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Climate technology and climate justice

Energy transitions in Germany, India and Australia

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Introduction

National-level renewable energy targets are now embedded in the UNFCCC climate policy and are being implemented across a wide range of countries as part of the "comprehensive" process of emission reduction launched at the 2015 Paris climate summit. Electricity powered by fossil fuels is the primary source of global greenhouse emissions, and meeting the Paris targets hinges on a global move to renewable energy (IPCC 2014: 8, 21). In practice, though, the task of transition falls to national-level institutions, which have different capacity and varying commitment to renewable energy. In this, national-level questions of climate justice and the wider social legitimacy for renewables have become centrally important. There may be widespread support for renewable energy as a concept, but that breaks down where regressive carbon pricing or climate taxes require low-income consumers to pay for the transition, or where subsidies flow to corporates and incentives are based on ability to pay, creating unjust outcomes. Likewise, large-scale corporate-controlled "wind farms" and "solar parks" can displace livelihood and land use, and may have next-to-zero local benefits (already evident in India; Scheidel and Sorman 2012). These outcomes can be seized upon by fossil-fuel advocates to slow decarbonisation and further entrench the status quo. Questions of social justice and social legitimacy must be addressed if decarbonisation is to occur at the pace and extent required. The chapter compares contrasting country contexts to better understand the socio-ecological relationship between climate change and social justice and its role in generating the process of climate justice.

At least since the 1988 Toronto "Conference on the Changing Atmosphere," there has been an international debate about how to exercise what Mike Hulme calls "purposeful" climate agency (Hulme 2010). That debate has centred on justice issues, and has unfolded and intensified across widening realms of social life. In this respect climate justice cannot easily be defined, except in broad terms as arising from the relationship between the biophysical process of climate disruption and the social process of making justice claims. It is better characterised as a process, not a fixed thing, with clearly defined parameters. While initially framed in terms of greenhouse gases and intergenerational impacts, climate justice has produced a number of distributive questions, across impacts, capacity, responsibility and representation, and has flowed from international to

subnational contexts for policy, across sinks and sources, and sites of remediation, adaptation and mitigation. At the same time, conflicts have erupted with existing structures of carbon-intensive production, consumption and waste, and their associated claims to "just transition."

At the core of climate justice, as a process, is the cumulative character of climate change. Unlike other cyclical or episodic crises, with the continued failure to reduce greenhouse gas emissions, climate crisis only intensifies over time. It is, as such, an unmanageable crisis, that produces a hydra of justice claims. Where one claim is addressed only more emerge, swarming across the social field, proliferating in the interaction between social and ecological dimensions. As an ecological biophysical process, climate change has begun to subsume the ecologies on which societies are based; as a social process, produced by and under capitalist relations, it has also begun to subsume questions of social justice and social agency. The subsumption process is conflictual in the first instance, with questions of climate justice defined against prevailing concepts of social justice; under advancing climate change we see a growing re-orientation in how social justice is conceived, which forces a social transformation process, potentially into a new type of social system. This trajectory of climate justice is characterised by urgency and necessity: with new relatively fixed horizons for a climate-constrained future, social agency in the present is forced into a new calendar (Chakrabarty 2009). Climate justice in this context becomes centred, as illustrated in the examples discussed here, on issues of "transition."

This chapter deliberately focuses on transition as a key site where the development of climate justice claims can be tracked, over time and "on the ground." It focuses especially on the justice requirements for energy decarbonisation, comparing energy transition and renewable energy in India, Germany and Australia. The three countries occupy radically different places in the decarbonisation process. As a high-emitting, post-industrial society, Germany positions itself as a front-runner in decarbonisation with its 2011 "Energy Transition" policy. While the fossil fuel sector has protected its share of German electricity generation, the largely community, cooperative and municipality-based renewables sector has played a key political role in legitimising renewables. By contrast, India is a rapidly industrialising country, with up to 40% of its population without access to electricity. The Indian Government's priority is to increase energy capacity, mainly through coal-fired power, but also through nuclear energy and expanded renewables, extending access to low-cost clean energy (Mohan 2015). As a high-income, high-emitting society, Australia is heavily dependent on fossil fuels for electricity and for export income. The renewables sector is relatively marginal both in terms of overall electricity supply and its political influence. Yet renewables have strong public support that can be mobilised, for instance, to protect the Renewable Energy Target (Lowy Institute 2014).

In all three countries, wind and solar power have become the dominant modes of electricity decarbonisation. Germany is most clearly committed, with renewables supplying 33.3% of electricity in 2017, and planned to produce 45% by 2030 (GoG 2015, AG Energiebilanzen 2018). India's non-fossil fuel sector produces 20% of its electricity, and with India's 2015 pledge to the UN, is planned to rise to 40% by 2030 (GoI 2015a). Australia has a target of 23% for renewable electricity generation by 2020, with substantial increases required after that date (GoA 2015a). In each country, the question of how to most effectively advance the production of electricity through the renewables sector has become critical. The chapter investigates the contingent interactions between energy transformations and social and ecological dynamics in the three country contexts as distinct "socio-ecological relations" (Moore 2015).

Decarbonising energy is no mere technical challenge. It is described as "the most thorough and far-reaching structural change since the beginning of the industrial revolution" (Scheer 2007: 5). As such it establishes new relationships between capitalist society and ecological contexts, transforming both (Moore 2015). Here the concept of socio-ecological relations can help

in understanding different configurations of electricity generation and distribution, as forms of social organisation distinguished by particular relations with an active biophysical world. The transition to "net zero carbon" can be achieved by very different decarbonisation pathways, each with specific impacts and social relations. Socio-political legitimacy is integral to these energy transitions and to achieving the required emissions "peaking." The social legitimation of decarbonisation is a contested and open-ended process: legitimacy for energy transformation is constructed in the flux of the social process and is embedded in wider socio-political power relations. As such, legitimation is a broad field – not simply a matter of public consent for "energy governance" (Michalena and Maxwell Hills 2013). The ostensibly precautionary state, in seeking to reduce the prospects of climate instability, plays a key role in the transition, but it does so as part of the much wider societal process (Renn 2014).

Energy transitions have both produced and been shaped by large-scale transformations in socio-ecological relations. Biomass, in the form of wood, fed the energy needs of early-modern cities, both constraining urban growth and leading to wholesale forest depletion. The mining and burning of coal catalysed industrial development, provided power for cities and precipitated a mass urban citizenry capable of deepening liberal democracy. The burning of coal for power had serious biophysical impacts at sites of extraction, and with urban smog it became the main cause of death in cities (Freese 2005). The invention of the first power stations during the 1890s then enabled mass electrification and the relocation of coal burning, creating the illusion of pollution-free power (Thorsheim 2006). The subsequent transition from coal to oil diminished dependence on a large industrial workforce to guarantee supplies of energy, and tended to fuel authoritarianism rather than democracy (Mitchell 2011). Oil's biophysical attributes, as a fuel that could be relatively easily transported and transformed into plastics, enabled new forms of social organisation, re-patterning settlement structures across the globe. Its ecological effects were likewise distinct from coal but shared coal's impact on global climate through its CO_2 emissions.

The biophysical attributes of particular regimes of energy production, whether based on biomass, coal or oil, have enabled radically different social formations, with contrasting ecological impacts. In this respect, the means of energy production characterise distinct "socio-ecological relations of energy." Such relations are not made inevitable by the biophysical attributes of the energy source but are enabled by them (Mitchell 2011). Likewise, ecological impacts result from the way the fuel is used, not from the character of coal itself. Electrification displaced coal smog, but the coal is still burnt. Biophysical attributes engender new forms of social agency and entail new forms of ecological change, but these changes are wrought in the social process, not pregiven. Within prevailing capitalist society this process of energy transition sees an entanglement, or a "bundling" as Moore terms it, of particular modes of institutional and corporate power, public involvement and participation, all embedded with the ecological context of particular sites and biophysical impacts, producing distinct socio-ecological relations (Moore 2015: 301). The impacts are far-reaching: as Mitchell argues in relation to renewables, the "building of solutions to future energy needs is also the building of new forms of collective life": "battles over the shape of future energy systems" are crucial for framing future possibilities for energy democracy and climate justice (Mitchell 2011: 238, 267).

With advancing climate change, such battles are embedded in the "negative value" of the current energy regime, in terms of the greenhouse gases it produces (Moore 2015: 277). Uniquely, the current transition is principally a political project designed to overcome the legacy of existing energy systems. The "negative value" of capitalism's fossil fuel dependence is now writ large as a global policy imperative. In this process, "externalised" nature is socialised into the internal logic of accumulation, forcing transformation (see O'Connor 1998 for a discussion of ecological socialisation). As such, the current energy transformation is a distinctively climate transition,

driven by the imperative to establish new socio-ecological relations in the face of climate crisis (Moore 2015).

This chapter investigates these transitions, asking what possibilities are opening up for climate justice. There are three sections. First, the theoretical and conceptual structure is further elaborated and the context of the three country cases is presented. Second, the chapter compares the social legitimacy of subnational cases across the three countries. Third, it evaluates the approach in terms of what it reveals about the changing socio-ecological relations of energy.

Background

'Fossil capital' is ubiquitous, entrenched in virtually every aspect of society, able to exert considerable influence on the state (Malm 2016: 391). Governments otherwise committed to decarbonisation compete to minimise, avoid, displace and offset their responsibilities, so as to retain fossil fuel power. There is public opposition to renewables from the beneficiaries of the carbon economy, including from coal-dependent communities and workers' organisations, and from some of those affected by the direct impacts of renewable energy. With "decarbonised" nuclear energy, opposition has a long history based on the specific biophysical dangers of radioactive power generation. With renewable power there is opposition to hydroelectric mega-dams in terms of displacement, impacts on livelihood, water flow and the wider ecology. Large-scale "wind farms" and "solar parks" can similarly displace livelihood and land use, and face opposition (Scheidel and Sorman 2012). Such conflicts can be seized upon to delegitimise decarbonisation and reverse the transition.

With the priority and urgency of decarbonisation, considerable research has been conducted into the politics of expanding renewable electricity (see Edenhofer 2012; Scheer 2007; Toke 2011; Bickerstaff et al. 2013; Sovacool and Dworkin 2014). Much of the research on climate transitions is focused on the policy field, discussing the technical capacity of renewables, the economics of transition and questions of legislative and administrative capacity (Sovacool 2014). There have been some studies of renewable energy initiatives and their social impact, especially in *Renewable and Sustainable Energy Reviews and in Energy Research and Social Science*, but generally not in a comparative perspective, nor addressing questions of social participation: Breukers and Wolsink's comparison of The Netherlands, England and Germany (2007); Hua et al.'s analysis of Australia and China (2016); and Mendonca's U.S.–Danish study are exceptions (2009). There is case study research into the social barriers to decarbonisation (see Agterbosch 2004; Aitken 2010; Wolsink 2012; Praene et al. 2012; Gross 2007; Bridge et al. 2013). Studies into electricity transition as a social process are focused on the question of community or household take-up of low-emissions technology, for instance of rooftop solar, rather than the social questions of larger-scale collective efforts at establishing distributed or de-linked energy supply (see IIASA 2012).

Rarely is climate transition researched in terms of social forces, social conflict and social change (Stirling 2014). There is an established instrumentalist and policy-focused literature on "social acceptance" for energy infrastructures (see Ribeiro et al. 2011), including renewable energy such as wind power (Thygesen and Agarwal 2014). A Special Issue on the topic of "social acceptance of renewable energy innovation" was published in *Energy Policy* in 2007, identifying socio-political, community and market acceptance as key aspects (Wustenhagen et al. 2007). From this perspective the focus is on public acceptance of proposed energy infrastructure, and questions centre on issues of impact assessment, stakeholder involvement and engagement. There is a discussion of how to gain "acceptance" for renewable energy projects (Enevoldsen and Sovacool 2016; see also Devine-Wright 2011), including studies from outside high-income contexts (e.g., in Tunisia, Hammami et al. 2016). Opposition to renewable energy projects is found to vary

according to the perceived community benefits and local ownership, and prior perception of the locale, as to whether it is already deindustrialised or is seen as pristine rural landscape (Bidwell 2013). Within this literature there is an emerging focus on the process of institutionalising participation within distributed energy systems where "consumers" become "co-producers," and energy becomes a "commons" where "common pool resources" are collectively managed (Wolsink 2012). Studies suggest that when people "take the initiative for their development, the local and public acceptance of RE projects is higher" (Mignon and Rüdinger 2016: 479–480).

More broadly, it is suggested that renewable energy planning should be embedded with wider concerns about socio-environmental change (Spath and Rohracher 2010). This may respond to the uneven geography of energy systems and of local identification, and leverage wider commitments. This broader lens allows a wider consideration of the institutional and political factors, across scales, including industrial development policy, as setting the framing context for renewables. Reflecting this more macro-level analysis, Jacobson and Lauber identified four aspects in the German experience of wind and solar energy: "institutional changes, market formation, the formation of technology-specific advocacy coalitions, and the entry of firms and other organisations" (2006: 258). Curran identifies the construction of public-political narratives as central to the contestations over renewable energy in Australia, finding four themes: feasibility, security, cost and employment. None of these question the need for renewable energy, but rather cast doubt on its practical application, generating a "reasonable" sceptical stance, creating unease about renewable energy (Curran 2012). Reflecting wider concerns that socio-political barriers pose the most difficult challenge for decarbonisation, voiced by, among others, the World Bank and the United Nations Development Program (World Bank 2012; UNDP 2008), this chapter seeks to develop concrete comparative studies, across social contexts addressing the socio-political forces both in favour of and inhibiting renewables. Comparative analysis is especially important in the context of the Paris Agreement, which defines a global emissions target without creating a roadmap for decarbonisation. Unlike the Kyoto commitments, which centred on legal obligations for the highest emitters, the Paris commitments use UN-endorsed "nationally determined" emissions reductions, to be defined and achieved as national policymakers see fit. Contrasting social conditions and political contexts produce varying possibilities for future development, though there are also wide commonalities, offering rich benefits for comparative analysis.

The envisaged comparison across Australia, Germany and India focuses on social legitimacy as a wide-scale structural social process. Drawing on Olin Wright, legitimacy crises are seen as symptomatic of deeper conflicts in capitalist society (Olin Wright 1978). In this case the focus is on conflicts over sustainability and climate change: as climate change accelerates, and authorities fail to respond adequately, we can anticipate cascading legitimacy crises across a widening social field. In their wake, crises create new forms of contestation, drive new social formations and enable the emergence of alternative relations. Here, contestation over the legitimacy of fossil fuels, exposing otherwise de-contested versions of the "national interest," especially in terms of energy security, is a key aspect, along with efforts to establish new sources of legitimacy for the renewables sector in terms of new relationships with global ecology.

Country cases: India, Germany and Australia compared

India

India has one of the world's lowest per capita greenhouse gas emissions rates, at 1.8 tonnes in 2008, and very low electricity consumption per capita, at about 900 kilowatts per hour (kWh) per person (GoI 2015b). Yet electricity is the most important driver of Indian emissions, at about 44%

in 2010. Indian industrial policy rests on postcolonial developmentalism, and this was reflected in the country's landmark 2008 Climate Action Plan that aligned India's development rights with increased emission of greenhouse gases up to the OECD per capita average (extrapolating to 13gt, against global emissions of 45gt). The Plan stressed uncertainties about the impact of climate change on India, equated fossil-fuel energy consumption with poverty reduction. It therefore planned to expand coal consumption three-fold by 2007–22, to about 1500mt, allowing a two- to three-fold rise in aggregate emissions by 2031 (GoI 2008).

Since the 2008 Plan, India has gradually embraced renewable energy and de-linked its goal of energy justice from fossil fuel dependence (Bickerstaff et al. 2013; Jaeger and Michaelowa 2015). India's "Intended Nationally Determined Contribution" (INDC) for the Paris UNFCCC, subtitled "Working towards Climate Justice," pledged to raise "non-fossil fuel-based" sources to 40% of electric power generation, reducing coal dependency to 53% of overall electricity generation, both by 2030 (GoI 2015a). The following 2017 "Draft National Energy Policy" projected a further reduction in reliance on coal for electricity, to 44–50% by 2040, with renewable energy overtaking at 42–52%, albeit with a doubling of energy-related greenhouse gas emissions to about 4gt (NITI 2017: 98).

The policy realignment is significant as it lent a new dynamism to the energy mix. This is reflected in the series of new energy policies announced by the government from 2014. These were principally designed to reduce coal imports, enable energy security for the growing economy and extend energy access (with decarbonisation as a by-product) (Buckley 2015). The policies envisaged expansion for both coal and renewables, but over time the scale of coal expansion may prove less feasible due to impacts on land, water and air quality (Goodman 2016). Reflecting this, a debate has opened up over whether India is embarking on its own "Energy Transformation" (Buckley 2015). The advocacy NGO, the Prayas Energy, for instance argues that given the difficulties in expanding domestic coal production, renewable energy will "form the most significant share of the incremental capacity addition" into the 2020s (Prayas 2018: 505). Others disagree, arguing that India will probably double its coal-based capacity in a decade given the lack of alternatives at the scale required (Sant and Gambhir 2015: 295). Reflecting this, Jairam Ramesh, a former Environment Minister of India, has insisted there is "no alternative to coal" despite the rush to renewables (Morton 2016).

If coal-fired power falters due to its lack of "social licence," then the renewables sector must be capable of offering a desirable alternative if it is to gain headway. Here, the social legitimacy of renewables as part of a wider industrial strategy is crucial. Since 2012 government incentives have "triggered the resurgence of on-grid solar," centred on eight of the country's 29 States (Moallemi et al. 2017: 242; see also Chandel et al. 2016). The emergent renewables sector is dominated by private financing, often international (Moallemi et al. 2017: 244), and in some parts of India something of a solar rush is underway, fuelled by investor exuberance. One example is the US$20 billion investment announced in 2015 by a group led by Japan's "Softbank" including Taiwan-based Foxconn, the world's largest IT manufacturer, said to be planning in-country manufacturing. The business case was simple, as the Softbank CEO put it: "India has two times the sunshine (of) Japan . . . the cost of construction of the solar park is half of Japan. Twice the sunshine, half the cost, that means four times the efficiency" (Global Energy News 2015). Supporting this, the Indian Government has created an intergovernmental "International Solar Alliance," with 120 member countries, aiming to raise US$1 trillion in mainly private financing by 2030 (World Bank 2016).

The expansion of large-scale renewables comes with social consequences, especially for land use. Available land for large solar parks is limited (Santhakumari and Sagar 2017), and as state authorities secure land for energy financiers, conflicts over "land grabbing" are already emerging,

for instance in Gujarat (Scheidel and Sorman 2012). A more distributed process, at village and community level, may hold greater potential. Paradoxically, this form of socially embedded and distributed transformation may have greater potential to meet the challenge of India's decarbonisation at the scale required than the current focus on centrally directed and corporate-run "ultra-mega" operations. It would also serve to underpin legitimacy for the transition and help delink energy access from coal, and to overcome the false opposition between social justice and decarbonisation.

Germany

Since the 1990s Germany has been strongly committed to the idea of the "green economy." German per capita greenhouse gas emissions fell from 12.6 to 11.5 tonnes CO_2e from 2000 to 2010, although since 2010 there has been little change (Amelang 2017). Electricity remains the key determinant of emissions, at about 40% (GoG 2017). In Germany domestic abatement is supplemented by international offsets, through the UN's "Clean Development Mechanism" and, more important, through growing imports of "embodied carbon," in the form of manufactured goods, mainly from China (Goodman 2016). Renewables are projected to supply 54% of electricity by 2030, up from 18% in 2010 (with coal falling from 41% to 31% of the energy mix) (GoG 2014: 129). Renewable energy is promoted as an alternative to nuclear power, as much as to fossil fuels: following the Chernobyl disaster a series of proposals for a renewable energy feed-in tariff were adopted in a cross-party consensus in 1991, along with a mixture of taxes and subsidies (Jacobsson and Lauber 2006). Efforts by energy industry groups to undermine the tariff saw major counter-mobilisations in 1997, partly enabling the entry of the Greens into coalition government in 1998 and the successful passage of the Renewable Energy Sources Act of 2000, which locked in a national feed-in tariff for 20 years. Rooftop solar power was initiated at the Federal level and taken up by municipalities, linked to an emergent advocacy network comprising ENGOs, renewables companies and associated trade unions. On this basis both wind and solar power made considerable advances (Chalvatzis and Hooper 2009).

The policy was reasserted in the Federal Government's "Energy Concept" (GoG 2010) and in the aftermath of the 2011 Fukushima disaster, with the "Energy Transition Laws" (GoG 2011). Felix Christian Matthes describes the long-term ambition of the *Energiewende* or energy transition as "full decarbonisation of the economy" by mid-century and "the transition to an energy system in which energy supply is almost fully based on renewable energies" (Fabra et al. 2015: 51). The 2011 measures were paired with an ambitious target of 60% renewables by 2050 (GoG 2011). A range of factors facilitate the sector, notably the requirement that grid operators facilitate access for cooperative energy projects; in support of this, public banks provide preferential financing and the feed-in tariff offers a predictable income flow. There is also strong public support, and cooperatives are networked via established and active associations (Mignon and Rüdinger 2016). Over half of the sector is owned by households and cooperatives, and these are increasingly joined by municipalities which have bought back generation capacity and the local grid, and directed it towards renewables (Buchan 2012). Expressing this, renewable power, and especially solar power, has attracted a "high level of legitimacy," since at least the late 1980s (Jacobson and Lauber 2006: 266).

The German energy transition has been variously criticised and delayed, especially by the four privatised energy utilities, which continue to produce three-quarters of Germany's electricity supply and much of the fossil fuel (Eon, Vattenfall, RWE and EnBW) (Buchan 2012). Despite the growth in renewables, a "paradox" of perverse incentives has favoured brown coal as the only source of electricity generation that is cheaper than renewables, though there is evidence

this has subsided (Renn and Marshall 2016; AG Energiebilanzen 2018: 28). At the same time, a strong sustainable energy bloc has emerged, across renewables companies and advocacy NGOs, both environment and energy-focused, such as the "German Association for Renewable Energies" established in 1991, and the Klima-Alliance, a climate action NGO with over 10 million members. The two blocs compete for influence over the bureaucracy and over party politics, ensuring that renewable energy policy has become a major stake in political rivalry, dramatically politicising energy policy (Kemfert and Horne 2013).

Yet public support cannot be assumed. Research conducted by the Institute for Advanced Sustainability Studies in 2017 found that public support for the *Energiewende* was conditional on burden-sharing, and that in the long term it had to be of more benefit for low-income groups (IASS 2017). Another study found that two-thirds of citizens believed households should be bearing less of a burden in terms of rising energy prices (Fischer et al. 2016: 1584). On the ground, efforts at exiting from coal-fired power have faced strong opposition in coal-mining regions, including from mining unions. The vigorous and ultimately successful public campaign in 2015 against the "climate contribution" or *Klimaabgabe* (a levy to be paid by older, more heavily polluting coal-fired power plants) was a particularly salient example of this tendency (Morton and Müller 2016). Thus climate justice in Germany is framed primarily in terms of the "costs of transition," as they impact both on consumers and on regions whose economies are structurally dependent on coal mining. Partly in response, in 2017 the Federal Government established a "Commission for Growth, Structural Change and Regional Development" with representatives from unions, industry, local, state and federal government, and other "regional actors," to prepare a blueprint for socially sustainable "just transitions" in coal mining regions (GoG 2018). In Germany decarbonisation depends on maintaining existing levels of citizen support for and involvement in the *Energiewende*, and a greater commitment to climate justice in its implementation, particularly through a more equitable distribution of its costs (Fischer et al. 2016: 1589; Setton et al. 2017).

Australia

Between 1990 and 2013, emissions rose in Australia by about 26% (before taking into account land-use changes). The World Bank databank states CO_2 emissions per capita were static over the period, at 15.4tpp. According to IEA data, in 2016 84% of domestic energy electricity was sourced from coal or gas, 63% from coal; solar and wind power contributed 7% of electricity by 2015, rising from zero in 2000 (IEA 2017). Electricity is the largest single source of greenhouse gas emissions at about one-third of the total, and Australia's coal-fired power stations, which were mainly constructed in the 1970s, are notable for their inefficiency (GoA 2015b). High emissions and fossil fuel dependency reflect Australia's status as a high-income extractivist economy (Goodman 2008). It is one of the world's largest exporters of coal, uranium and (increasingly) gas. Three-quarters of Australian coal is exported. In the context of a coal and gas export boom in 2012 the Government stated fossil fuel exports would address energy poverty and "support higher living standards for billions of people" (GoA 2012: x); three years later the Government announced its strategy of defining Australia as an "energy superpower" through energy exports, including coal, gas and uranium (GoA 2015b).

Australia pursued a successful strategy at the UN in the 1990s to allow the inclusion of land use changes in carbon accounting, giving it windfall emissions reductions from reduced land clearing (Hayley 2009). It also argued successfully that Australia's special dependence on fossil fuels meant it should be permitted to increase its emissions under the Kyoto Protocol (by 8%, 1990–2012). Having insisted on its special status, Australia followed the U.S. in refusing to sign the Protocol, and the country finally joined, in 2007. In 2011 the country introduced a fixed

"carbon price," under "Clean Energy Futures" package. The package defined a 5% reduction in emissions on 2000 levels, making deeper reductions dependent on parallel action by competing countries (Lyster 2011). The minimalism was outflanked as the conservative Coalition mobilised social justice concerns against carbon pricing, as the "Great Big Tax on Everything." The 2013 election brought the Coalition to power principally on a platform of dismantling the carbon price. Subsequently Australia's INDC at Paris defined a modest target of 26% below 2005 levels by 2030 (below the EU and U.S. target of about 35%; GoA 2015c).

The energy mix has remained fossil fuel centred, though the renewables sector has benefitted from a relatively mandatory Renewable Energy Target (to 23% by 2020). The key driver for change has been the closure of ageing privately owned coal-fired power stations. Twelve had closed by 2016, accounting for 6.5gw, with a further 15.1gw slated for closure before 2030, leaving about 10gw of coal-fired power remaining post-2030 (Renew Economy 2017). The rapidity of closures was not expected, and it exposed government attempts to shore up coal generation. In this context an active "climate action" movement has become increasingly radicalised (Bulkeley 2000; Baer 2014). Since 2009, and in the midst of a coal boom, a mass-based movement of civil disobedience led by national advocacy organisations such as "Lock the Gate" has emerged, focused on organising farmers in rural areas against new coal mines and especially against coal seam gas (CSG). These campaigns have had some traction in delaying if not halting coal mines, and in preventing the expansion of CSG (Organ 2016).

A parallel effort to promote renewables has had some success. Plans for "100% Renewable" have become mainstreamed, for instance with a 2013 report from the Electricity Market Operator, a federal government agency, that found "no fundamental limits" to reliance on renewable energy (AEMO 2013). With the falling per-unit cost of renewable power now well below that of new coal-fired power, the only "barrier to entry" for 100% renewables is the negligible fixed cost of old (and now closing) coal-fired power stations (Parkinson 2016). In 2015 Federal Labor (in opposition) adopted a target of 50% renewables by 2030, and several State governments adopted the Paris target of net zero emissions by 2050. In 2016 the Australian Council of Trade Unions adopted a more proactive policy of "just transition" for workers and regions dependent on declining fossil fuels (ACTU 2016). At the same time a new industrial lobby was emerging, centred on corporate-owned wind farms and especially on small-scale solar, with 1.4 million or 15% of households having solar PV, one of the highest in the world (Energy Supply Association of Australia 2016).

The fossil fuel energy sector retains considerable influence in Australian political life, but this is not uncontested (Curran 2011; Bell and Hindmoor 2013). Governments have posed climate policy as a threat to livelihood, setting climate policy against social justice (Effendi and Courvisanos 2012), though this strategy has weakened as renewable power becomes cheaper. At the Federal level political incentives for minimalism and denialism have remained high (Byrnes et al. 2013). Yet there are more positive sum developments promoting renewables at the subnational level, as a vehicle for industrial, regional or community renewal. These demonstrate the vitality of renewables as vested in political advocacy coalitions, household and community solar advocacy, and the emerging corporate-renewable sector, linked to State governments. In this context, the challenges posed by the continued leverage of coal and gas, despite waning legitimacy, should not be underestimated.

Conclusion: dynamics of energy and climate justice

Climate justice agendas can and arguably must be enabled to flourish in the transition to decarbonised energy. Energy decarbonisation points to new relationships with biophysical and social forces: most important, it does not depend on exhaustible sources of fossil fuels, and instead taps an

inexhaustible biophysical force, and offer strategies for technology-driven economic development beyond resource dependence. Further, the diversity of renewable energy is far greater than for fossil energy. Electricity derived from solar and wind can be generated at multiple scales and consumed with or without distribution from a fixed network. Large-scale renewables may be privately owned by diversified energy corporations, feeding into a centralised grid, or by new configurations of community-owned, locally operated generation and distribution systems. These arrangements are conditioned by government policies that incentivise and plan the transition, by corporate and financial market calculations, and by community campaigns and direct initiatives with strong normative concerns linked to climate change and also to a new vision for distributed energy (IRENA 2015).

The outcome, as outlined, hinges on contests over the meaning, and attainment, of legitimacy. As new players, policy coalitions and political constituencies have emerged, dedicated to decarbonisation, the existing array of fossil fuel interests and infrastructures has become highly visible and politicised. The fossil fuel bloc may retain a capacity, at least in the short term, to block or undermine transition, but this is no longer a technicised and depoliticised process, and instead is highly contested and politicised. The fossil fuel veto may be maintained, but at the cost of a widespread and accelerating crisis of legitimacy for the sector. Even in Australia, where the fossil fuel bloc is especially resilient, reflecting its export orientation, the sector is under assault on a variety of flanks. This is a genuinely new development that comes in the context of growing global uncertainty over the future of carbon-intensive sectors.

Across the three countries questions of climate policy and social justice have become more salient, in some respects have generated climate justice agendas. In Germany, community-level solar has gained its own logic, facilitated by the government's "Energy Transformation," though social justice claims can still be mobilised to threaten climate policy. In Australia household solar has played an important role, and there has been strong community mobilisation for climate justice, against the failure of federal climate policies. In India the nexus between energy justice and fossil fuels is increasingly superseded by an emergent renewable sector, and social justice is increasingly aligned with decarbonisation, albeit corporate-led. In all three countries the transition process is reordering social hierarchies and creating new possibilities for realising both emission reduction and social justice. As argued here, for socially driven take-up to generate transformation at the scale needed, these re-orderings have to be weighted to enable distributed models, meeting finance, technical and administrative requirements for community-level modes of technology and institutionalisation. The three cases, as discussed, demonstrate the centrality of these socio-political frameworks and their relevance to local needs and potential to achieve social transformation at the scale and intensity required.

Overall, in the current period mass-scale distributed renewables offer the best chance of extending the energy transformation to the degree needed to achieve global "net zero carbon" by 2050. They do so as they harness the social legitimacy of renewable energy to a participatory structure that empowers communities and collectivities. That social process is not simply preferred but necessary to achieve the required political and social leverage, as well as the required cross-societal scope for energy transformation. The experience of renewables in Germany demonstrates the vitality and dynamism injected by a socially owned and collectively organised renewables sector. The Australian case offers some potential in this regard, as in part reflected in efforts to organise the existing household sector, through the "solar citizens" initiative for instance, as well as efforts to extend "community power" beyond presently limited social provision. In India the critical issue will be the capacity to downscale the existing "ultra-mega" initiatives and upscale household-based programs. Renewables at the intermediate scale, especially at village, neighbourhood and municipality level, offer real prospects for socialising the energy transformation and extending the social dynamic of its development.

The danger, as noted, across all three countries, is that renewables and associated climate and energy policy become discredited by the forms of disempowerment and stratification that they generate. Renewables "from above" closely replicates the centralised energy management practices derived from the fossil fuel era. There is widespread evidence that corporate and semi-state agencies in the energy sector are now moving to dominate the field and secure their control of renewable energy flows (Glover 2006). Their capacity to monetise renewables hinges on centralising generation and delivery structures, to re-institute their income flow. Household and community renewables, whether on or off-grid, are antagonistic to the centralised model but offer real foundations for a deeper transformation. The challenge of climate change, the necessity for emissions reduction, and the rise of distributed renewable energy, have all dramatically exposed fossil fuel energy, and have politicised energy policy. The newly recognised socio-ecological relations of fossil fuel energy are transforming the policy landscape. The result is a new political dynamism that engages new players and constituencies, and pursues new frameworks for just transitions and climate justice.

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