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Governing clean energy transitions in China and India

A comparative political economy analysis

Karoliina Isoaho,¹ Alexandra Goritz,² and Nicolai Schulz³

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In partnership with



Abstract: China and India will have to radically transform their electric power systems in order to decouple economic growth from unsustainable resource consumption. While the majority of transition literature has focused on the diverse socio-technical factors that could enable such a transformation, more recently scholars have called for a deeper analysis of political economy factors. This paper contributes to this approach by studying how a ruling coalition's ability and willingness to promote a clean energy transition is shaped by societal pressures, vested interests, and its power and cohesiveness. In doing so, we identify central drivers and barriers to a clean energy transition in China and India.

Keywords: green growth, state capacity, political settlement, ruling coalition survival, renewable energy policy, sub-national variation

JEL classification: Q42, Q55, Q56, O44

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1 Introduction

Among the fastest growing economies worldwide, China and India face a tremendous dilemma in addressing their developmental needs. On the one hand, there is an imperative need to keep pushing economic and social development to respond to demands in poverty reduction, energy access, and urbanization. On the other hand, the development pathways of both countries have been highly coupled to fossil fuel use, making them major global greenhouse gas (GHG) emitters as a result. In light of the escalating growth in energy demand and their growing emissions, the two Asian giants are today facing increasing domestic and international pressure to reconsider the conventional path of encouraging economic development at the expense of the environment and global climate.

Renewable energy technologies (RETs) offer a solution for this dilemma. Decoupling economic growth from unsustainable resource consumption through the development and deployment of RETs would enable the transition to a clean energy economy, helping to reduce China and India's GHG emissions while allowing societal and economic development (Altenburg and Pegels 2012). The rapid innovation and fall of prices in the RET sector indicates that a shift to RETs is becoming both economically and technologically more feasible (World Energy Council 2013). Yet, in energy transition literature broad consensus exists round the view that for a full transition to RETs, an energy system would have to go through radical and 'deep structural' changes (Geels 2011: 24). While the vast majority of transition literature has looked at the characteristics and development of socio-technical aspects in transitions (Geels and Schot 2007; Smith et al. 2005), more recently some scholars have been increasingly emphasizing the importance of political structures and political economy factors (Fouquet 2010; Meadowcroft 2009, 2011), whereas others have revived the analysis of how regional variation and geographical structures influence energy transition (IEA 2015b; Jiusto 2009; Smith et al. 2005). In this paper, we aim to contribute particularly to the growing political economy literature. We do this by looking at how a ruling coalition's ability and willingness to promote a clean energy transition is shaped by societal pressures, vested interests, and its power and cohesiveness. Moreover, we study how these aspects interplay with other transition factors, and how these interactions vary between sub-national units. In doing so, we seek to identify and analyse the key drivers and barriers for the promotion of RETs in the electric power systems of China and India.

The remainder of the paper is divided into four parts. First, we briefly discuss the theoretical underpinnings of the study. Next, we analyse and compare the drivers and barriers of clean energy transition in China and India. We conclude by summarizing our findings and presenting an outlook for further research.

2 Theoretical underpinnings

A clean energy transition is characterized by a shift from a fossil fuel energy regime (pollution-intensive) to a cleaner one.¹ In this paper, we consider a clean energy transition occurring if the share of renewable energy in the power mix is growing faster than the shares of the other energy

¹ In this paper, we consider a clean energy transition in terms of renewable energy technologies (RETs). We acknowledge that energy efficiency, nuclear power, and carbon capture and storage (CCS) technologies play a significant part in the debates around clean energy transition, but we perceive RET as more radical. We define RETs according to Martinot et al. as 'modern technologies based on solar, wind, biomass, geothermal, and small hydropower' (2002: 310). Our focus, however, is primarily on solar and wind energy technologies.

sources. The vast majority of transition literature has aimed at explaining the processes of such shifts by analysing socio-technical and techno-economic means through which a transition could occur (Geels and Schot 2007). As part of such analyses a range of models and approaches have been put forward, such as the ‘multi-level perspective’ (MLP) as well as the ‘transition management’ and ‘strategic niche management’ approaches (Geels and Schot 2007; Rotmans and Loorbach 2009; Smith et al. 2005). Of these, the MLP has received the most attention. According to this approach, technological transformation occurs as an outcome of linkages between developments at three levels. These are ‘niche’ (micro level radical innovation and experimentation), ‘regime’ (dominant practices, rules, and technologies), and ‘landscape’ (social values, political beliefs, world views, and the built environment in institutions and marketplace) (Geels and Schot 2007; Rip and Kemp 1998).

Recently, transition scholars are increasingly incorporating political economy analyses in their transition studies (Baker et al. 2014; Goldthau and Sovacool 2012). The rationale for this is the emerging view that socio-technical transition literature has thus far not adequately taken into account important political economy factors that influence the interest for and governance of clean energy transitions (Fouquet 2010; Kern 2011; Meadowcroft 2009, 2011; Voß and Bornemann 2011). Simultaneously, more geography-based literature on transitions has emerged. These studies stress the importance of geographic context and spatial variations, arguing that the quality and location of energy resources interplay with social and political economy factors in transition (Justo 2009; Smits 2015). In other words, the significance of socio-technical and political economy factors varies across regions and is shaped by specific geographic circumstances (Bridge et al. 2013; Curtin 2015).

In this paper, while being attentive to the geographical and spatial context in which transition occurs, we align particularly with the more political economy-oriented literature. The key political economy variable in our analysis of the drivers and barriers of energy transition in China and India is how power between competing interest groups in society is structured and how it changes, in accordance with the ‘political survival of ruling elites’ approach of Whitfield et al. (2015: 6) and particularly Khan’s (2011) political settlement theory. The core premise of these congeneric approaches is that ruling coalitions want to stay in power and their political survival strategies are shaped by the distribution of power in society. This produces two crude implications of what drives ruling coalitions to promote RETs and whether they are then actually capable of doing so. First, according to these theories, change towards a clean energy transition would occur if: (i) the ruling coalition faces pressure from (potentially) powerful groups in society that are negatively affected by current non-renewable energies (e.g. through pollution) or that profit from promotion of RETs. This could endanger the ruling coalition’s power and political survival—especially if such movements are allowed to gain momentum—pushing it to promote green energy transition as part of its survival strategy. Or, if: (ii) societal pressure on the ruling coalition could be less RET-specific, but rather about providing broad access to electricity. However, when this can be feasibly addressed using RETs, then these are likely to be promoted as well.

Second, according to Khan (2011), how power is distributed within and outside the ruling coalition shapes its ability to make and implement policy effectively. Generally, once decision-makers in a ruling coalition have decided to implement a certain policy, they will be more able to do so the less fragmented the coalition is and the less external opposition it faces. This is because weak and fragmented ruling coalitions are more likely to have to allow policy capture in order to hold together factions within the ruling coalition and to co-opt other social organizations in society as a survival strategy (Migdal 1988). Logically then, while certain distributions of power can strengthen a government’s policy implementation capacity, others can act as a barrier.

Apart from having a fragmented and weak ruling coalition, a country can face a range of other power-, actor-, and interest-based barriers to energy transition. Consistent with the political settlement theory, scholars from the field of policy analysis have emphasized the importance of vested interests and veto players in the policy cycle (Tsebelis 2002). It is likely that powerful actors exist within and outside the ruling coalition who have a strong vested interest in keeping the status quo, because they profit from it (Moe 2010). Plausible examples could be operators of coal mines or plants. Vested interest, however, might be more subtle. Central power agencies (e.g. State Grid Corporation of China) might suffer considerably if power were generated and provided in a more decentralized manner. Whether within or outside the ruling coalition, such actors are likely to use their strength to veto radical energy transition and, hence, ensure that they remain strong. Vested interests do not, however, pertain to elites only. Non-elites or popular groups can also have vested interests in certain institutionalized resource distribution mechanisms (such as subsidized electricity intended for farmers in India), although these are likely to damage them as well as energy transition in the long-term. Whether such vested interests can be overcome essentially depends on the size of their power relative to that of groups favouring a clean energy transition.

Finally, the role of institutions should be emphasized. Certain institutional setups—such as the constitutionally defined federal structure of a country—are hard to change and strongly shape how conflicts and negotiations of policy-making and implementation function. Whether the central government can push sub-national governments to implement RETs, for example, is highly dependent on what federal ‘rules of the game’ structure the polity (North 1990). Some institutions, however, are more flexible and can be changed relatively easily, whether as outcome of shifting priorities or power struggles. An example would be how powers and budgets are divided to different ministerial portfolios. It might be important whether there is one powerful well-resourced lead agency or rather several under-resourced and badly co-ordinated agencies in charge of implementing clean energy policy. The next section analyses whether and how these factors matter for China and India.

3 Background

China is the second largest economy in the world, and with a population of 1.35 billion it is also the most populous country globally (World Bank 2015b). In the past 30 years, China has had an average annual growth rate of 10 per cent (World Bank 2015b); however, there has been an economic slowdown in recent years. In 2015, China’s economy grew by 6.9 per cent, its slowest rate in 25 years (Vaswani 2016). Large-scale urbanization is still ongoing in China and, although poverty rates have decreased significantly along with economic growth (Shah 2013), China still has the second largest number of poor at a global scale, with 99 million people living below US\$1.25 purchasing power parity (PPP) per day in 2012 (World Bank 2015b).

India is currently the second most populated country in the world with 1.29 billion inhabitants, representing 18 per cent of the world’s population (World Bank 2015a). Current estimates suggest that India will outgrow China and become the most populated country by 2022 (UNDESA 2015). Large parts of India’s population are, however, extremely poor: 21.3 per cent (259 million people) were living off <US\$1.90 PPP per day in 2011, representing the largest concentration of poverty in the world (World Bank 2015a). India’s great poverty issue also translates into poor energy access. In 2012, 25 per cent of India’s population, about 305 million households, did not have access to electricity (IEA 2014). Over the last 10 years (2005–14), the Indian economy has grown at an average rate of 7.7 per cent (World Bank 2015a), which has been associated with a simultaneous 15 per cent decrease in poverty (Shivakumar 2013).

Table 1 provides a comparative overview of key demographic, economic, environmental, and political variables.

Table 1: Comparison of China and India in key variables

	China	India
Demographic and economic variables		
Population size	1.36 billion (2014 est.)	1.27 billion (2014 est.)
Population growth rate	0.44% (2014 est.)	1.25% (2014 est.)
GDP (PPP)	US\$13.39 trillion (2013 est.)	US\$4.99 trillion (2013 est.)
GDP per capita (PPP)	US\$9800 (2013 est.)	US\$4000 (2013 est.)
Relative/absolute number of poor (living below US\$1.90 PPP)	11.2%/149.6 million (2010)	21.3%/259 million (2011)
State budget (expenditures)	US\$2.3 trillion (2013 est.)	US\$0.28 trillion (2013 est.)
Environmental variables		
CO ₂ emission (kilotons)	9,019,518 (2011)	2,074,345 (2011)
CO ₂ emission (metric tons per capita)	6.7 (2011)	1.7 (2011)
Electric power consumption (% kilowatt-hour)	3475 (2012)	744 (2012)
Renewable energy consumption without large hydropower (% of total)	2% (2014)	2.2% (2014)
Coal consumption (% of total)	66% (2014)	56.5% (2014)
Intended nationally determined contributions (INDCs)	<ul style="list-style-type: none"> To reduce carbon intensity by 60–65% by 2030 below 2005 levels To increase the share of non-fossil primary energy to 20% To peak carbon emissions by around 2030 and earlier if possible 	<ul style="list-style-type: none"> To reduce the emissions intensity of its GDP by 33–35% by 2030 from 2005 levels To increase cumulative electric power installed capacity from non-fossil fuel energy resources to 40% by 2030 To create an additional (cumulative) carbon sink of 2.5–3 GtCO₂e through additional forest and tree cover by 2030
Investments in RE	US\$83.3 billion (2014)	US\$7.4 billion (2014)
Projections of GHG emissions with current policies	<ul style="list-style-type: none"> GHG emission level in 2020: 12.2–12.6 GtCO₂e; in 2030: 13.8–14.4 GtCO₂e 22% increase above 2010 levels by 2020 and 33–44% by 2030 	<ul style="list-style-type: none"> GHG emission level in 2020: (excluding LULUCF) 3.5 GtCO₂e; in 2030: 5.0–5.1 GtCO₂e 40% increase in emissions from 2010 levels by 2020; and a doubling of 2010 levels by 2030
Political variables		
Regime type	Autocracy	Democracy
State type	Communist unitary state	Federal state
Number of parties	Chinese Communist Party (CCP) and 8 nominally independent small parties controlled by the CCP)	6 national, 49 state, and 1706 unrecognized parties registered

Source: CAT (2015a, b), CIA (2015), FS-UNEP (2015), World Bank (2015a), and World Resources Institute (2015).

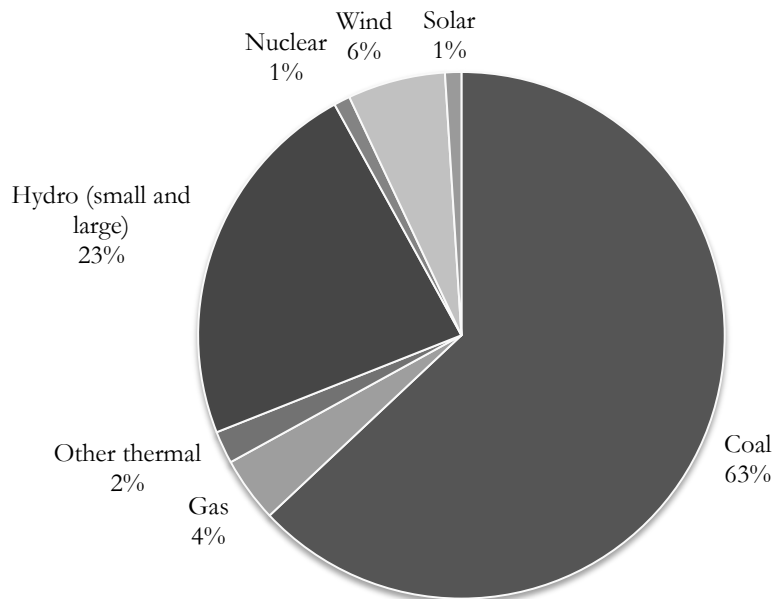
The following section analyses political economy drivers and barriers for a clean energy transition in China and India. The data used for the qualitative analysis is grounded in primary and secondary sources. We draw upon existing literature, policy documents, government reports, newspaper articles, and databases from institutions such as the World Bank, International Energy Agency (IEA), International Renewable Energy Agency (IRENA), and Climate Action Tracker (CAT).

4 Analysis of drivers and barriers

4.1 Drivers in China

China's rapid economic development has been in close correlation with fossil fuel energy consumption. In 2014, coal accounted for 66 per cent of total energy consumption, followed by oil (18 per cent), hydroelectricity (8 per cent), natural gas (6 per cent), and nuclear power (1 per cent). Non-hydropower renewable energy only accounted for 2 per cent of the energy mix (BP 2015).² Figure 1 illustrates total installed capacity in 2013.

Figure 1: Total installed capacity in 2013 (1247 GW)



Source: Authors' depiction, based on Cornot-Gandolphe (2014).

Yet, this rather bleak picture painted by the energy mix is contrasted with recent developments to push renewable energy in installed capacity. For the first time, China's new renewable power capacity surpassed new fossil and nuclear capacity in 2013, and the same was achieved in the following year (REN21 2015). In 2014, China also emerged as the world leader in clean energy investment with US\$83.3 billion invested (FS-UNEP 2015). Strikingly, China's GHG emissions stagnated for the first time in a decade (IEA 2015a). First results from 2015 estimate that coal consumption fell by 5 per cent (Greenpeace 2014; Magill 2016). Moreover, Chinese authorities have estimated that the total cumulative installed wind capacity would have reached 145 GW and solar 38 GW by the end of 2015 (Chan 2016; Hu 2015).

These developments indicate a shift towards increasingly promoting RET policies. Indeed, the government has introduced a mix of regulatory mandates, financial support, and market-based mechanisms to promote renewable energy (Carbaugh and St Brown 2012). Wind and solar power have been strongly supported by long-term feed-in tariffs (Dai 2015; Spratt et al. 2014). Although there was limited policy support from the State Council of the People's Republic of

² China counts large- and medium-scale hydropower projects as renewable or non-fossil fuel energy and dams with an individual capacity of <50 MW as small-scale hydropower projects (Wang and Tseng 2012). In this paper, we do not consider large-scale hydroelectricity as renewable energy because of their negative effects on sustainability.

China for small hydropower (SHP) projects during the first decade of the millennium, in recent years state policies and fiscal support has been provided to encourage private investment in SHP projects and the industry’s development by locals (Heng and Xiaobo 2011; Wang and Tseng 2012). Given its huge potential as a source of grid-connected electric power, the State Council has made biomass power projects eligible for a feed-in tariff and introduced tax breaks (Campbell 2014; IRENA 2014a).

China has demonstrated that these policies can be translated into concrete achievements. The 11th Five-Year Plan’s (FYP) target of having non-fossil fuel energies (i.e. renewables and nuclear) account for 10 per cent of total primary energy consumption was barely missed, achieving 9.6 per cent (Liu 2013; NEA 2012). Moreover, China is estimated to be on track meeting its 2020 targets from the 12th FYP (CAT 2015a). The target of installing 30 GW in wind capacity, for example, has been achieved long ago, with installed wind capacity already amounting to 89–91 GW in 2013 (Campbell 2014; Schoen 2013). In 2013, China had installed 12 GW of solar photovoltaic (PV) projects, which largely surpassed the official goal for solar power of 1.8 GW by 2020 (FS-UNEP 2015). In December 2015, the Chinese energy authorities announced that no new coal mines would be approved for the next three years, as well as the closing of 1000 coal mines in an attempt to reduce the burden of air pollution (Greenpeace 2016). Hence, overall, China has been able to implement its ambitious clean energy policies relatively well (Curtin 2015) (Figures 2 and 3).

Figure 2: Wind installed capacity by province in 2014



Source: Chu (2015).

Figure 3: Solar installed capacity by province in 2014



Source: Chu (2015).

Societal pressures: pollution

This increasing ambition and capacity to implement REIT policy can be partly explained by changes in societal pressure and elite priority resulting from increasing concern over air pollution and environmental degradation. China's energy consumption is estimated to grow by 60 per cent by 2035, which has made diversifying energy supply fundamental to the country's energy security (BP 2015). At the same time, as a result of its fossil fuel-intensive development, China has faced serious pollution-based environmental and health problems. The most developed and populated areas, such as city clusters in the Beijing–Tianjin–Hebei region, have the highest pollution levels (Zhang and Cao 2015), but other areas are highly impacted as well: in 2012 <1 per cent of the 500 largest Chinese cities met the World Health Organization's air quality standards (Zhang and Crooks 2012). Recent studies estimate that pollution is causing the death of 1.6 million people per year (Rohde and Muller 2015).

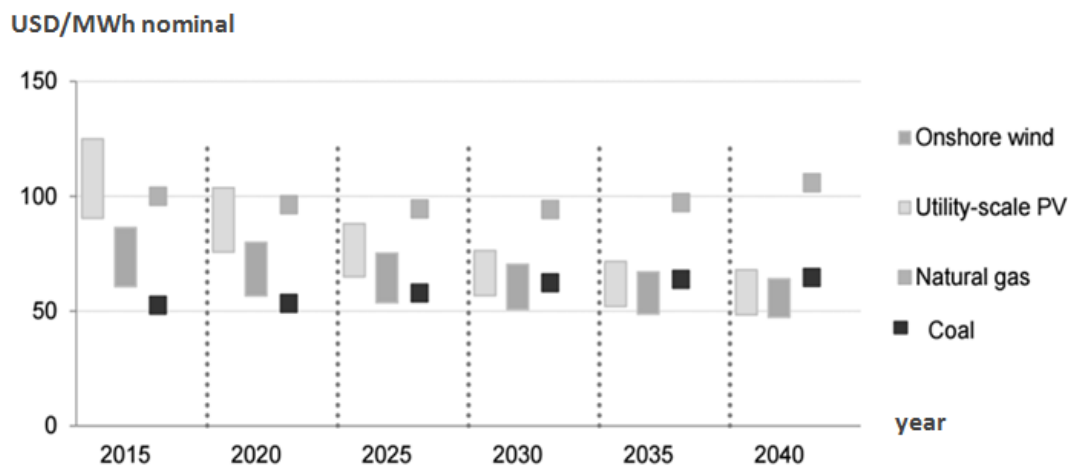
The atmosphere surrounding pollution started becoming more volatile in the mid-2000s, with increasing complaints and protest over environmental degradation. One of the biggest movements took place in 2007, when Chinese residents in Xiamen city forced the relocation of a chemical plant that had been announced to be built in the Fujian province (Tong and Lei 2014). Moreover, it has been found that letters sent to the Chinese Communist Party (CCP) complaining about environmental problems increased from 100,000 to 400,000 between 1997 and 2002, and catapulted to over 600,000 a year in 2006 (Jing 2010). This gives indications of the rising societal pressure on the ruling coalition. The leadership now acknowledges that, if not adequately addressed, societal pressure on emission reduction could have destabilizing effects on the political regime. Hence, reducing emissions and addressing energy challenges have emerged as an increasingly important part of the Chinese ruling coalition's political survival strategy (Chen 2012; Stensdal 2012; Yuge and Sandhu 2014).

Evidence from China's renewable policy formulation further supports this argument. A clear shift in energy policy took place in 2005, with the establishment of the renewable energy law (Chen 2012). It developed pioneering measures ranging from targets in installed capacity to

direct financial support policies. Since then, China has developed comprehensive renewable energy policies and included renewable energy targets in its FYPs (Appendix Table A1). Interestingly, the 12th FYP set the objective to reorient China’s economic growth to make it more balanced and sustainable. It acknowledged that reorientation needs to take place even if it necessitates adapting to slower growth rates compared with those the country has got used to in the previous decade. It also clearly identified new energy³ as one of the key ‘emerging strategic industries’ (Lewis 2011; Wang 2014).

This changing interest has also been demonstrated in China’s cleaner growth discourse at international level, most recently through the United States–China Joint Agreement and the Intended Nationally Determined Contributions (INDCs) for the Paris Climate Summit (COP21) (Appendix Table A1). As part of the former, China announced new policies to tackle fossil fuel use, such as a cap on coal consumption at 4.2 billion tonnes until 2020, and a nationwide emissions-trading scheme to reduce the price gap between coal and clean energy sources (White House 2014, 2015). In the INDCs China added, inter alia, a target to make carbon dioxide (CO₂) emissions peak by 2030 or earlier (CAT 2015a). During COP21, China released a national policy recommendation to further reduce coal-fired generation at the same time as Beijing city government issued a red pollution alert, the most serious level as per air quality index, for the first time ever (Phillips 2015). Hence, these changes suggest a shifting elite preference from purely high economic growth towards incorporating environmental concerns in the ruling coalition’s strategy to stay in power. Of course, RET development has also been incentivized by decreasing costs (Liebreich 2015). In China, both small and large hydropower projects are the most competitive energy technologies, followed by biomass, wind power, and solar PV (IRENA 2014b). Owing to the abundance of coal and rather low costs required to install conventional power plants, the RET industry still requires some support to compete with fossil fuel technologies (Figure 4).

Figure 4: Levelized cost of electricity in China (US\$/MWh, nominal)



Note: Capacity factors are onshore wind, 25–35 per cent, and solar photovoltaic (PV), 10–15 per cent.

Source: Liebreich (2015).

³ In the 12th FYP, new energy is defined as hydro, nuclear, solar, and wind.

Increasing institutional and political capacity

China's rapid RET development has been driven by changes that have taken place within the bureaucratic and institutional structure. The new millennium saw a shift to recentralize the Chinese energy management at the top level. As of 2014, however, there has been a swing back to decentralize administration in implementation (Zhao 2014). It is interesting to note that though the institutional restructuring started at the end of the 1990s, the biggest changes occurred in parallel to the period when the problem of air pollution started to get more serious.

As Appendix Figure A1 illustrates, the State Council (i.e. the central government) sets the broad directions for RET policy development (Chen 2012; Liu 2011), whereas the ministries and their departments are responsible for policy drafting and formulation. Given that there are several administrative bodies under the State Council that have purview over clean energy and climate-related policies (Andrews-Speed 2012; Zhang et al. 2013), the National Leading Group on Climate Change Energy Conservation and Emissions Reduction (NLGACCERCER) was established in 2007 to act as an advisory and co-ordinating body in energy-related areas (Bao and Gordon 2013; Ong 2011). Its members are the leaders of the State Council and 20 key ministries.

Since then, decision-making with regard to energy and climate policy has been further streamlined and reinforced via institutional reforms. First, in 2008, two incremental steps were taken to grant the National Development and Reform Commission (NDRC)—the highest rank ministry in charge of China's macroeconomic and social development—more power in the fields of energy, climate, and carbon reduction policy. In a first step, the National Energy Administration (NEA) was established under the NDRC to function as the agency responsible for RET formulation and implementation at the national level. The NLGACCERCER's climate change department was placed under the NDRC as well, thus assigning the NDRC a central role in climate policy formulation in addition to addressing energy questions.

Second, the institutional rearrangement culminated in 2010 in the creation of the National Energy Commission (NEC). The NEC functions as a 'super ministry', and is in charge of drafting the national energy development strategy. Its role is to enhance regulatory efficiency and strengthen energy decision-making among high-level entities (Bao and Gordon 2013; Tsang and Kolk 2010; Williams 2014). Locating clean energy and climate change policy within the most influential agencies at the top level can be seen as an attempt to avoid the struggles and buy-ins that often emerge when clean energy policy drafting is dealt with within weaker ministries. However, given that the institutional reforms brought about many new agencies with purview and interest over energy questions, it is important to note that these bodies at the central level—including within the NDRC—are also often competing for authorship (Zhang et al. 2013).

4.2 Barriers in China

Despite the increasing institutional capacity, the implementation of central policies, especially in the case of energy, remains highly complex. This is, in part, visible in the political and regulatory failures that China has faced in RET development. For example, power generation from solar and wind has been significantly curtailed because of a lack of sufficient grid infrastructure, leaving a large share of their power capacity non-grid connected (IRENA-GWEC 2013).

Geographic variation in energy resources and air pollution levels can result in differences in efforts across provinces to curb emissions from coal. That is, most coal reserves and the majority of currently operating plants are located in the north and north-east of China, and these regions also have the most polluted cities (Cornot-Gandolphe 2014). In these provinces, there is a need to respond to the energy and electricity demands while simultaneously improving air quality in

their cities. There are indications of this kind of regional societal pressure: the most coal-intensive provinces have set absolute coal consumption targets in order to address air quality issues. The cities of Beijing, Hebei, Tianjin, Shandong, Chongqing, and Shaanxi have pledged to reduce their coal use by 2017 (Greenpeace 2014). Not surprisingly, regionally differing societal pressure has been visible in the recent action of Chinese authorities: although senior authorities vowed to shut down coal plants in the Inner Mongolia region—the hub of coal production in northern China—because of social unrest over pollution (*The Japanese Times* 2015), they also announced shifting to build more power plants in inland provinces that are more underdeveloped (Clifford 2015).

Overall, projections of China's energy consumption and demand indicate that fossil fuels will maintain their key role in China's energy mix in the coming decades. Policy evidence supports this argument: the State Council has put significant effort towards accelerating the development of 'clean coal' and other fossil fuels, such as gasification and carbon capture and storage, natural gas, and nuclear energy (NDRC 2013). Hence, rather than moving away from coal completely, there are attempts to reform the coal industry to a 'cleaner' direction and to rely more heavily on natural gas in the future. These developments seem to indicate that China's energy strategy is still in many ways guided by the requirements of actors and agencies that promote conventional energy, rather than putting more effort into RETs.

Therefore, we next analyse potential factors that might explain why the transition to clean energy power systems has not been advancing as fast as it could have. We argue that these factors consist largely of political and institutional barriers at different levels of government.

Central level

One of the key political barriers to a clean energy transition in China is that actors with strong vested interests in the power sector have significant political influence at the top levels of the CCP. Although it is difficult to accurately analyse the internal composition of the CCP owing to its secrecy, there is strong evidence that these actors have built powerful factions within the party, such as the so-called Petroleum Gang, named after its members' position in the state-owned oil sector, or the Shanxi Gang, whose members are leading officials and managers of state-owned enterprise (SOE) from the coal-rich Shanxi region (Xiaofei 2013).

Given that much of the top party ranks and former leaders are intertwined in its decision-making, the power sector is particularly prone to political corruption (Moses 2014). A case in point is Li Peng, former Chinese premier from 1988 to 1998, and his family who are considered figureheads of the oil and coal factions of the CCP (Hornby 2014). Li Peng ran China's energy monopoly throughout the 1990s, staffing the top management positions with his relatives, running what Bezlova (2002) calls a 'family fiefdom'. While the monopoly was broken up into five power generation firms, Li's children, Li Xiaopeng and Li Xiaolin, became the heads of two of them. In 2012, Li Xiaopeng was then promoted to governor of the coal-rich Shanxi region (Hornby 2014). Liu Zhenya, president of China's largest power SOE State Grid Corporation, is another example of the overlap of vested interest in the electric power sector and political power in the CCP. Liu, who has been openly opposing the central government's plans to break up the firm he heads (Zhu and Lague 2012), is also an alternate member of CCP's central committee, one of China's top ruling bodies.

This formal and informal amalgamation of political and business power implies that strong incumbent SOEs have the means to challenge and influence the top authorities at the central and provincial levels in cases where their interests conflict (Ai 2006; Bergsager and Korppoo 2013; Heggelund 2004; Williams 2014). Today, the large power generation companies and two grid

companies are major players in conventional and renewable energy power generation (Dai 2015). The government's ability to make SOEs responsible for RET growth has been one of the main enabling factors for the impressive development of RETs. Yet, the power of SOEs has also blocked policy developments. The lack of sufficient RET-friendly grid infrastructure is one of the greatest issues (Liu 2013). Moe (2015) argues that even though the State Council mandated the grid companies to make the transmission system more favourable for RETs, the measure failed because of the resistance of these companies. Similarly, grid SOEs have used their monopoly positions to block grid access for electricity generated by SHP projects. Although this blockage of a 'potentially system-disruptive' renewable energy policy has perhaps also to do with past and current cost and capacity advantages of coal (Moe 2015; Tyfield et al. 2015; Williams 2014), we argue that the vested interest of certain SOEs and political elites, as well as their associated fear of losing power, is at least as important if not more so.

Recent developments suggest that some of these central level institutional and political barriers are addressed by the current leadership. In March 2015, the Chinese authorities gave momentum to the unfinished power sector reform, initiated in 2002, with pledges to gradually loosen the state's monopoly in energy pricing and to make the monopolistic power sector more transparent and competitive. In November 2015, the NDRC released further policy recommendations that aimed to prioritize renewable energy over coal in their proposed electricity trading markets. Pilot trading platforms for allowing energy generators and big end-users to negotiate prices are also promoted (Chu 2015). Furthermore, the 12th FYP set a goal of developing an ultra-high-voltage power transmission (UVH) grid. With many smart grid lines already under construction, the UVH is a project in which the interests of State Grid Corporation and the State Council have aligned: it will reduce pollution, help take power from distant western regions to major cities in the east, and better integrate RETs in the current system (Mathews and Tan 2015; State Grid Corporation 2014).

In addition, by launching anti-corruption campaigns in the power sector, President Xi Jinping has directly targeted and weakened the vested interest groups that oppose energy reforms. Senior officials at NEA, State Grid Corporation, and the NDRC pricing department and leaders in the coal-intensive Shanxi province—associated with the Shanxi Gang faction—have been dismissed (Hornby 2014; *The Economist* 2014). Although this campaign might primarily be a way for President Xi Jinping to consolidate and concentrate power, these incidents do also indicate that there is increasing pressure for vested interest groups to comply with the pro-RET mandate of top authorities.

Provincial level

Barriers can also emerge among local level actors. In the Chinese system, responsibilities during RET implementation are not always clearly allocated, increasing the risk of both interest bargaining and issues in accountability (Kostka 2014; Ran 2013). Local SOEs, key stakeholders in implementation, have a reputation of getting away with violating environmental standards and pushing their own agendas as local governments have limited capacities to enforce compliance, and international oversight is not permitted (Curtin 2015). This is particularly difficult in areas where the companies are major contributors to the local economic development. Nonetheless, as the top officials of local SOEs are also evaluated in the cadre system, local authorities have more control over them than over managers of private sector firms (Harrison and Kostka 2014; Kostka and Hobbs 2012). This is important when considering that the largely private-owned small and medium enterprise sector is concentrated in very energy-intensive economic sectors (Kostka 2014).

Central versus provincial level

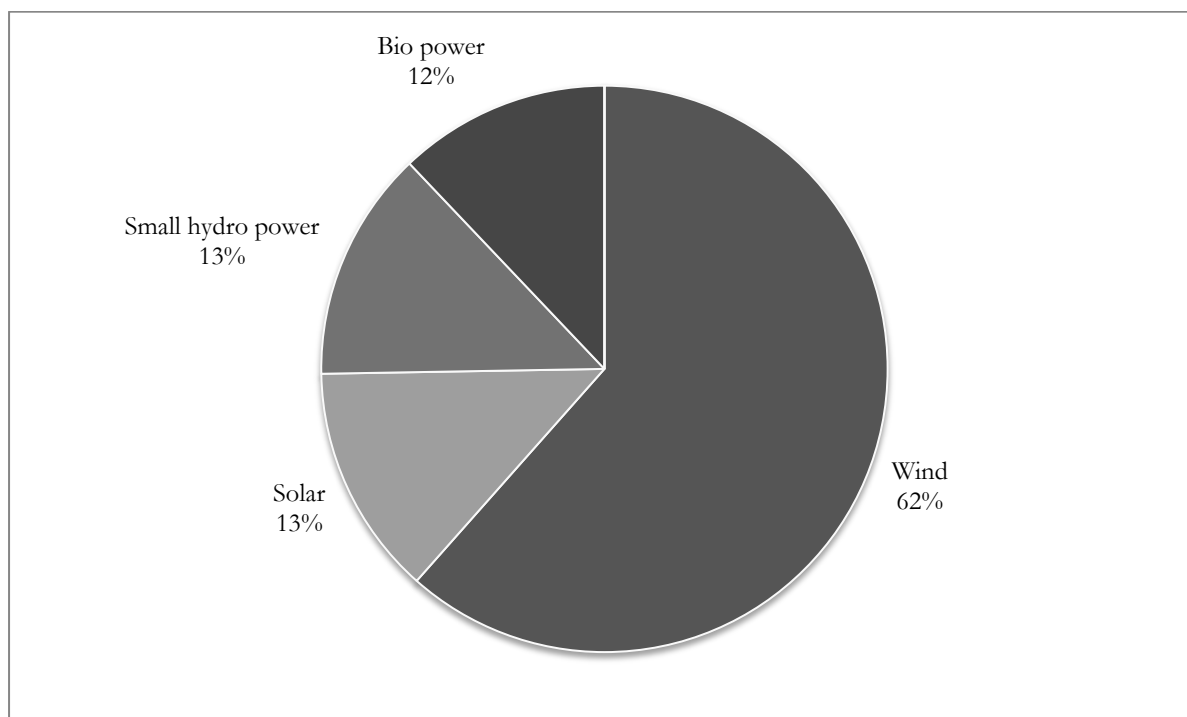
Bureaucratic and institutional barriers are particularly prevalent in centre–province relationships. In general, local governments and provincial authorities are responsible for the implementation of the policies set by the central government. Although the country is officially a unitary state, local governments in China have considerable autonomy regarding the economic development of their areas and rights over land use (Qi and Wu 2013). The power sector reform initiatives in 2015 granted more power to local authorities: in addition to RET projects, all new coal power plants can now officially be approved by provincial governments. Contrary to the objective of this state measure, there is evidence that local officials have taken advantage of their new powers to boost economic development. In the Shanxi and Inner Mongolia provinces, for example, many coal-fired power plants that were previously discarded by top authorities because of their environmental impact have now been re-opened by local leaders (Lingyu 2016). In this way, although clean energy projects could generate ‘co-benefits’ in improving air quality, energy security, and public health, there is evidence that economic development risks outweighing green policy within local jurisdictions (Dai 2015; Richerzhagen and Scholz 2007; Yuge and Sandhu 2014).

Furthermore, the Chinese bureaucracy is characterized by administrative ranks of power and status, which can constitute a barrier for the relationship between state agencies and provincial level actors. Although the CCP has gradually given environmental issues more weight in the cadre evaluation as a result of increasing societal pressures (Wang 2013), this does not necessarily translate into better pro-RET incentives at the provincial level. Earlier unsuccessful experiments in this direction, such as the ‘green GDP’ scheme that ran between 2004 and 2006 as well as the introduction of binding environmental targets in the 11th FYP, provide evidence that provincial level actors have been reluctant to change their evaluation criteria (Wang 2013). The high cadre turnover has also been found to impede the implementation of environmental policy given that authorities tend to adopt short-term policy solutions that may not be viable in the long term (Kostka 2014). Thus, the central and provincial level interaction is often characterized by a certain organizational divide, which could be described as a principal–agent problem in many instances, as well as driven by perverse incentives at the provincial level.

4.3 Drivers in India

For several years India has been promoting RETs, especially wind and solar (see Appendix Table B1). Wind is the oldest renewable energy in India and has been promoted since the early 1980s, but solar received a big push since 2008. There are various mechanisms in place to support the deployment of RETs, such as grants to develop technologies, tax incentives, as well as generation-based incentives (Hogg and O’Regan 2010). Today, India is the fifth largest producer of wind energy worldwide, with an installed capacity of 24.8 GW (MNRE 2016a). While installed solar capacity is smaller, accounting for 4.7 GW, this is not surprising given that it has only been promoted in the last seven years. Figure 5 provides an overview of the current renewable power mix in India. As of November 2015, India has a total installed capacity of renewable energy grid-interconnected power of 38.3 GW (MNRE 2016a).

Figure 5: India's grid-interconnected generation capacity for renewables



Source: Authors' depiction, based on data from MNRE (2016a).

Renewable energy goals

Although India's installed capacity for renewable energy is growing steadily on an average of 20 per cent per annum (Factchecker Team 2015), its pace needs to increase tremendously in order to meet the very ambitious goals it announced in November 2014. By 2022, India wants to command a total renewable energy generation capacity of 175 GW; 100 GW from solar power, 60 GW from wind power, 10 GW from SHP, and 5 GW from biomass-based power projects (GoI 2015). The investment needed to finance its solar goal of 100 GW is estimated at US\$100–113 billion (Ghosh 2015). Although India is one of the largest investors in renewable energy, with US\$7.4 billion in 2014 (FS-UNEP 2015), this is far from what is needed, which is why the country tries to attract more investors. At RE-invest, the investors' conference for renewable energy in India held in February 2015, the Modi-led government secured pledges from national and international companies to deploy 266 GW of renewable energy in the next five years, and financial institutions committed to finance RE projects amounting to 78 GW (Bhaskar 2015; Ghosh 2015). Later that year, at COP21 in Paris, Prime Minister Narendra Modi launched the International Solar Alliance where 120 states committed to promote solar energy and mobilize >US\$1 trillion of investments by 2030 to install 1 TW of solar power (Ananthakrishnan 2015; SustainableBusiness.com 2015; UNFCCC 2015). With India expected to be the second largest solar market by 2030 (IEA 2015c), this alliance is a crucial step towards this goal.

In general, it can be said that India's ambitions with regard to RET promotion have reached a new level with the election of Modi as prime minister in 2014. Although the former prime minister, Manmohan Singh, had launched the original solar mission with a goal of installing 20 GW by 2020, Modi has increased this target fivefold to 100 GW. He is also encouraging foreign investment especially in solar, and wants to attract US\$100 billion to the sector until 2022 (Parkes 2015). He has already secured a US\$1 billion deal with the US Export–Import Bank to facilitate shipping equipment from the United States (Parkes 2015), and a US\$2.25 billion deal with the German government for solar and other RETs (Reuters 2015).

Pollution, energy access, and regional variation

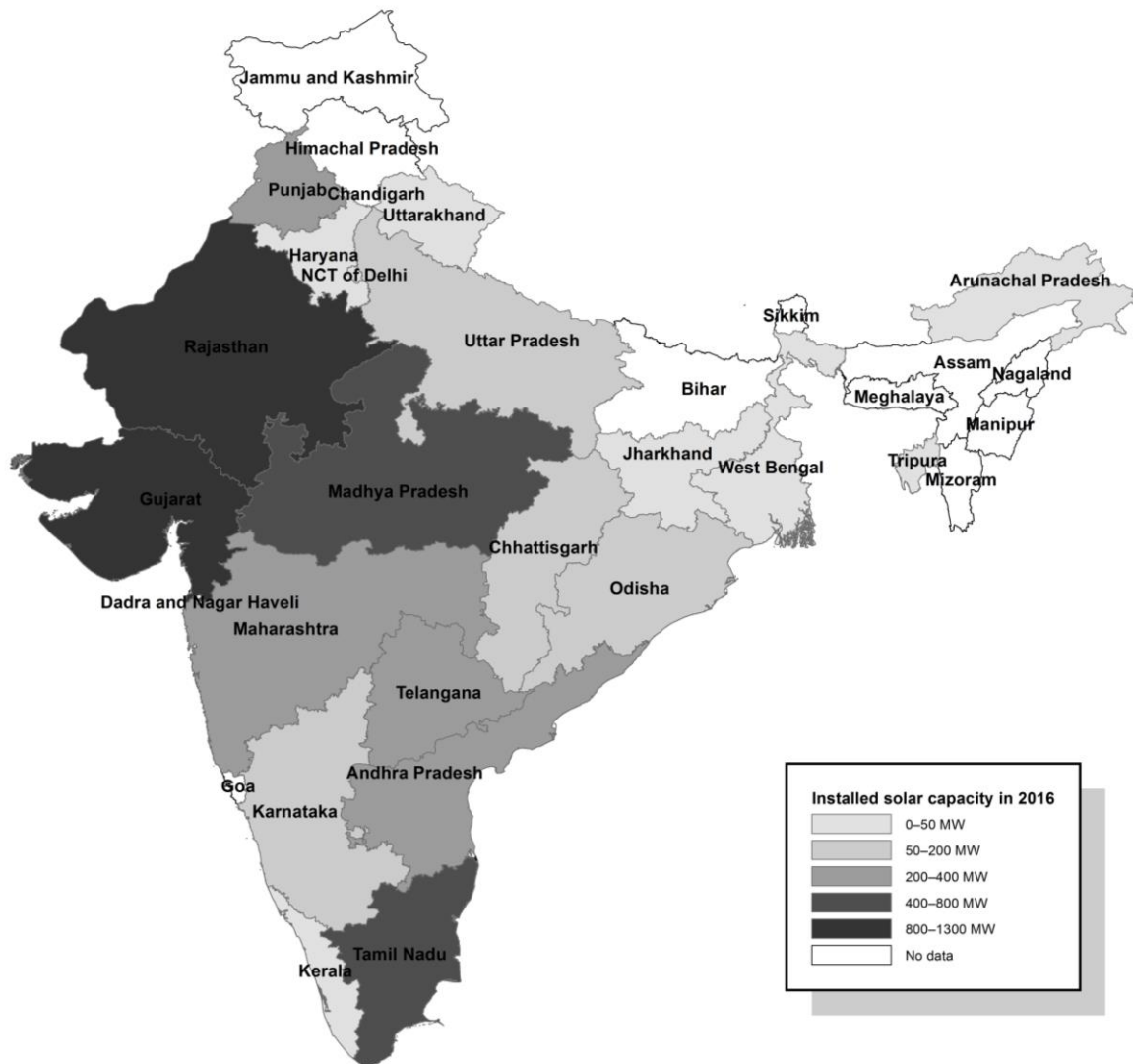
Unlike in China, so far there appears to be no great pressure from the Indian population on its government to decrease air pollution. Although 13 of the 20 most polluted cities worldwide are located in India (Chauhan 2015), many Indians seem to perceive environmental standards as barriers to economic growth and job creation. For example, Vapi, a city in Gujarat, West India, is one of the most polluted cities in the country. Its pollution-ridden population, however, protested against higher environmental standards and was relieved when the government reduced them again (Barry and Bagri 2014). What seems paradoxical at first becomes rational given the fact that the poor population of Vapi is completely dependent on the city's large and highly polluting pharmaceuticals and chemicals industries. Although extreme, the example of Vapi is representative of the priorities of large parts of the Indian population. Thus, in contrast to China, health issues related to environmental degradation (although existing) do not seem to be a central concern for the majority of society, or, at least, clearly less important than economic needs.

India, however, shares an absolute key priority with China: providing broad and stable access to electricity to its fast-growing population (Ghosh and Ganesan 2015). In this paper, we argue that the key to understanding India's growth in RETs in recent years is in fact a story of regional variation. Figure 6 shows that installed solar power capacity is largely concentrated in the north-west of the Indian sub-continent, particularly in the three states of Gujarat, Rajasthan, and Madhya Pradesh, which are home to 60 per cent of the country's solar capacity. In contrast, particularly in the north-eastern states, however, solar power is rare. We argue that in some regions of the country RETs are a financially and politically feasible way to satisfy the large energy demand of a city, whereas in others coal remains in this position.

Figures 7 and 8 help to illustrate the financial feasibility argument. Figure 7 shows clearly that the states with the highest installed solar capacity are also those with the highest solar radiation, which also implies lower solar power costs. As we can see from Figures 7 and 8, the north-eastern states not only have lower solar potential but they also have the largest concentration of coal mines⁴ and plants in the country, making solar less competitive to coal in these regions (see Figure 9 for average current and prospective levelized costs of electricity in India). Arguably, this regional variation in solar radiation and coal deposits can explain large parts of the across-state variation in installed solar power capacity on its own.

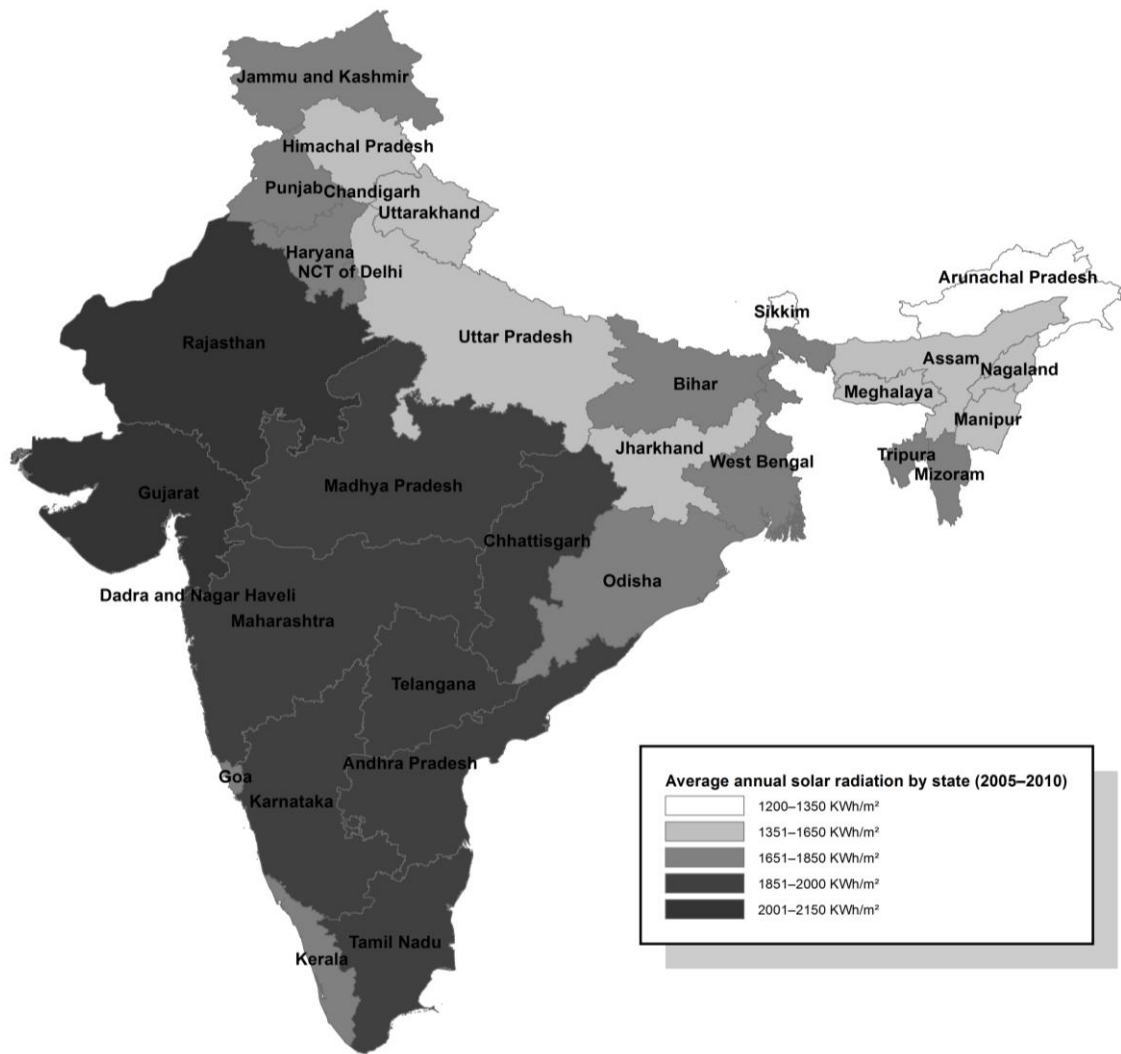
⁴ Although Gujarat and Rajasthan also have two larger coal deposits, these are only lignite fields, considered the lowest rank of coal because of its low heat content. In contrast, the coal deposits in the north-eastern states contain higher ranked coal.

Figure 6: Installed solar power capacity in India



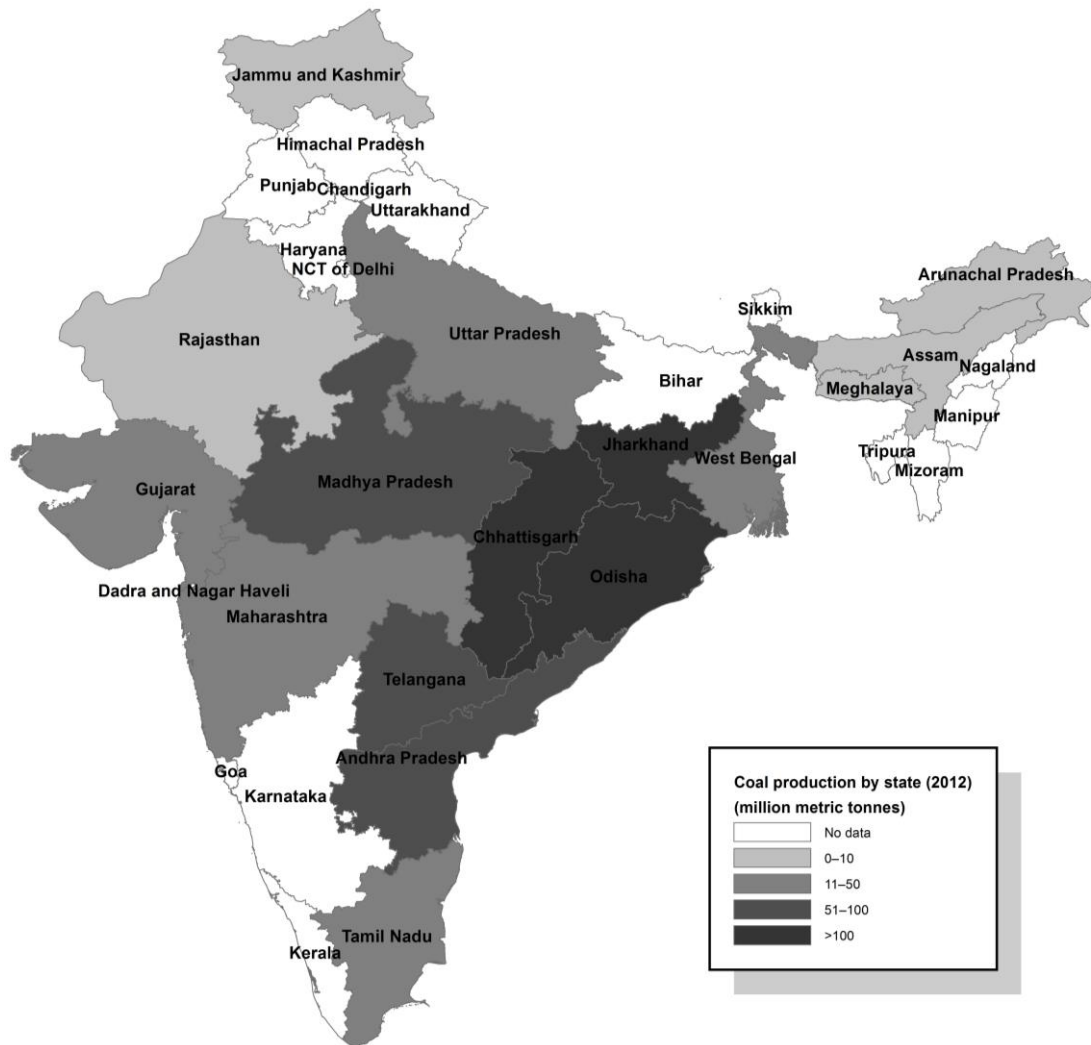
Source: Authors' depictions, based on data from MNRE (2016b).

Figure 7: Global horizontal irradiation in India



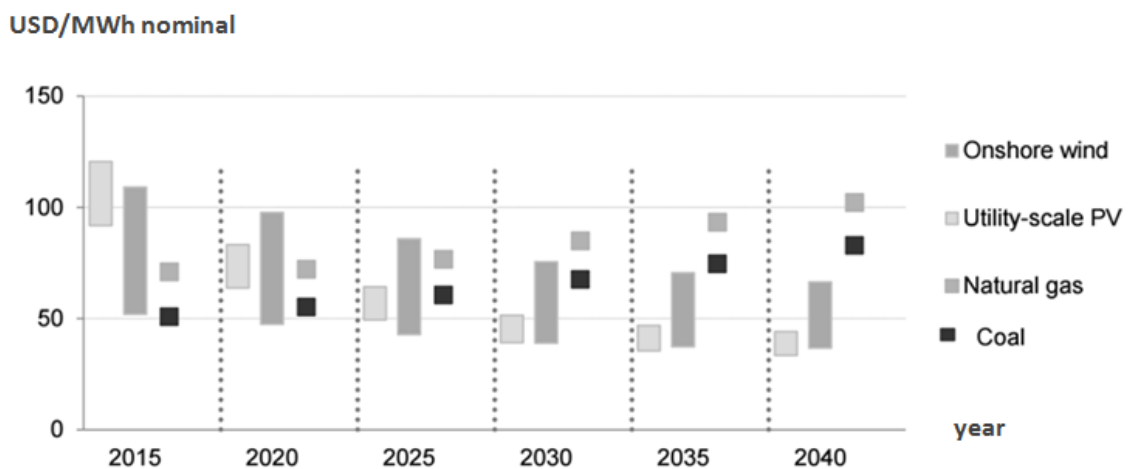
Source: Authors' depiction, based on GeoModel Solar s.r.o. (2011).

Figure 8: Coal production by state in India



Source: Authors' depiction, based on data from the Ministry of Coal (2014).

Figure 9: Levelized cost of electricity in India



Note: Capacity factors are onshore wind, 25–35 per cent, and solar PV, 10–15 per cent.

Source: Liebreich (2015).

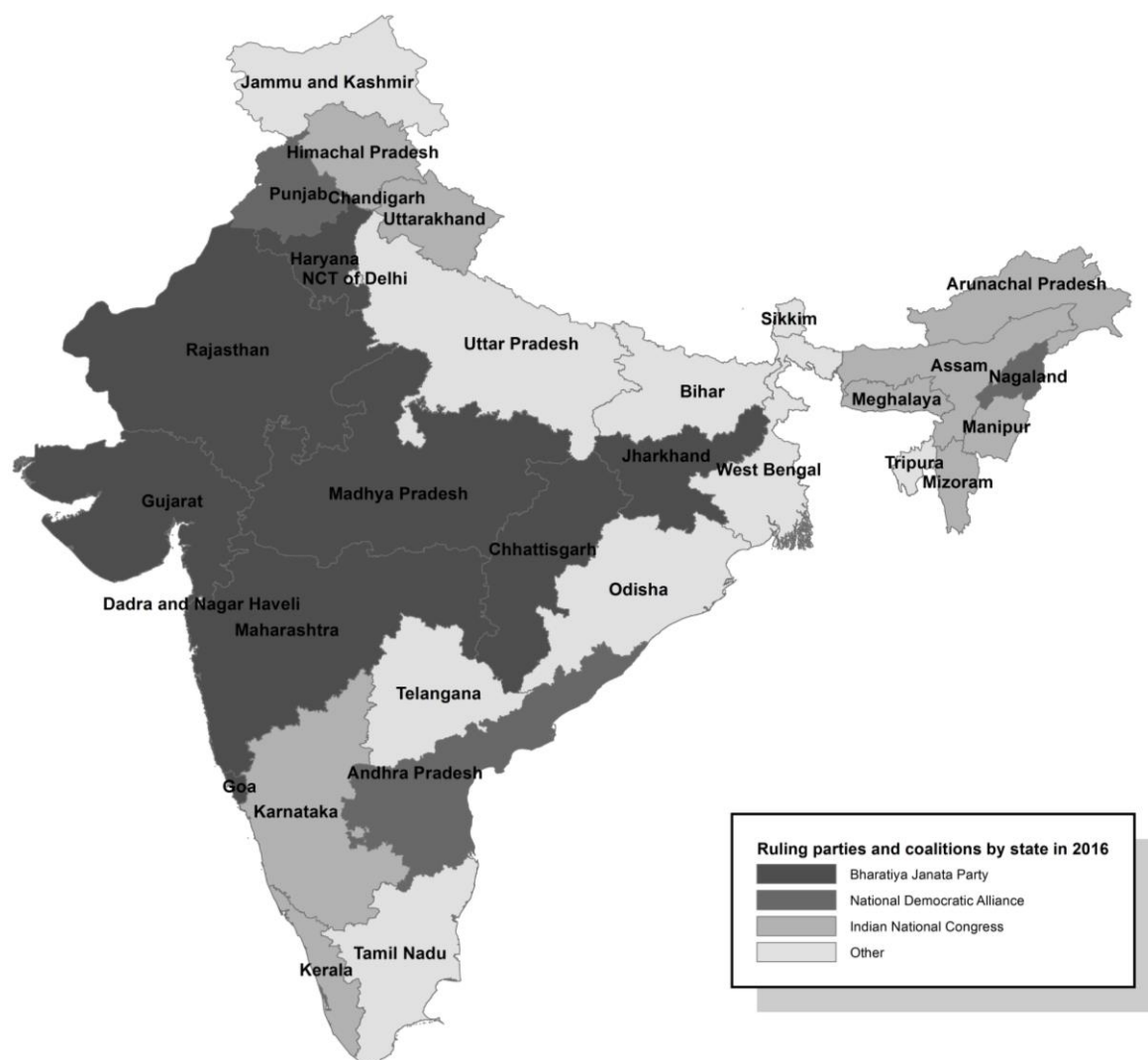
We argue, however, that in India geographical (or financial) feasibility is often also accompanied by what can be termed as political feasibility. In order to make this argument it is important to understand India's federal division of responsibilities with regard to energy policy. According to India's constitution, both the federal and the 29 state governments are responsible for energy policy. Both can set incentives, but the state government bodies are closer to the project level and, thus, usually powerful in terms of project implementation (Krishna et al. 2015). Moreover, state governments develop their own complimentary renewable energy policies and can provide fiscal incentives for the promotion of renewable energy sources (Krithika and Mahajan 2014; Appendix Figure B1). Nodal state agencies are responsible for the implementation of these policies. They conduct resource assessments for various renewable energy sources, allocate renewable energy projects, and monitor their progress. In a nutshell, whereas the federal level is partly responsible for policy-making, the state level is responsible for both policy-making and implementation.

This fact, and the general strong autonomy of states in India, implies that politics at the state level are particularly important with regard to policy implementation. Figure 10 shows a distribution of the ruling parties that govern the 29 Indian states. The states with large installed solar capacities are dominated by the Hindu nationalist Bharatiya Janata Party (BJP). As we argued, the cohesiveness and power of a ruling coalition are key determinants of its capacity to implement policy. We certainly do not claim that the BJP is a cohesive and powerful party in all of the states it governs (as with the Indian Congress considerable variation exists), but there is strong evidence that this was the case for the north-western states, and particularly in Gujarat, where the current Indian prime minister, Modi, was previously chief minister for 12 years.

Roy (2013) analysed the political settlement in Gujarat and describes how Modi managed to create a strong support base cutting across class and caste (usually *the* political cleavages in India) built on his leadership. The author compares the characteristics of Modi's government with the dominant party and authoritarian developmental regimes of East Asia (although different in several regards): cohesive, basically without alternative and strong opposition, fostering strong state-business relationships, and high governance and policy implementation capacities. Modi transformed Gujarat not only into an economic powerhouse but also a solar one. Local and international businesses in general and in the solar sector specifically invested heavily in the state. In 2014, Gujarat was home to 40 per cent of India's solar capacity (Pearson and Chakraborty 2014) and in 2015 became the nation's third largest wind producer (Parkes 2015). To a large part, this massive expansion of RETs was the reason that the Modi government successfully provided stable energy access for all its citizens. Thus, the case of Gujarat underpins the interplay of conducive geographic and political factors. The combination of high solar and political capacity made RETs a feasible tool to address the key social demand of energy access.

Furthermore, we argue that this regional success is closely related to India's recent massive push for solar power on a national level: Modi became the prime minister in 2014. Gujarat's success story strengthened his and voters' confidence that this is replicable on a national level. At least as important, Modi can use the international financial support and national RET programmes to support the expansion of RETs in BJP-ruled states with high solar potential, thereby consolidating his party's power, and at the same time be a progressive actor in international climate change negotiations.

Figure 10: Ruling parties in different states of India



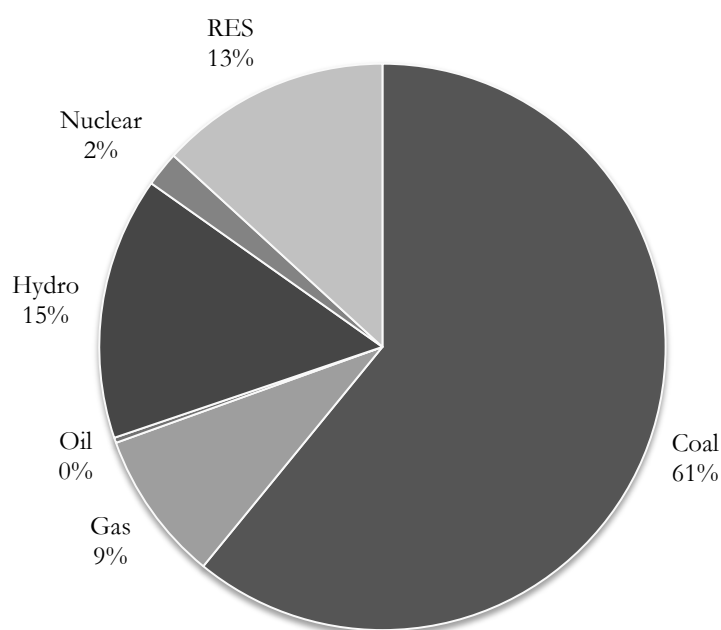
Source: Authors' depictions.

Another factor influencing Modi's renewable energy ambition is the decreasing cost of implementation: prices for solar and wind have been falling drastically over recent years. The levelized costs of electricity for (onshore) wind are nearly at grid-parity and solar (utility-scale PV) is catching up rapidly (compare Figure 9). Moreover, ambitious policy announcements increase the confidence of global players in the sector, which leads to a further decrease in prices. In November 2015, the Indian state awarded solar power contracts to global companies at levels more than 20 per cent below 2014. SunEdison won a US\$500 million /500 MW solar auction with a pricing at 7.1 US\$¢/kWh, 10 per cent below the record low (Macdonald-Smith 2016).

4.4 Barriers in India

Although RETs have gained considerable momentum in India, significant barriers to a clean energy transition remain. In the current Indian power mix, renewable energies represent only 13 per cent, whereas fossil fuels still have a share of 70 per cent (see Figure 11). While future energy scenarios for India predict that renewable and nuclear energy will play a more important role, fossil fuels are expected to remain the main energy sources with an estimate of 56 per cent in power generation capacity for 2030 (CAT 2015b).

Figure 11 Indian power mix



Note: RES include small hydropower, biomass gasifier, biomass power, urban and industrial waste power, solar power, and wind energy.

Source: Authors' depictions, based on data from MoP (2015).

Coal has a particular importance in the Indian power mix. It is the most used and cheapest energy source in the country and accordingly accounts for over 60 per cent of the power mix. Importantly, the government of India—under Singh and Modi—strongly pushed and continues to push the expansion of coal. The annual production shall be increased from a current level of 600 million metric tonnes to 1.5 billion metric tonnes in 2020 (EIA 2015). The amount of environmental clearances given by the government to new mining projects translates into the opening of a new mine every month until 2020 (Rose 2015). China, in contrast, reduced its coal use in 2014 by 2.9 per cent and is trying to further reduce its fossil fuel use (Light 2015). Different projections for India suggest that coal use is set to increase between two and a half and three times compared with the current levels (Dubash et al. 2015). These predictions are expected to hold, even under the most optimistic assumptions for the increase of renewable energy sources and nuclear energy.

However, India introduced a coal tax for imported and national coal in 2010, which should internalize some of its environmental externalities. This tax was doubled in March 2015 to US\$3.2. The revenues from the tax are going into the National Clean Energy Fund that will finance research and innovative projects for renewable energy and energy efficiency. It was estimated that the fund had generated about US\$2.7 billion by the end of the 2014/15 fiscal year. Where the money goes, however, is unclear (Ghosh 2015). Also, no clear information exists about any disbursements of the fund and critics argue that instead of funding innovative RET projects, it is used to balance the books of several ministries (Krithika and Mahajan 2014). This contributes to the already difficult finance environment in India (Chaudhary et al. 2014), which makes RET projects very expensive in comparison to other countries. In the following subsection, we look at factors that can explain this adherence to coal as well as other barriers to RET expansion in India.

Vested interests

As in China, many political elites and bureaucrats have vested interests in fossil fuels, more prominently in coal. In the coal allocation scam, or ‘Coalgate’, that emerged in 2012, the former Singh government is accused of having allocated coal blocks inefficiently and using a system that was subjective and opaque instead of a competitive bidding system (*The Hindu* 2015; Rajshekhar and Celestine 2012). Thereby, public sector entities and private enterprises acquired coal blocks for less than they would have otherwise paid. According to government auditors’ estimations, this scandal has cost the country US\$31 billion (Mathiesen 2014). Coalgate is perceived as reflecting the crony capitalism in the country. Another incident highlights the problems that corruption-prone politicians can create for renewable energy firms. Suzlon, the Indian wind turbine supplier, accused state and local level politicians and bureaucrats of extortion, as these had threatened to rile up local communities against a planned wind farm unless they agreed to receive large bribes (Phillips et al. 2011).

Discoms

One of the, if not *the*, greatest barriers to energy transition in India are state-government-owned electricity distribution companies, the so-called discoms. Of 29, 21 are deeply indebted, with total debt amounting to over US\$2.5 billion in January 2014 (Mohan 2015; Pearson and Chakraborty 2014), which has great implications for renewable energies. First, owing to their bad financial shape, discoms are unable to meet their renewable purchase obligations that were introduced with the Electricity Act (Krithika and Mahajan 2014). They prefer to feed in coal-generated power to the grid, as this has been considerably cheaper in the past and easier to handle. Feeding in RETs, they fear, will further increase their debt. Second, RET investors shy away from investing in states with highly indebted discoms, as they fear that their generated electricity will not be bought and that discoms might default on them. Third, the discoms are too indebted to invest in major grid improvements, which not only lead to more losses and more debt, but also make the RET-generated power less viable. In general, this creates a highly adverse environment for RET promotion.

The main reasons for the immense debt of the discoms are theft, a badly implemented subsidy scheme for the rural and poor, and technical losses. The total amount of transmission and distribution losses is at 20 per cent, double the world average (Aniti 2015). Most of this loss occurs because of electricity theft. Per year these ‘non-technical’ losses amount to US\$16.2 billion (Northeast Group 2015). The large part of this thievery, however, is not accounted by the poor who struggle to afford electricity, but rather by well-off farmers who do not fear prosecution.⁵ Interestingly, theft seems to increase before elections. In their analysis of the politics of electricity theft in Uttar Pradesh, Golden and Min (2012) find that this can be explained by clientelism and political capture by local elites which increases in election years. Thus, in many Indian states, ruling coalitions appear so vulnerable that as part of their political survival strategy, they need to allow both the mass and elite thievery of electricity during their terms and particularly during elections. Strongly resembling the patterns of electricity theft, mismanaged subsidies are another reason for indebted discoms. Originally, these subsidies were introduced exclusively for farmers, who are already an enormous group (Antholis 2014). However, many non-farmers, businessmen, and wealthier citizens free-ride on this subsidized power, as in many states the government appears to allow this practice or to be incapable of

⁵ Personal communication with Detlef Sprinz (25 January 2016).

stopping it. The only way discoms seem to be able to reduce the speed of increasing debt is drastic and extremely harmful: cut power regularly.

Modi-governed Gujarat is one of the rare exceptions in this regard. The state is able to provide its citizens with 24-hour access to electricity (Pearson and Chakraborty 2014). To counteract the crippling abuse of the subsidy schemes, electricity for agriculture was split from the rest, and farmers received subsidized tariffs only for a few hours per day. Other paying customers received uninterrupted supply at normal rates. To determine who merits subsidized power, the government sent officials to check. Similar strategies in other states were met with extreme and violent responses by groups to be controlled (Katakey and Singh 2014). As a consequence, all four of Gujarat's discoms received A+ ratings from the Ministry of Power for their performance in 2013–14. The only other discom with this kind of rating is in Punjab (*The Economic Times* 2015). This relates to the points made earlier about the relative power and cohesiveness of the BJP ruling coalition in Gujarat. In contrast to other state governments, Modi's ruling coalition was strong enough—that is, had a broad and stable political foundation—to execute such undertakings, which were extremely unpopular in the short term but very effective in the long term. In many other Indian states, ruling coalitions were much more vulnerable; hence, in order to secure their political survival, they had to fold to strong short-term and unsustainable demands.

Land rights

Another enormous barrier for the fast deployment of RETs is land acquisition (Ghosh 2015). Although land in India is very scarce, it is essential for large-scale solar projects and wind farms. The process of land acquisition for private companies, however, is expensive (four times the market price in rural areas) and complicated (70–80 per cent of the affected families have to agree and social impact assessments have to be conducted). Thus, if everything goes smoothly the process would last 58 months (Kazmin 2015). This is a largely the legacy of a law introduced in 2013 by the then ruling Congress party, in order to strengthen the rights of land owners. Before 2013, land owners felt mistreated by the state, because it could expropriate them if they would use the land for 'public good'. The definition of 'public good' was unclear and thus state governments bought land for under-market value from farmers and sold it for much more to businesses. Unsurprisingly, the suspicion was great that corruption was often involved in such transfers. Wanting to strengthen landowners—and arguably its support base before the 2014 elections—the Congress-led government passed the law that massively complicated land acquisition. As part of his drive to attract more investment, Modi tried to change this law and make it possible for authorities to take land without social impact assessments and without farmers' consent, although buyers would have had to pay the same increased compensation. His proposal met strong resistance from the Congress and other parties with big agrarian constituencies. As these parties still hold the majority in the Indian upper house, the Rajya Sabha, they were able to repel Modi's land reform. This not only is perceived by many as the biggest failure of the current Modi government but also illustrates how difficult it is for national governments to pass laws in the Indian polity (Kazmin 2015).

5 Discussion and conclusion

A successful transition to RET-based energy systems requires radical changes in the current energy regimes. In this paper, we have argued that although ruling coalitions of states play a key role in pushing such change, their ability and willingness to do so depends particularly on a range of political economy factors, which also interplay with geographical and technological ones. Our goal was to analyse how these factors drive and impede a transition to clean energy power

systems in China and India, two of the current and future most-emission-intensive countries in the world.

Our findings suggest that in China increasing societal pressures due to increasing environmental pollution was key in pushing the CCP to turn more towards environment-friendly power production in order to secure its political survival. This has been accompanied by an increasing institutional and political capacity for clean energy policy-making at the central and local level. Nevertheless, the state appears to be constrained by powerful political vested interest in the power sector on the one hand and imbalances within institutional structures on the other. Importantly, there are arrangements where provincial level actors or incumbent SOEs have the capacity to override top-level incentives when interests conflict, which has often been problematic for RET development.

In contrast to China, we found that environment-related societal pressures have not been the key driver for RET promotion in India. Rather, a number of Indian states—above all Modi-governed Gujarat—profited from a combination of beneficial geographic (high solar radiation and wind capacity) and political (strong and cohesive ruling coalitions) circumstances, which allowed them to address their populations' growing demand for electricity through the promotion of RETs. We argue that the recent upswing in support of RETs at the national level is closely associated with the fact that leaders of the RET-feasible states are also leading the national government since 2014. Besides these positive developments, severe barriers for a clean energy transition pertain. India plans to increase coal production massively, which can be seen as a symptom of the vested interests that many politicians have in the sector. Moreover, Indian discoms are in very bad shape financially because they are often used as a political tool to strengthen the ruling coalition's political survival. Finally, the problems of land acquisition in India present a major barrier for renewable energy projects, which often need large tracts of land.

Our analysis generates three broad implications. First, it provides strong evidence for the argument that employing political economy analysis is crucial to better understanding clean energy transitions. It helps unveil how politics in general, and the balance of power between contending interest groups in particular, drives or hinders system change. We saw that, in China and India, vested interests in incumbent electric power systems can inhibit the promotion and deployment of RETs in electricity. Second, the comparison of the two cases shows that the drivers of change can be significantly different in distinct contexts. In both countries, changes in the landscape—that is, what the transition literature calls the overarching socio-technical macro-structures in a country—were key to driving RET promotion. The landscape dynamics, however, were very different. In China, it has been a change in the attitude of affected citizens to increasing levels of pollution that has effectively *coerced* the ruling coalition to promote a cleaner electric power system. In India, however, we found that it has been much less a change in attitudes or beliefs but rather in financial and political feasibility that has *allowed* or *incentivized* certain state ruling coalitions to promote RETs as engines for energy access. Third, the paper strengthens the view that, when analysing energy transitions, it is key to observe how politics depends on and interplays with regional contexts. A constrained analysis at the national level bears the risk of missing the crucial variation that occurs at the sub-national level. For example, in China we saw that principal-agent problems between the central and provincial levels are a key barrier to change, whereas in India the causal drivers and barriers to RET promotion can be found largely at the sub-national state level.

This study highlights questions for further research. First, we see the need for more in-depth analyses of the dynamics surrounding clean energy transition in sub-national entities. Second, it would be interesting to further investigate why massive pollution in India has not created the same societal pressures (in the form of anti-pollution protests) as in China. Is this mainly a

reflection of lower economic development levels and, hence, an acceptance of pollution if it provides economic growth? Do environmental protests build more pressure on an autocratic ruling coalition than a democratically elected one, because such protests bear the risk of transforming into an outright revolt against the overall political system? Finally, it would be interesting to analyse how the choice to privilege certain framings of transition solutions (i.e. nuclear or clean coal as equivalent to RETs) shapes elite policy responses and societal preference.

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Appendix A: Renewable energy policies, targets, and actors in China

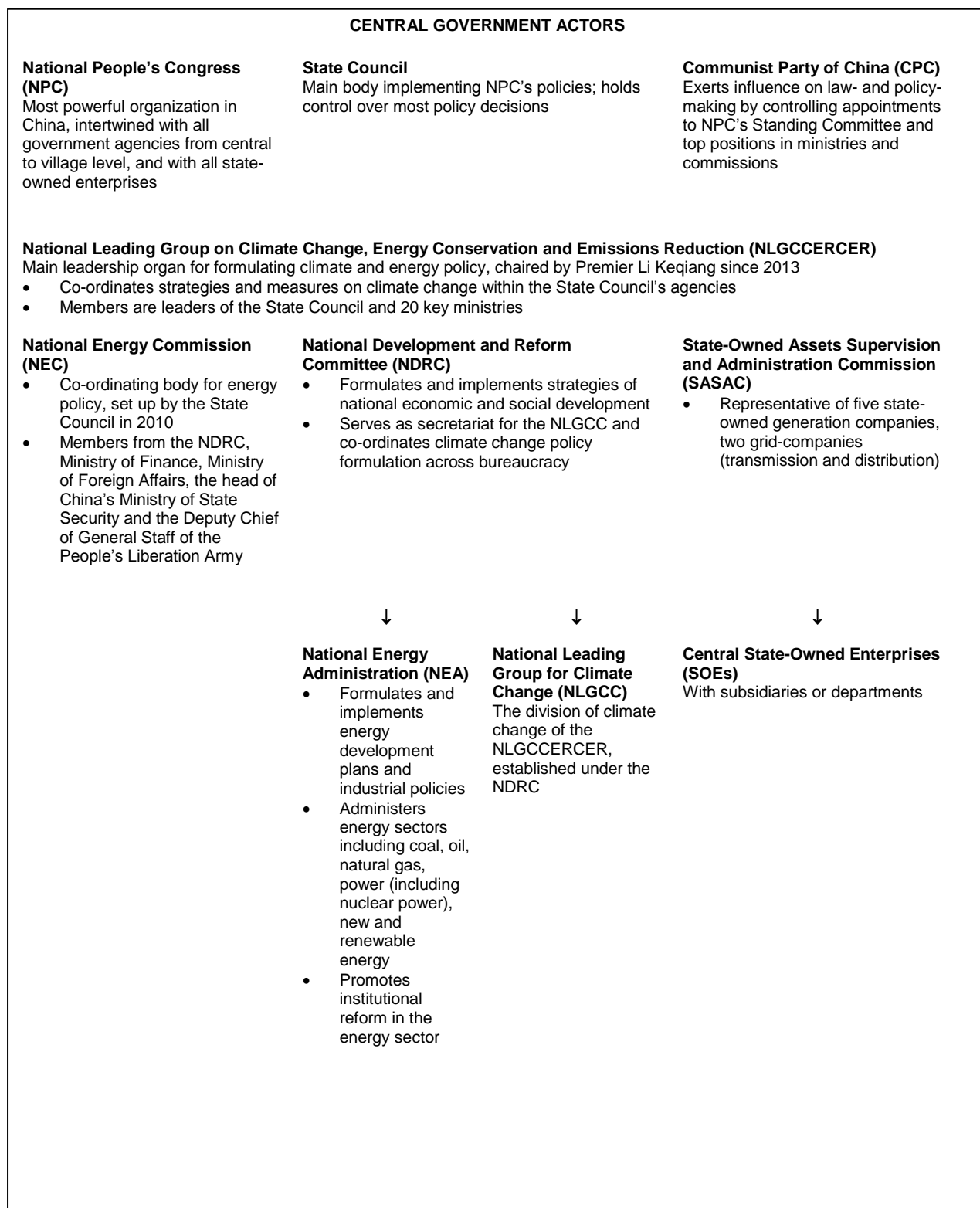
Table A1: China's primary renewable energy policies and objectives

Category	Selected laws, policies, and measures	Targets and objectives	Time adopted
Law	Renewable Energy Law	Four mechanisms to promote clean energy: (1) a national renewable energy target; (2) a mandatory connection and purchase policy; (3) a feed-in tariff system; and (4) a cost-sharing mechanism, including a fund for renewable energy development	2005, amended in 2009
Development planning	Climate Change Law (Draft)		2012
	Reaffirmation of US–China Joint Announcement	Launch a national emissions trading scheme in 2017	September 2015
	Intended Nationally Determined Contributions (INDC)	<ul style="list-style-type: none"> • Increase the share of non-fossil energy sources in the total primary energy supply to 20% by 2030 • Peak CO₂ emissions by 2030 or earlier • Reduce carbon intensity by 60–65% by 2030, below 2005 levels • Increase the volume of forest stock by approximately 4.5 billion cubic metres, over 2005 levels 	June 2015
	US–China Joint Announcement on Climate Change	<ul style="list-style-type: none"> • Increase the share of non-fossil fuels in primary energy consumption to 20% by 2030 • GHG output to peak by 2030 or earlier 	November 2014
	The Energy Development Strategy Action Plan 2014–20	<ul style="list-style-type: none"> • Annual coal consumption to be capped at 4.2 billion tonnes until 2020 • The share of non-fossil fuels in the total primary energy mix to rise to 15% by 2020 from 9.8% in 2013. The installed capacity of hydro, wind, and solar power will reach 350, 200, and 100 GW, respectively, by 2020 	2014
	The 12th Five-Year Plan for Renewable Energy Development	<ul style="list-style-type: none"> • Increase non-fossil energy to 11.4% of total energy use, 2009–15, and 15% by 2020 <ul style="list-style-type: none"> ○ Solar: 35 GW by 2015 and 70 GW by 2020 ○ All hydropower, including large- and small-scale production: 290 GW by 2015, 330 GW by 2017, and 420 GW by 2020 ○ Wind: 100 GW by 2015, 150 GW by 2017 and 200 GW by 2020 ○ Biomass: increase the share to 13 GW by 2015 and to 30 GW by 2020 • A US\$610 billion funded programme to promote seven strategic emerging industries (SEIs) for 'clean' development and a 'new industry base'. One of the seven industries is 'new energy' with a key renewable energy component. 	2012
	The 2012 Energy Policy White Paper	Increase the share of non-fossil fuels in primary energy consumption to 11.4% and increase that of installed generating capacity from non-fossil fuels to 30% by the end of 2015	2012
China National Climate Change Programme (CNCCP)	A sustainable and stable expanding market for renewable energy will be fostered; market environment for renewable energy will be improved and obligation of national electricity grids and petroleum sales enterprises under the renewable energy law to purchase renewable energy products will be implemented (NDRC 2007: 31–2)	2007	
Mid- to Long-Term Development Plan for Renewable Energy	<p>Raise the share of renewable energy in total primary energy consumption to 10%, and raise this share to 15% by 2020</p> <ul style="list-style-type: none"> • 300 GW of hydropower • 30 GW of wind power • 30 GW of biomass • 1.8 GW of solar power 	2007	

Note: The list does not attempt to be exhaustive.

Source: Liu (2013), State Council (2012), and Wang (2014).

Figure A1: Chinese government actors in clean energy policy



PROVINCIAL GOVERNMENT ACTORS

Provincial/autonomous regional government

- Responsible for the implementation of policies

Provincial Development and Reform Committee (PDRC)

- Responsible for the implementation of the State Council's policies
- In 2007, Leading Groups for Climate Change were created at provincial, prefectural, and county level

Price Bureau

Provincial State-Owned Assets Supervision and Administration Commission (SASAC)



Local SOEs
With subsidiaries or departments

Source: Curtin (2015), Liu (2013), and Tsang and Kolk (2010).

Appendix B: Main renewable energy policies, targets, and actors in India

Table B1: India's primary renewable energy policies and objectives

Category	Selected laws, policies, and measures	Targets and objectives	Time adopted
Law	Renewable Energy Act (Draft)	<ul style="list-style-type: none"> • Constitution of the National Renewable Energy Committee • Appointment of a National Renewable Energy Advisory Group 	Draft version 2015
Development planning	Intended Nationally Determined Contribution (INDC)	<ul style="list-style-type: none"> • To reduce the emissions intensity of GDP by 33% to 35% by 2030 below 2005 levels • To increase the share of non-fossil based energy resources to 40% of installed electric power capacity by 2030, with help of transfer of technology and low-cost international finance, including from Green Climate Fund • To create an additional (cumulative) carbon sink of 2.5–3 GtCO_{2e} through additional forest and tree cover by 2030 	2015
	12th Five-Year Plan (2012–17)	Target is to have 12% RE in the electricity mix by 2017	2012
	Strategic Plan for Renewable Energy (2011–17)	Target for the six-year period: 21.7 GW for grid-interactive RE power	2011
	National Action Plan on Climate Change (National Solar Mission)	<ul style="list-style-type: none"> • Minimum 15% RE in the energy mix by 2020 • NSM: first target was 20 GW of grid connected solar power by 2022; it was increased to 100 GW in 2015 	2008
	11th Five-Year Plan (2007–12)	Target was to establish 10% power capacity from RE by 2012	2007

Note: The list does not attempt to be exhaustive.

Source: NITI Aayog (2015).

Figure B1: Indian government actors in clean energy policy

CENTRAL GOVERNMENT ACTORS			
<p>Ministry for New and Renewable Energy (MNRE) Main ministry responsible for renewable energy in India: Its broad aim is to develop and deploy new and renewable energy for supplementing the energy requirements of the country</p>	<p>Ministry of Finance (MoF) Responsible for budgeting and providing financial incentives for renewable energy development</p>	<p>Ministry of Power (MoP) Responsible for policies that promote renewable energy as power sources (e.g. the National Electricity Policy and the National Tariff Policy)</p>	<p>Ministry for Environment, Forest and Climate Change (MoEFCC) Responsible for environmental clearances of renewable energy projects</p>
<p>Indian Renewable Energy Development Agency (IREDA) Non-banking financial institution under the administrative control of the MNRE for providing term loans for renewable energy and energy efficiency projects</p>	<p>Central Electricity Regulatory Commission (CERC) Sets guidelines for feed-in tariff design to regulate the regional electricity corporation mechanism and to regulate interstate access and third-party sales</p>		
STATE GOVERNMENT ACTORS			
<p>State Governments Develop their own complimentary renewable energy policies and provide fiscal incentives for the promotion of renewable energy sources</p>		<p>State Electricity Regulatory Commissions (SERCs) Develop feed-in tariff methodologies for different renewable energy technologies, determine renewable portfolio obligations and enforcement mechanism, and set regulations in intrastate wheeling, open access, and third-party sale</p>	
<p>State Nodal Agencies (SNAs) Responsible for the implementation of renewable energy policies, conducting research assessments for renewable energy sources, and allocating renewable energy projects and monitoring their progress</p>			

Source: Krithika and Mahajan (2014) and Sargsyan et al. (2011).