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# Who drives climate-relevant policies in the rising powers?

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## Abstract

The future of human life on our planet is influenced increasingly by what goes on in the rising powers. This paper provides a political economy analysis of the climate-relevant policies of China, India, Brazil and South Africa. It shows that alliances play a key role in driving such policies. However, most actors who support such policies have priorities other than climate-change mitigation. Their support for such policies comes from concerns with securing energy, building competitive green industries, creating jobs or providing a basis for future public revenue. This insight is not just of analytical but also of political importance. It means that climate-relevant policies can draw on support from a wide constituency – not just those with green convictions. Such analysis provides the stepping stone for understanding the political feasibility of low-carbon transformations.

# 1 Introduction<sup>1</sup>

Extreme weather events have become more common in many parts of the world. The evidence for this increasing climate chaos is strong, as is the evidence that carbon emissions – resulting from human activity – are the main cause (IPCC 2014). Reducing these emissions is one of the defining challenges of our time. It requires structural changes that help the global economy operate within environmental boundaries (Rockström *et al.* 2009; Steffen *et al.* 2015). While controversies remain over how quickly the emissions have to be reduced (Tol 2015), it is increasingly accepted that delays are likely to increase the costs of dealing with the climate chaos. The low-carbon transformation is urgent in a way that previous transformations were not.

This recognition of urgent action led to enormous efforts to find global solutions. Little progress was made in international negotiations, however, until the breakthrough in Paris where a global agreement was reached in December 2015. The main question now is how credible these commitments are. Will they be acted on? This question is relevant for all countries, but most attention will be paid to those countries responsible for the stock of carbon emissions, and those responsible for increases in carbon emissions – notably the rising powers that are the focus of this paper.<sup>2</sup>

The paper looks behind the scenes asking who drives the climate-relevant policies in the rising powers and who holds them back. We have investigated these questions in four countries: India, China, Brazil and South Africa. Researchers from these countries have – in separate reports – sought answers by screening the available literature and then conducting interviews with key stakeholders. This paper pulls together the main findings. The main conclusion is that the key actors behind climate-relevant policies are not primarily concerned with environmental or climate issues. Their prime concerns are securing energy for the country, fostering new green industries and making them competitive, creating jobs and incomes in these industries, or laying the foundation for increasing public revenue. Mitigating climate change is not irrelevant, but it tends to be a co-benefit rather than driver.

Although this is the overall picture, there are substantial differences between these countries because problem constellations and actor constellations are different. This paper therefore looks into each of the four countries and sets the findings in context. While necessarily brief it shows who the key actors are, what their priorities are, which arena they operate in, and how opportunity and crisis influence policy. The paper thus contributes to understanding the domestic politics of global policymaking. The prime concern, however, is not to trace the global–national policy connections in each moment; it is to get an analytical grip on the forces that drive climate-relevant policies.

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<sup>1</sup> A longer version of this paper came out in the IDS series of Evidence Reports. <https://www.ids.ac.uk/publications/ids-series-titles/ids-evidence-reports>. The underlying research was funded by the UK Department for International Development. Valuable comments on an earlier draft were provided by Wen Shen and Stephen Spratt. Further useful suggestions were made by two anonymous referees.

<sup>2</sup> This project was conceived in 2012 when the rising powers were just that: countries with increasing influence on the world due to their size and fast growth. A lot has changed since then. While China and India continue to grow fast (albeit at less spectacular rates), South Africa and Brazil have stagnated if not declined. Nevertheless, answering the question that drives this paper remains of great importance to the debate on who can accelerate transformations towards sustainability.

Given that many policies and sectors have climate repercussions, we had to be selective. We paid special attention to the transformation from fossil fuel to renewable energy, because it is a central component of decarbonisation and has become increasingly feasible from a technological and economic point of view. This puts the political feasibility centre stage and underlines the need for adopting a political economy approach.

This is precisely what the authors of the four country studies did: Chaudhary *et al.* (2014) for India; Dai (2015) and Shen (2016) for China; Schaeffer *et al.* (2015) for Brazil; and Morris and Martin (2015) for South Africa. They conducted political economy analyses addressing the question that drives this paper and followed a common methodological guideline (Schmitz 2012). This synthesis of their findings is structured as follows: Section 2 positions the paper in the theoretical debate on green transformations and sets out the approach adopted in the country studies. Sections 3, 4, 5 and 6 present the findings from China, India, Brazil and South Africa, respectively. Overall lessons, positive and negative, are set out in Section 7. The final section makes suggestions for future research.

## 2 Theoretical positioning

This paper is situated in a wider debate on green transformations defined as the processes of structural change that bring the economy within planetary boundaries.<sup>3</sup> The purpose of this section is to show where we position ourselves in the green transformations debate, and to specify where and how we seek to add value to the debate.

### 2.1 Key challenge for green transformation theory

There is no established transformation theory, but various lines of work provide useful insights on how transformations occur. The most fundamental point is that there is no single line of causation: *transformation results from a concurrence of multiple changes*. This is the conclusion of Osterhammel (2014)'s history of the nineteenth century, Leggewie and Messner (2012)'s review of theory and history of transformations, and Geels and Schot (2007)'s analysis of big 'Technological Transitions'. This emphasis on the concurrence and interaction of multiple changes highlights the immensity of the challenge of formulating a theory of green transformations and conducting empirical research on causal connections.

When seeking historical parallels for the green transformation, reference is often made to the industrial revolution (Leggewie and Messner 2012; Mathews 2015). This is very helpful for bringing out the enormity of what needs to be achieved, but it also raises questions about the feasibility of a meaningful theory. The industrial revolution resulted from the *incidental* concurrence of changes in several fields:

- Energy (from wood to coal);
- Beliefs (from religion to enlightenment);
- Technology (from crafts to science);
- Finance (from inherited immobile property to mobile capital generated by international trade);
- Institutions (more reliance on the 'rule of law');
- Social standing (from ascribed to earned positions in society).

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<sup>3</sup> Different meanings of 'green transformation' and the significance of planetary boundaries are discussed in several chapters of Scoones, Leach and Newell (2015).

Along with other changes, they interacted to bring about a set of transformations that was historically unprecedented in depth and speed. Understanding the interconnections and specifying timescale is daunting.

Historically informed approaches to understanding transformations are therefore helpful. One such approach that has become influential is the multi-level perspective on socio-technical change (Geels 2002; Geels and Schot 2007). It distinguishes three analytical levels: niches, the locus of radical innovations; socio-technical regimes, encompassing diverse actors and institutions; and wider landscapes. Transformations are shifts brought about through interactions between these levels. Radical innovations that take place in niches can destabilise existing regimes and break through more widely if changes in the external landscape (for example, the global financial crisis or the Fukushima disaster) create pressures on the regime that lead to cracks and windows of opportunity. As a result, the existing regime might be replaced – or it might be strengthened if it can adapt.

As a framework for retrospective analysis, the framework offers useful insights, but it is much stronger on understanding structures than agency and agency is our central concern. The key feature of green transformations – and where they differ from previous transformations – is urgency. This means paying particular attention to timescales and understanding who accelerates the process and who slows it down, which is our central question.

There is no ready-made theory for this task, but there are lines of work – set out below – that help us in moving forward. So as to facilitate our task, we concentrate on the transformation of the energy system: from fossil fuels to renewable energy. There are two strong reasons for our focus on energy: first, it is a central input for the entire economic system; second, the energy system is the single most important contributor to carbon emissions.

On semantics, the change from fossil fuel to renewable energy is sometimes referred to as energy *transition* and sometimes *transformation*. In this paper we use the two terms interchangeably. This is controversial. Stirling (2015), for example, suggests that transitions are managed under orderly control through incumbent structures, whereas transformations involve unruly political alignments that challenge incumbent structures. Distinguishing between different political processes and actor constellations is indeed important, but our use of transition or transformation does not imply that the changes occur in one or other way.

## **2.2 Path dependence and path creation**

Positioning this paper in the green transformation debate means taking a view on what the main obstacles are and how to overcome them. The main obstacle for transforming the energy system is its strong path dependence. Path dependence is a central concept in evolutionary knowledge economics (David 1985; Arthur 1989), but other branches of social science and management studies have adopted it. The central point is that history matters: past decisions limit the options available today. They lock societies into particular technological and institutional trajectories. Breaking path dependence is especially difficult in the transition from high- to low-carbon technologies. According to Unruh (2000), most countries are locked into fossil fuel-based energy systems, which he termed the ‘carbon lock-in’. He also stressed that this carbon lock-in has globalised rapidly (Unruh and Carillo-Hermosilla 2006). Numerous contributions to the sustainability and climate change debate have recognised the existence of the lock-in and problems arising from it (for example, WBGU 2011).

The recognition of cumulative causation is central to path dependence theory. However, history also shows that paths are sometimes disrupted and unexpected new pathways emerge. Marx and Schumpeter remind us that change is built into the capitalist system.

Schumpeter (1942) interpreted capitalist development as a process of newcomers continuously challenging, and eventually outcompeting, established ways of doing business. Perez (2002, 2010) took this a step further, showing that the big technological changes have common phases.

Theories of how path creation occurs and who drives it forward are central to the concerns of this paper. Such path creation theory is much less developed than path dependency theory but we need both.

The evolution of technologies and industries can be described as a battle between the old and the new, that is, between the path-dependence forces of the old path and the attempt to create new paths. Path dependence and path creation are thus competing processes in times of technological transition. (Lovio, Mickwitz and Heiskanen 2011: 274)

Path creation is a relatively new concept that Garud and Karnøe (2001, 2003) and Garud, Kumaraswamy and Karnøe (2010) put forward. They are particularly concerned with the role of entrepreneurs in shaping new paths by triggering processes that lead to a change in social practices and technologies. They do not mean the lone, heroic entrepreneur but distributed entrepreneurship. Their key point is that path creation requires agency, which is distributed across heterogeneous actors (Garud and Karnøe 2003). These actors are seen to fall into four groups (Smith, Stirling and Berkhout 2005; Lovio *et al.* 2011):

- New market entrants, spin-offs, venture capital;
- Renewal and diversification of old corporations (incumbents);
- Civic activity: consumer activism, environmental movements, user-driven innovation;
- Government interventions: regulations, taxes and subsidies, public investment.

### **2.3 Actor constellations and transformative alliances**

Scoones, Leach and Newell (2015) share this recognition of agency distributed across heterogeneous actors, although their grouping is slightly different. In the introductory chapter of *The Politics of Green Transformations*, they distinguish between four narratives of green transformations and bring out the roles of different actors in:

- Technocentric transformations;
- Market-led transformations;
- State-led transformations;
- Citizen-led transformations.

Their discussion of these narratives is particularly useful because it highlights the strengths, limitations – and, in some cases, dangers – of relying on the different actor groups involved. While closely aligned with citizen-led transformations in their own work, Scoones *et al.* (2015) stress that no single group can bring about the required changes.

This is the starting point for this paper and the underlying project. To answer our central question – who drives low-carbon policies? – we take four critical steps: (1) recognising that no single actor has the resources to bring about the transition; (2) recognising that – within government, within business and within civil society – there are actors seeking to advance or slow down the process; (3) focusing attention on alignments of interest across government, business and civil society; and (4) including actors with different motives, to help understand these alignments (Schmitz 2015a).

The literature supports proceeding in this way. Political science analysis shows that alliances (or coalitions) are effective in overcoming complex collective action problems (Leftwich 2009;

Peiffer 2012). Maxfield (1991: 421) stressed the critical role of policy coalitions that cut across state and society and include business. More recently, Abdel-Latif and Schmitz (2010) have shown why and how state–business alliances matter in overcoming bottlenecks in economic development. When it comes to green transformations, the inclusion of business seems particularly important. As Newell and Paterson (2011: 41, 23) stressed:

many capitalists and state elites, for a range of different reasons, now have a political and financial stake in the project of decarbonisation... short or medium term transitions to a low-carbon economy will have to be supported (financially and politically) by powerful fractions of capital with a stake in the success of such a project.

Hess (2014) and Schmitz (2015a) have stressed that a political coalition perspective is equally important for understanding the opposing forces. So the case has been made for applying a coalition perspective in order to understand the dynamics of green transformations. However, applying this perspective is not easy. It requires dealing with complex issues and changing actor constellations. Doing just that and applying it to the case of the rising powers is the value added which this paper seeks to provide.<sup>4</sup>

## 2.4 Rapid political economy analysis

Addressing our central question has to take into account that there are many different types of actors – from government, business and civil society – who operate at different levels (global, national and local), have different priorities, and often use competing narratives; that the policy process has different stages; and that actor constellations change over time and according to the specific policy in question. The country studies on which this paper is based tried to do just that, namely cutting through such complexities. There was a further challenge: the political economy analysis had to be rapid since time and funding were very limited. Coping with these challenges was only possible by working with researchers who had good advance knowledge of the policies and actors.

These researchers followed a guide for taking on this difficult task (Schmitz 2012) and proceeded as follows: first, they built their analyses as much as possible on secondary sources (including sources in Chinese and Portuguese). Second, they filled the gaps by interviewing key respondents. Third, they drew on their own experience and knowledge which sometimes came from participant observation at important events at which policies and their design were negotiated. The combination of these sources varied between the four country studies and the policies in question but common principles were applied of cross-checking information and triangulating sources before drawing conclusions. Further details on these sources and their combination can be found in the country studies on India (Chaudhary *et al.* 2014), China (Dai 2015; Shen 2016), Brazil (Schaeffer *et al.* 2015) and South Africa (Morris and Martin 2015).

These country reports make explicit the value added they provide but also their limitations. This paper brings together their main findings but - where appropriate – also draws on the work of others. Where the evidence remains shaky this is made explicit.

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<sup>4</sup> In this paper we use the terms coalition and alliance interchangeably. Leftwich (2009) suggests that ‘coalitions are best understood as the political solution to collective action problems’ (p.8) and defines them as ‘formal and informal groups which come together to achieve goals which they could not achieve on their own’ (p.14). In our definition, we also include actors that join forces and support (or oppose) a policy without forming a group. The reason will become apparent in the course of the empirical sections.

### 3 China

We start with China because it is the most important country in all respects, leading Hamilton (2014) to ask 'Will China save the world or destroy it?' China has been the world's biggest carbon emitter since 2006 and has accounted for a greater increase in carbon emissions this century than any other country (World Bank 2015). However, focusing on carbon production gives different results from measuring carbon consumption. European carbon production has fallen because many carbon-intensive products are no longer made in-country but imported from China (Lin and Sun 2010; Helm 2012). Nevertheless, it is worth recording that in absolute terms China's energy-related greenhouse gas emissions almost reach the combined total of the US and EU (IEA 2015).

China is trying hard to contain its emissions in a number of ways, in particular by incentivising investment in renewable energy. Pushing investments in renewables has occurred on such a scale that China has been the world's leading investor in renewable energy for several years. Making renewables a priority has a strong legal foundation in the Renewable Energy Law of 2006, an umbrella regulation for renewable energy development. It not only emphasised the importance of renewable energy development as a national strategy, but also assigned responsibility to different parts of government, putting them in charge of technological development, setting standards, grid connection, developing feed-in tariffs, promoting industry, and creating a national renewable energy fund. The law guided all other policies and combinations thereof. In the remainder of this section on China we concentrate on the question of who was behind this law (policy formulation) and who drives its implementation.

Given the strong legal foundation and spectacular build-up of renewable energy capacity in China, a credible case can be made for presenting these advances as effective climate policies. Climate considerations, however, were not the driving force behind the Renewable Energy Law. The consensus among those who formulated the law, and those who have studied it since then, is that the key concerns were securing energy and building a competitive industry.<sup>5</sup> Mathews and Tan (2015) have called it 'building energy security through manufacturing' (page xiii). This is also the central theme of Mathews' (2015) book *Greening Capitalism – How Asia is Driving the Next Great Transformation*.

China's energy security has haunted Chinese policymakers for a long time, because the country's rapid growth led to a shortage of nearly all forms of energy resources. Given that China must increase its energy imports to meet domestic energy demand, its dependence on overseas energy resources has become a major worry to the government, particularly when most of the imports are from volatile countries in the Middle East and sub-Saharan Africa. On top of these worries is the long and risk-prone maritime transportation route, notably through the narrow Straits of Malacca and of Hormuz. Therefore, energy diversification and localisation of energy production is of strategic importance to China. Renewable energies such as wind and solar are locally produced and hence believed to have strategic geo-political value (Wei Shen, pers. comm., 20 November 2015).

Other parts of government were more concerned with enabling Chinese enterprises to catch up with the technological leaders and building industries that make the wind turbines and solar panels (Dai and Xue 2015). To build up production and innovation capabilities, the government introduced a raft of policies that complemented the Renewable Energy Law. This aim to build up competitive green industries added to the political support for renewable

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<sup>5</sup> Based on conversations with Professor Qi Ye, Director of the Brookings-Tsinghua Centre for Public Policy during Climate Change Conference, Chatham House, 3–4 November 2014.

energy policies. With hindsight we can say that this ambition has been fulfilled. China has become the world's foremost producer of wind turbines and solar panels, and has reduced the technological gap with European leaders (Lewis 2013; Schmitz and Lema 2015; Lema, Sagar and Zhou 2016). The policies and timings differed between wind and solar, but were driven in both cases by the ambition to build new globally competitive industries.

Recent discussions over the motives for supporting renewable energy have also referred to problems of air pollution. While it is clear that air pollution is a huge problem in China's big cities, and has thus become part of the renewable energy narrative at conferences and in the media, it is not clear whether it played a role in the policy formulation process. It seems safe to say that it did not play a role at the time the Renewable Energy Law was introduced, but it might have added to the momentum for subsequent complementary policies.

While policy formulation takes place at central level, implementation has required active participation at the local level. Dai (2015) emphasises that local governments that were active in implementation were concerned mainly with fostering local economic development, creating jobs and increasing public revenue. Local government leaders and officials are responsible for stimulating private-sector investment, job creation and tax collection; and their promotion prospects are influenced by how their localities perform in this respect.

In summary the reasons for supporting renewable energy policies vary. Different actors have different priorities. What they have in common is that mitigating climate change is not a priority. To what extent climate issues have played a role is hard to tell from the available accounts. Presumably they have begun to play a role more recently at the central level where China's global responsibilities have been discussed. The 12th Five-Year Plan, which the government adopted in March 2011, devotes considerable attention to climate change issues and establishes a comprehensive set of targets and policies for the period 2011–15. But climate change has not been a driver of *China's Renewable Energy Revolution* (title of a book by Mathews and Tan 2015).

So far we have concentrated on the motives for supporting low-carbon policies but said little about the actors. In most accounts the state is seen as the central actor, pushing policies through the formulation and implementation stages in a top-down fashion (Gilley 2012; Dai and Xue 2015; Lewis 2013). While the role of local government in implementation and the power dynamics between central and local levels receive some attention, the policy process is assumed to be largely, if not entirely, state led.

This state-led view, which is explicit or implicit in most accounts of the rapid growth of the Chinese renewable energy industry, seems correct for the time when the Renewable Energy Law was discussed and introduced (2005). However, it seems simplistic when applied to later years when complementary policies were made. Shen (2016) has argued that, in recent years, business has come to play an active role in all stages of climate-relevant policy processes, in particular for the renewable energy sector. His central argument is that a coalition of state–business actors has played a key role in driving the policy process and that this role has increased over time. 'Policy decisions are made jointly by a small group of private and public actors as the core members of the renewable energy coalition via internal discussion and negotiation' (p.13).

The key actors are from the Energy Bureau of the National Development and Reform Commission (NDRC), which is the main economic policymaking body of central government; state-owned power utility companies as the major investors; and large manufacturers of wind turbines and solar panels. This group of actors has no formal status; it is an informal coalition that meets frequently to discuss new policies and review the implementation of existing policies. According to Shen (2016), Energy Bureau officials tend to organise these meetings and invite key business actors to express their opinions and concerns on the design of new

policy. There are no explicit rules for such meetings but their frequency is high. The common goal is to increase the share of renewables in the energy mix. NDRC officers recognise that increasing their administrative power relies on the expansion of the industry they regulate.

It seems that the application of the 2006 Renewable Energy Law created its own constituency. The key actors in the coalition are newly established organisations. The Energy Bureau was only established in 2008. Its renewable energy wing is the newest section in the bureau compared to other traditional departments that regulate fossil fuels and nuclear energy. Investors in wind farms and solar are new subsidiaries of state-owned utilities. The main manufacturers of wind and solar equipment are spin-offs of heavy machinery or electric equipment companies. By joining forces these actors have kept up the momentum that came from the initial push emanating from the Renewable Energy Law.

Essential to the success of the coalition were opportunistic narratives that appealed to other parts of the state (or party) apparatus, which had different concerns such as energy independence, national security, technological catch-up, industrial expansion, climate change and 'ecological civilisation' (Geall and Ely 2015). Shen (2016) suggests that this renewable energy coalition encountered little opposition from the fossil fuel industries because – given the rapidly rising energy demand – the expansion of one was not at the expense of the other. This might change as the economy slows.

The main resistance came – mainly in the implementation phase – from the grid companies. Under the Renewable Energy Law they were obliged to connect new wind parks and solar power stations to the grid, but found it difficult to do so in a safe way because these new producers 'mushroomed in uncontrollable fashion' (Shen 2016). It seems, however, that this was a transitional problem because it gave grid companies the opportunity to negotiate more resources and new regulatory powers. This helped to overcome the earlier technical problems and led to a political solution. In a shrewd move, the grid companies have been invited to join the frequent coalition deliberations and in effect become part of it (Shen 2016).

While its achievements have been impressive, it is important not to exaggerate the influence of the coalition. It sometimes fizzles out at the local level, where local governments play an essential role in implementation. Local authorities have discretion whether to join the 'renewable energy revolution'; many do not. Those that join rarely do so because they buy into the grand narratives of the coalition, which tries to orchestrate activities from the centre. They have their own reasons, namely fostering local economic development and raising public revenue (Dai 2015). Whatever their motives, their support for establishing wind farms or solar power stations is climate relevant.

Harrison and Kostka (2014) have suggested that the local politics of climate change mitigation in China can be understood in terms of the 'bundling of interests'. This seems a very useful notion. The implication, however, is not that business actors are passive in this process. Dai (2015) shows that local governments that participate in the implementation of renewable energy policies do so because investors have lobbied them, and they work with the investors to ground the projects. Shen (2016) suggests that the investors play a further role by helping to overcome the implementation gap that frequently exists between central and local government levels. The investors' connections help them to play an intermediary role, providing information and influence that accelerates the implementation.

In summary, the question of who drives climate-relevant policies in China does not have a simple answer; it varies over time and along the central–local axis. The bundling of interests, however, has been important in all instances, supporting the coalition perspective.

## 4 India

In moving from China to India it is useful to draw again on the work of Harrison and Kostka because their analysis of the politics of climate change straddles both of these rising powers.

In both countries the ability to build and sustain coalitions is central to the effectiveness and sustainability of climate change policy. For various reasons, state strategies in China and India have focused on the need to bring different parties with otherwise divergent interests on board to build a coalition in favour of climate mitigation measures.

(Harrison and Kostka 2012: 5)

The previous section has shown that this perspective – in which different actors for different reasons support low-carbon policies – helps in understanding the Chinese case. This section examines whether it also helps with the Indian case.

Two features that India shares with China are its enormous size and fast growth. But India is much poorer than China and has much lower per capita carbon emissions. Nevertheless, India is called on and is willing to participate actively in global climate change debates. Like China, India is a strong supporter of ‘common but differentiated responsibilities’, insisting that its economic ambitions must not be held back by commitments to reduce emissions – in view of its large numbers of poor people. While Indian elites have faced criticism that they are hiding behind the poor (Chakravarty and Ramana 2011), the prevailing view is that the main responsibility for climate action lies with rich countries. But this does not mean that the elites take no account of climate issues. ‘Indian climate politics supports domestic measures toward adaptation, and mitigation measures that are consistent with domestic development objectives’ (Dubash 2012: 12). Behind this stance is a ‘co-benefits’ approach, which is essential to understanding the politics of climate-relevant policies in India. The key point is that such policies are driven by actors who have other priorities, but welcome carbon reductions as a co-benefit.

Concern with energy security plays the central role in Indian climate politics. While climate action remains controversial, energy security enjoys strong political support from government, business and civil society. Energy concerns were a major driving force behind India’s National Action Plan on Climate Change.

The political priority given to actions to address energy security, and the alignment of climate mitigation as a potential co-benefit of such action, has created the impetus for policies that have the effect of climate mitigation, although they may not be primarily labelled as such.

(Dubash 2012: 11)

The concern with building new green industries also played a role but its importance varied between sectors, being strong in the case of solar energy policies but much less so in the case of wind power. This comes out clearly from a comparison of the two sectors by Chaudhary *et al.* (2014). They show that there are no easy answers to the question of who drives the renewable energy policies. Many policies were adopted over different phases, with big differences between sectors, states, and changing actor constellations. Nevertheless, a number of findings, directly relevant to the objectives of this paper, can be distilled for the wind and solar energy sectors, drawing on the analyses of Chaudhary *et al.* (2014) and Spratt *et al.* (2014).

The solar sector benefits from the more comprehensive policies and political support. The largest policy initiative is the National Solar Mission, which is an explicit part of India’s

National Action Plan on Climate Change. A number of reasons led to the introduction of a mission-based policy approach. By the late 2000s, the Indian government was increasingly under pressure at various international fora to take steps towards climate change mitigation. Meanwhile, central government ministries were drawing up plans to boost the solar sector due to industrialisation, job creation and energy security considerations. This combination of pressures and ambitions led to the initiative's being packaged and presented externally as a way to reduce India's carbon footprint, but domestically actors with different concerns were driving it.

One of the key drivers of the National Solar Mission was Indian policymakers' aspiration to become a major global solar player by establishing a domestic solar manufacturing base. While energy security also played a role, it was the sector's industrialisation potential (with associated economic growth and job creation possibilities) that was the more important consideration for central policymakers. State-level policies were mostly aimed at deployment of solar technologies rather than making them. The most vigorous implementation of solar policies occurred in the state of Gujarat where chief minister Narendra Modi (now prime minister), spearheaded an alliance of government and business interests that was determined to accelerate economic development. More generally, political leaders and policymakers sought to enhance their re-election prospects and careers. Business leaders, in particular developers, supported the policies because they saw opportunities for high returns on investments, as did financial institutions.

Policies for the wind energy sector have a longer history. Again we draw on the analyses of Chaudhary *et al.* (2014) and Spratt *et al.* (2014) to bring out who was driving the policies for this sector. As in the case of solar, given the number of policies, phases, levels and actors, it is not easy to summarise, but clear findings emerge that are relevant to our concerns. Political support for the wind power sector is mainly an energy security story right from the beginning. Wind power in India dates back to the global energy crisis of the 1970s, which prompted the building of institutional capacity for renewables. International agencies sought to help India to reduce the crippling effects of energy shortages and played an important role in policy framing, but not in later phases (1990s onwards).

The National Ministry of New and Renewable Energy became the most important institutional actor in shaping policy and securing resources. State governments also played a key role, especially in states such as Maharashtra, Tamil Nadu and Gujarat, which were suffering from severe energy shortages but had strong wind resources. In the 1990s and 2000s their governments, and in particular their regulatory agencies, introduced policies that other states subsequently emulated. The policy processes were complex but the motivations were clear: 'energy security concerns and attractive returns on wind power were of paramount importance' (Chaudhary *et al.* 2014: 19). Business in general was a strong supporter because its expansion required more reliable energy access, and firms specialising in the wind sector (manufacturers of wind turbines and developers of wind farms) sought a stable return on their investment.

Climate concerns were not particularly relevant for the wind policy debate. In the early phases this was for the obvious reason that the wind policy debate preceded the climate debate. But even in the later phases the climate change narrative did not gain prominence. The National Action Plan for Climate Change refers to wind power as a necessary sector in ensuring that 15 per cent of India's installed capacity is renewable power. But although the plan includes a National Solar Mission, it does not include a National Wind Mission. The contrast with the solar sector reveals another oddity. Concerns with fostering industrial development did not drive the wind policies, at least not on the government side. This seems odd because India is more competitive in making wind turbines than solar panels. It seems

that central policymakers assumed that the wind power equipment sector was already mature and no longer required an industrial policy.<sup>6</sup>

For a European or North American observer, however, an important similarity between the wind and solar power-sector policies was lack of opposition. While in Europe and North America the fossil fuel industries have sought to undermine and hold back renewable energy policies, this did not happen in India. The reason is straightforward: energy shortages were, and continue to be, a major problem.

To summarise the Indian case, the articulation of a co-benefits approach has enabled stakeholders to engage in the climate change debate without conceding on their priority of accelerating economic development. The pursuit of energy security has been the most powerful driver of domestic action. Other than the co-benefits approach, however, no coherent strategy exists, as is exemplified by the contrasts in political support for wind and solar power.

## 5 Brazil

The starting position of Brazil is very different from that of China and India. For a long time, Brazil has met increasing energy demand with renewable sources, mainly biofuel (sugar cane) and hydropower. In 2013, over 40 per cent of energy came from renewable sources (EPE 2014). This is a high share when compared to the world average of around 13 per cent, and even more so when compared with other rising powers. The purpose of this section is to show which forces drove this and look at the connections between Brazil's renewable energy story and its climate policy.

The high share of renewables in the energy mix has helped Brazil to take a climate-friendly position in international fora. At first sight, this external position seems anchored in internal policies. Government institutions were created and formally tasked with mitigating climate change. An Inter-Ministerial Committee on Climate Change (CIM) was created in 2007 to formulate and implement a National Plan on Climate Change (NPCC), which was elaborated in 2008 and became law in 2009. However, the NPCC has faced criticism domestically and internationally. It entails a commitment to reduce carbon emissions that relies on a baseline which makes it easy to meet the commitment. Reductions in carbon emissions that were achieved came mainly from a reduction in deforestation rates, which resulted from measures already in place at the time the National Climate Policy was being formulated (Viola and Franchini 2014). The Federal Government, however, was keen to present them as achievements of a deliberate climate policy: 'Brazil longs to be seen as a rising power that is progressive and which cares for the planet' (Schaeffer *et al.* 2015: 17).

The attention given to climate policy was linked to an ambition to establish Brazil as a rising power. According to Viola and Franchini (2014), green diplomacy played a major role under the presidency of Luiz Inácio 'Lula' da Silva (2003–10). The image of Brazil as a low-carbon country was regarded as crucial for the country's ambition to be seen as a leader internationally. For example, Lula campaigned for Brazil to gain a permanent seat on the United Nations Security Council. Such ambitions to play a role on the world stage gave

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<sup>6</sup> And presumably India's wind turbine champion, the manufacturer Suzlon, has engaged less in Indian policy networks because it exports to other countries, thereby reducing its dependence on the Indian market and domestic policies. In contrast, in an earlier period when it was more dependent on the Indian market, Suzlon was very active in building an alliance of manufacturers and state banks to advance its commercial interests (Spratt *et al.* 2014).

national climate policy a push and influenced the agenda that Brazil pursued internationally and nationally.

Translating global ambitions into national realities, however, has been difficult because climate policy cuts across different sectors and is a source of power disputes between ministries responsible for these sectors. The positions that these ministries take are, in turn, influenced by interests that pull in different directions and end up slowing if not undermining progress in reducing carbon emissions. Under the presidency of Dilma Rousseff (who succeeded Lula in 2011), the climate agenda has lost momentum because of these conflicting interests. Internal conflicts have deepened in the second term of Rousseff's presidency, which is mired in corruption allegations and concerned above all with short-term political survival.

While the short term is unpredictable, important conclusions can be derived from historical analysis. Brazil's enviable position of a high share of renewables in the energy mix is the result of government policies adopted over the course of four decades. The promotion of biofuels – in particular the production of ethanol from sugar cane – was the most prominent programme and gained worldwide attention. Given the central concern of this paper with policy drivers, we have to ask which forces were behind the ethanol programme (PROALCOOL), which started in 1975.

The impetus came from a concern with energy security and from the need to save foreign exchange. The quadrupling of oil prices in 1973 had major repercussions for the country's balance of payments. But this was not the only driver. Political support for the ethanol policies came from a convergence of interests between different parts of the government and of the private sector. The Federal Government's priority was to secure energy for continued economic growth and reduce the outflow of foreign currency by reducing the dependence on oil imports. The sugar cane industry had a direct interest in fostering ethanol production because international sugar prices had collapsed. State governments in the sugar cane-producing regions of the northeast were keen to promote rural employment. And the capital goods industry in the southeast (São Paulo) had a direct interest in producing equipment for the new ethanol distilleries. While the literature is not clear about how they joined forces and exerted influence, a strong alignment of interests backed the national ethanol programme. The alignment of interests was somewhat different in the National Biodiesel Programme, which was introduced 30 years later (in 2005), but again climate concerns played no role (Schaeffer *et al.* 2015).

Given that the earlier sections on China and India pay explicit attention to wind and solar energy, these two sectors are also examined for Brazil, although they have received only very limited attention in government policy. Understanding this neglect is not easy but provides some useful insights for our concerns.

Although Brazil has been very active in government-led renewable energy, no policy has focused on wind power in particular. The policies that have influenced wind power production have targeted a range of alternative electricity sources, including wind, biomass and small hydroelectric plants. The PROINFA programme, which went into operation in 2008, was complemented with special auctions for alternative energy suppliers. These policies seem to have helped the wind power sector grow quickly, but its share in the energy mix remains small (1.6 per cent in 2013).

Policies to foster solar energy have a slightly longer history and have been aimed mainly at rural electrification. The largest programme, 'Light for All', which was launched in 2003, was a response to the constitutional obligation to provide remote communities with electricity, but it has progressed more slowly than planned. While important for the communities that now

have electricity, the overall significance of solar energy remains even smaller than that of wind. However, no reliable statistics for solar energy production are available.

Given that Brazil is well endowed with solar and wind resources, and given the central question of this paper, it is important to ask why these two sectors have received only limited attention. As stressed by Newborne and Welham (2014: 29):

This is in marked contrast to the approach taken to developing a market for ethanol to become a viable liquid fuel, where substantial public and private funds have been invested over the longer term... Solar energy is at a more preliminary stage of development than wind power, providing a further point of contrast with the government's long term investment in developing technology to promote ethanol as a liquid fuel.

Although we did not find an in-depth investigation of the deeper reasons, we distilled insightful indications from recent studies. The climate relevance of wind and solar energy has not gone unnoticed in Brazil, but actors with green concerns have little or no influence on energy policy. The Ministry of Environment is not included in the decision-making process of the energy ministry. 'There is a clear disconnect between the climate and energy policies in the country' (Schaeffer *et al.* 2015: 33). Business support has also been weak. There are business associations for the wind and solar sectors, but – being young associations – their level of influence in policymaking is very limited.

Perhaps, the most interesting insight, however, concerns opposition from within the renewables sector itself. Although often latent, it seems to have played a role.

Ironically, the sectors associated with hydroelectricity and sugarcane generally oppose other renewable sources such as wind and solar. These sectors include large construction firms specialised in building dams and conservative segments of the energy bureaucracy, as well as the '*usineiros*' (sugar plantation/mill owners)... They emphasise the higher costs and dispatchability problems of wind and solar energy to argue for the construction of new hydropower plants. As hydroelectricity faces large opposition from environmentalists and social movements, undermining other renewable power generation options such as wind and solar is a strategy used by the hydroelectricity and sugarcane sectors. (Schaeffer *et al.* 2015: 30–1)

Solar and wind energy are also regarded as competitors for renewable energy incentives by the sugarcane industry. Biofuels, once in the spotlight of renewable energy in Brazil, see their leading role threatened by these newcomers. The reasons for this include not only the competition for limited public resources... but also the loss of political capital and bargaining power in terms of being the best low-carbon solution for Brazil. To complete the picture, it is worth mentioning that the ethanol sector has been unable to compete with wind in the most recent electricity auctions. (Schaeffer *et al.* 2015: 34–5)

This competition among Brazilian renewables producers provides an important general insight. Conducting political economy analysis of climate relevant policies in terms of low-carbon versus high-carbon alliances does not always work. While it is important to keep this in mind, it is equally important to pay attention to the context in which conflicts between low-carbon forces take place. In the Brazilian case this context is one of shrinking political space for low-carbon solutions and increasing political space for high-carbon solutions. The latter occurred because of an unexpected event: the discovery of significant oil reserves off the Brazilian coast. The discovery was made in 2007 and oil production started in 2011, contributing to a decline in the share of renewables in the energy mix. 'The discovery of

these oil reserves was probably the single greatest obstacle to Brazilian policy-makers' choosing to transition to a low-carbon economy' (Viola and Franchini 2014: 7).

In conclusion, the Brazilian case is in some respects different and in others similar to that of China and India. While the political space for low-carbon solutions is increasing in China and India, it is shrinking in Brazil. Nevertheless, Brazil benefits from a historically high share of renewables in the energy mix. The policies that led to this favourable situation were driven by foreign exchange, energy security, industrial policy and job creation motives, similar to the motives that prevailed in China and India.

## 6 South Africa

South Africa starts from a situation very different from that of Brazil and has relied mainly on abundant coal reserves to produce electricity. As in the previous sections, the purpose of this section is to reveal the forces that hold back the transition in South Africa to renewable energy and those that would move it forward. A number of studies investigate the forces against, including Eberhard (2007), Baker (2011), Baker, Newell and Phillips (2014), Pegels (2014) and Morris and Martin (2015).

Cheap and plentiful coal-generated energy has been essential for South Africa's 'minerals and energy complex'. Actors from business, the government and trade unions have an interest in the competitiveness of this complex. They have used their engagement in the policymaking process to keep energy prices low and minimise the amount spent on supporting renewable energy. The central actor in this alliance was energy supplier Eskom, a vertically integrated state-owned monopoly, well connected to key government departments and energy-intensive companies. In the words of Baker *et al.* (2014: 23):

Given the strength of the incumbent regime in the form of the MEC (minerals and energy complex) that is so tied to and reliant upon the production of cheap fossil fuels and their distribution through a grid controlled by a virtually monopoly actor, opportunities for large-scale and widespread transitions (to renewables) are hard to discern.

But 'moments of crisis create opportunities for change' (p.23) and such a change towards renewables has emerged. Understanding why is critical. South Africa has strong environmental reasons for raising the share of renewables in the energy mix: its carbon emissions per capita are twice the global average (Pegels 2014). However, the driving force behind its renewable energy policies was not a commitment to reduce high-carbon emissions and mitigate climate change. Rather, it was prompted by a crisis in electricity supply:

The importance of achieving energy security was brutally put on the political agenda by an inability of Eskom to meet the new demands of a post-apartheid period of industrial growth and rapid electrification programmes for the poorer, previously disadvantaged segments of South African society. The breakdown of Eskom's generating, transmission and distribution capacity and rapidly escalating electricity prices shock business and residential householders to the core.  
(Morris and Martin 2015: 68)

The crisis loosened the grip of the minerals and energy complex on the policy process, but moves towards renewables continue to be contested. Morris and Martin (2015) unravel a struggle between two coalitions, one against and one in favour of renewables, splitting the public and the private sectors while civil society (trade unions and householder associations) remains undecided.

On the government side, the coalition in favour of renewables consists of the Policy and Clean Energy Branch of the Department of Energy, the National Treasury, the Department of Environmental Affairs, and parts of the Department of Trade and Industry; and private-sector support comes from foreign-based independent power producers and ancillary business professionals tied to their operations. This alliance is gaining influence over the policy process and creating a platform for a renewable energy path but the process has been messy. Morris and Martin (2015) cut through this complexity by providing three insights:

First, support for renewables comes from a range of actors with different motives. Climate change mitigation is a major concern of the Department of Environmental Affairs, but actors with greater influence have other priorities. The Treasury's main concern is reliable energy supply, which is essential for raising public revenue. Similarly, the Department of Energy is concerned with choice and reliability in the energy supply. The priority for independent power producers is to establish profitable wind or solar power stations in South Africa.

Second, there is a convenor. The above alignment of interests has translated into effective support for renewable energy policy because a unit in government spearheaded the Renewable Energy Independent Power Producer Procurement Programme (RE-IPPPP). Previous policy initiatives were ineffective, but the RE-IPPPP succeeded because it was led by an inter-ministerial body, the IPP Unit. The unit was not tied to the hierarchies and procedures of other government departments but was well connected to key leaders in the public and private sectors, and could take funding decisions that the Treasury backed.

Third, political circumstances matter. The political momentum for the renewable energy programme came from a conjunction of three developments: pressure to showcase South Africa on the international stage at the time of the Climate Change Conference held in Durban (COP 17 in 2011); pressure from electricity users to respond to the electricity crisis; and the inability of Eskom to meet the financial and time demands to generate the capacity that was immediately required for energy security.

A coalition for change thus opened the door for renewables. Scaling up renewable energy, however, will not be easy. The key obstacle is likely to be Eskom. The state-owned company is keen to defend its near monopoly, but history suggests that it will not declare its opposition to renewable energy openly. Eskom slowed down, if not killed off, previous initiatives with sabotage by inaction and 'malicious compliance' (Morris and Martin 2015: 8). Eskom is not just the main producer of (coal-based) energy, it is also in charge of transmission and distribution, and can make it difficult for the new private renewable energy producers to connect to the grid. The renewables agenda is thus linked to an agenda of breaking up a vertically integrated, state-owned, company backed by the Department of Public Enterprises and Department of Minerals and Energy.

## **7 Overall lessons**

The four cases reviewed above have presented empirical findings on who drives climate-relevant policies. To a lesser extent they have also addressed the question of who obstructs such policies. In synthesising the findings, we have tried to bring out commonalities and paid attention to specific insights that promise to add value. This section brings together the key points, starting with the commonalities.

All four cases underlined the value of adopting a political economy approach, which takes four analytical steps:

1. Recognising that no single actor has the resources to bring about the transition to renewable energy;
2. Recognising that actors in government, business and civil society seek to advance or slow down the process;
3. Paying attention to alignments of interest across government, business and civil society;
4. Including actors with different motives to understand these alignments.

While our syntheses of the four cases pay more attention to government and business actors, the implication is not that civil society organisations are irrelevant. However, they have been less influential, or at least seemed to have been, in the case material we reviewed.<sup>7</sup>

The case material highlights in particular the need to pay attention to actors who support climate-relevant policies even if mitigating climate change is not their main concern. However, in terms of providing support in the formulation and implementation of such policies, their actions are of direct relevance. We saw in all four cases that the most significant actors had other priorities. These included: securing energy for the country, region or company, fostering new industries, creating jobs, or providing a basis for generating public revenue. This is not to say that actors with green motives have been irrelevant. Their relevance lies in strengthening coalitions, and sometimes providing the flag under which all the others are willing to join. The Indian debate, in particular, has shown the analytical and political importance of considering climate change mitigation as a ‘co-benefit’.

The notion of co-benefit does not automatically mean that an alliance was created for the purpose of joint action. In many cases alliances emerged in incidental ways, which is why we sometimes referred to ‘alignments of interest’. It is clear from the case material that different actors’ interests were aligned, but it is not always clear whether they consciously pursued joint action. We cannot tell from the studies on India and Brazil whether there were gatherings or communications for the purpose of coordinated action, or which actor had convening power.

A transformative alliance – operating strategically – was, however, a clear finding that emerged from the China research (Shen 2016). The alliance is informal but a small group of NDRC officers has *de facto* convening power. In South Africa, a small informal inter-ministerial unit was pulling the strings. It could do so precisely because it was not that visible and was not in a hierarchical relationship with other actors. Of course, where the convening power does not come from holding a high-ranking public office, the experience, capabilities and networks of individuals are particularly important (Morris and Martin 2015).

Taken together, these insights lead to three general conclusions: First, the motives for supporting climate-relevant policies vary a great deal. These motives can be seen to fall into two groups: material and moral.<sup>8</sup> Most importantly, they are not mutually exclusive but – in some cases - complementary. Opportunities for understanding and fostering change open up once we allow for alignments between the two. The point is made neatly by Hochstetler

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<sup>7</sup> Detailed research would probably show differences between countries and over time. Historically, environmental non-governmental organisations have had more influence in India than in China, but recently their prospects of working with government have shrunk in India and increased in China (Chaturvedi and Schmitz 2015).

<sup>8</sup> ‘Material’ includes both individual interests (for example, businesses concerned with profits or workers concerned with their jobs) and collective interests (for example, securing energy for a region). ‘Moral’ includes in particular the concern with safeguarding the sustainability of human life on our planet. But the latter could also be seen as a (long term) material interest, so the dividing line between material and moral motives is not always clear.

and Viola (2012: 755) in their conclusion that Brazil's biggest advance in climate policy was made (in the late 2000s) 'when principled actors found common ground with self-interested ones to promote policy change'.

Second, there are different types of alliances. At one end, there is the *strategic alliance* based on joint action; at the other is the mere *alignment of interest* without coordination between the parties. Closely related and also very useful is the distinction between *consciously pursued* and *incidental* alliance. Both can be transitional (short term) or enduring (long term), but the incidental alliance is more likely to be short term. Information on the longevity of alliances is rare (not just in our case material) but it seems that short term alliances, triggered by particular events or focused on specific initiative, are more common.

Third, alliances make a difference. They are instrumental in accelerating change or blocking it. Although the case material on how alliances organise and operate is patchy, we can state with some confidence that they matter. Matter when and for what? Here we need to unpack the policy process and pay particular attention to bottlenecks. Without subscribing to a linear policy process we can helpfully distinguish between policy formulation and implementation.

This is underlined by the case of China where policy formulation happens mainly at central level in negotiations between various actors (Shen 2016). The implementation of policies requires other or additional actors, typically at the sub-national level, and it requires cooperation between local government and business. This comes out clearly from the studies of Dai (2015) and Spratt *et al.* (2014). We are also reminded by Spratt *et al.* (2014) that we must not get carried away with alliance thinking. Giving alliances the status of a necessary condition for transformation would not be helpful. There are cases when due to fortuitous circumstances things fall into place without actors' shepherding, pushing or pulling.<sup>9</sup> In most cases, however, blockages or crises occur that require some form of joint action for policy implementation to happen. We learn from Spratt *et al.* (2014) that greater attention to financial actors would help in understanding how such blockages are resolved.

While the case material tells us a lot about who drives climate-relevant policies, there is less on who obstructs such policies. Nevertheless, important insights emerge. Low-carbon policies are intensely contested in Western Europe and North America (Newell and Paterson 2010; Meckling 2011; Helm 2012). The fossil fuel and related industries have opposed, in particular, policies aimed at pushing up the share of renewables in the energy mix. Such opposition did not seem to play a role in the cases of China and India because energy shortages due to rapidly rising demand were the main concern. The advance of one was not at the expense of the other. This seems relevant to political assessments of renewables in many other countries. It is particularly relevant for revisiting the path dependency argument. Where substantial energy shortages prevail or arise, path dependency is put on hold, temporarily at least. Energy shortages provide a window of opportunity to create new paths and to try out and establish renewable energies.

A very different insight emerges from Brazil where renewables have played a prominent role for some time and account for over 40 per cent of the energy mix. The Brazil case suggests that a political assessment in terms of high versus low-carbon alliances might not always work. As shown earlier, opposition to new renewables (wind and solar) comes from well-established renewables (hydropower and biofuel). But this opposition from within the renewables industry has to be seen in a context where the discovery of new sources of fossil fuel has put all renewables on the defensive.

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<sup>9</sup> The likelihood of this happening increases when new energy technologies become more economical.

The Brazilian example emphasises that context matters; but it matters in all cases and there are many contextual variables. The key ones emerging from the reviewed cases are natural endowments (e.g. fossil fuel reserves), the degree of energy shortage, what stage the country is at in its transition to renewables, and the institutional system.<sup>10</sup> How and the extent to which they matter would need to be examined through future *comparative* research, which is the focus of the next section.

## 8 Future research

This paper has brought together insights on drivers and obstacles in the energy transitions of rising powers, focusing in particular on key actors in the policy process. We have seen that alliances of actors have played a big role. Particularly important is the insight that some of the most influential actors have priorities other than climate change mitigation. Reducing the climate chaos is at best seen as a co-benefit. This insight is not just of analytical but also political importance. It means that climate-relevant policies can draw on support from a wide constituency, not just those with green convictions.

This then provides a stepping stone for more ambitious research on the political feasibility of low-carbon transformations. The critical next step is to specify the conditions under which alliances make a difference. To explain this, we need to return to the big picture.

A number of analyses have been commissioned on the feasibility of low-carbon transformations, in particular for the energy sector. Such assessments have been very useful because they have provided a view on the technological and/or financial feasibility of transforming the energy system (WBGU 2011; IIASA 2012) or protecting the climate (Stern 2007, 2014). While these assessments are controversial on grounds of methodology, assumptions and data quality, they share a noteworthy common message. They suggest that (1) transformations are possible from a technological and financial point of view; (2) they are urgent; and (3) the key to faster progress lies in the political sphere. The German Advisory Council for Global Change carried out one of the most comprehensive assessments and concluded:

the technological potential for comprehensive decarbonisation is available... and the policy instruments needed for a climate-friendly transformation are widely known. *Now it is foremost a political task to overcome the barriers of such a transformation, and to accelerate the change.*  
(WBGU, 2011: 1; emphasis added)

The political economy insights pulled together in the previous sections of this paper have sought to contribute to this debate. We have shown who drives and who slows the formulation and implementation of low-carbon policies, stressing that alliances are critical. The next step is to examine under what conditions such alliances matter. Addressing this question would help with judging the *political feasibility* of transformations. Many factors play a role, but structural factors deserve explicit attention.

The political feasibility of low-carbon transformations is likely to be influenced by a number of structural factors such as the extent of energy scarcity, natural endowments (fossil fuel

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<sup>10</sup> The relevance of the institutional system is highlighted by Hochstetler and Kostka (2015: 90) in their analysis of why China's advance in wind and solar power was much more rapid than that of Brazil. They argue that 'the observed difference in renewable energy outcome is partly explained by variations in state-business relations in Brazil and China. Brazil's public-private partnership model and China's state-corporatist model are different approaches to aligning interests between the state and market players.'

reserves, solar and wind resources), capacity to produce and adopt new technologies, and existing energy infrastructure. It is plausible that such structural differences between countries play a role in the political process but little, if any, *comparative* research appears to have been conducted on whether, how and why they matter to low-carbon transformation.

This recognition helps to situate further research in the debate on the role of agency versus structure in transformations. The earlier theoretical discussion in Section 2 and the concluding observations in Section 7 prioritised the role of agency. This was not a voluntarist choice but derived from the – widely agreed – need for urgent action. We concluded that alliances play a key role in accelerating the process, but we must also recognise that these alliances operate within structures. Unpacking these structures seems essential for future research.

Our country studies show structural factors that inhibit or facilitate transformations. Some inhibiting factors are inherited from millions of years of evolution, namely the fossil fuel endowments; others are of recent origin and man-made, notably investment in fossil fuel infrastructure. The facilitating factors can also be subdivided into those ‘given by nature’, namely the wind and solar endowments, and those which are man-made, notably the national capacity to produce the new renewable energy technologies. Where such capacity exists the lobby for renewables is likely to be much stronger. As discussed above, we must also consider an involuntary facilitating factor, namely energy shortages, which are likely to lower resistance to introducing renewables. Our overall argument is that all these factors influence the political feasibility of transformations and that inter-country comparative research would reveal how (in)significant they are to the formation of alliances that accelerate or slow down the transformations.<sup>11</sup>

These are not the only factors. Institutional systems play a role. The distinction between coordinated and liberal institutional systems (Hall and Soskice 2001) seems relevant. Given the high interdependence of public and private investments in the energy sector, we can hypothesise that coordinated institutional systems are more conducive to energy transitions (Lockwood 2015, Hochstetler and Kostka 2015). And given the enormous uncertainties and the need to experiment, we can hypothesise that decentralised systems are more conducive to rapid learning (Schmitz *et al.* 2015b). For example, Altenburg and Engelmeier (2013) highlight the importance of sub-national experimentation and learning to promote solar energy in India. Finally, crises affect the political feasibility of policies. Crises provide alliances with new political spaces – essential for bringing about change. In summary, research which is comparative - between countries and/or over time - would help researchers or policymakers to make a judgement on the political feasibility of climate-relevant policies.

At the risk of getting carried away, one could go further by making dynamic assessments that experiment with the notion of *political tipping points*. The tipping point idea refers to a process where, beyond a certain point, changes accelerate. It is a point at which little things make a big difference (Gladwell 2000). The inspiration for using it here comes from earth and climate scientists, who suggest that changes in the bio-sphere or earth system are not linear and that tipping points exist that are critical for the future of human life on our planet.

The Paris Agreement of December 2015 has been hailed as a tipping point. This global agreement to curb carb emissions is built on the assumption that political support for climate-relevant policies is growing at the national level and that this will have a knock-on effect for global negotiations – making global agreements more ambitious and binding. It is a bottom up process of building global governance. The political feasibility of this approach can be investigated by concentrating on the alliances for and against it. Comparisons over time can

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<sup>11</sup> Making such assessments dynamic would be essential because the stage in the energy transition plays a role. As countries increase the share of renewables in the energy mix, the issues change and the winner and loser constellations change (Lockwood 2015).

trace whether the alliances behind the national commitments can be counted on for the implementation. And comparisons between countries can help to discern how different structural features influence the composition and strength of alliances. This would mark a novel way of examining whether and how global sustainability can be constructed in a purposeful way and showing how academic research can influence this process.

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