In Pursuit of a Low Fossil Energy Future

Interrogating Social, Political and Economic Drivers and Barriers in India's Energy Transition

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FRIEDRICH EBERT STIFTUNG

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AT&C	Aggregate Technical and Commercial
BEE	Bureau of Energy Efficiency
CAGR	Compounded Annual Growth Rate
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CEEW	Council on Energy, Environment and Water
DCR	Domestic Content Requirement
DELP	Domestic Efficient Lighting Programme
DGs	Diesel Generators
DISCOMs	Distribution Companies
EESL	Energy Efficiency Services Limited
ESCOs	Energy Service Companies
EY	Ernst & Young
FAO	Food and Agriculture Organization
FES	Friedrich-Ebert-Stiftung
FPC	Fuel Policy Committee
FY	Fiscal Year
GDP	Gross Domestic Product
GoI	Government of India
INDC	Intended Nationally Determined Contributions
IREDA	Indian Renewable Energy Development Agency
IRENA	International Renewable Energy Agency
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
NEP	National Electricity Plan
NGOs	Non-government Organisations
NRDC	Natural Resources Defense Council
NSAs	Non-state Actors
NTPC	National Thermal Power Corporation
PLF	Plant Load Factor
RE	Renewable Energy
RPO	Renewable Purchase Obligation
SREDAs	State Renewable Development Agencies
T&D	Transmission and Distribution
UPA	United Progressive Alliance
WGEP	Working Group on Energy Policy
WTO	World Trade Organization

Foreword

Tackling climate change will not be possible without a significant contribution from Asia. According to economic forecasts, Asia's share of global greenhouse gas emissions will grow dramatically in the coming decades due to increasing population rates and relatively robust economic growth. At the same time, millions of people in the region will be affected by climate change. Serious environmental pollution has resulted from the burning of fossil fuels. Health risks due to air pollution already affect millions of Asians.

There is growing interest in renewable energy in many parts of Asia as a result of energy security and environmental concerns and the need to deliver electricity to energy-poor regions. With dropping renewable energy prices, there is growing investment in the sector in Asia. This makes it increasingly possible to talk about the beginning of energy transitions in the region. Greater use of renewable energy may lead to more socially and environmentally just energy structures. We still know little, however, about the actual social and political contributions, costs and implications of renewable energy expansion.

Friedrich-Ebert-Stiftung (FES) decided to examine these questions with a series of country studies in Asia. The studies looked at the political and social factors that drive—but also hamper—socially just energy transitions. The authors of each case study in China, India, Indonesia, Japan, the Philippines, the Republic of Korea, Thailand and Vietnam worked with Miranda Schreurs, Professor of Environmental and Climate Policy in the Bavarian School of Public Policy, Technical University of Munich, to provide in-depth analysis of the situation in their respective countries. Julia Balanowski, a climate change consultant based in South-East Asia, supported the preparation of each country study and their review.

The country case studies provide insights into the status of climate and energy policies, their socio-economic implications and the actors involved in developing and implementing those policies. Two of the important questions that motivated this comparative study were whether renewable energy development was contributing to a more socially just energy structure and which factors foster and impede political acceptance of RE development.

The Indian government´s position is changing, from a static interest in coal-based energy generation towards increasing clean energy development. We hope that this study provides a starting point for further debate and analysis and provides incentives for policymakers, academics and civil society to work together towards low-carbon development in India and beyond.

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Introduction

India says it is undertaking a thorough transition towards a low-fossil energy future for the country, stepping up renewable energy and energy efficiency efforts. The objective has been made explicit in its Intended Nationally Determined Contribution (INDC) with regard to climate change mitigation. In the INDC, India has made a global pledge to achieve 40 per cent cumulative installed capacity from fossil fuel-free resources by 2030. In addition, it has committed to reduce its emission intensity per unit of gross domestic product (GDP) by 33 to 35 per cent below the 2005 level by 2030, through industrial optimisation and intensive energy efficiency measures. In addition, India's INDC recognises the importance of restoring forest cover, for additional carbon storage of 2.5 to 3 billion tonnes of carbon dioxide (CO_2).[1]

India's global pledge for an energy transformation has received significant attention and applause for multiple reasons.

As an emerging economy, between 1950 and 2008, India's economic growth simultaneously resulted in a rampant growth of its absolute CO2 emissions averaging 5.7 per cent per year, making it the world's third-largest emitter after China and the United States (US).[2]

Given the recent high growth rate and projected double-digit growth rate of the Indian economy, the country is expected to increase its energy demand by a multiple. While much of India's energy consumption is gradually shifting towards electricity, Indian electricity remains heavily fossil fuel dependent. While India has already achieved 33.22 per cent fossil fuel-free generation capacity in its energy mix of 330 gigawatts (GW) (as of 31 July 2017),[3] more than 80 per cent of the generated electricity came from fossil fuel sources in 2016-17.[4] It has been estimated that emissions from electricity generation in India rose by 8.2 per cent in 2014, whereas the corresponding global figure was only 0.5 per cent. The year 2015 witnessed a further 5.2 per cent rise in India's CO2 emissions with a double digit increase in coal demand and 7.4 per cent growth in GDP.[5] In addition, about 220 million citizens do not yet have access to basic electricity services, while an additional 200 million are facing serious supply interruptions. The Government of India (GoI) has committed to provide round-the-clock, uninterrupted supply to all Indian households by 2022.[6]

Undoubtedly, India has a legitimate need for more power and is expected to contribute majorly to the future global energy demand. In this context, its commitment to ramp up fossil-fuel-free generation capacity has not only raised international awareness, but also made India a leading player in the global energy transition. India's global pledge has been backed by an even stricter domestic policy goal for renewable energy generation capacity addition. India has a long history with RE and energy efficiency, which started back in the 1970s during the global oil crisis. However, the initial several decades of engagement were much more focussed on experiments and demonstrations as alternative options.[7]

In 2008, India came out with a National Action Plan on Climate Change. As part of the plan, two dedicated missions were established to facilitate an energy transition, viz. the National Solar Mission and the National Mission for Enhanced Energy Efficiency. At this point, India set a target to raise the solar power generation capacity to 22 GW under the solar mission, while increasing the total renewable energy generation capacity to 74 GW by 2022. In 2014, the GoI further ramped up the RE policy target to 175 GW by 2022. India had an equally promising goal for energy efficiency enhancement and sought to avoid capacity addition of 19,598 MW by 2014-15.

In the INDC, it said it avoided capacity addition of about 10,000 MW between 2005 and 2012. If calculated by using a low capacity utilisation factor of renewable energy generation plants, this achievement on energy efficiency translates into about 26 GW of RE installed capacity, which was higher than the amount of RE deployment in 2012. If India has achieved its 2015 target (evaluation is still due and being commissioned by the Bureau of Energy Efficiency), the result would be equal to more than 50 GW of RE installed capacity, again higher than renewable energy deployment at that time.

Though there is no updated target for energy efficiency, ongoing and proposed initiatives will have much higher gains and thus reduce the need for energy, at least matching with India's renewable energy aspirations. Given the developments, India's pursuit of energy transformation is unfeigned.

Against this backdrop, this paper aims to analyse the social, economic and political drivers for and feasibility of India's planned energy transition, from an energy system mainly based on fossil fuels towards a future system with a high share of non-fossil fuel-based energy. The objective is to gain knowledge about the present electricity sector scenario in India and to identify opportunities for the transition from fossil fuel-based towards RE in the light of present political and social scenarios.

It will further consider various technological and financial challenges on the path towards an energy transition. The stress will be on the social and political acceptability of the energy transition in India with a bigger picture of addressing the concerns of climate change and global warming.

Social aspects of the energy transition

Renewable energy is categorised in India as solar, wind, biomass, waste-to-energy and small hydro. The topic started receiving policy attention from the mid-1980's, mostly through wind-farming that still contributes a major share of the total RE generation capacity (57 GW as of March 2017), earning India the fourth position globally in terms of wind-power capacity. However, RE did not find a place in the mainstream policy narrative/ agenda on power (solar was barely an off-grid solution for remote areas) until January 2010 when the then Prime Minister Manmohan Singh, who led the United Progressive Alliance (UPA) government (2004-2014), announced a plan to add 2 GW solar capacity a year under the National Solar Mission, [8] ensuring priority in policy implementation. With vast domestic reserves of coal vis-à-vis other fossil fuels, such as gas, India's policymakers always had a preference for coal as the primary energy source, followed by large hydro (categorised as a conventional energy source in India).

The dependence on coal in electricity generation increased in the last decade, as India went on a massive capacity addition drive to end supply constraints and increase access to electricity. In the seven years from 2007 to March 2015, the country's power generation capacity doubled from 132 GW to 267 GW (326 GW in March 2017) with the share of coal increasing from 53 per cent to 61 per cent of the total amount (see Table 1).[9] The shift was more than estimated as India missed its hydro capacity addition target by a wide margin, due to social and environmental resistance, while coal capacity addition, which was spearheaded by the private sector, exceeded its target.

Table 1: Installed capacity in March 2015 & 2017 & projected capacity in March 2022

Source	March 2015 (GW)	Share in grid-connected capacity (%)	March 2017 (GW)	Share in grid-connected capacity (%)	Projected March 2022 (GW)	Share in grid-connected capacity (%)
A) Grid connected						
Coal	164.63	**61.5**	**192.16**	**58.79**	**248.51**	**48**
Gas	23.06	8.6	25.32	7.7	29.9	6
Nuclear	5.78	2.1	6.78	2	10.08	2
Hydro	41.26	15.41	44.47	13.6	59.82	11
Total RES	**31.62**	**11.8**	**57.26**	**17.5**	**175**	**33**
i) Small Hydro	3.8		4.37		5	
ii) Wind	21.13		32.27		60	
iii) Biomass/ cogeneration	4		8.18		10	
iv) Waste to energy	0.1		0.13		NA	
v) Solar	31.62		12.28		100	
Total: Grid connected (A)	267.63	99.41*	326.84	99.59	523.38	100
B) Captive	40.72		40.72		NA	
Total A+B			367.56		NA	

* The rest are marginal capacities are distributed over liquid fuel etc
(Source: CEA Executive Summary for March 2017 and Draft National Electricity Plan, 2016)

Having come to power in May 2014, the present Narendra Modi-led central government escalated the green tax on coal (introduced in 2010) steeply to 6 US dollars (400 Indian rupees) a tonne. This was progressively increased over the years. As of 31 March 31 2017, the accumulated coal tax collection is now projected to be around 543.36 billion Indian rupees (over 8 billion US dollars).[11] Considering the global meltdown in commodity prices, this eroded the price advantage of domestic coal. The most notable policy change took place in June 2015 when the Modi government decided to increase RE-based electricity generation capacity five-fold, from approximately 32 GW as of March 2015 to 175 GW in March 2022.[12] The plan was linked to India's INDC pledge in October 2015, which included cutting the carbon intensity of GDP by 33 to 35 per cent by 2030 compared to the 2005 level.

Corresponding to the global trend, solar became the main agent of this beginning energy transition. The target of the ongoing National Solar Mission (projects taken under mission mode enjoy the highest priority) was increased by five times to 100 GW in 2022. This includes 40 GW of grid-connected rooftop and 60 GW of large- and medium-scale grid-connected utility projects. The total investment in 100 GW solar is estimated at 92 billion US dollars.[13] The rest of the projected RE capacity in 2022 will be contributed by wind (60 GW), biomass (10 GW) and small hydro (5 GW) (See Table I).

According to the Draft National Electricity Plan (NEP) for 2017-2022, as released by the Central Electricity Authority (CEA) in December 2016, RE will contribute 33 per cent of the total capacity and 20.3 per cent of total energy requirements (three times the current share in electricity generation) in 2022.[14] The government has already drafted the renewable purchase obligation (RPO) guidelines to support the RE plan. In addition, in order to foster the energy transition, no additional coal capacity is being proposed between 2017 and 2022. The Draft NEP further suggests that no additional coal capacity is required until 2027. However, some coal projects with a total capacity of 50 GW which are currently at different stages of implementation will come on stream during 2017 to 2022.

The NEP also highlights the need for additional hydro and gas-based sources for balancing the increasing need for power, but their availability remains a subject of concern. The Draft NEP mentions that gas-based stations will be established as a priority, immediately once the fuel becomes available. Considering social resistance against large-scale land acquisition, the planners do not expect much growth in large domestic hydro capacity and place their hopes on importing 24 GW of hydro-electricity supplies from Nepal (10 GW) and Bhutan (14 GW) in the next 10 years. The plan is based on major uncertainties. Though India imports hydro electricity from Bhutan, there is a growing demand from Bangladesh for a share of electricity being generated from common rivers. Nepal is a classic case of political instability and unrealised potential to generate hydropower. At the present time, it is dependent on imports from India (380 MW, to be scaled up to 500 MW this year). The Draft NEP is expecting Nepal to reverse the trend and become an exporter to India.

Over the last two years, India has shown some ambitions in translating the revised RE plan into action. RE contributed nearly 67 per cent of the total added capacity of 28 GW in the 2017 fiscal year (FY17). As of March 2017, the total RE capacity is barely 3 GW below the annual target of 60 GW. The progress is slow with regard to rooftop solar (1 GW), but capacity addition is moving in full swing in utility-scale solar.[15] The distribution of RE capacities, however, is not even across the country. Only five states out of 29—Tamil Nadu, Maharashtra, Rajasthan, Gujarat and Karnataka— contribute three-quarters of the total RE capacity. At least four of these states are among the most industrialised and score well above the national averages on many socio-economic indicators.

Wind generation is highly location-specific and the concentration of such units is attributed to technical reasons. But the concentration of solar may be indicative of limited availability of land for utility-scale projects. Rajasthan and Gujarat, two leader states in solar capacity addition, for example, have a vast share of India's arid land. According to the country's largest power generation company, NTPC Ltd., which has investments in RE, solar needs six times more land area than thermal on per MW basis. That is a serious constraint for a country which is 10 times more densely populated than the US and 2.5 times more compared to China; and where the ratio of arable land to total land is three times higher than in the US or China. According to the World Bank, the farm sector contributed 51 per cent of the total employment the country in 2010. This, coupled with the Food and Agriculture Organization's (FAO) estimate of 194 million undernourished people in India, in 2015, makes diversion of farm land a contentious issue in India.

A recent trend is that the leading states, such as Gujarat or Maharashtra are slowing down in capacity addition and a new group of states like Andhra Pradesh, Telengana and Madhya Pradesh have started adding RE capacity at a greater speed. Among the states having the bulk of the installed RE capacity, three are in the South. According to a report, southern states may be filling the generation gap created by idling gas-based stations.[16] However, considering the easy availability of electricity on the grid, the argument is not conclusive.

Leaving aside environmental goals, the government has linked RE transition to the long-term stability of the power tariff (as RE is fuel-free), ensuring the accessibility of electricity to all and improving the competitiveness of industry. Investments in RE generation and equipment manufacturing are expected to boost GDP and employment numbers. To what extent India achieves these economic goals will depend on the country's ability to negotiate a string of technical, economic, social and political challenges, as the next section will show.

As of 2015, India's total generation capacity was double the peak demand of 140 GW.[17] Surplus-capacity led to a spiral of a falling plant load factor (PLF)[18] (down from 70 per cent to 60 per cent during 2012-17, according to the Central Electricity Authority), higher generation costs and low returns due to pressure on tariffs[19] PLF is a measure of the actual output of a power plant, compared to the maximum output the plant in theory could produce. The Draft NEP estimates that the coal PLF may decline to 48.6 per cent[20] in 2022, if India achieves the 175 GW RE target. The peak demand is estimated to reach 235 GW, against a total capacity of 523 GW in 2022.

Despite falling solar photovoltaic prices and rising efficiency, RE is still expensive in India due to a low PLF and high investment requirements in balancing power and transmission infrastructure. The responsibility of recovering this cost lies with state-owned distribution companies (referred as DISCOM in India), which are witnessing increasing revenue gaps running into billions of dollars. For the future, it remains a huge challenge for India to solve this problem and to create more scope for RE development.

Further, consumers gained from the coal-based capacity additions. Comparing 2005-6 and 2015-16, per-capita electricity consumption increased by 75 per cent to 1075 kilowatt/hours (kw/h).[21] Also, the demand-supply gap was reduced.[22] The questions arise, whether RE in India will equally be suitable for meeting the increasing energy demand, whether it may help the rural electrification agenda, and whether it may stimulate job growth. Considering the reality on the ground in India, these questions will be investigated below.

Access to energy for the population and key industries

India's energy access profile has been changing over the last decade due to a rapid extension of grid connectivity to villages as part of the 'Rural Electrification' drive. In March 2017, 30,000 rural connections were granted within a week and the residual 4000 villages will be 'electrified' by March 2018.[23] This does not mean that the entire population is reliably supplied with electricity, and the government is planning to start a campaign for the intensification of rural connections, beginning 2018-19.

In India, industry cross-subsidizes residential tariffs. The expansion of the residential consumer base, therefore, is increasing industrial tariffs (this will be discussed in the section dealing with affordability). According to 'Energy Statistics 2016', published by the Ministry of Statistics and Programme Implementation of the Government of India, industry consumes 44 per cent of the total 948,328 GW/hrs of available electricity, followed by the domestic sector (23 per cent), agriculture (18 per cent), the commercial sector (8 per cent), railways (2 per cent) and others (5 per cent). Industrial and commercial consumption witnessed fastest growth of 10.69 per cent and 8.10 per cent, respectively, between FY06 and FY15.[24] There are information gaps on energy use. 'Energy Statistics 2016' estimates that electricity consumption grew by 8.72 per cent compounded annual growth rate (CAGR) between FY06 and FY15, whereas, according to the Draft NEP, 2016, "actual energy demand" grew by 4.42 per cent CAGR between FY13 and FY16.

RE offers no solution to meet peak deficit in electricity supply

One of the most interesting features of the Indian power system is the coexistence of surplus capacity as well as a peak deficit. In India, demand peaks for a few hours in the evening and there is no viable solution to meet this evening demand. According to the Draft NEP, the falling share of hydro- and gas-based electricity vis-à-vis coal is creating technical barriers in maintaining grid stability. Since coal generation is not suitable for a quick ramp-up and the share of hydro-thermal is declining (from 22.86 per cent in FY12 March 2012 to 17.53 per cent in January 2016), the peak deficit continues. Despite increasing availability, RE does not currently offer any solution to balancing power needs. The scenario, however, may change with the availability of viable storage options, a topic to which attention needs to be shifted.

On the contrary, the Draft National Electricity Plan estimates a "huge balancing capacity requirement" to support RE expansion. It points out that while solar peaks at noon, and wind power peaks during the monsoon in July, these periods coincide with low demand for electricity and high availability of hydro-electricity. A study published in the Economic and Political Weekly in 2016, points out that Karnataka had an unmet peak demand of 14 per cent in FY13 despite sourcing 10 per cent RE, which was significantly higher than the national average.[25]

To sum up, the introduction of RE will widen the balancing power gap and increase the propensity of a peak deficit. As a solution, the CEA aims to solve the puzzle partly by adding pumped storage capacities (63 sites with an installed capacity of 4.7 GW identified) and mostly through imports.

Captive generation and RE opportunity

The grid coverage does not meet the entire electricity needs of consumers in India. Part of the reason is technically imposed, as, for example, industries like petroleum refineries or petrochemicals require captive support for an uninterrupted supply. Other reasons are economic. With industrial tariffs soaring, industry is looking for cheaper alternatives. According to the CEA, captive capacity increased from 14 GW to 40 GW during the 2007-12 energy boom, and has remained static since then. Most of the power-intensive industries such as steel, cement, and paper have captive sources. The choice of fuel may not be static. Some cement makers are using petroleum coke or pet coke for power generation to take advantage of the lower prices compared with imported coal which must pay a green tax.[26]

Many industries in Gujarat switch between liquid fuel and gas depending on the price arbitrage. Refineries and petrochemicals use naphtha and flue-gas for captive generation. Diesel generators are the most common modes of captive generation. The Economic Survey 2016, published by the Union Finance Ministry, mentions that 47 per cent of firms (business entities) use diesel generators (DGs) to protect against the uneven and costly electricity supply from the grid.[27] Contrary to the CEA's estimate of a static 40 GW captive source since 2012, the survey estimated a total capacity of DGs to be around 72 GW – growing by 5 GW a year. According to a December 2013 report by Nielsen (for the Petroleum Studies and Analysis Cell, under the Ministry of Petroleum and Natural Gas), the shares of diesel consumption (of total sales) of key non-transport sectors (for running DG sets), were as follows: Mobile towers (1.54 per cent), non-industry genset (6.45 per cent), and industrial genset (4.06 per cent).[28] Theoretically, RE has a clear advantage over costlier captive generation.

The government is promoting the use of solar pumps to partly replace agricultural DG sets. Units of solar pumps have crossed 92,000.[29] and industry is actively exploring this option. ITC Ltd – one of the top market cap companies with a presence in the power-intensive paper manufacturing sector met 43 per cent of its approximately 22000 TJ, or terajoule, energy requirements from RE, mostly from waste in FY15.[30] However, for a variety of reasons as discussed in the following sections, the use of RE by industry is mostly limited to on-site development. Off-site captive generation of wind or solar is low.

Affordability of the energy transition

According to the Census 2011, India had 1.19 billion people, growing by 15.9 per cent over the last decade. According World Bank estimates, 21.2 per cent of the 1.19 billion people earn less than 1.9 US dollars a day. To add to the complexity, there is a wide regional disparity, which is also reflected in access to electricity. As of 2011, 90 per cent of the households in southern states were using electricity, while coal producing states in the east were largely un-electrified. Given the widespread poverty, a vast majority in India is more concerned about the cost of electricity than the source of its generation. The only exception are nuclear power plants, as in the meantime awareness – and fear – has grown among the population about the risks linked with nuclear power generation.

State competitiveness and regional disparity

With a view to the realities on the ground and voters, the state governments have focused on offering electricity to a large section of society at a grossly subsidised rate. The burden of paying for this subsidy has partly gone to industry, and partly to commerce and a section of premium household consumers. There has also been a gap between intake and level of subsidy payments. The revenue gap widened with the progress of the rural electrification campaign (refer to Table 2). This led to huge outstanding losses, estimated at approximately 58 billion US dollars (3.8 trillion Indian rupees) at the exchange rate as of March 2015.[31] Distribution companies could, however, run operations due to lenient refinancing from banks as evident in the accumulation of 66 billion US dollars in total debts.

Table 2: Average cost of power supply and average realisation (paise/kwh)

Year	Cost of supply (paise/unit)	Realisation (paise/unit)	
		Total realisation including agriculture	Realisation from agriculture
2004-05	254	209	75.68
2005-06	260	221	76.36
2006-07	276	227	74.23
2007-08	293	239	77.27
2008-09	340	263	87.13
2009-10	355	268	88.70
2010-11	398	303	119.75
2011-12	455	330	135.14
2012-13	501	376	148.67

(Source: CEA Executive Summary for December 2016)

For the last one-and-a-half decades the Indian government has been trying to address this issue through financial bailouts (debt restructuring), but with limited success. It took just three years for states to pile up fresh loans since the 2012 bailout. Often, financial indiscipline paves the way for offering electricity to industry at relatively affordable rates. For example, the state of Tamil Nadu has one of the poorest track records when it comes to cost recovery, but its industrial tariffs are significantly lower than the national average.[32] On the other hand, West Bengal has one of the best records in cost realisation and it charges industry much higher rates than the national average. The irony is that West Bengal is an investment-starved state while Tamil Nadu is an automobile and IT hub and among the top five industrialised states in the country.

The Economic Survey, 2016 reflects that measured against per capita GDP (PPP), the industrial tariff for electricity in India is higher than in OECD countries such as Australia, the USA or Denmark. "Electricity tariffs are unusually high for the Indian industry," according to the Survey. To sum up, India is yet to solve the revenue puzzle on its distribution front, and so far as politics is concerned, right from the centre to the states, governments are keen to continue with the subsidised electricity supply regime. In a recent interview to Business Line[33] on 11 May 2017, the Union Power Minister Piyush Goyal offered reassurances that subsidies are going to stay for the poor and the farming sector. He also announced an offer of cheap power to industry. He did not elaborate, however, how doing this would help to mitigate the revenue puzzle faced by the state government-run distribution companies.

Clean energy jobs

A new industry will create new jobs. The Draft NEP projections for the next 10 years clearly reflect that coal will continue to be the basic energy source. But its growth will be muted, compensated by a higher share of RE. In the US, the solar power sector now employs twice as many people as coal did in 2016, hence the question is whether the clean energy branch bears the potential of creating additional jobs in India, too.

Yet, the job creation scenario appears unclear due to contradictory claims and estimates presented by different agencies. The International Renewable Energy Agency (IRENA) predicted that 100 GW of solar will create 1 million jobs in India. According to IRENA, as of 2015, India was supposed to be "[…] the world's fourth-largest employer in the sector, with 391,000 renewable energy jobs."[34]

According to a media report on 25 August 2014, quoting a study by the New York-based non-profit Natural Resources Defense Council (NRDC) and the Delhi-based non-profit Council on Energy, Environment and Water (CEEW), India created 74,000 clean energy jobs between 2011 and 2014.[35] Of the total, approximately 45,000 were employed in the wind-energy sector and, around 24,000 in grid-connected solar projects. However, "most of the jobs were generated during the construction and commissioning of the project. The local communities get benefitted during the operations and maintenance of the consignment", the report said. Industry experts say there is limited mapping of the operation and maintenance jobs as they are created in the unorganised sector.

In contrast, the Draft NEP reports that approximately 269,000 additional power jobs will be created between 2017 and 2022. Of the total, RE generation will contribute 74,000 jobs. The study points out that on a per-MW basis, hydro offers the maximum job opportunity of 1.74 persons, followed by nuclear. Wind requires the least manpower, at 0.41 persons per MW; solar 0.71 persons; bio-mass with 0.62 persons is the same as coal-fired plants. It is, however, believed that India has lost solar equipment manufacturing jobs mostly to China.[36] The World Trade Organisation (WTO) ruled against the domestic content requirement (DCR)[37] clause early in 2016, which was a setback to the 'Make-in-India' campaign.[38] In comparison, the more mature wind-power sector is mostly backed by Indian manufacturers. Meanwhile, the concentration of RE capacity may add to the regional disparity, as new jobs are mostly created in states that have better economies and a broader variety of job opportunities compared to states like Jharkhand or Odisha where mining is a major source of livelihoods.

How to make the transition socially just and affordable

Rather than hiking electricity tariffs, the solution for a socially equitable and affordable energy transition in India should be explored in increasing efficiency and transmission improvement. In doing so, it is essential that the government avoids passing on the final savings to consumers for immediate popularity.

In the following section, some recommendations are given:

Multiplicity of tariff lines: The Economic Survey, 2016, pointed out that there exist multiple, even hundreds, of tariff levels for electricity. There are separate tariffs for poultry firms, senior citizens, fisheries, wetland farms, to name just a few. Going by the experiences in taxation, such distortions lead to financial leakages. The Economic Survey, 2016 suggests the simplification of the tariff structure to "perhaps no more than 2-3 categories". This is a "low-hanging fruit", and states could be convinced to reform their tariff structure for an improved average realisation with minimum or bearable impact on consumers.

Stop electricity theft and pilferage: Average transmission and distribution (T&D) and aggregate technical and commercial (AT&C) losses stood at 22.77 per cent and 24.62 per cent of generation in FY15.[39] This is more than twice the world average and nearly three times the system loss in the United States.[40] Over the last decade India has missed many opportunities to reduce the T&D loss to 15 per cent. As in FY15, the T&D losses of Tamil Nadu and Uttar Pradesh were 21.10 per cent and 33.40 per cent, respectively. The three state distribution companies in Rajasthan reported T&D losses of 24.2 per cent, 25.9 per cent and 31.3 per cent. This is a vast amount of wastage and a huge part of this loss is due to theft, resulting from poor governance and unbridled corruption. Smart metering can help solve the problem partially. Private distribution franchises are normally more effective in recovering dues. However, the award of such franchises is moving at very low speed, both due to lack of political will and bureaucratic hurdles.

Energy savings in households: As DISCOMS are failing to pass on the cost of electricity supply to a majority of the rural consumers, the win-win solution lies in helping the poor to cap their energy bill by promoting energy savings and using the cost savings to support an energy transition. One possibility is to offer LED lamps: The price of LED lamps has declined over the last two years, but is still a few times costlier than ordinary incandescent lamps or normal or compact fluorescent lamps. In January 2015, India launched a Domestic Efficient Lighting Programme

(DELP) through the Energy Efficiency Services Limited (EESL) to distribute LED lamps to households and recover costs in easy instalments from the monthly electricity bill. The scheme comes with a three-year replacement warranty and is not backed by any subsidy. Various other schemes like LED-based street lights were also undertaken.

Community involvement: Sanjay Kumar Borha, the garden manager of Arun Tea Estate of Gillanders Arbuthnot & Co in Sonitpur district of Assam, presents an interesting model of community involvement in making energy affordable.[41] In 2007, Borha invested 3000 US dollars in replacing ordinary lamps in 800 labour quarters with energy saving lamps, supplied through a bulk meter. Savings on the energy bill were retained in a community account. The results surpassed all expectations: The capital investment was recovered in a few months. Despite tariff revisions by the distribution company, the electricity bill of the workers has remained low for the last 10 years. And still, the community savings grew to 23,000 US dollars. The garden gained in terms of lower cost on surveillance of usage and pilferage became a thing of the past. This is a lesson learnt for innovative modelling in making energy affordable and accessible and reducing pilferage.

Political aspects of an energy transition

This section will look into the competing narratives for a move away from fossil fuel-based energy production and consumption. In the process, it will identify some of the biases in the Indian system.

Energy security narrative

India's status as a net energy importer nation has for a long time motivated policymakers to pursue energy security as a strategic goal.[42] Renewable energy programmes have been primarily aimed at this motivation over the past three decades. The origins of RE in India are rooted in the concerns of the global fuel crisis of the 1970s. Since then, energy security at the national and state level has driven the sector forward. The Ministry of New and Renewable Energy (MNRE) as an institutional actor has been the most important player in shaping policy and securing resources. For many years now, it has been the stability of its agenda for wind power initially and solar power more recently that has provided a valuable backbone to RE policy.

The importance of the energy security narrative is also highly visible at the state level of policymaking. The state governments in Gujarat, Tamil Nadu and Maharashtra have been leading players in adopting and creating incentives for investors. States like Rajasthan, Madhya Pradesh and Andhra Pradesh have joined the bandwagon later. It is no surprise that these states host a number of high-growth industries and are also home to high-income entities for whom a secure source of power and tax savings are important. Interestingly, policies both at the central and state level are geared towards the promotion of utility-scale RE and there is no concrete framework for small-scale off-grid applications.[43]

The long-term success of such initiatives, however, depends on the particular level of proactiveness, and independence of the state nodal agencies, electricity boards and the regulatory commissions, as it is these bodies that revise tariffs and address regulatory issues thereby facilitating better services. Evidence of political patronage in some states (such as Tamil Nadu) has coincided with poor incentive structures or sluggish revision of policies. Gujarat, with its efficient bureaucracy, has shown strong, predictable policy action in the recent past. The energy security narrative has also been used by firms (mostly manufacturers) as part of their marketing strategies, but in recent times has evolved to include large independent power producers who seek massive expansions of their portfolios.

Despite the high technical potential in the country, intermittency and seasonality are natural constraints of renewable energy. This was compensated for in earlier periods by the state's thermal power capacity and measures, such as banking of power, and easy-grid-integration from the perspective of the utilities was feasible. Banking of power is an arrangement where one utility banks or supplies its surplus power to another utility which is in need. The former gets it back from the latter as it is needed in a lean period.

However, if India manages to meet its RE aspirations, it will have to develop storage facilities to compensate for the unreliability of both solar and wind power. Storage technologies are becoming more and more advanced and are essential to boost RE's contribution to India's energy security. Assuming that storage technology will be ready for commercial uptake by 2025, a recent study says that India will not need to add any fossil fuel-based capacity post-2025 and possibly go all RE by 2050.[44]

Early initiatives towards energy efficiency

India has made several significant efforts towards greater energy efficiency over the past four decades. While early initiatives were focused on "energy conservation" for domestic energy security, more recent ones emphasise "energy efficiency" for both energy security and climate mitigation. There has been also a noticeable evolution and transformation in the concept, context and the institutions of energy efficiency.

The early 1970s witnessed the emergence of the idea, when energy policy was integrated into development policy at the time of the fossil-fuel crisis. In 1970, a Fuel Policy Committee (FPC) was set up to prepare an outline for a national fuel policy for the next 15 years. A Working Group on Energy Policy (WGEP) was created in 1979 to carry out a comprehensive review of the energy situation in the light of developments both within the country and outside, to develop an outlook for the next 5-15 years and to recommend policy measures for the optimal utilisation of available energy resources, including non-conventional ones.

Transformation of energy efficiency in the Indian context [45]

Despite strong recommendations for a National Energy Plan from both the FPC and WGEP, the government took no immediate action. An Inter-Ministerial Working Group on Utilisation and Conservation of Energy was formed in 1981 to recommend actual policies and programmes, which resulted in the first-ever concrete proposal for reducing energy consumption in India. The working group suggested the creation of an apex body to initiate, coordinate and monitor the progress and implementation of various energy conservation measures. In 1983, an Advisory Board on Energy was set up to provide energy policy guidance directly to the Prime Minister's Office.

The Board has made several recommendations on the technical, financial and institutional aspects of energy and detailed projections of energy demand in different regions. It also commissioned a draft Energy Conservation Bill for enactment by the parliament. In line with the Inter-Ministerial Working Group, the Board emphasised the need for a nodal energy conservation organisation.

As a result, the Department of Power (which became an independent ministry in 1992) was designated as the nodal energy conservation organisation: Its recommendations would be binding on all central and state government agencies as well as on other specified public authorities. Yet, this institutional arrangement was replaced in 1989 with the creation of an Energy Management Centre, a body under the Department of Power. The 1990s largely focused on improving economic efficiency in the energy sector and much less attention was paid to improving usage efficiency. Measures taken at this time were more symbolic than effective.

In 2001, an Energy Conservation Act was passed. It provided energy conservation norms and required a range of designated consumers to adhere to them. Though the Act does not differ much in form and content from the 1988 Energy Conservation Bill, its notable difference is that it facilitated the creation of a new administrative body. Under the provisions of the Act, a Bureau of Energy Efficiency (BEE) was indeed created in 2002 to implement this very Act.

During the past four decades, energy efficiency as a concept, strategy and practice has evolved and transformed. There have been at least four key shifts. Firstly, there has been a shift in language from "energy conservation" to "energy efficiency". Though the two phrases are often used as synonyms, energy conservation covers any behaviour that results in a reduction in energy consumption, while energy efficiency typically implies the use of technology to reduce energy intensity. In the Indian context, energy conservation was used in a wider sense that included substituting costly imported energy with cheaper energy, harnessing non-conventional energy resources and substituting oil with coal. As it emerged in the 1970s, energy conservation was clearly a strategy for addressing the problem presented by the Oil Crisis.

In recent years, energy efficiency has become a strategy to reduce the energy intensity of production through the use of new technologies.[46]

Secondly, there has been a shift in focus away from fossil fuels to electricity demand and consumption. Thirdly, there has been a shift in the drivers of change. In the initial period, the key driver for energy conservation was energy scarcity, which has continued to be a driver so far. In 1990s, however, achieving economic efficiency by reducing the cost of production became an additional driver. In the last decade, climate mitigation has become the third driver. Finally, there has been an institutional shift from ad hoc and embedded institutions to a permanent and relatively autonomous institution.

Economic development narrative

As discussed earlier, the promotion of renewable energy and energy efficiency (EE) in India predates the discourse on climate change by many years. The origins were rooted in energy security concerns rather than the perceived need for mitigation action, and unlike the case in developed countries where RE is a substitute for conventional forms, in India it remains a supplementary source.[47] As the climate dialogue evolved on the ground, however, RE and EE received some amount of indirect attention and influence from other elements engaged in the form of the Clean Development Mechanism (CDM) and later the RPO. As the debate matured, and the government's stance on mitigation action shifted from one of defensiveness to action, RE and EE began to gain some attention as a strategic asset for climate mitigation. The co-benefits narrative particularly has allowed RE to creep into the national interest and awareness.[48]

Climate change narrative

Within the industry, the climate perspective was brought in during COP8 in New Delhi in 2002, when the Confederation of Indian Industries recognised the benefits which the Clean Development Mechanism could provide and pushed government negotiators to adopt it. As the climate debate intensified in India, in the late 2000s, and the stance on the country´s role in global mitigation efforts changed, RE was viewed as a sector that could contribute to the national strategy. The 12th National Five-year Plan, particularly, provides a co-benefits assessment framework towards this sector in which carbon reductions are strongly featured. Energy security considerations have been a constant thread with regard to the establishment and evolution of the RE sector in India. Over time, though, other considerations, particularly those of industrial development and climate change mitigation, have also become part of the sectoral narrative, driving policy support for the sector, and the actor mix has diversified significantly, with some changes in influence as new policy elements have been introduced

Key trends in the transition

High return, low attention, and slow implementation regarding energy efficiency

India says it is undertaking a thorough transition to low-carbon electricity as a response to a range of competing priorities and constraints. It seems the country has made a smart choice for energy policy by focusing on a two-way approach – stepping up renewable energy and energy efficiency initiatives. Enhanced energy efficiency is expected to partly avoid the demand for additional generation capacity, while much of the remaining demand is expected to be met through renewable energy. Both approaches have equal potential to lead the Indian electricity system on a low-carbon development pathway as well as ensure much needed energy security. Considering their equal potential and complementarity, both the approaches merit equal and simultaneous attention.

India's ambitious targets to achieve 175 GW of RE capacity by 2022 and 40 per cent of cumulative generation capacity from non-fossil fuel-based energy resources by 2030 have got some attention in public and in the policy discourse. However, India had an equally promising goal for EE enhancement and sought to avoid capacity addition of 19,598 MW by 2014-15. In the INDC, it says it has avoided capacity addition of about 10,000 MW, between 2005 and 2012.[49] If we factor in low PLF of RE generation plants, this achievement on EE translates into about 26 GW of RE installed capacity, which was higher than RE deployment in 2012.

If India has achieved its 2015 target (evaluation is still due and being commissioned by BEE), the result would be equal to more than 50 GW of RE installed capacity, again higher than RE deployment until then. Though there is no updated target for EE, ongoing and proposed initiatives will have much higher gains and thus reduce the need for energy, matching with India's RE aspirations. First, India's renewable energy strategy, following a top-down approach of grid-connected generation, is easier to implement than the energy efficiency strategy that requires action on the part of consumers.

Second, the presence of concentrated interests, including few manufacturers, project developers and generators, facilitates expedited implementation in the renewable sector as opposed to energy efficiency where the interests are diffused across utilities and a large number of consumers. Entry of big business conglomerates, such as Tata and Reliance, into manufacturing has further strengthened the lobby for renewable energy.

Third, the institutional architecture for renewable energy, including an independent ministry at the centre and dedicated agencies at the state level, is much stronger than the institutional architecture for energy efficiency that includes a 'bureau' at the centre and state-level "designated" agencies with other (primary and often competing) policy priorities.

Fourth, India seems to perceive a larger developmental benefit from renewable energy, including employment opportunities, regional economic growth and energy access for the poor. Consequently, the political will to promote renewable energy is stronger than energy efficiency promotion.

Finally, while there seems to be an emerging global governance framework for renewable energy, with several recent initiatives, including the International Renewable Energy Agency, energy efficiency lacks a global governance framework that could put political emphasis on the issue.

While political will has been neither always strong nor always present, India has gained significant experience in designing and implementing energy efficiency policies. Since its formation, the BEE has prepared an Action Plan, giving a boost on almost all fronts of energy efficiency, and has taken several initiatives in keeping with the Energy Conservation Act, 2001. However, not all initiatives were implemented with equal vigour and outcomes vary across consumer sectors. Although the initiatives taken by the BEE are commendable, owing to political sensitivity, implementation is slower in sectors where energy saving potential is higher.

Based on conservative estimations, agriculture has a potential to save 30 per cent of its sectoral consumption and to contribute 36 per cent to national potential, while the domestic sector has a potential of 20 per cent savings on sectoral consumption, amounting to 32 per cent of the national potential.[50] Combining both the dimensions, the agriculture and domestic sectors offer a higher collective return in terms of energy savings and, thus, need to be prioritised.[51] Yet, BEE actions represent a different trend prioritising the industrial sector, while the agricultural sector is almost ignored.

Firstly, this trend of focusing more attention on RE instead of EE may further be related to the relatively low incentives perceived by individual consumers, despite the fact that the overall collective return and incentives are high in the energy sector. Obviously, implementation is higher when individual incentives are higher. Secondly, in the absence of an effective incentive structure, upfront investment for energy efficiency is often unaffordable for most agricultural and domestic consumers. Thirdly, the low level of public awareness about the benefits of energy efficiency has contributed to low willingness and acceptance. Fourthly, while limited numbers of industrial and large commercial consumers are easy to target, the BEE finds it difficult to reach out to geographically dispersed agricultural and domestic consumers. Finally, the technocratic orientation of the Indian electricity industry has led to an overemphasis on technology-based solutions. Yet, the promotion of energy efficiency, particularly in the agricultural and domestic sectors, requires governance innovations and behavioural changes, along with technology.[52]

Mega-scale generation bias

During the last three decades, India has carried out many experiments with RE deployment. The first set of initiatives focused on small-scale deployment. These included standalone household systems and off-grid community electricity programmes. Some of these projects have not only brought electricity into areas where it would have taken much longer to establish a grid-connection, but also contributed to its international reputation. Given the large size and dispersed settlement in the country, small-scale deployment of RE still holds high potential. Moreover, as the utilities are not in a position to meet the peak consumption of latent demand, small-scale RE provides a good opportunity to diversify the peak demand.

However, there is a sudden switch to large-scale RE deployment, as reflected in government policies. Both the central government and state governments are keen on promoting MW-scale deployment. In the process, small-scale deployment has been neglected. For example, while India is well on track to achieve 60 GW of grid-scale solar installed capacity by 2022, its target for 40 GW of solar rooftop capacity is already faltering.[53] A possible explanation for this bias could be the fact that governments see large projects as having greater economic benefit. Traditionally, the Indian system has a bias for large-scale infrastructure projects, which have greater public visibility and offer opportunities for rent-seeking.

Finally, the bias has been fuelled by the assumption that large deployments will bring in scale in the sector and bring down the cost. While scale is important to bring down the costs, what is required is scale in demand for equipment. This can also be achieved through expedited small-scale deployments. Another assumption is that small projects have higher per unit cost, which is not the case regarding India's mostly favoured RE technology, solar. In fact, off-grid projects and roof-top solar reduce the cost by mitigating the need to invest in evacuation and transmission.

Mapping agencies and actors in India's energy transition

This sector will identify the actors and agents who facilitate and/or obstruct the transition. What are their underlying reasoning and vested interests?

Role of central and state governments

These actors include several public institutions created to perform specific mandates related to clean energy development. For renewable energy development, the state has established an independent ministry (MNRE) and a public agency, i.e. Indian Renewable Energy Development Agency (IREDA), at national level, and State Renewable Development Agencies (SREDAs) at subnational level to implement mandates forwarded by national agencies. Similarly, for energy efficiency, the state has set up an independent agency (BEE) at the national level to assist the government in developing policies and strategies and coordinate with designated consumers and agencies.

However, there is no dedicated agency at the subnational level to implement BEE's mandates, which is as yet being done by the designated agencies. In the presence of these public agencies, a set of non-state actors has emerged and gained strength, primarily for two reasons. First, awareness has grown that the elite institutions at the national and subnational level remain sound and functional, but they have less control over their field agents.[54] As a consequence, national agencies in India are less confident that national policies will be implemented effectively at the local level. In response, the state has taken up a 'market plus' approach towards clean energy development: While clean energy is promoted on market principles, the state has been intensively involved in seeking to build the players and rules that enable these market mechanisms to operate.[55]

Second, the private actors who have come forward to take up new responsibilities within the energy sector have seen this development as a business opportunity. This has further been facilitated by India's shift towards a partnership model, pairing the public sector with the private sector, for energy development.

Role of non-state actors in promoting RE

In an era of new governance structures emerging around the globe, and seeking to achieve the multiple objectives of energy security, climate mitigation, energy poverty alleviation and reliable energy for growth, a range of new institutions and actors has been created and/or emerged to take over responsibility. These new, primarily non-state actors in energy governance, are not confined to lobbying and advising governments on policy-making and implementation. Rather, they seek a greater role in the clean energy transition by substantive engagement and setting rules for clean energy development.

A credible, stable, adaptive and inclusive governance system requires the active involvement of these non-state actors.[56] This section of the paper discusses who these new actors are, their emergence and engagement in energy governance, what level of authority they hold and to whom they are accountable. These non-state actors (NSAs) include manufacturers, project developers, financing institutions, proactive consumer groups and a handful of non-government organisations (NGOs). While the manufacturers, project developers and financing institutions have been encouraged (by the state) to take up the business opportunity in clean energy development, the proactive consumers are the direct clients of clean energy and energy NGOs which have been trying to participate in the process.

Though the non-state actors are capable of setting norms, they do not have the authority to do so. The non-state actors can certainly gain the authority through continued engagement in the process over time and across contexts. A lack of authority in some of the NSAs is partly an outcome of the absence of a proper accountability mechanism. In a pluralised governance system, like the one in the Indian energy sector, the accountability and legitimacy of the actors is the key to the sustainability of the governance system.

However, as with many other countries,[57] Indian energy governance is byzantine and fragmented. The sector is controlled by two independent ministries, the Ministry of Power (MoP) and the MNRE[58] and a number of state-owned enterprises engaged in everything from generation to financing to marketing of energy. This not only impairs coordination among these state agencies, but also weakens their capability to hold the non-state actors accountable.

Further, the lack of a proper monitoring mechanism provides the opportunity for perverse incentives. For example, a study by the Centre for Science and Environment revealed how a major renewable energy conglomerate has subverted the rules to acquire a stake in the solar incentive scheme that is much larger than legally allowed.[59] Similarly, the Energy Service Companies (ESCOs) are keen for businesses that have a secure return without any sort of risk. Consequently, they end up conducting only energy audits in most cases rather than executing and investing in actual implementation.

The emergent governance model is a complex partnership of multiple agencies with varying capacity and responsibilities. For example, in the case of an energy efficiency project, the rules/norms are set by the BEE, implementation is done by the ESCOs, equipment provided by the manufacturer, funding is sought from a financer and above all, it requires the consent/willingness of the consumer. The complexity is further aggravated by the fact that there is neither any mechanism for risk sharing nor are any of the partners willing to take the risk. Moreover, clean energy governance lacks an adequate mechanism to ensure accountability among the partners, an effective monitoring and evaluation mechanism, and proper coordination among the partners.

Institutional barriers and other externalities

Transition potential and state capacities

Despite three decades of experience and evolution of institutions and actors, India's energy transition is ailed by many institutional barriers with bureaucratic interference. These institutional barriers, subsequently, have hampered the implementation of well-formulated and well-designed policies, and are thus creating a gap between rhetoric and action.

Subnational variations and lack of cooperation

The potential for transition, especially on RE deployment, varies across states and is often not synchronous with the capacity of the state. States which have a large amount of RE resources often do not have the need for the additional energy produced. This is quite evident in the case of states like Gujarat and Rajasthan, where solar deployment has slowed down after the initial hype.

Surplus power scenario

A state like Madhya Pradesh is promoting RE on a large scale, but without much demand for the power. The state already has a surplus capacity of 20 per cent, which is lying stranded.[60] While the neighbouring states do have a requirement for power, the high costs of the RE tariff and the embedded preferential tariff (at least existing so far) has acted as a barrier to interstate power trade. Most of the state governments are not keen to pay a premium price for industrial development in their neighbouring states, whom they often perceive as competitors.

Financial ill-health of DISCOMs

The situation is further complicated by the financial distress faced by the distribution companies. Most of the DISCOMS in the country are running at a loss, as they fail in effective revenue realisation and are not able to stop power pilferage, mainly due to political reasons. This has resulted in empty coffers for the utilities who then fail to upgrade their distribution system which is essential for effectively managing renewable electricity in the distribution network.

Regulatory ineffectiveness

India's RPO and REC programme have failed to push the selling of RE power. This is partly explained by the ineffectiveness of regulatory institutions and also due to the financial ill-health of the utilities as previously discussed. While the existing policy instruments for RE promotion are being executed by the sector regulators, there is a need for their proactive engagement in monitoring, evaluation and impact assessment. Since the policies are not self-implementing, the independent electricity regulators would emerge as key facilitators (or blockers). The regulators have crucial roles to play in implementing these policies and would affect the pace and pattern of the transition from a fossil fuel-driven electricity sector towards an RE based-electricity sector.[61]

Conclusion

It seems that the Indian government´s position has changed over recent years, from a static interest for coal-based energy towards the pursuit of a clean energy transformation. Three recent developments illustrate it. Firstly, India added more RE generation capacity than conventional generation capacity in 2016/17: 14.41 GW of newly added RE in this period accounted for 58 per cent of the overall capacity addition.[62] Secondly, the RE tariffs have now dropped to a level that is cost-competitive with coal-fired generation. At 0.04 US dollars, the solar tariff is below, and the wind tariff at 0.06 US dollars is comparable to, the average National Thermal Power Corporation (NTPC) coal plant tariff, which is 0.05 US dollars.[63] Thirdly, recently, India outpaced the US to be the second most attractive country for RE investments, according to the Ernst & Young (EY) Renewable Energy Country Attractiveness Index.[64] These developments imply India´s change of direction towards becoming a global leader of the energy transition.

Simultaneously, there have been several substantive developments, contributing to a social and political mandate for greater renewable energy deployment. While climate action is at the centre of India's global narrative, energy security and economic development dominate the domestic narrative. On a positive development, some Indian states seem to be aligning with the domestic narrative, though with varying objectives and approaches. While states like Madhya Pradesh and Andhra Pradesh have added RE to their industrial thrust, building on the economic development narrative, states like Odisha have taken up renewable energy to bridge their energy access gap. As seen in the past, state policies and actions have been crucial and will remain important in pushing for the national energy transition aspirations.

Similarly, there is an emerging political mandate for RE. Many legislators (Members of State Legislative Assemblies and the Parliament) across party lines have taken up renewable energy installation as a key part of their local area development. During recent State Assembly elections, renewable energy development featured in the manifestos of many political parties. Government departments are being encouraged to adopt renewable energy deployment in their activities. It is allowed as a legitimate item under corporate social responsibility spending,[65] a mandatory social spending for India-based corporate entities. All these developments have fostered the expansion of renewable energy technologies and solutions.

While the initial phase of renewable energy development was induced by short-term winners, seeking to gain from state incentives, the current phase has seen the emergence of actors genuinely dealing with the advantages and co-benefits of a clean energy pathway. A high-level policy signal is in place, the political mandate is shaping up and implementing actors are proliferating. Now the intermediaries need to be strengthened for an effective orchestration and for creating social legitimacy for the Indian energy transformation.

To meet its energy transition aspirations, India needs many more proactive, premeditated and creative actions to be co-ordinated by the MNRE. It needs to ensure that the proposed renewable capacity transforms the consumable energy mix. To do so, India must balance complementing generation capacities rather than pushing for preferred technologies. In addition, given the unpredictability of RE generation, it is essential to include storage capacity development as a policy priority. Finally, the state must facilitate a domestic coalition for the energy transformation, by bundling policies and aligning interests.

Notes

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10 400 Indian rupees a tonne converted at current exchange of 64.64 Indian rupees to the US dollar.

11 http://www.deccanchronicle.com/lifestyle/viral-and-trending/080417/the-gutsy-coal-tax-raises-a-question.html.

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Imprint

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