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The political economy of energy transitions in Mozambique and South Africa: The role of the Rising Powers

Abstract: In a world in which ‘rising powers’ are reconfiguring global development trajectories with significant implications for their sustainability, it becomes increasingly important to understand *whether* and *how* low carbon energy transitions might be enabled or frustrated by this new global geography of power. Towards this end, this paper makes the case for bringing together insights from three broad sets of literature on: (1) socio-technical transitions; (2) ‘the rising powers’ as (re)emerging development donors and; (3) energy geographies. In building bridges between these three bodies of scholarship we seek to develop an alternative analytical framework that attends more effectively to the global and domestic political economy of transitions and whose value is illustrated empirically in relation to the growing involvement of Brazil, India and China in the energy systems of Mozambique and South Africa. We argue that this alternative framework provides a better understanding of how the rising powers are influencing the changing relationships between low carbon and fossil-fuel based energy pathways and of the multiple roles they are playing in the development and transformation of energy systems, through the development of ‘niches’ where innovation can emerge, or in reinforcing or challenging existing ‘regimes’ or dominant ways of providing energy services.

Introduction: The ‘Rising Powers’ and energy transitions in Southern Africa

In recent years the growing importance of ‘rising powers’ like China, India and Brazil in the African continent has attracted considerable attention and controversy. Their (re)emergence as international development actors has often been discussed principally in terms of their role in the exploitative acquisition of natural resources such as coal, oil and gas and their growing presence in Africa has regularly been represented as a kind of neo-colonial resource ‘grab’ characterised by a plundering of Africa reminiscent of the darkest days of empire (Power et al 2012). What such representations preclude, however, is recognition of the simultaneous and growing involvement of the ‘rising powers’ in the transfer of renewable energy technologies in Africa and their potential significance in reconfiguring a range of energy systems within the continent. In 2014, for the first time ever, over half of all new annual investment into clean energy power generation globally went toward projects in emerging markets, rather than toward wealthier countries (Climatescope, 2015) whilst “South-South” investment surged to US\$79 billion in 2014 from US\$53 billion the year prior.

This paper seeks to address the question of how best to *theorise* these emerging forms of South-South co-operation around clean energy and comparatively draws out the different ways in which China, India and Brazil have facilitated the growth of renewable energy technologies in each country alongside the pursuit of more ‘traditional’ forms of resource diplomacy designed to enhance access to hydrocarbon resources like coal and gas. It seeks to explore the significance of this engagement and the different forms it is taking in two contrasting countries in Southern Africa, Mozambique and South Africa, characterised by very different energy systems and political economies. In the first section we identify three bodies of literature relevant to the study of emerging energy transitions in Southern Africa

and examine their relative utility in understanding the reconfiguration of energy systems in the region. Firstly, we engage with the literature on theorising energy transitions which usefully situates the emergence of new ‘niche’ technologies, such as renewables, in interaction with incumbent energy ‘regimes’ such as fossil fuel based power systems and engages with the detail of the practice and politics of these socio-technical arrangements (Geels 2002). Secondly, we engage with literatures concerned with the ‘rising powers’ as emerging development donors and global actors in the new ‘scramble for Africa’ which usefully raises questions about the changing nature of international development cooperation, the growing significance of south-south flows of trade, investment and finance and the geopolitics of resource extraction and diplomacy. Thirdly, we engage with a growing body of scholarship concerned with ‘energy geographies’ which addresses energy infrastructures, transitions, agencies and materialities and which views ‘energy landscapes’ as dynamic entities constituted by complex local, national and transnational flows of technology, funding and ideology. We argue that although each of these bodies of scholarship have a number of merits, none of them, on their own, are sufficient and as a result we seek to develop and apply a more integrated and interdisciplinary framework.

In the second section of the paper we then develop an alternative framework that provides a more multi-actor and ‘global’ reading of the politics of transition by integrating these three groups of literature and by bringing them into conversation with a number of different strands of work within global political economy concerning the role of transnational actors in enabling and constraining particular energy pathways. Engaging with political economy enables a better understanding of the discourses, institutions and interests that shape energy transitions and enhances our understanding of who sets the terms of energy transition and

how, whose interests are served as a result and how relations of power within and beyond the state shape the adoption of one energy pathway over another.

Our proposed alternative and integrated framework, we argue, enables a better handle on the *power, capacity* and *autonomy* that states have to secure and negotiate different outcomes with important implications for diverse pathways. It allows for an analysis of the transnational spaces of transition by attending to questions of geopolitics, diplomacy and international relations. But at the same time it also helps to situate, historicise and contextualise the embryonic energy transitions unfolding in South Africa and Mozambique by complementing the more macro focus of global political economy on the broader landscape of power (regarding aid dependence and attractiveness to international capital for example) with a grounded and nationally-oriented domestic political economy analysis (regarding the role of ruling elites and labour for example).

In the third section we then seek to systematically apply this framework to an analysis of the energy transitions unfolding in Mozambique and South Africa. Our analysis is informed by 178 interviews¹ undertaken in Mozambique, South Africa, China, India and Brazil during 2012-2014 and by the creation of a database of low carbon energy projects in South Africa and Mozambique established to understand trends in investments by type of actor, energy source and service, technology type and provider, project scale and location, levels of grid connectivity and type of financing. The data was gathered using policy reports, press releases and web-based sources and then triangulated with findings from interviews and project site

¹ Interviews were undertaken with project developers, industry and industry associations, civil society organizations and trade unions, governments, the utilities and municipal level entities, bilateral donors, debt financiers, equity investors, academia and think tanks.

visits. Before developing an alternative framework to account for the trends observed in our fieldwork, we first reflect upon existing ways of explaining energy transitions to garner applicable insights.

Theorising energy transitions and the rising powers: the limits of existing approaches

In seeking to understand *whether* and *how* low carbon energy transitions might be enabled or frustrated by the rise of emerging development donors and the growing significance of ‘south-south’ co-operation around clean energy there are a number theoretical and conceptual tools and literatures that provide some useful intellectual purchase. Of particular interest here is the growing literature on socio-technical transitions. Conceptualised as ‘major technological transformations in the way societal functions such as transportation, communication, housing, feeding, are fulfilled’ (Geels 2002: 1257), a great deal of insight into the nature of socio-technical transitions has been generated through a ‘multilevel perspective’ (MLP) on transitions. The multi-level approach identifies different sets of processes operating across three conceptual levels – the landscape, regime and niche – through which socio-technical systems are both sustained and reconfigured.

The ‘landscape’ of a socio-technical system is seen to comprise of the structuring forces of ideologies, institutions, discourses and political and economic trends that constitute enduring forms of socio-technical organisation. ‘Regimes’ in contrast are made up of the complex of practices, regulatory requirements, institutions and infrastructures required to achieve particular societal functions, such as housing, mobility or power. This provides a useful point of departure for thinking about the role of incumbent actors involved in fossil-fuel energy systems whose structural dominance in energy investment and policy shapes the spaces

available for developing alternatives. ‘Niches’ meanwhile provide a space within which social and technological learning processes, networking, and expectations develop in relation to alternative forms of socio-technical configuration. Niche spaces can often fail to cultivate the economies of scale and scope to become competitive, particularly without support from the landscape or the regime.

Successful systems are regarded as tending towards stability, held in place through regimes with ‘relatively stable configurations of institutions, techniques and artefacts, as well as rules, practices and networks that determine the ‘normal’ development and use of technologies’ (Smith et al. 2005, 1493). The operations of these regimes in turn create both ‘path dependency’ and ‘lock-in’ to certain forms of dominant energy socio-technical configuration while others remain ‘locked-out’ and marginal. It is expected that structural changes in the socio-technical system occur where there are ‘alignments’ between the three levels resulting in ‘transformations’ (Geels and Kemp 2007) or in ‘transitions’ (Geels 2002). Thus the ways in which regimes, niches and landscapes interact will have an effect on the form of transformation that unfolds and a plurality of possible transformation pathways can result. Typically, these involve shifts that permit the increasing influence and development of niches as socio-technical configurations, and the unsettling and decline of regime configurations, such that what had hitherto been niche development pathways transform into more regime-like paths. This would be indicated not only by increasing shares of renewables in the energy mix, for example, but also by greater power for renewable energy actors in the design and development of energy institutions.

There are a number of limitations, however, with this corpus of scholarship and its ability to effectively account for and make sense of emerging south-south co-operation around clean

energy. Firstly, there is the Eurocentric orientation of much theorising about transitions to date. Work on socio-technical transitions has typically been focused on Europe and as a result, it makes assumptions about the nature of state capacity, markets, institutions and infrastructural systems which do not hold in the context of Southern Africa, for example, where state capacity is often weak and institutions are subject to elite capture and lack resources or where markets and infrastructural systems are under-developed, as in Mozambique (Berkhout et al, 2010; Bridge et al, 2013; Hansen and Coenen, 2014; Lawhon and Murphy, 2012; Murphy, 2001; Raven, Schot and Berkhout, 2012; Rock et al, 2009).

Underpinning the MLP framework and its assumptions are the experiences of countries in Europe, in which access to energy is more or less universal and where structures of energy provision such as electricity and transport are heavily regulated and energy governance has not had to deal with crises such as outages and an outdated grid. In contrast, in Southern Africa energy access is far from universal and there are multiple forms of energy provision operating concurrently, from the large-scale hydroelectricity for heavy industrial use to burning firewood and charcoal for domestic use. Moreover, in Europe many countries have liberalised their electricity sector whereas South Africa, for example, has a monopoly utility in the form of Eskom. Only recently have some scholars attempted to think beyond the European setting to include developing countries and specifically sub-Saharan Africa (Simelane and Adbel-Rahman, 2012; Swilling and Annecke 2012; Hancock 2015) combined with more inter-connected, multi-scale, and regional or global perspectives on socio-technical transitions which are of greater relevance for understanding developments in Southern Africa, given the extent of involvement by external actors, including the ‘rising powers’.

Secondly, the foregrounding of technology within transitions means that approaches typically place significant emphasis on the ability of ‘bottom up’ niche led innovations to bring about change, but often fail to adequately consider powerful landscape or regime stakeholders such as multinational firms, whose behaviour cannot be easily shaped by the state (Coenen and Truffer 2012; Truffer 2012). In this sense, there is a need to bring political economy into socio-technical literatures to allow us to understand how, where and why transnational actors, including the ‘rising powers’, are playing a role in shaping the regimes, landscapes and niches of Southern African energy systems and with what implications. More generally transitions literatures also have relatively little to say about questions of (geo)politics and diplomacy or about the political factors that impact on interstate economic relations and domestic and international energy policy choices. A third concern is the dominant focus on niches and the elite actors involved in promoting innovation (Lawhon and Murphy 2012) in which deliberate efforts to innovate are seen to be undertaken by specific groups of actors (Hegger et al 2007). This view tends to overlook the informal networks of innovation and diffusion that characterise the development and uptake of many technologies from ‘rising powers’ in Southern Africa such as cook-stoves or solar PV panels.

Also of potential relevance here is also a growing body of scholarship concerned with the ‘rising powers’ as emerging development donors and global actors in the new ‘scramble for Africa’ (Brautigam, 2010; Power et al 2012; Mawdsley 2012; Carmody 2011) which usefully raises questions about the changing nature of international development co-operation, the growing significance of south-south flows of trade, investment and finance and the geopolitics of resource extraction and diplomacy. There are, however, a number of significant lacunae in this emerging literature. Firstly, there has been a heavy focus on China in particular (and to a lesser extent India and Brazil) such that other emerging actors (e.g. South

Korea, Thailand, Malaysia or the UAE) have been somewhat neglected. Secondly, there has been very little attention given to the role that the rising powers are playing in relation to renewable energy technology in Africa or in the wider reconfiguration of African energy systems. Typically, the focus is more often on extractive industries and efforts to secure access to Africa's hydrocarbon resources, often viewed through geopolitical approaches that frame energy issues in terms of zero-sum games between state actors or that make simplistic distinctions between politics and economics, viewing them as discrete analytical areas (Keating et al, 2012).

Although a large share of China's investment in African countries has traditionally been in extractive industries and construction, investment in manufacturing has clearly increased in recent years (World Bank, 2015) and there is evidence that the advancement of Chinese industrial interests is increasingly central to China-Africa relations. At the most recent meeting of the Forum on China-Africa Co-operation in South Africa in December 2015 President Xi Jinping announced a 'China-Africa industrialization programme', moving China up the value chain – not only by upgrading China's capabilities to make high-tech products, but also by building up lower-end industrialization capacities in other countries. Looking beyond China's state-owned enterprises (SOEs), however, the role of non-state and quasi-state actors or of China's wider domestic political economy in driving and shaping China's 'go out' strategy has often not been properly recognised (Shen and Power, 2016). Thirdly, there has also often been a failure to adequately disaggregate and historicise the range of different actors involved *within* each of these (re)emerging powers and a methodological statism that usually ignores wider structural forces (Ayers 2013), whilst the importance of African agency in mediating these relationships has not always been sufficiently acknowledged.

Finally, there is also a growing body of literature concerned with energy geographies which usefully raises questions about energy infrastructures as sites of contestation, the development of which has significant ethical and socio-economic implications. The concept of ‘energy landscapes’ developed in some recent work by geographers (Frantál et al, 2014) urges us to see the landscape of an energy system not as a physically delimited space, but rather as dynamic entities constituted by complex local, national and transnational flows of technology, funding and ideology. Geographers have used the concept to describe the constellation of activities and socio-technical linkages associated with energy capture, conversion, distribution and consumption and the assemblage “of natural and cultural features across a broad space and the history of their production and interaction” (Bridge et al, 2013: 335). Again, however, much of this work has been focused on the industrialised world with the energy infrastructures, transitions, agencies and materialities that characterise the Global South receiving far less attention. In particular, there has been an upsurge of work on extractive geographies in recent years where political ecology approaches have been popular, but the focus has often been on resources rather than energy –with energy seen as simply an empirical object of inquiry as opposed to an underlying analytical concept (Huber, 2015). There is, however, a need to examine more carefully how global energy power politics (e.g. around resource extraction) intersects with local energy dynamics in Africa (Büscher, 2009).

Thus we require a geographical analysis that extends *beyond* the territories of energy production/extraction (Huber, 2015). Until recently, energy geography has also largely ignored the culture and politics of energy consumption practices with a constricted view on who “counts” as energy consumers – namely, individuals in the “residential” sector with industrial consumers typically overlooked. It is therefore necessary to ‘scale up’ the analysis

here (Huber, 2015) as well as to consider the ways in which uneven access to energy systems and the resultant energy consumption patterns reflect and intersect with larger social and political patterns of inequality (particularly in developing countries).

In summary, although there are a number of useful literatures concerned with socio-technical transitions, with the ‘rising powers’ and ‘new’ development donors and with energy geographies, none of them, on their own, are sufficient in making sense of emerging forms of south-south cooperation around clean energy and technology transfer. In the following section we seek to outline and develop an analytical framework that brings these literatures into conversation with a number of comparative and context-specific political economy literatures. Recognising the ‘fragmented nature of knowledge about energy in the social sciences’ (Obeng-Odoom 2015: 159) we seek to build bridges between these literatures in proposing an alternative framework to provide the “unity of vision” that comes from bringing different analytical lenses together.

Towards a global political economy of energy transitions in Southern Africa

In developing a political economy of energy transitions in the Southern African context, we are responding to calls from others who find the ‘political economy of energy transitions is a vastly understudied area’ (Goldthau and Sovacool 2012: 238) or call for a ‘politically oriented literature on sustainability transitions’ (Meadowcroft 2011: 70), a demand some writers have recently started to respond to (Kern 2011; Geels 2014). Rather than this being merely about bringing institutions or the state into the analysis of actors and power relations which shape the prospects of low carbon energy transformations, drawing on literatures from global political economy we seek to develop a more multi-actor and ‘global’ reading of the

politics of transition. This goes beyond the analysis of inter-state resource diplomacy common to existing literatures on ‘rising powers’ to look within and across the state at some of the key political economic factors that shape landscapes, regimes and niches.

In terms of how best to understand the degree of power Southern African countries have to set the terms of their own transition, literatures within global political economy can help to get a better handle on the *power*, *capacity* and *autonomy* that states have to secure and negotiate different outcomes and the implications for diverse pathways to more sustainable forms of energy production. In addressing the neglect of wider structural forces in particular, insights from critical International Political Economy (IPE) can be applied to understand the scope that states have to establish their own development policies in a context of what has been referred to as ‘disciplinary neo-liberalism’ (Gill 1995) where the structural power of capital in a globalised economy, supported by global economic institutions, is used to discipline states adopting policies and interventions that run counter to prevailing neo-liberal orthodoxy. The wave of World Bank influenced power sector reform and electricity privatization programmes undertaken in Africa throughout the 1980s and 1990s (Gratwick and Eberhard 2008) and the drive for market solutions to energy problems are indicative of this trend, as is the withdrawal of support from states adopting more interventionist modes of regulation.

This usefully highlights how the type and depth of power sector liberalization inhibits freedom of manoeuvre to select energy pathways that depart from prevailing neo-liberal policy orthodoxy (Tellam 2000). At the same time literature which examines the ‘policy autonomy’ and ‘development space’ (Wade 2007; Gallagher 2005) available to African states is helpful in understanding their scope to withstand pressures from transnational capital and

international organizations with regard to their differential ability to shape the terms of their energy transitions. It draws attention to their relative power in the global economy (their attractiveness as investment locations); aid dependence (and the extent to which they are subject to loan conditionalities); their degree of penetration by transnational capital; and their capacity to negotiate within global institutions.

Political economy perspectives enable us to get at how the terms of ‘transition’ are set and by whom and in so doing, usefully check the assumption that transitions are made up of open ended choices. They offer an understanding of power and its effects on the terrain upon which transitions are negotiated among a range of domestic, regional and international and public and private actors enabling a better understanding of the emerging patterns of energy access and the (uneven) distribution of ‘rising power’ investments in projects, innovation and infrastructure. In particular, IPE approaches draw attention to the forms of power that derive from control over the production, technology and finance and investment that will underpin a transition, visible in the influence of incumbent regimes as opposed to those entrepreneurs seeking to protect and promote particular niches.

This sheds light on the uneven access to energy and the benefits of rising power investments in the energy sector since the interests of elites involved in making key decisions on energy investment, technologies and institutions do not align readily with those without energy access, or those who suffer the harmful consequences of extraction, processing, and consumption of fossil fuels, and yet are often excluded from the benefits of these processes. It also raises questions about state-capital-labour relations which usefully focuses attention on, for example, the role of trade unions representing the large numbers of workers employed in the mining and energy industries and the influence this may have on the speed and depth of

transition away from fossil fuels (Newell and Mulvaney 2012). In South Africa, for example, there are some important policy initiatives around local manufacturing content, job creation and black economic empowerment that are having a significant bearing on the nature of the country's energy transition and emerging renewable energy landscapes.

Our analysis thus seeks to examine the discourses, institutions and interests that shape energy transitions and energy policy. In doing so we build upon the work of Newell et al (2014) who seek to understand the ways in which forms of power combine to determine the scope for climate compatible development in Kenya: *discursive power* (who gets to define what is clean, green and affordable; how are the energy needs of the poor represented and for whose benefit?); *institutional power* (where does power lie within and across government and how far is it reinforced or undermined by actors beyond the state, especially donors?) and *material power* (who controls the finance, technology and means of producing 'clean energy' and what power does that confer upon them to shape energy pathways?).

Although complex state-market interactions are a key part of the focus here, our approach does not view states as the only, or even the dominant, actor in energy governance. Sub-state, inter-state, and supra-state actors, as well as non-state actors both market and non-market are also important. We thus seek to develop an analytical framework that is able to show how energy regimes are constituted through a dispersed 'state' that involves complex relationships between multiple actors and operates across borders and one that can account for the ever-growing role of transnational actors and emerging transnational spaces of south-south co-operation around clean energy. A focus on global production networks and value chains is also useful here in that it helps offset more macro-scale, geopolitical interpretations by taking an actor-centric approach to understanding the variegated, country and industry-specific

development implications of south-south trade flows (Horner 2015) particularly those around renewable energy (c.f. Dunford et al 2013; Curran 2015).

Work on the rising powers also helps to identify and contextualise the transnational spaces of transitions by attending to questions of geopolitics, diplomacy and international relations and in so doing enables us to get a better understanding of the discursive, institutional and material power behind China, Brazil and India's energy diplomacy and private investments in Southern Africa's energy systems. In terms of what is driving these investments (both state and private), there are emerging literatures on energy statecraft and diplomacy (Dalgaard, 2012; Santos Vieira de Jesus, 2013; Wilson, 2015) that have usefully examined the investments that rising powers like Brazil are making in renewable energy (Fulquet and Pelfini 2015) and which complement more traditional preoccupations with the political economy of resource diplomacy.

Energy statecraft, for example, focuses on the 'conditions for successful implementation of energy resources as an instrument of foreign policy' (Dalgaard 2012:4), both to pursue energy security and commercial diplomacy. Brazil's early engagements with Mozambique and investments in biofuels in particular clearly formed part of a global strategy for exporting Brazil's domestic bio-ethanol programmes and building a global structure of supply and demand for what former President Lula strongly advocated as a 'clean' source of energy (Interview with representatives of the Ministry of Development, Industry and Trade, Brazil, April 2nd 2014). In this sense it is important to remember that energy is central to both the production and reproduction of geopolitical imaginaries of international relations and the ways in which the rising powers understand and narrate south-south co-operation around

clean energy as part of a long history of progressive development collaboration (Interview with Africa Department Head, Ministry of Foreign Affairs, Brazil, April 24th 2014).

The growing literature on energy geographies can also be brought to bear in seeking to understand the geopolitics and political economy of energy transitions in Southern Africa. Geographers have shown that energy infrastructures, including electricity generation, transmission and distribution facilities, can be understood as sites of contestation and as spatial expressions or material articulations of dominant political-economic ideologies and geographic imaginaries. Prospects for new flows of energy bring together disparate social groups into conversations about allocation, costs/benefits and acceptable end uses whilst the development of energy infrastructure has significant ethical and socio-economic implications which are not diffused or experienced evenly across space (Calvert, 2015). Decisions about which resources to prioritise and where to build new infrastructure can thus (re)produce uneven economic development at regional scales (Bouzarovski et al., 2012) along with conditions of energy poverty at local and household scales. The energy geographies literature has also shown that energy production and use translates directly into control over space so that energy is an important physical medium through which to express state authority, to extend the reach of the state and to exert territorial control. It also shows that the attempted shift towards renewable energy is productive of new energy landscapes and new spatialities, some of which are highly contested, raising questions about which landscapes should be made and ultimately for whom.

The political economy of energy infrastructure also needs to be understood in historical context. In Southern Africa and other parts of the global south, energy regimes are shaped by histories of colonisation, apartheid, nationalism, state-led development and market-oriented

liberalisation. This helps us to make sense of the path dependence that shapes the contemporary features of both country's energy systems or the ways in which decisions taken in the past limit the options available today. As Goldthau and Sovacool (2012:235) explain, the nature of an electricity system means that it "exhibits strong path dependencies due to the large investments made into grids and plants, perpetuating a mostly fossil fuel based system of electricity production and consumption" and is therefore unable to adapt quickly to sudden changes. It is thus important that such energy investments are adequately historicised.

Understanding which 'niche' technologies are supported or neglected in the course of transition, how power relations operate around the 'regime' and the extent to which incumbent power can successfully resist 'landscape' pressures requires a deeper understanding of the domestic political economy of South Africa and Mozambique. Work on the minerals-energy complex (MEC), for example, describes South Africa's economic accumulation strategy, historically predicated on the relationship between mining, manufacturing and electricity, and also provides a framework of analysis for the country's political economy (Fine and Rustomjee 1996). The historical basis of the MEC is a regime of accumulation based on low cost state-owned electricity production (via the public utility Eskom), cheap labour and large-scale national and international corporate capital tightly bound to the energy and mining sector (Swilling and Anneck 2012: 218). As one of the world's largest mining countries, South Africa's dependence on historically abundant sources of low-cost coal for 96 percent of its electricity has resulted in a highly energy-intensive economy.

This low-cost coal, coupled with the availability of low cost labour (a key legacy of apartheid) has led to the generation of electricity for minerals-based export-oriented industry

which forms the basis of its ‘minerals-energy complex’ (Fine and Rustomjee 1996). The apartheid era produced an electricity sector exclusively directed towards the consumption needs of industry and the elite, largely white, minority aimed at shoring up their power through energy independence amid isolation from the international community. This historical background is critical to understanding how the structural power of actors in the incumbent energy regime is used to shape and contest the prospects for alternatives such as renewable energy technologies, through, for example, control over market access for independent power producers. South Africa’s electricity system has been dominated until now by its monopoly utility, Eskom, while some 44 percent of the country’s electricity is consumed by its Energy Intensive User’s Group, whose 31 members include some of the world’s largest resource and mining conglomerates.

Infrastructure provision in South Africa is also influenced by a history of racially determined socio-spatial differentiation. Though the country’s unprecedented post-apartheid expansion programme between 1994 and 2000 saw domestic connection rates rise from approximately 30 to 70 percent of the population (Bekker et al 2008), one third of the population still lack access to electricity, particularly in rural areas. Despite the free basic electricity tariff of 50 KWh per month, millions of low-income houses—who account for no more than 5 percent of national electricity—do not have enough regular income to buy sufficient electricity, notwithstanding grid connections (McDonald 2009: 16). This provision of highly subsidised electricity to multinational capital is the basis of what McDonald (2009) calls ‘electric capitalism’ in the region and has perpetuated a ‘colonial electrical geography’ where the needs and interests of elites and corporations are placed above those of households and communities.

The MEC offers a way of understanding power and critical networks between South Africa's financial sector, parastatals, government, the private sector and the country's Industrial Development Corporation (Freund 2010). This contributes to an analysis of 'the social forces of production' over 'technical solutions to the economics of transition' (Fine and Rustomjee 1996: 4). Such an approach permits an analysis of historical power relations, structural change and the interests of dominant actors and thus avoids reducing a complex debate to a technocratic perspective on governance or, in other words, a 'policy fix' (Büscher 2009: 5). Despite considerable diversification in the electricity mix and a significant decline in the contribution that mining and minerals-beneficiation makes to the country's economy, coal-based vested interests as key players in the minerals-energy complex still dominate at the level of supply and demand in electricity.

In neighbouring Mozambique, a 'troubled transition' (Abrahamsson and Nilsson 1995) from Marxism-Leninism to free market capitalism has also produced a very particular political economy that shapes the country's energy sector. Historically there has been a heavy dependence on foreign donors and creditors who have played a key role in shaping and defining Mozambique's development agenda. The post-war turn towards neo-liberalism and privatization has led to a proliferation of state capture and administrative corruption within the Frelimo party-state (Pitcher 2008) where there is now arguably a greater concern with maintaining relationships of patronage and rent-seeking than with providing services to citizens (Söderbaum and Taylor, 2010). Power remains heavily concentrated in Frelimo, which has increased its hold during the liberal period through successful monopolization of access to donors and international networks together with a privatization process and natural resources boom that has allowed it to further centralise wealth and power (Sumich 2010).

Frelimo has heavily manipulated the state power utility *Electricidade de Moçambique* (EDM) to achieve its own political objectives with electrification efforts closely shaped by geopolitical imaginaries and a desire to extend the reach of the state and to exert territorial control in remote regions. The development of the national electricity infrastructure and rural electrification efforts have often lacked transparency or been mired in allegations of corruption as projects have regularly been awarded to companies with links to the main political and economic elites (Nhamire and Mosca 2014). Mozambique also has its own emergent MEC that builds on a long history of an economy based on an extractive system of capital accumulation and is currently pursuing a vision of development that is heavily centred on extractive industries (especially coal and gas) and energy-intensive mega-projects (Kirshner and Power, 2015).

Southern Africa's energy transitions: an integrated framework for analysis

Within Mozambique and South Africa high-carbon and low-carbon pathways to development are being pursued in parallel and interconnected ways, so this is not a simple choice between pathways, but rather a case of multiple pathways emerging across a fragmented energy system that consists of multiple regimes. In this regard we engage with the socio-technical transitions framework not to produce a kind of yes/no assessment of the presence or absence of transitions but rather to understand the dynamics of niche development in the context of powerful regimes.

In both Mozambique and South Africa the rising powers are playing a role in the continued entrenchment of high carbon pathways. India and China have been significant export markets for South African coal and even as attempts at alternative energy pathways are made there

remain very substantial commitments to building new coal-fired power generation facilities as the heavy reliance on coal created by the MEC continues (Baker et al 2015). In Mozambique rising power interest in the energy sector has predominantly concentrated on securing access to fossil fuel resources through resource diplomacy following the recent discovery of significant coal and gas reserves (Kirshner and Power, 2015). In 2013 the Indian High Commission to Mozambique predicted ‘an inevitable competition for markets and [natural] resources between China and India’ but was confident that in Mozambique India will be able to ‘checkmate China’ (Wikileaks 2013). Indeed, India has in recent years stepped up its diplomatic efforts around natural resources and renewable energy in Mozambique, signing a bilateral accord in October 2014 to enhance co-operation in the oil and gas sector followed by an MoU promoting co-operation in the renewables sector signed in October 2015 (Macauhub 2015). The struggle for access to Mozambique’s newly exploited offshore gas resources in Cabo Delgado province has also brought Chinese companies including the China National Petroleum Corporation (CNPC), the China National Offshore Oil Corporation (CNOOC), Sinopec and Huadian into direct competition with Indian firms such as ONGC Videsh and Oil India. These companies are also, however, in competition with actors from other emerging economies including South Korea’s Kogas, Mitsui of Japan and PTT of Thailand along with more established Western companies such as Anadarko and ENI (England 2014).

With respect to coal, the Brazilian mining giant Vale has invested US\$8 billion to date in coal mining and associated operations in Mozambique, whilst Indian corporations are also a growing presence, including Tata Steel, Jindal Steel and Power (JSPL) and International Coal Ventures Limited (ICVL). Many firms have pulled out or downgraded their operations due to the complex infrastructural challenges in transporting the coal for export along with

plummeting global coal prices since 2013 (Interview with Manoj Gupta, Jindal Africa, October 29th 2013). Significantly, many of these foreign firms also plan to build coal-fired power stations linked with their mining operations that will feed excess power to the grid, further committing Mozambique to a high-carbon energy pathway.

Echoing some of the concerns in the rising powers literature about the weaker standards of governance adopted by rising powers with regard to their investments in Africa (Ayers 2013), civil society organizations have expressed concerns about the lack of transparency in the governance of extractive industries and about the social and environmental impacts of the coal rush including displacement and resettlement of local communities in mining areas (Human Rights Watch 2013). Much of the critique centres on the Mozambican government's failure to uphold its resource sovereignty, locally redistribute the wealth generated by hydrocarbon revenues, create jobs for local populations in coal-producing areas, or negotiate favourable terms with investors. There is also a risk that the emerging coal complex centred in Moatize, in Tete province, will become an extractive natural resource-based enclave with weak productive linkages to local enterprises, foreign ownership of capital, and export of goods with limited or no value added (Besharati 2012; Bloch and Owusu 2012). This emerging coal complex has thus become an important site of contestation in Mozambique's energy landscape and can be understood as a material articulation of Frelimo's dominant political-economic ideology and its vision of development centred on extractive industries and energy-intensive mega-projects as a means to modernise the national economy. Such spaces are also a key part of Frelimo's continued centralisation of wealth and power (Sumich 2010).

Energy companies are not, however, the only external and global actors that are part of the ‘landscape’ of socio-technical systems in Southern Africa. The competition between higher and lower carbon energy pathways is also influenced by global institutions, donors and broader economic developments that configure the landscape of energy politics in ways drawn attention to by the IPE literatures discussed above. In South Africa, finance and technical assistance from European bilateral donors, particularly Denmark and Germany, have been influential in the early stages of the renewable energy industry and have played a considerable role in project development, shaping policy, directing research and developing the Renewable Energy Independent Power Producer’s Procurement Programme (RE IPPPP) for utility-scale privately generated renewable electricity. Prior to the introduction of this programme South Africa managed to preserve some developmental space by resisting pressures to liberalise its electricity sector and open up competition to private energy providers (Baker et al 2014). The RE IPPPP initiative has so far attracted R168-billion (US\$14bn) of private investment into the supply-stressed electricity sector, allocating approximately 6.5 GW of generation capacity, largely from wind, solar PV and concentrated solar power (CSP). Thus there are parallel and competing pathways being pursued both in terms of technology and the nature of how this technology should be procured – whether via the state utility Eskom or independent power producers (Baker 2015).

RE IPPPP also requires that renewable energy developers meet criteria for socio-economic and community development and Black Economic Empowerment (BEE). However, implementing these can be problematic. For instance, as one engineer working in the renewable industry stated in interview (November 5th 2013): “Meeting the economic commitments of the project can be a huge challenge.... not all developers will coordinate with each other over labour and socio-economic issues as the industry is too competitive”.

There are thus particular state-capital-labour relations in South Africa shaping key policy domains such as energy and industry and the scope for their reform where, for example, trade unions have a powerful role in shaping the speed and depth of transition away from fossil fuels by protecting the large numbers of workers employed in the mining and energy industries or where the emphasis on black job creation and concerns about the need for local content and community development have significantly shaped the emerging low carbon transition. As one member of government stated in interview (November 28th 2013) “the holistic advantage to the country needs to be managed. If the company coming in from abroad is not comfortable with these criteria, then it will struggle”.

South Africa’s attractiveness to investors, the size of the market and its strategic location in the region and low level of aid dependence, place it very differently to Mozambique in its ability to set the terms of its own transition and negotiate more favourable terms with donors and investors from Europe and increasingly the rising powers. Reflecting the high levels of aid dependence in Mozambique, off-grid rural electrification and grid extension has frequently been funded by grants and soft loans from European bilateral donors (Power and Kirshner, 2016) who have played a key role in configuring the landscape of energy politics and closely shaped the Mozambican state’s capacity to pursue different renewable energy pathways. Thus far Mozambique has had a much lower degree of policy autonomy and developmental space around energy and consequently less capacity to withstand pressures from domestic, regional and international and public and private actors. This may be set to change in the years ahead as hydrocarbon revenues increasingly come online and as dependence on aid consequently decreases, affording the state more room for manoeuvre (Power and Kirshner, 2016).

Despite the fact that RE IPPPP has been celebrated globally as a leading model for independent power procurement, and also for its progressive socio-economic development and community ownership requirements, ensuring universal energy access is not the main objective of commercial energy developers whose business models are determined by a desire for high returns over short time frames (Baker and Wlokas 2015). As one technical advisor for an engineering company stated (in interview, November 5th 2013) “it has become quite a competitive and commoditised industry now”. The Mozambican state has also recently increased the licensing and divestment of power generation operations to Independent Power Producers (IPPs) amid serious supply shortfalls, often with no competition or public tender, which have in many cases produced cheaper energy for large-scale industrial consumers, but raised costs for the majority (Nhamire and Mosca 2014). In both cases there is thus a prioritisation of commercial providers of energy in ways which appear to have little to do with the expansion of energy access or increasing its affordability. As a result, the socio-economic benefits of the development of energy infrastructure are not being diffused or experienced evenly across the energy landscape, reinforcing the key question of whose energy needs are represented and acted upon in policy.

What is also noticeable, however, mirroring international trends (Lema and Lema 2012), is that emerging market companies are also beginning to support renewable ‘niches’ alongside the more dominant role of European and US companies in South Africa’s wind and solar PV sector. The RE IPPPP process in South Africa provides one space for niche development. Chinese firms (including Yingli Green Energy, Suntech, Jinko Solar, Chint and Powerway) are involved as suppliers of solar PV technologies or of technological components. Indian company Suzlon and Chinese firms Guodian and Sinovel are also involved in engineering procurement and construction (EPC) and technology supply. India’s Tata Power and China’s

Longyuan Power Group are additionally involved in joint ventures with South African companies in project development in the wind industry. Our research in South Africa thus highlights the importance of tracking emerging global value chains and production networks where rising power companies are bound up in wider transnational networks of construction firms, renewable energy development companies, technology providers and national and international finance and investment coalitions in complex value chains.

There is no specific Chinese ‘go out’ government policy focused on promoting renewable energy companies. Instead it is the saturation of China’s domestic wind and solar power industries and the surplus of production capacity in China that is one of the main drivers pushing Chinese firms towards the South Africa market (Shen and Power, 2016). Chinese firms see in Southern African markets an opportunity to upgrade from equipment producers to project owners/operators and unlike their rivals from India and Brazil they can draw on extensive financial support and detailed market and political analyses available from quasi-state agencies like the China Development Bank, Exim and Sinosure (Shen and Power, 2016). Our interviews also indicated that Chinese investors are focusing on South Africa because they believe the political and economic risks in the country are negligible compared to other countries in Africa. Such was their confidence in the country some even rejected the export credit insurance cover available from Chinese export credit agencies:

“Our company is confident with the investment environment in this country... The country’s economy is in good shape. But no other countries [in Africa] can provide such a favourable macro environment” (Interview with a Chinese wind farm investor in South Africa, April 11th 2014).

Another significant factor was the perception that South Africa had a greater commitment to renewable energy than many other countries (including Mozambique). As one representative of a Chinese solar company put it:

“We are always attracted by good policy and ambitious plans [for renewable energy]... That is a precondition as we couldn't possibly go for a market where there is no special treatment for renewable energy” (Interview with senior manager from Chint, October 9th 2014).

In Mozambique the rising powers are also beginning to play a role in supporting renewable niches, but on a much smaller scale compared to South Africa. Brazilian firms in particular initially played a significant role in the development of biofuels whilst the construction of Mozambique's first ever solar PV module manufacturing plant in 2013 was funded by the Export-Import Bank of India (Interview with Fernando Namburete, FUNAE, August 8th 2014). These niche spaces, however, have failed to cultivate the economies of scale and scope to become competitive, lacking support from the wider energy landscape and regime. In part this is because there are multiple fractions of the state invested in different energy pathways in Mozambique, leading to the emergence of cleavages based upon competing fractions of both state and capital. As a result, there are significant differences in the resources and priority given to solar PV and mini-hydro as opposed to coal, gas and large-scale hydro where potential rents are higher and more easily captured by state elites and incumbent regime interests, the largest beneficiaries.

It is also important to recognise the differences that exist *within* the state. Mozambique's National Energy Fund (*Fundo de Energia* - FUNAE) set up within the Ministry of Energy in 1997 has been addressing off-grid energy access and has a focus on renewable energy and rural (off-grid) electrification funded largely by donors, whilst other elements of the state apparatus, such as the Ministry of Mineral Resources and Energy (MIREME) and EDM working together with foreign mining and infrastructure companies, pursue hydrocarbon revenue streams, extractive industries and fossil-fuel based power generation. FUNAE's concern with renewable energy has thus been somewhat under-resourced (relative to the

pursuit of lucrative hydrocarbon revenues) and has frequently been seen as driven by the finance and priorities of development donors.

Characterised by a history of colonial underdevelopment and following decades of civil war the socio-technical energy system of Mozambique has an extremely limited grid infrastructure. The state has consequently been pursuing a grid extension programme since 2009 which has been shaped by national geopolitical imaginaries and a desire to enhance state legitimacy and to extend the reach of the state in remote regions. There is a particular political economy of electrification, however, largely focused on connecting urban district capitals with the main beneficiaries often being local elites, public employees, commercial agents and NGO officials with little wider benefit for the surrounding rural areas, despite the claims being made in official discourses about rural energy access (Nhamire and Mosca 2014).

Alongside the development of renewables and the recent extension of the centralised network, the Mozambican state is planning the construction of several large scale hydro-power projects which are likely to become an important part of the energy landscape in the years ahead. Many of these are being contested by civil society organizations, such as *Justiça Ambiental!*, which have expressed concerns about the lack of transparency and the social and environmental impacts including displacement and resettlement of local communities (Interview with Daniel Ribeiro, *Justiça Ambiental!*, October 23rd 2013). The distribution of impacts from energy production (who benefits and who experiences the burdens) relates to decision making processes (who participates and influences policy): hence questions of social and political power are central within Mozambique's power sector. As Isaacman and Isaacman (2013) have argued, the overarching focus of recent energy and development

discourses on hydroelectricity foment a powerful type of ‘post-colonial amnesia’ given that some of the planned projects are just a short distance from Cahora Bassa, the construction of which during the late colonial period had significant implications in terms of population displacement, lost livelihoods and deteriorated ecosystems.

Indeed, this focus on hydroelectricity, rather than opportunities for small-scale distributed renewables, appears to be the priority for some of the rising powers interested in Mozambique’s energy system. Chinese firms have undertaken feasibility studies around the potential for large-scale hydro-power projects and are also becoming involved in the construction of electricity transmission infrastructure in Mozambique. China State Grid has expressed intent to finance the controversial Mphanda Nkuwa dam and has an interest in the Cahora Bassa north central hydroelectric project along with a 46 percent stake in the US\$2 billion Centre-South (CESUL) project to build a HVDC transmission line from the Zambezi Valley to Maputo (Interview with Andre Santos, African Development Bank, October 25th 2013). China Three Gorges has also expressed an interest in hydro-power plants in Mozambique along with the Brazilian construction company Camargo Corrêa.

Mozambique has prioritised large-scale hydro partly as a result of the path dependencies created by Cahora Bassa which saw most of the electricity generated there exported to neighbouring countries (principally South Africa). The transfer across national borders of electric power has become an important source of revenue generation with MIREME arguing that electricity companies should be allowed to get involved in foreign trade and that Mozambique could not build a new dam based solely on its own electricity needs (AllAfrica, 2015). Indeed, Mphanda Nkuwa’s construction depends on Eskom’s commitment to buy most of its electricity (Isaacman and Isaacman, 2013), neatly connecting the political

economy of energy in Mozambique to South Africa's minerals-energy complex and illustrating South Africa's own rising power status.

Mozambique's major energy developments in coal, gas and hydroelectricity have thus been heavily shaped by elites involved in making key decisions on energy investment, technologies and institutions working together with fractions of international capital increasingly sourced from the 'rising powers'. The generation of power by IPPs and the sale of electricity to regional markets is symptomatic of emerging forms of 'electric capitalism' (McDonald 2009) and arguably offers Mozambican elites much more lucrative opportunities for accumulation than do small-scale distributed renewable technologies (Power and Kirshner, 2016) with significant implications for the speed and depth of energy transition and the (uneven) distribution of 'rising power' investments in projects, innovation and infrastructure.

Conclusions: energy regimes, the 'rising powers' and Southern Africa

In seeking to understand, theorise and accelerate transitions towards a low carbon economy, we have argued that it is necessary to integrate insights from a number of disciplines in order to adequately comprehend the complexity of this process. In building bridges between literatures concerned with socio-technical transitions, 'the rising powers' as (re)emerging development donors and energy geographies we sought to develop an alternative analytical framework that attends more effectively to the global and domestic political economy of transitions. The value of this integrated and interdisciplinary approach was illustrated empirically in relation to the growing involvement of Brazil, India and China in the energy systems of Mozambique and South Africa. In both countries there is clear evidence of

competition between lower and higher carbon trajectories and despite substantial domestic and foreign (including ‘rising power’) investments in new infrastructures, levels of energy poverty remain very high. In part this is due to particular regimes of accumulation in each country centred on the generation of electricity for minerals-based export-oriented industry and a prioritisation of private commercial providers of energy in ways which appear to have little to do with the expansion of energy access. As a result, the development of infrastructure across the energy landscapes of both countries is socially and spatially uneven and consequently there is a risk (particularly in Mozambique) of perpetuating a ‘colonial electrical geography’ (McDonald, 2009) where the needs and interests of elites and corporations are placed above those of households and communities.

We suggest that international political economy provides valuable insights about the degree of policy autonomy and developmental space that states in Southern Africa have to negotiate the terms of their own energy transitions and helps to correct the a-political and a-material basis of much transitions theorising. It does so by foregrounding relationships between the state, capital and labour, while placing them in a more global context, and fostering an appreciation of the uneven power to create and contest transitions based on control of production, technology and finance. We also suggest, however, that IPE’s focus on the complex interactions between states and markets and between states, capital and labour can be usefully complemented by the more granular focus of transitions work on how niches and regimes produce and resist change within particular sites of socio-technical innovation and competition in a manner which is subject to broader (global) political economies, but not reducible to them. With respect to the role of the rising powers in reconfiguring energy systems in the two countries, we drew on, but also sought to nuance, approaches concerned with the changing nature of international development co-operation, the growing significance

of south-south flows of trade, investment and finance and the geopolitics of resource extraction and diplomacy. In drawing on the energy geographies literature we sought to show that Southern Africa's energy infrastructures can be understood as sites of contestation and as spatial expressions or material articulations of dominant political-economic ideologies and geographic imaginaries and we conceptualised the region's 'energy landscapes' as dynamic entities constituted by complex local, national and transnational flows of technology, funding and ideology.

We sought to go beyond the narrow inter-state focus on resource diplomacy to look within and beyond the state at uneven power in the competition over competing energy trajectories and to develop a genuinely transnational understanding of energy, one that is able to track global value chains and production networks and to capture complex linkages between diverse transnational actors from development donors to national energy companies. This, we argue, provides a richer account of the terrain of power (discursive, institutional and material) upon which a range of actors and institutions operate across a vast array of political and institutional settings and upon which competing visions play out about what forms transitions should take, at what pace and on whose terms. To adequately understand the historical context and contemporary dimensions of the politics of energy in South Africa and Mozambique meanwhile, we drew on literature on the domestic political economy of the two countries to account for the forms that incumbent power takes and how this shapes the prospects of low carbon energy transitions. Taken together this provides a more rounded sense of the drivers of transition and the role of key actors such as the 'rising powers' in this process.

While noting both the on-going power of the incumbent regime in Mozambique and South Africa and the central role that fossil fuels play in the strategies of state and commercial elites in the two countries, we have presented evidence both of embryonic attempts to diversify the energy mix and increased interest on the part of ‘rising powers’ in renewable technologies and infrastructures as part of moves towards a lower carbon economy. Low carbon transitions are being pursued and enacted in different ways across these regimes. In the case of South Africa and Mozambique, the regime is often supported and developed by international or regional interests that are far more powerful than any national entity and we observed a diversity of support for different energy pathways within the state. This lends support to calls for more inter-connected, multi-scale, and regional or global perspectives on socio-technical transitions (Truffer 2012). Indeed, the presence of the ‘rising powers’ in energy systems in Southern Africa underscores the need to enrich insights from transitions literatures that have largely evolved in Northern settings with the realities of the political economy of energy transition in the global South.

In terms of developing a future, more global, agenda for undertaking research on low carbon transitions beyond European contexts, it is crucial to further develop the conceptual engagement between different strands of (global) political economy and theories of socio-technical transition in order to capture the complex assemblages of practices, technologies and actors that shape energy transitions. In all cases an account of where a country is located in the global geography of energy has to be complemented by an appreciation of what is unique about the historical, material, political and economic context in which energy transitions are unfolding and which will strongly configure the form they take and who benefits from them. Engaging more directly with the political economies of transition enables a better understanding of how energy regimes serve to promote the interests of some actors

and interests at the expense of others and whether and how global institutions can support transitions that are both lower carbon and socially just (Newell and Mulvaney, 2012; Swilling and Annecke 2012). This implies a more dynamic understanding of the emergent cleavages within states and within capital seeking to either protect conventional accumulation activities or experiment with new forms of lower carbon accumulation or indeed both trajectories simultaneously. This is critical for conceptualizing the role of the ‘rising powers’ in regimes, as at once ‘part’ of the governing of existing energy regimes and as ‘external’ actors seeking to intervene, invest and innovate within energy systems.

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