating to the price system seems impossibly hard. But India has achieved this in other sectors before, such as civil aviation, mutual funds and telecom. In each of these areas, the full arc was traversed, from a completely centrally planned system, to the price system.

These ideas play out over long time horizons. The decarbonisation problem has horizons of about 30 to 35 years. In the thought process of this paper, perhaps there could be a five to ten year process of building the mechanism for the climate transition through electricity reform, and then a 25-year journey of decarbonisation through an escalating carbon tax.

This paper has sketched a set of ideas at a high level. The devil, of course, lies in the detail. A large body of work is required, where evidence is brought to

bear on the numerous questions that need to be answered. The field requires bringing together climate science, energy engineering, state political economy, international relations, international trade, finance, public economics, public finance, law, regulation, and public administration.

References

- [1] Montek Singh Ahluwalia and Utkarsh Patel. *Getting to Net Zero: An Approach for India at CoP-26*. Tech. rep. 13. New Delhi: CSEP, Sept. 2021.
- [2] *All India Installed Capacity of Power Stations*. Tech. rep. Central Electricity Authority, Sept. 2021. URL: https://cea.nic.in/wp-content/uploads/installed/2021/09/installed_capacity.pdf.
- [3] Matt Andrews, Lant Pritchett and Michael Woolcock. *Building State capacity*. Oxford, 2017.
- [4] Gautam Bambawale et al. ‘Strategic patience and flexible policies: How India can rise to the China challenge’. xKDR Working Paper No. 2. Mar. 2021. URL: https://xkdr.org/releases/Bambawaleetal2021_strategicPatienceandFlexiblepolicies.html.
- [5] CERC. *Report on Short Term Power Market in India: 2019-20*. Tech. rep. Central Electricity Regulatory Commission, 2020. URL: https://cercind.gov.in/2020/market_monitoring/Annual%20Report%202019-20.pdf.
- [6] Ashwini Chitnis, Shripad Dharmadhikary et al. *Many Sparks but Little Light: The Rhetoric and Practice of Electricity Sector Reforms in India*. Prayas, Jan. 2018.
- [7] Ashwini Chitnis, Shantanu Dixit et al. ‘Electricity Distribution Companies in India: Preparing for an uncertain future’. Discussion Paper. May 2018. URL: <https://www.prayaspune.org/peg/publications/item/377>.
- [8] European Commission. *Carbon Border Adjustment Mechanism*. July 2021. URL: https://ec.europa.eu/taxation_customs/green-taxation-0/carbon-border-adjustment-mechanism_en.
- [9] *Corporate Renewable PPAs in India: Market and Policy Update*. Tech. rep. World Business Council for Sustainable Development, Jan. 2021. URL: <https://www.wbcsd.org/contentwbc/download/11241/165820/1>.
- [10] Navroz K. Dubash, Sunila S. Kale and Ranjit Bharvirkar, eds. *Mapping Power: The Political Economy of Electricity in India’s States*. OUP India, 2018.
- [11] Garrett Fitzgerald et al. *Turning Around the Power Distribution Sector: Learnings and Best Practices from Reforms*. Tech. rep. NITI Aayog and RMI India, Aug. 2021.
- [12] Vibhuti Garg. ‘Deepening India’s Short-Term Power Market: New Financial Products Will Boost Trading of Renewable Energy’. In: *The Institute for Energy Economics and Financial Analysis* (Sept. 2020). URL: <https://ieefa.org/wp-content/uploads/2020/09/Deepening-India-Short-Term-Power-Market-September-2020.pdf>.
- [13] Vibhuti Garg and Jyoti Gulia. ‘The Impact of the 10kW Net Metering Limit on India’s Rooftop Solar Market Potential Solutions for Consumers, Developers and Discoms’. In: *The Institute for Energy Economics and Financial Analysis* (Feb. 2020). URL: https://ieefa.org/wp-content/uploads/2021/02/The-Impact-of-the-10kW-Net-Metering-Limit-on-Indias-Rooftop-Solar-Market_February-2021.pdf.
- [14] Ananya Goyal, Renuka Sane and Ajay Shah. ‘What year in the history of an advanced economy is like India today?’ In: *The leap Blog* (Aug. 2021). URL: <https://blog.theleapjournal.org/2021/08/what-year-in-history-of-advanced.html>.
- [15] IEA. *India Energy Outlook 2021*. Tech. rep. International Energy Agency, 2021.
- [16] Girishkumar Kadam, Sabyasachi Majumdar and V Vikram. *Distribution sector reforms imminent with rising discom debt and dues to gencos*. Tech. rep. International Credit Rating Agency, Mar. 2021. URL: <https://www.icraresearch.in/research/ViewResearchReport/3567>.
- [17] D. Kapur and M. Khosla. *Regulation in India: Design, Capacity, Performance*. Hart Studies in Comparative Public Law. Bloomsbury Publishing, 2019. URL: <https://books.google.co.in/books?id=2tKIDwAAQBAJ>.

- [18] Vijay Kelkar and Ajay Shah. *In Service of the Republic: The art and science of economic policy*. Penguin Allen Lane, 2019. URL: <https://www.mayin.org/ajayshah/books/isotr2019.html>.
- [19] Jyoti Parikh and Kirit Parikh. ‘Linking climate science and climate action: An equitable way to raise climate finance’. In: *Energy for Sustainable Development* 65 (Dec. 2021), pp. 185–188. URL: <https://www.sciencedirect.com/science/article/pii/S0973082621001228>.
- [20] Kirit S. Parikh, Jyoti K. Parikh and Probal P. Ghosh. ‘Can India grow and live within a 1.5 degree CO2 emissions budget?’ In: *Energy Policy* 120 (Sept. 2018), pp. 24–37. URL: <https://www.sciencedirect.com/science/article/pii/S0301421518303057>.
- [21] Ajay Shah. ‘Can India leapfrog into decentralised energy’. In: *The Leap Blog* (Apr. 2015). URL: <https://blog.theleapjournal.org/2015/04/can-india-leapfrog-into-decentralised.html>.
- [22] Ajay Shah. ‘Retreat from private infrastructure projects’. In: *The Leap Blog* (Apr. 2017). URL: <https://blog.theleapjournal.org/2017/04/retreat-from-private-infrastructure.html>.
- [23] Gireesh Shrimali. ‘Financial Instruments to Address Renewable Energy Project Risks in India’. In: *Energies* 14.19 (Oct. 2021). URL: <https://doi.org/10.3390/en14196405>.
- [24] Daljit Singh. ‘Newer Challenges for Open Access in Electricity: Need for Refinements in the Regulations’. In: *Brookings India IMPACT Series*. 042017-02 (Apr. 2017). URL: https://www.brookings.edu/wp-content/uploads/2017/04/open-access_ds_042017.pdf.
- [25] Varun Sivaram. ‘The Global Warming Wild Card’. In: *Scientific American* 316.5 (May 2017), pp. 48–53. URL: <https://www.scientificamerican.com/article/can-india-save-the-warming-planet/>.
- [26] 2017-2018 Standing Committee on Energy. *Thirty Seventh Report: Stressed/Non-Performing Assets in Electricity Sector*. Tech. rep. Ministry of Power, Mar. 2018. URL: http://164.100.47.193/lssccommittee/Energy/16_Energy_37.pdf.