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The role of the state in the politics of disruption and acceleration

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EXECUTIVE SUMMARY

- **Disruptive innovation in politics is a pre-requisite for ambitious and progressive decarbonisation** through finance, technology and other means. Challenging incumbent control over transition pathways is vital.

- **Addressing climate change effectively requires active interventions from all actors. But governments are particularly well placed to orchestrate other ecosystems of transformation** using a variety of levers and tools at their disposal. Interventions in one area have knock-on effects elsewhere, amplifying their overall impact.

  Supply-side policies that restrict access to remaining reserves of fossil fuels and redirect finance in new directions can shift business practices away from fossil fuels when combined with new rules on disclosure and corporate governance. Tax and fiscal measures to help local businesses and cities raise their level of ambition can trigger change from below, setting off waves of change among transnational city networks.

  Alongside such economic policies that withdraw state support to fossil fuel industries, policies that enhance the participation and representation of beneficiaries of climate action in decision making can tilt the balance of power towards even more ambitious action.

- **Necessity is the mother of all invention. Governments must seriously consider so-called supply-side policies by placing clear limits on further fossil fuel reserves extraction.** The only way to redirect finance towards lower-carbon technologies, infrastructures and services is to make clear that some models of wealth creation have reached their sell-by date are off limits. In practice, this implies using bans and moratoria, active phase-downs and clear timelines for managed decline. Businesses need a clear and consistent signal that the end game for fossil fuels has arrived.

- **Building multi-level and multi-actor alliances is key to engaging different parts of the state in ambitious and progressive innovation and experimentation.** It is important not to treat 'the state' as a monolithic entity. States can have large stakes in incumbent systems and be incumbent actors themselves—such as those with state-owned enterprises—making them reluctant to support niche innovation and experimentation.

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- Some states clearly have more power than others to enact ambitious climate policy or to facilitate and finance global transitions, with the state, certain ministries and levels of office more inclined to support transformative action than others. This points to the need for creative multi-actor alliances that work with central and local governments, business, civil society groups and trade unions.

  Coalition building among these groups can help rally support for bolder interventions and involve important actors who have often been excluded from decision making. This is already happening in Europe around calls for greater support for renewable energy and for divestment, including most recently the European Investment Bank's plan to drop funding for new coal (Roggenbuck 2013).

- In this regard, **there is a key role for cities, municipal and regional governments and supranational institutions** in supporting more ambitious forms of innovation and experimentation by creating positive enabling environments through regulation, participatory planning, fiscal policy and other measures (such as tax breaks, preferential rates for local businesses) to support niche business and community actors.

  Sub-national experimentation can create positive practice that is shared across networks and amplified by coalitions of business and civil society actors, showcasing what is possible and generating demand for positive change elsewhere. Bodies such as the Committee of the Regions in Europe[3] can play an important role in diffusing positive examples, as well as in ensuring that transitions are managed by partnerships between local actors and other levels of government.

- Past experience suggests that **if innovation and experimentation are to deliver social as well as environmental benefits, it is vital to open up decision making to potential beneficiaries as well as groups that may be impacted** negatively. The use of citizens' assemblies and other participatory approaches can help chart out socially acceptable decarbonisation pathways, as can more active consultations on specific innovations.

  Such political innovations can help to avoid the imposition of unpopular policy measures, thereby improving the chances of lasting success with deeper ownership and public acceptance. These are being trialled in France and the United Kingdom (UK) and existing frameworks for doing this in the European context are available through the Aarhus Convention.[4]

- **Support for innovation and experimentation cannot be reduced to decarbonisation.** Governments in Europe and around the world have signed up to the Sustainable Development Goals (SDGs) , so their responses to climate change also have to be cognisant of impacts on food security, access to water and energy, economic inequality, the need to avoid conflict and more.

  This poses a huge challenge for conventional policymaking. But the more inclusive and participatory processes we advocate, the better the chances of decarbonisation initiatives not passing the costs and burdens on to poorer and more vulnerable members of society .

- **The pace and depth of innovation and experimentation are often frustrated by dominant incumbent actors who seek to protect their market share. Their access to decision making must be restricted to create space and demand for new forms of innovation.** In practical terms, this means enacting policies and measures that restrict party funding, minimise the revolving door between governments and incumbent industry actors and enlarge the representation of beneficiaries of ambitious climate action, including younger people. Greater *de facto* representation of future generations and efforts to lower voting ages might be further ways to do this.

- **Changes to the political balance of power are a prerequisite for moving beyond what we call 'plug-and-play' approaches to enable disruptive and ambitious forms of innovation and experimentation.** Efforts to slot new energy sources or technologies into existing infrastructures and decision making tend to generate negative social and environmental outcomes.

  Dominant approaches to innovation and experimentation assume an 'as well as' model of adding to existing forms of innovation and experimentation rather than an 'instead of' approach.

The latter requires abandoning the strategies, tools and business models of existing consumption and production that are no longer compatible with tackling climate change and achieving just transitions.

Disruptive approaches need to actively enable new social and economic actors to lead transitions that redesign transport, food and waste systems, for example, so that they meet broader social and human needs.

1 Introduction: Recentring the state

Achieving and replicating rapid transitions that are both far-reaching and unprecedented in terms of scale—which, as the Intergovernmental Panel on Climate Change (IPCC) *Special Report on Global Warming of 1.5 °C* (SR15) suggests, are required to keep warming below 1.5 °C — means engaging with the deep politics of transition and transformation.[5]

We argue here that it implies supporting political and institutional innovations that disrupt incumbent power and enable new actors and voices to drive socially just transitions. We suggest such innovations are a requisite to effective innovations in technology and to rapid decarbonisation that does not entrench social inequalities.

This goes beyond questions of good governance and policy design for decarbonisation, which imply more incremental realignments of sociotechnical systems, to questions of how to disrupt the dominant political economies that frustrate the possibility of both rapid and just transitions required by the Paris Agreement.

Not only do incumbent industries resist required changes; the speed and scale of interlinked shifts required also demand simultaneous changes in the larger social order. This includes shifts in finance, production and technologies, consumption patterns, infrastructures, governance, social behaviours and culture.

Prescriptions for change cannot be formulaic, as decarbonisation will take different forms around the world, where state capacity, the nature of markets and finance and the form of civil society engagement are diverse and uneven. To complicate matters further, there are few direct historical parallels to turn to for answers about how to realise the transformations now envisaged, as the IPCC itself acknowledges.[6]

So how do forms of innovation and experimentation contribute to processes of deepening and accelerating just transitions and broader transformations beyond generic appeals to scale up and roll out new technologies and innovations? The answer begs a further question: Which groups and institutions will orchestrate and accelerate transition and transformation, and to what ends?

In answering this question, we argue that disruptive politics is a crucial dimension of transition and needs more attention compared to the ongoing dominance of work on disruptive technologies and finance. This raises key questions of democracy and accountability.

While recognising the central importance of technology and finance in rapid transitions, plugging in alternative technologies or mobilising new flows of finance is unlikely to produce the sorts of accelerated and transformational changes now required without shifts and realignments in the distribution of political power and influence.

A plug-and-play approach reinforces and reproduces incumbent power, undermining our collective ability to attend to questions of inclusion and social justice that are, in our view, prerequisites to lasting and deeper transformations.

Having introduced these themes in the first part of the paper, we then elaborate through examination of a series of short case studies from the energy, transport and land and agricultural sectors where radical decarbonisation is required, but currently elusive.

The dangers of a plug and play approach to transitions is that new technologies are financed and adopted without challenging existing power relations, such that decision-making authority continues to reside with incumbents. This, we show, often results in business-as-usual patterns of production, consumption and exclusion that risk not tackling the source of the problem, thereby reproducing or exacerbating social and environmental injustices, and avoiding deep decarbonisation.

In a third section, we move towards sketching out the forms of disruptive politics that may contain and roll back incumbent power. Fundamentally, disruptive politics withdraw support for incumbents involve a broader range of social actors in innovation and experimentation. We go beyond narrower questions of governance and transition policy to look at interventions and leverage points that can activate and deepen the democratic politics and strengthen accountability in processes of transition through greater attention to voice, participation, transparency and oversight for core areas of economic policy.

Our argument is that the state will play a crucial role in managing and accelerating the sorts of disruptive change now called for to address climate change, and that the question of how to support innovation and experimentation needs to be framed according to broader issues of social, cultural and political change. Some transformations are more state-led, market-led, technology-based or citizen-led (Scoones et al. 2015), but most imply a combination of these, with the state reacting to, or reinforcing, the changes demanded by other actors. For this reason, the state features centrally in our discussion.

There are empirical justifications for this focus on the state. Past cases of large-scale, swift sociotechnical change reveal that new technological systems require significant public support in the form of state investment, regulation, establishing and enforcing property rights, and more (Vogel 2018; Mazzucato 2011).

Moreover, the state sits at the centre of the contested politics of disruptive and accelerated transformative change (albeit with some states playing a more central role than others). Whether examined in its entrepreneurial, regulatory, competitive, developmental or welfare form, states are the arenas of struggle in which social actors negotiate how transitions should be governed, and on whose terms, and are the target of social demands when things go wrong.

Yet much public discourse on decarbonisation tends to ignore this understanding of the state entirely. The conventional framing conceptualises governments and markets separately, with the market constituting a kind of natural order and government 'intervention' as undesirable yet necessary and auxiliary.

This framing was on display recently when Microsoft co-founder and philanthropist Bill Gates made headlines after a *Financial Times* interview. Gates asserted that divestment strategies had little impact, having neither reduced emissions nor "capital-starved [the] people making steel and gasoline," leading him to argue that more venture capitalists funding "breakthrough energy ventures" for "disruptive technologies" would provide real emission reductions (Edgecliffe-Johnson and Nauman 2019).

Leaving aside reports that divestment has materially impacted fossil fuel companies (see, for example, McKibben 2018; Bergman 2018) and critiques of the idea that 'breakthrough funding' holds such potential, Gates' proposal demonstrates how widespread and deeply culturally entrenched the view is that markets alone can deliver transitions. It also finds expression in ongoing and renewed support for carbon trading as the principle vehicle for achieving net zero by 2050 and the goals of the Paris Agreement, despite widespread evidence of its shortcomings to date (Newell and Lane 2016).

The need for speed and acceleration called for by the IPCC among others does not just recentre the state; it also changes the conduct of politics. It is scientists, not revolutionaries, who tell us we need 'transformative' and 'systemic' change within the next 10–20 years.

But as Naomi Klein (2015) notes, it is unfortunate (to say the least) that at the height of our awareness about the severity of climate change, neoliberal ideology is paramount and governments in many contexts exercise only indirect control over their energy, transport and food systems, for example.

Hence, at the very time we most need the steering capabilities of democratic governments, the power (or perhaps more pertinently, willingness) to intervene has been diminished in many contexts. Ignoring, dismissing or dismantling democratic states as the primary arena of

negotiation for decarbonisation threatens to further delay transition and transformation, leading to some of the consequences we describe below.

This perspective posits the state as neither an inherently good or bad actor, nor an inherently captured one, but as a site of conflict and an arena of negotiation. It is within the state that demands of capital and the demands of a broader society produce contingent social frictions across what we broadly consider to be 'the market' (Burawoy 2003; Polanyi 1944).

The dual imperative of responding to pressures from both citizen-consumers and producers is the 'twin dilemma' of democratic capitalist states (Prudham and Morris 2006). Elsewhere, this has been described as the tension between accumulation and legitimation, which is apparent in many arenas of climate politics (Paterson 2010).

States in capitalist democracies balance this tension between industry's demands for growth and collective concern for the environmental and social risks generated by industry growth through a complex, differentiated and contested state apparatus—one that is not inherently reducible to any particular class or faction, but is 'open' to political mobilisation (Prudham and Morris 2006).

The state is not one, unitary, rational entity, but rather a large web of governance relations and forms of authority (Newell et al. 2012). Key decision-making sites within the state shift constantly as the agenda-setting, law-making and rule-implementing arms of the state respond to the pressure of non-state actors (including private individuals, interest groups and specific firms) as well as the specific political culture of the state (the norms, values and identities of a particular society).

1.1 Ecosystems of transformation

The implications that flow from this view of the state are important for understanding how societies can pursue action across what we call 'ecosystems of transformation'. Ecosystem here refers to interdependencies between multiple pathways to transformation—the intertwined routes of change dominated by various segments in society, including the financial sector, the productive capacities of the 'real economy,' civil society and the state.

It also refers to the polycentric nature of contemporary governance. Transnational climate governance initiatives in which sub-state and non-state actors seek to reduce greenhouse gases (GHGs) have an important role to play in achieving just transitions and decarbonisation, given that multilateral efforts to mitigate climate change are seemingly in gridlock and the current global political landscape is far from conducive to ambitious action underpinned by radical innovation and experimentation (Bulkeley et al. 2014).

These initiatives include networks of cities committed to lowering their carbon footprints, voluntary corporate reduction targets and disclosure processes, and the revision of many of the rules that govern carbon markets reworked for Article 6 of the Paris Agreement.

Nevertheless, many scholars continue to emphasise nation states and intergovernmental organisations as the primary actors capable of orchestrating such transnational climate governance initiatives. According to one estimate, this strategy accounts for nearly one-third of transnational climate governance initiatives (Hale and Roger 2014).

In the paper, we describe ecosystems of transformation within which there are numerous entry points, levers and moments to try and accelerate disruptive change. Interventions in one place can trigger change elsewhere, spreading and reverberating across highly interdependent assemblages of production, finance, technology, the state and civil society. This points to more sites of vulnerability as well as more scope for change, for which the state is uniquely positioned to orchestrate these ecosystems of transformation.

1.2 States in transition

Our intention is also to emphasise that the state itself is in transition. Regardless its wide variety of geographically and institutionally distinct forms, the state is not a static or universal entity. As part of broader ecosystems of transformation, states are intertwined with changes in technological, productive, financial and social movement arenas.

In helping to bring about swift sociotechnical change, the state itself will undergo transformations in political institutions and relations of power. Indeed, histories of energy statecraft (Yergin 1991; Gore 2017) show that particular forms of energy production and infrastructures (Bridge et al. 2018) require or at times make possible particular types of politics.

For example, nuclear energy requires a more centralised and militarised state. Quoting Denis Hayes, Hammarlund and Linberg suggest "The nuclear option requires… widespread surveillance" such that "police infiltration of all dissident organisations will become social imperatives, as will the deployment of a paramilitary nuclear police force to safeguard every facet of the massive and labyrinthine fissile fuel cycle" (1976: 187).

Indeed, concerns around the 'plutonium economy' (Patterson 1984) and the 'nuclear state' (Jungk 1979) highlighted how the security implications of plutonium meant that there was a necessary level of secrecy and non-transparency due to the nature of materials being handled which reduced democratic control.

In France, the 'centralised and secretive nature' of nuclear power policymaking has meanwhile meant that there has been very limited access from anyone outside the official nuclear elite, resulting in a closed system that maintains the status quo, crowds out alternative energy imaginaries, and silences opponents (Sovacool et al. 2019). As such, nuclear power decision making in France is not likely to be based on fair representation and open participation, increasing the risk that procedural injustices prevail.

Yet despite this, attention to state transformation in debates about energy and sustainability transitions often reduces the state to enabler, regulator and manager of transitions, without sufficient attention to the ways in which the state itself transforms as it attempts to disrupt and manage transformative change in technological and sociopolitical systems. Choreographing deep structural change on an urgent timeline calls for new distributional and procedural capacities in states to balance, mitigate and manage transition and its impacts across society.

Distributional capacities must attend to the spatial and temporal dimensions of just transitions, given that decarbonisation in one community can redistribute risks and benefits in undesirable ways elsewhere in another, both locally and globally. These include through land grabs driven by the expansion of biofuel consumption and the demand for offset programmes (Fairhead et al. 2012) or scrambles for lithium and cobalt (Sovacool et al. 2019) to sustain battery production for increased electrification.

The disruptive and contested nature of low-carbon transitions can have profound impacts on certain groups of people (Sovacool et al. 2019), underscoring how transitions can create new vulnerabilities or worsen existing ones if led by dominant incumbent actors and visions.

Developing the distributional and procedural capacities needed to achieve decarbonisation and just transitions requires greater participation and representation from civil society, which is admittedly the most ambiguous and ambivalent of social actors.[7] Civil society operates at the core of 'ecosystems of transformation'; the third sector is uniquely positioned to pressure the public and private sectors to propel forward mutually supportive and virtuous cycles of change around transitions.

For instance, divestment pressures can trigger actions in both the public and private sectors, such as institutional investors excluding fossil fuel stocks from their portfolios and governments using procurement programs to support non-fossil fuel products. These, in turn, can trigger larger shifts in global value chains, rendering fossil fuel leases and industrial equipment 'stranded assets'. Civil society can also hold the public and private sectors to account in pursuing desired justice-oriented outcomes.

This raises the question of what constitutes legitimate participation in decision making and who has a right to a seat at the decision-making table. Strengthening procedural justice (fairness in decision making) requires opening up what are often considered the domains of experts, bureaucrats and elected representatives to civil society, including lay people and those who represent groups historically denied adequate representation or who will be disproportionately impacted by climate change.

Strengthening procedural justice also means ensuring basic protections for civil society. An ideal civil society that is capable of autonomous action and provides subordinate groups the possibility of collective action lies at the core of democratic governance (Evans and Heller 2012).

Civil society requires effective electoral competition—the *sine qua non* of any effective democracy—to hold those who control the state accountable to electoral majorities. It also requires basic rights to speech and social movement organising, which have come under attack in the face of attempts to delegitimise and criminalise protest movements as seen in the United States (US) and the UK (Brock et al. 2018; Dodd and Grierson 2020).

It should also be recognised that in some instances, there are limits to the role civil society can play in driving socially inclusive decarbonisation. The associations at the core of civil society may not be inherently democratising, such as when associations form around the goal of democratic exclusion (Evans and Heller 2012).[8]

This is the risk presented by some populist movements in Europe and elsewhere. The growing list of authoritarian leaders who have recently won or consolidated power over their country's central state, often by deploying or harnessing some variant of populism, appears to threaten democratic liberalism. While election outcomes may be questionable in some cases (for example, gerrymandering and voter suppression in the US), many authoritarian regimes won the support of electoral majorities.

Some diagnose this phenomenon as a widespread protest against decades-long neglect of working classes and rural populations that has resulted in stark economic inequalities (Fraser 2017). In this view, dismissing populist resentment as fascism overlooks important calls for justice and political opportunities (Bessner and Sparke 2017). A 2019 survey of citizens in four European countries where populism has been on rise in recent years found there is a clear demand for more direct forms of democracy alongside a growing distrust of representative democracy, traditional parties and online (dis)information (Lessenski and Kavrakova 2019).

Greater participation and representation from civil society in the governance of socially just decarbonisation, then, offers the means to develop the distributional and procedural capacities of the state as well as the means to strengthen democratic practice amid authoritarianism.

Opening up opportunities for greater inclusion and genuinely democratic practices to address climate change requires symbolically and affectively linking disparate interests (Laclau 2005) in a shared struggle. This, in turn, requires experimentation with many different forms of democratic participation. Political scientists caution that more direct forms of democratic participation must be bolstered by deliberative institutions and processes. The growing turn to citizens' assemblies to help set climate policy in the UK and France (Chrisafis 2020; Murray 2020) is an important experiment that seeks to deepen public participation in deliberation about the fastest and fairest ways to end GHG emissions.

Whether populist resentments channel into progressive, inclusive and democratic disruptive politics is an empirical question. As McCarthy (2019) notes, ringwing authoritarian populist regimes share common features,[9] one of which is promises of strong direct action to respond effectively to threats, which can strengthen a regime's legitimacy in the face of climate-induced crises.

Moreover, such crises present opportunities for regressive military interventions (Buxton and Hayes 2016) and 'shock doctrine' strategies in which people turn to decisive political actors that proclaim to have solutions to 'fix' the crisis. This happened, for example, with the rapid roll-out of neoliberal development projects in the wake of the violent aftermath of the Indian Ocean tsunami in 2004 and hurricane Katrina in 2005 (Klein 2007). The point is that populism and authoritarianism present serious risks as well as opportunities to democratic states working to orchestrate ecosystems of transformation.

The next section illustrates the scope of incumbent resistance and control of transition pathways to argue that alternative approaches are needed. Here we focus on how and why technology, regulation, governance, policy, behaviours and values currently interact in ways that limit decarbonisation and undermine transformative change.

Finally, Section 3, 'Towards disruptive politics,' presents an approach to thinking about ecosystems of transformation that looks at what leverage points might exist to accelerate transformations that both align with the goals of the Paris Agreement and attend to questions of justice. The analysis will foreground issues of power and politics that all forms of innovation and experimentation have to navigate and disrupt if they are to be successful. But we also suggest that innovations and experiments in disruptive politics are required to move beyond business-as-usual transition trajectories to deliberately socialise control over transition pathways towards broader publics and away from incumbent actors.

2 Dismantling incumbency to accelerate transitions

Achieving decarbonisation and rapid transitions on the scale suggested by the IPCC requires the active and accelerated dismantling of incumbency currently manifested most obviously (but clearly not exclusively) in the political power of fossil fuel interests. This is vital to unleashing innovation and experimentation with lower-carbon pathways.

The fossil fuel complex extends not just to large producers and users of fossil fuels. It also encompasses key actors that are often neglected in transition debates, like the military (Newell and Johnstone 2018). That incumbents have successfully resisted ambitious climate action for decades underscores the urgent need to dismantle public support for incumbents as well as scaling existing technologies (such as wind and solar) and widening support for new niches (such as the deployment of electric vehicles for transport as well as energy storage) (Newell and Paterson 1998).

Many important efforts are underway to unsettle incumbents, including continued institutional divestment in fossil fuel giants, mobilisations and protests over new oil and gas infrastructures and policymaking to keep fossil fuels in the ground, such as recent moratoria on new oil exploration and production announced in 2017 and 2018 by a number of countries including New Zealand, France, Costa Rica and Belize.

However, much more must be done to ensure that phasing out fossil fuel production proceeds according to clear near-term timetables. The recent Stockholm Environment Institute (SEI) report, *The Production Gap*, makes very clear that governments are planning to produce about 50 per cent more fossil fuels by 2030 than would be consistent with limiting warming to 2°C and approximately 120 per cent more than would be consistent with limiting warming to 1.5°C (SEI et al. 2019).

Avoiding such outcomes will require that states end support for fossil fuels. This means refusing access to fossil fuel resources by ending leases on public land and refusing permits. It may require restructuring and re-regulating downstream energy-consuming sectors, such as electricity generation and transport. In the power sector, where the majority of the world, led by the World Bank, has attempted to 'unbundle' and privatise energy provision (Newell and Phillips 2016; Tellam 2000), decarbonising electricity supply has proven difficult.

Reports from the UK indicate the auction-based approach to securing decarbonised electricity supplies has had perverse results, encouraging the deployment of old conventional oil and gas plants over renewables.[10] Likewise, some of the beneficiaries of carbon market finance for decarbonisation through the Clean Development Mechanism ended up being fossil fuel entities securing finance for incremental innovations to coal and gas projects (Baker et al. 2014).

Dismantling incumbency also requires discouraging plug-and-play transitions. Rolling out and scaling up technologies and production systems that have ostensible climate benefits, but fundamentally avoid disrupting the conditions of accumulation that benefit entrenched technologies and industries, threatens deep decarbonisation. To date, many of the major state-led decarbonisation efforts such as biofuels in transportation, natural gas in the electricity sector, climate-smart agriculture (CSA) and electric vehicles do not constitute what we consider to be rapid and just transitions.

State-supported decarbonisation initiatives that reinforce incumbency at the expense of deep emission cuts have consequences for the groups that are already disproportionately vulnerable to the effects of climate change. The broader implications of these choices for markets, democratic politics and climate change can be summarised as having repercussions for: (1) addressing climate change (deep or shallow emissions reductions); (2) distributing risk and benefits (how the threat of harm and privilege are socially and geographically organised); and (3) political institutions (how procedural injustices reinforce unequal distributions of power in society).

We explore each of these issues in further detail below, drawing on natural gas, biofuels, CSA and the rapid expansion of electric vehicles as examples, underscoring the need for more ambitious yet democratic state action and disruptive political innovations.

2.1 Low-carbon bridges to questionable emission savings

There is a dilemma at the core of how to accelerate transitions. On the one hand, the window of opportunity to avoid more catastrophic forms of climate change is closing quickly. Insisting on addressing social inequalities including power relations as a precondition to transition can be also recipe for intransigence.

After all, although capitalism is prone to crisis and instability, it has demonstrated a remarkable capacity for resilience over 400 years and is unlikely to come to an end any time soon. From this point of view, short-term actions that go with the grain of incumbent power—namely those who currently control industrial production, finance and technological innovation—provide the most expedient way forward.

On the other hand, there is debate about whether emphasising urgency and the need for radical and rapid interventions makes potentially regressive decarbonisation initiatives more likely. Rapid but ill-conceived transitions imposed from above without social acceptance and for the benefit of entrenched interests have significant costs.

It is precisely the desire of incumbent actors to address challenges of sustainability through denial, greenwashing, false solutions and foot-dragging that has led to our current predicament. We may acknowledge the power of restless finance capital to drive waves of creative destruction (Perez 2002) and the political popularity of 'win-win' scenarios for business and the public sector.

Indeed, many waves of innovation rise on the tide of optimism about a newfound ability to address longstanding problems while generating unprecedented levels of wealth. But, in the end, there little evidence that entrenched economic interests can achieve the outcomes associated with environmentally and socially just transitions. Investors operate according to the logic of profit and accumulation, which skews toward protecting business-as-usual regimes and forgoing deep GHG reductions and more transformative action. The examples below explore this dynamic.

2.1.1 Natural gas

Proponents of natural gas in North America and Europe have long justified public support for natural gas on the basis of it being a cheap form of energy and a 'clean' fossil fuel. As with other energy booms like hydropower and nuclear power, public support for gas has been fuelled by promises of abundant, cheap energy paired with rapid wealth creation.

The gas industry has also wooed lawmakers and regulators with claims that gas-fired power plants are cleaner due to lower point-source emissions of nitrous oxides (NOX), sulphur oxides (SOX) and carbon dioxide (CO2), compared to coal-fired power plants. Such claims have been a boon for the industry's efforts to successfully push for deregulation in gas and electricity markets, greater access to gas reserves underground, and publicly funded research and development (R&D) for improved gas extraction technologies.

Today, among all energy sources, gas accounts for the largest increase in world primary energy consumption and has become a key fuel and feedstock for the industrial sector. Yet, it is the expansion of gas-fired power plants that accounts for the majority of recent and projected growth in gas consumption globally. Underlying the gas industry's ability to expand marketing as a climate mitigation strategy is the claim that gas offers a 'bridge' from fossil fuels to renewables in the power sector.

Yet, the shale gas boom has reinforced incumbency in numerous ways, with implications for whether and how societies achieve deep emission reductions. For instance, gas-fired power plants provide air quality benefits compared to coal-fired power, and gas-fuelled electricity generation remains too carbon-intensive to achieve the deep reductions needed to meet long-term climate goals.

Methane, the primary component of natural gas, is 34 times stronger than CO2 at trapping heat over a 100-year period (Myhre 2013). Methane leaks during gas extraction and distribution by pipeline account for somewhere between 1 to 9 per cent of total lifecycle emissions for natural gas (Tollefson 2013; Cathles et al. 2012; Howarth et al. 2012), which means the lifecycle emissions of many natural gas power plants are not lower than new coal power plants (Farquharson, et al. 2016; Alvarez et al. 2012).[11]

Preventing methane leaks from aging oil and gas infrastructure may be technologically feasible, given methane leaks are widespread across oil and gas infrastructure (Michanowicz et al. 2017). But plugging leaks constitutes a management strategy of incremental performance improvement without eliminating the problem entirely and immediately. Moreover, tighter

methane regulations do little to relieve releases of methane and other pollutant accomplish little for the climate so long as overall oil and gas production continue to rise as more wells are drilled and oil and gas production continues to increase (Thompson et al. 2014), which undermines any climate benefits achieved from gas-based transitions away from coal-friend electricity production.

Fracked gas has reinforced global production networks for fossil fuels, in which incumbent constituencies work to undermine deep GHG reductions. The natural gas industry continues to draw investment in building infrastructure-based businesses such as pipelines, liquefaction plants and liquefied natural gas (LNG) terminals (Carbon Tracker 2019) and provides petrochemical firms that manufacture plastics and commodity chemicals with a relatively cheap feedstock.

Gas feedstocks have also revitalised domestic fertiliser industries in the US and India, which depend on an ample supply of natural gas. Nitrogen fertilisers are incredibly efficient inputs for increasing crop yields and are credited with kickstarting the technological shift to agricultural treadmills brought by the Green Revolution.

But they are also the leading cause of human-driven nitrous oxide (N2O) emissions, which are higher and growing faster than previously thought, having gone unabated for many decades (Thompson et al. 2019). As the third-most-important GHG after CO2 and methane, N2O has a heat-trapping effect and depletes ozone in the stratosphere, contributing to the ozone hole.

The success of the US shale gas boom and availability of cheap gas has encouraged many countries to pursue gas-based decarbonisation strategies and to pursue their own new shale gas development projects. As Henriet and Schubert (2019) confirm, economic case studies indicate that shale gas developments slow a country's transition to deeper emission reductions via renewables, as once shale gas displaces coal it becomes harder to phase out.

For instance, in Pennsylvania, recent investments for new gas power plants will all but ensure a frenzied build-out of gas generation with opportunity costs for renewables (Szybist 2019). Shale gas has also enabled utilities to claim decarbonisation of their supply without having to fundamentally redesign their operations to accommodate grid-integrated rooftop solar. To date, many utility resources planning initiatives have failed to identify exactly where a gas 'bridge' leads amid ever-increasing power consumption in consumer and industrial markets.

Perhaps most concerning is the way in which fracked gas has reinforced the political economy of oil, while stalling efforts to invest in the political economy of renewables. The integrated nature of gas and oil production has enabled shale gas producers to access oil resources. For instance, more than 50 per cent of new fracked wells drilled in the US between 2011 and 2012 produced both oil and natural gas (EIA 2013), enabling US oil industry to increase its rate of production by more than one million barrels of oil a day every year since 2011, albeit in a more flexible fashion (Kleinberg 2019).

Producers can slow production of oil or gas in response to price declines and increase production when prices rebound. This flexibility to shift between oil and gas production has infused certain global oil majors with a new source of market power (Clemente 2019). At 12.4 million barrels a day, the US is now the world's biggest oil producer, ahead of Russia and Saudi Arabia.

The gas industry is further positioned to support fossil fuel incumbency by reorienting its expertise and capabilities to offer sequestration services to the power and industrial sectors. Geologic storage of CO2 in depleted shale gas reservoirs requires R&D to understand the geologic characteristics of different kinds of reservoirs (Khosrokhavar et al. 2014).

Commercial-scale carbon capture and storage is now a central pillar of the oil and gas industry's promises to address climate, alongside proposed cuts in the intensity of methane leaks and support for carbon taxes, all of which enables the oil and gas industry to carry out current production plans, which are incompatible with the international goal of keeping global warming under 2°C (OGCI 2019).

2.1.2 Biofuels

The industrial agricultural industry has similarly marketed biofuels as a 'cleaner', drop-in alternative to gasoline and diesel fuels for automobiles as well as a bridge to a low-carbon, sustainable bio-based economy. Proponents of biofuel support policies have promised greater energy independence, GHG emission reductions and economic opportunities for agricultural producers and processors.

Importantly, biofuel support policies have posed little threat to the business models of fossil fuel suppliers and automobile manufacturers. North American and European policymakers supported the biofuel industry with a wave of biofuel consumption targets and mandates in early 2000s, including the Directive on Biofuels for Transport (2003/30/EC).

The rationale for these policies not only invoked climate benefits and agricultural opportunities; they also centred on a larger vision a future knowledge-based economy, in which European agriculture biotechnology provides the basis for profit from new intellectual property (Levidow 2013; Birch et al. 2010). New cellulosic conversion technologies enabled a low-carbon, bio-based economy in which agricultural crops provide petrochemical manufacturers with agro-feedstocks like bioethylene to manufacture plastics and other industrial materials (Martin 2017).

Although biofuel support policies have yet to deliver many of these promises, they have ushered in a remarkable expansion of global biofuels production and trade. Yet increasing the proportion of biofuel blends in the transportation sector has done little to challenge fossil fuel incumbency.

As biofuel producers have gained market share in fuel and petrochemical markets, oil demand has remained strong (Fitzgibbon et al. 2018). Unlike Brazil's s early experiment with ethanol as a gasoline replacement used in ethanol-only flex-fuel cars, European and North American biofuel mandates have largely limited biofuels to use as a fuel additive for fossil-fuel based vehicles.

For instance, most member states have blend-wall limitations of E5 or E10 (5 or 10 per cent ethanol) for gasoline blends and B7 (7 per cent biodiesel) for diesel blends. Absent major changes to combustion engines by automakers, fuel suppliers cannot blend greater volumes of biofuel at the pump for risk that fuel mixtures causes engine damage.

In addition to supporting incumbent fossil fuel production as well as large agricultural producers and processors, there is scant evidence of substantial GHG savings from biofuels. The first wave of biofuel support policies rested on the general logic that, because plants sequester CO2 from the air and biofuels release less CO2 when combusted in automobile engines, more biofuel consumption would mean less net CO2 emissions in the transportation sector.

This logic went unquestioned by policymakers and was supported by influential life cycle assessments backed by government ministries and industry thinktanks, even though peer-reviewed science remained unsettled on the nature of the GHG reductions and other environmental benefits, which many studies showing the benefits from biofuels varied widely according to crops, farming practices and vehicle type (Pimentel and Patzek 2005; Crutzen 2007; Farrell et al. 2006; Youngquist 1997).

As the industry grew quickly in the mid-2000s, so too did the number of peer-reviewed studies confirming uncertainties about GHG savings from biofuels compared to fossil fuels, given the risk of land use change as farmers expand agricultural production to meet the growing demand for food, feed and fuel (Searchinger et al. 2008; Fargione et al. 2008).

To address the multiple risks that expanded biofuels production posed to the environment, a second round of European biofuel support policies passed in 2008–2009 further solidified the role of biofuels in the transportation and power sectors (Renewable Energy Directive II and the Fuel Quality Directive) by requiring for member states to implement biofuel sustainability assurance schemes as a regulatory approach to disincentivising undesirable biofuel production associated with greater GHG emissions and harmful land use change.

Sustainability reporting systems aimed to increase the transparency about the lifecycle GHG impacts of biofuels so that governments can provide preferential market access for biofuels with better GHG performances without violating World Trade Organization (WTO) rules. Yet these programmes that have proven to be so complex as to be ineffectual.

First, the models used to calculate lifecycle GHG emissions for biofuels can vary substantially from one jurisdiction to the next, depending on modelling assumptions and data inputs, meaning that estimated GHG emission savings are highly sensitive and difficult to audit.

Second, the carbon intensity regulatory thresholds against which a given biofuel's GHG performance is measured may be set too leniently, raising doubts about whether the thresholds can incentivise producers to grow lower-carbon biofuels without triggering land expansion into sensitive

ecosystems over high-carbon biofuels. This has generated ongoing conflicts about whether a given producer's biofuels are accurately represented by carbon accounting, and whether certain governments have set fair regulatory thresholds.

This problematic reliance on lifecycle accounting and carbon intensity performance auditing is the result of WTO laws that limit the ability of countries to discriminate against commodities from specific regions, making more direct forms of biofuel governance subject to trade disputes. Early proposals from member states to simply avoid purchasing biofuels from countries with poor environmental regulations and high rates of deforestation were deemed likely to trigger complaints from developing countries that European countries were using biofuel mandates to advantage domestic producers over foreign competitors.

These and other challenges of global environmental governance for the biofuels industry reflect the limitations of a plug-and-play approach that attempts to achieve climate benefits without disrupting incumbent power.

Moreover, the next phase of biofuels development with carbon capture and sequestration (BECCS) will add more value to the industrial agricultural system, which is among the most significant contributors to climate change. The spread of industrialised agriculture accounts for 56 per cent of global non-CO2 GHG emissions through the production of methane and N2O from fertiliser use and animal wastes, and 19 to 29 per cent of total GHG emissions (Vermeulen et al. 2012).

And, as a major driver of deforestation, the agricultural sector accounts for an additional 17 per cent of global GHG emissions (Smith et al. 2007), through incursions for the grazing of cattle and the cultivation of animal foodstuffs such as soya and other cheap feed made from industrialised monoculture crops and release large amounts of methane to the atmosphere (Garnett 2011).

Even the midstream and downstream actors in global agricultural commodity chains constitute major fossil fuel consumers, including the storage and transportation firms as well as distributors, retailers and consumers (Oosterveer and Sonnenfeld 2012).

BECCS offers the possibility that the emissions from global agricultural commodity production and trade can be offset without challenging industrial agriculture's poor environmental and social track record. The stakes are not limited to climate change, as industrial agriculture is a resource-intensive industry that consumes some 70 per cent of global fresh water and occupies 40 per cent of global land area (Braimoh 2013).

The meat and dairy industry consumes additional large amounts of land, energy and water inputs to rear livestock in concentrated animal feeding operations (CAFOs) and monoculture crop constitute is a major source of widespread public exposure to the toxic chemicals in crop pesticides and antibiotics released into water and soil from CAFOs, which presents a growing threat to public health from antibiotic resistance (Casey et al. 2013).

These public health risks say nothing of the industry's high human costs, including migrant workers, women, and children who are vulnerable to forced labour, human trafficking, extremely hazardous work conditions, land grabs and the overall economic vulnerability and food insecurity of smallholders.

2.2 Distributional injustices in incumbent-friendly transitions

Transitions require attending to the question of how risk and reward are allocated and managed, bringing the state centre stage as the mediator of distributional justice. There is the need to avoid the latent dangers of nurturing new niches and ambitious programmes of technology development that either fail to deliver the same services in a more climate compatible way, or do so without disrupting the unsustainable trajectories of production and consumption that entrench existing social inequalities.

The issue here is not only about policy tools that steer capital and build markets, but about developing sociotechnical systems that respond to decarbonisation by advancing social justice and resilience in the interrelated transitions in energy, food, water and land systems.

Rapid decarbonisation has to be undertaken alongside action to achieve the SDGs. This means that the design of climate policies must go far beyond consideration of how to, directly or indirectly, influence the distribution of capital. Redirecting finance in the face of resistance from incumbent actors is a complex task, but doing so in a way that advances the goals of environmental justice and reduces economic inequality demands even more state capacity to address distributional impacts and issues of equity (Newell et al. 2011).

2.2.1 Natural gas

European gas consumption has been on the rise in recent years, despite growing acknowledgement of the questionable climate benefits of natural gas due to methane leaks. The energy scenarios charted by European Commission's Long-Term Strategy (European Commission 2018) project the share of natural gas to decline over time from 23 per cent of total EU primary energy consumption.

Although European Commission (EC) policymakers expect gas demand to remain stable as the EU moves towards its 2030 and 2050 targets under the Paris Agreement, this demand will be increasingly met by low and zero-carbon alternatives to natural gas, such as biogas, biomethane, hydrogen and synthetic methane.

This raises questions about future investments alternative gas sources and gas infrastructure, and about where European natural gas consumption will be met from and how it will be met in the near term.

Currently, the major sources of natural gas supply for Europe are domestic production, pipeline imports from Russia, Norway and Algeria, as well as liquified natural gas imports from the US and Qatar. Most projections for the next decade foresee increases in gas imports via pipeline and LNG to meet Europe's robust demand for gas amid decreasing domestic gas production.

The growing reliance on gas imports to meet demand suggests European electric and industrial gas consumers are inextricably tied to environmental injustices generated by natural gas production abroad. Given shale gas production drives world natural gas production, the costs of hydraulic fracturing in communities that play host to unconventional shale gas extraction activities are well known in the US context and can be expected in other countries mobilising investment to develop their shale resources like Argentina and China.

The fracking process entails vertical and horizontal drilling with large volumes of water mixed with chemicals and proppant (sand) to open up fractures in rocks to allow extraction of hydrocarbons, which can induce earthquakes, contaminate local water supplies, worsen local air quality and more.

Not only can fracking diminish local (and often scarce) water resources, the injection fluid constitutes a large quantity of contaminated wastewater, some of which remains deep underground in the geologic formation from where the oil or gas was extracted and some of which returns to the surface as 'produced water.'

Depending on the region and local regulations, this produced water may be treated and discharged into local watersheds. Because treatment is expensive and energy-intensive, operators often opt for recycling the water onsite for future hydraulic fracturing operations or disposal by reinjecting into deep-injection wells for storage purposes.

A substantive body of research from the US shows that these activities translate to elevated health risks to the over 17 million people living within one mile of an active oil and gas well in the US, leading to adverse health outcomes (PSR 2019) can translate to a number of adverse health outcomes.

For instance, US researchers found that children born within a mile of fracked wells are at elevated risk of low birth weight and birth defects such as heart and neural tube defects (Currie et al. 2017; Janitz et al. 2019). This kind of water and soil contamination can concentrate in host communities made vulnerable by weak environmental laws and may persist for generations. There is also strong evidence showing that hydraulic fracturing for oil as well as gas threatens an area's seismic stability, community cohesion, long-term economic vitality and more (PSR 2019).

A growing share of natural gas production is retrieved using unconventional methods such as fracking and coal bed methane extraction, both of which involve high levels of air pollution, tremors, the use of toxic produced water and many other social and environmental risks as detailed above, public opposition to these activities will continue to intensify.

To be sure, there are examples in which states have chosen to back public opposition to fracking through bans and moratoria (Evensen 2018)—the most recent being the UK's announcement at the end of 2019 that it would suspend fracking operations until new evidence suggests it can be done safely, reversing a decade of government support for the industry.

However, the majority of gas producers in North America, the Middle East, Russia and Latin America continue to pursue shale gas development by permitting, mapping reserves and investing in R&D for technological

innovations such as hydraulic fracking, magnetic imaging and seismic monitoring technologies.

Strong civil society opposition is a necessary but insufficient response for challenging incumbents. Ultimately, it is states that have the ultimate say in keeping fossil fuels in the ground, which underscores the need for inclusive democratic governance.

2.2.2 Electric vehicles

The uptake of electric vehicles (EVs) is another example of how transitions that centre on new technologies can generate or exacerbate environmental and social injustices if not carefully managed through inclusive democratic governance. Those who want to see societies transition away from fossil fuel-based transportation towards the electrification of personal transport face what Phadke (2018) calls a 'green energy bargain' (Phadke 2018).

On the one hand, EV transitions are an important pathway for deep GHG reductions in the transportation sector, assuming governments can coordinate parallel transitions away from coal- and gas-fired electricity even as electricity demand is set to increase drastically. On the other hand, expanding the production and consumption of EVs and other ostensibly 'green' technologies like renewable energy and storage can contribute serious environmental and social injustices.

The adoption of low-carbon consumer goods and services have generally concentrated in wealthier households that have the resources needed to reap the environmental and economic benefits offered by rooftop solar installations and electric vehicles (Zabin et al. 2016).

Greater policy attention to this disparity may increase access to low-carbon consumer products. However, for many people, car ownership—like home ownership—is out of reach and mobility depends on access to affordable public transportation networks. Moreover, merely plugging EVs into the same transportation patterns established over decades of fossil fuel road transport could exacerbate the chronic road congestion plaguing many major cities.

Policymakers focused on incentivising lower-cost EV production and consumption, and investing in EV charging infrastructure at the expense of improving public transportation networks will, at best, miss a crucial opportunity to enhance connections for all European communities, urban and rural alike, and at worse, exclude certain populations from the benefits of individual EVs and public transport.

Viewed through the lens of the SDGs, EVs can bring certain societies closer to achieving affordable and clean energy (SDG7), sustainable cities and communities (SDG11) and climate action (SDG13) (Vandecasteele et al. 2019). However, only by electrifying and expanding public transport can governments address systemic inequalities, such as economic, gender and racial inequalities (SDG5 and SDG10).

Research from Spain and the US shows that mobility needs vary by race, gender and economic status, with certain groups being more likely to use public transportation than others (Sánchez de Madariaga 2013; Gendered Innovations 2012). For instance, mobility to conduct caring work (such as childcare and elder care) has not figured into public transportation design, despite being the second-largest mobility need after travel for formal employment.

Scaling up EV adoption entails scaling up EV production chains, making the SDGs more elusive for certain communities, especially those playing host to mining operations in the Global South. This raises important questions about how the impacts of accelerating EV uptake will be managed outside of the centres of EV adoption, given the global nature of EV supply chains.

Emerging work on 'renewable extractivism' shows how rising demand for solar, wind and electric vehicles can further entrench incumbent supply chains and political economies rife with social and environmental injustices, passing the costs of decarbonisation onto some of the world's most vulnerable groups (Mulvaney 2014; Dunlap 2018; Zehner 2012; Sovacool et al. 2019).

The mobility of capital and the willingness of host governments to create sacrifice zones in exchange for foreign investment within or outside of their own societies through spatial and temporal fixes (Harvey 1981) is something that has to be challenged by 'home' countries where firms are based.

A dramatic move away from fossil-fuelled to electrified automobiles links European EV consumers to mining communities all over the world. The multi-billion-dollar industry for rare earth elements (REEs)[12] supplies a critical resource for manufacturing EVs and other sustainable technologies such as energy-efficient light bulbs and

certain offshore wind turbines that can help wean societies from dependence on fossil fuels.[13]

Currently, LEDs, wind turbines and EVs constitute very small shares of total REE commercial end uses, but could be one of the biggest drivers of REE demand in the future (based on mass) alongside the rare-earth magnet sector more generally (US Geological Survey 2018). EVs rely heavily on two particular REEs, dysprosium and neodymium. Whereas conventional fossil-fuel powered cars may use about one pound of REEs for small motorised components like windshield wipers, the various motors and batteries of an electric vehicle can require nearly ten times more REE materials than conventional cars (Alonso et al. 2012).

These two REEs have improved the performance of EV engines and batteries and some analysts predict electric vehicles will be the biggest driver of REE growth, with demand for dysprosium and neodymium increasing by more than 700 and 2,600 per cent respectively.[14] However, in recent years, EV manufacturers have begun to reduce their REE demand by transitioning to lithium-ion batteries, which require colbalt and are now powering the current EV boom.

Whether EVs expand mining for colbalt, dysprosium or neodymium, the mining of ore from the Earth creates serious threats to the environment and the wellbeing of communities adjacent to mines. Removing large amounts of earth can scar the landscape for generations, limiting alternative land uses and livelihoods such as agriculture.

Extracting and processing rare earth materials generates large amounts of toxic releases into local air, water and soil. People living and working near mining sites face an increased risk of developing cancers and other serious illnesses due to contaminated drinking water and food. Large-scale mining operations can also introduce and exacerbate social conflicts over how resources are controlled, accessed, and profited from.

These negative impacts can be found in mining communities all over the world, but supply and demand for REEs is current concentrated in China, with the world supply of cobalt divided between China and the Democratic Republic of Congo. China tightened its supply of REE beginning in 2006, spurring investment in new REE mining projects all over the world in Vietnam, Brazil, Russia, India, Canada, South Africa, Malawi, the US, Australia and Malaysia.

Although China's Bayan Obo deposit remains the world's main REE supplier due to its unmatched processing capabilities, the quick emergence of REE projects elsewhere and the construction of REE processing sites in Australia, the US and Malaysia (Haque et al. 2014) underscores how quickly the geography of REE supply chains can shift depending on Chinese trade policy.

Recent campaigns have targeted hybrid and electric vehicle manufacturers directly for introducing or exacerbating conflicts between industry and local communities, suggesting a greater role to be played by governments in mediating these conflicts. In many mineral-rich environments, local people seek to maintain control over resources as well as prevent pollution to groundwater, surface water, air and soil.

For instance, the 'Tarnish Toyota' campaign led by the Algonquin tribe contested the acid mine drainage and public health impacts that would result from building a heavy REE open-pit mine directly next to Kipawa Lake in Quebec, the geographical, ecological, and cultural centre of Kipawa people (Stewart-Kanigan 2014).

Elsewhere, communities in mineral-rich areas have sought opportunities for community mining and artisanal small-scale mining (ASM) as part of a larger movement to address the injustices associated with large-scale mining. ASM has roots in community-based natural resource management practices and common property resource regimes in which local people govern land and resources to support their livelihoods (Lahiri-Dutt 2018).

Policies to formalise ASM through community-controlled licensing and permitting have emerged in the Philippines, Indonesia, Zimbabwe and other countries, where communities want to access the economic benefits of extraction in contrast to national mining permits that generally benefit large-scale mining companies exclusively while making small-scale mining illegal (Moretti and Garrett 2018).

ASM may represent one opportunity for states to turn away from incumbents to help generate remunerative opportunities that facilitate local self-determination and democratic governance over community resources (Bryceson 2018).

Developing ASM projects is challenging. There is no single model and any effort to formalise ASM by creating legal rights to land and resources must be grounded in a

place's unique sociopolitical struggles over how resources are extracted and how any benefits from extraction are distributed (Peluso 2018).

But a growing body of regional expertise and guidance on how to support environmentally and socially just ASM suggests that collaborative stakeholder governance is key, involving iterative consultation with artisanal miners, local communities, civil society, government, larger mining interests and other value chain actors (UNEP 2015; Moretti and Garrett 2018).

Initiatives like Fairmined, ITSCI and the Better Sourcing Program could play a role in facilitating market access for ASM materials in a way that promotes human rights, environmental protection and peace. Increasing EV consumption requires that states engage more directly in how these supply chain develop.

2.2.3 Climate-smart agriculture

CSA has been promoted in recent years as a way to 'climate-proof' the food system and increasingly features in discussions about food transitions. It was promoted in the IPCC SR15, which highlighted CSA in emphasising the need for rapid transitions towards plant-based diets and has received significant support from the international community.[15]

CSA—as defined and presented by the Food and Agriculture Organization (FAO) at the Hague Conference on Agriculture, Food Security and Climate Change in 2010—is an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change.

CSA "contributes to the achievement of national food security and development goals with three objectives: increase agricultural productivity and incomes, build resilience to climate change, reduce/remove GHG where possible" (IPCC 2018). Thus, CSA speaks to the problems posed by the global food and agricultural system as a large emitter of GHGs, the vulnerability of food production to the effects of climate change and the relationship between agricultural productivity, incomes and food security.

Two and a half billion people—or 41 per cent of the world's population—depend on agriculture for their livelihood (FAO 2013b). The figure rises in sub-Saharan Africa, where on average over 60 per cent of the population works primarily in agriculture (FAO 2012).

The CSA framework fits neatly into the global climate agenda's search for 'triple wins'—practices that can mitigate emissions, increase resilience or adaptation and increase productivity. The issue is conventionally framed as such: "Between now and 2050, the world's population will increase by one-third. Most of these additional 2 billion people will live in developing countries…agricultural production will have to increase by 60 per cent by 2050 to satisfy the expected demands for food and feed. Agriculture must therefore transform itself if it is to feed a growing global population and provide the basis for economic growth and poverty reduction. Climate change will make this task more difficult under a business-as-usual scenario, due to adverse impacts on agriculture, requiring spiralling adaptation and related costs" (FAO 2013a, ix).

However, while there is a strong case for thinking more systematically about the relationship between climate change and the organisation of global systems of food and agriculture, CSA is unlikely to contribute pathways towards more inclusive and equitable agricultural development.

Rather than embracing an opportunity to reflect on and address the contribution of agricultural models organised along industrial, high-energy and chemical inputs, and export-led lines (as discussed above), the advent of CSA has been used to exploit opportunities to consolidate and advance the control of private actors over land, technology and livelihoods in ways that are inimical to addressing either rural poverty or sustainability.

The same can be said about biofuel support policies. This has occurred by advancing controversial agricultural biotechnologies like pesticide-resistant genetically modified plants, by promoting agricultural practices with poorly understood social and environmental benefits like biochar and no-till agriculture, and by seeking to finance CSA through new forms of 'green economy' financing and global carbon markets whose dubious environmental benefits and negative social impacts have been widely documented (Stephan and Lane 2015).

Attention to the structural and systemic drivers of crises around climate change and food insecurity is thereby distracted by the emphasis on incremental technological, economic and behavioural change, affecting individual acts of consumption (through standards and corporate social responsibility best practice) and realignments in pricing, technology and property regimes (as promoted by actors such as the FAO and World Bank).

What these initiatives and collaborations reveal is the significant investment in asserting the capacity of incumbents to successfully manage the challenges that climate change poses to business-as-usual politics and practice in the agricultural sector.

Discursively, CSA initiatives are linked to acts of de-politicisation that attempt to translate contentious politics into manageable technocratic responses that obscure trade-offs through 'triple-win' initiatives. As over 350 civil society organisations declared in a statement from September 2015 criticising the Global Alliance for Climate-Smart Agriculture:

> *"Agribusiness corporations that promote synthetic fertilisers, industrial meat production and large-scale industrial agriculture—all of which are widely recognised as contributing to climate change and undermining the resilience of farming systems—can and do call themselves 'Climate Smart.'"*
>
> *Climate-Smart Agriculture Concerns 2015*

Solutions proposed under the umbrella of CSA reward and thus consolidate the power of large agribusiness corporations and finance capital. CSA efforts diffuse political threats to the fossil fuel-intensive, technology-driven, export-led food systems on which the current food regime is organised, while bolstering the bureaucratically secure position of incumbents in accessing the large amounts of climate finance directed to agriculture.

CSA has become a site for the attempted resolution of the need for finance to find something to invest in, extending their control over land; for governments and neo-liberal global institutions to shore up flagging carbon markets by expanding into agriculture; for biotechnology firms to reinvent genetically modified organisms as 'climate-smart'; and for global agricultural institutions to raise their profile and diversify their funding streams by taking on mandates for tackling and responding to climate change.

The effectt of discursive privileging and institutional support for only those solutions that are consistent with the existing distribution of power, finance and technology in global food systems is to delegitimise—and in some cases appropriate—alternative solutions that offer important alternative pathways for climate change mitigation and adaptation that enhance the security of smallholder farmers, who remain the major source of food production and income for global rural populations.

By eluding questions about which farmers and whose environment will be protected and how, CSA privileges carbon fetishism, reducing the climate–agriculture interface to the commensurate fungible units of industrial agriculture's 'carbon cash crops'.

An emphasis on emissions trading has displaced a focus on emissions reduction; an emphasis on control through technology has predominated over access to technology and radical innovation; consolidation of land rather than redistribution; and reinforcement of property rights rather than the sharing of technologies central to climate-resilient agricultural practices.

This confluence of agendas ensures that other responses to crises facing food, farming and the environment are sidelined and ignored. We do not see the kinds of equity wins achieved through approaches like agroecology, which in contrast to CSA leverages time-tested agronomic approaches that advance food justice and food sovereignty in ways that are less subject to potential misinterpretations and abuses (Chappell and Majot 2014; Newell and Taylor 2018).

We also see little evidence that agriculture will become more resilient in a changing climate, where heavy rain events have increased soil nitrogen loss, prompting farmers to increase nitrogen application rates to reduce their economic vulnerability—and an adaptive strategy that increases agricultural contributions to climate change (Houser and Stuart 2019), again highlighting the way in which obstacles to deep emission reductions are intertwined with the incumbent political economies.

The case suggests, once again, the need to move beyond short-term fixes for structural problems of production, distribution and consumption. While innovations in biodigesters, animal feed and conservation agriculture, for example, are to be welcomed, they do guarantee deeper decarbonisation in agricultural supply chains dominated by incumbent agrifood corporations that make incremental adjustments to their product lines.

Fuller decarbonisation of food and agricultural systems requires revisiting assumptions about how industrial agriculture is organised, even under the mantra of 'sustainable intensification.' It is also necessary to put planned shifts in land use more firmly on the policy agenda. A more transformative politics linked to sustainable farming practices situated in more localised food value chains will not be met by relegating problem-

solving to poorer populations and economically vulnerable farmers, many of whom are trapped in a treadmill of industrial agricultural production.

Just as the state has played a central role in establishing today's industrial agricultural incumbents, it must again play a central role in convening contestations over different futures and making sure that all key actors are included in imagining and moving towards alternative food futures and not just incumbent actors.

2.3 Procedural injustices in incumbent-friendly transitions

There are numerous procedural injustices tied to incumbent-friendly transitions. Here, we use the term procedural justice broadly to mean fairness in authoritative decision-making processes. Below, we highlight three areas in which incumbent power contributes to procedural injustices in: (1) formal processes of representative decision making, (2) public imagination, and (3) governance and accountability.

2.3.1 Representative decision making

First, incumbent-friendly transitions can directly undermine inclusive, fair and representative participation in decision making. The risk of investing in the wrong sociotechnical systems is heightened in times of crisis, often with dire consequences for democratic institutions and basic rights.

In many of the cases discussed above, the threat of climate change has been invoked to justify the adoption of controversial technologies and pursue incumbent-dominated visions of what a low-carbon future should look like. Crisis induces states of exception, as we know from recent experiences with securitisation. The dangers here are ripe conditions for what has been called 'post-politics' and the bypassing of the normal politics of deliberation and contestation by diverse publics (Swyngedouw 2010).

For instance, the basis for the UK government overriding Lancashire Council's decision to reject fracking was that domestically produced, unconventional shale gas is a necessary bridge to a low-carbon economy (Williams and Sovacool 2019). Such moves contradict the UK's Localism Act of 2011, which devolved power to local communities.

Similarly, in Poland, new laws threaten to expropriate recalcitrant landowners sitting atop gas deposits, weaken the role of local self-government in planning permissions to non-binding opinions and empower central government intervention when local governments fail to grant permission in a timely manner (Szolucha 2019). Efforts to speed up the approval process for new nuclear power plants have invoked similar justifications.

2.3.2 Public imagination

Second, elevating incumbent-dominated visions about what energy futures are possible and desirable, as well as what means are available to reach those ends, is a procedural injustice that is rarely acknowledged. In its most nefarious form, this entails public deception. Major US fossil fuel companies continue to spread climate disinformation in ways that directly support their decision to avoid planning to transform their businesses for a low-carbon world (CDP 2018; UCS 2019).

Less overt, but arguably more powerful, are the ways in which incumbents craft sociotechnical imaginaries that weave their material interests into the fabric of collective identity or broader social change agendas.

In the case of natural gas and biofuels, producers and supportive policymakers have successfully defined their product as having inherent environmental credentials, enabling their business models to appear congruent with pressing environmental policy agendas. The 'clean' and 'low-carbon' credentials of biofuels and natural gas went largely unquestioned by legislators, regulators and even professional environmental nongovernmental organisations (NGOs) until the implementation of these visions were well underway and civil society groups forced a critical reckoning.

There is a growing body of research that reveals policymaking to emerge from larger shared understandings about what futures align with national identity and public concerns about risks and benefits (Jasanoff and Kim 2013; Scoones et al. 2015), rather than the rational outcome of the demands of powerful interest groups.

Generic appeals to simply help the strongest markets actors scale up and roll out new technologies ignore the more fundamental and substantial role that states play to redirect financial capital—and the larger financial system—towards the broader notions of the public interest, as well as the ways in which the state already attempts to do this, however misguidedly (Block 2008; Mazzucato 2011; Perez 2002).

The current situation in which governments 'pick winners' that are incumbents is often hidden from public view, behind outward-facing rhetoric about 'letting all flowers bloom' and allowing the market's logic to work its magic by letting competition determine where demand is greatest.

Yet, since the 1970s, many governments have shifted the sites of developmental and industrial policymaking away from legislative bodies and public debate to the halls of regulatory agencies and government ministries, from where the state steers markets through the funding of basic science, R&D projects, demonstration plants and public procurement programmes and less obvious marketing strategies (Block 2008; Mazzucato 2011).

In the case of natural gas and biofuels, governments laboratories not only provided key technologies such as hydraulic fracturing demonstration projects, 3D geologic mapping technologies, and cellulosic conversion processes, but also helped create markets for gas through deregulation and for biofuels through national consumption mandates.

Today, these activities have become less hidden in the climate and energy policy arena, where the scale of decarbonisation has helped relegitimise government coordination of markets. The global recession and novel coronavirus pandemic have also helped to demonstrate the willingness of governments to coordinate resources and investment for public policy goals.

Feed-in tariffs are perhaps one of the most successful examples of how policymaking designed to promote the uptake of small-scale renewable and low-carbon electricity generation can herd venture capital and private equity funds towards certain technological winners (Bürer and Wüstenhagen 2009).

But states must now be pushed to envision futures and pick winners more democratically, in ways that go beyond backing drop-in plug-and-play solutions, strategies that maintain the conditions of accumulation for dominant firms, especially when those firms engage in activities that undermine sustainable transitions away from fossil fuels. What matters, then, is how participation and representation take shape around policy initiatives, since this affects what pathways are pursued (Scoones et al. 2015).

There are opportunities to transform the imaginative dimensions of public authority by building deliberative, inclusive spaces that encourage social learning and persuasion. This is a difficult task, but it may be more straightforward and easier to accomplish in some arenas than others. As all the case examples explored above make clear, the state has leverage: industry already heavily depends on publicly provided resources to access the resources, markets, technologies and relationships that enable their accumulation strategies.

Fundamentally, then, the state must craft policy agendas around subordinating short-term profits and investor returns to what helps to achieve the greatest emission reductions, what addresses widespread inequality and what helps communities become more resilient to climate and economic crises. This can mean making public support conditional on social and environmental criteria or making public resources contingent on participation in a broader policy plan developed through an inclusive, deliberative process.

It can also mean bringing decision making about permit allocations, science funding, R&D policy, innovation hubs, regulatory science, the design of market incentives, technology transfer, and the entrepreneurial state more generally, out into the open and inviting public critique and engagement.

Politically, this is challenging. But the overarching goal is to open up decision making to learning and deliberation, inviting a wider range of affected publics to partake in imagining what futures are desirable and what means are justified to realise those ends.

2.3.3 Governance and accountability

Third, the governance of low-carbon transitions fundamentally requires transparency and accountability, both of which can suffer when regulatory strategies are made in the image of incumbents' accumulation strategies. As the biofuel case shows, incumbent-led transitions can involve governance institutions that purport to manage risks and address public concern while protecting the business-as-usual practices of industrial agriculture.

Overly complex technical regulations convolute accountability relations, keeping the public at bay and ill-equipped to hold decision makers to account in how they govern industry actors. A similar dynamic has been observed in carbon pricing and trading.

The belief in the transformative power of markets as a force for good governance continues to grip the

imagination of the World Bank, numerous governments setting up emission trading schemes at national and regional level (including the flagship European Emissions Trading Scheme) as well as many in the environmental movement.

Emissions trading has arguably served as a decade-long distraction that has served to delay efforts to effectively confront climate change and precluded the creation of deliberative spaces in which diverse publics can engage decision makers on the matter by moving contentious issues (such as conflicts over initial allocations) into the realm of technocratic authority.

Undoing political economies that sustain the fossil fuel complex will require more general social and political innovations to manage accelerated decline. If ambitious targets are to be met, there will be losers and sectors and industries whose role in the economy needs to diminish.

The issue here is not only about just transitions (Swilling and Annecke 2012; Newell and Mulvaney 2013) through compensation packages and retraining for the fossil fuel-based workforces, though those are clearly important too (Caldecott et al. 2017). It is about disembedding the state from its deeply intertwined relationship to carbon intensive sectors and building out new inclusive institutional spaces and deliberative processes in which civil society can help advance sustainable transformations. This requires building new state capabilities.

We argue that we need stronger democratic institutions to guide the practice of 'picking winners,' revisiting policies around tax breaks and the vast amount of subsidies that still go to fossil fuel industries (Skovgaard and Van Asselt 2017). Questions of 'transition to what, for whom, and when?' must be publicly debated and democratically framed, not only in the policy process, but in the larger visions a society assembles.

We need states that can support socially embedded entrepreneurialism: transitions that are moulded according to the visions of a broader range of social actors. And we need institutional innovations that enhance transparency and accountability, as well as more traditional 'good governance' checks on the regulation of party funding and the representation of lobbyists in policy processes (see table 1 for further examples).

Though challenging, shifts in political power are a prerequisite to transformative change that can carry society beyond plug-and-play approaches to realigning sociotechnical configurations (providing services differently) while keeping the power relations intact in terms of who provides those services and on what terms (Newell 2018). In the next section, we turn our attention to the question of how we get towards disruptive political innovations.

3 Towards disruptive political innovations

Table 1: Ecosystems for transformation / Innovations for a disruptive political innovation and experimentation

	Example	Significance
Within the state		
Supply-side industrial policies that withdraw support for incumbents / support innovation and experimentation	*Market-restricting policies:* ▪ Fossil fuel subsidy reform ▪ Moratoria on fossil fuel extraction (examples from New Zealand, Belize, Costa Rica, France) ▪ Trade and investment agreements (energy chapters that exclude fossil fuels) ▪ Supply-side treaties, (e.g. Fossil Fuel Non-Proliferation Treaty)[16]	Restricting space for expansion and consciously withdrawing fiscal support to incumbents Redistributing funds towards lower-carbon pathways and creating opportunities for niche actors Rebalancing economic power in markets to promote the goals of climate policy
	Market-supporting policies: ▪ Low-carbon infrastructure investments to support falling price of renewables ▪ Expanding and supporting renewable energy (e.g. feed-in tariffs, smart export guarantees, net metering) ▪ VAT reductions ▪ Mission-oriented finance (H2020 Missions, Green New Deal, Apollo programme for climate change)	Market making and supporting Setting goals that attract finance Clarifying the direction of change Providing certainty for investors (investment grade policy)
	Incentives: ▪ Carbon taxes, landfill taxes ▪ Border tax adjustments to prevent the relocation of industrial production in response to climate policy	Encouraging shifts in production and consumption by making environmental and social costs more transparent
	Clusters and regional development for low carbon alternatives: ▪ Managing decline of fossil fuels: just transitions (coal phase-outs in Germany, UK, etc) ▪ EU trade union training and apprenticeships for low-carbon economy	Building capacity for accelerating transitions Managing the inevitable distributional impacts of transitions, especially rapid ones (regional redevelopment plans and retraining)
	Municipal-level actions: ▪ Remunicipalisation, including municipal ownership ▪ Energy communities [17]	

	Example	Significance
Within the state		
Institutions for increasing accountability and deepening democracy	*Climate change committees*	Building cross-party political support Establishing ongoing reporting and accountability mechanisms.
	Rules on party financing: ▪ State funding of political parties (Germany)	Managing interest group control of politics: captive state phenomena.
	Participatory democratic innovations: ▪ Deliberative governance (e.g. citizens' assemblies in the UK, participatory budgeting in Lichetenberg ▪ Standing citizen panels able to hold governments to account for agreed transitions pathways[18]	Bring in more actors with an interest and stake in bolder action.
	Governing participation and representation: ▪ Ombudspeople for future generations (Israel, Hungary, Wales) [19] ▪ Diversifying expert committees ▪ Lowering voting age to 16 to widen the constituency of actors with a stake ▪ Registries of interests and active exclusion of politicians with conflicts of interest	Foreground in policy issues consequences of decisions for future generations Limit incumbent interest group penetration of decision making processes Advisory committees on business appointments could be given statutory powers and resources to investigate and no power to block appointments where there is a clear conflict of interest
	Creating knowledge for change: ▪ Debate-shifting reports: Stern Review ▪ Cultural interventions through arts, music etc to inspire action and change (e.g. Julie's Bicycle [20], Metis in the UK)	State sponsored interventions to shift the terms of debate and prepare the ground for change
	Regulating advertising: ▪ Tobacco precedent applied to fossil fuels (e.g. Article 13 of the World Health Organization's Framework Convention on Tobacco Control)	Managing demand generation for further fossil fuel use

Beyond the state		
Societal actions that delegitimise and encourage divestment from incumbents	Divestment movement (e.g. 350.org) Shareholder activism	Delegitimising fossil fuel finance. Repositioning fossil fuels as liabilities and not assets Deterring future investors from supporting further fossil fuel expansion
	Direct action: ▪ Blockadia: resistance to infrastructures- pipelines, projects (fracking), occupations of oil rigs and company HQs (e.g. BP)	Challenging the social license to operate Encouraging, through media, awareness of the impact of fossil fuel economies
	Cultural politics: ▪ Cultural politics: (e.g. Art not Oil RSC, Platform) ▪ Brand attacks ▪ Anti-fossil fuel norms	Makes it harder for states to justify support for fossil fuels
Societal actions that support innovation/experimentation	*Landscape pressures:* ▪ Climate regime ▪ New international norms and laws (e.g. ecocide, loss and damage) ▪ Climate litigation [21]	Strong market signals accelerate transitions Strong legal frameworks provide entry points and obligations for action
	Disruptive finance capital: ▪ Many historical examples of this (Perez 2002): industrial revolution, Fordism, IT etc ▪ Insurance industry in climate change negotiations (Paterson 1999) ▪ CERES ▪ Shareholder activism ▪ Foundations	Drive for profit and return of restless capital drives 'creative destruction' and unseats incumbents
	Power of business: ▪ Breakaway business coalitions (e.g. science-based targets/ Aldersgate group) ▪ Falling price of renewable energy, especially solar	Key to breaking bloc of resistance to action by umbrella and sectoral business organisations
	Transnational governance: ▪ Numerous examples of transnational climate change Governance (Bulkeley et al. 2014) (e.g. C40, Covenant of Mayors) many of which have European origins [22]	Fills in the gaps (regionally, sectorally and functionally) of other public and private forms of climate governance

The discussion above has made very clear that if the social and democratic dimensions of disruption and acceleration associated with the transformations required to move the world onto a 1.5°C pathway are to be adequately attended to, we have to centre the state in our analysis. Only the state has the powers of convening, regulating, distributing and enforcing in legitimate, transparent and inclusive ways that will be called on to accelerate just transitions.

In some cases, this takes the form of scaling up and supporting transition initiatives that originate in business communities or among cities. Some states are also clearly better placed and better able to perform those roles than others, suggesting the limits of overly generic prescriptions for the role of the state in low carbon transitions. The political innovations we feature in table 1 provide a menu for possible options and intervention points, rather than an off-the-shelf checklist for action.

The examples in table 1 point to the need for disruptive politics. Institutional innovations and attempts to shift power relations may be a prerequisite to accelerating disruption through new configurations of finance and technology.

Challenging incumbency through greater citizen engagement, controls on party funding, changes to corporate governance, independent climate committees, votes for 16-year-olds, ombudspeople for future generations may be among the democratic and participatory innovations that prepare the ground for transformation (see table 1).

To take one example, fossil fuel political giving outdoes renewables 13-to-1. During the latest midterm election cycle in the US, the fossil fuel industry paid at least $359 million for federal campaign donations and lobbying (Kirk 2020). As of 13 December 2019, 134 members of Congress and their spouses owned as much as $92.7 million worth of stock in fossil fuel companies and mutual funds (Kotch 2020). This has global implications, given the weight and profile of the US in global climate politics. Globally, every year, the world's five largest publicly owned oil and gas companies spend approximately $200 million on lobbying designed to control, delay or block binding climate-motivated policy.

Companies are generally reluctant to disclose such lobbying expenditure of course, but a report from InfluenceMap used a methodology focusing on the best available records along with intensive research of corporate messaging to gauge their level of influence on initiatives to halt climate change (McCarthy 2019).[23]

As a first step, some of this might require greater attention to the innocuous sounding 'good governance': an effort to ensure greater transparency and accountability and scrutiny over decisions about future pathways. It would also need to shine a bright light, however, on the economic and political ties between incumbent actors, severing ties between business and state.

This could imply having clearer party financing rules, registries of politicians' interests, boards of companies they sit on and corresponding restrictions on which committees they sit on and policymaking processes they are part of when there are obvious conflicts of interest. For example, nearly 90 per cent of people leaving the UK's Department of Energy and Climate Change took up jobs in the energy sector, including six former energy ministers.

But the door swings both ways. In 2010, Lord Browne, former CEO of BP, was appointed by David Cameron to be the 'lead nonexecutive director' at the Cabinet Office. He was also chair of fracking company Cuadrilla at the time and pledged to do 'whatever it takes' to promote shale gas. Charles Hendry as Minister of State for Energy secured £3,333 a day as a consultant for Vitol, the world's biggest oil trader handling 270 million tonnes of oil in 2016 (Cato 2018).

Though this might be thought to be an issue more acutely at national level, there is increasing discussion about conflicts of interest at the international level. Attention has focused on delegates attending the United Nations Framework Convention on Climate Change (UNFCCC) negotiations that are in the pay of oil companies are able to stall progress of the negotiations by challenging the science and adopting delaying tactics in bad faith, as observed most recently at the Madrid Conference of the Parties (COP).

For example, at COP25, over 40 Gulf State delegates were current or former employees of fossil fuel companies (Collett-White 2019). In other words, they are using veto power to block progress towards the stated aim of the negotiations and have a clear material interest in slowing progress wherever possible.

Stronger governance of lobbying and political donations needs to be combined with stronger mechanisms of accountability for key decisions about transition pathways.

This needs to go beyond isolated sites of engagement such as citizens' assemblies, important though they are, and independent oversight committees, such as the Committee on Climate Change, to incorporate areas of state decision making that are traditionally protected from democratic scrutiny and oversight and forms of citizen engagement.

This includes policy domains of 'high politics' concerned with industrial policy, energy policy and trade policy, for example. These are decision-making sites where incumbent power is strongest and which exercise most power over the direction, speed and nature of transitions and who therefore benefits from them. Work on environmental justice continually emphasises the relationship between procedural and distributive justice: who participates in policy has a big bearing on who wins and who loses. There needs to be stronger answerability and enforceability: the two key dimensions of accountability (Newell and Wheeler 2006).

Disrupting these relations to incumbents presages support for more ambitious alternatives. As well as planning and mobilising investment in new infrastructures and institutional architectures, if capital is to be redeployed for a low-carbon economy or Green New Deal, limits will need to be placed on further investments in fossil fuels as recent reports (UNEP 2019; SEI 2019) make abundantly clear.

Necessity is said to be the mother of all innovation. Putting down clear limits through national regulation and international law on the further expansion of fossil fuel extraction—perhaps through a fossil fuel non-proliferation treaty (Newell and Simms 2019) as was recently proposed at the UN Security Council[24]—could drive a huge reallocation of capital towards renewables and away from fossil fuels. Such moves need to be accompanied by intense and sustained social pressure—the like of which we are seeing through the school strikes—resistance politics against new fossil fuel infrastructures (such as Dakota pipeline XL) and divestment movements (see table 1).

It may require the state to step in to re-regulate certain sectors and industries. In the UK, there is widespread public support for the renationalisation of the railways amid unreliable services, record profits and poor services. And all this at a time when passengers and freight need to be using rail rather than road if climate targets are to be met.
Social and political pressure will be key to emboldening the state to adopt these forms of leadership. This is perhaps especially true of 'hotspot' sectors of the economy where decarbonisation is harder to achieve, such as aviation and the meat and livestock industry, where entrenched behaviours and cultural values and powerful incumbent interests conspire to resist change at the pace required.

As noted above, the state is not a monolithic entity and there are opportunities and spaces within the state to forge new alliances for progressive change. There are also opportunities (as well as challenges) presented by the devolution of state power and the democratisation of the energy system. In federal systems, this can magnify battles over authority between the state and federal states regarding energy policy, including over who captures the rent. As has been observed in Kenya, state elites will not allow too much devolution if it challenges their position and disrupts clientelist politics from which state elites profit (Newell and Phillips 2016).

There is a danger here that responsibility gets pushed back and forth between different arenas of power. We can observe this in current discussions about the formation of citizens' assemblies on climate change where local councils are keen to emphasise how little power and authority they have over decision making on transport, energy and housing policy, for example, to deflect citizen demands for more ambitious action up to the national level.

As well as more 'top-down' interventions, the state also needs to harness more bottom-up, alternative innovations and face the pressing need to roll back state support—of all forms—to incumbents. The state then exercises power through inaction too: tolerating, allowing alternatives to flourish, or at least not crushing, regulating or imposing requirements on them.

By emphasising democracy, we are not romanticising bottom-up change and grassroots mobilisation as the only way to deliver rapid and progressive transitions. Indeed, it is sometimes important to challenge the idea that rapid change is necessarily top-down and regressive.

A combination of divestment of finance from fossil fuels, mobilisations and protests over new infrastructures, and laws and regulations that many governments have recently shown themselves willing to adopt to keep fossil fuels in the ground (such as recent moratoria on new oil exploration and production announced in 2017 and 2018 by a number of countries including New Zealand, France, Costa Rica and Belize), or which set clear near-term

timetables for their phase out, show what is possible.

In terms of bottom-up innovations, there is a key role for cities and municipalities, many of whom have declared climate emergencies. Within just three months, 42 councils have signed the pledge—representing over 17 million people between them in the UK—and more than 34 million in the US, Australia, Canada and Switzerland.[25]

For a council to have called a 'climate emergency', commonly advanced guidelines say that they must have: used these specific words in a motion or executive decision; set a target date to reduce their local climate impacts consistent with the IPCC report; set up a working group to report within a short timescale; and engaged with a cross section of the community.

When in 'emergency mode', councils must allocate discretionary funds towards climate action. That includes things such as: educating the community, advocating for action from higher level governments, mitigating and building resilience against the impacts of climate change, and funding or undertaking the planning and research needed to implement full state and national emergency mobilisation.

Exhibit A.
The case of council action in the UK: Declaring a climate emergency

So far, councils' pledges and aims have varied enormously. For example, Scarborough Council has committed to a target of zero carbon emissions by 2030, and will seek up to £80,000 in funding over two years for a sustainability officer to help achieve their goals. Meanwhile, Liverpool City Council deleted all references to declaring a climate emergency and many of the suggested actions to be taken. Its plan has no stated target, no timeline and no budget.

In Lancaster and Oxford, a citizens' assembly is being set up as part of their process; this is a deliberative process in which a representative group of citizens selected at random from the population learn about, discuss, and make recommendations in relation to a particular issue or set of issues.

Local governments are often on the frontline of dealing with climate change impacts (such as flooding, fires, storm damage) and on the receiving end of demands for mitigation action. A key issue is working out what local governments have exclusive control over (as opposed to national and regional authorities) and where the boundaries of responsibility lie, because with climate change, they are often complex and diffuse. Clearly councils are also facing funding constraints. Yet, across transport, energy, housing, waste, buildings, people are looking to councils for leadership.

So what can they do?
We are not short of concrete ideas about what to do. Reports such as *Zero Carbon Britain* show sector-by-sector analysis of what is possible in the UK by 2030. Many cities have already taken the lead with emissions reduction pledges and zero carbon targets, including commitments from Bristol and Manchester aiming to be carbon neutral by 2030 and 2038 respectively.

Across the world, the cities' organisation C40 has been calling for fossil-free streets through commitments to procure only zero-emission buses from 2025 and ensuring a major area of the city is zero emission by 2030.

Planning is key and so is reducing demand. The services people want, such as heat and mobility, are often those they show the greatest indifference towards. We can be fearful of challenging people's attachment to their cars, for example. But if safe, reliable and affordable alternatives are provided,

people will use them. When affordable and accessible infrastructures are built for buses, bikes and pedestrians, people use them, as numerous examples around the world have shown.

Around housing, councils can help to deliver on the government pledge to halve energy use from new build by 2030 and for all new homes to be heated by fossil-free systems by 2025. They can promote energy efficiency schemes and exploit other grant funding, promote new carbon-neutral housing schemes, either as authority owned projects or with partners and transform councils' own properties to maximise their own potential for energy production and saving.

Councils can promote energy efficiency in local transport, promote cycling and car sharing, consider car exclusion zones or access charges, promote the use of electric cars by providing charging points and investing in EV infrastructure, improve public transport integration (bikes, buses and trains) and consider how transport contracts can be used to promote green travel.

On energy, councils can promote low energy use through smart energy, energy efficiency and conservation. They can consider providing funding for solar energy installations on the basis of shared returns, review the authority's own energy use and consider setting up energy service companies.

Other areas include waste and food. Councils can review waste and recycling policies to take pressure off landfill and reduce methane and other emissions. Where possible, they might target food consumption through procurement and menus in schools to include less meat and dairy.

In terms of business, they can promote support services for local businesses. Preferential business rates for local firms, for example, as part of much-needed regional redevelopment, or creating local enterprise partnerships to set up low-carbon enterprise zones with tax breaks to nurture jobs, investment and innovation.

What can we stop doing?

As well as thinking creatively about how to deliver services in low-carbon ways, we also need to accelerate the shift away from the fossil fuel economy.

Declaring an emergency permits a veto over actions that are incompatible with radical decarbonisation in line with the Paris Agreement and climate-proofing all areas of policy. This should mean divestment from fossil fuels.

Local councils in the UK invest over £14 billion in the fossil fuel industry. Divesting cities' assets from fossil fuels though pension funds sends a powerful signal and makes a major contribution. Of the 1,032 institutions that have divested from fossil fuels worldwide, just 15 per cent are governments. But there are now more than 15 UK councils—from Sheffield to Stroud, Brighton to Birmingham—calling for divestment from their pension funds.

Beyond the local

Local council action does not exist in a vacuum, of course. Some of the measures described above require a supportive national regulatory environment. Financing could be delivered as part of a Green New Deal. Carbon budgets need to be set and enforced by independent national agencies such as the Climate Change Committee.

National government needs to give direction by laying down limits and reversing major decisions that produce carbon lock-in incompatible with 1.5 around airport expansion and fracking, for example. Local government can make their voice heard to lobby government on this.

Declaring a climate emergency is just a starting point, and not without its challenges. But the good news is there are numerous policies that can be put in place as well as initiatives bubbling up from below that can be harnessed to scale up and accelerate the pace of change.

It is clear, then, that diverse ecosystems of transformation will need to be developed which enable mutually supportive forms of interaction (or virtuous cycles) between the production, financing, governance of and mobilisation around transitions with the state playing a key (but not exclusive) role as orchestrator.

Shifts in finance such as divestment, stemming from social pressure, can shift production in new ways, accelerating the move away from 'stranded assets'. The governance of production and finance needs to be extended and strengthened and to include greater participation and representation from civil society actors in ways that extend beyond the state.

Transnational climate governance is significant here in plugging governance gaps, bringing novel constellations of actors together and raising the level of ambition within and beyond arenas controlled by the state (Bulkeley et al. 2014).

European cities and businesses, investors and NGOs (such as The Climate Group) have played key roles in leading and facilitating these processes. In the case of the US administration under Donald Trump, this can partially compensate for the lack of state leadership: when key US cities are part of the C40 alliance of major cities, for example, they can set their own carbon reduction targets.

3.1 The procedural politics of disruption

Innovation and experimentation need to go beyond a narrow focus on decarbonisation if they are to be successful. A more holistic or systemic view of transformation also highlights the need not just to fetishise carbon, but to look at the range of social and ecological impacts associated with different pathways.

Achieving the SDGs requires this. Hence, it is less a question of taking carbon out of systems as innovating, experimenting with, supporting and scaling up technologies, infrastructures and practices that build resilience and regenerate ecosystems rather than deplete them.

An ecosystemic perspective also helps to keep in mind the global nature of transition processes. Experimentation and innovation in one part of the world has impacts for the pathways and policy options available to others. As we saw in the previous section with respect to natural gas, biofuels, EV and CSA, the costs of adjustment and decarbonisation can be passed on to other societies and social groups in the search for 'low-carbon' energy, food and transportation for example. Just transitions have to socially just in global and temporal ways, and not just in relation to particular places and transitions.

The conversation about justice has to be opened up to its global and even intergenerational dimensions in ways that go beyond the national focus of most discussions and dialogues on energy transitions. One country's energy choices cannot be seen in isolation from their global effects, in terms of shifts in demand for land (for biofuels for example) for minerals (for car batteries or photovoltaic panels, for example) or the waste they generate (nuclear, for example).

Justice is oftentimes relative and not absolute. So it is often a case of minimising injustices and maximising justice for the majority of the world's citizens in handling complex trade-offs. The principles by which this should proceed will no doubt be deeply contested and we do not yet have democratic institutions for dealing with issues of representation and participation across regions and time. Civil society advocacy in global fora fills some of the void, but we also know its limitations.

A real and troubling trend is emerging that low-carbon transitions may be leaving some behind, especially those working within incumbent fossil fuel regimes. This suggests that research so rigorously identifying and calculating the co-benefits of low-carbon transitions be complemented with that looking at the non-benefits or dis-benefits, as well as their effect on vulnerable groups (Sovacool et al. 2019).

Interestingly, though arguments about the need to attend to all social inequalities and exclusions as part of a transition often come from the political Left, incumbent industry actors often make similar arguments under the guise of advocating for a 'just transition'. Calls for retraining and compensation for poorer workers in sectors that will lose out from the restructuring and managed decline that form an inevitable and necessary part of transitions and processes of 'creative destruction' make sense and appeal to an intrinsic sense of fairness.

But they can also be employed as a political device by fossil fuel industries, for example, to undermine calls for more ambitious action. Whereas businesses routinely uproot their operations and relocate to other jurisdictions with loss of jobs and devastation for communities left in their wake, and there are rarely calls for special treatment to cope with the social effects of adjustment, somehow fossil fuel industries, because of their structural power, are afforded special privileges.

Hence, in an ironic twist, powerful businesses invoke a rarely detectable concern for workers' welfare when faced with profit losses due to enhanced action on climate change. So, while concern for the welfare of workers in incumbent industries is something we need to address, we need to be wary of strategies that invoke calls for 'just transitions' in order to stall the ambition of transitions

4 Conclusions

We have argued in this paper that accelerating and deepening transitions in line with the goals of the Paris Agreement and broader SDGs requires us to undo existing political economies as much as roll out new technologies and infrastructures. Despite some recent attention (Johnstone and Hielscher 2017; Johnstone and Kivimaa 2018), the issue of undoing incumbency and the political relations that hold it in place constitutes a neglected issue in transition debates.

Viewed this way, the politics of transition might be about decentralising control and power over key systems, around energy, food, water and transport provision. Democratising elite control and the devolution of power serves to shift some of the discussion about desirable, achievable pathways to sustainability away from those actors that benefit most from unsustainability and the pursuit of business as usual and conventional transition strategies of pricing, innovation and incremental reform.

Opening up spaces for deeper and more meaningful engagements with different pathways for transitioning to a lower-carbon economy, for example, could usefully be subject to more rounded and critical scrutiny of the pros and cons of different options. This could ensure advocates of more rapid transitions are more attentive to near and longer-term social justice implications, but also that those resisting such claims are obliged to spell out proposals for rapid reductions in emissions that are compatible with pathways of 1.5°C warming, for example.

This might help widen the circle of engaged actors from business, labour and environmental groups to others that have entirely different visions for near-term but deeper change that might include serious efforts at demand reduction, big changes to planning regulations or agreements to leave fossil fuels in the ground or to reallocate fossil fuel subsidies. All proposals would have to compatible with a pathway that keeps warming below 1.5°C if they are not to push many of the world's poorest people further into poverty.

This would shift the debate away from the narrower discussion of which combinations of big technologies and infrastructures can meet rising energy demand in a warming world without first attending to the possibility of reducing demand and questioning patterns of consumption and production through changes to work (a shorter working week), different models of mobility, localising economies and shifts to the tax regime, for example.

Such shifts would be combined with the political disruptions to incumbent power we have described above: decentralisation, controls on conflicts of interest, transparency around financing of parties and politicians, ombudspeople for future generations and so on (see table 1). This allows us to pose (and engage with) the more difficult questions of who and what transitions are for, who sets their terms and the overall direction of change. It also suggests at least one way of squaring rapid and just change in a way that goes against the grain without bypassing the necessity of the messy politics of compromise and negotiation.

This does mean opening up spaces to engage with and interrogate existing trajectories. Many of the ambitions of the 2015 UNFCCC Paris Agreement about net zero emissions, for example, imply the widespread use of negative emission technologies. The most commonly proposed form of these technologies are BECCS, which are used in more than 80 per cent of IPCC pathway projections.

BECCS involves the mass planting of trees to absorb CO2 from the atmosphere. Even in spite of the technological issues involved here, for these to work at the scale necessary, plantations three times the size of India, consuming one-third of the planet's arable land, would need to be created (Anderson and Peters 2016). Silences around the viability of such assumptions, given the competition over land and resulting social dislocation they would presage, are deafening.

The reality of failed climate mitigation is the starting point for the promotion of CCS, CO2 removal technologies and geoengineering and reflects the reluctance of powerful states and corporations to contemplate the sorts of economic restructuring required to adequately address climate change. Without challenging and shifting power relations, appeals to act on the urgency of climate change can lead to these sorts of regressive responses.

This is not to say opening up will always lead to greater ambition and faster transitions. Resistance from the Gilets Jaunes in France, from farmers in Germany, and in the UK over fuel tax rises in the early 2000s, illustrates the need

for policies to be debated, alternatives presented, and equity and fairness in terms of ask and offer to be clear.

Interventions imposed from above where social implications are ill-considered often result in backlash. Examples from the politics of fossil fuel subsidy reform (Lockwood 2015) also suggest the need for equity and sequencing so that poorer consumers are not hit hardest first by companies just passing costs straight onto consumers. These issues place a real strain on conventional democracies as, in addition to the social dimensions, we need to evolve a 360-degree view of transitions and not fetishise decarbonisation devoid of context.

The advent of the SDGs means plans to decarbonise the energy system, for example, need to be cognisant of impacts on energy access, availability of water, implications for food security and so on. National pathways also need to bear in mind global implications, as we saw above with the examples of biofuels and EV vehicles. To be truly sustainable, just and transformative, we need to check moves to displace and use spatial and temporal fixes to secure decarbonisation.

Undoing dominant political economies does not just refer to the state, however, as the epicentre of contestation around the competitive politics of transition. It also means reforming finance, as a sector and set of actors increasingly central to the contemporary economy. Re-embedding and repurposing finance might imply revisiting fiduciary duties, questions of the limited liability of company directors and shareholders, issues of corporate governance and the responsibilities of directors.

Some of this is about environmental corporate governance: better systems of disclosure that go beyond voluntary systems such as CDP to look at the role of bodies such as the Securities and Exchange Commission in the US.

Can we imagine a system in which all firms of a certain size and contribution to climate change have to adopt science-based targets that demonstrate how their corporate strategies are in line with a 1.5°C pathway?[26] Where companies are refusing or ultimately unable to realign their business model with such a trajectory, governments may have to reconsider and—in some circumstances, revoke—their license to operate?

Businesses are vehicles for improving wellbeing and prosperity in society. Where they fail to achieve this and instead systematically undermine societal wellbeing and ultimately prospects of survival by accelerating climate change, their social license to operate should be thought to have expired.

We have argued here for a more disruptive politics of transition that requires us to acknowledge and then challenge and change the relations of power where the state sits at the centre. We need to take a deeper view of politics and the state to understand its role in disruption and acceleration. This requires us to take a broader view of the state to understand its military and other functions and how these may impinge on the possibilities of transition trajectories (Johnstone and Newell 2018).

There is no one model of 'the state', and just as there are varieties of capitalism, so too there will be varieties of transition and pathways to sustainability. But in most cases, the state is at the centre of competing claim-making about the politics of different pathways. This is true in relation to who participates and on what terms. Democracy is critical here. Having robust and inclusive institutions that can deal with the inevitable intensification of competing social demands is vital as pressures on remaining resources increase.

Who frames the issue of who and what is to be transitioned, towards what end and over which timeframe will affect who is entitled to be involved and which pathways are pursued (Scoones et al. 2015). Again, democracy in the form of participation and representation is critical to whether emergent pathways are socially inclusive and environmentally responsible or serve to entrench and exacerbate social inequalities and displace or magnify negative environmental impacts.

This illustrates the need to take transformation more seriously: to go beyond plug-and-play approaches that insert different technologies and energy or food sources while everything else stays the same. Dominant approaches to innovation and experimentation assume an 'as well as' model of adding to existing forms of innovation and experimentation rather than an 'instead of' approach, which requires abandoning certain strategies, tools and approaches that are no longer compatible with the imperative of tackling climate change.

Endnotes and references

Endnotes

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3. In launching the European Green Deal Investment Plan, the European Committee of the Regions (CoR 2020) calls for coordinated structural reform across every region and city and between all levels of government, but without further centralisation towards Brussels or EU capital cities, as a precondition for success.

4. The United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters was adopted on 25 June 1998 in the Danish city of Aarhus (Århus) at the Fourth Ministerial Conference as part of the 'Environment for Europe' process. ec.europa.eu/environment/aarhus/

5. In transition terms, this should be distinguished from work on 'deep transitions' (Schot and Kanger 2016), which looks at longer transitions across pathways over decades.

6. "Such transitions have been observed in the past within specific sectors and technologies. But the geographical and economic scales at which the required rates of change in the energy, land, urban, infrastructure and industrial systems would now need to take place, are larger and have no documented historic precedent" (IPCC 2018).

7. We define civil society as the full range of voluntary associations and movements that are distinct from the market or the state and operate to shape the public sphere, including social movements, unions, advocacy groups and autonomous NGOs and community-based organisations (Evans and Heller 2012).

8. Evans and Heller (2012) point to associations that are clearly uncivil on the basis of being formed to deny other groups their associational rights, such as chauvinist or white supremacists associations.

9. Other shared features include the advancement of militant forms of nationalism, insistence on sovereignty over shared global interests, decisive action in the name of 'the people' defined in explicitly nativist, xenophobic and racist terms, suspicion of experts and elites, and a willingness to suspend the rule of law to mobilise state-sanctioned violence against internal and external enemies (see McCarthy 2019, Fraser 2017; Snyder 2017; Bello 2018; Scoones et al. 2018).

10. burges-salmon.com/news-and-insight/legal-updates/has-the-uk-governments-policy-on-electricity-market-reform-succeeded/

11. Alvarez et al. (2012) estimate the total lifecycle methane emissions for natural gas must fall below 3.2 per cent to offer improve lifecycle assessment emissions over coal-fired power plants.

12. This larger group of 15 lanthanide metals commonly referred to as REEs or rare earth metals are not only important to decarbonisation initiatives, but also constitute a critical resource base for consumer, industrial, military and medical product manufacturing, including industrial glasses, filters, lenses, semiconductors and the catalysts used to refine petroleum into gasoline, which comprise one of the largest markets for REE.

13. A small amount of REEs are used to create red and blue phosphors for energy-efficient light emitting diodes (LEDs), which use a much smaller quantity of REEs than incandescent and fluorescent lights but offer greater energy savings. Certain kinds of offshore wind turbines use dysprosium and neodymium, and by some estimates there are about 600 kilograms, or 1,300 pounds, of rare earth metals in a wind turbine that generates 3.5 megawatts of electricity (Alonso et al. 2012).

14. This assumes a decarbonisation path of electrifying 80 per cent of automobile sales by 2035 in line with the goal of limiting average global temperature to 2°C (Alonso et al. 2012).

15. CSA has received significant support from major institutional actors, in particular from UN institutions such as the FAO, the World Bank, and the International Fund for Agriculture and Development, as well as from agricultural research organisations such as the Consultative Group for International Agricultural Research and private sector actors ranging from agrifood to fertiliser and biotechnology corporations.

16. fossilfueltreaty.org

17. energy-cities.eu/policy/committee-of-the-regions-opinion/

18. edmonton.ca/city_government/documents/PDF/Citizens_Panel_Handbook.pdf

19. futuregenerations.wales/

20. juliesbicycle.com/

21. www.urgenda.nl/en/themas/climate-case/global-climate-litigation/

22. Examples include the Institutional Investors Group on Climate Change www.iigcc.org/ and the role of The Climate Group in setting numerous business and city-based partnerships and carbon market standards as well as initiatives such as Under2, EP100, RE100 and We Mean Business. theclimategroup.org/our-work

23. BP has the highest annual expenditure on climate lobbying at $53 million, followed by Shell with $49 million and ExxonMobil with $41 million.

24. theelders.org/news/multilateral-solutions-are-vital-tackling-global-challenges-we-face

25. rapidtransition.org/commentaries/what-would-a-climate-emergency-plan-look-like/

26. sciencebasedtargets.org/

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List of acronyms

ASM	artisanal small-scale mining
BECCS	bioenergy and carbon capture and storage
CAFO	concentrated animal feeding operations
CO2	carbon dioxide
COP	conference of the parties
CSA	climate-smart agriculture
EC	european commission
EV	electric vehicle
FAO	food and agriculture organization
GHG	greenhouse house gas
IPCC	intergovernmental panel on climate change
LNG	liquified natural gas
N2O	nitrous oxide
NGO	nongovernmental organisation
NOX	nitrogen oxides (generic term)
R&D	research and development
REE	rare earth elements
SDG	Sustainable Development Goals
SEI	Stockholm Environment Institute
SOX	sulphur oxides
SR15	Special Report on 1.5°C (IPCC)
UK	United Kingdom
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WTO	World Trade Organisation

About our Working Papers
Working Papers contain the background research that feeds into EIT Climate-KIC's *Climate Innovation Insights*. This Working Paper is linked to *Climate Innovation Insight* 5.3. See the full collection of *Climate Innovation Insights* at climate-kic.org/insights.

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