7

Phase IV

The Politics of Accelerating GHG Emissions Reduction amidst Multiple Crises

7.1 Introduction

And so, we come to the last phase of the politics of climate mitigation to be explored in this book – the latest phase available to consider at the time of writing. By the start of this phase, 2018, climate mitigation had become sufficiently engrained to be framed, in some countries, as part of élite global and domestic institutions and had resulted in wide-ranging outcomes. At the same time, the world remained off-track to meet UN climate goals. The emphasis in this phase of mitigation politics is on questions of how to accelerate policy so that the world can limit the degree to which it misses the 1.5ºC aim and do so in ways that are socially more engaging and just. This latter question had, in this time frame, become even more important to consider within the context of wars, multiple crises, and a refocus within some domestic political debates on contestations of mitigation framed in relation to policies as unjust or unfair. This phase, like those before, has its own opportunities and conflicts. It has been marked both by the build-up in experiences of mitigation policies and capacities and by the many conflicts that surround fossil fuel phase out (Markard et al. 2020).

A second, related, emphasis in this chapter is on how this phase has been informed by previous iterations of mitigation policies, choices, outcomes, and politics. The overriding argument is that by this stage it had become more possible to think politically about how to design medium- to long-term mitigation strategies that can take account of the temporalities, the value of state agency and of deliberation, and of social interaction as part of the politics of mitigating. This phase can be understood as different from previous ones – not least as mitigation had started to mature as a policy area and was increasingly informed by the experiences, successes, and failures of the past decades. The current phase is profoundly shaped by early political struggles to get mitigation onto agendas, the kinds of mitigation choices that have been made, and their outcomes and political implications. Mitigation politics had become, as such, more dynamically informed by its own policy history, as well as

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by historical high emissions incumbencies and changing global events. Narratives of climate policy dismantling and delay, articulated in the first phase, had persisted but, as suggested in Chapters 5 and 6, against a different backdrop of rising renewables and growth from green sectors, new mitigation capacities, and some improvements in understanding the socio-economic implications of mitigation policies.

This chapter sets out, and explores, reconstructions of climate politics – mainly by revisiting and comparing recent framings, policies, and institutional and material changes with the first phase of climate politics. The analysis is categorised into sections that assess changes relative to UN Kyoto compromises. There are subsections on: mitigation targets that suggest greater ambition but maintain loopholes; new, often more state-led, policy approaches; growth orthodoxies and the stickiness of fossil fuels; and on equity and justice in transitions. One purpose of assessing changes is to be able to consider the nature of low emissions change, politically and materially, and what this means in terms of delivering on more rapid and just mitigation.

In Section 7.3, the chapter makes some concrete suggestions about how to proceed politically by directly applying insights about climate mitigation, and how it has been politicised, from previous phases. Essentially, the following sections explore what thinking politically about climate mitigation entails in this phase. The time for technocratic climate policy is, from the perspective of this book, past – the politics of mitigating has not gone away and has, in some senses, intensified. This phase requires policies that: enable citizens to benefit from low-emissions transitions; fairly distribute the costs of change; phase out fossil fuels in as just a manner as possible and manage complex, associated infrastructure decommissioning; and ensure accessible, affordable, and sustainable energy, transport, and food.

The analysis in this chapter starts in 2018 and finishes at the end of 2024. A great deal had happened in this six-year period. In the years running up to 2020 it appeared that the global mitigation 'leader', the EU, might well not meet their widely vaunted 2020 emissions reduction target, highlighting the many issues associated with taking successful climate action. In 2018 the seminal, in policy influence terms, special report of the Intergovernmental Panel on Climate Change (IPCC) on 1.5ºC was published, which made the most explicit claims yet about the urgency of reducing emissions (2018). It stated that targets and policies in place were insufficient and that globally emissions needed to fall by a whopping 43% by 2030. At around this time climate change activism took off again, underpinned in no small measure by youth movements, including Fridays for the Future, the School Strike for Climate, the high-profile advocacy of Greta Thunberg, a then 15-year-old schoolchild, and Extinction Rebellion. Public awareness of and support for climate action went through another phase of growth in a wide range of countries, partly informed by the clarity associated with children reminding

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adults of the futures that await them if further actions are not taken. The adoption of relatively more ambitious, 'net zero' emissions targets by a wide range of national and sub-national governing bodies, and corporations, was framed as a direct response to the IPCC 1.5ºC report, environmental activism, and public support in this short era (Newell 2021; Van Coppenolle et al. 2022). By 2023 a UN Development Programme (UNDP) survey of 73,000 people in 53 countries had found 80% of those surveyed wanted stronger climate action from their leaders (UNDP 2024), whilst by 2022, clean energy jobs globally, for the first time, overtook fossil fuel energy jobs (IEA 2022).

By the end of 2024, however, the political conditions within which mitigation choices were being made took another shift in some parts of the world as key elections in the US and EU produced a swing back towards parties less supportive of mitigation. The outbreak of the COVID-19 global pandemic, in 2020, marked a distinctly different phase of world politics – one of extreme crisis, increased death rates, and changed social practices. This short period also saw varying but overall increased levels of government intervention to limit the spread of COVID-19, protect the most vulnerable in society, and support businesses and livelihoods (Kuzemko et al. 2020). During this period, as might be expected, GHG emissions fell – albeit not as far as might have been expected given shifts in social practices under lockdown conditions in many countries – but had rebounded to 2019 levels by 2021. The fall in emissions did, however, contribute towards the EU meeting its 2020 emissions reduction target of 20% versus 1990 levels. COVID-19, because of lower energy demand and temporarily affected workforces, also contributed towards unstable supply chains globally and upward pressure on a wide range of material goods prices. In energy, these conditions contributed towards lower production of gas and, by late 2021, a considerable increase in global energy prices, which constituted the start of the latest energy crisis.

In February 2022, Russia invaded the Ukraine for the second time. The EU, US, and UK responded with sanctions on Russia and military support for the Ukraine. At very similar times, the EU announced its intention to phase out all imports of Russian fossil fuels, by 2027, and Russia cut off pipeline gas supplies to EU countries (Pye et al. 2024). The EU's policy of drastically reducing demand for Russian fossil fuels had a number of knock-on effects: further sharp increases in energy prices in Europe and, indirectly, for much of the rest of the world; a need to diversify EU gas imports, not least by importing more liquified natural gas (LNG) and pipeline gas from Norway and the UK; and a doubling-down on narratives of geopolitical conflict and energy security (Kuzemko et al. 2022). It also resulted, via the RePowerEU strategy, in another marked shift upwards in EU mitigation-related targets, GHG emissions reduction, renewables, and energy efficiency, and in new low-emissions transitions policies and technology investments (ibid.). Partly as a

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result, by 2024 renewables generated 48% of electricity in the EU, gas demand had fallen 18%, and heat pump sales had hit three million (European Commission 2025a). Russia's invasion of the Ukraine also indirectly supported the direction of travel away from global economic interdependence and 'free' trade towards 'onshoring' and 'friend-shoring' of resources and manufacturing in low-emissions sectors. These economic deglobalisation tendencies received a further boost with various changes announced by the Trump presidency in the US – not least new rounds of trade tariffs and spectres of trade wars.

There has also been a rapid build-up in climate change attributable extreme weather-related events around the world – far too many to list here – but death, displacement, disease, and economic losses had been experienced by many people and countries as a result. Associated with these experiences, there had been a growth in research that estimates the considerable social and economic costs of climate change (Newman & Noy 2023; Bilal & Känzig 2024). This, together with growing evidence of the co-benefits associated with certain mitigation policies, provides a useful counterpoint to framings of mitigation policy largely as an economic cost.

By 2024 a poll of IPCC climate scientists predicted that global temperatures would rise to at least 2.5ºC above pre-industrial levels – whilst only 6% of climate scientists agreed that 1.5ºC would be met (Carrington 2024). Emissions continued to grow, by 1.9% from 2022 to 2023, with the biggest contributors being new coal-fired power stations and increases in sports utility vehicle (SUV) sales. Copernicus, the EU's climate monitoring service, reported that 2023 was already 1.52ºC hotter than pre-industrial levels (Dewan 2024). At the same time, of course, future temperatures and GHG emissions would be much higher still without current mitigation policies (Climate Action Tracker 2024), whilst many OECD countries had started to reduce GHG emissions. Questions, then, of whether the world's largest emitter in absolute terms, China, would meet its target of peaking coal use by 2025 and for emissions to start falling by 2030 became key.

7.2 Revisiting Early Compromises, Narratives, and Themes

One of the ideas behind this book was that exploring the politics of climate mitigation over an extended timeframe would reveal change. This section revisits the core compromises reached in 1997, set out in Chapter 4, and the political discourses of mitigation that underpinned them, to identify how they compare to dominant discourses and compromises in this phase. The aim here is to also explore the political implications of changes that have occurred.

What remains unchanged is the world's inability to meet emissions reduction targets, whilst many early anti-mitigation framings persist today. At the same time,

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of course, there have been some notable politicisations. There has been relatively more popular support for addressing climate mitigation, climate mitigation targets, policies, and capacities have expanded, whilst political debates about mitigation have become increasingly focused on questions of (domestic) distributional justice. One further overall shift is in the middle ground of the spectrum of ideas between denial and urgent climate action. If the 'liberal environmental compromise' was the middle ground upon which countries could finally agree in 1997, there seems to have been movement, particularly over the past five or so years, towards a mainstream pro-mitigation position that infers a need for higher degrees of state intervention to actively engender faster and more just emission reduction. This shift is partly underpinned by perspectives that locate economic and job opportunities in emissions reduction processes, hence the growing prevalence of green industrial strategy, debates about the 'cleantech race', and about competition for associated profits, low-emissions manufactured goods, and resources.

7.2.1 Mitigation Targets: Ambition, Norms, and Loopholes

In the decades since Kyoto, the norm that emissions are harmful has persisted. The mass adoption of net zero targets, from 2018 onwards, represented a worldwide upping of ambition compared to 1997, but had become necessary due to earlier inactions. GHG emissions targets had become a key aspect of the institutionalisation of mitigation (Dubash 2021), a central new policy 'norm'. Using emissions reduction targets as a core aspect of policy remains, however, problematic on many levels – not least as it continues the practice of collapsing the complexity of social-climate system interactions into a single metric (Van Coppenolle et al. 2022). As climate mitigation policies have grown, and as their success is so often measured based on (expected) emissions reductions, wider ecologies have often become relatively less visible. Clean Development Mechanism (CDM) projects have had detrimental implications for local environments (Newell & Bumpus 2012; Newell 2021; Lerner 2023); nuclear electricity continues to be treated as a 'clean' technology in some jurisdictions on the basis of low emissions and despite its environmental hazards; whilst renewable electricity expansions have contributed towards land-use and resource extraction issues – something that human geography and post-growth research had done much to highlight (Kallis 2018; Hickel 2019; Hickel & Kallis 2020; Riofrancos 2022 and 2023; Kuzemko et al. 2024). 'Green' now, instead of being used to denote broadly environmentally sustainable projects, was also sometimes used to denote *relatively* lower emissions projects – as in the EU's 'green' investment taxonomy, which included gas in 2022. Another persisting issue was that the long-term nature of net zero emissions reduction targets, stretching out to 2050

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and beyond, sometimes allowed for near-term policy delay, for the avoidance of making difficult choices, and over-reliance on future technical solutions – like negative emissions technologies (Anderson & Peters 2016; Stoddard et al., 2021; Clift & Kuzemko 2024).

It is also true to say that targets had become more ambitious. At the global level, there was a shift from limited Kyoto, Annex 1 commitments to a situation where, by 2024, 147 countries, 193 regions, 281 cities, and 1,172 companies had 'net zero' emissions targets (Net Zero Tracker 2024). This shift happened rapidly, at the end of 2018, only a handful of countries had adopted net zero targets – by the end of 2021, this had risen to 148 (Van Coppenholle et al. 2022). New policies capable of meeting these more ambitious emissions reduction targets became necessary. For example, Vietnam adopted a new goal of 50% renewable energy by 2050 and formulated the 'Power Development Plan 8' to meet it, whilst in 2023 Vietnam became one of the fastest growing renewable countries, alongside Poland. At the same time, there were elements of consistency with earlier policy compromises. The 'net' in net zero meant that any remaining emissions, measured territorially, could be balanced through removals, by offsetting, by sinks or technologies (ibid.). Indeed, the framing of net zero was informed by climate science research on allocating and limiting budgets and on carbon offsetting and accounting.

At the regional, country, and some sub-national levels, there have been related increases in the level of commitment to other mitigation targets, that is, for renewable energy, as in the case of Vietnam; energy efficiency; and set dates for phase-outs of coal, internal combustion engine (ICE) cars, and fossil gas based home heating. Only in a few countries had firm commitments to other fossil fuel phase-outs been agreed – notably in Denmark with its commitment to cease production of oil and gas by 2050, and the Netherlands had committed to phase out of gas use by 2050 as part of the 2019 Dutch Climate Agreement (Beckman & van den Beukel 2019). This broadening out of the range of mitigation targets has emerged as a new norm – extending targets in an attempt to make clear to citizens and market actors what the direction of travel is and the timescales within which actions need to be taken.

What has proven equally politically interesting is the legally binding nature of some net zero emissions targets, including, as of 2021, those of the EU, Canada, Denmark, France, Luxembourg, New Zealand, South Korea, Spain, Sweden, Hungary, and the UK (UK Parliament 2022). The EU's renewable energy target, recently raised to 42.5%, with an aim to get to 45%, by 2030 is also legally binding. This has, in turn, both depoliticised the question of whether emissions should be reduced but politicised in terms of increasing the capacities of citizens and other groups to hold governments, and in some cases energy corporations, to account for failing to reduce emissions. As a result of legally binding targets, but also

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sometimes based on human rights law, governments and oil and gas corporations are being taken to court by ENGOs and groups of citizens. There had been 2,500 lawsuits recorded globally by 2022 – what some have referred to as the 'climate litigation phenomenon', from Indonesia to the Netherlands, and from the UK to Vermont (Kaminski 2022). In 2023 the UK government lost a landmark case, brought by Friends of the Earth, ClientEarth, and the Good Law Project, proving that their net zero strategy was unlawful and requiring the government to draw up a new strategy that meets targets (Lawson 2023). Vermont and New York have passed new laws stating that oil and gas companies will have to pay for climate damage (Noor 2024). It has been estimated that fines levied on fossil fuel companies by the state of New York will total $75 billion, with the intention of shifting adaptation and climate change recovery costs away from taxpayers (Allen 2024). This is a new direction of travel that raises the costs of *not* mitigating and shifts some legal advantage away from corporations. Not forgetting, of course, that oil and gas companies have historically used investor–state dispute settlement courts to sue governments over environmental policies that damage their businesses, receiving $80 billion in publicly funded compensation since 1998 (Nelsen 2024; Sus-Pol 2024).[1]

Targets then have been raised, extended in scope, and norms have emerged around having legally binding targets that can be used in attempts to hold governments and companies to account. The question remains, then, whether targets are a useful means of reducing emissions. They provide some clarity for citizens and market actors, particularly as they extend to phase-out dates for high-emissions technologies. They can also support civil servants by providing clarity and focusing decision-making onto specific goals and whether sufficient policies and resources are available to meet them. High-profile targets, like the EU's 20-20-20 emissions, renewable, and efficiency, have been met, whilst some predict that China may meet its peak emissions by 2030 target, with recent analysis suggesting no growth in Chinese emissions in the third quarter of 2024 (Myllyvirta 2024). At the same time, mitigation targets, often for phase-out timelines, have been delayed or reversed – often as a result of electoral shifts and/or in response to perceived or real market or public objections – in a number of countries. This includes countries often thought of as climate 'leaders' – see decisions in Germany and the UK, in 2024, to delay phase-out timelines for fossil-gas household heating. This highlights, again, the importance of how mitigation policies put in place to meet targets are designed, in distributional terms and of politicisation in terms of learning to balance mitigation with other social goals.

[1] The Energy Charter Treaty (ECT) was one of the most significant sources of investor-state claims. In May 2024, EU countries agreed to withdraw from ECT (Climate Action Network involved in process).

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7.2.2 Expansions of Mitigation Policy and Political Approaches

With time, mitigation policy has become less focused on target setting and more on complex policy choices. A clear 'implementation' gap had emerged between global aims to limit warming and emissions reduction targets and policies. Overall, in comparison to 1997, there had been a considerable proliferation in the scale, breadth, and types of mitigation policies, as well as widespread overlaps between mitigation and other policy areas. These included the quite rapid growth in the 2020s of low-emissions foreign policy, often concentrated on natural resources and tariffs, and 'green', relatively more state-led, industrial strategies focused on developing low-emissions sectors and supply chains. At times, given these shifts, and new heat, buildings, industrial decarbonisation, and fossil fuel phase-out policies, it has become harder to see where mitigation policy ends and other policy 'areas' begin. This expansion of mitigation into other policy areas is an important insight and one that, arguably, anti-mitigation groups have started to capitalise on.

Turning to comparisons in types of policy, although emissions trading schemes (ETSs) were in place in 36 countries in 2024, up from 25 in 2021, including China's new scheme, they no longer represented the core of mitigation policy. Whilst global revenues from ETSs surpassed $74 billion in 2023 (ICAP 2024), embedding them in a financial returns sense, there is also more recognition of the insufficiencies of emissions trading in relation to driving complex change (Green 2021). Offsetting as a principle underlying mitigation policy has both grown as a strategy, particularly in corporate circles, and started to face higher levels of contestation. Contestations in many policy circles, however, have been limited to questions of governance, whilst maintaining the principle of offsetting. For example, in 2024 the US Federal government announced new rules governing voluntary carbon credit markets after several high-profile offset projects failed to deliver promised emissions reductions (Volcovici 2024). In some ENGO and academic circles, data is also being produced on negative social and/or environmental outcomes associated with offsetting projects, holding offsetting regimes to account, and politicising the question of whether offsetting should continue as a policy practice (Dunne & Quiroz 2024).

As already suggested, other types of mitigation policy have expanded considerably – further diluting the earlier focus on flexible and narrow policies.[2] In the period immediately post Kyoto, renewable energy policies were limited, but they have since become part of policy in most countries in the world (IEA 2024b and 2024d). For many countries renewables have also become core to industrial

[2] Somewhat bizarrely, IPCC models and scenarios still tend to rely on putting a price on carbon as the main policy driver for extensive system changes required to meet 1.5ºC targets – illuminating the gap between science and social science knowledge (Clift & Kuzemko 2024). The most recent IPCC mitigation report (AR6, WG III) included, however, a narrative section on the wide range of policies now available.

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strategy – from India's 'solar mission' to the rapid solar and battery expansions to burgeoning renewable markets in Poland, Vietnam, and Texas; from China's EV revolution and global dominance of many low-emissions manufactured goods markets to the EU's 2024 Clean Industrial Deal. Green industrial policy has been supported in some parts of the world by a narrative shift away from emphasising renewables as a policy 'cost' to one encompassing a variety of economic and other secondary benefits. Renewable policies over the past decades have rapidly lowered the cost of renewable energy, in economic and arguably also political terms (Breetz et al. 2018), whilst by 2023 wind and solar PV had become the fastest growing electricity sources in history (Lempriere 2024). The IEA, in October 2024 – having historically consistently revised up its expectations for renewable energy growth – again raised its expectations to a 2.7 times increase in renewables between 2024 and 2030 (IEA 2024d). They further claimed, importantly, that 84% of the growth in utility scale renewables will be stimulated by public policy (ibid.).

The EU's REPowerEU and Fit-for-55 packages of measures have underpinned significant outcomes – in 2023, wind produced more electricity than gas for the first time, coal generation fell by 26%, whilst renewables made up 44% of electricity consumed (Green Forum 2024). Even Poland, previously reluctant about renewables, had shifted course (ibid.) – helped by domestic views about Russia and a shift from a right-wing nationalist to a centrist government in the 2023 election. Some countries, Germany, the Netherlands, Austria and Denmark, brought in targets for 100% of electricity from renewables (de Pous 2022), whilst Albania, Bhutan, Costa Rica, Nepal, Paraguay, Iceland, Ethiopia, and the Congo produced more than 95% of electricity they consumed using a combination of geothermal, hydro-, solar, and/or wind power. Large electricity consumers, like the US and UK, targeted 100% 'clean' electricity by 2035 and 2030, respectively, but also included nuclear in the definition of 'clean' (Department of Energy 2023).

The rapid expansion of renewables contributed towards falls in electricity sector emissions, which fell by 28% in OECD countries between 2007, pre-financial crisis, and 2023 (Jones 2024), whilst in the EU they fell 20% between 2019 and 2023 (Carbon Brief 2024). With electricity sector emissions falling, it made more sense in emissions reduction terms to expand towards electrification in transport and heat sectors. Recent research points out that EVs and heat pumps are already less-emissions intensive than fossil fuel based alternatives in 53 regions of the world, covering 95% of global transport and heating demand, partly because they are more energy efficient (Knobloch et al. 2020). Changes in the EU partly stemmed from the significant boost to electrification policy, including subsidies implemented as part of the RePowerEU strategy since 2022 to reduce EU reliance on Russian gas (ibid.).

That renewable electricity, and electrification and storage, had come to be viewed by the EU as part of a broader energy security strategy arguably reveals

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the degree to which renewable electricity had become materially, economically, and politically embedded. The coming together of renewable and energy security strategy was further underpinned, at a time of fears about mounting global conflict, by the fact that renewables are, for Europe, relatively more 'domestic' than fossil fuels, which are largely imported (Kuzemko et al. 2022; Bordoff & O'Sullivan 2022; Goldthau & Sitter 2022; Maltby & Misik 2024). This also echoes energy geopolitics arguments, made by IRENA, about the benefits of all countries being, at least geographically, able to produce some form of renewable energy as opposed to being reliant on a limited number of countries for their fossil fuel energy imports (2019). Some policy programmes, under the Biden administration in the US and in the EU, also started to frame renewable energy as more affordable and as a part of the solution to cost-of-living crises (Stokols 2023; IEA 2024b).

The renewable electricity boom has its complications, not least as it is projected to be the most significant energy source in future, with more daily activities reliant upon it. Expansions have not unfolded uniformly, leaving many least developed countries underserved in terms of both energy and renewables (Newell & Mulvaney 2013; Sovacool et al. 2020b; Papathanasiou 2023). Albeit there has been some growth in off-grid renewables in least developed countries – such that 155 million people in rural communities now have access (IRENA 2025a). Some countries, particularly those that invested early in renewable technological development and manufacturing, have benefitted economically more than others (Lachapelle et al. 2017).

A further complication is that electricity storage and grid developments, essential to integrating renewables, have not kept pace with renewable generation in a range of countries, including Germany, China, and the UK. New policies are being implemented, but network buildouts take time and encroach on more land, whilst large-scale storage is a way off maturity. Meanwhile, grid constraints in a wide range of countries mean that plenty of low-emissions, renewable electricity is being wasted and, thereby, not contributing to emissions reduction (IEA 2024b). For example, the curtailment of renewable electricity because of insufficient grid capacity not only cost €3 billion but also wasted clean electricity that could have lowered emissions further (European Commissions 2025). Grid expansion, moreover, has faced opposition from the communities through which pylons will be built – further exacerbating risks of negative mitigation policy feedback. Electricity storage has also emerged as a key mitigation policy – with a heavy emphasis on subsidies for batteries, for cars and domestic-scale batteries. Increasingly, policy attention has started to shift towards questions of grid resilience under high percentages of renewables and the need for long-duration storage. California is emblematic here – its policies over the last decade or so have

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resulted in a huge influx of battery storage onto the grid, reshaping the demand curve and contributing to lower gas use (Parkinson 2024). It remains, however, far ahead of the curve in terms of resolving key electricity storage issues, with long-duration, grid-scale storage remaining an emergent technology requiring considerable further development and investment (Lait & Walker 2022).

Demand-side policies have also been expanding – as recognised for the first time in the IPCC's 6th Assessment Report (IPCC 2022). Historically, demand-side policies had been heavily focused on using energy efficiency measures and standards to reduce territorial energy demand. However, growing recognition of the need to balance renewable-based electricity grids has also led to greater interest in demand flexibility. Demand flexibility is about being more responsive to supply conditions – for example, encouraging greater consumption at times when solar or wind power is in high supply. Flexibility can also be about reducing 'peak' electricity demand, a strategy that the EU brought in as part of its RePowerEU strategy. Lowering peak demand and increasing flexibility are also understood as strategies that can deliver more secure and affordable energy systems (Li & Pye 2018).

Political commitments to improve resource efficiency and reduce extraction, bolstered in the 2020s by concerns about low-emissions supply chains, have underpinned another set of demand-side policies, 'circular economy'. Again, China and the EU have led in this area – building up zones of recycling, repurposing, and reuse of materials within wider systems of manufacturing (McDowall et al. 2017; Mallick et al. 2024). Such strategies indicate politicisations of overly supply oriented policy and in a deliberative sense given growing experiences of a broader range of demand-side policy design and implementation. Both flexibility and circular economy strategies, however, infer a need for further legal and regulatory deliberation and change (Mallick et al. 2024).

Reductions in fossil fuel production and use have become vital to more rapid emissions reduction in this phase. Given the rapid rise in availability of cost-competitive, renewable alternatives, conditions for fossil fuel phase-out have also changed. There have been expansions of fossil fuel phase-out strategies – with a heavy emphasis on coal. Twenty-seven of 38 OECD countries are now committed to being coal-free by 2030 (Jones 2024), whilst China has plans to start coal phase down in the 15th five-year plan period, starting in 2026.[3] There are some indications that growth in renewables has displaced fossil fuel usage – again, with a heavy emphasis on coal. Expectations are that although global coal use continued to rise in 2023, with quite stark differences between

[3] See Newell & Carter (2024) and Maltby & Misik (2024: 162–163) for excellent roundups of policies affecting fossil fuel demand indirectly.

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regions – that is, falling in the EU and US but rising in Asia – it will peak in 2024 (IEA 2023c). China claims that coal-fired power will peak in 2025; OECD coal generation has already fallen 52% since 2007, whilst EU coal and gas-powered electricity fell 20% between 2019 and 2024 (Rangelova et al. 2024). Indonesia has agreed to an ambitious coal phase-out target of 2040 as part of its target to reach net zero by 2050 – albeit both targets are considered a stretch by many given historic performance (Setyawati & Sucahyo 2024). The speed at which heavy coal users, like China, India, and Indonesia, phase coal down has become crucial to global emissions reduction but is complicated by the position of coal-fired generation as a basis of industrialisation and economic growth. Indeed, in China 80% of coal power is used by industry.

In the last few years, debate about oil and gas phase out has emerged and intensified – expanding from the narrower policy focus on coal. At COP26, in 2021, it was agreed for the first time that all fossil fuels should be phased down and that 'inefficient' subsidies for fossil fuels should be phased out, by 2030 in developed countries, by 2040 for developing countries. Two years later, at COP28, 198 countries, more than those for coal, recognised the imperative of "transitioning away from fossil fuels in the energy system" (IISD 2024). These commitments mirror new analysis which suggests that all future fossil fuel projects must be abandoned to meet global net zero targets (IEA 2021), and that existing fossil fuel production needs to fall by at least 65% by 2050 (IPCC 2022). Such claims have politicised fossil fuel production but not provided answers as to how to phase out.

There have been fewer concrete country, or sub-national, direct oil and/or gas phase-out commitments – as might be expected in this highly contested area. There are, however, some examples: the Dutch ruling, as part of 2019 Climate Agreement, that all homes should be gas free by 2050 (Klimaatakkoord 2019); Denmark is to phase out oil and gas production by 2050 (Farand 2020); there is moratoria on new oil exploration in New Zealand, France, Costa Rica, and Belize (Newell 2021: 145; Newell & Carter 2024); and 2022 Columbian and Spanish bans on oil and gas exploration (Newell & Carter 2024). The cities of Mannheim and Hamburg, in Germany, initiated active policies of gas phase out – indeed, Mannheim plans to shut down its gas network completely by 2035 (Rosenow & Kemfert 2025). Perhaps as significant as direct phase-out policies are those that indirectly affect supply and/or demand for fossil fuels – including divestment strategies, EU RePowerEU gas demand reduction policies, and bans on gas-fired heating or ICE cars. This phase is, then, at the sharper end of fossil fuel phase-down, marked by a considerable uptick in relevant policies, which is partly why, see sub-section 7.2.3, contestations of these types of mitigation policies have become more prevalent.

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Thus far, this sub-section has concentrated on change over time in the types of policy being pursued and how they are framed and, sometimes, contested. Evidence has also started to emerge of change in understandings of the role of public policy in delivering more rapid and just emissions reductions. Indeed, many of the policies discussed above have involved higher degrees of state intervention. On one level the role of the state remains, as Tim DiMuzio put it in Carbon Capitalism, to manage populations and resources – with high levels of resource consumption and commodification inferred under Keynesian, authoritarian, and neoliberal models of governing (2015). On another, however, there are noticeable changes in the inferred role(s) of public policy in ensuring lower emissions and more just systems. Analyses of IGO approaches to climate change argue that a shift away from the dominance of neoliberal economic ideas has occurred – towards a position where multiple sets of (mostly) economic ideas inform policy deliberation and decision-making (Meckling & Allen 2020; Allen & Meckling 2021). Others have observed a similar movement towards a slightly different mix of neoliberal economic, realist, and climate change ideas – but equally signalling a post-paradigm ideational environment – in EU policy (Kuzemko 2015; Goldthau & Sitter 2022). This suggests political shifts towards the notion, outlined in Chapters 2 and 3, that complex sustainable transitions, and all that they entail, require increasing degrees of management, co-ordination, and control (Mazzucato 2013; Kuzemko 2019; Newell & Simms 2020; Goedeking & Meckling 2024).

Political strategies, from the REPowerEU programme to the Inflation Reduction Act (IRA), in regions more often associated with market-liberal ideas also demonstrated this relatively greater acceptance of the need for public policy in driving low emissions change (Kuzemko et al. 2022; Tooze 2024). The IRA was described, by Al Gore, as part of a process of building a political constituency for climate mitigation through state action (Mundy 2023). In the UK, the government's 'renewable energy revolution', including the creation of a publicly owned 'GB Energy' renewable energy company, likewise infer shifts towards state-led change. Building from the Fit-for-55 package, the EU's REPowerEU package listed a range of distinctly non-market oriented policies to support accelerated low-emissions transitions, including the 'temporary' lifting of state-aid rules, considerable public investment in low-emissions technologies, and changing permissions processes for renewables, signifying them as in the public good (Kuzemko et al. 2022; Goldthau & Sitter 2022; Moro & Cesaro 2024).

Such strategies have been further underpinned by the notion that countries can benefit economically from green industrialisation, by competing in and 'winning' aspects of green transitions, but only as long as they take strategic state action (McDaniel & Bailey 2024). These coincided with a range of measures to

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ease the social burden of the energy crisis and to redistribute costs and benefits of energy systems – including windfall taxes on energy companies and direct interventions into gas markets (Kuzemko et al. 2022). Whilst for the US, UK, and the EU, the direction of travel towards greater levels of state intervention marked a shift away from more market-friendly approaches, green industrial strategies in countries like China, South Korea, Brazil, and Indonesia maintained preferences for a relatively stronger role for the state. The prevalence of green industrial strategies in high- and middle-income countries underpinned claims of a new phase in (green) state capitalism in this timeframe (Allan & Nahm 2024; Robertson 2024). Green industrial strategies contribute towards a further blurring of boundaries between mitigation and other policy areas. Further, in some states that produce critical materials, like Chile and Bolivia, there have been marked attempts in this phase to take more control of domestic resources and challenge the dominance of transnational corporations and the movement of resource-associated profits abroad (Johnson et al. 2024). In Chile this involved specific developments of the state's capacities, including the establishment of a new national development corporation (CORFO).

Lastly, on the relative return of the state, global increases in demand, and competition, for clean tech products and materials, and concerns over China's dominance, have contributed towards a return to efforts by states to control markets and to shifts away from economic globalisation. The EU, UK, and US all now have critical mineral strategies which include domestic production and 'onshoring' and 'friendshoring' strategies, whilst the US has been steadily increasing the tariffs that it places on green materials and goods. If US tariffs were initially focused on China, under the second Trump presidency they are being expanded to other parts of the world. It is also notable that Trump's attempts to broker a peace deal between Russia and the Ukraine have been motivated by a desire to control half of the Ukraine's significant critical materials (Reuters 2025). Such mercantilist responses to global competition are, notably, 'supply oriented', based on assumptions about continued economic and energy demand growth. Others argue such measures would be less necessary in low energy demand scenarios (Clift & Kuzemko 2024; Price et al. 2023). Indeed, the EU, notably, has made shifts towards a circular economy in clean tech sectors as part of its attempt to build regional capabilities and reduce reliance on Chinese imports.

Taken together, this phase has seen further, quite rapid, shifts in the dynamics of relations between mitigation and other policy, and a blurring of boundaries. The pursuit of low-emissions transitions has contributed towards a considerable increase in industrial policy, shifted some policy approaches away from liberal economic governance and globalisation, and inferred a variety of different roles for state actors across multiple sectors.

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7.2.3 Growth Orthodoxies and the Political Challenges of Fossil Fuel Phase-out

All phases of constructing climate mitigation so far have taken place within widespread political fixations with economic growth that have complicated emissions reduction. As outlined above, the current phase has also been characterised by the need to accelerate GHG emissions reduction and by the rise in renewable electricity, which makes fossil fuel phase out both crucial and technically more doable. Despite recent expansions of phase-out policies, energy remains, at 72%, by far the largest contributor to global emissions. Research at the forefront of deliberating how to reduce fossil fuel usage has started to argue that a considerable array of policies that can explicitly both enable and manage complex phase-out processes are required (see Newell & Daley 2024 for a useful review). Such strategies include identifying those most vulnerable to phase-out, deciding if and who to compensate, which actors should be allowed to access reserves in future, how to decommission high-emissions infrastructures, and who should pay.

Oil and gas phase-out is politically complex, even with affordable and accessible alternatives in place under continued conditions of political fixations with growth. Whilst coal is still predominantly used in electricity generation, where renewables have become more established, oil and gas are used in sectors that have been most resistant to change – notably transport and heat. This connects us to questions about the power of incumbent actors, the wider socio-economics of phasing out embedded regimes, as well as of instabilities within fossil fuel regimes and regions (Newell 2021; Ivleva & Tänzler 2019). None of the countries committed to oil and gas phase out, mentioned above, are significant producers – albeit gas has been historically quite deeply embedded within the Dutch political economy. Most global oil majors do not have plans to phase out fossil fuel based business models (Trencher et al. 2023), albeit many have plans to transition from fuels to petrochemical materials (Tilsted et al. 2023).

But, and this is important, more information has become available about the details of resistance, partly as experiences of phase-out policies and responses emerge. Opposition to fossil fuel phase-out is still framed in remarkably similar ways to the pre-Kyoto phase, whilst social and electoral pushbacks reveal some of the underlying social issues involved. Notions of ‘stranded assets’ and ‘oil gluts’ have emerged (Roberts et al. 2018; Moore 2024), which can be used to understand the vulnerabilities of fossil fuel assets to low carbon change (Colgan et al. 2021). It has also become more apparent that infrastructures and cost distributions matter deeply. For example, as gas systems are phased out, who will be responsible for paying the cost for decommissioning extensive pipeline infrastructures (Rosenow et al. 2025). Further, if 65% of fossil fuel resources need to stay in the

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ground, political agreement will need to be reached about which country's assets can be capitalised and which not, whilst some research has started to consider how this might be organised based on justice considerations (Welsby et al. 2021).

Countries like Indonesia and Nigeria still spend quite high proportions of public monies on fossil fuel subsides (McCulloch 2023). These subsidies, in turn, support industry, households, and associated businesses, whilst cost-of-living implications complicate questions of how to phase them out. Beyond energy use, plastics and fertiliser industries made up quite considerable oil demand, whilst policies to address these aspects of fossil fuel use are under-developed (Balmaceda et al. 2023). These are important social and political questions. Knowing that they are is a form of capacity in processes of designing phase-out management strategies that recognise tensions and takes decisions about how, and on what basis, costs will be distributed (see also Newell & Carter 2024).

The centrality of economic growth socially and politically remains a core consideration in the politics of phase-out. Whilst policies to support renewables, and to a lesser extent energy efficiency, can be convincingly made to fit growth narratives, to the extent that they infer new markets, businesses, and jobs, fossil fuel phase-out can easily be narrated as anti-growth, anti-jobs, and anti-security. High-emissions companies have maintained considerable policy and strategy capabilities. For example, 'big oil' spent $1 billion on narrative capture and lobbying just between 2015 and 2019 (Influence Map 2019). A narrative strategy that has persisted across phases is to appeal to preoccupations with growth and development, and their alleged position in supporting it, countering arguments to scale-up mitigation (Buller 2022; Paterson et al. 2022; Lund et al. 2023). Politicians from fossil fuel producer countries have also persisted in this course. Recent examples include Sultan Al Jaber, the United Arab Emirates (UAE) Minister for Industry and COP28 president, who suggested that fossil fuel phase out would bring humanity back to 'the caves' (Carrington & Stockton 2023). This was a narrative construction not dissimilar to Donald Trump's claims across both election campaigns. Appeals to growth, as supported by fossil fuels as socially necessary, have in turn enabled and legitimised high-emissions lifestyles (Lund et al. 2023) – helping to explain the reluctance, from Kyoto to today, to enact phase-out policies (Paul & Moe 2023). Indeed, some academics interested in the relationship between climate mitigation policy and politics have warned against phase out policies on the basis of their association with social backlash risks (Meckling et al. 2015).

Fossil fuel producers, companies, and states also continued to rely on the growth fixation to argue that more extraction is needed. See, for example, Norway and the UK, both self-identifying climate 'leaders', announced increased licencing for North Sea extraction in 2023. This was partly justified on the basis of energy crises and European energy security, but also on the basis of economic recovery

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(Kuzemko et al. 2022). Oil and gas majors, including BP and Shell, took the same opportunity to lower their climate mitigation targets to free up more investment in today's energy system (BP 2023). From their perspective, energy supply security remains a pre-requisite for economic development, whilst existing (fossil fuel) supply systems are still portrayed as delivering on that security. Research on national targets for oil and gas extraction shows that "governments collectively expect to produce 29% more oil and 82% more gas by 2030 than is consistent with 1.5ºC global warming pathway" (IISD 2024: iii). The 2022–2023 energy crisis might have provided the ground cover for the return of such counter-mitigation corporate and national policies – but it is the fundamental belief that fossil fuel energy still delivers growth and security that informs them.

At the same time, the fundamental assumption that growth is necessary remains embedded in international organisations (IOs). The OECD and the UN assume that 3% growth per annum is what is required to meet human development objectives (Hickel 2019), again equating development with growth. The right to fossil fuel based industrialisation has underpinned China's and India's extraordinary economic development as well as their movement to the top of the list of global emitters in absolute territorial terms. Integrated assessment models (IAMs), and associated scenarios, that envisage 1.5ºC and 2ºC compliant futures, used by the IPCC, also continued to assume year-on-year economic growth through to 2050 – partly because they use OECD socio-economic data to populate their models (Clift & Kuzemko 2024).

Many IAMs and scenarios, used by IGOs, global corporations, and policymakers, have continued to incorporate the economic costs of climate mitigation policy in their calculations but, remarkably, not to incorporate the considerable costs associated with climate change (ibid.). The emergence, however, of research on the (social) and economic cost of climate change has meant that there is more data available to amend IAMs and account for this, frankly unsupportable, omission. The latest estimation, at the high end of expectations, is that a 1ºC rise in temperature results in a 12% decline in world GDP (Bilal & Känzig 2024). Other studies have estimated that, since 2000, climate-related weather events have cost $143 billion per year, the majority of which (63%) came from human loss of life (Newman & Noy 2023). These findings, of course, deeply complicate assumptions about the positive relationship between economic growth and mitigation which have sat at the heart of the liberal environmental compromise of the 1980s and 1990s.

Some of these questions are reflected in academic research centred on the question of growth. There has been considerable debate between advocates of a 'greening' of growth and de-growth scholars (Kalis 2018; Pollin 2018; Hickel & Kallis 2020). Policy narratives in OECD countries have shifted towards a concentration on green growth, backed up by some evidence of some decoupling of

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economic growth from GHG emissions in OECD countries, and overtly reflected in the numerous green industrial strategies that have become established. The problem of growth, however, in broader environmental, extraction, and global terms remains a crucial question – explored in some depth in de-growth scholarship (Kallis 2018; Schmelzer 2016; Jackson 2021; Green 2022; Hickel & Kallis 2022). There is little evidence of any widespread decoupling between economic growth and wider ecological harms – including pollution, biodiversity loss, and harmful resource extraction – hence arguments for avoiding economic growth in certain, more resource intensive, sectors in the Global North (Hickel 2019; Hickel & Kallis 2022). Although such debates are emerging as important aspects of deliberation about climate mitigation in academic circles, the links between the benefits of limiting growth and positive societal outcomes have not been made apparent to wider publics.

Green new deals, and industrial policies, tend to accept that public policy has an active role to play in engendering the 'greening' of growth. The US IRA had marked an uptick in the degree and scale of Federal intervention, whilst some had hoped that doing so would result in a wider distribution of the benefits of mitigation policy – not least in key Republican states where much of the investment was targeted. President Trump announced his intentions to get rid of many aspects of the IRA soon after assuming office, but some Republican Senators have asked him to reconsider given the growth and jobs emerging because of IRA investments (Budryk 2024). 'Green deals', like the EU's, more explicitly set out the role of public policy in ensuring that systematic change resulting from technological shifts is socially acceptable within all member states. EU transitions funds and social climate funds have been targeted at protecting vulnerable regions and communities as fossil fuels are phased out, including reskilling, and at making clean investment funds available at low interest rates (Kuzemko et al. 2022; Moro & Cesaro 2024). What had started to matter increasingly, then, is the type of growth being pursued and who benefits, whilst there has been a broadening out of ideas about how green growth can be achieved at international and national governing scales (Meckling & Allan 2020; Allan & Meckling 2021). This suggests a small degree of politicisation of growth, and some questioning of its qualities, and other politicisations in terms of expansions of what aspects of mitigation are subject to processes of collective choice.

Reflecting this era of 'green' industrial strategy, companies that directly profit from the production of a range of lower emissions goods and services have emerged strongly over the past decade – although not always in linear fashion – whilst companies with critical material resources also seek to capitalise on clean transitions. In 2024, studies emerged starting to quantify the GDP contribution of 'clean' and/or 'green' sectors – including the IEA's study which claimed that 'clean' energy

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added $320 billion to the world economy, 10% of global economic growth, in 2023 (IEA 2024a). It has been estimated that, in the same year, clean energy sectors accounted for 40% of overall economic growth in China, and that without this contribution China would have missed its annual growth target (Myllyvirta 2024a). Recent research estimates that the green economy will be worth $10.3 trillion by 2050 (Lambert 2022). This phase, then, is also characterised as being part of the transition phase between a global economy where 90% of economic growth still comes from high-emissions sectors, and futures with higher proportions coming from low-emissions sectors. There will, of course, also be considerable diversity. For many, in countries and regions that do not, for social, political, or economic reasons, develop green sectors mitigation may continue to feel like a cost for some time.

7.2.4 Equity and Justice in Transition

Just as historic economic, political, and energy systems have entailed inequalities and injustices, and as there are considerable justice implications of *not* reducing emissions, system-wide change almost always implies costs that someone, somewhere bears. The thinking behind mitigation is to enact sufficient changes to make things better for more citizens, with some emphasis on inter-generational justice, but the processes of transition that need to occur for that future to be reached will be experienced differently by different groups within society and between countries of the world. The approaches that different countries or regions take influence the degree of change – but, arguably, the greater the change, the greater the need to actively redistribute costs and benefits during the transition. This notion has been reflected in recent shifts towards framing justice as a low-emissions transition issue. Some have, in a similar vein, argued that distributive outcomes are the single greatest 'characteristic' of politics of climate change (Aklin & Mildenberger 2020), and a job particularly suited to state actors (Perez 2002).

Justice, at the time of Kyoto, was largely framed in inter-generational and inter-national terms. As seen in Chapter 4, the latter became central to UNFCCC agreements, in the form of the CBDR-RC principle. The Kyoto agreement that only historically responsible countries should commit to emissions reductions allowed some, at that time still, developing countries to become significant emitters in absolute, if not always in per capita, terms. New research, utilising an equality-based quantification of responsibility for climate breakdown, claims that Global North nations were, even up to 2015, still responsible for 92% of emissions (Hickel 2022). Reflecting the CBDR-RC principle, Annex 1 countries had committed to climate investment in lower income countries, but had, up to 2022, not met Paris agreed climate investment targets, whilst the return of

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Donald Trump as President of the US makes it less likely that overall targets will be met. Others have argued that the international emphasis on CBDR-RC had, by this phase, relatively reduced some disparities between Global North and South regions – but increased disparities within countries and within the Global South (Van der Straaten 2023).

Since the UN Paris accord, however, all signatories have committed to emissions reduction. China had already become the world's largest emitter in absolute, if not in per capita, terms and had overshot its boundary fair share of emissions. At the same time, failure to limit emissions, and associated climatic changes, have exposed many around the world to the loss of livelihood, community, home, and life (Newman & Noy 2023). This has shifted global justice negotiations towards the need for greater and accelerated loss and damage payments – given that those that have started to suffer the most are often those with the least responsibility and capacity to adapt (Ciplet et al. 2015; Hickel 2022).

In addition to justice framed according to the uneven distributions of harms, abilities to adapt, and as loss and damage, justice debates have expanded recently to cover questions of 'just transitions' (Goldthau & Sovacool 2012; Newell & Mulvaney 2013; Cantoni & Brisbois 2024). For many decades of this century, high-emissions, fossil fuel-based, and low-emissions systems will co-exist, peacefully or otherwise, under conditions of more or less rapid transition (Kuzemko et al. 2024). In the period since Kyoto, those that benefit socio-economically from high-emissions systems have extended beyond incumbent actors and populations of OECD countries through to the rising middle classes of BRICS countries – hence complicating distributional questions during transition. At the same time, increased national emissions reduction targets and emergence of fossil fuel phase-out policies imply greater levels and rapidity of change and, thus, potential for losses in some countries and communities. The rising risk of negative mitigation policy outcomes and resistances to certain mitigation policies has, in turn, underpinned calls for just transitions (Cantoni & Brisbois 2024). It has also underpinned a successful political framing, at different times in different countries, of climate mitigation as a process that harms hard-working domestic populations whilst enriching (global) élites (Marquardt et al. 2022).

Transitions justice emerged as key to the politics of mitigation over the course of the current phase and is likely to be increasingly core over the next decades, whilst it is a growing field in academic and policy circles. Trade unions were some of the first organisations to coin the phrase transitions justice – whilst it had become a key issue in election campaigns, particularly in fossil fuel producing countries. Interestingly, debates about transition justice were also utilised by incumbent high-emissions companies for whom reaching net zero, especially without the aid of negative emissions technologies, could be existential (Colgan et al. 2021).

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Incumbents regularly (re)deployed just transitions discourses in efforts to align organised labour with their interests – emphasising high-emissions corporations as employers, suppliers of essential goods and services, and important to collective well-being (Newell 2021; Harry et al. 2024).

Elsewhere, however, the need to recognise social and economic injustices associated with sustainable transitions had moved from an area of debate to active policy. The EU's Green Deal is a clear example in that it made an explicit attempt to extend mitigation policy to also include social policy, in an overt bid to engender a fairer transition within member states. This is about justice within the EU, rather than in a more cosmopolitan sense. Much transitions justice policy has been centred on redistribution of costs and benefits via funds, such as the 'just transitions' and 'social climate' funds, from high-emissions sectors, including via receipts from the EU ETS, towards reskilling and clean investments (Bolet et al. 2023; Crespy & Munta 2023). The EU's just transitions policy has often directly targeted coal-producing regions with the intention of avoiding mass regional or community unemployment and local economic crises. This has partly been based on associations between 'left behind' communities and the rise of right-wing populism (Brisbois & Cantoni 2024).

At national and sub-national levels, just transitions policies, task forces, and/or commissions had been set up, with an emphasis on equity within countries, in Australia, Czech Republic, Germany, New Zealand, South Africa, Spain, and Vietnam and Ontario, Alberta, and Scotland (Bolet et al. 2023). Here the emphasis has been on improving social interactions by including more stakeholder engagement, regeneration projects, opportunities for reskilling, and making allowances for those most affected by fossil fuel phase-out in attempts to lower social costs of change. One of the outcomes of renewable expansions and the emphasis on the importance of grids has been a boom in investment in subsea electricity cables. This has informed a new regeneration project, in part funded by Scottish and UK governments, in a former coal-handling port – explicitly seeking to attract investment and well-paid jobs to a formerly high-emissions industry region (Kerr 2025).

As such, renewable electrification has been increasingly framed in policy terms as representing opportunities for development and poverty alleviation (Prizzon et al. 2024). Here, renewable energy is also understood as more affordable and fairer (IEA 2024b), offering job opportunities, whilst some developing countries, China, South Korea, Taiwan, Malaysia, and India, have emerged as leaders in clean tech manufacturing markets (Lachapelle et al. 2017). Countries like Morocco that have more recently invested in capturing electricity from their vast solar potential and in siting EV car manufacturing to benefit from cheap solar are also starting to benefit from net zero transitions.

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To continue in terms of distributions of benefits associated with mitigation policies, more countries have, from a geography perspective, the opportunity to create domestic, renewable energy, thereby reducing import dependency on fossil fuels (IRENA 2019). Related to this are arguments that some least developed countries can 'leapfrog' the traditional, centralised electricity model to provide access via distributed renewable resources. Recent research on distributed renewable energy in Africa points towards significant growth in domestic solar access. It is estimated that more than 400 million Africans get electricity from home solar, reports of rapid growth in mini grids, whilst in Kenya distributed renewable energy firms employ more than six times as many people as the largest utility firm (Economist 2024). This is, in part, happening because of the failure of traditional, centralised grid model but also because the costs of renewables have fallen.

There are, of course, significant differences within Africa in terms of where renewable investments are made – indeed 75% of investments made between 2010 and 2020 were in four countries; South Africa, Morocco, Kenya, and Egypt (IRENA and AfDB 2022). Significant transition justice issues have also emerged for low-income countries that have not yet had the opportunity to capitalise on their fossil fuel assets associated with starting to develop those assets. On the basis of an equitable share of future emissions, such countries would be allowed to develop those assets (Welsby et al. 2021). However, fossil fuel development might not necessarily benefit those countries – depending on the speed of global demand reduction for fossil fuels, given the long lead times associated with fossil fuel investments, and the fact that the companies that extract resources are often transnational corporations. At the same time, extracting those assets might imply climate costs for other countries without such assets.

There are further differentials between low-income countries in terms of national capacities to invest in clean electricity generation and storage and clean-tech manufacturing – much of which is based on significant differences in costs of capital and access to finance, but also political will and knowledge capacity (Azubuike et al. 2024). Whilst 'Just Transitions Partnerships' have emerged to extend affordable climate finance to middle-income countries, like South Africa and Indonesia, to support transitions from coal to renewables, bypassing gas (IISD 2022), there has been relatively less emphasis on lower income countries. One core justice question remains as to whether low-emissions systems will be fairer, more accessible, and affordable – or whether the benefits will continue to accrue to large corporations and already wealthy countries and sections of society (the global minority) (Newell 2021; Prizzon et al. 2024).

In a further departure from understandings of equity and justice in the Kyoto period, some recent research, in academic and policy circles, has started to focus the analytical lens on transitions injustices between societal groups rather

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than nations. It reveals that the level of emissions from the 'top' 1% of people, measured in income terms, are the same as the 'bottom' 69%, whilst the top 10% produce 48% of global emissions (Chancel 2022; Tandon 2022; IEA 2023a). This has been an overt politicisation of high-emissions lifestyles, afforded by a tiny global minority, and has been accompanied by political arguments that the top 1% should face more of the costs of mitigation – possibly via a global wealth tax and/or a frequent flyer levy (Harvey 2024). It has also suggested concentrating political responses on high-impact behaviours and high-emitting groups (Whitmarsh et al. 2021). Other narratives highlight the responsibility of oil and gas corporations for emissions – as well as their historic and ongoing attempts to deny and delay – and recommend windfall taxes to pay for mitigation policies. This approach was taken up by the EU in response to the 2022–2023 energy crisis when windfall taxes on energy company profits provided much-needed funding for social and welfare policies to protect citizens from the worst effects of price rises (Kuzemko et al. 2022). Such policies imply that public policy plays a central redistributive role within transitions, as suggested by various scholars reviewed in Chapter 2.

A further development in how justice has come to be considered within recent climate mitigation debates extends beyond economic losses to encompass experiences of loss as places and communities change – including those with long histories of/attachment to fossil fuel industries, like coal regions in Australia, US, and Poland (Della Bosca & Gillespie 2018; Kurchner & Bridge 2018; Zuk & Szulecki 2020). There are also societal groups experiencing loss because of the expansion of low-emissions technologies and infrastructures – as clean simply replaces dirty in support of high-consumption systems. These take account of a wide variety of extraction, land, and food issues associated with the return of energy to 'the surface' (Newell & Mulvaney 2013; Huber & McCarthy 2017; Kuzemko et al. 2024). Injustices associated with the extraction of 'critical' resources and changes of land use, often affecting indigenous populations and subsistence farming, have been recognised politically, with some countries seeking to address such issues via nationalisation, that is, Chile's lithium nationalisations (Estes 2019; Kuzemko et al. 2024).

Just as citizens became more aware of the environmental implications of industrialisation in the 1950s and 1960s, so too is awareness of new justice issues associated with different types of mitigation policy growing – as well as deliberations over potential solutions. If in the early years the key social outcome of mitigation policy was to limit climate change by reducing emissions, justice and other social considerations have also significantly broadened the societal remit of climate mitigation policy. This, again, highlights the importance of policy design, policy mixes, flexibility, and dynamic interrelationships between traditional policy areas.

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An emerging question within mitigation politics debates had become whether action to mitigate climate change can be steered not just towards better distributing the costs and benefits of systems transitions – but also towards rectifying some of the inequities built into current economic and energy systems – that is, a broader transformative agenda (Newell & Mulvaney 2013; Rosenbloom et al. 2019). In a sense this is about politicising low-emissions transitions such that they become sustainable transformations wherein inequalities, issues with energy access and affordability, and land and human exploitation are also addressed. Something more akin to Andy Stirling's 'emancipatory transformations' (Stirling 2014a).

7.3 Politicising Mitigation to Increase Ambition, Pace, and Justice

Reducing emissions more rapidly, in a just manner that has wider societal benefits, is hard but, on the basis on analysis so far, vital. Essentially, this book has argued that we now, as a result of earlier phases, know so much more about *why* it is hard and advocated for approaches to research and policy design that use this knowledge to actively think politically about how to proceed. There is a greater degree of understanding of the scale of change yet required to meet mitigation targets within a more conflictual world. There have also been significant relative politicisations in deliberative, collective choice, and agency terms, which are summarised in Chapter 8, Table 8.1, that could form a basis for further action. Markard et al. classify 'acceleration' as a distinct phase of transitions which entails specific challenges (2020). These challenges include: resistance from declining industries; more obvious changes to some livelihoods and consumer practices; the need for more co-ordinated interactions between systems (like transport and electricity); and, relatedly, more policy coordination. This is partly because the rapid growth in renewables, electrification, and storage in a range of countries has made fossil fuel phase-out more technically and socially plausible – hence attempts to bring in phase-out policies.

Like Rogge & Goedeking (2024), Newell & Simms (2020), and Roberts et al. (2018), the analysis in this chapter is more focused on questions of how to design policies that can reduce emissions and improve societal outcomes. My interest in designing policies with better distributive outcomes relates not just to questions of equity but also to questions of political feasibility, particularly in relation to fossil fuel phase-out (Muttitt et al. 2023). As discussed in Chapter 6, political contestations of mitigation are increasingly focused on objections to policies with outcomes that threaten high-emissions profits, lifestyles, and jobs, whilst the approach taken in this book overtly recognises conflict as a natural part of processes of collective choice and of change.

Taking inspiration from the politicisations of mitigation that have already occurred, I offer below four ways of framing mitigation policy and politics attuned

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to the acceleration phase. These frames explicitly recognise conflict, view contestations as useful policy information, take account of dynamic links between mitigation and other policy areas, and consider the extent to which political experiences and material changes can inform and underpin policymaking. Arguably, because this phase of climate mitigation politics comes at a time when other crises have taken up political space and attention, it necessitates an intentional upping of our collective abilities to think politically about how to mitigate.

This can be understood as a targeted exercise in reviewing mitigation policy successes in relation to what needs to be achieved in this phase, whilst being cognisant of potential conflicts and of types of policy that can ameliorate them. The emphasis is not on policy instruments that last, as policy flexibility is also important, but on ensuring actively politicised mitigation policy with benefits that spill out more broadly. In doing so, this section starts to explore the question, considered in more detail in Chapter 8, of what politicised climate mitigation looks like in practice.

7.3.1 Politicising Societal Outcomes

One of the central arguments of this book, which structured Chapter 6, was that mitigation policy outcomes are central to the development of climate politics over time, including new contestations and coalitions of support. At the same time non-emissions social outcomes, although often under-considered in mitigation policymaking circles, are a core aspect of how mitigation policy and politics dynamically interact over time. Here, of course, social interactions, as argued in Chapter 3, become vital to understanding how mitigation politics changes – hence the attempts across this book to foreground societal experiences of mitigation policy and recommendations to more actively base policy design on improving social interactions.

Negative societal (side-)effects of mitigation policies have led to negative social feedback. Those that seek to depoliticise mitigation would prefer to avoid backlash, whilst anti-mitigation coalitions encourage and magnify mitigation policy backlash in their strategies of delay (Paterson et al. 2023). Negative feedback can, then, lead to the depoliticisations of mitigation both in terms of attempts to shield decisions from public feedback and of politicising policy outcomes to get mitigation off agendas. This, as I have argued across this book, is not the route to accelerated mitigation. Indeed, making policy behind closed doors in ways that ignore real-world, non-emissions outcomes would resign us to making the same mistakes repeatedly. This risks failing to sufficiently broadly embed low-emissions changes socially or politically, engendering further delay, whilst the contested politics of mitigation do not go away. Instead, contestation can be understood not just as a normal part of policymaking processes but explicitly,

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through studying actual contestations, strategies of those that stir up contestations, and experiences of policy, as a route through which we can learn more about how to design better policies.

Chapters 3 and 4 argued that incumbency can be considered not just as about powerful corporations and embedded material infrastructures, but as deeply embedded societal practices. One of the challenges associated with the 'acceleration' phase is that the degree of social change, in countries and regions where high-emissions businesses and practices are embedded, is higher versus previous phases. Early policies tended to be about developing new, lower emissions technologies and businesses and increasing the percentage of renewables in electricity mixes – letting those citizens that can afford to make lower emissions choices do so with the support of various incentives. There were distributional issues associated with this form of change and with existing high-emissions systems – particularly in terms of how policy costs were distributed and uneven transitions. Under fossil fuel phase-out, as outlined above, social impacts for some sections of society and countries become yet more tangible. In some consumer-based societies, households have been told that their choices will be restricted, as ICE cars and gas-fired heating are phased out. As fossil fuel phase-out continues in coal sectors, and starts in gas and oil sectors, losses of livelihoods will become more tangible, particularly in the absence of regenerative and social policies to ameliorate losses and/or offer new opportunities. At the same time, research suggests that public views differ in relation to different mitigation policies, whilst support is closely associated with jobs and fairness (Lim & Tanaka 2020; Caggiano et al. 2024).

Taking the social outcomes of mitigation policy more seriously, however, implies a different emphasis on the role of the state in engendering low-emissions futures. Here, the role of the state in ensuring improved distributional forms of justice becomes key. This is not to say that all states do take on this role – but that in terms of motivations and/or capacities to actively redistribute the costs and benefits of low-emissions transitions, they stand apart from market actors whose motivations are profit focused. This, of course, is a direct challenge to notions of depoliticisation that prefer to leave change to market actors. This also recognises the fact that policies can have more than one goal in mind – from emissions reduction as the main indicator(s) of policy success to actively considering meeting multiple social goals of, say, welfare, poverty, and employment. Carlotta Perez's work on historical sociotechnical transitions emphasises that, although initial innovations were market led, they became embedded socially through active and widespread distributions of the benefits of change, for example, through state-led universal access to new electricity services (2002). There has been some focus in scholarly work on the politics of transitions in creating corporate constituents

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for low-emissions systems (Meckling et al. 2015), but this is more about wider, societal benefit and support (Bickerstaff et al. 2024).

In Chapter 6 various examples of policies that have resulted in social benefits for some groups were explored, including renewable policies that have contributed to reduced pollution, emissions, and new markets and jobs. Indeed, the renewable energy industry was worth $2 trillion by 2023 (Statista 2024), offering 16.2 million in renewable energy jobs (IRENA & ILO 2024). Benefits, however, including in jobs terms, are not evenly distributed between countries – with 7.4 million, or 46%, based in China, 1.8 million in the EU, 1.6 million in Brazil, and around 1 million each in India and the US. The big difference in renewable jobs between China and the US is, of course, that China made early, strategic, long-term decisions to invest in renewables, whilst this has not been the case in the US. The notion that low-emissions policies can enable new markets and offer opportunities for citizens has become more established, underpinning what IRENA refers to as a 'people-centric' energy transition. Beyond the focus on markets and jobs, again as outlined above, recent evidence suggests that clean energy sectors also contribute towards economic growth. These more opportunity-focused aspects of mitigation policy are more readily evidenced during this phase but, still, tend to be less well communicated than well-financed media campaigns that highlight jobs and economic risks and costs of mitigation. There is room, then, for politicisation here in deliberative and social interaction terms.

The cost of change, and who bears it, is the other side of considerations of improving distributional outcomes. On the basis that doing so was regressive in distributional terms, Germany decided in 2022 to take renewable energy levies off consumer bills (German Federal Government 2022). Other mitigation policy-making processes that, sometimes based on early contestations of initially poorly designed policies, then directly engaged affected stakeholders have shown that participation, beyond technocratic and other élites, can result in policy that not just lasts but engenders further political support (Newell & Simms 2020; Bolet et al. 2023; Cantoni & Brisbois 2024). Engaging directly with workers allowed policy-makers to understand their perspective, specifics reasonings behind contestations, but can also provide an opportunity to minimise the co-option of 'just transitions' by incumbent corporations as a delaying tactic. Given that fossil fuels are fixed in place, they are extracted only in certain regions – and much participatory phase out policy has been undertaken by sub-national governments (Bolet et al. 2023).

Balancing mitigation with other goals has become a core aspect of politicisation. Often this is centred around the need for re-skilling and considerable new capacities for training for employees of high-emissions sectors, whether organised through corporations or the third sector/colleges. Indeed, training in low-emissions manufacturing and other sectors is increasingly understood as central in underpinning

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fossil fuel phase-out in a just manner, as in heating and transport, where jobs have started to move from ICE manufacturing to EVs and from gas-fired heating to heat pump installation and maintenance. Public–private partnerships, including the third sector, corporations and unions, have emerged as important to increasing re-skilling capacities (Szabo & Newell 2024). Re-skilling is also, clearly, crucial in relation to the continued expansion of low-emissions sectors (IRENA & ILO 2024). Signatories to the 2015 UN Paris agreement agreed to improve education around climate change and it is now taught as a school-level and/or university-level subject in many parts of the world. At the same time, however, the climate crisis had affected education for a quarter of the world's children by 2024 (UNICEF 2025). There has, however, been relatively less emphasis on education focused on the many different ways of addressing climate change. More education here could help to reduce social spaces in future for anti-mitigation campaigns to steer conversations towards delayed action.

The varied types of policy successes, discussed above, suggest that more open and inclusive deliberation of different approaches to mitigation policy can be conducive to more lasting change, particularly to the extent that more widespread societal buy-in to mitigation policies is secured (Bolet et al. 2022), thereby reducing electoral risks associated with mitigation. This, in turn, supports wider arguments about the need for greater deliberative capacities in climate change (Eckersley 2004; Willis 2020; Newell 2021; Bickerstaff et al. 2024). Citizens' Assemblies have shown that once citizens can make connections between everyday choices and climate consequences and are given responsibility to decide what to do, they make more informed mitigation decisions (Willis 2020). At the same time, interestingly, citizens are less likely to think an issue is serious if politicians do not talk about it and address it in that vein (Willis 2020: 82;Newell 2021). This suggests that strategically choosing to hide mitigation policies behind a rhetoric of delivering other policy goals, like security or jobs, although it might be perceived as helping with initial policy approvals, might not be a good, medium- to long-term tactic. Recent examples of this include the US IRA being labelled as an 'inflation reduction' policy or the UK's flagship clean power mission being 'marketed' largely in terms of improved energy security. This is about how policies are initially communicated socially and what messages are attached to it. A politicising approach would ensure that it is clearly communicated that a policy both has the intention to reduce emissions and enable other social goals. We can extend this thinking to other ways in which governments and their representatives talk about mitigation. Given that citizens are exposed to plenty of media-based arguments about why they should avoid different technologies, like heat pumps or EVs, there should be just as many attempts to communicate the *actual* positive non-emissions outcomes associated with-low emissions transitions.

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As such, alongside more active attempts to design mitigation policies with better distributional outcomes, policymakers should also work on improved transparency and clearer public engagement about benefits (Stokes 2020; Willis 2020). This could be supported by the growth in available information, for example, about the growth of low-emissions jobs around the world (IRENA and ILO 2024); the degree to which low-emissions jobs have already started to outpace those associated with fossil fuel sectors (Hepburn et al. 2020; IEA 2023d); the boost to economic growth associated with low-emissions sectors (IEA 2024a); and, of course, about the significant avoided costs of climate change (Newman & Noy 2023). Such forms of communication, supported by increasingly available evidence, could form part of wider attempts to improve leadership and vision associated with mitigation. Beyond questions of whether citizens, as consumers, would prefer electricity or gas-based heating – this entails actively engaging them in wider, more substantive deliberation and education. This approach would also leave less deliberative space for coalitions against mitigation to fill with negative and 'backlash' style stories. These stories, in any event, often overplay the risks for citizens associated with fossil fuel phase out and sometimes underplay levels of support for climate mitigation.

This social interaction-focused framing of policymaking suggests that further rounds of politicisation in terms of deliberation about policy design, how to balance policy goals, and communicate about mitigation policy is possible if we face contestations and use them to inform policy-society-politics links. This is about proactively seeking to manage aspects of change, but also about making socially informed choices, fairness within change, how to better realise opportunities associated with low-emissions transitions, and what policy or structural changes might be required to better support citizens in low-emissions living.

7.3.2 Time: Climate Mitigation as a Long Process

I make a second appeal here to embrace the politics of mitigating for climate change as a process that takes place over many decades and involves varied phases – depending on local material, political, and socio-economic contexts. This approach, of course, has structured the analysis in this book and revealed a range of insights. Policymakers in different jurisdictions are now in a position to take stock of where their processes of mitigation are, in relation to where they have come from, and where they need to go next. This could extend to the deliberation of the outcomes of previous (non-)decisions and experiences in mitigation from other countries, cities or, indeed, sectors. Thinking politically in this way, by taking time into account, can underpin policy design more attuned to considering social interaction, given its importance in remaking mitigation politics over time. It can also encourage longer term thinking based on understandings of what needs to happen

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next, not least the continued extension of emissions reduction to heat and transport sectors and fossil fuel phase out, improving societal outcomes, the specific complexities associated with doing so, and how they might be better anticipated and managed. For countries that started to develop renewable electricity alternatives more recently, there are plenty of useful insights into how incumbency, climate and development finance, and technological innovation can differently shape outcomes. There are also useful insights into the contributions, in emissions terms, of phasing out coal use, as well as the need to do so in a more just manner.

There have been many ways, explored in Chapters 4 to 6, to think about how policies and material, deliberative, and social changes interconnect over time. In one sense, rounds of increasing ambition in targets have taken place in response to historic policy failures to reduce emissions and to growing scientific evidence of the implications of those failures. It is also the case that recent rounds of increased ambition in terms of targets have been supported by growing technical abilities to decarbonise electricity based on availability and cost reductions in wind, solar, and battery storage (Ives et al. 2021), as well as new scientific evidence. For countries that have already made significant investments in renewable development, this is the phase for further policies to support transmission grid upgrades, demand flexibility, and more availability of storage – especially those countries targeting 100% renewable electricity – whilst recognising and facing into conflicts associated with grid expansion. Given the decreased cost of renewables, for countries that have yet to invest in clean energy the cost of technologies, if not always of capital, is lower than it was. What these insights encourage is domestic climate mitigation analysis and policy design that takes the relevant mitigation phase into account, as well as material, political, and social contexts.

As discussed in Chapter 3, process and phases are also important when thinking about sustainable change from a whole systems perspective. STT research has suggested that there is a need to adjust policies to the phase of transition – with some emphasis on the need to respond to technical and systemic changes that have already taken place (Breetz et al. 2018; Markard et al. 2020; Meadowcroft & Rosenbloom 2023). A whole-systems and time-sensitive approach has also been taken by scholars interested in policy mixes and how they need to adapt at different phases of change (Rogge et al. 2016; Meadowcroft & Rosenbloom 2023; Rogge & Goedeking 2024). On a quite fundamental level, many countries have now reached a point where low-emissions alternatives are sufficiently available that domestic fossil fuel phase-out becomes socially, economically, and technically more possible. At the same time, it is notable that state intervention has been increasing around the world – both for developing low-emissions markets and for setting time frames and rules for fossil fuel phase-out (Breetz et al. 2018; Johnstone & Newell 2018; Kuzemko et al. 2022; Mathieu & Valenzuela 2024).

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Policy choices made in this phase are also dynamically linked to system, social and political change temporally, as they too have possibilities to lead to further institutional change and embedding of low-emissions systems and practices. This suggests opportunities, as discussed above, for policy design with the intention of ensuring structures that better support low-emissions practices and bring on board a broad range of constituents to better facilitate more rounds of just, low-emissions change yet further down the road (Roberts et al. 2018; Kivimaa & Rogge 2022; Rogge & Goedeking 2024). There has been quite a bit of emphasis on policy design for the creation of new corporate constituents (Jacobsson & Lauber 2006; Meckling et al. 2015; Rosenbloom & Meadowcroft 2022), but this can also apply to citizens as voters (including young and new voters). For citizens, this ties us back into questions of improved distributions of costs and benefits of core systems, like transport or energy, and of processes of transition, as well as questions of communicating links between policy action and actual and projected opportunities.

This can also include policies designed to support citizens in making specific choices that could lower their emissions. For example, Spanish policymakers realised that in order to make EVs a viable option for citizens, they would need to make EV recharging facilities available and affordable. As such, they hardwired funding and plans for recharging into the Climate Change and Energy Transition Act of 2021. At the same time, we know that wider trends in some sectors, like transport, continue to negatively affect emissions. For example, SUVs have become both aspirational and deeply embedded – in developed countries they made up over 50% of new car sales in 2023, with similar trends emerging in some middle-income economies (IEA 2024c). Indeed, if SUVs were a country, they would be the world's fifth largest emitter as they accounted for more than 20% of the growth in global energy-related CO^2 emissions in 2023 (ibid.). In the end, people want affordable, reliable, and accessible services but also, often, aspirational material goods. This suggests an extension of phase-out strategies beyond ICE cars to include heavy passenger vehicles.

Despite increased availability of lower emissions alternatives, fossil fuel use remains the core explanation as to why the global 'emissions gap' between the Paris aim of 1.5ºC and stated policies persists. Differential phases of mitigation are relevant here – this time in relation to the Kyoto agreement to continuing economic development based on the widely accepted industrialisation model for developing countries. Some large economies, like China, India, and Indonesia, have in the intervening years grown rapidly via energy-intensive growth models, thus maintaining demand for coal-fired electricity, whilst at the same time producing low-emissions technologies, often for export. Differential phases between countries and regions also became evident in net zero targets that are decades

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apart – for example, Copenhagen's target for net zero by 2025 and India's by 2070. In a narrow sense, countries that had not yet reduced emissions and with further away targets for doing so could be framed as playing catch-up with regions, 'leaders', that had already started to reduce emissions. This is important largely to the extent that some of those countries are very high emitters, that is, China, India, Indonesia, and Russia. The fate of China's emissions, whether they peak as planned by 2030, is politically important internationally, not least to the extent that their ability to do so reduces the effectiveness of anti-mitigation campaigns in OECD countries that frame domestic action as futile given China's rising emissions. For China, reducing emissions is a fine balancing act between huge growth in renewables, the need for grid improvements to make more use of renewables, and economic development based on coal-fired power. Interestingly, in another sense, some OECD countries are playing catch-up with countries like China and South Korea in terms of green industrial policy and strategies to capitalise on global clean-tech markets.

At the same time, some large producers of fossil fuels, not least Saudi Arabia and Russia, have no fossil fuel phase-out plans, whilst large incumbent energy companies tend to have extremely varied but largely insufficient sustainable transitions plans (Trencher et al. 2023). The social implications of phasing out fossil fuels remain vast – reduced tax income and social spending, lower foreign exchange income, job losses, and stranded assets – particularly in the absence of clear diversification plans (Ivleva & Tänzler 2019). These tensions are far more widely recognised now – we are in an era when the actualities of fossil fuel phase out are being politicised in a deliberative sense. There has been a considerable rise in research that explores and explains strategies and tactics used by anti-mitigation coalitions to contest mitigation, with some emphasis on energy incumbents (Downie 2017; Franta 2021; Buller 2022; Paterson et al. 2023; Daley et al. 2024).

At the same time, attempts are under way to position the persistence of fossil fuel production and use as essentially avoidable and not natural and/or essentially socially positive. In 2021, at COP26, fossil fuel phase-down was finally recognised for the first time within UNFCCC protocols, at COP28 a pact calling on countries to transition away from fossil fuels was agreed, whilst more detailed questions of how to address this thorniest of issues remained central to discussions at COP29 in Baku, Azerbaijan. The International Energy Agency (IEA) is now one of the most vocal global proponents of fossil fuel phase-out, with claims increasingly backed by evidence of how it can be achieved. This suggests relatively more widespread recognition, beyond specific divestment and other movements, that it is time to make coal, oil, and gas more subject to mitigation policy and political agency and agreements. Some claim that 'supply side' policies that explicitly seek to restrict the production of fossil fuels and keep

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sizeable quantities in the ground have emerged as the new 'frontier' of climate governance (Newell & Daley 2024).

Finding workable solutions necessarily involves contestations with powerful actors. Not least as many anti-mitigation groups may have historically thought that they might be able to forever put this question off but now find themselves devising, albeit insufficient, net zero strategies. There is a growing emphasis in these debates on leaving assets in the ground – something previously unimaginable when fears centred around peak supply. Contestations by energy corporations are now as much about delay and perpetuating their businesses – often through an emphasis on carbon capture and storage (CCS), blue hydrogen, and offsetting – than denial and obfuscation. Many within climate coalitions are now far more familiar with such tactics, partly as a result of the growing availability of relevant research.

On another level, it is becoming clearer that it is extremely hard to phase fossil fuels out without active negotiation and management of the process. Time is important here too. Governments tend to set temporal targets for phasing out different fossil fuels and associated technologies, to give stakeholders time to adapt – but phase-out time commitments can also be altered by new political parties as they come into power (Newell & Daley 2024). Energy companies also continue to develop mitigation delay strategies, recently around promoting CCS, offsetting, and petrochemical use, which offer more space for continued fossil fuel production even under 'net zero' futures (Tilsted et al. 2023). More complicated still, and requiring greater levels of debate, deliberation and compromise, are questions of whose fossil fuel assets should stay in the ground and of who pays the cost of decommissioning complex infrastructures, like national gas networks (Rosenow et al. 2025). Equity and justice are sometimes cited as the basis for deciding whose assets should stay in ground (Welsby et al. 2021) – but others, like Saudi Arabia, have argued that the cheapest and cleanest fossil fuels should be produced.

What is needed, then, are political approaches that directly engage fossil fuel interests and are aware of tactics and arguments used to counter mitigation and their weaknesses. This would also explicitly include far better articulations of evidence of economic, jobs, avoided costs, and improved welfare opportunities associated with low-emissions alternatives – to narrow down the space for anti-mitigation fears to inform public opinion. Indeed, there are others who argue that backlash against mitigation is less prevalent than support, particularly in Europe, but, because it is magnified by actors with money and access to media channels, it can be overplayed politically (Abou-Chadi et al. 2024).

Rather, then, than running away from complex questions about phase out, exploring it as a process that happens over time, and at different times in different parts of the world, offers opportunities for more extended deliberations. It also offers opportunities for greater consideration of active demand side policy as one

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method of addressing phase-out conundrums as well, arguably, as addressing fears over geoeconomic competition for critical materials needed during the decades of renewable expansion. Whilst destruction of demand for fossil fuels has not been an automatic outcome of the increased availability of low-emissions alternatives, it is also increasingly argued that explicitly lower energy demand systems offer emissions, welfare, and supply security benefits (Selvakkumaran & Limmeechokchai 2013; Grubler et al. 2018; Barrett et al. 2021; Price et al. 2023; Bento et al. 2024). This also relates to questions of what actions policymakers can take today given the need to accelerate change and the widespread availability of demand-side policies and technologies. Explicitly asking about how one might act today – for example, through establishing circular economies, reductions in peak electricity demand, enabling more flexible demand, improving housing stock, and making large-scale storage more available – to manage demand can be considered a further form of deliberative politicisation.

7.3.3 Proactive Policymaking Based on Experience and Learning (in Context)

Closely related to sensitivity to time is the research and policy idea of deliberately setting out to take better account of the accumulation of experience, ideas, knowledge, and data related to the increasingly broad task of mitigation. This approach hinges on the importance to mitigation policy and politics of deliberation. Research that has explored questions of how to make more *deliberate* attempts to accelerate mitigation (Roberts et al. 2018) has provided interesting insights about opportunities for creating new pro-mitigation constituents, the needs to focus on positive feedback loops in policy design, and the importance of context to policy design. Here, however, I argue that it is also vital that climate mitigation researchers and policymakers make the most of collective mitigation experiences as a basis for thinking politically about how to proceed.

The world is explicitly no longer at the start of the political process of trying to reduce emissions and that matters in many ways – not least in terms of capacities to deliberate and to act. Put simply, we (collectively) know more now, whilst there are more organisations dedicated to the sharing and transfer of mitigation experiences – both in technical and policy terms. Interestingly, whilst the narratives used to delay climate mitigation still highlight uncertainties around economic costs of action, energy security implications, and public preferences for continued high carbon lifestyles, narratives used to inform sustainable change have started to become more firmly based in evidence of emissions reductions, and of the social benefits, and avoided costs, associated with mitigation.

From the perspective developed in this book, the politics of mitigation has become just as much a question of accelerating sustainable change as about how

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to make the best use of capacities that are committed to deliberating mitigation policies, in specific places, and at points in time. Instead of lamenting the gap between what 'the science' tells us needs to be done and what targets and policies in place today may deliver in terms of warming, and blaming politics, it is more useful to repoliticise current policy-making on the basis of knowledge and data that has become available. Put another way, it is important not to waste knowledge but to take experiences about mitigation successes, conflicts, and about how political and material institutions have shaped choices and outcomes, and put them to good use. For example, countries and cities starting to expand renewables can anticipate what kinds of policies will be needed next to balance a more intermittent electricity supply – that is, grid improvements, storage, and flexibility. Other countries, like Indonesia, have responded to high pollution levels from coal use as well as insights from China in taking the decision to integrate low-carbon growth into its national development strategy (World Resources Institute 2020).

On one level, if a core question of this phase is what can be done to reduce emissions globally by phasing out fossil fuels – the answer is increasingly that a lot *can* be done because of decades of low-emissions policies, investments, experiments, demonstrations of the possible, dissemination, and reduced technology costs. Recent research highlights the degree to which models and scenarios have consistently underestimated cost reductions in solar, wind, and storage and global renewable growth (Ives et al. 2021). On another level, there is far greater understanding, as discussed above, of the power and tactics of anti-mitigation coalitions, why they are receptive to certain audiences, and ways that they can be countered.

Other important areas of learning about low emissions transitions have emerged. Not all low-emissions technologies follow the same development and cost trajectories. Part of the reason for rapid cost reductions in solar, wind, and batteries has been their modularity – as opposed to technologies like CCS and nuclear electricity, which have not experienced similar cost reductions over time. Indeed, CCS has been in development, underpinned by public and private investment, since the 1970s, but by 2021 only 27 plants were operational capturing 0.1% of total fossil fuel CO^2 emissions. In 2022 it was estimated that if projects in 'advanced development' come off, that could amount to 0.2% by 2030 (Calverley & Anderson 2022). Growing experience, of expanding clean alternatives, is also showing us that critical materials are essential to low-emissions technologies and manufacturing processes, that demand will be extremely high, and that much production and refining is dominated by one country. So, too, however is it becoming clear that the materials used in these processes are reusable – unlike coal, oil, and gas, which are used up through energy creation – with much more potential to underpin circular economies (Kuzemko et al. 2024).

Staying abreast of all of this geographical and material detail, of course, requires capacity that not all governing bodies have – making the role of trans- and

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inter-national knowledge exchange all the more important. Importantly, transnational organisations have also expanded. Bodies like the IEA, IRENA, and C40 provide significant amounts of free-to-access date, information, and mitigation policy-relevant materials. What these learnings suggest is that policymakers need to differentiate better between clean technologies and 'critical' material associated with low-emissions transitions, whilst strategies to avoid resource use have become more important in an increasingly conflictual world.

Beyond technical and material learnings and cost reductions, there has also been an accumulation of potential policy and political experience in mitigation, which can be used to inform policy design to reflect historic policy experimentation and learning (Kivimaa and Rogge 2022; Bolet et al. 2023). New understandings of mitigation, policies, and outcomes have already been used as the basis for contesting insufficient mitigation policy – from the use of the IPCC's 1.5ºC report to underpin net zero commitments; to learning in the EU and elsewhere about the social costs of low-emissions transitions and the need for just transition policy; to local government turnarounds in policy approaches when they better understood potential effects on workers. There are also a number of ongoing political experiments – Germany's commitment to 100% renewable electricity will be closely watched to see if it can work in a large-scale, relatively industrialised economy; as will ongoing political programmes of phasing-out gas in the Netherlands, Hamburg, and Mannheim. Important insights still need to be gained into how to more proactively manage the decline in fossil fuel infrastructures, like national gas grids (Rosenow et al. 2025).

Given the growth in mitigation scepticism, experiments are even more important when they can demonstrate what has become possible in mitigation terms and wider positive effects. This includes projects explicitly designed to demonstrate the use of low-emissions technologies and practices with a view to making them more tangible, understandable, and normalising them where they were previously viewed as something to be wary of. A good example of this is policy projects supported by sub-national governments to demonstrate what it is like to live in insulated homes with a renewable electricity supply and storage – by scheduling local viewings of those homes for surrounding communities (Kuzemko & Britten 2020). Clearly, many policies have worked towards emissions reduction, some in relatively more just ways, but it is also becoming increasingly clear that there have been too many failures in communicating benefits and successes.

7.3.4 Policy Integration and Dynamic Interactions between Policy Areas

One of the core insights of this book, set out in Chapter 3 but explored in more detail in Chapter 5, is that mitigation policies and politics are dynamically interrelated to

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other policy areas and goals, whilst meeting goals in most other areas of policy has historically produced GHG emissions. These dynamic relations have done much to shape mitigation policy decisions, outcomes, and politics. At the same time, as discussed above, the outcomes of some mitigation policies, for example to deliver high percentages of electricity from renewable sources, have cascaded into other sectors. Industrial policies increasingly seek to capitalise on global demand growth for resources and manufactured goods required to build renewable systems, fears of competition over the same resources and goods have resulted in new foreign policy and security strategies, whilst the EU's Green Deal explicitly sought to integrate mitigation goals with the delivery of health, welfare, and growth goals. What this suggests are some shifts away from making individual policy choices, based largely on least-cost policy principles, towards more overt realisations of how policy areas interact with one another as nations attempt to meet net zero goals in a more just manner. This takes us one step towards more nuanced understandings of how climate mitigations polices have become enmeshed within wider systems of policymaking and politics that can be born in mind when designing new policies.

The early notion of integrating environmental goals, like climate mitigation, across all departments of government proved itself to be a major challenge in practice. As explored in Chapter 5, this was not least because in most national, if not sub-national, settings, policymaking has tended to be siloed, with each department committed to public policy goals that often inferred high(er) emissions, whilst departments have often competed with one another for resources within pre-existing hierarchies. Placing emissions reduction goals on existing department or ministries of government, like energy, business, or transport, has resulted in public policy language of trade-offs between meeting pre-existing goals, like between road expansion to accommodate more cars and demands for more walking and cycling. Framing relations between policy areas in terms of trade-offs has often been taken up strategically by those seeking delay to climate mitigation measures and by those, of a market liberal persuasion, who emphasise policy costs over the socio-economic costs of climate change. Competition between departments for fiscal resources has often been heightened at times of austerity or polycrisis. This has often led to preferences to concentrate public resources on fixing, say, cost of living crises but it, arguably, has also raised the importance of designing policies that resolve more than one policy goal.

Interrelationships between policy areas differ depending on material and social contexts, for example, how reliant a nation/region is on fossil fuels or whether low-emissions alternatives are available yet, but they also change over time. As discussed above, trade-offs between meeting multiple policy goals change, whilst mitigation policy co-benefits develop over time. Take the energy sector – which is further down the path of low-emissions transition than heat, transport,

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or agriculture. Because in many countries, low-emissions electricity-generation alternatives, like solar, wind, batteries, and demand reduction technologies, have become more accessible and affordable, this has led to relatively fewer trade-offs with existing policy goals, like energy security and affordability. Interestingly, this was the conclusion that the EU came to post Russia's invasion of the Ukraine – that is, a more rapid low-emissions transition, based in turn on demand reduction and flexibility, clean technology development and roll-out, heat and transport electrification, and gas phase-down, is now what will deliver secure and affordable energy. This is now also encapsulated in talk of a new energy security paradigm based on a far broader variety of clean energy solutions, with some emphasis on increased energy independence (Hanoteaux et al. 2024), and within strategies for lower resource demand systems that rely more on circular economies (Bento et al. 2024; Grabbe & Moffat 2024; European Commission 2025a).

Climate mitigation policy integration can also be about avoiding the playing off of mitigation goals against other departments, by designing policies that meet more than one goal. At a basic level, some countries and cities pursue climate mitigation because of an interest in addressing hunger and poverty issues. A recent example is Indonesia's 2024 G20 announcement on coal phase out and green industrial policy, which was framed in relation to the effects of climate change on domestic welfare, as well as opportunities associated with clean energy based growth (Cabinet Secretariat of the Republic of Indonesia 2024). The EU Green Deal and Fit-for-55 packages represent a clear recognition that policy areas inter-relate and attempts to more positively connect mitigation strategies with employment, welfare, and health goals (Dupont et al. 2024). Recent EU planning regulation changes likewise recognise the implications of, often local, planning decisions on the roll-out of renewables and an attempt to integrate mitigation goals, not least via the designation of renewables as in the 'overriding public interest' (EC 2022). There is increasing evidence globally, and from nations like China, South Korea, and the UK, that green industrial strategies can be expansionary in job and economic terms. From this perspective, policies that result in higher emissions, either by neglecting to develop clean alternatives or overly subsidising high-emissions practices, may deliver short-term but not medium- or long-term gains.

Related research explores the question of policy mixes and their role in climate mitigation at national (Kivimaa & Kern 2016; Rogge & Reichardt 2016) and sub-national levels (Trencher & van der Heijden 2019). The argument here is that multiple policies affecting different areas are needed to achieve low-emissions transitions. Policy mixes might, then, include policies that increase electricity generated by renewables balanced by those that insulate households from high household energy costs (Kuzemko et al. 2016a). They can also include policies to destabilise high-emissions regimes, that is, by phasing out coal, whilst also

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creating alternative low-emissions goods, services, and jobs (Kivimaa & Kern 2016). Recently, the emphasis in many countries has been on finding the right mix of policy, which might include welfare, technology, and industrial policies, to engender fairer emissions reduction within and across systems. Policy mix research has more recently set out how to identify positive, neutral, and negative interactions between policy instruments, and how to recognise opportunities for at least neutral or, preferably, positive interactions (Trencher & van der Heijden 2019). Recent research on the effectiveness of climate mitigation policy, which analysed 1,500 policies, found that when policies are part of a mix, they tend to be more effective (Stechemesser et al. 2024).

Developing deliberative capacities to think across departments is also relevant in a technical sense, to the extent that, with the progression of electrification, changes have become increasingly multi-sector – connecting renewable power, heat, mobility, and industrial processes (Olbrich et al. 2024). Circular economy processes, being developed in China, the EU, and Africa, can be applied in multiple sectors, including electricity storage, technological appliances, furniture, and battery production. The EU's 2025 'Clean Industrial Deal' explicitly sets out industrial strategy as pushing a move beyond traditional silo solutions to look at entire value chains (European Commission 2025b). Thinking across departments is also crucial to avoiding policies that reduce emissions but hinder livelihoods or quality of life for already vulnerable sections of the population. In some jurisdictions mitigation policy is now substantially more focused on integrating improved health and welfare outcomes into low-emissions transitions processes, with some emphasis on processes of coal phase-out (Sanz-Hernandez et al. 2020; Bolet et al. 2024; Cantoni & Brisbois 2024). This is partly about identifying possible, and ensuring more, co-benefits resulting from mitigation policy, as explored in Chapter 6, but also about understanding the knock-on effects of policy in other areas for attempts to mitigate fairly.

In terms of identifying further positive interactions between mitigation policy and other policy areas, the increasingly wide suite of demand-side management policies have much to offer in health, welfare, and security terms (Barrett et al. 2021; Creutzig et al. 2022). Demand-side measures include more distributed renewable generation that is situated closer to sites of demand; energy efficiency of products and buildings; demand that is responsive to the supply of electricity; overall reductions in demand, including by lowering levels of 'peak' demand; and recycling, repurposing, and reuse strategies. Research into how different demand-side measures relate to other policy goals has expanded considerably to detail co-benefits of lower demand with energy security and with welfare, health and well-being, and development in a wide variety of national settings (Selvakkumaran & Limmeechokchai 2013; Grubler et al. 2018; Chatterjee et al.

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2022; Creutzig et al. 2022; Bento 2024). Energy efficiency is an area where there has been more longstanding multiple policy goal thinking – by using household retrofits and welfare policy to support lower household energy prices during transition phases towards renewables and away from fossil fuels (Kuzemko et al. 2016b). Circular economy strategies also offer novel solutions to current fears of overreliance on single-country sources of vital low-emissions goods and associated refining and mining products. The 'resource efficient Europe' roadmap and Circular Economy Action Plan of 2020 reflect overall concerns with resource extraction and about global supply chains (European Commission 2020 and 2025b). By 2025, the EU's new 'Clean Industrial Deal' placed the circular economy at the centre of its bid to compete globally whilst decarbonising (European Commission 2025b). As such, the circular economy is also increasingly an area of interest in jobs, development, and growth terms.

7.4 Conclusions

This chapter has both explored ways in which mitigation politics has changed since the first phase of getting climate onto agendas and particular aspects of the phase of seeking to accelerate emissions reductions and improve distributional outcomes, amidst multiple crises. The starting position was, of course, that this is a mighty challenge – but one that can be made easier by thinking politically about how to balance mitigation with wider societal concerns. This involves a reframing of how we think about mitigation policymaking by foregrounding societal experiences of mitigation; explicitly recognising the temporalities of change; considering how interrelationships between policy areas work; and proactively using historical mitigation experiences, learnings, and examples as a basis for better policy design and communication. Too often mitigation policy has been assessed on a policy-by-policy basis using narrow criteria; positive emissions and non-emission outcomes have not been routinely communicated; whilst policies that can result in lower emissions are often hidden behind other potential outcomes. Political challenges to mitigation can hoover up a lot of space and lead to despair over possibilities for mitigation, but in most countries climate change has remained a majority societal concern, whilst phasing out fossil fuels was always going to attract high levels of policy push-back – given the resources of actors that stand to lose out.

Arguably the current context of needing to accelerate mitigation policy and emissions reduction at a time of wars, growing trade barriers, and cost-of-living crises more than ever foregrounds the need for those that research mitigation and policymakers to think more politically. The approach to policy suggested in this chapter could contribute towards lessening possibilities for anti-mitigation coalitions to undermine mitigation on the basis of negative socio-economic outcomes.

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Whilst media coverage in many countries is often concentrated on what is wrong with mitigation policy, informed by arguments of anti- and pro-mitigation groups, it rarely equivocally sets out what mitigation policy has achieved in avoided emissions and warming and in economic growth and jobs terms. This seems to be a serious failing. For example, if economic growth remains a vote-winner, then the significance of contributions from clean energy sectors to global, and many national economies, should be far more widely discussed. This is not to argue that 'clean' energy is going to solve climate change in the medium term, but at a time when political parties in some countries have become more polarised on mitigation, communicating the benefits of mitigation in tangible terms seems like a useful approach. Assumptions, within STT literatures, that clean innovations would naturally disrupt fossil fuel regimes may have been overly optimistic, but given that the politics of mitigation in this phase is so clearly associated with fossil fuel phase-out, clear narratives about the readiness of, and opportunities associated with, clean alternatives would also seem appropriate.

Recommendations for a reframing of mitigation policy in this chapter have been closely informed by the more nuanced and disaggregated concept of politics and politicisation developed in this book, which foregrounds collective choice and conflict, state agency and capacity, deliberation, and social interaction as aspects of politics. The concluding chapter, which focuses the analysis back on questions of politicisation, further explores the complexities and opportunities associated with being actively political, in a sustained manner, about climate change mitigation.

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