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National and Sub-national Policies and Institutions

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Executive Summary

Long-term deep emission reductions, including the reduction of emissions to net zero, is best achieved through institutions and governance that nurture new mitigation policies, while at the same time reconsidering existing policies that support continued Greenhouse Gas (GHG) emissions (*robust evidence*, *high agreement*). To do so effectively, the scope of climate governance should include both direct efforts to target GHG emissions and indirect opportunities to tackle GHG emissions that result from efforts directed towards other policy objectives. {13.2, 13.5, 13.6, 13.7, 13.9}

Institutions and governance underpin mitigation by providing the legal basis for action. This includes setting up implementing organisations and the frameworks through which diverse actors interact (*medium evidence*, *high agreement*). Institutions can create mitigation and sectoral policy instruments; policy packages for low-carbon system transition; and economy-wide measures for systemic restructuring. {13.2, 13.7, 13.9}

Policies have had a discernible impact on mitigation for specific countries, sectors, and technologies (*robust evidence*, *high agreement*), avoiding emissions of several GtCO^2-eq yr^{-1} (*medium evidence*, *medium agreement*). Both market-based and regulatory policies have distinct, but complementary roles. The share of global GHG emissions subject to mitigation policy has increased rapidly in recent years, but big gaps remain in policy coverage, and the stringency of many policies falls short of what is needed to achieve strong mitigation outcomes (*robust evidence, high agreement*). {13.6, Cross-Chapter Box 10 in Chapter 14}

Climate laws enable mitigation action by signalling the direction of travel, setting targets, mainstreaming mitigation into sector policies, enhancing regulatory certainty, creating law-backed agencies, creating focal points for social mobilisation, and attracting international finance (*medium evidence*, *high agreement*). By 2020, 'direct' climate laws primarily focused on GHG reductions were present in 56 countries covering 53% of global emissions, while more than 690 laws, including 'indirect' laws, may also have an effect on mitigation. Among direct laws, 'framework' laws set an overarching legal basis for mitigation either by pursuing a target and implementation approach, or by seeking to mainstream climate objectives through sectoral plans and integrative institutions. {13.2}

Institutions can enable improved governance by coordinating across sectors, scales and actors, building consensus for action, and setting strategies (*medium evidence*, *high agreement*). Institutions are more stable and effective when they are congruous with national context, leading to mitigation-focused institutions in some countries and the pursuit of multiple objectives in others. Sub-national institutions play a complementary role to national institutions by developing locally-relevant visions and plans, addressing policy gaps or limits in national institutions, building local administrative structures and convening actors for place-based decarbonisation. {13.2}

Sub-national actors are important for mitigation because municipalities and regional governments have jurisdiction over climate-relevant sectors such as land-use, waste and urban policy; are able to experiment with climate solutions; and can forge partnerships with the private sector and internationally to leverage enhanced climate action (*robust evidence*, *high agreement*). More than 10,500 cities and nearly 250 regions representing more than 2 billion people have pledged largely voluntary action to reduce emissions. Indirect gains include innovation, establishing norms and developing capacity. However, sub-national actors often lack national support, funding, and capacity to mobilise finance and human resources, and create new institutional competences. {13.5}

Climate governance is constrained and enabled by domestic structural factors, but it is still possible for actors to make substantial changes (*medium evidence*, *high agreement*). Key structural factors are domestic material endowments (such as fossil fuels and land-based resources); domestic political systems; and prevalent ideas, values and belief systems. Developing countries face additional material constraints in climate governance due to development challenges and scarce economic or natural resources. a broad group of actors influence how climate governance develop over time, including a range of civic organisations, encompassing both pro-and anti-climate action groups. {13.3, 13.4}

Mitigation strategies, instruments and policies that fit with dominant ideas, values and belief systems within a country or within a sector are more easily adopted and implemented (*medium evidence*, *medium agreement*). Ideas, values and beliefs may change over time. Policies that bring perceived direct benefits, such as subsidies, usually receive greater support. The awareness of co-benefits for the public increases support of climate policies (*robust evidence*, *high agreement*). {13.2, 13.3, 13.4}

Climate litigation is growing and can affect the outcome and ambition of climate governance (*medium evidence*, *high agreement*). Since 2015, at least 37 systemic cases have been initiated against states that challenge the overall effort of a state to mitigate or adapt to climate change. If successful, such cases can lead to an increase in a country's overall ambition to tackle climate change. Climate litigation has also successfully challenged governments' authorisations of high-emitting projects setting precedents in favour of climate action. Climate litigation against private sector and financial institutions is also on the rise. {13.4}

The media shapes the public discourse about climate mitigation. This can usefully build public support to accelerate mitigation action, but may also be used to impede decarbonisation (*medium evidence*, *high agreement*). Global media coverage (across a study of 59 countries) has been growing, from about 47,000 stories in 2016–2017 to about 87,000 in 2020–2021. Generally, the media representation of climate science has increased and become more accurate over time. On occasion, the propagation of scientifically misleading information by organised counter-movements has fuelled polarisation, with negative implications for climate policy. {13.4}

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Explicit attention to equity and justice is salient to both social acceptance and fair and effective policymaking for mitigation (*robust evidence*, *high agreement*). Distributional implications of alternative climate policy choices can be usefully evaluated at city, local and national scales as an input to policymaking. Institutions and governance frameworks that enable consideration of justice and just transitions are likely to build broader support for climate policymaking. {13.2, 13.6, 13.8, 13.9}

Carbon pricing is effective in promoting implementation of low-cost emissions reductions (*robust evidence, high agreement*). While the coverage of emissions trading and carbon taxes has risen to over 20% of global CO_2 emissions, both coverage and price are lower than is needed for deep reductions. The design of market mechanisms should be effective as well as efficient, balance distributional goals and find social acceptance. Practical experience has driven progress in market mechanism design, especially of emissions trading schemes (*robust evidence*, *high agreement*). Carbon pricing is limited in its effect on adoption of higher-cost mitigation options, and where decisions are often not sensitive to price incentives such as in energy efficiency, urban planning, and infrastructure (*robust evidence*, *medium agreement*). Subsidies have been used to improve energy efficiency, encourage the uptake of renewable energy and other sector-specific emissions saving options (*robust evidence*, *high agreement*). {13.6}

Regulatory instruments play an important role in achieving specific mitigation outcomes in sectoral applications (*robust evidence*, *high agreement*). Regulation is effective in particular applications and often enjoys greater political support, but tends to be more economically costly, than pricing instruments (*robust evidence*, *medium agreement*). Flexible forms of regulation (for example, performance standards) have achieved aggregate goals for renewable energy generation, vehicle efficiency and fuel standards, and energy efficiency in buildings and industry (*robust evidence*, *high agreement*). Infrastructure investment decisions are significant for mitigation because they lock-in high- or low- emissions trajectories over long periods. Information and voluntary programmes can contribute to overall mitigation outcomes (*medium evidence*, *high agreement*). Designing for overlap and interactions among mitigation policies enhances their effectiveness (*robust evidence*, *high agreement*). {13.6}

Removing fossil fuel subsidies would reduce emissions, improve public revenue and macroeconomic performance, and yield other environmental and sustainable development benefits; subsidy removal may have adverse distributional impacts especially on the most economically vulnerable groups which, in some cases can be mitigated by measures such as redistributing revenue saved, all of which depend on national circumstances (*high confidence*); fossil fuel subsidy removal is projected by various studies (using alternative methodologies) to reduce global CO_2 emissions by 1–4%, and GHG emissions by up to 10% by 2030, varying across regions (*medium confidence*). {6.3, 13.6}

National mitigation policies interact internationally with effects that both support and hinder mitigation action (*medium evidence*, *high agreement*). Reductions in demand for fossil fuels tend to negatively affect fossil fuel exporting countries (*medium evidence*, *high agreement*). Creation of markets for emission reduction credits tends to benefit countries able to supply credits. Policies to support technology development and diffusion tend to have positive spillover effects (*medium evidence*, *high agreement*). There is no consistent evidence of significant emissions leakage or competitiveness effects between countries, including for emissions-intensive trade-exposed industries covered by emission trading systems (*medium evidence*, *medium agreement*). {13.6}

Policy packages are better able to support socio-technical transitions and shifts in development pathways toward low-carbon futures than are individual policies (*robust evidence*, *high agreement*). For best effect, they need to be harnessed to a clear vision for change and designed with attention to local governance context. Comprehensiveness in coverage, coherence to ensure complementarity, and consistency of policies with the overarching vision and its objectives are important design criteria. Integration across objectives occurs when a policy package is informed by a clear problem framing and identification of the full range relevant policy sub-systems. {13.7}

The co-benefits and trade-offs of integrating adaptation and mitigation are most usefully identified and assessed prior to policy making rather than being accidentally discovered (*robust evidence*, *high agreement*). This requires strengthening relevant national institutions to reduce silos and overlaps, increasing knowledge exchange at the country and regional levels, and supporting engagement with bilateral and multilateral funding partners. Local governments are well placed to develop policies that generate social and environmental co-benefits but to do so require legal backing and adequate capacity and resources. {13.8}

Climate change mitigation is accelerated when attention is given to integrated policy and economy-wide approaches, and when enabling conditions (governance, institutions, behaviour, innovation, policy, and finance), are present (*robust evidence*, *medium agreement*). Accelerating climate mitigation includes simultaneously weakening high carbon systems and encouraging low-carbon systems; ensuring interaction between adjacent systems (e.g. energy and agriculture); overcoming resistance to policies (e.g., from incumbents in high carbon emitting industries), including by providing transitional support to the vulnerable and negatively affected by distributional impacts; inducing changes in consumer practices and routines; providing transition support; and addressing coordination challenges in policy and governance. {13.7, 13.9}

Economy-wide packages, including economic stimulus packages, can contribute to shifting sustainable development pathways and achieving net zero outcomes while meeting short term economic goals (*medium evidence*, *high agreement*). The 2008–2009 Global Recession showed that policies for sustained economic recovery go beyond short-term fiscal stimulus to include long-term commitments of public spending on the low-carbon economy; pricing reform; addressing affordability; and minimising distributional impacts. COVID-19 spurred stimulus packages and multi-objective recovery policies that may have the potential to meet short-term economic goals while enabling longer-term sustainability goals. {13.9}

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13.1 Introduction

This chapter assesses national and sub-national policies and institutions. Given the scale and scope of the climate challenge, an immediate challenge for this assessment is defining its scope. Because a very wide range of institutions and policies at multiple scales carry implications for climate change, the approach followed here is to embrace a broad approach. Consequently, institutions and policies discussed include dedicated climate laws and organisations (Section 13.2) and direct mitigation policies such as carbon taxes (Section 13.6), but also those, such as sectoral ministries and their policies (Sections 13.6 and 13.7) and sub-national entities such as regional bodies, cities, and their policies (Section 13.5), the implications of which are salient to mitigation outcomes. This approach recognises that there are important linkages with international climate governance (Chapter 14), notably the role of internationally mandated Nationally Determined Contributions' in stimulating domestic policy development (Section 13.2), transnational networks in spurring sub-national action (Section 13.5), and international effects of domestic policies (Section 13.6).

This encompassing approach to climate governance is also built on a recognition that climate policymaking is routinely formulated in the context of multiple policy objectives such as energy security, energy access, urban development, and mitigation-adaptation linkages. This informs policymaking based on an understanding that to fully maximise direct and indirect climate mitigation potential, maximising co-benefits and minimising trade-offs should be explicitly sought rather than accidentally discovered and policies designed accordingly. This understanding also informs the design of institutions (Section 13.2) and policies (Sections 13.6 and 13.7) as well as the linkage between mitigation and adaptation (Section 13.8).

The chapter also engages with several new developments and an expansion of the literature since AR5.

A growing literature assesses how national policymaking on climate mitigation is dependent on national politics around, and building consensus on, climate action. This, in turn, is shaped by both nationally specific structural features (Section 13.3) and the role of different actors in the policymaking process (Section 13.4). Important new avenues through which climate policy making is shaped, such as climate litigation (Section 13.4.2), and channels for public opinion formation, such as the media (Section 13.4.3) are also assessed. The chapter weaves discussions of the role of justice, understood through a discussion of procedural justice (Section 13.2), distributional justice (Section 13.6) and vulnerability (Section 13.8), and its role in creating public support for climate action (Section 13.9).

A significant new theme is the focus on the dynamic elements of policy making, that is, how policy can be designed to accelerate mitigation. This includes through technological transitions, socio-technical transitions, shifts in development pathways and economy-wide measures. This literature emphasises the importance of examining not just individual policies, but packages of policies (Section 13.7) and how these are enabled by the alignment of policy, institutions, finance, behaviour and innovation (Section 13.9). Also new is attention to the opportunities for economy-wide system change presented by consideration of post-COVID recovery packages, and wider efforts at sustainable economic restructuring (Section 13.9). Consistent with the discussion in Chapter 4, these larger approaches offer opportunities to undertake systemic restructuring and shift development pathways.

Finally, the chapter addresses core themes from earlier assessment reports, but seeks to do so in an enhanced manner. The discussion of climate institutions assesses a growing literature on climate law, as well as both purpose-built climate organisations and the layering of climate responsibilities on existing organisations at national and sub-national scales (Section 13.2). The discussion of policies focuses on an *ex post* assessment of policies, as well as the interaction among them, and learnings on how they can be combined in packages (Sections 13.6 and 13.7). It also lays out a framework for their assessment that encompasses environmental effectiveness, economic effectiveness, distributional outcomes, co-benefits, institutional requirements, as well as a new criterion of transformational potential (Section 13.6).

The aim of this chapter is to assess the full range of the multi-stranded and diverse literature on climate institutions and policy, reflecting the richness of real-world climate governance.

13.2 National and Sub-national Institutions and Governance

Institutions and governance arrangements can help address 'policy gaps' and 'implementation gaps' (Cross-Chapter Box 4 in Chapter 4) that hinder climate mitigation. While the need for institutions and governance is universal, individual country approaches vary, based on national approaches and circumstances, as discussed in this section.

Since AR5, the understanding of climate governance has become more encompassing and complex, involving multiple actors, decision-making arenas, levels of decision-making and a variety of political goals. Climate governance sometime directly targets GHG emissions; at other times mitigation results from measures that primarily aim to solve other issues, for instance relating to food production, forest management, energy markets, air pollution, transport systems or technology development, but with mitigation or adaptation effects (Karlsson et al. 2020).

Consistent with usage in this assessment, institutions are rules, norms and conventions that guide, constrain or enable behaviours and practices, including the organisations through which they operate, while governance is the structure, processes and actions that public and private actors use to address societal goals (See Glossary for complete definitions). Multiple terms are used in the literature to discuss climate governance, often varying across countries. Climate laws, or legislation, is passed by legislatures, and often sets the overarching governance context, but the term is also used to refer to legislation that is salient to climate outcomes even if not centrally focused on climate change. National strategies, often referred to as plans, most often operate through executive action by government, set guidance for action and often are not legally binding, although strategies may also be enshrined in law. Both laws and strategies may elaborate targets, or goals, for emissions outcomes, although these are not necessary components of laws and strategies. While laws typically operate at the national level (states may also make laws in federal nations), strategies, plans and targets may also operate at the sub-national level.

This section begins with a discussion of national laws for climate action (Section 13.2.1), followed by a discussion of national strategies (Section 13.2.2). The third section examines institutions (Section13.2.3), including organisations that are established to govern climate actions, and the final section explores sub-national institutions and their challenges in influencing climate mitigation (Section 13.2.4).

13.2.1 Climate Laws

National laws that govern climate action often set the legal basis for climate action (Averchenkova et al. 2021). This legal basis can serve several functions: establish a platform for transparent target setting and implementation (Bennett 2018); provide a signal to actors by indicating intent to harness state authority behind climate action (Scotford and Minas 2019); promise enhanced regulatory certainty (Scotford et al. 2017); create law-backed agencies for coordination, compliance and accountability (Scotford and Minas 2019); provide a basis for mainstreaming mitigation into sector action, and create focal points for social mobilisation (*medium evidence*, *high agreement*) (Dubash et al. 2013). For lower/middle income countries, in particular, the existence of a law may also attract international finance by serving as a signal of credibility (Fisher et al. 2017). The realisation of these potential governance gains depends on local context, legal design, successful implementation, and complementary action at different scales.

There are both narrow and broad definitions of what counts as 'climate laws'. The literature distinguishes direct climate laws that explicitly considers climate change causes or impacts – for example through mention of greenhouse gas reductions in its objectives or title (Dubash et al. 2013) – from indirect laws that have 'the capacity to affect mitigation or adaptation' through the subjects they regulate, for example, through promotion of co-benefits, or creation of reporting protocols (Scotford and Minas 2019). Closely related is a 'sectoral approach' based on the layering of climate considerations into existing laws in the absence of an overarching framework law (Rumble 2019). Many countries also adopt executive climate strategies (discussed in Section 13.2), which may either coexist with or substitute for climate laws, and that may also be related to a country's NDC process under the Paris Agreement.

The prevalence of both direct and indirect climate laws has increased considerably since 2007, although definitional differences across studies complicate a clear assessment of their relative importance (*medium evidence*, *high agreement*) (Iacobuta et al. 2018; Nachmany and Setzer 2018). Direct climate laws – with greenhouse gas limitation as a direct objective – had been passed in 56 countries (of 194 studied) covering 53% of emissions in 2020, with most of that rise happening between 2010 and 2015 (Figure 13.1). Both direct and indirect laws – those that have an effect on mitigation even if this is not the primary outcome – is most closely captured by the 'Climate Change Laws of the World' database, which illustrates the same trend of growing prevalence, documenting 694 mitigation-related laws by 2020 versus 558 in 2015 and 342 in 2010 (Nachmany and Setzer 2018; LSE Grantham Research Institute on Climate Change and the Environment 2021).[1] Among these, the majority are accounted for by sectoral indirect laws. For example, a study of Commonwealth countries finds that a majority of these countries have not taken the route of a single overarching law, but rather have an array of laws across different areas, for example, Indian laws on energy efficiency and Ghana's laws on renewable energy promotion (Scotford et al. 2017).

Some direct climate laws may serve as 'framework' laws (Averchenkova et al. 2017; Rumble 2019) that set an overarching legal context within which other legislation and policies operate. Framework laws are intended to provide a coherent legal basis for action, to integrate past legislation in related areas, set clear directions for future policy, and create necessary processes and institutions (*medium evidence*, *medium agreement*) (Townshend et al. 2013; Averchenkova et al. 2017; Fankhauser et al. 2018; Rumble 2019; Averchenkova et al. 2021). There are a variety of approaches to framework laws. Reviews of climate legislation, many of which draw particularly from the long-standing UK Climate Change Act, suggest the need for statutory targets with a long-term direction, shorter term instruments such as carbon budgets to induce action toward targets, a clear assignment of duties and responsibilities including identification of policies and responsibility for their implementation, annual reporting to Parliament; an independent body to support evidence-based decision-making and rules to govern information collection and provision (Barton and Campion 2018; Fankhauser et al. 2018; Abraham-Dukuma et al. 2020; Averchenkova et al. 2021).

However, country examples also suggest other, different approaches to framework laws. Korea's Framework Act on Low Carbon, Green Growth seeks to shift business and society toward green growth through a process of strategy setting and action plans (Jang et al. 2010). Kenya's framework Climate Change Act creates an institutional structure to mainstream climate considerations into sectoral decisions, one of several examples across Africa of efforts to create framework legislation to promote mainstreaming (Rumble 2019). Mexico's General Law on Climate Change includes sectoral emission targets, along with the creation of coordinating institutions across ministries and sub-national authorities (Averchenkova and Guzman Luna 2018). Consequently, different countries have placed emphasis on different aspects of framework laws, although the most widely prevalent approach is that exemplified by the UK.

Climate laws spread through multiple mechanisms, including the impetus provided by international negotiation events, diffusion by

[1] Data from climate-laws.org, search for mitigation focused legislation for different time frames. Accessed Oct. 31, 2021.

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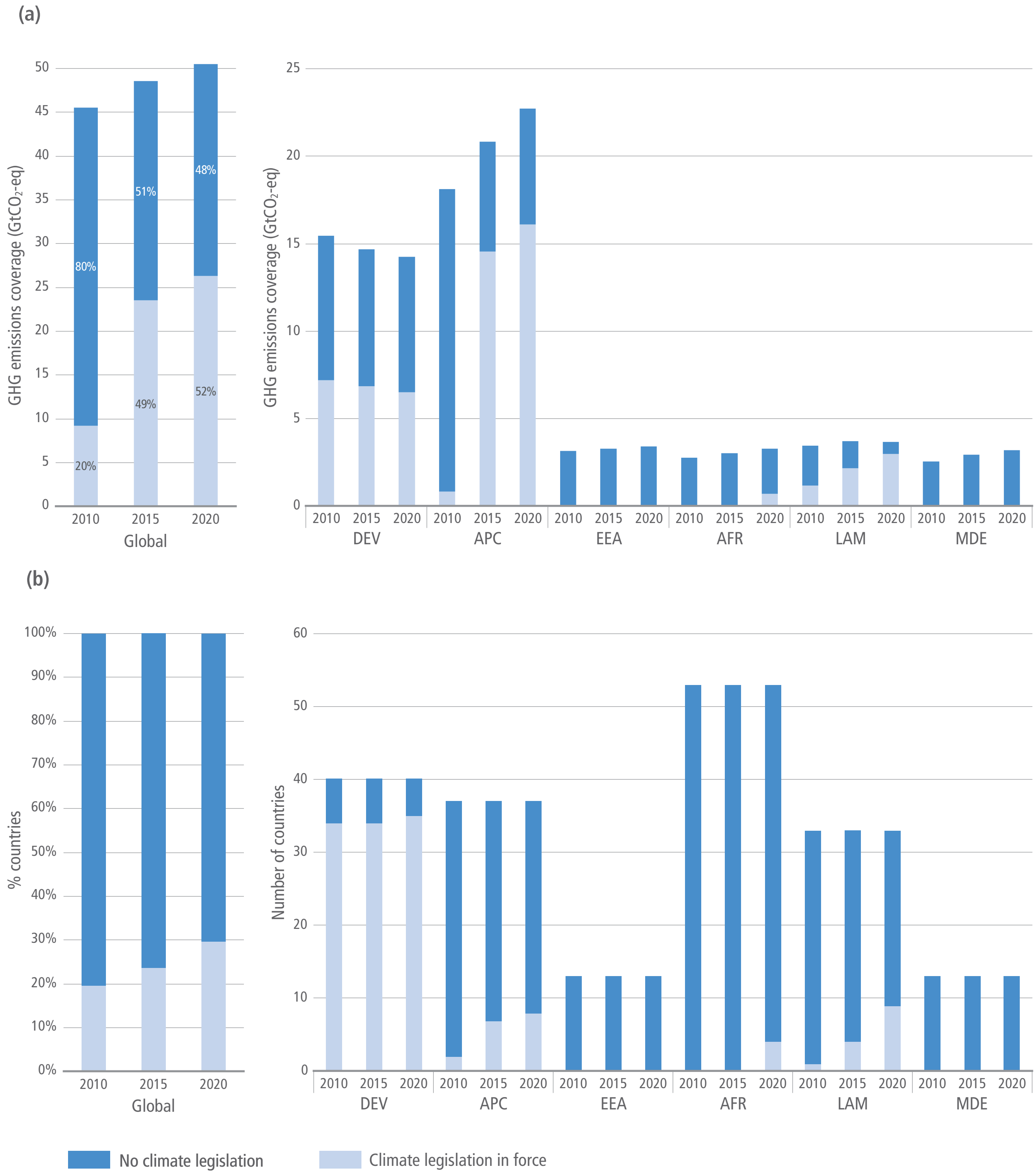

Figure 13.1 | Prevalence of legislation by emissions and number of countries across regions. Top: Shares of global GHG emissions under national climate change legislations – in 2010, 2015 and 2020. Emissions data used are for 2019, since emissions shares across regions deviated from past patterns in 2020 due to COVID. **Bottom:** Number of countries with national climate legislation – in 2010, 2015, and 2020. Climate legislation is defined as an act passed by a parliament that includes in its title or objectives reductions in GHGs. AR6 regions: DEV = Developed countries; APC = Asia and Pacific; EEA = Eastern Europe and West-Central Asia; AFR = Africa; LAM = Latin America and the Caribbean; MDE = Middle East. Source: updated and adapted with permission from Iacobuta et al. (2018) to reflect AR6 regional aggregation and recent data.

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example across countries, and domestic factors such as business cycles (*medium evidence*, *medium agreement*). Major landmark events under the UNFCCC have been associated with increases in national legislation (Iacobuta et al. 2018), with a stronger effect in countries where international commitments are binding (Fankhauser et al. 2016). Diffusion through example of legislation from other countries has been documented (Fankhauser et al. 2016; Fleig et al. 2017; Torney 2017; Inderberg 2019; Torney 2019). For example, the UK Climate Change Act was an important influence in pursuing similar acts in Finland and Ireland (Torney 2019) and was also considered in the formulation of Mexico's General Law on Climate Change (Averchenkova and Guzman Luna 2018). The presence of a framework law is positively associated with creation of additional supportive legislation (Fankhauser et al. 2015). Domestic contextual factors can also affect the likelihood of legislation such as a weak business cycle that can impact the political willingness to pass legislation (Fankhauser et al. 2015). In some cases, civil society groups play a role as advocates for legislation, as occurred in the UK (Lockwood 2013; Lorenzoni and Benson 2014; Carter and Childs 2018; Devaney et al. 2020) and in Germany in the build up to passage of their respective Climate Change Act (Flachsland and Levi 2021).

The performance of framework laws suggests a mixed picture. While the structure of the UK Act successfully sets a direction of travel and has resulted in a credible independent body, it performs less well in fostering integration across sectoral areas and providing an enforcement mechanism (Averchenkova et al. 2021). a review of seven European climate change acts concludes that overall targets may not be entirely aligned with planning, reporting and evaluation mechanisms, and that sanction mechanisms are lacking across the board (Nash and Steurer 2019), which limit the scope for legislation to perform its integrative task. These observations suggest the need for careful attention to the design of framework laws.

There is extremely limited evidence on the aggregate effects of climate laws on climate outcomes, although there is a broader literature assessing climate policies (Section 13.6 in this chapter and Cross-Chapter Box 10 in Chapter 14). a single assessment of direct and indirect climate laws as well as relevant executive action across a global database finds a measurable and positive effect: global annual emissions have reduced by about 5.9 CO_2 compared to an estimation of what they otherwise would have been (Eskander and Fankhauser 2020). Climate laws require further research, including on the quantification of impact, framework versus sectoral approaches, and the various mechanisms through which laws act – target setting, creating institutional structures, mainstreaming and ensuring compliance.

13.2.2 National Strategies and Nationally Determined Contributions

National climate strategies, which are often formulated through executive action, contribute to climate governance in several ways. Strategies enable discussion of low-emissions pathways while accounting for uncertainty, national circumstances and socio-economic objectives (Falduto and Rocha 2020). They frequently set out long term emission goals and possible trajectories over time, with analysis of technological and economic factors (Levin et al. 2018; WRI 2020). This can include quantitative modelling of low-emissions transitions and their economic effects to inform policymakers and stakeholders of potential outcomes (Waisman et al. 2019; Weitzel et al. 2019). Scenario analysis can be used to explore how to make strategies more robust in the face of uncertainty (Sato and Altamirano 2019). Strategies and their regular revision can support long-term structural change by stimulating deliberation and learning (Voß et al. 2009), and to make the link between mitigation and adaptation objectives and actions (Watkiss and Klein 2019; Hans et al. 2020). As part of the Paris Agreement process, several countries have prepared and submitted long-term low-emissions development strategies (Levin et al. 2018), while others have different forms of national climate change strategies independently of the UNFCCC process. Strategies set over time by the European Union are discussed in Box 13.1.

Nationally Determined Contributions (NDCs) prepared under the Paris Agreement may be informed by national strategies (Rocha and Falduto 2019). But the process of preparing NDCs can itself raise political awareness, encourage institutional innovation and coordination, and engage stakeholders (Röser et al. 2020). Nationally Determined Contributions (NDCs) illustrate a diversity of approaches: direct mitigation targets, strategies, plans and actions for low-GHG emission development, or the pursuit of mitigation co-benefits resulting from economic diversification plans and/or adaptation actions (UNFCCC Secretariat 2021). Figure 13.2 shows that the prevalence of emission targets increased across all regions between 2010 and 2020, the period during which the Paris Agreement was reached.

The NDCs vary in their scope, content and time frame, reflecting different national circumstances, and are widely heterogeneous in both stringency and coverage of mitigation efforts (UNFCCC Secretariat 2016, 2021; Pauw et al. 2018; Campagnolo and Davide 2019; Pauw et al. 2019). The mitigation targets in the new or updated NDCs range from economy-wide absolute emission reduction targets to strategies, plans and actions for low-emission development, with specific time frames or implementation periods specified. Less than 10% of parties' NDCs specify when their emissions are expected to peak and some of these parties express their target as a carbon budget (UNFCCC Secretariat 2021). Many long-term strategies submitted by Parties to the UNFCCC refer to net zero emissions or climate neutrality, carbon neutrality, or GHG neutrality with reference to 2050, 2060 or mid-century targets (UNFCCC Secretariat 2021). The growing prevalence and coverage of emission targets is documented in Figure 13.2.

Almost all Parties outlined domestic mitigation measures as key instruments for achieving mitigation targets in specific priority areas such as energy supply (89%), transport (80%), buildings (72%), industry (39%), agriculture (67%), LULUCF (75%) and waste (68%). Renewable energy generation was the most frequently indicated mitigation option (84%), followed by improving energy efficiency of buildings (63%) and multi-sector energy efficiency improvement (48%); afforestation, reforestation and revegetation (48%);

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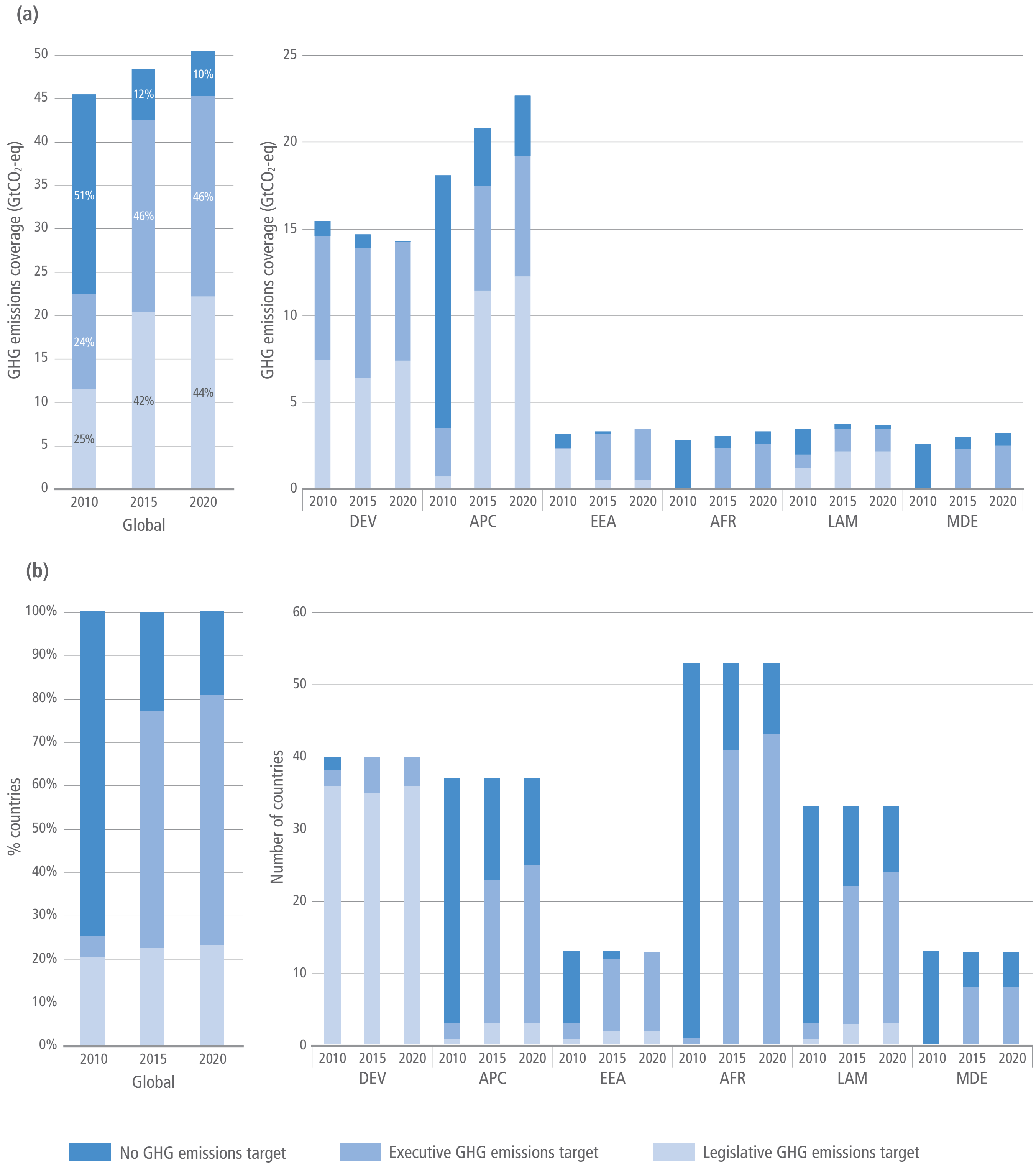

Figure 13.2 | Prevalence of targets by emissions and number of countries across region. Top: Shares of global GHG emissions under national climate emission targets – in 2010, 2015 and 2020. Emissions data used are for 2019, since emissions shares across regions deviated from past patterns in 2020 due to COVID. **Bottom:** Number of countries with national climate emission targets – in 2010, 2015, and 2020. Emissions reductions targets were taken into account as a legislative target when they were defined in a law or as part of a country's submission under the Kyoto Protocol, or as an executive target when they were included in a national policy or official submissions under the UNFCCC. Targets were included if they were economy wide or included at least the energy sector. The proportion of national emissions covered are scaled to reflect coverage and whether targets are in GHG or CO_2 terms. AR6 regions: DEV = Developed countries; APC = Asia and Pacific; EEA = Eastern Europe and West-Central Asia; AFR = Africa; LAM = Latin America and the Caribbean; MDE = Middle East. Source: updated and adapted with permission from Iacobuta et al. (2018) to reflect AR6 regional aggregation and recent data.

Box 13.1 | EU Climate Policy Portfolio and the European Green Deal

The European Union (EU)[1] has developed an encompassing climate governance framework (Kulovesi and Oberthür 2020), having ratified the Kyoto Protocol in 2002. In 2003 the EU adopted an Emissions Trading System for sectors with large GHG emitters, which started in 2005. From 2007 to 2009, the EU revised its climate policies, including for vehicle emissions, renewable energy and energy efficiency, and adopted targets for 2020 for GHG emissions reductions, renewable energy shares and energy efficiency improvements. It also adopted in 2009 an Effort Sharing Decision for Member States' emissions reductions for the period 2013–2020 in sectors not covered by the ETS (Boasson and Wettestad 2013; Bertoldi 2018). The ETS has been improved multiple times, including through a 2015 Market Stability Reserve to reduce the surplus of emission allowances (Chaton et al. 2018; Wettestad and Jevnaker 2019). In 2010, the European Commission created a directorate-general (equal to a ministry at the domestic level) for Climate Action. Between 2014 and 2018, the EU agreed on emission reduction targets for 2030 of 30% GHG emission reductions compared to 1990, and again revised its climate policy portfolio including new targets for renewable energies and energy efficiency and a new Effort Sharing Regulation (Fitch-Roy et al. 2019a; Oberthür 2019).

From 2018, climate planning and reporting has been regulated by the EU Governance Regulation (Regulation (EU) 2018/1999), requiring member states to develop detailed and strategic National Energy and Climate Plans (Knodt et al. 2020). In 2019, the European Commission, backed by the European Council (heads of states and government in the EU) and the European Parliament, launched a new broad climate and environment initiative; the 'European Green Deal', implying the revision of many EU polices and introducing the Climate Pact (European Commission 2019a). This roadmap develops a 'new growth strategy for the EU' aimed at reaching climate neutrality by 2050 and spans multiple sectors. In 2020, the European Commission introduced a new climate law establishing the framework for achieving the climate neutrality by 2050 principle, and upgraded its 2030 GHG emission reduction target to at least net 55% reduction, which was adopted in June 2021 (European Commission 2020a). In June 2021, the new policy package 'Fit for 55' was adopted by the Commission; the packages included a proposal for the revision of the ETS, including its extension to shipping and a separate emission trading system for road transport and buildings, a revision of the effort sharing regulation, an amendment of the regulation setting CO_2 emission standards for cars and vans, a revision of the energy tax directive, a new carbon border adjustment mechanism, a revision of renewable energy and energy efficiency targets and directives, and a new social fund to make the transition to climate neutrality fair.

and improving energy efficiency of transport (45%) (UNFCCC Secretariat 2021). Parties often communicated mitigation options related to the circular economy, including reducing waste (29%) and recycling waste (30%) and promoting circular economy (25%). Many Parties highlighted policy coherence and synergies between their mitigation measures and development priorities, which included long-term low-emission development strategy(LT-LEDS), the sustainable development goals (SDGs) and, for some, green recovery from the COVID-19 pandemic.

Some countries approach NDCs as an opportunity to integrate mitigation objectives and broader economic shifts or sectoral transformations (*medium evidence*, *medium agreement*). For example, Brazil's 2016 NDC focussed on emissions from land-use change, including agricultural intensification, to align mitigation with a national development strategy of halting deforestation in the Amazon, and increasing livestock production (De Oliveira Silva et al. 2018). While the forest sector accounts for the bulk of Madagascar's mitigation potential, its NDC promotes GHG mitigation in both AFOLU and energy sectors to maximise co-benefits, and achieve a higher number of sustainable development goals (SDGs) (Nogueira et al. 2020).

13.2.3 Approaches to National Institutions and Governance

13.2.3.1 The Forms of Climate Institutions

Universal 'best-practice' formulations of organisations may not be applicable across country contexts, but institutions that are suited to national context can be ratcheted up over time in their scope and effectiveness (*medium evidence*, *medium agreement*). National climate institutions take diverse forms because they emerge out of country-specific interactions between national climate politics and existing institutional structures. Certain institutional forms tend to be common across countries, such as expert climate change commissions; a review finds eleven such institutions in existence as of mid-2020. Although this institutional form may be common, these commissions vary in terms of expertise, independence and focus (Abraham-Dukuma et al. 2020), reinforcing the important shaping role of national context.

A review of institutions in eight countries suggests three broad processes through which institutions emerge: 'purpose-built' dedicated institutions focused explicitly on mitigation; 'layering' of mitigation objectives on existing institutions; and 'latent' institutions

[1] The European Union is an international organisation that is discussed here because it plays a large role in shaping climate obligations and policies of its Member States.

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Box 13.2 | Climate Change Institutions in the UK

The central institutional arrangements of climate governance in the UK were established by the 2008 Climate Change Act (CCA): statutory five-year carbon budgets; an independent advisory body, the Committee on Climate Change (CCC); mandatory progress monitoring and reporting to Parliament; and continuous adaptive planning following a five-yearly cycle. The CCC is noteworthy as an innovative institution that has also been emulated by other countries.

The design of the CCC was influenced by the concept of independent central banking (Helm et al. 2003). It has established a reputation for independent high quality analysis and information dissemination, is frequently referred to in Parliament and widely used by other actors in policy debates, all of which suggest a high degree of legitimacy (Averchenkova et al. 2018). However, since the CCC only recommends rather than sets budgets (McGregor et al. 2012), accountability for meeting the carbon budgets works primarily through reputational and political effects rather than legal enforcement.

Box 13.3 | China's Climate Change Institutions

Climate governance in China features a combination of top-down planning and vertical accountability (Sims Gallagher and Xuan 2019; Teng and Wang 2021). An overarching coordination role is performed by the Leading Group on Carbon Peaking and Carbon Neutrality, appointed by and reporting to the Central Committee of the Chinese Communist Party, and the National Leading Group on Climate Change Response, Energy Conservation, and Emissions Reduction (NLGCCR), headed by the Premier and consisting of more than 30 ministers (Wang et al. 2018a). The Department of Climate Change (DCC) under the Ministry of Ecology and Environment (MEE) is the primary agency in charge of climate issues, with a corresponding local Bureau of Ecology and Environment in each province or city. While MEE is the leading agency for climate policy, the National Development and Reform Commission (NDRC) is the leading agency for setting overall and industry-specific targets in five-year plans, and thus has a key role in coordinating carbon emissions targets with energy and industrial development targets (Wang et al. 2019; Yu 2021). Involvements of ministries related to foreign affairs, public finance, science and technology, as well as sector ministries such as transportation, construction, and manufacturing industries are also needed to push forward sector-specific climate initiatives. At subsidiary levels of government carbon intensity targets are enforced through a 'targets and responsibilities' system that is directly linked to the evaluation of governments' performances (Lin 2012a; Li et al. 2016).

created for other purposes that nonetheless have implications for mitigation outcomes (Dubash 2021). In relatively few countries do new, purpose-built, legally-mandated bodies created specifically for climate mitigation exist although this number is growing; examples include the UK (Averchenkova et al. 2018), China (Teng and Wang 2021), Australia (Keenan et al. 2012) and New Zealand (Timperley 2020). These cases indicate that dedicated and lasting institutions with a strategic long-term focus on mitigation emerge only under conditions of broad national political agreement around climate mitigation as a national priority (Dubash 2021). However, the specific forms of those institutions differ, as illustrated by the case of the UK's Climate Change Committee established as an independent agency (Box 13.2) and China, which is built around a top-down planning structure (Box 13.3).

Where economy-wide institutions do not exist, new institutions may still address sub-sets of the challenge. In Australia, while political conditions resulted in the repeal of an overarching Clean Energy Act in 2014, although a Climate Change Authority continued, other institutions primarily focused on the energy sector such as the Clean Energy Regulator, the Clean Energy Finance Corporation, and the Australia Renewable Agency continued to shape energy outcomes (MacNeil 2021).

Where new dedicated organisations have not emerged, countries may layer climate responsibilities on existing institutions; the addition of mitigation to the responsibilities of the US Environmental Protection Agency is an example (Mildenberger 2021). Layering is also a common approach when climate change is embedded within consideration of multiple objectives of policy. In these cases, climate institutions tend to be layered on sectoral institutions for the pursuit of co-benefits or broader development concerns. Examples include India, where energy security was an important objective of renewable energy promotion policy (Pillai and Dubash 2021), Brazil's mitigation approach focused on sectoral forest policy (Hochstetler 2021) and South Africa's emphasis on job creation as a necessary factor in mitigation policy (Chandrashekeran et al. 2017; Rennkamp 2019). Prior to this process of layering, sectoral institutions, such as in forest and energy sectors, may play an important latent role in shaping climate outcomes, before climate considerations are part of their formal mandate.

New rules and organisations are not only created, they are also dismantled or allowed to wither away. Cases of institutional dismantling or neglect include the Australian Clean Energy Act (Crowley 2017; MacNeil 2021), the Indian Prime Minister's Council on Climate Change, which, while formally functional, effectively does not meet (Pillai and Dubash 2021), and the weakening of climate units inside sectoral ministries in Brazil (Hochstetler 2021). While there is limited literature on the robustness of climate institutions, case studies suggest institutions are more likely to emerge, persist and be effective when institutions map to a framing of climate change that has broad political support (*medium evidence*, *medium agreement*). Thus while mitigation focused framings and institutions may win political support in some countries, in other cases sectorally focused or multiple objectives oriented institutions may be most useful and resilient (Dubash 2021).

13.2.3.2 Addressing Climate Governance Challenges

Climate governance challenges include ensuring coordination, building consensus by mediating conflict, and setting strategy (*medium evidence*, *high agreement*). Coordination is important because climate change is an all-of-economy and society problem that requires cross-sectoral and cross-scale action; building consensus is needed because large-scale transformations can unsettle established interests; and strategy setting is required due to the transformative and time-bound nature of climate mitigation (Dubash et al. 2021). Yet, climate institutions have a mixed record in addressing these challenges.

Institutions that provide coordination, integration across policy areas and mainstreaming are particularly important given the scope and scale of climate change (Candel and Biesbroek 2016; Tosun and Lang 2017) (Section 13.7). Ministries of environment are often appointed as *de facto* agents of coordination, but have been hampered by their limited regulative authority and ability to engage in intra-governmental bargaining with ministries with larger budgets and political heft (Aamodt 2018).

Creation of a high-level coordinating body to coordinate across departments and mainstream climate into sectoral actions is another common approach (Oulu 2015). For example, Kenya has created a National Climate Change Council, which operates through a climate change directorate in the environment ministry to mainstream climate change at the county level (Guey and Bilich 2019). Zhou and Mori (2011) suggest that well-functioning inter-agency coordination mechanisms require support from heads of government, involvement by industry and environment agencies; and engagement by multiple sectoral agencies. However, coordination mechanisms without a clear authority and basis for setting directions run the risk of 'negative coordination', a process through which ministries comment on each other's proposals, removing any ideas that run counter to the interests of their own ministry, leading to even weaker decisions (Flachsland and Levi 2021). Countries with dedicated, new climate institutions tend to have a more explicit and authorised body for climate coordination, such as China's National Leading Group (Box 13.3).

Without explicit coordination with finance ministries, there is a risk of parallel and non-complementary approaches. For example, the South African Treasury pursued a carbon tax without clear indication of how it interfaced with a quantitative sectoral budget approach espoused by the environment ministry (Tyler and Hochstetler 2021). Skovgaard (2012) suggests that there is an important distinction between finance ministries that bring a limiting 'budget frame' to climate action, versus a 'market failure frame' that encourages broader engagement by relevant ministries.

Coordination within federal systems poses additional complexities, such as overlapping authority across jurisdictions, multiple norms in place, and approaches to coordination across scales (Brown 2012). Multi-level governance systems such as the EU can influence the design and functioning of climate policies and institutions in member states, such as Germany (Skjærseth 2017; Jänicke and Wurzel 2019; Flachsland and Levi 2021) and the UK (Lockwood 2021a). In some cases, this can result in distinct European modes of governance as has been suggested occurred in the case of wind energy (Fitch-Roy 2016).

Within countries, institutional platforms allow federal and sub-national governments to negotiate and agree on policy trajectories (Gordon 2015). In Germany, cooperation is channelled through periodic meetings of environment ministers and centre-state working groups (Weidner and Mez 2008; Brown 2012), and in Canada through bilateral negotiations and side-payments between scales of government (Rabe 2007; Gordon 2015). Federal systems might allow for sub-national climate action despite constraints at the federal level, as has occurred in Australia (Gordon 2015; MacNeil 2021) and the United States (Rabe 2011; Jordaan et al. 2019; Bromley-Trujillo and Holman 2020; Thompson et al. 2020). Where agenda-setting rests with the central government, coordination may operate through targets, as with China (Qi and Wu 2013), or frameworks for policy action, as in India (Vihma 2011; Jogesh and Dubash 2015).

Because transition to a low-carbon future is likely to create winners and losers over different time scales; institutions are needed to mediate these interests and build consensus on future pathways (Kuzemko et al. 2016; Lockwood et al. 2017; Finnegan 2019; Mildenberger 2020). Institutions that provide credible knowledge can help support ambition. For example, analysis by the UK Climate Change committee has been harnessed, including by non-state actors, to prevent backsliding on decisions (Lockwood 2021a). Institutions can also help create positive feedback by providing spaces in decision-making for low-carbon interests (Aklin and Urpelainen 2013; Roberts et al. 2018; Lockwood et al. 2017; Finnegan 2019). For example, a renewable energy policy community emerged in China through key agenda setting meetings (Shen 2017), and in India, a National Solar Mission provided a platform for the renewable energy industry (Pillai and Dubash 2021). Conversely, institutions can also exert a drag on change through 'regulatory inertia', as in the case of the UK energy regulator Ofgem, which has exercised veto powers in ways that may limit a low-carbon transition (Lockwood et al. 2017).

Institutions can also create spaces to accommodate concerns of other actors (Upadhyaya et al. 2021). Deliberative bodies, such as Germany's Enquete Commission (Weidner and Mez 2008; Flachsland and Levi 2021) or the Brazilian Forum on Climate Change (Tyler and Hochstetler 2021) provide a space for reconciling competing visions and approaches to climate change. Many countries are creating deliberative bodies to forge 'Just Transition' strategies (Section 13.9).

Box 13.4 | Procedural Justice

Decision-making consistent with energy and climate justice requires attention to procedural justice (McCauley and Heffron 2018), which includes how decisions are made, and who is involved and has influence on decisions (Sovacool and Dworkin 2015). Procedural justice emphasises the importance of equitable access to decision-making processes and non-discriminatory engagement with all stakeholders (Jenkins et al. 2016), attention to the capability, particularly of marginalised groups, to shape decisions (Holland 2017) and recognition of their specific vulnerabilities in collective political processes (Schlosberg 2012). Consensus-building institutions should avoid reducing normative questions to technical ones, recognising that values, interests and behaviours are all shaped by ongoing climate governance (Ryder 2018; Schwanen 2021). Additionally, communities affected by low-carbon transition may face challenges in articulating their understandings and experiences, which needs to be addressed in the design of climate institutions (Ryder 2018; Schwanen 2021).

Spatially localised alternative discourses of justice are often more recognised socially than national and universal framings of climate justice (Bailey 2017). Participatory forms of governance such as climate assemblies and citizen juries (Ney and Verweij 2015) can help enhance the legitimacy of institutional decisions, even while empirical assessments suggest that these approaches continue to face practical challenges (Devaney et al. 2020; Sandover et al. 2021; Creasy et al. 2021).

Box 13.5 | South Africa's Monitoring and Evaluation System

South Africa's national monitoring and evaluation system provides high-level guidance on information requirements and assessment methodologies (DEA 2015). The country is developing a comprehensive, integrated National Climate Change Information System, to enable tracking, analysis and enhancement of South Africa's progress towards the country's transition to a low-carbon economy and climate-resilient society (DFFE Republic of South Africa 2021). It includes information on GHG emission reductions achieved, observed and projected climate change, impacts and vulnerabilities, the impact of adaptation and mitigation actions, financial flows and technology transfer activities. South Africa's approach is premised upon continuous learning and improvement through a phased implementation approach (DEA 2019).

a recent innovation is the creation of Citizens' Assemblies that bring together representative samples of citizens to deliberate on policy questions with the intent of informing them (Devaney et al. 2020; Sandover et al. 2021). The ability of institutions to forge agreement also rests on attention to procedural justice (Box 13.4).

Since addressing climate change requires transformative intent and shifting development pathways (Sections 1.6, 3.6, 4.3, 4.4, 13.9, 17.3.2, and Cross-Chapter Box 5 in Chapter 4), institutions that can devise strategies and set trajectories are useful enablers of transformation. Strategy setting often requires an overarching framework such as through framework laws that set targets (Averchenkova et al. 2017), or identify key sectors and opportunities for low-carbon transition (Hochstetler and Kostka 2015) and innovation (UNEP 2018). Few countries have built deliberate and lasting institutions that provide strategic intent, and those that have, have pursued different approaches. The UK's approach rests on five-yearly targets (Box 13.2); Germany requires sectoral budgets enforced through the Bundestag (Flachsland and Levi 2021); and China uses an apex decision-body to set targets (Teng and Wang 2021) (Box 13.3).

Addressing all of these governance concerns – coordination, mediating interests, and strategy setting – require attention to institutional capacity. These include the capacity to address 'upstream' policy issues of agenda setting, framing, analysis and policy design; pursue goals even while mediating interests (Upadhyaya et al. 2021); identify and manage synergies and trade-offs across climate and development objectives (Ürge-Vorsatz et al. 2014; von Stechow et al. 2015; McCollum et al. 2018); identify and choose amongst possible policy options (Howlett and Oliphant 2010); identify areas for transformation and the means to induce innovation (Patt 2017; UNEP 2018); and developing the ability to monitor and evaluate outcomes (Upadhyaya et al. 2021) (Box 13.5). Domorenok et al. (2021) highlight different aspects of the capacity challenge particularly necessary for integrated policy making including: the capacity for horizontal and vertical coordination; implementation capacity including the independence of the state from interests; and administrative capacity required to address compound problems. At a basic level, questions of governmental capacity – the numbers and training of personnel – can shape the choices available for climate institutions and their ability to be strategic (Richerzhagen and Scholz 2008; Harrison and Kostka 2014; Kim 2016). Box 13.5 describes South Africa's approach to building monitoring and evaluation capacity.

The perceived need for attention to institutional capacity is highlighted by the fact that the NDCs of 113 developing countries out of 169 countries studied list capacity building as a condition of NDC implementation (Pauw et al. 2020). While international support for capacity is widely articulated as essential for many countries (Khan et al. 2020), ensuring the form of capacity is appropriate, effective and led domestically remains a challenge (Nago and Krott 2020; Sokona 2021).

13.2.4 Institution Building at the Sub-national Level

Jurisdiction over significant mitigation-related arenas like planning, housing and community development reside at the sub-national level. To address linkages between mitigation and local concerns, sub-national actors engage in institution building within a broader socio-economic and political context, with actors and institutions at a multitude of scales shaping the effectiveness of sub-national-scale interventions (Romero-Lankao et al. 2018a). Mitigation policies may demand coordination between sectoral and jurisdictional units that historically have not collaborated; they may require sub-national actors to confront politically sensitive issues such as carbon taxes or increases in utility rates; and they may demand a redistribution of resources to protect endangered ecosystems or vulnerable populations (Hughes and Romero-Lankao 2014).

Sub-national actors have built climate institutions by creating new visions and narratives, by setting new entities or committing existing offices, providing them with funds, staff and legal authority, or by experimenting with innovative solutions that could be transferred to other local governments or scaled nationally (Hoffmann 2011; Hoornweg et al. 2011; Aylett 2015; Hughes and Romero-Lankao 2014; Romero-Lankao et al. 2015; Hughes 2019b). These actors have also created task forces, referendums, coordination of financial and human resources, technical assistance, awareness campaigns and funding (Castán Broto 2017; Romero-Lankao et al. 2018a; Hughes 2019b). National governments can play a key role supporting planning for climate change at the regional and national level, for example, through the articulation of climate change action in national urban politics (Van Den Berg et al. 2018; Cobbinah et al. 2019).

13.2.4.1 Significance of Sub-national Networks

Multi-jurisdictional and multi-sectoral sub-national networks in dozens of countries globally have helped build climate institutions. They have also facilitated social and institutional learning, and addressed gaps in national policy (Holden and Larsen 2015; Jordan et al. 2015; Setzer 2015; Haarstad 2016; Hermwille 2018; Kammerer and Namhata 2018; Rashidi and Patt 2018; Westman and Castan Broto 2018; Lee and Jung 2018; Lee 2019; Schwartz 2019).

Transnational networks have opened opportunities for sub-national actors to play a crucial mitigation role in political stalemates (Jones 2014; Schwartz 2019). The C40, the Global Covenant of Mayors for Climate and Energy, and ICLEI have disseminated information on best practices and promoted knowledge sharing between sub-national governments (Lee 2013; Hakelberg 2014; Heidrich et al. 2016; Kona et al. 2016; Di Gregorio et al. 2020) (Section 14.5.5). Organisations such as the US Carbon Cycle Working Group of the United States Global Change Research Program, the Australian Climate Action Network, and the Mexican Metropolitan Environmental Commission have helped facilitate coordination and learning across multiple jurisdictions and sectors, and connected ambiguous spaces between public, private and civil society actors (Romero-Lankao et al. 2015; Horne and Moloney 2019; Hughes 2019b).

Transnational networks have limited influence on climate policies where national governments exert top-down control (e.g., in the city of Rizhao, China) (Westman et al. 2019); where sub-national actors face political fragmentation, lack regulations, and financial and human resources; or where vertically-integrated governance exists, as in State of São Paulo, Santiago de Chile, and Mexico City (Romero-Lankao et al. 2015; Setzer 2017).

Public support for sub-national climate institutions increases when climate policies are linked to local issues such as travel congestion alleviation or air pollution control (Puppim de Oliveira 2013; Romero-Lankao et al. 2013; Simon Rosenthal et al. 2015; Romero-Lankao et al. 2015; Ryan 2015), or when embedded in development priorities that receive support from the national government or citizens (Jörgensen et al. 2015b; Floater et al. 2016; Dubash et al. 2018). For example, Indian cities have engaged in international climate cooperation seeking innovative solutions to address energy, water and infrastructure problems (Beermann et al. 2016).

13.2.4.2 Factors Influencing Institution Building at the Sub-national Level

Availability of federal funding is a fundamental pillar of city actors' capacity to develop mitigation policies. Administrative structures, such as the presence of a professional city manager and staff assigned specifically to climate efforts (Simon Rosenthal et al. 2015). Cooperation between administrative departments, and the creation of knowledge and data on energy use and emissions are also essential for mitigation planning (Hughes and Romero-Lankao 2014; Ryan 2015). For example, the high technical competency of Tokyo's bureaucracy combined with availability of historical and current data enabled the city's unique cap-and-trade system on large building facilities (Roppongi et al. 2017).

Visions and narratives about the future benefits or risks of climate change are often effectively advanced at the sub-national level, drawing on local governmental abilities to bring together actors involved in place-based decarbonisation across sectors (Hodson and Marvin 2009; Bush et al. 2016; Huang et al. 2018; Prendeville et al. 2018; Levenda et al. 2019). For example, in the plans of 43 C40 Cities, climate action is framed as part of a vision for vibrant, economically prosperous, and socially just cities, that are habitable, secure, resource-efficient, socially and economically inclusive, and competitive internationally (Romero-Lankao and Gnatz 2019).

However, institution building is often constrained by a lack of national support, funding, human resources, coalitions, coordination across old and new organisations, and the ability to create new institutional competences (Valenzuela 2014; Jörgensen et al. 2015a; Ryan 2015; Dubash et al. 2018; Romero-Lankao et al. 2018a; Anderton and Setzer 2018; Cointe 2019; Di Gregorio et al. 2019; Jaccard et al. 2019; Hughes 2019b). Climate mitigation can also be limited by cultural norms and values of policy actors with varying levels of power, and shifting alliances (Lachapelle et al. 2012; Damsø et al. 2016; Giampieri et al. 2019; Romero-Lankao et al. 2018a).

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Box 13.6 | Institutionalising Climate Change Within Durban's Local Government

Durban has effectively linked climate change agendas with ongoing sustainability actions and goals. To do so, adaptation has been broadened to include a just transition to a low-carbon future to address development, energy security and GHG reduction (Roberts et al. 2016).

Durban has mainstreamed climate and justice concerns within local government through strong local leadership by key individuals and departments; included climate concerns within various municipal short-term and long-term planning processes; mobilised civil society; enhanced local and international networking; explored funding opportunities; and restructured institutions (Roberts et al. 2016).

Durban shows that embedding responses to climate change within local government activities requires that climate change is made relevant locally and framed within a broader environmental justice framework (Roberts 2010). Civil society has been key in balancing the influence of the private sector on Durban's dynamic political process (Aylett 2013).

Institution building is constrained by inequities; resources, legal remit, knowledge, and political clout vary widely within and among sub-national governments globally (Jörgensen et al. 2015b; Genus and Theobald 2016; Joffe and Smith 2016; Klinsky 2018; Reckien et al. 2018; Markkanen and Anger-Kraavi 2019). Dominant discourses tend to prioritise scientific and technical expertise and, thus, they focus on infrastructural and economic concerns over the concerns and needs of disadvantaged populations (Heikkinen et al. 2019; Romero-Lankao and Gnatz 2019).

In addition, expert driven, technical solutions such as infrastructural interventions can undermine the knowledge of lower income countries, communities or indigenous knowledge holders, yet are often used by sub-national governments (Ford et al. 2016; Brattland and Mustonen 2018; Nagorny-Koring 2019; Whyte 2017, 2020). Technical solutions, such as electric vehicles or smart grids rarely address the needs and capabilities of disadvantaged communities that may not be able to afford these technologies (Mistry 2014; Romero-Lankao and Nobler 2021). However, mitigation strategies in sectors such as transport and buildings have often focused on technical and market outcomes, the benefits of which are limited to some, while others experience negative externalities or face health risks (Markard 2018; Williams and Doyon 2019; Carley and Konisky 2020). Delivering climate justice requires community-driven approaches to understanding the problem addressing structural inequities and fostering justice, while reducing carbon emissions (Romero-Lankao et al. 2018b; Carley and Konisky 2020; Lewis et al. 2020).

To address this situation requires procedural justice that involves all communities, particularly disadvantaged, in climate mitigation decisions and policies (Box 13.4). Also essential is recognition justice, that addresses past inequities through tools such as subsidies, tariffs, rebates, and other policies (Agyeman 2013; Rydin 2013; UN Habitat 2016). Both tenets are key to ensure the fair distribution of benefits or negative impacts from mitigation policies (distributional justice) (McCauley and Heffron 2018; Lewis et al. 2020). However, the benefits of inclusive approaches are often overlooked in favour of growth oriented mitigation and planning (Rydin 2013; Altenburg 2011; Smith 2019; Lennon 2020). Box 13.6 discusses how the city of Durban has internalised climate change with attention to considerations of justice.

Moreover, deep mitigation requires moving beyond existing technological responses (Mulugetta and Castán Broto 2018) to policies that correspond to the realities of developing countries (Bouteligier 2013). However, best practice approaches tend to be fragmented due to the requirements of different contexts, and often executed as pilot projects that rarely lead to structural change (Nagorny-Koring 2019). Instead, context-specific approaches that include consideration of values, cultures and governance better enable successful translation of best practices (Affolderbach and Schulz 2016; Urpelainen 2018).

13.3 Structural Factors that Shape Climate Governance

A growing literature suggests that ambitious climate policy emerges out of strong domestic political support (*medium evidence*, *medium agreement*) (Aklin and Mildenberger 2020; Lamb and Minx 2020; Colgan et al. 2021). Such support is the outcome of political interest constellations and struggles that vary from country to country. Structural factors (such as economic wealth and natural resources, the character of the national political system, and the dominant ideas, values and beliefs) shape how climate change is governed (*medium evidence*, *high agreement*) (Boasson 2015; Hochstetler 2020). This section assesses the ways these structural factors affect political dynamics and decision-making, and ultimately constrain, sustain or enable development of domestic climate governance.

While these structural factors are crucial, they do not determine the outlook of given countries' climate governance, as civic, corporate and/or political groups or individuals can be mobilised and seek to counteract these structural effects, as indicated in the following Section 13.4 that examines the role of various actors and agencies in shaping governance processes. Taken together, Sections 13.3 and 13.4 show that domestic climate governance is not fully constrained by structural factors, but rather that diverse actors can and do achieve substantial changes.

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13.3.1 Material Endowments

Material endowments are natural and economic resources, such as fossil fuels and renewable energy, forests and land, and economic or financial resources, which tend to shape developments of domestic climate governance (*medium evidence*, *high agreement*) (Friedrichs and Inderwildi 2013; Lachapelle and Paterson 2013; Bang et al. 2015; Lamb and Minx 2020). Most countries' social and economic systems are largely developed on the basis of their material endowment, and thus they contribute to shape the distribution of political power in that country (Hall and Soskice 2001). Material endowments are by no means the only influencing factor, and actors may succeed to either circumvent or exploit material endowments to impact climate governance (*limited evidence*, *medium agreement*) (Boasson 2015; Green and Hale 2017; Aklin and Mildenberger 2020).

Since countries are not bound by their material endowment, countries with similar material endowments may differ in climate governance, whereas those with notable differences in material endowments may have similar policies. For instance, countries with rich fossil fuel endowments are found either adopting rather ambitious emission reduction targets and measures, or remaining weak in developing domestic climate policies (Eckersley 2013; Farstad 2019). Further, countries with radically different electricity systems and energy resource potentials are found developing rather similar renewables support schemes such as feed-in-tariff subsidies and competitive tendering programmes (Dobrotkova et al. 2018; Vanegas Cantarero 2020; Boasson et al. 2021). Some policy instruments are widely applied in both developed and developing countries with similar or different material endowment. For example, renewable energy auctions have been experimented by over 100 countries by the end of 2018 (IRENA 2019).

Rich carbon-intensive resources and well developed infrastructure can make low-carbon activities relatively less economically profitable, and negatively influence some perceptions of climate mitigation potential (Bertram et al. 2015a; Erickson et al. 2015). If effective climate policies are introduced despite this, they can alter the importance of country's material endowments in a way that underpin more forceful climate governance over time. For instance, policy interventions to limit fossil fuel exploitation or support renewable energy deployment may change the value of these energy resources over time (Schmitz et al. 2015; Ürge-Vorsatz et al. 2018; Chailleux 2020; Colgan et al. 2021).

Developing countries face additional material constraints in climate governance due to challenges associated with underdevelopment and scarce economic or natural resources (*medium evidence*, *high agreement*). Hence, many developing countries design domestic climate mitigation policies in combination with policy goals that address various developmental challenges (von Stechow et al. 2016; Deng et al. 2017; Thornton and Comberti 2017; Campagnolo and Davide 2019), such as air quality, urban transportation, energy access, and poverty alleviation (Klausbruckner et al. 2016; Li et al. 2016; Melamed et al. 2016; Slovic et al. 2016; Khreis et al. 2017; Geall et al. 2018; Xie et al. 2018). Combining climate and developmental policies for beneficial synergies should not overlook potential trade-offs and challenges (Dagnachew et al. 2018; Ellis and Tschakert 2019; Peñasco et al. 2021) (Section 13.7.2 for wider discussion).

13.3.2 Political Systems

The effectiveness of domestic climate governance will significantly rely on how well it fits with the features of the countries' specific political systems (*limited evidence*, *high agreement*) (Schmitz 2017; Lamb and Minx 2020). Political systems have developed over generations and constitute a set of formal institutions, such as laws and regulations, bureaucratic structures, political executives, legislative assemblies and political parties (Egeberg 1999; Pierson 2004). Different political systems create differing conditions for climate governance to emerge and evolve, but because political systems are so politically and historically entrenched they are not likely to change quickly even though this could facilitate domestic climate mitigation efforts (*medium evidence*, *high agreement*) (Duit and Galaz 2008; Boasson et al. 2021). In addition, variations in governance capacities also affect climate policy making and implementation (Meckling and Nahm 2018).

Broader public participation and more open contestation spaces tend to nurture more encompassing climate policies, facilitate stronger commitments to international agreements (Bättig and Bernauer 2009; Böhmelt et al. 2016), achieve more success in decoupling economic growth from CO_2 emissions (Lægreid and Povitkina 2018), reduce more CO_2 emissions (Clulow 2019; von Stein 2020), and maintain lower deforestation rates (*medium evidence*, *medium agreement*) (Buitenzorgy and Mol 2011). States with less public participation and contestation space can also develop ambitious climate emission reduction targets and institutions (Zimmer et al. 2015; Eckersley 2016; Han 2017; Engels 2018), but the drivers and effects of climate policies within less open and liberal political contexts has not yet been sufficiently investigated.

Election systems based on proportional representation tend to have lower emissions, higher energy efficiency, higher renewable energy deployment, and more climate friendly investment than systems where leadership candidates have to secure a majority of the votes to be elected (*medium evidence*, *high agreement*) (Fredriksson and Millimet 2004; Lachapelle and Paterson 2013; Finnegan 2019). Such systems better enable voters supporting ambitious climate positions to influence policymaking (Harrison and Sundstrom 2010; Willis 2018), place less political risks on legislators from additional costs incurred from climate actions on voters (Finnegan 2018, 2019), and strengthen credible commitments to climate policy (Lockwood 2021b). Similarly, rules that govern the relationship between governments and civic societies in decision-making have also been shown to matter in climate governance. Corporatist societies, where economic groups are formally involved in public policy making, have better climate-related outcomes (lower CO_2 emissions and higher low-carbon investments) than liberal-pluralist countries, where a larger array of non-governmental organisations compete for informal influence, often through lobbying (*medium evidence*, *medium agreement*) (Liefferink et al. 2009; Jahn 2016; Finnegan 2018).

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Political parties with similar ideological roots in different countries (for instance social democratic or conservative parties) may have different positions on climate governance across countries (Boasson et al. 2021). Nevertheless, on average, a higher share of green parties in a parliament is associated with lower greenhouse gas emissions (Neumayer 2003; Jensen and Spoon 2011; Mourao 2019), and left-wing parties tend to adopt more pro-climate policy positions (*medium evidence*, *high agreement*) (Carter 2013; Tobin 2017; Farstad 2018; Ladrech and Little 2019). There is also evidence, however, that conservative parties in some countries support climate measures (Båtstrand 2015) and consensus can be achieved on climate actions across the political spectrum (Thonig et al. 2021). At the same time, it seems harder to get support for new climate governance initiatives in systems where many political groups can block decision due to many veto points, for instance in systems with bicameralism (the legislature is divided into two separate assemblies) and/or in federalist governments (where regions have national political representation, e.g. USA and Brazil) (*medium evidence*, *high agreement*) (Madden 2014; von Stein 2020) although federal systems hold out the possibility of sub-national action when federal agreement is limited (Section 13.2). There remains a limited literature on the role of green parties and veto points in developing countries (Haynes 1999; Kernecker and Wagner 2019).

In any political system, climate policy adoption and implementation may be obstructed by corrupt practices (Rafaty 2018; Fredriksson and Neumayer 2016) that entail an abuse of entrusted power for private gain (*medium evidence*, *high agreement*) (Treisman 2000). Evidence shows that CO_2 emissions levels can be affected by corruption, either through the direct negative effect of corruption on law enforcement, including in the forestry sector (Sundström 2016), or through the negative effect of corruption on countries' income (Welsch 2004).These early findings are reinforced by studies of a global sample of countries (Cole 2007) and from across the developing world (Sahli and Rejeb 2015; Bae et al. 2017; Wang et al. 2018b; Ridzuan et al. 2019; Habib et al. 2020). Corruption also disrupts public support of climate policies by affecting the levels of trust (*medium evidence*, *high agreement*) (Harring 2013; Fairbrother et al. 2019; Davidovic and Harring 2020), which then impact on the compliance of climate policies. More research is required to further understand the causal mechanisms between corrupt practices and emissions.

13.3.3 Ideas, Values and Belief Systems

Ideas, values and beliefs affect climate governance by shaping people's perceptions, attitude, and preferences on specific policy and governance issues (*medium evidence*, *high agreement*) (Boasson 2015; McCright et al. 2016b; Schifeling and Hoffman 2019; Leipold et al. 2019; Boasson et al. 2021). While these are often entrenched, they can also change, for instance when facing growing exposures to climate risks, stronger scientific evidence, and dominant public or political discourse (Mayer et al. 2017; Diehl et al. 2021). While change tend to be incremental, the pace of change may vary substantially across countries and specific climate issue areas.

However, new norms sometimes only influence political discussion and not actual governance. For instance, more ambitious climate emission reduction targets may not lead to more effective mitigation actions or policy instruments. Put another way, words do not replace actions (Geden 2016).

Different sets of beliefs can shape climate-related policies, targets, and instruments (Boasson and Wettestad 2013; Boasson 2015; Boasson et al. 2021). First, beliefs link climate governance with social justice concerns; policies, targets and instruments may therefore reflect justice issues (Fuller and McCauley 2016; Reckien et al. 2017; McCauley and Heffron 2018; Routledge et al. 2018; Bäckstrand and Lövbrand 2006, 2019). Second, climate mitigation may be seen as primarily a market correction issue and mitigation compatible with economic growth, as exemplified by ecological modernisation (Mol et al. 2009; Bäckstrand and Lövbrand 2006, 2019), climate capitalism (Newell and Paterson 2010), market logics (Boasson 2015; Boasson et al. 2021) or a global commons approach (Bernstein and Hoffmann 2019). Third, climate governance may be understood relative to policies on technological innovation and progress, often conceptualised as social-technical transformations (Geels et al. 2017a).

Significant variation in ideas, values and beliefs related to climate governance are detected across and within regions, countries, societies, organisations, and individuals (*medium evidence*, *medium agreement*) (Shwom et al. 2015; Boasson et al. 2021; Knox-Hayes 2016; Wettestad and Gulbrandsen 2018). These factors provide the context for climate policymaking and include differences in countries' histories (Aamodt 2018; Aamodt and Boasson 2020); the political culture and regulatory traditions in governing environmental and energy issues (Tosun 2018; Aamodt 2018; Boasson et al. 2021); and even bureaucrats' educational background (Rickards et al. 2014). Structural factors in a country, such as deeply held value systems, are not changed rapidly, just as political systems or natural endowments, are not changed rapidly. Consequently, climate policy and governance is more effective if it takes into account these deep-rooted values and beliefs.

Differences in dominant individual preferences may also be important. The factors that shape individual ideas, values and beliefs about climate governance include trust in politicians, the state and other people in general (Drews and van den Bergh 2016; Harring et al. 2019; Huber et al. 2020), fairness beliefs, variation in political orientation (left leaning more concerned), and class (*medium evidence*, *medium agreement*) (Schmitz et al. 2018; Inglehart and Norris 2017).

Levels of climate change concern on the individual level have increased in most countries (Shwom et al. 2015), and vary with gender (females are more concerned), and place of residence (urban residents are more concerned) (Shwom et al. 2015; McCright et al. 2016a; Ziegler 2017). The higher educated in developing countries tend to be more concerned (Lee et al. 2015) while individuals working in polluting industries tend to oppose forceful climate governance (Bechtel et al. 2019; Mildenberger 2020).

Shifts in mainstream ideas, values and beliefs can underpin changes in climate policy choices and policy outcomes (*limited evidence*, *medium agreement*) (Schleich et al. 2018; Mildenberger and Tingley 2019). For example, emission trading schemes are welcomed as a new regulatory instrument in China in the context of its market-oriented reforms and ideological shift in the past decades (Lo 2013). Based on the study of 167 nation-states and 95 sub-national jurisdictions with carbon pricing, researchers find that that high public belief in climate science underpin adoption of systems that produce a rather high carbon price (Levi et al. 2020). These public opinions need to be identified and leveraged in supporting specific policy choices or changes (Mildenberger and Tingley 2019). Policy support tends to be greater if people believe effective measures are being taken by other actors, including other households (Bostrom et al. 2018; Marlon et al. 2019), and other countries and at the international level (Schleich et al. 2018).

On the other hand, anti-climate ideas or beliefs may arise due to the introduction of more constraining or ambitious climate policies, for example protests in reaction to toll roads in Norway, which increase the cost of driving, or protests in France against increasing carbon taxes (Grossman 2019; Wanvik and Haarstad 2021). The policy implication is that vulnerable or effected groups should be considered when introducing policy change, and that participation, transparency, and good communication all helps to reduce climate-related discontent.

Survey-based studies of public perceptions on hypothetical policy instruments or activities, such as carbon taxes or energy infrastructure, suggest that linking climate policy to other economic and social reforms can increase public support for climate governance (Carattini et al. 2019; Bergquist et al. 2020). People and politicians tend to underestimate other peoples' and politicians' willingness to support mitigation policies (Hurlstone et al. 2014; Mildenberger and Tingley 2019), but if actors are informed about other actors actual perceptions and behaviours this may reduce the tendency to underestimate climate governance support (Mildenberger and Tingley 2019).

13.4 Actors Shaping Climate Governance

While Section 13.3 shows that structural factors condition climate governance, their ultimate importance also depends on whether and how various actors are mobilised (Hochstetler 2020; Boasson 2015). a wide range of regional and local governments as well as non-governmental actors have become increasingly engaged in climate governance, for instance through public-private partnerships and transnational networks (Jordan et al. 2015; Dorsch and Flachsland 2017; Jordan et al. 2018) and through the media and litigation, as discussed here.

Climate governance processes result from both slow-moving incremental changes to policy and more rapid bursts of change due to, for example, responses to dramatic weather events, general elections or global climate summits (*medium evidence*, *high agreement*) (Aamodt and Stensdal 2017; Jordan and Moore 2020; Boasson et al. 2021). While Section 13.3 assessed how entrenched structural factors conditions climate governance developments, this section examines how actors are able to alter climate governance by engaging the climate policy process, undertaking litigation and interacting with media.

13.4.1 Actors and Agency in the Public Process

A broad array of actors are engaged in shaping mitigation policy processes, including politicians and political parties, corporate actors, citizen groups, indigenous peoples organisations, labour unions and international organisations. Actors aiming to influence the climate-related policymaking process are studied together to understand climate policy dynamics and outcomes (Bulkeley 2000; Fisher 2004; Jost and Jacob 2004; Jasny et al. 2015; Fisher and Leifeld 2019; Jasny and Fisher 2019) and collaboration and influence within climate policy networks (Ingold and Fischer 2014; McAllister et al. 2014; Wagner and Ylä-Anttila 2018; Kammerer et al. 2021). Most research, however, focuses on one particular type of actor.

Political actors are decision-makers, and also influence whether climate governance is perceived as urgent and appropriate (Okereke et al. 2019; Ferrante and Fearnside 2019; Boasson et al. 2021). They include political parties, legislative assemblies and committees, governmental executives and the political leaders of governmental ministries (Boasson 2015). They are more likely to pay attention to climate issues when polling indicates high political salience with the public (Carter 2006, 2014), or when it becomes a contested issue among differing political parties (Boasson et al. 2021). Fluctuations in the public's interest and attention may underpin a disjointed approach in politicians' engagement (Willis 2017, 2018). Policy implementation can be hampered if political actors propose frequent policy changes (Boasson et al. 2021).

Corporate actors often influence policies and their adoption (Pulver and Benney 2013; Mildenberger 2020; Goldberg et al. 2020). Corporate actors acting individually or through industry associations, have worked to sway climate policy in different countries (Falkner 2008; Bernhagen 2008; Newell and Paterson 2010; Meckling 2011; Mildenberger 2020). Their ability varies by country and issue (*medium evidence*, *medium agreement*) (Skjærseth and Skodvin 2010; Boasson and Wettestad 2013; Boasson 2015; Boasson et al. 2021) and depends on material endowments (Moe Singh 2012), access to the political system (Dillon et al. 2018; Mildenberger 2020), and the ability to shape ideas, values and belief systems (Boasson 2015). Corporate actors tend to change their climate policy preferences over time, as indicated by longitudinal studies of some European countries (Boasson and Wettestad 2013; Boasson 2015; Boasson et al. 2021).

Corporate actors are crucial to policy implementation because they are prominent emitters of the greenhouse gases and owners of carbon-intensive technologies and potential providers of solutions as developers, owners and adopters of low emission practices and technologies (Falkner 2008; Perrow and Pulver 2015). Many climate policies and measures rely on businesses' willingness to exploit newly created economic opportunities, such as support schemes for renewable energy and energy efficiency sector or carbon pricing (Olsen 2007; Newell and Paterson 2010; Shen 2015; World Bank 2019). Some corporate actors provide climate solutions, such as renewable energy deployment, and have successfully influenced climate policy development related to feed-in tariffs, taxations, quotas, or emission trading schemes, in the EU (Boasson 2019), Germany (Leiren and Reimer 2018), the USA (Stokes and Breetz 2018), the Nordic countries (Kooij et al. 2018), China (Shen 2017) and Japan (Li et al. 2019).

Fossil fuel industries have been important agenda-setters in many countries, including the USA (Dunlap and McCright 2015; Supran and Oreskes 2017; Downie 2018), the EU (Skjærseth and Skodvin 2010; Boasson and Wettestad 2013), Australia (Ayling 2017), China (Shen and Xie 2018; Tan et al. 2021), India (Schmitz 2017; Blondeel and Van de Graaf 2018), and Mexico (Pulver 2007), with differing positions and impacts across countries (Kim et al. 2016; Nasiritousi 2017). In the US, the oil industry has underpinned emergence of climate scepticism (Dunlap and McCright 2015; Farrell 2016a; Supran and Oreskes 2017), and its spread abroad (Dunlap and Jacques 2013; Engels et al. 2013; Painter and Gavin 2016). Corporate opposition to climate policies is often facilitated by a broad coalition of firms (Cory et al. 2021).

Conservative foundations, sometimes financed by business revenues, have funded a diversity of types of groups, including think-tanks, philanthropic foundations, or activist networks to oppose climate policy (Brulle 2014, 2019). However, there is limited knowledge about the conditions under which actors opposed to climate action succeed in shaping climate governance (Kinniburgh 2019; Martin and Islar 2021).

Some labour unions have developed positions and programmes on climate change (Snell and Fairbrother 2010; Stevins 2013; Räthzel et al. 2018), formed alliances with other actors in the field of climate policy (Stevis 2018) and participated in domestic policy networks on climate change (Jost and Jacob 2004), but we know little about their relative importance or success. In countries with significant fossil fuel resources such as Australia, Norway, and the United States, labour unions, particularly industrial unions, tend to contribute to reducing the ambition of domestic climate policies mainly due to the concern of job losses (Mildenberger 2020). Other studies find that the role of labour unions varies across countries (Glynn et al. 2017).

Civil society actors can involve citizens working collectively to change individual behaviours that have climate implications. For example, environmental movements that involve various forms of collective efforts encourage their members to make personal lifestyle changes that reduce their individual carbon footprints (Ergas 2010; Middlemiss 2011; Haenfler et al. 2012; Cronin et al. 2014; Saunders et al. 2014; Büchs et al. 2015; Wynes et al. 2018). These efforts seek to change individual members' consumer behaviours by reducing car-use and flying, shifting to non-fossil fuel sources for individual sources of electricity, and eating less dairy or meat (Cherry 2006; Ergas 2010; Middlemiss 2011; Haenfler et al. 2012; Stuart et al. 2013; Cronin et al. 2014; Saunders et al. 2014; Büchs et al. 2015; Wynes and Nicholas 2017; Wynes et al. 2018; Thøgersen et al. 2021). Consumer/citizen engagement is sometimes encouraged through governmental directives, such as the 'renewable energy communities' granted by the EU renewable energy directive 2018/2001 (The European Parliament and the Council of the European Union 2018). To date, there are only a limited number of case studies that measure the direct effect of participation in these types of movements as it relates to climate outcomes (Saunders et al. 2014; Vestergren et al. 2018, 2019).

Citizens with less access to resources and power also participate by challenging nodes of power – policymakers, regulators, and businesses – to change their behaviours and/or accelerate their efforts. Tactics include lobbying, legal challenges, shareholder activism, coop board stewardship, and voting (Gillan and Starks 2007; Schlozman et al. 2012; Viardot 2013; Bratton and McCahery 2015; Yildiz et al. 2015; Olzak et al. 2016). Citizens provide the labour and political will needed to pressure political and economic actors to enact emission-reducing policies, as well as providing resistance to them (Fox and Brown 1998; Boli and Thomas 1999; Oreskes and Conway 2012; McAdam 2017).

Other citizen engagement involves a range of more confrontational tactics, such as boycotting, striking, protesting, and direct action targeting politicians, policymakers, and businesses (Fisher et al. 2005; Tarrow 2005; Fisher 2010; Saunders et al. 2012; Walgrave et al. 2012; Wahlström et al. 2013; Eilstrup-Sangiovanni and Bondaroff 2014; Hadden 2014, 2015; O'Brien et al. 2018; Chamorel 2019; Cock 2019; 2019b; Hadden and Jasny 2019; Swim et al. 2019). Climate strikes and other more confrontational forms of climate activism have become increasingly common (O'Brien et al. 2018; Evensen 2019; D.A. Fisher 2019; Boulianne et al. 2020; Martiskainen et al. 2020; de Moor et al. 2021; Fisher and Nasrin 2021a). Very few studies look specifically at the effect of these tactics on actual climate-related outcomes and more research is needed to understand the climate effects of citizen engagement and activism (Fisher and Nasrin 2021b).

Citizen engagement has also become common among indigenous groups who tend to have limited structural power but often aim to shape the formation and effects of projects that have implications to climate change. These include opposing extraction and transportation of fossil fuels on their traditional lands (especially in the Americas) (Bebbington and Bury 2013; Hindery 2013; Coryat 2015; Claeys and Delgado Pugley 2017; Wood and Rossiter 2017); large-scale climate mitigation projects that may affect traditional rights (Brannstrom et al. 2017; Moreira et al. 2019; Zárate-Toledo et al. 2019); supporting deployment of small-scale renewable energy initiatives (Thornton and Comberti 2017); seeking to influence the development of REDD+ policies through opposition (Reed 2011); and participation in consultation processes and multi-stakeholder bodies (Bushley 2014; Gebara et al. 2014; Astuti and McGregor 2015; Kashwan 2015; Jodoin 2017). Indigenous groups have been reported to have had some influence on some climate discussions, particularly forest management and siting of renewable energy (Claeys and Delgado Pugley 2017; Jodoin 2017; Thornton and Comberti 2017). Further, more scientific assessments are required on the role of indigenous groups in climate activism and policy (Jodoin 2017; Claeys and Delgado Pugley 2017; Thornton and Comberti 2017).

Activism, including litigation, as well as the tactics of protest and strikes, have played a substantial role in pressuring governments to create environmental laws and environmental agencies tasked

Box 13.7 | Civic Engagement: The School Strike Movement

On Friday 20 August 2018, Greta Thunberg participated in the first climate school strike. Since then, Fridays for Future – the name of the group coordinating this tactic of skipping school on Fridays to protest inaction on climate change – has spread around the world.

In March 2019, the first *global* climate strike took place, turning out more than one million people around the world (Carrington 2019). Six months later in September 2019, young people and adults responded to a call to participate in climate strikes as part of the 'Global Week for Future' surrounding the UN Climate Action Summit (Thunberg 2019), and the number of participants globally jumped to an estimated six million people (Taylor et al. 2019). Although a handful of studies have reported on who was involved in these strikes, how they were connected, and their messaging (Marris 2019; Wahlström et al. 2019; Evensen 2019; D. Fisher 2019; Boulianne et al. 2020; Bevan et al. 2020; Han and Ahn 2020; Holmberg and Alvinius 2020; Jung et al. 2020; Martiskainen et al. 2020; Thackeray et al. 2020; Trihartono et al. 2020; de Moor et al. 2021; Fisher and Nasrin 2021b), its consequences in terms of political outcomes and emissions reductions have yet to be fully understood (Fisher and Nasrin 2021b).

Although digital activism makes it easier to connect globally, it is unclear how digital technology will affect the youth climate movement, and its effects on carbon emissions. Research suggests that online activism is likely to involve a more limited range of participants and perspectives (Bennett 2013; Elliott and Earl 2018). Digital tactics could also mean that groups are less embedded in communities and less successful at creating durable social ties, factors that have been found to lead to longer term engagement (Tufekci 2017; Rohlinger and Bunnage 2018; Shirky 2010).

with enforcing environmental laws that aimed to maintain clean air and water in countries around the world (*medium evidence*, *high agreement*) (McCloskey 1991; Schreurs 1997; Rucht 1999; Brulle 2000; Steinhardt and Wu 2016; Longhofer et al. 2016; Wong 2018). Several studies find environmental NGOs have a positive effect on reductions in carbon emissions, whether through effects that operate across countries or (Frank et al. 2000; Schofer and Hironaka 2005; Jorgenson et al. 2011; Baxter et al. 2013; Longhofer and Jorgenson 2017; Grant et al. 2018) through impact of NGOs within nations (Shwom 2011; Dietz et al. 2015; Grant and Vasi 2017).

At the same time, other research has documented various forms of backlash against climate policies, both in terms of voting behaviour, as well as other collective efforts (Hill et al. 2010; Williamson et al. 2011; McAdam and Boudet 2012; Wright and Boudet 2012; Walker et al. 2014; Boudet et al. 2016; Fast et al. 2016; Krause et al. 2016; Lyon 2016; Mayer 2016; Stokes 2016; Stokes and Warshaw 2017; Muradian and Pascual 2020; Stokes 2020). In a systematic analysis that includes movements against fossil fuel investments along with those against low-carbon emitting projects around the world, research finds that a quarter of all projects (no matter their targets) were cancelled after facing resistance (Temper et al. 2020).

A range of international organisations can be important, particularly in developing countries, for instance by assisting in framing of national climate governance and supporting the design of climate policies through technical assistance projects (Talaei et al. 2014; Ortega Díaz and Gutiérrez 2018; Kukkonen et al. 2018; Bhamidipati et al. 2019; Charlery and Trærup 2019). Yet for these climate aid initiatives to work effectively requires improved institutional architecture, better appreciation of local contexts, and more inclusive and transparent governance, based on evidence from many multilateral mechanisms like REDD+, CDM, GEF and GCF (Gomez 2013; Arndt and Tarp 2017), and bilateral programmes on energy, agriculture and land-use sectors (Arndt and Tarp 2017; Rogner and Leung 2018; Moss and Bazilian 2018).

13.4.2 Shaping Climate Governance Through Litigation

Outside the formal climate policy processes, climate litigation is another important arena for various actors to confront and interact over how climate change should be governed (*robust evidence*, *high agreement*) (Wilensky 2015; Peel and Osofsky 2015, 2018; Bouwer 2018; Setzer and Byrnes 2019; Calzadilla 2019; Setzer and Vanhala 2019; Paiement 2020; Wegener 2020). Climate litigation is an attempt to control, order or influence the behaviour of others in relation to climate governance, and it has been used by a wide variety of litigants (governments, private actors, civil society and individuals) at multiple scales (local, regional, national and international) (Osofsky 2007; Lin 2012b; Keele 2017; McCormick et al. 2018; Peel and Osofsky 2018; Setzer and Vanhala 2019). Climate litigation has become increasingly common (UNEP2020b), but its prevalence varies across countries (*medium evidence*, *high agreement*) (Peel and Osofsky 2015; Wilensky 2015; Bouwer 2018; Lin and Kysar 2020; Setzer and Higham 2021). This is not surprising, given that courts play differing roles across varying political systems and law traditions (La Porta et al. 1998).

This sub-section focuses on relevant climate litigation for policies and institutions. Climate litigation is further discussed in Sections 14.5.1.2 (linkages between mitigation and human rights) and Section 14.5.3 (cross-country implications and international courts/tribunals).

The vast majority of climate cases have emerged in United States, Australia and Europe, and more recently in developing countries (Humby 2018; Kotze and du Plessis 2019; Peel and Lin 2019; Setzer and Benjamin 2019; Zhao et al. 2019; Rodríguez-Garavito 2020).

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Box 13.8 | An Example of Systemic Climate Litigation: Urgenda vs State of the Netherlands

The judgement in *Urgenda vs State of the Netherlands* established the linkage between a state's international duty, domestic actions, and human rights commitments as to the recommendations of IPCC's AR5 (Burgers and Staal 2019; Antonopoulos 2020). It was the first to impose a specific emissions reduction target on a state (de Graaf and Jans 2015; Cox 2016; Loth 2016). The District Court of The Hague ordered the Dutch Government to reduce emissions by at least 25% by the end of 2020. Following the decision of the district court of The Hague in 2015 the Dutch government announced that it would adopt additional measures to achieve the 25% emissions reduction target by 2020 (Mayer 2019). The decision was upheld by the Court of Appeal in 2018 and the Supreme Court in 2019. Since the first judgment in 2015 significant changes in the climate policy environment have been reported, the results of which have included the introduction of a Climate Act and the decision to close all remaining coal fired power plants by 2030 (Verschuuren 2019; Wonneberger and Vliegenthart 2021).

As of 31 May 2021, 1841 cases of climate change litigation from around the world had been identified. Of these, 1387 were filed before courts in the United States, while the remaining 454 were filed in 39 other countries and 13 international or regional courts and tribunals (including the courts of the European Union). Outside the US, Australia (115), the UK (73) and the EU (58) remain the jurisdictions with the highest volume of cases. The majority of cases, 1006, have been filed since 2015 (Setzer and Higham 2021). The number of climate litigation cases in developing countries is also growing. There are at least 58 cases in 18 Global South jurisdictions (*robust evidence*, *high agreement*) (Humby 2018; Kotze and du Plessis 2019; Peel and Lin 2019; Setzer and Benjamin 2019; Zhao et al. 2019; Rodríguez-Garavito 2020; Setzer and Higham 2021).

Overall, courts have also played a more active role for climate governance in democratic political systems (Peel and Osofsky 2015; Eskander et al. 2021). Whether and to what extent differing law traditions and political systems influence the role and importance of climate litigation has, however, not been examined enough scientifically (Setzer and Vanhala 2019; Peel and Osofsky 2020).

The majority of climate change litigation cases are brought against governments, by civic and non-governmental organisations and corporations (Eisenstat 2011; Markell and Ruhl 2012; Wilensky 2015; Fisher et al. 2017; Setzer and Higham 2021). Many, although not all of these cases, seek to ensure that governmental action on climate change is more ambitious, and better aligned with the need to avert or respond to climate impacts identified and predicted by the scientific community (Markell and Ruhl 2012; Setzer and Higham 2021). Climate aligned cases against governments can be divided into two distinct categories: claims challenging the overall effort of a State or its organs to mitigate or adapt to climate change (sometimes referred to as 'systemic climate litigation') (Jackson 2020) and claims regarding authorisation of third-party activity (Bouwer 2018; Gerrard 2021; Ghaleigh 2021).

Systemic climate litigation that seeks an increase in a country's ambition to tackle climate change has been a growing trend since the first court victories in the Urgenda case in the Netherlands (see Box 13.8 below) and the Leghari case in Pakistan in 2015. These cases motivated a wave of similar climate change litigation across the world (Roy and Woerdman 2016; Ferreira 2016; Peeters 2016; Mayer 2019; Paiement 2020; Barritt 2020; Sindico et al. 2021). Between 2015 and 2021, individuals and communities initiated at least 37 cases (including Urgenda and Leghari) against states (Setzer and Higham 2021), challenging the effectiveness of legislation and policy goals (Jackson 2020; Setzer and Higham 2021). Some cases also seek to shape new legal concepts such as 'rights of nature' recognised in the Future Generations case in Colombia (Savaresi and Auz 2019; Rodríguez-Garavito 2020) and 'ecological damage' in the case of Notre Affaire à Tous and others vs France (Torre-Schaub 2021).

Moreover, there are a number of regulatory challenges to state authorisation of high-emitting projects, which differs from systemic cases against states (Bouwer 2018; Hughes 2019a). For instance, the High Court in Pretoria, South Africa, concluded that climate change is a relevant consideration for approving coal-fired power plants (Humby 2018). Similarly, the Federal Court of Australia concluded that the Minister for the Environment owed a duty of care to Australian children in respect to climate impacts when exercising a statutory power to decide whether to authorise a major extension to an existing coal mine (Peel and Markey-Towler 2021).

Climate change litigation has also been brought against corporations by regional or local governments and non-governmental organisations (Wilensky 2015; Ganguly et al. 2018; Foerster 2019). One type of private climate change litigation alleges climate change-related damage and seeks compensation from major carbon polluters (Ganguly et al. 2018; Wewerinke-Singh and Salili 2020). The litigators claim that major oil producers are historically responsible for a significant portion of global greenhouse gas emissions (Heede 2014; Frumhoff et al. 2015; Ekwurzel et al. 2017; Stuart-Smith et al. 2021). These cases rely on advancements in climate science, specifically climate attribution (Marjanac et al. 2017; Marjanac and Patton 2018; McCormick et al. 2018; Minnerop and Otto 2020; Burger et al. 2020b; Stuart-Smith et al. 2021). It is alleged that major carbon emitters had knowledge and awareness of climate change and yet took actions to confound or mislead the public about climate science (Supran and Oreskes 2017). Strategic climate change litigation has also been used to hold corporations to specific human rights responsibilities (Savaresi and Auz 2019; Savaresi and Setzer 2021) (Box 13.8).

In addition to direct cases targeting high emitters, litigation is also now being used to argue against financial investments in the fossil fuel industry (Franta 2017; Colombo 2021). In May 2021, the Hague District Court of the Netherlands issued a ground-breaking judgment holding energy company Royal Dutch Shell (RDS) legally responsible for greenhouse gas emissions from its entire value chain (Macchi and Zeben 2021). Claims have also been brought against banks, pension funds and investment funds for failing to incorporate climate risk into their decision-making, and to disclose climate risk to their beneficiaries (Wasim 2019; Solana 2020; Bowman and Wiseman 2020). These litigation cases also impact on the financial market without directly involving specific financial institutions into the case (Solana 2020) but somehow aim to change their risk perceptions and attitude on high carbon activities (Griffin 2020).

The outcomes of climate litigation can affect the stringency and ambitiousness of climate governance (McCormick et al. 2018; Eskander et al. 2021). In the United States, pro-regulation litigants more commonly win in relation to renewable energy and energy efficiency cases, and more frequently lose in relations to coal-fired power plant cases (McCormick et al. 2018). Outside the US, more than half (58%) of litigation have outcomes that are aligned with climate action (Setzer and Higham 2021). But these cases can also have impacts outside of the legal proceedings before, during and after the case has been brought and decided (Setzer and Vanhala 2019). These impacts include changes in the behaviour of the parties (Peel and Osofsky 2015; Pals 2021), public opinion (Hilson 2019; Burgers 2020), financial and reputational consequences for involved actors (Solana 2020), and impact on further litigation (Barritt 2020). Individual cases have also attracted considerable media attention, which in turn can influence how climate policy is perceived (Nosek 2018; Barritt and Sediti 2019; Hilson 2019; Paiement 2020). While there is evidence to show the influence of some key cases on climate agenda-setting (Wonneberger and Vliegenthart 2021), it is still unclear the extent to which climate litigation actually results in new climate rules and policies (Peel and Osofsky 2018; Setzer and Vanhala 2019; Peel and Osofsky 2020) and to what degree this holds true for all cases (Jodoin et al. 2020). However, there is now increasing academic agreement that climate litigation has become a powerful force in climate governance UNEP 2020b; Burgers 2020). In general, litigations can be applied to constrain both public and private entities, and to shape structural factors mentioned in Section 13.3, such as the beliefs and institutions around climate governance.

13.4.3 Media as Communicative Platforms for Shaping Climate Governance

Media is another platform for various actors to present, interpret and shape debates around climate change and its governance (Tindall et al. 2018). The media coverage of climate change has grown steadily since 1980s (O'Neill et al. 2015; Boykoff et al. 2019), but the level and type of coverage differs over time and from country to country (*robust evidence*, *high agreement*) (Boykoff 2011; Schmidt et al. 2013; Schäfer and Schlichting 2014). Media can be a useful conduit to build public support to accelerate mitigation action, but may also be utilised to impede decarbonisation endeavours (Boykoff 2011; O'Neill et al. 2015; Farrell 2016b; Carmichael et al. 2017; Carmichael and Brulle 2018). Different media systems in different regions and countries and with unique cultural and political traditions also affect how climate change is communicated (Eskjær 2013).

A broad variety of media platforms cover climate change issues, including traditional news media, such as newspapers and broadcasting, digital social media (Walter et al. 2018), creative narratives such as climate fiction and films (Svoboda 2016); humour and entertainment media (Brewer and McKnight 2015; Skurka et al. 2018; Boykoff and Osnes 2019); and strategic communications campaigns (Hansen and Machin 2008; Hoewe and Ahern 2017). Media coverage can have far-reaching consequences on policy processes, but we know less about its relative importance compared to other policy shaping factors (*medium evidence*, *medium agreement*) (Liu et al. 2011; Boykoff 2011; Hmielowski et al. 2014).

Popular culture images, science fictions and films of ecological catastrophe can dramatically and emotively convey the dangers of climate change (Bulfin 2017). The overall accuracy of the media coverage on climate change has improved from 2005 to 2019 in the United Kingdom (UK), Australia, New Zealand, Canada, and the USA (McAllister et al. 2021). Moreover, coverage of climate science is increasing. One study (MeCCO) has tracked media coverage of climate change from over 127 sources from 59 countries in North and Latin America, Europe, Middle East, Africa, Asia and Oceania (Boykoff et al. 2021). It shows the number of media science stories in those sources grew steadily from 47,376 per annum to 86,587 per annum between 2017 and 2021 across print, broadcast, digital media and entertainment (Boykoff et al. 2021).

However, increasing media coverage does not always lead to more accurate coverage of climate change mitigation, as it can also spur diffusion of misinformation (Boykoff and Yulsman 2013; van der Linden et al. 2015; Whitmarsh and Corner 2017; Fahy 2018; Painter 2019). In addition, media professionals have at times drawn on the norm of representing both sides of a controversy, bearing the risk of the disproportionate representation of scepticism of anthropogenic climate change despite the convergent agreement in climate science that humans contribute to climate change, (*robust evidence*, *high agreement*) (Freudenburg and Muselli 2010; Boykoff 2013; Painter and Gavin 2016; Tindall et al. 2018; McAllister et al. 2021). This occurs despite increasing consensus among journalists regarding the basic scientific understanding of climate change (Brüggemann and Engesser 2017).

Accurate transference of the climate science has been undermined significantly by climate change counter-movements, particularly in the USA (McCright and Dunlap 2000, 2003; Jacques et al. 2008; Brulle et al. 2012; Boussalis and Coan 2016; Farrell 2016a; Carmichael et al. 2017; Carmichael and Brulle 2018; Boykoff and Farrell 2019; Almiron and Xifra 2019) in both legacy and new/social media environments through misinformation (*robust evidence*, *high agreement*) (van der Linden et al. 2017), including about the causes and consequences of climate change (Brulle 2014; Farrell 2016a; Farrell 2016b; Supran and Oreskes 2017). Misinformation can rapidly spread through social media (Walter et al. 2018). Together with the proliferation of suspicions of 'fake news' and 'post-truth', some traditional and social media contents have fuelled polarisation and partisan divides on climate change in many countries

(Feldman et al. 2017; Hornsey et al. 2018), which can further deter development of new and ambitious climate policy (Tindall et al. 2018). Further, the ideological stance of media also influences the intensity and content of media coverage, in developed and developing countries alike (Dotson et al. 2012; Stoddart and Tindall 2015).

Who dominates the debate on media, and how open the debate can be varies significantly across countries (Takahashi 2011; Poberezhskaya 2015) based on participants' material and technological power. Fossil fuel industries have unique access to mainstream media (Geels 2014) via advertisements, shaping narratives of media reports, and exerting political influence in countries like Australia and the USA (Holmes and Star 2018; Karceski et al. 2020). For social media, novel technical tools, such as automated bots, are emerging to shape climate change discussion on major online platforms such as Twitter (Marlow et al. 2021). Open debates can underpin the adoption of more ambitions climate policy (Lyytimäki 2011). Media coverage on energy saving, patriotism, and social justice in the countries like USA and the UK have helped connect mitigation of climate change with other concerns, thereby raising support to climate action (Leiserowitz 2006; Trope et al. 2007; Doyle 2016; Corner and Clarke 2017; Whitmarsh and Corner 2017; Markowitz and Guckian 2018). Further, media coverage of climate change mitigation has influenced public opinions through discussions on political, economic, scientific and cultural themes about climate change (*medium evidence*, *high agreement*) (Irwin and Wynne 1996; Smith 2000; Boykoff 2011; O'Neill et al. 2015).

Common challenges in reporting climate change exist around the world (Schmidt et al. 2013; Schäfer and Painter 2021), but particularly so in the developing countries, due to lower capacities, lack of journalists' training in complex climate subjects, and lack of access to clear, timely and understandable climate-related resources and images in newsrooms (*robust evidence*, *high agreement*) (Harbinson 2006; Shanahan 2009; Broadbent et al. 2016; Lück et al. 2018). Ugandan journalist Patrick Luganda has said, 'Those most at risk from the impacts of climate change typically have had access to the least information about it through mass media.' (Boykoff, 2011), indicating that information availability and capacity is a manifestation of global climate (in)justice.

13.5 Sub-national Actors, Networks, and Partnerships

In many countries, sub-national actors and networks are a crucial component of climate mitigation as they have remit over land-use planning, waste management, infrastructure, housing and community development, and their jurisdictions are often where the impacts of climate change are felt (*robust evidence*, *high agreement*). Depending on the legal framework and other institutional constraints, sub-national actors play crucial roles in developing, delivering and contesting decarbonisation visions and pathways (Schroeder et al. 2013; Ryan 2015; Abbott et al. 2016; Bäckstrand et al. 2017; Amundsen et al. 2018; Fuhr et al. 2018) (Section 13.3.3).

Sub-national actors include organisations, jurisdictions, and networks (e.g., a coalition of cities or state authorities). These are either formal or informal, profit or non-profit and public or private (Avelino and Wittmayer 2016). For example, corporations are formal, private, and for-profit, the state and labour organisations are formal, public, and non-profit, and communities are private, informal, and non-profit. An intermediary sector, crossing the boundaries between private and public, for profit and non-profit, includes energy cooperatives, not-for-profit energy enterprises, and the scientific community (Avelino and Wittmayer 2016).

To address the challenge of climate mitigation, a range of actors across sectors and jurisdictions have created coalitions for climate governance, operating as actor-networks. For example, mitigation policies are particularly effective when they are integrated with co-benefits such as health, biodiversity, and poverty reduction (Romero-Lankao et al. 2018a). Transnational business and public-private partnerships and initiatives, as well as international cooperation at the sub-national and city levels are discussed in Chapter 14.

13.5.1 Actor-networks and Policies

The decision adopting the Paris Agreement welcomed contributions of sub-national actors to mobilising and scaling up ambitious climate action (see also Chapter 14). They engage in climate relevant mechanisms, such as the Sustainable Development Goals and the New Urban Agenda. Sub-national actors fill a gap in national policies, participate in transnational and sub-national climate governance networks and facilitate learning and exchange among governmental, community, and private organisations at multiple levels, gathering knowledge and best practices such as emission inventories and risk management tools that can be applied in multiple contexts (Kona et al. 2016; Sharifi and Yamagata 2016; Michaelowa and Michaelowa 2017; Warbroek and Hoppe 2017; Bai et al. 2018; Busch et al. 2018; Hsu et al. 2018; Lee and Jung 2018; Marvin et al. 2018; Romero-Lankao et al. 2018b; Ürge-Vorsatz and Seto 2018; Amundsen et al. 2018; Heikkinen et al. 2019; Hultman et al. 2020).

Sub-national climate change policies exist in more than 142 countries and exemplify the increasing significance of mitigation policy at the sub-national level (Hsu et al. 2018). However, estimations of the number of sub-national actors pledging voluntary climate action are challenging and underreporting is a concern (Hsu et al. 2018; Chan and Morrow 2019). As can be seen in Figure 13.3 more than 10,500 cities and nearly 250 regions representing more than 2 billion people, factoring for overlaps in population between these jurisdictions, have pledged climate action as of December 2020 (Hsu et al. 2020a). More jurisdictions in Europe and North America have pledged action, but in terms of population almost all regions are substantially engaged in sub-national action.

Many of these efforts are organised around transnational or regional networks. For example, a coalition of 130 sub-national (in other words, state, and regional) governments, representing 21% of the global economy and 672 million people, has pledged about 9% emissions reduction compared to a base year (CDP 2020). More than 10,000 cities, representing more than 10% of the global population, participate in the Global Covenant of Mayors, C40 Cities

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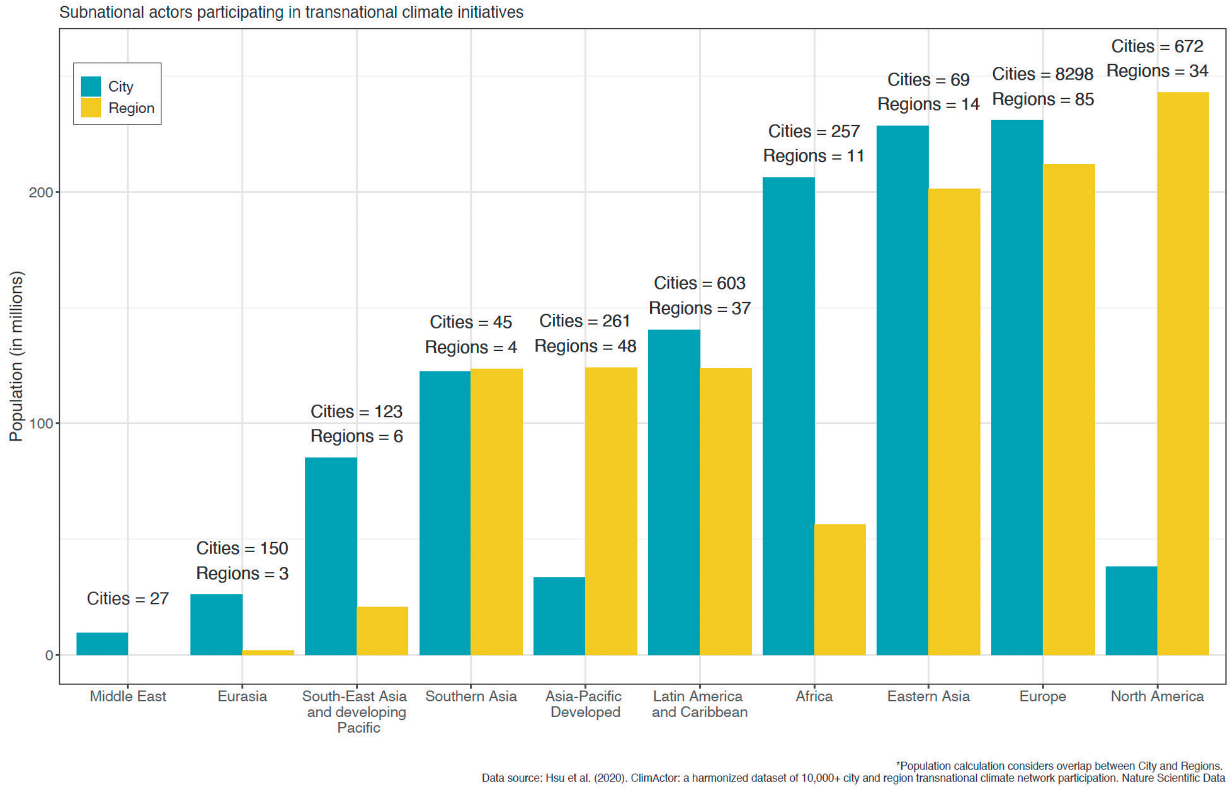

Figure 13.3 | Sub-national GHG mitigation commitments: Total population by IPCC region. Population of sub-national actors (cities and regions) recording climate action commitments as captured in the ClimActor dataset. Population calculation considers overlap between City and Regions by only accounting for population once for Cities and Regions that are nested jurisdictions. Source: adapted with permission from Hsu et al. (2020a) to reflect IPCC AR6 aggregation. Compiled in 2020 from multiple sources based on most recent year of data available.

(Global Covenant of Mayors for Climate and Energy 2018), and ICLEI's – Local Governments for Sustainability carbon registry (Hsu et al. 2018). In Europe alone, more than 6000 cities have adopted their own climate action plans (Palermo et al. 2020a) and nearly 300 US sub-national actors – cities and states – were committed to maintaining momentum for climate action as part of the 'We Are Still In' coalition (We Are Still In coalition 2020) in the absence of national US climate legislation. Further, as of October 2020, more than 826 cities and 103 regional governments had made specific pledges to decarbonise, whether in a specific sector (e.g., buildings, electricity, or transport) or through their entire economies, pledging to reduce their overall emissions by at least 80% (NewClimate Institute and Data Driven EnviroLab 2020). Cities such as Barcelona, Spain and Seattle, Washington have adopted net zero goals for 2050 in policy legislation, while many more cities throughout the world, including the Global South such as Addis Ababa in Ethiopia, have net zero targets under consideration (ECIU 2019, 2021).

Sub-national mitigation policies are highlighted below, based on the taxonomy of policies in Section 13.6.1:

a) Economic instruments: as of 2020, there were carbon pricing initiatives (ETS, carbon tax or both) in 24 sub-national jurisdictions (World Bank 2021a). Examples include emission trading systems within North America, such as the Regional Greenhouse Gas Initiative (RGGI) and Western Climate Initiative (which also includes two Canadian provinces); tax rebates for the purchase of EVs; a carbon tax in British Columbia; and a cap-and-trade scheme in Metropolitan Tokyo (Houle et al. 2015; Murray and Rivers 2015; Hibbard et al. 2018; Bernard and Kichian 2019; Raymond 2019; Xiang and Lawley 2019; Chan and Morrow 2019).
b) Regulatory instruments: policies such as land use and transportation planning, performance standards for buildings, utilities, transport electrification, and energy use by public utilities, buildings and fleets are widely prevalent (Bulkeley 2013; Jones 2013; C40 and ARUP 2015; Martinez et al. 2015; Hewitt and Coakley 2019; Palermo et al. 2020b). Policies such as regulatory restrictions, low emission zones, parking controls, delivery planning and freight routes, focus on traffic management and reduction of local air pollution but also have a mitigation impact (Slovic et al. 2016; Khreis et al. 2017; Letnik et al. 2018). For instance, in coordination with national governments, sub-national actors in China, Europe and USA have introduced access to priority lanes, free parking and other strategies fostering the roll-out of EVs (Creutzig 2016; Zhang and Bai 2017; Teske et al. 2018; Zhang and Qin 2018; Romero-Lankao et al. 2021).
c) Land-use planning addresses building form, density, energy, and transport, which are relevant for decarbonisation (Creutzig et al. 2015; Torabi Moghadam et al. 2017; Teske et al. 2018). Its effectiveness is limited by absent or fragmented jurisdiction, financial resources and powers, competition between authorities and policy domains, and national policies that restrict local governments' ability to enact more ambitious policies (Fudge et al. 2016; Gouldson et al. 2016; Petersen 2016). Most rapidly

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growing smaller cities in Latin America, Asia and Africa lack capacity for urban planning and enforcement (Romero-Lankao et al. 2015; Creutzig 2016).

d) Other policies: these include information and capacity building, such as carbon labelling aimed at providing carbon footprint information to consumers (Liu et al. 2016); disclosure and benchmarking policies in buildings to increase awareness of energy issues and track mitigation progress (Hsu et al. 2017; Papadopoulos et al. 2018); and procurement guidelines developed by associations (Sustainable Purchasing Leadership Council 2021). For instance, a building retrofit programme was initiated in New York and Melbourne to foster energy efficiency improvements through knowledge provision, training, and consultation (Trencher et al. 2016; Trencher and van der Heijden 2019). Also significant is government provision of public good, services, and infrastructure (Romero Lankao et al. 2019), which includes provision of electric buses or buses on renewable fuels for public transportation (Kamiya and Teter 2019) and zero emission urban freight transport (Quak et al. 2019), sustainable food procurement for public organisations in cities (Smith et al. 2016), decentralised energy resources (Marquardt 2014; Hirt et al. 2021; Kahsar 2021), and green electricity purchase via community choice aggregation programmes and franchise agreements (Armstrong 2019).

13.5.2 Partnerships and Experiments

Partnerships, such as those among private and public, or transnational and sub-national entities, have been found to enable better mitigation results in areas outside direct government control such as residential energy use, emissions from local businesses, or private vehicles (Fenwick et al. 2012; Castán Broto and Bulkeley 2013; Aylett 2014; Hamilton et al. 2014; Bulkeley et al. 2016; Wakabayashi and Arimura 2016; Grandin et al. 2018). Partnerships take advantage of investments that match available grants or enable a local energy project, or enhance the scope or impact of mitigation (Burch et al. 2013).

Sub-national actors have also been associated with experiments and laboratories, which promise to achieve the deep change required to address the climate mitigation gap (Smeds and Acuto 2018; Marvin et al. 2018). Experiments span smart technologies, for example, in Malmö, Sweden (Parks 2019), Eco-Art, Transformation-Labs and other approaches that question the cultural basis of current energy regimes and seek reimagined or reinvented futures (Castán Broto and Bulkeley 2013; Guy et al. 2015; Voytenko et al. 2016; Hodson et al. 2018; Peng and Bai 2018; Smeds and Acuto 2018; Culwick et al. 2019; Pereira et al. 2019; Sengers et al. 2019). They may include governance experiments, from formally defined policy experiments to informal initiatives that mobilise new governance concepts (Kivimaa et al. 2017a; Turnheim et al. 2018), and co-design initiatives and grassroots innovations (Martiskainen 2017; Sheikh and Bhaduri 2021). These initiatives often expand the scope for citizen participation. For example, Urban Living Labs foster innovation, coproducing responses to existing problems of energy use, energy poverty and mobility that integrate scientific and expert knowledge with local knowledge and common values (Voytenko et al. 2016; Marvin et al. 2018). The European Network of Living Labs – with a global outreach – has established a model of open and citizen-centric innovation for policy making. The proliferation of Climate Assemblies at the national and sub-national level further emphasises the increasing role that citizens can play in both innovating and planning for carbon mitigation (Sandover et al. 2021).

State and local authorities are often central to initiating and implementing experiments and use an incremental, 'learning by doing' governing approach (Bai et al. 2010; Nevens et al. 2013; Castán Broto and Bulkeley 2013; Mcguirk et al. 2015; Nagorny-Koring and Nochta 2018; Hodson et al. 2018; Peng and Bai 2018; Smeds and Acuto 2018; Culwick et al. 2019; Sengers et al. 2019). Experiments relate to technological learning and changes in policies, practices, services, user behaviour, business models, institutions, and governance (Castán Broto and Bulkeley 2013; Wieczorek et al. 2015; Kivimaa et al. 2017a; Laurent and Pontille 2018; Torrens et al. 2019).

Experimentation has contributed to learning, changes in outcomes when implemented, and shifts in the political landscape (Turnheim et al. 2018). Experiments, however, are often isolated and do not always result in longer-term, more widespread changes. The transformative potential (understood as changes in the fundamental attributes of natural and human systems, see Annex I: Glossary) of experiments is constrained by uncertainty about locally relevant climate change solutions and effects; a lack of comprehensive, and sectorally inclusive national policy frameworks for decarbonisation; budgetary and staffing limitations; and a lack of institutional and political capacity to deliver integrated and planned approaches (Evans and Karvonen 2014; Mcguirk et al. 2015; Bulkeley et al. 2016; Voytenko et al. 2016; Wittmayer et al. 2016; Webb et al. 2017; Grandin et al. 2018; Hölscher et al. 2018; Nagorny-Koring 2019; Sengers et al. 2019).

13.5.3 Performance and Global Mitigation Impact

The performance of sub-national actors' mitigation policies have been measured using criteria such as existence of mitigation targets, incentives for mitigation, definition of a baseline, and existence of a monitoring, reporting, and verification procedure (Hsu et al. 2019). Existing evaluations range from small-scale studies assessing the mitigation potential of commitments by sub-national regions, cities and companies in the USA or in 10 high-emitting economies (Roelfsema 2017; Hsu et al. 2019), to larger studies finding that over 9149 cities worldwide could mitigate 1400 $MtCO_2$-eq in 2030 (Global Covenant of Mayors for Climate and Energy 2018; Hsu et al. 2018, 2019). These sub-national mitigation potential estimates vary since a range of approaches exists for accounting for overlaps between sub-national governments and their nested jurisdictions (e.g., states, provinces, and national governments) (Roelfsema et al. 2018; Hsu et al. 2019). One analysis found that the cities of New York, Berlin, London, Greater Toronto, Boston, and Seattle have achieved on average a 0.27 tCO_2-eq per capita per year reduction (Kennedy et al. 2012). Hsu et al. (2020c) found that 60% of more than 1000 European cities, representing 6% of the EU's total emissions, are on track to achieving their targets, reducing more than 51 $MtCO_2$-eq. While evidence is

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limited, there are concerns that implementation challenges persist with city level plans, particularly tied to management of initiatives and engagement of the population (Messori et al. 2020).

Whether participation in transnational climate initiatives impacts sub-national governments' achievement on climate mitigation goals is uncertain. Some find that higher ambition in climate mitigation commitments did not translate into greater mitigation (Kona et al. 2016; Hsu et al. 2019). Other studies associate participation in networks with increased solar photovoltaic systems (PV) investment (Khan and Sovacool 2016; Steffen et al. 2019), and with potential to achieve carbon emissions reductions per capita in line with a global 2°C scenario (Kona et al. 2016).

Reporting networks may attract high-performing actors, suggesting an artificially high level of cities interested in taking climate action or piloting solutions (self-selection bias) that may not be effective elsewhere (van der Heijden 2018). Many studies present a conservative view of potential mitigation impact because they draw upon publicly reported mitigation actions and exclude sub-national actions that are not reported (Kuramochi et al. 2020).

In addition to direct mitigation contributions, climate action partnerships may deliver indirect effects that, while difficult to quantify, ensure long-term change (Chan et al. 2015). Experimentation and policy innovation helps to establish best practices (Hoffmann 2011); set new norms for ambitious climate action that help build coalitions (Chan et al. 2015; Bernstein and Hoffmann 2018); and translate into knowledge sharing or capacity building (Lee and Koski 2012; Hakelberg 2014; Purdon 2015; Acuto and Rayner 2016). Emergent research explores whether, in addition to realising outcomes, mitigation initiatives also provide the resources, skills and networks that governments and other stakeholders currently use to target other development goals (Shaw et al. 2014; Wolfram 2016; Wiedenhofer et al. 2018; Amundsen et al. 2018; Heikkinen et al. 2019).

13.6 Policy Instruments and Evaluation

Institutions and governance processes described in previous section result in specific policies, that governments then implement and that shape actions of many stakeholders. This section assesses the empirical experience with the range of policy instruments available to governments with which to shape mitigation outcomes. Section 13.7 that follows deals with how these instruments are combined into packages, and Section 13.9 addresses economy-wide measures and issues.

Many different policy instruments for GHG reduction are in use. They fall into a few major categories that share key characteristics. This section provides one possible taxonomy of these major types of policy instruments, presents a set of criteria for policy evaluation, and synthesises the literature on the most common mitigation policies. The emphasis is on recent empirical evidence on the performance of different policy instruments and lessons that can be drawn from these experiences. This builds on and enhances the AR5 Chapter 15, which provided a more theoretical treatment of policy instruments for mitigation.

13.6.1 Taxonomy and Overview of Mitigation Policies

13.6.1.1 Taxonomy of Mitigation Policies

A large number of policies and policy instruments can affect GHG emissions and/or sequestration, whether their primary purpose is climate change mitigation or not. Consequently, consistent with the approach in this chapter, this section adopts a broad interpretation to what is considered mitigation policy. Also, the section recognises the multiplicity of policies that overlap and interact.

Environmental policy instruments, including for climate change mitigation, have long been grouped into three main categories – (i) economic instruments, (ii) regulatory instruments, and (iii) other instruments – although the specific terms differ across disciplines and additional categories are common (Kneese and Schultze 1975; Jaffe and Stavins 1995; Nordhaus 2013; Wurzel et al. 2013). Examples of common policies in each category are shown in Table 13.1, but this is not a comprehensive list. Principles of and empirical experience with the various instruments are synthesised in Sections 13.6.3 to 13.6.5, international interactions are covered in Section 13.6.6.

Table 13.1 | Classification of mitigation policies.

Category	Examples of common types of mitigation policy instruments
Economic instruments	Carbon taxes, GHG emissions trading, fossil fuel taxes, tax credits, grants, renewable energy subsidies, fossil fuel subsidy reductions, offsets, R&D subsidies, loan guarantees
Regulatory instruments	Energy efficiency standards, renewable portfolio standards, vehicle emission standards, ban on SF_6 uses, biofuel content mandates, emission performance standards, methane regulations, land-use controls
Other instruments	Information programmes, voluntary agreements, infrastructure, government technology procurement policies, corporate carbon reporting

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13.6.1.2 Coverage of Mitigation Policies

An increasing share of global emissions sources is subject to mitigation policies, though coverage is still incomplete (Eskander and Fankhauser 2020; Nascimento et al. 2021).

While consistent information on global prevalence of policies is not available, in G20 countries the use of various policy instruments has increased steadily over the past two decades (Nascimento et al. 2021). The share of countries that had mitigation policy instruments in place rose across all sectoral categories, albeit to different extents in different sectors and for different policy instruments (Figure 13.4). Among G20 countries the electricity and heat generation has the greatest number of policies in place, and the agriculture and forestry sector the fewest (Nascimento et al. 2021).

The mix of policies has shifted towards more regulatory instruments and carbon pricing relative to information policies and voluntary action (Schmidt and Fleig 2018; Eskander and Fankhauser 2020).

The IEA database, which tracks renewable energy and energy efficiency policies at the national and sub-national levels for about 160 countries, indicates an average of about 225 new renewable energy and energy efficiency policies annually from 2010 through 2019 with a peak in the number of new renewable energy policies in 2011 (IEA 2021).

While an increasing share of CO_2 emissions from fossil fuel combustion is subject to mitigation policies, there remain many countries and sectors where no dedicated mitigation policies apply to fuel combustion. Fossil fuel use is subject to energy taxes in the majority but not all jurisdictions, and in some instances, it is subsidised.

The main gaps in current mitigation policy coverage are non-CO_2 emissions and CO_2 emissions associated with production of industrial materials and chemical feedstocks, which are connected to broader questions of shifting to cleaner production systems (Bataille et al. 2018a; Davis et al. 2018). Sequestration policies focus mainly on forestry and carbon capture and storage (CCS) with limited support for other carbon dioxide removal and use options (Geden et al. 2019; Vonhedemann et al. 2020).

13.6.1.3 Stringency and Overall Effectiveness of Mitigation Policies

The stringency of mitigation policies varies greatly by country, sector and policy (Box 13.9). Stringency can be increased through sequential changes to policies (Pahle et al. 2018).

Estimates of the effective carbon price (as an estimate of overall stringency across policy instruments) differ greatly between countries and sectors (World Bank 2021a). Countries with higher overall effective carbon prices tend to have lower carbon intensity of energy supply and lower emissions intensity of the economy, as shown in an analysis of 42 G20 and OECD countries (OECD 2018). The carbon price that prevails under a carbon tax or ETS is not directly a measure of policy stringency across an economy, as the carbon prices typically only cover a share of total emissions, and rebates or free allowance allocations can limit effectiveness (OECD 2018). At low emissions prices, mitigation incentives are small; as of April 2021, seventeen

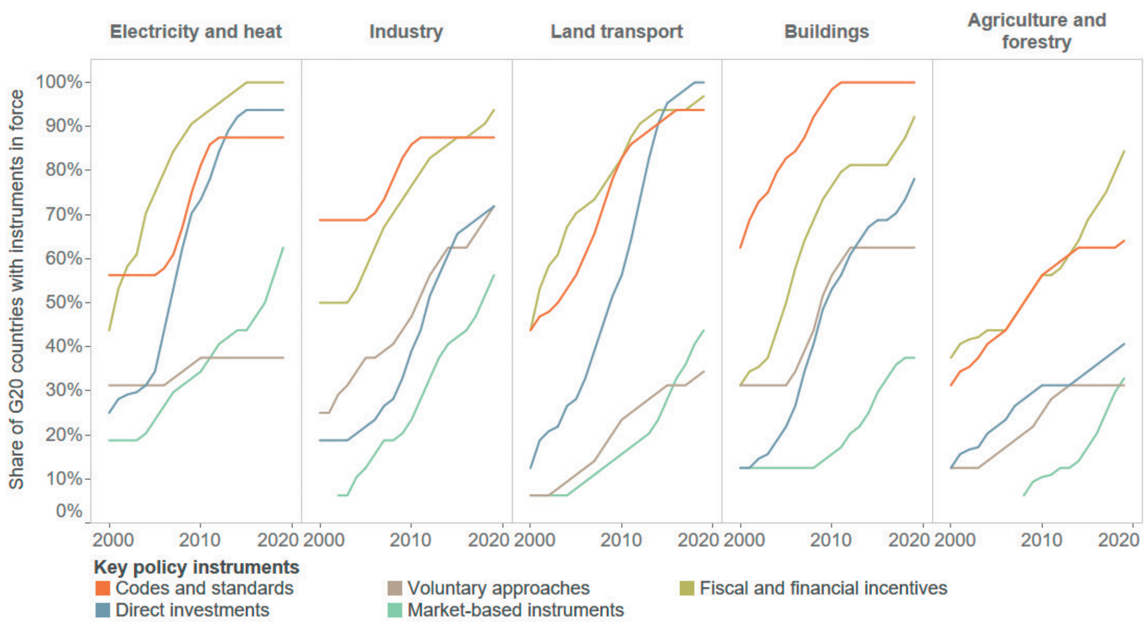

Figure 13.4 | Share of countries that adopted different policy instruments in different sectors, 2000–2020 (three year moving average). Source: reproduced with permission from Nascimento et al. (2021).

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Box 13.9 | Comparing the Stringency of Mitigation Policies

Comparing the stringency of policies over time or across jurisdictions is very challenging and there is no single widely accepted metric or methodology (Compston and Bailey 2016; Burck et al. 2019; Tosun and Schnepf 2020; Fekete et al. 2021). Policies are also assessed for their estimated effect on emissions, however, this requires estimation of a counterfactual baseline and isolation of other effects (Cross-Chapter Box 10 in Chapter 14). Economic instruments can be compared on the basis of their price or cost per tCO_2-eq. Even that is fraught with complexity in the context of different definitions and estimations for fossil fuel taxes and subsidies. For non-price policies an implicit or equivalent carbon price can be estimated. Factors such as the tax treatment of compliance costs can increase complexity. Accounting for the combined effect of overlapping policies presents additional challenges and such estimates are subject to numerous limitations.

jurisdictions with a carbon pricing policy had a tax rate or allowance price less than USD5 per tCO_2 (World Bank 2021a).

Other policies, such as fossil fuel subsidies, may provide incentives to increase emissions thus limiting the effectiveness of the mitigation policy (Section 13.6.3.6). Those effects may be complex and difficult to identify. In most countries trade policy provides an implicit subsidy to CO_2 emissions (Shapiro 2020). The analysis of emissions from energy use in buildings in Chapter 9 illustrates the factors that support and counteract mitigation policies.

Furthermore, emissions pricing policies encourage reduction of emissions whose marginal abatement cost is lower than the tax/allowance price, so they have limited impact on emissions with higher abatement costs such as industrial process emissions (Bataille et al. 2018a; Davis et al. 2018). EU ETS emission reductions have been achieved mainly through implementation of low cost measures such as energy efficiency and fuel switching rather than more costly industrial process emissions.

Estimating the overall effectiveness of mitigation policies is difficult because of the need to identify which observed changes in emissions and their drivers are attributable to policy effort and which to other factors. Cross-Chapter Box 10 in Chapter 14 brings together several lines of evidence to indicate that mitigation policies have had a discernible impact on mitigation for specific countries, sectors and technologies and led to avoided global emissions to date by several billion tonnes CO_2-eq annually (*medium evidence*, *medium agreement*).

13.6.2 Evaluation Criteria

Policy evaluation is a 'careful, retrospective assessment of merit, worth and value of the administration, output and outcomes of government interventions' (Vedung 2005). The inherent complexity of climate mitigation policies calls for the application of multiple criteria, and reflexiveness of analysis with regard to governments' and societies' objectives for policies (Huitema et al. 2011).

Evaluation of climate mitigation policy tends to focus on the environmental effectiveness and economic efficiency or cost-effectiveness of GHG mitigation policies, with distributional equity sometimes as an additional criterion. In policy design and implementation there is rising interest in co-benefits and side-effects of climate policies, as well as institutional requirements for implementation and the potential of policies to have transformative effect on systems. Table 13.2 elaborates.

Table 13.2 | Criteria for evaluation and assessment of policy instruments and packages.

Criterion	Description
Environmental effectiveness	Reducing GHG emissions is the primary goal of mitigation policies and therefore a fundamental criterion in evaluation. Environmental effectiveness has temporal and spatial dimensions.
Economic effectiveness	Climate change mitigation policies usually carry economic costs, and/or bring economic benefits other than through avoided future climate change. Economic effectiveness requires minimising costs and maximising benefits.
Distributional effects	The costs and benefits of policies are usually distributed unequally among different groups within a society (Zachmann et al. 2018), for example between industry, consumers, taxpayers; poor and rich households; different industries; different regions and countries. Policy design affects distributional effects, and equity can be taken into account in policy design in order to achieve political support for climate policies (Baranzini et al. 2017).
Co-benefits, negative side-effects	Climate change mitigation policies can have effects on other objectives, either positive co-benefits (Mayrhofer and Gupta 2016; Karlsson et al. 2020) or negative side-effects. Conversely, impacts on emissions can arise as side-effects of other policies. There can be various interactions between climate change mitigation and the Sustainable Development Goals (Liu et al. 2019).
Institutional requirements	Effective implementation of policies requires that specific institutional prerequisites are met. These include effective monitoring of activities or emissions and enforcement, and institutional structures for the design, oversight and revision and updating of policies. Requirements differ between policy instruments. a separate consideration is the overall feasibility of a policy within a jurisdiction, including political feasibility (Jewell and Cherp 2020).
Transformative potential	Transformational change is a process that involves profound change resulting in fundamentally different structures (Nalau and Handmer 2015), or a substantial shift in a system's underlying structure (Hermwille et al. 2015). Climate change mitigation policies can be seen has having transformative potential if they can fundamentally change emissions trajectories, or facilitate technologies, practices or products with far lower emissions.

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Not all criteria are applicable to all instruments or in all circumstances and the relative importance of different criteria depend on the objectives in the specific the context. a given policy instrument may score highly on only some assessment criteria. In practice, the empirical evidence seldom exists for assessment of a policy instrument across all criteria.

13.6.3 Economic Instruments

Economic instruments, including carbon taxes, emissions trading systems (ETS), purchases of emission reduction credits, subsidies for energy efficiency, renewables and research and development and fossil fuel subsidy removal, provide a financial incentive to reduce emissions. Pricing instruments, especially ETS and carbon taxes, have become more prevalent in recent years (Section 13.6.1). They have proven effective in promoting implementation of the low-cost emissions reductions, and practical experience has driven progress in market mechanism design (*robust evidence*, *high agreement*).

13.6.3.1 Carbon Taxes

A carbon tax is a charge on carbon dioxide or other greenhouse gases imposed on specified emitters or products. In practice features such as exemptions and multiple rates can lead to debate as to whether a specific tax is a carbon tax (Haites 2018). While other taxes can also reduce emissions by increasing the price of GHG emitting products, the result may be inefficient unless the tax rate is proportional to the emissions intensity. a tax on value of fossil fuels, for example, could raise the price on natural gas more than the price of coal, and hence increase emissions if the resulting substitution towards coal were to outweigh reductions in energy use.

As of April 2021, 27 carbon taxes had been implemented by national governments, mostly in Europe (World Bank 2021a). Most of the taxes apply to fossil fuels used for transportation and heating and cover between 3% and 79% of the jurisdiction's emissions. Several countries also tax F-gases. Tax rates vary widely from less than USD1 to over USD137 per tCO_2-eq. a few jurisdictions lowered existing fuel taxes when they implemented the carbon tax, thus reducing the effective tax rate (OECD 2021a). How the tax revenue is used varies widely by jurisdiction.

Carbon taxes tend to garner the least public support among possible mitigation policy options (Rhodes et al. 2017; Rabe 2018; Maestre-Andrés et al. 2019; Criqui et al. 2019) although some regulations also meet with opposition (Attari et al. 2009). Policymakers sometimes use the revenue to build support for the tax, allocating some to address regressivity, to address competitiveness claims by industry, to reduce the economic cost by lowering existing taxes, and to fund environmental projects (Gavard et al. 2018; Klenert et al. 2018; Levi et al. 2020).

Carbon tax rates can be adjusted for inflation, increases in income, the effects of technological change, changing policy ambition, or the addition or subtraction of other policies. In practice, numerous jurisdictions have not increased their tax rates annually and some scheduled tax increases have not been implemented (Haites et al. 2018). Predictability of future tax rates helps improve economic performance (Bosetti and Victor 2011; Brunner et al. 2012). Uncertainty about the future existence of a carbon price can hinder investment (Jotzo et al. 2012) and uncertainty about future price levels can increase the resource costs of carbon pricing (Aldy and Armitage 2020).

13.6.3.2 Emission Trading Systems

The most common ETS design – cap-and-trade – sets a limit on aggregate GHG emissions by specified sources, distributes tradable allowances approximately equal to the limit, and requires regulated emitters to submit allowances equal to their verified emissions. The price of allowances is determined by the market, except in cases where government determined price floors or ceilings apply.

ETSs for GHGs were in place in 38 countries as of April 2021 (World Bank 2021a). The EU ETS, which covers 30 countries, was recently displaced by China's national ETS as the largest. ETSs tend to cover emissions by large industrial and electricity generating facilities.[2] Allowance prices as of April 1, 2021 ranged from just over USD1 to USD50, and coverage between 9% and 80% of the jurisdiction's emissions.

Multiple regional pilot ETSs with different designs have been implemented in China since 2013 to provide input to the design of a national system that is to become the world's largest ETS (Jotzo et al. 2018; Qian et al. 2018; Stoerk et al. 2019). Assessments have identified potential improvements to emissions reporting procedures (Zhang et al. 2019) and the pilot ETS designs (Deng et al. 2018). China's national ETS covering over 2200 heat and power plants with annual emissions of about 4 $GtCO_2$ took effect in 2021 (World Bank 2021a).

All of the ETSs for which data are available have accumulated surplus allowances which reduces their effectiveness (Haites 2018). Surplus allowances indicate that the caps set earlier were not stringent relative to emissions trends. Most of those ETSs have implemented measures to reduce the surplus including removal/cancellation of allowances and more rapid reduction of the cap. Several ETSs have adopted mechanisms to remove excess allowances from the market when supply is abundant and release additional allowances into the market when the supply is limited, such as the EU 'market stability reserve' (Hepburn et al. 2016; Bruninx et al. 2020). Initial indications are that this mechanism is at least partially successful in stabilising prices in response to short term disruptions such as the COVID-19 economic shock (Gerlagh et al. 2020; Bocklet et al. 2019).

Some ETS also include provisions to limit the range of market prices, making them 'hybrids' (Pizer 2002). a price floor assures a minimum level of policy effect if demand for allowances is low relative to the ETS emissions cap. It is usually implemented through a minimum price at auction, as for example in California's ETS (Borenstein et al. 2019).

2 The UK was a member of the EU ETS until December 31, 2020. A UK Emissions Trading Scheme (UK ETS) came into effect on 1 January 2021.

a price ceiling allows the government to issue unlimited additional allowances at a pre-determined price to limit the maximum cost of mitigation. Price ceilings have not been activated to date.

13.6.3.3 Evaluation of Carbon Pricing Experience

A carbon tax or GHG ETS increases the prices of emissions intensive goods thus creating incentives to reduce emissions (Stavins 2019) for a comparison of a tax and ETS). The principal advantage of a pricing policy is that it promotes implementation of low-cost reductions; for a carbon tax, reductions whose cost per tCO_2-eq reduced is lower than the tax and for an ETS the lowest cost (per tCO_2-eq) reductions sufficient to meet the cap. Both a tax and an ETS can be designed to limit adverse economic impacts on regulated sources and emissions leakage.

The corresponding limitations of pricing policies are that they have limited impact on adoption of mitigation measures when decisions are not sensitive to prices and do not encourage adoption of higher cost mitigation measures. Their effectiveness in influencing long-term investments depends on the expectation that the policy will continue and expectations related to future tax rates or allowance prices (Brunner et al. 2012). Other policies can be used in combination with carbon pricing to address these limitations.

The number of pricing policies has increased steadily and covered 21.5% of global GHG emissions in 2020 (World Bank 2021a). Effective coverage is lower because virtually all jurisdictions with a pricing policy have other policies that affect some of the same emissions. For example, a few jurisdictions reduced existing fuel taxes when they introduced their carbon tax thus reducing the effective tax rate, and many jurisdictions have two or more pricing policies

Environmental effectiveness and co-benefits

There is abundant evidence that carbon pricing policies reduce emissions. Statistical studies of emissions trends in jurisdictions with and without carbon pricing find a significant impact after controlling for other policies and structural factors (Best et al. 2020; Rafaty et al. 2020). Numerous assessments of specific policies, especially the EU ETS and the British Columbia carbon tax, conclude that most have reduced emissions (*robust evidence*, *high agreement*) (Narassimhan et al. 2018; Haites et al. 2018; Aydin and Esen 2018; Pretis 2019; Andersson 2019; FSR Climate 2019; Metcalf and Stock 2020; Rafaty et al. 2020; Bayer and Aklin 2020; Diaz et al. 2020; Green 2021; Arimura and Abe 2021).

Estimating the emission reductions due to a specific policy is difficult due to the effects of overlapping policies and exogenous factors such as fossil fuel price changes and economic conditions. Studies that attempt to attribute a share of the reductions achieved to the EU ETS place its contribution at 3–25% (FSR Climate 2019; Bayer and Aklin 2020; Chèze et al. 2020). The relationship between a carbon tax and the resulting emission reductions is complex and is influenced by changes in fossil fuel prices, changes in fossil fuel taxes, and other mitigation policies (Aydin and Esen 2018). But the effectiveness of a carbon tax generally is higher in countries where it constitutes a large part of the fossil fuel price (Andersson 2019).

Few of the world's carbon prices are at a level consistent with various estimates of the carbon price needed to meet the Paris Agreement goals. In modelling of mitigation pathways that limit warming to 2°C (>50%)(Section 3.6.1) marginal abatement costs of carbon in 2030 are about 60 to 120 USD2015 per tCO_2, and about 170 to 290 USD2015 per tCO_2 in pathways that limit warming to 1.5°C (>50%) with no or limited overshoot (Section 3.6). One synthesis study estimates necessary prices at USD40–80 per tCO_2 by 2020 (High-Level Commission on Carbon Prices 2017). Only a small minority of carbon pricing schemes in 2021 had prices above USD40 per tCO_2, and all of these were in European jurisdictions (World Bank 2021a). Most carbon pricing systems apply only to some share of the total emissions in a jurisdiction, so the headline carbon price is higher than the average carbon price that applies across an economy (World Bank 2021a).

Where ETS or carbon taxes exist, they apply to different proportions of the jurisdiction's greenhouse gas emissions. The share of emissions covered by ETSs in 2020 varied widely, ranged from 9% (Canada) to 80% (California) while the share of emissions covered by carbon taxes ranged from 3% (Latvia and Spain) to 80% (South Africa) (World Bank 2021a).Where carbon pricing policies are effective in reducing GHG emissions, they usually also generate co-benefits including better air quality. For example, a Chinese study of air quality benefits from lower fossil fuel use under carbon pricing suggests that prospective health co-benefits would partially or fully offset the cost of the carbon policy (Li et al. 2018). Depending upon the jurisdiction (for example, if there are fossil fuel subsidies) carbon pricing could also reduce the economic distortions of fossil fuel subsidies, improve energy security through greater reliance on local energy sources and reduce exposure to fossil fuel market volatility. Substantial carbon prices would be in the domestic self-interest of many countries if co-benefits were fully factored in (Parry et al. 2015).

Economic effectiveness

Economic theory suggests that carbon pricing policies are on the whole more cost effective than regulations or subsidies at reducing emissions (Gugler et al. 2021). Any mitigation policy imposes costs on the regulated entities. In some cases entities may be able to recover some or all of the costs through higher prices (Neuhoff and Ritz 2019; Cludius et al. 2020). International competition from less stringently regulated firms limits the ability of emissions-intensive, trade-exposed (EITE) firms to raise their prices. Thus, a unilateral mitigation policy creates a risk of adverse economic impacts, including loss of sales, employment, profits, for such firms and associated emissions leakage (Section 13.6.6.1).

Pricing policies can be designed to minimise these risks; free allowances can be issued to EITE participants in an ETS and taxes can provide exemptions or rebates. An extensive *ex post* literature finds no statistically significant adverse impacts on competitiveness or leakage (13.6.6.1).

An *ex post* analysis of European carbon taxes finds no robust evidence of a negative effect on employment or GDP growth (Metcalf and Stock 2020). The British Columbia carbon tax led to a small net increase in employment (Yamazaki 2017) with no significant negative impacts on GDP possibly due to full recycling of the tax revenue (Bernard and Kichian 2021). Few carbon taxes apply to EITE sources (Timilsina 2018), so competitiveness impacts usually are not a particular concern.

Government revenue generated by carbon pricing policies globally was approximately 53 billion USD in 2020 split almost evenly between carbon taxes and ETS allowance sales (World Bank 2021). Revenue raised though carbon pricing is generally considered a relatively efficient form of taxation and a large share of revenue enters general government budgets (Postic and Fetet 2020). Some of the revenue is returned to emitters or earmarked for environmental purposes. Allowance allocation and revenue spending measures have been used to create public support for many carbon pricing policies including at every major reform stage of the EU ETS (Klenert et al. 2018; Dorsch et al. 2020) (Box 5.11).

Distributional effects

The most commonly studied distributional impact is the direct impact of a carbon tax on household income. Typically it is regressive; the tax induced increase in energy expenditures represents a larger share of household income for lower income households (Grainger and Kolstad 2010; Timilsina 2018; Dorband et al. 2019; Ohlendorf et al. 2021). Governments can rebate part or all of the revenue to low-income households, or implement other changes to taxation and transfer systems to achieve desired distributional outcomes (Jacobs and van der Ploeg 2019; Saelim 2019; Sallee 2019) (Box 5.11). The full impact of the tax – after any distribution of tax revenue to households and typically adverse effects on investors – generally is less regressive or progressive (Williams III et al. 2015; Goulder et al. 2019). Where the tax revenue is treated as general revenue the government relies on existing income redistribution policies (such as income taxes) and social safety net programmes to address the distributional impacts.

Carbon taxes on fossil fuels have effects similar to the removal of fossil fuel subsidies (Ohlendorf et al. 2021) (Section 13.6.3.6). Even if a carbon tax is progressive it increases prices for fuels, electricity, transport, food and other goods and services that adversely affect the most economically vulnerable. Redistribution of tax revenue is critical to address the adverse impacts on low-income groups (Dorband et al. 2019) (Box 5.11). In countries with a limited capacity to collect taxes and distribute revenues to low-income households, such as some developing countries, carbon taxes may have greater distributional consequences.

Distributional effects have generally not been a significant issue for ETSs. Equity for industrial participants typically is addressed through free allocation of allowances. Impacts on household incomes, with the exception of electricity prices, are too small or indirect to be a concern. Some systems are designed to limit electricity price increases (Petek 2020) or use some revenue for bill assistance to low-income households (RGGI 2019).

Technological change

Carbon pricing, especially an ETS that covers industrial sources, stimulates technological change by participants and others (Calel and Dechezleprêtre 2016; FSR Climate 2019; van den Bergh and Savin 2021) (Section 13.6.6.3 and Chapter 16). The purpose of pricing policies is to encourage implementation of the lowest cost mitigation measures. Pricing policies therefore are more likely to stimulate quick, low cost innovation such as fuel switching and energy efficiency, rather than long term, costly technology development such as renewable energy or industrial process technologies (Calel 2020; Lilliestam et al. 2021). To encourage long-term technology development carbon pricing policies need to be complemented by other mitigation and research and development (R&D) policies.

13.6.3.4 Offset Credits

Offset credits are voluntary GHG emission reductions for which tradable credits are issued by a supervisory body (Michaelowa et al. 2019b). a buyer can use purchased credits to offset an equal quantity of its emissions. In a voluntary market governments, firms and individuals purchase credits to offset emissions generated by their actions, such as air travel. a compliance market al.ows specified offset credits to be used for compliance with mitigation policies, especially ETSs, carbon taxes and low-carbon fuel standards. (Newell et al. 2013; Bento et al. 2016; Michaelowa et al. 2019a).

When used for compliance, governments typically specify a maximum quantity of offset credits that can be used, as well as the types of emission reduction actions, the project start dates and the geographic regions eligible credits. Initially, the EU ETS, Swiss ETS and New Zealand ETS accepted credits issued under the Kyoto Protocol (Chapter 14), but they terminated or severely constrained the quantity of international credits allowed for compliance use after 2014 (Shishlov et al. 2016) (Section 13.6.6).

A key question for any offset credit is whether the emission reductions are 'additional': reductions that only happen because of the offset credit payment (Greiner and Michaelowa 2003; Millard-Ball and Ortolano 2010; van Benthem and Kerr 2013; Burke 2016; Bento et al. 2016). To assess additionality and to determine the quantity of credits to be issued, regulators develop methodologies to estimate baseline (business-as-usual) emissions in the absence of offset payments (Newell et al. 2013; Bento et al. 2016). Credits are issued for the difference between the baseline and actual emissions with adjustments for possible emissions increases outside the project boundary (Rosendahl and Strand 2011). Some research suggests that procedural and measurement advances can significantly reduce the risk of severe non-additionality (Mason and Plantinga 2013; Bento et al. 2016; Michaelowa et al. 2019a).

13.6.3.5 Subsidies for Mitigation

Subsidies for mitigation encourage individuals and firms to invest in assets that reduce emissions, changes in processes or innovation. Subsidies have been used to improve energy efficiency, encourage the uptake of renewable energy and other sector-specific emissions

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saving options (Chapters 6 to 11), and to promote innovation. Targeted subsidies can achieve specific mitigation goals yet have intrinsically narrower coverage than more broad-based pricing instruments. Subsidies are often used not only to achieve emissions reductions but to address market imperfections or to achieve distributional or strategic objectives. Subsidies are often used alongside or in combination with other policy instruments, and are provided at widely differing cost per unit of emissions reduced.

Governments routinely provide direct funding for basic research, subsidies for R&D to private companies, and co-funding of research and deployment with industry (Dzonzi-Undi and Li 2016). Research subsidies have been found to be positively correlated with green product innovation in a study in Germany, Switzerland and Austria (Stucki et al. 2018). Government subsidies for R&D have been found to greatly increase the green innovation performance of energy intensive firms in China (Bai et al. 2019). For more detail see Chapter 16.

Subsidies of different forms are often provided for emissions savings investments to businesses and for the retrofit of buildings for energy efficiency. Emissions reductions from energy efficiencies can often be achieved at low cost, but evidence for some schemes suggests lower effectiveness in emissions reductions than expected *ex ante* (Fowlie et al. 2018; Valentová et al. 2019). Tax credits can be used to encourage firms to produce or invest in low-carbon emission energy and low-emission equipment. Investment subsidies have been found to be more effective in reducing costs and uncertainties in solar energy technologies than production subsidies (Flowers et al. 2016).

Subsidies have been provided extensively and in many countries for the deployment of household rooftop solar systems, and increasingly also for commercial scale renewable energy projects, typically using 'feed-in tariffs' that provide a payment for electricity generated above the market price (Pyrgou et al. 2016). Such schemes have proven effective in deploying renewable energy, but lock-in subsidies for long periods of time. In some cases they provide subsidies at higher levels than would be required to motivate deployment (del Río and Linares 2014). High levels of net subsidies have been shown to diminish incentives for optimal siting of renewable energy installations (Penasco et al. 2019).

A variant of subsidies for deployment of renewable energy are auctioned feed-in tariffs or auctioned contracts-for-difference, where commercial providers bid in a competitive process. Auctions typically lead to lower price premiums (Eberhard and Kåberger 2016; Roberts 2020) but efficient outcomes depend on auction design and market structure (Grashof et al. 2020), although an emergent literature also questions whether spread of auctions is due to performance or the dynamics of the policy formulation process (Fitch-Roy et al. 2019b; Grashof et al. 2020; Grashof 2021). The prequalification requirements or the assessment criteria in the auctions sometimes also include local co-benefits such as local economic diversification (Buckman et al. 2019; White et al. 2021).

Support for rollout clean technologies at high prices can be economically beneficial in the long run if costs are reduced greatly as a function of deployment (Newbery 2018). Deployment support, much of it in the form of feed-in tariffs in Germany, enabled the scaling up of the global solar photovoltaic industry and attendant large reductions in production costs that by 2020 made solar power cost competitive with fossil fuels (Buchholz et al. 2019). There is also evidence for increased innovation activity as a result of solar feed-in tariffs (Böhringer et al. 2017b).

Many governments have also provided subsidies for the purchase of electric vehicles, including with strong effect in China (Ma et al. 2017), Norway (Baldursson et al. 2021) and other countries, and sometimes at relatively high rates (Kong and Hardman 2019).

13.6.3.6 Removal of Fossil Fuel Subsidies

Many governments subsidise fossil fuel consumption and/or production through a variety of mechanisms (Burniaux and Chateau 2014) (Figure 13.5). Different approaches exist to defining the scope and estimating the magnitude of fossil fuel subsidies (Koplow 2018), and all involve estimates, so the magnitudes are uncertain. Rationalising inefficient fossil fuel subsidies is one of the indicators to measure progress toward Sustainable Development Goal 12: Ensure sustainable consumption and production patterns (UNEP 2019a).

Consumption subsidies represent approximately 70% of the total. Most of the subsidies go to petroleum, which accounts for roughly 50% of the consumption subsidies and 75% of the production subsidies (IEA 2020; OECD 2020). Much of the variation in the consumption subsidies is due to fluctuations in the world price of oil which is used as the reference price.

Reducing fossil fuel subsidies would lower CO_2 emissions, increase government revenues (Jakob et al. 2015; Dennis 2016; Gass and Echeverria 2017; Rentschler and Bazilian 2017; Monasterolo and Raberto 2019), improve macroeconomic performance (Monasterolo and Raberto 2019), and yield other environmental and sustainable development benefits (*robust evidence*, *medium agreement*) (Jakob et al. 2015; Rentschler and Bazilian 2017; Solarin 2020). The benefits of gasoline subsidies in developing countries accrue mainly to higher income groups, so subsidy reduction usually will reduce inequality (Coady et al. 2015; Dennis 2016; Monasterolo and Raberto 2019; Labeaga et al. 2021). Some subsidies, like tiered electricity rates, benefit low-income groups. Reductions of broad subsidies lead to price increases for fuels, electricity, transport, food and other goods and services that adversely affect the most economically vulnerable (Coady et al. 2015; Zeng and Chen 2016; Rentschler and Bazilian 2017). Distributing some of the revenue saved can mitigate the adverse economic impacts on low-income groups (Dennis 2016; Zeng and Chen 2016; Labeaga et al. 2021; Schaffitzel et al. 2020).

The emissions reduction that could be achieved from fossil fuel subsidy removal depends on the specific context such as magnitude and nature of subsidies, energy prices and demand elasticities, and how the fiscal savings from reduced subsidies are used. Modelling studies of global fossil fuel subsidy removal result in projected emission reductions of between 1% and 10% by 2030 (Delpiazzo et al. 2015; IEA 2015; Jewell et al. 2018; IISD 2019) and between 6.4% and 8.2% by 2050 (Schwanitz et al. 2014; Burniaux and Chateau 2014).

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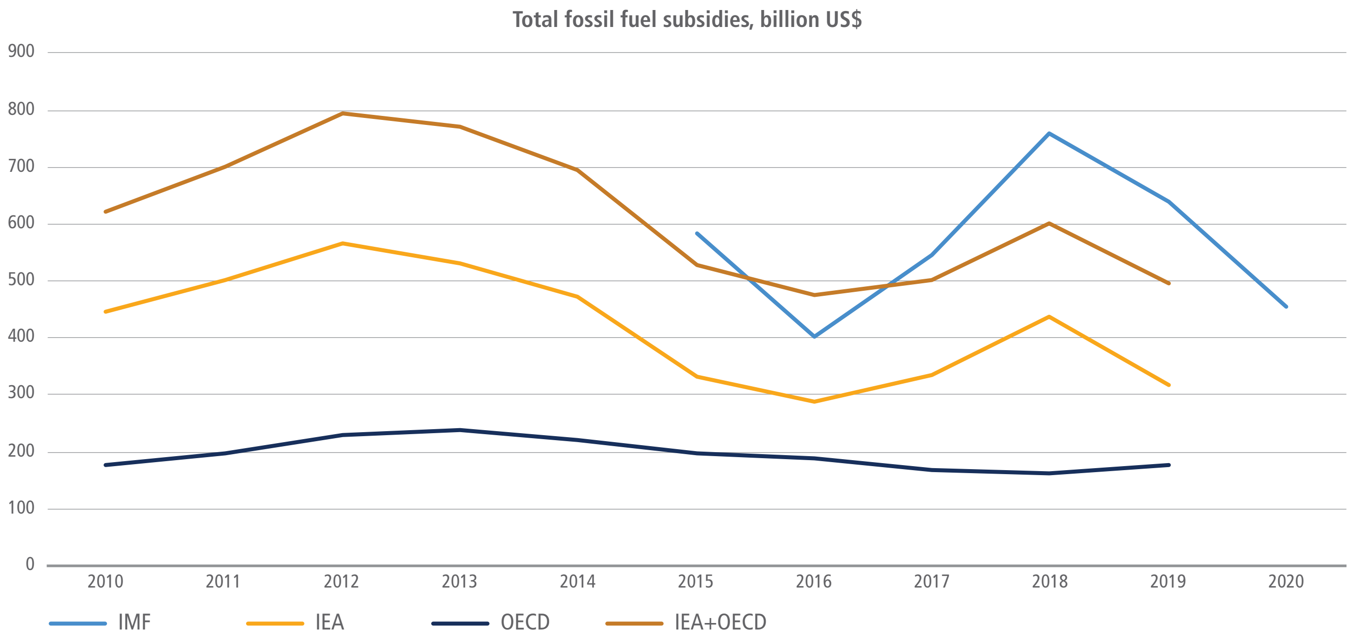

Figure 13.5 | Total fossil fuel subsidies, 2010–2019, in USD billion (USD2021 for IMF, USD2019 for others). Source: data from OECD (2020) (43 countries, mainly production subsidies), IEA (2020) (40 countries, mainly consumption subsidies), IMF (Parry et al. 2021; explicit subsidies for all countries).

An extensive literature documents the difficulties of phasing out fossil fuel subsidies (Schmidt et al. 2017; Gass and Echeverria 2017; Skovgaard and van Asselt 2018; Kyle 2018; Perry 2020; Gençsü et al. 2020). Fossil fuel industries lobby to maintain producer subsidies and consumers protest if they are adversely affected by subsidy reductions (Fouquet 2016; Coxhead and Grainger 2018). Yemen (2005 and 2014), Cameroon (2008), Bolivia (2010), Nigeria (2012), Ecuador (2019) all abandoned subsidy reform attempts following public protests (Rentschler and Bazilian 2017; Mahdavi et al. 2020). Indonesia is an example where fossil fuel subsidy removal was successful, helped by social assistance programmes and a communication effort about the benefits of reform (Chelminski 2018; Burke and Kurniawati 2018). To-date instances of fossil fuel subsidy reform or removal have been driven largely by national fiscal and economic considerations (Skovgaard and van Asselt 2019).

13.6.4 Regulatory Instruments

Regulatory instruments are applied by governments to cause the adoption of desired processes, technologies, products (including energy products) or outcomes (including emission levels). Failure to comply incurs financial penalties and/or legal sanctions. Regulatory instruments range from performance standards, which prescribe compliance outcomes – and in some cases allow flexibility to achieve compliance, including the trading of credits – to more prescriptive technology-specific standards, also known as command-and-control regulation. Regulatory instruments play an important role to achieve specific mitigation outcomes in sectoral applications (*robust evidence*, *high agreement*). Mitigation by regulation often enjoys greater political support but tends to be more economically costly than mitigation by pricing instruments (*robust evidence*, *medium agreement*).

13.6.4.1 Performance Standards, Including Tradable Credits

Performance standards grant regulated entities freedom to choose the technologies and methods to reach a general objective, such as a minimum market share of zero-emission vehicles or of renewable electricity, or a maximum emissions intensity of electricity generated. Tradable performance standards allow regulated entities to trade compliance achievement credits; under-performers can buy surplus credits from over-performers thereby reducing the aggregate cost of compliance (Fischer 2008).

Tradable performance standards have been applied to numerous sectors including electricity generation, personal vehicles, building energy efficiency, appliances, and large industry. An important application is Renewable Portfolio Standards (RPS) for electricity supply, which require that a minimum percentage of electricity is generated from specified renewable sources sometimes including nuclear and fossil fuels with CCS when referred to as a clean electricity standard (Young and Bistline 2018) (Chapter 6). This creates a price incentive to invest in renewable generation capacity. Such incentives can equivalently be created through feed-in tariffs, a form of subsidy (Section 13.6.3) and some jurisdictions have had both instruments (Matsumoto et al. 2017). RPS can differ in features and stringency, and are in operation in many countries and sub-national jurisdictions, including a majority of US states (Carley et al. 2018).

Vehicle emissions standards are a common form of performance standard with flexibility (Chapter 9). a corporate fuel efficiency standard specifies an average energy use and/or GHG emissions per kilometre travelled for vehicles sold by a manufacturer. Another version of this policy, the zero-emission vehicle (ZEV) standard, requires vehicle sellers to achieve minimum requirements for sales

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of zero-emission vehicles (Bhardwaj et al. 2020). Both instruments allow manufacturers to use tradable credits to achieve compliance.

Low-carbon fuel standards (LCFS), which set an average life-cycle carbon intensity for energy that declines over time, are another example. LCFS are in place in many different jurisdictions (Chapter 9) and have been applied to petroleum products, natural gas, hydrogen and electricity (Yeh et al. 2016). An LCFS allows regulated entities to trade credits creating the potential for high carbon intensity fuel suppliers to cross-subsidise low-carbon intensity transport energy providers including low-carbon biofuels, hydrogen and electricity (Axsen et al. 2020).

Trading and other flexibility mechanisms improve the economic efficiency of standards by harmonising the marginal abatement costs among companies or installations subject to the standard. Nevertheless tradable performance standards are less economically efficient in achieving emissions reductions than carbon pricing, sometimes by a significant amount (Giraudet and Quirion 2008; Chen et al. 2014; Holland et al. 2015; Fox et al. 2017; Zhang et al. 2018).

13.6.4.2 Technology Standards

Technology standards take a more prescriptive approach by requiring a specific technology, process or product. They typically take one of three forms: requirements for specific pollution abatement technologies; requirements for specific production methods; or requirements for specific goods such as energy efficient appliances. They can also take the form of phase-out mandates, as applied for example to planned bans of internal combustion engines for road transport (Bhagavathy and McCulloch 2020), coal use; for example, Germany's decisions to phase out coal (Oei et al. 2020), and some industry processes and products, for example, hydrofluorocarbons (HFCs) and use of sulphur hexafluoride (SF_6) in some products (see Box 13.10 on non-CO_2 gases). Technology standards are also referred to as command-and-control standards, prescriptive standards, or design standards.

Technology standards are a common climate policy particularly at the sector level (Chapters 6–11). Technology standards tend to score lower in terms of economic efficiency than carbon pricing and performance standards (Besanko 1987). But they may be the best instrument for situations where decisions are not very responsive to price signals such as consumer choices related to energy efficiency and recycling and decisions relating to urban land use and infrastructure choices.

By mandating specific compliance pathways, technology standards risk locking-in a high-cost pathway when lower cost options are available or may emerge through market incentives and innovation (Raff and Walter 2020). Furthermore, standards may require high-cost GHG reductions in one sector while missing low-cost options in another sector. Technology standards can also stifle innovation by blocking alternative technologies from entering the market (Sachs 2012). Benefits of technology standards include their potential to achieve emission reductions in a relatively short time frame and that their effectiveness can be estimated with some confidence (Montgomery et al. 2019).

13.6.4.3 Performance of Regulatory Instruments

Regulatory policy instruments tend to be more economically costly than pricing instruments, as explained above. However, regulatory policies may be preferred for other reasons.

In some cases, regulatory policy can elicit greater political support than pricing policy (Tobler et al. 2012; Lam 2015; Drews and van den Bergh 2016). For example, USA citizens have expressed more support for flexible regulation like the RPS than for carbon taxes (Rabe 2018). And a survey in British Columbia a few years after the simultaneous implementation of a carbon tax and two regulations – the LCFS and a clean electricity standard – found much less strong opposition to the regulations, even after being informed that they were costlier to consumers (Rhodes et al. 2017). The degree of public support for regulations depends, however, on the type of regulation, as outright technology prohibitions can be unpopular (Attari et al. 2009; Cherry et al. 2012).

In comparison to economic instruments, regulatory policies tend to cause greater cost of living increases in percentage terms for lower income consumers – called policy regressivity (Levinson 2019; Davis and Knittel 2019). And unlike carbon taxes, regulations do not generate revenues that can be used to compensate lower income groups.

A renewable energy procurement obligation in South Africa successfully required local hiring with perceived positive results (Walwyn and Brent 2015; Pahle et al. 2016), a clean energy regulation in Korea was perceived to provide greater employment opportunities (Lee 2017), and a UK obligation on energy companies to provide energy retrofits to low-income households improved energy affordability according to participants (Elsharkawy and Rutherford 2018).

From an energy system transformation perspective, technology standards, including phase-out mandates, have particular promise to achieve profound change in specific sectors and technologies (Tvinnereim and Mehling 2018). As such policies change the technologies available in the market, then economic instruments can also have a greater effect (Pahle et al. 2018).

Box 13.10 | Policies to Limit Emissions of Non-CO_2 Gases

Non-CO_2 gases weighted by their 100-year GWPs represent approximately 25% of global GHG emissions, of which methane (CH_4) accounts for 18%, nitrous oxide (N_2O) 4%, and fluorinated gases (HFCs, PFCs, SF_6 and NF_3) 2% (Minx et al. 2021). Only a small share of these emissions are subject to mitigation policies.

Methane (CH_4). Anthropogenic sources include agriculture, mainly livestock and rice paddies, fossil fuel extraction and processing, fuel combustion, some industrial processes, landfills, and wastewater treatment (EPA 2019). Atmospheric measurements indicate that methane emissions from fossil fuel production are larger than shown in emissions inventories (Schwietzke et al. 2016). Only a small fraction of global CH_4 emissions is regulated. Mitigation policies focus on landfills, coal mines, and oil and gas operations.

Regulations and incentives to capture and utilise methane from coal seams came into effect in China in 2010 (Tan 2018; Tao et al. 2019). Inventory data suggest that emissions peaked and began a slow decline after 2010 (Gao et al. 2020) though satellite data indicate that China's methane emissions, largely attributable to coal mining, continued to rise in line with pre-2010 trends (Miller et al. 2019). Methane emissions from sources including agriculture, waste and industry are included in some offset credit schemes, including the CDM and at national level in Australia's Emissions Reductions Fund (Australian Climate Change Authority 2017) and the Chinese Certified Emission Reduction (CCER) scheme (Lo and Cong 2017).

Nitrous oxide (N_2O). N_2O emissions are produced by agricultural soil management, livestock waste management, fossil fuel combustion, and adipic acid and nitric acid production (EPA 2019). Most N_2O emissions are not regulated and global emissions have been increasing. N_2O emissions by adipic and nitric acid plants in the EU are covered by the ETS (Winiwarter et al. 2018). N_2O emissions are included in some offset schemes. China, the United States, Singapore, Egypt, and Russia produce 86% of industrial N_2O emissions offering the potential for targeted mitigation action (EPA 2019).

Hydrofluorocarbons (HFCs). Most HFCs are used as substitutes for ozone depleting substances. The Kigali Amendment (KA) to the Montreal Protocol will reduce HFC use by 85% by 2047 (UN Environment 2018). To help meet their KA commitments developed country parties have been implementing regulations to limit imports, production and exports of HFCs and to limit specific uses of HFCs.

The EU, for example, issues tradable quota for imports, production and exports of HFCs. Prices of HFCs have increased as expected (Kleinschmidt 2020) which has led to smuggling of HFCs into the EU (European Commission 2019b). HFC use has been slightly (1–6%) below the limit each year from 2015 through 2018 (EEA 2019). China and India released national cooling action plans in 2019, laying out detailed, cross-sectoral plans to provide sustainable, climate friendly, safe and affordable cooling (Dean et al. 2020).

Perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). With the exception of SF_6, these gases are emitted by industrial activities located in the European Economic Area (EEA) and a limited number (fewer than 30) of other countries. Regulations in Europe, Japan and the USA focus on leak reduction as well as collection and reuse of SF_6 from electrical equipment. Other uses of SF_6 are banned in Europe (European Union 2014).

PFCs are generated during the aluminium smelting process if the alumina level in the electrolytic bath falls below critical levels (EPA 2019). In Europe these emissions are covered by the EU ETS. The industry is eliminating the emissions through improved process control and a shift to different production processes.

The semiconductor industry uses HFCs, PFCs, SF_6 and NF_3 for etching and deposition chamber cleaning (EPA 2019) and has a voluntary target of reducing GHG emissions 30% from 2010 by 2020 (World Semiconductor Council 2017). Europe regulates production, import, export, destruction and feedstock use of PFCs and SF_6, but not NF_3 (EEA 2019). In addition, fluorinated gases are taxed in Denmark, Norway, Slovenia and Spain.

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Box 13.11 | Shadow Cost of Carbon in Regulatory Analysis

In some jurisdictions, public administrations are required to apply a shadow cost of carbon to regulatory analysis.

Traditionally, for example in widespread application in the United States, the shadow cost of carbon is calibrated to an estimate of the social cost of carbon as an approximation of expected future cumulative economic damage from a unit of greenhouse gas emissions (Metcalf and Stock 2017). Social cost of carbon is usually estimated using integrated assessment models and is subject to fundamental uncertainties (Pezzey 2019). An alternative approach, used for example in regulatory analysis in the United Kingdom since 2009, is to define a carbon price that is thought to be consistent with a particular targeted emissions outcome. This approach also requires a number of assumptions, including about future marginal costs of mitigation (Aldy et al. 2021).

In some jurisdictions, the analysis of regulatory instruments is subject to an assessment on the basis of a shadow cost of carbon, which can influence the choice and design of regulations that affect GHG emissions (Box 13.11).

13.6.5 Other Policy Instruments

A range of other mitigation policy instruments are in use, often playing a complementary role to pricing and standards.

13.6.5.1 Transition Support Policies

Effective climate change mitigation can cause economic and social disruption where there is transformative change, such as changes in energy systems away from fossil fuels (Section 13.9). Transitional assistance policies can be aimed to ameliorate effects on consumers, workers, communities, corporations or countries (Green and Gambhir 2020) in order to create broad coalitions of supporters or to limit opposition (Vogt-Schilb and Hallegatte 2017).

13.6.5.2 Information Programmes

Information programmes, including energy efficiency labels, energy audits, certification, carbon labelling and information disclosure, are in wide use in particular for energy consumption. They can reduce GHG emissions by promoting voluntary technology choices and behavioural changes by firms and households.

Energy efficiency labelling is in widespread use, including for buildings, and for end users products including cars and appliances. Carbon labelling is used for example for food (Camilleri et al. 2019) and tourism (Gössling and Buckley 2016). Information measures also include specific information systems such as smart electricity meters (Zangheri et al. 2019). Chapters 5 and 9 provide detail.

Information programmes can correct for a range of market failures related to imperfect information and consumer perceptions (Allcott 2016). Alongside mandatory standards (13.6.4), information programmes can nudge firms and consumers to focus on often overlooked operating cost reductions (Carroll et al. 2022). For example, consumers who are shown energy efficiency labels on average buy more energy efficient appliances than those who are not (Stadelmann and Schubert 2018). Information policies can also support the changing of social norms about consumption choices, which have been shown to raise public support for pricing and regulatory policy instruments (Gössling et al. 2020).

Energy audits provide tailored information about potential energy savings and benchmarking of best practices through a network of peers. Typical examples include the United States Better Buildings Challenge that has provided energy audits to support USA commercial and industrial building owners, energy savings have been estimated at 18% to 30% (Asensio and Delmas 2017); and Germany's energy audit scheme for SMEs achieving reductions in energy consumption of 5–70% (Kluczek and Olszewski 2017).

Consumption-oriented policy instruments seek to reduce GHG emissions by changing consumer behaviour directly, via retailers or via the supply chain. Aspects that hold promise are technology lists, supply chain procurement by leading retailers or business associations, a carbon-intensive materials charge and selected infrastructure improvements (Grubb et al. 2020).

The information provided to consumers in labelling programmes is often not detailed enough to yield best possible results (Davis and Metcalf 2016). Providing information about running costs tends to be more effective than providing data on energy use (Damigos et al. 2020). Sound implementation of labelling programmes requires appropriate calculation methodology and tools, training and public awareness (Liang Wong and Krüger 2017). In systems where manufacturers self-report performance of their products, there tends to be misreporting and skewed energy efficiency labelling (Goeschl 2019).

A new form of information programmes are financial accounting standards as frameworks to encourage or require companies to disclose how the transition risks from shifting to a low-carbon economy and physical climate change impacts may affect their business or asset values (Chapter 15). The most prominent such standard was issued in 2017 by the Financial Stability Board's Task Force on Climate-related Financial Disclosures. It has found rapid uptake among regulators and investors (O'Dwyer and Unerman 2020).

Traditionally, corporate reporting has treated climate risks in a highly varied and often minimal way (Foerster et al. 2017). Disclosure of climate-related risks creates incentives for companies to improve their carbon and climate change exposure, and ultimately regulatory standards for climate risk (Eccles and Krzus 2018). Disclosure can also reinforce calls for divestment in fossil fuel assets predominantly promoted by civil society organisations (Ayling and Gunningham 2017), raising moral principles and arguments about the financial risks inherent in fossil fuel investments (Green 2018; Blondeel et al. 2019).

13.6.5.3 Public Procurement and Investment

National, sub-national and local governments determine many aspects of infrastructure planning, fund investment in areas such as energy, transport and the built environment, and purchase goods and services, including for government administration and military provisioning.

Public procurement rules usually mandate cost effectiveness but only in some cases allow or mandate climate change consideration in public purchasing, for example in EU public purchasing guidelines (Martinez Romera and Caranta 2017). Green procurement for buildings has been undertaken in Malaysia (Bohari et al. 2017). a paper cites Taiwan (province of China) green public procurement law, which has contributed to reduced emissions intensity (Tsai 2017). In practice, awareness and knowledge of 'green' public procurement techniques and procedures is decisive for climate-friendly procurement (Testa et al. 2016). Experiences in low-carbon infrastructure procurement point to procedures being tailored to concerns about competition, transaction costs and innovation (Kadefors et al. 2020).

Infrastructure investment decisions lock-in high or low emissions trajectories over long periods. Low-emissions infrastructure can enable or increase productivity of private low-carbon investments (Jaumotte et al. 2021) and is typically only a little more expensive over its lifetime, but faces additional barriers including higher upfront costs, lack of pricing of externalities, or lack of information or aversion to novel products (Granoff et al. 2016). In low-income developing countries, where infrastructure has historically lagged developed countries, some of these hurdles can be exacerbated by overall more difficult conditions for public investment (Gurara et al. 2018).

Governments can also promote low-emissions investments through public-private partnerships and government owned 'green banks' that provide loans on commercial or concessional basis for environmentally friendly private sector investments (David and Venkatachalam 2019; Ziolo et al. 2019). Public funding or financial guarantees such as contracts-for-difference can alleviate financial risk in the early stages of technology deployment, creating pathways to commercial viability (Bataille 2020).

Government provision can also play an important role in economic stimulus programs, including as implemented in response to the pandemic of 2020–2021. Such programmes can support low-emissions infrastructure and equipment, and industrial or business development (Elkerbout et al. 2020; Hainsch et al. 2020; Barbier 2020; Hepburn et al. 2020).

13.6.5.4 Voluntary Agreements

Voluntary Agreements result from negotiations between governments and industrial sectors that commit to achieve agreed goals (Mundaca and Markandya 2016). When used as part of a broader policy framework, they can enhance the cost effectiveness of individual firms in attaining emission reductions while pricing or regulations drive participation in the agreement (Dawson and Segerson 2008).

Public voluntary programmes, where a government regulator develops programs to which industries and firms may choose to participate on a voluntary basis, have been implemented in numerous countries. For example, the United States Environmental Protection Agency introduced numerous voluntary programmes with industry to offer technical support in promoting energy efficiency and emissions reductions, among other initiatives (EPA 2017). a European example is the EU Ecolabel Award programme (European Commission 2020b). Agreements for industrial energy efficiency in Europe (Cornelis 2019) and Japan (Wakabayashi and Arimura 2016) have been particularly effective in addressing information barriers and for smaller companies. The International Civil Aviation Organization's CORSIA scheme (Prussi et al. 2021) is an example of an international industry-based public voluntary programme.

Voluntary agreements are often implemented in conjunction with economic or regulatory instruments, and sometimes are used to gain insights ahead of implementation of regulatory standards, as in the case of energy efficiency PVPs in South Korea (Seok et al. 2021). In some cases, industries use voluntary agreements as partial fulfilment of a regulation (Rezessy and Bertoldi 2011; Langpap 2015). For example, the Netherlands have permitted participating industries to be exempt from certain energy taxes and emissions regulations (Veum 2018).

Box 13.12 | Technology and Research and Development Policy

Private businesses tend to under-invest in research and development because of market failures (Geroski 1995), hence there is a case for governments to support research and technology development. a range of different policy instruments are used, including government funding, preferential tax treatment, intellectual property rules, and policies to support the deployment and diffusion of new technologies. Chapter 16 treats innovation policy in-depth.

13.6.6 International Interactions of National Mitigation Policies

One country's mitigation policy can impact other countries in various ways including changes in their GHG emissions (leakage), creation of markets for emission reduction credits, technology development and diffusion (spillovers), and reduction in the value of their fossil fuel resources.

13.6.6.1 Leakage Effects

Compliance with a mitigation policy can affect the emissions of foreign sources via several channels over different time scales (Zhang and Zhang 2017) (Box 13.13). The effects may interact and yield a net increase or decrease in emissions. The leakage channel that is of most concern to policymakers is adverse international competitiveness impacts from domestic climate policies.

In principle, implementation of a mitigation policy in one country creates an incentive to shift production of tradable goods whose costs are increased by the policy to other countries with less costly emissions limitation policies (Section 12.6.3). Such 'leakage' could to some extent negate emissions reductions in the first country, depending on the relative emissions intensity of production in both countries.

Ex ante modelling studies typically estimate significant leakage for unilateral policies to reduce emissions due to production of emissions intensive products such as steel, aluminium, and cement (Carbone and Rivers 2017). However, the results are highly dependent on assumptions and typically do not reflect policy designs specifically aimed at minimising or preventing leakage (Fowlie and Reguant 2018).

Numerous *ex post* analyses, mainly for the EU ETS, find no evidence of any or significant adverse competitiveness impacts and conclude that there was consequently no or insignificant leakage (*medium evidence*, *medium agreement*) (Branger et al. 2016; Haites et al. 2018; Koch and Basse Mama 2019; FSR Climate 2019; aus dem Moore et al. 2019; Venmans et al. 2020; Kuusi et al. 2020; Verde 2020; Borghesi et al. 2020). This is attributed to large allocations of free allowances to emissions-intensive, trade-exposed sources, relatively low allowance prices, the ability of firms in some sectors to pass costs on to consumers, energy's relatively low share of production costs, and small but statistically significant effects on innovation (Joltreau and Sommerfeld 2019). Few carbon taxes apply to emissions-intensive, trade-exposed sources (Timilsina 2018), so competitiveness impacts usually are not a particular concern.

Policies intended to address leakage include a border carbon adjustment (Ward et al. 2019; Ismer et al. 2020). a border carbon adjustment (BCA) imposes costs – a tax or allowance purchase obligation – on imports of carbon-intensive goods equivalent to those borne by domestic products possibly mirrored by rebates for exports (Böhringer et al. 2012; Fischer and Fox 2012; Zhang 2012; Böhringer et al. 2017c) (Chapter 14). A BCA faces the practical challenge of determining the carbon content of imports (Böhringer et al. 2017a) and the design needs to be consistent with WTO rules and other international agreements (Cosbey et al. 2019;

Box 13.13 | Possible Sources of Leakage

Competitiveness: Mitigation policy raises the costs and product prices of regulated sources which causes production to shift to unregulated sources, increasing their emissions.

Fossil fuel channel: Regulated sources reduce their fossil fuel use, which lowers fossil fuel prices and increases consumption and associated emissions by unregulated sources.

Land-use channel: Mitigation policies that change land use lead to land use and emissions changes in other jurisdictions (Bastos Lima et al. 2019).

Terms of trade effect: Price increases for the products of regulated sources shift consumption to other goods, which raises emissions due to the higher output of those goods.

Technology channel: Mitigation policy induces low-carbon innovation, which reduces emissions by sources that adopt the innovations that may include unregulated sources (Gerlagh and Kuik 2007).

Abatement resource effect: Regulated sources increase use of clean inputs, which reduces inputs available to unregulated sources and so limits their output and emissions (Baylis et al. 2014).

Scale channel: Changes to the output of regulated and unregulated sources affect their emissions intensities so emissions changes are not proportional to output changes (Antweiler et al. 2001).

Intertemporal channel: Capital stocks of all sources are fixed initially but change over time affecting the costs, prices, output and emissions of regulated and unregulated products.

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Mehling et al. 2019). Model estimates indicate that a BCA reduces but does not eliminate leakage (Branger and Quirion 2014). No BCA has yet been implemented for international trade although such a measure is currently under consideration by some governments.

13.6.6.2 Market for Emission Reduction Credits

A mitigation policy may allow the use of credits issued for emission reductions in other countries for compliance purposes (see also Section 13.6.3.4 on offset credits and Chapter 14 on international credit mechanisms). Creation of international markets for emission reduction credits tends to benefit other countries through financial flows in return for emissions credit sales (*medium evidence*, *high agreement*).

The EU, New Zealand and Switzerland allowed participants in their emissions trading systems to use credits issued under the Kyoto Protocol mechanisms, including the Clean Development Mechanism (CDM), for compliance. From 2008 through 2014, participants used 3.76 million imported credits for compliance of which 80% were CDM credits (Haites 2016).[3] Use of imported credits has fallen to very low levels since 2014 (World Bank 2014; Shishlov et al. 2016).[4]

The Clean Development Mechanism (CDM) is the world's largest offset programme (Chapter 14). From 2001 to 2019 over 7500 projects with projected emission reductions in excess of 8000 $MtCO_2$-eq were implemented in 114 developing countries using some 140 different emissions reduction methodologies (UNFCCC 2012; UNEP DTU Partnership 2020). Credits reflecting over 2000 $MtCO_2$-eq of emission reductions by 3260 projects have been issued. To address additionality and other concerns the CDM Executive Board frequently updated its approved project methodologies.

13.6.6.3 Technology Spillovers

Mitigation policies stimulate low-carbon R&D by entities subject to those policies and by other domestic and foreign entities (FSR Climate 2019). Policies to support technology development and diffusion tend to have positive spillover effects between countries (*medium evidence*, *high agreement*) (Section 16.3).

Innovation activity in response to a mitigation policy varies by policy type (Jaffe et al. 2002) and stringency (Johnstone et al. 2012). In addition, many governments have policies to stimulate R&D, further increasing low-carbon R&D activity by domestic researchers. Emitters in other countries may adopt some of the new low-carbon technologies thus reducing emissions elsewhere. Technology development and diffusion is reviewed in Chapter 16.

13.6.6.4 Value of Fossil Fuel Resources

Fossil fuel resources are a significant source of exports, employment and government revenues for many countries. The value of these resources depends on demand for the fuel and competing supplies in the relevant international markets. Discoveries and new production technologies reduce the value of established resources. Mitigation policies that reduce the use of fossil fuels also reduce the value of these resources. A single policy in one country is unlikely to have a noticeable effect on the international price, but similar policies in multiple countries could adversely affect the value of the resources. For fossil fuel exporting countries, mitigation policies consistent with the Paris Agreement goals could result in greater costs from changes in fossil fuel prices due to lower international demand than domestic policy costs (*medium evidence*, *high agreement*) (Liu et al. 2020).

The impact on the value of established resources will be mitigated, to some extent, by the reduced incentive to explore for and develop new fossil fuel supplies. Nevertheless, efforts to lower global emissions will mean substantially less demand for fossil fuels, with the majority of current coal reserves and large shares of known gas and oil reserves needing to remain unused, with great diversity in impacts between different countries (McGlade and Ekins 2015) (Chapters 3, 6, 15).

Estimates of the potential future loss in value differ greatly. There is uncertainty about remaining future fossil fuel use under different mitigation scenarios, as well as future fossil fuel prices depending on extraction costs, market structures and policies. Estimates of total cumulative fossil fuel revenue lost range between 5–67 trillion USD (Bauer et al. 2015) with an estimate of the net present value of lost profit of around 10 trillion USD (Bauer et al. 2016). Policies that constrain supply of fossil fuels in the context of mitigation objectives could limit financial losses to fossil fuel producers (Chapter 14).

13.7 Integrated Policy Packages for Mitigation and Multiple Objectives

Since AR5, the literature on climate policies and policymaking has expanded in two significant directions. First, there is growing recognition that mitigation policy occurs in the context of multiple climate and development objectives (Chapter 4). Different aspects of these linkages are discussed across the AR6 WGIII report, including concepts and framings (Section 1.6.2), shifting sustainable development pathways (Section 4.3 and Cross-Chapter Box 5 in Chapter 4), cross-sectoral interactions (Sections 12.6.1 and 12.6.2), evidence of co-impacts (Section 17.3), links with adaptation (Section 4.4.2) and accelerating the transition (Sections 13.9, 17.1.1, 17.4.5 and 17.4.6). While the concept of development pathways is salient in all countries, it may particularly resonate with policymakers in developing countries focused on providing basic needs and addressing poverty and inequality, including energy poverty (Ahmad 2009; Fuso Nerini et al. 2019; Bel and Teixidó 2020; Caetano et al. 2020; Röser et al. 2020). Consequently, some countries may frame policies predominantly in terms of accelerating mitigation, while in others a multiple objectives approach linked to development pathways may dominate, depending on their specific socio-economic contexts and priorities, governance capacities (McMeekin et al. 2019) and perceptions of historical responsibility (Winkler and Rajamani 2014; Friman and Hjerpe 2015; Winkler et al. 2015; Pan et al. 2017).

3 2010 through 2014 for the New Zealand ETS.

4 All three ETSs were modified after 2012 including provisions that affected compliance use of imported credits.

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		Framing of outcome	
		Enhancing mitigation	Addressing multiple objectives of mitigation and development
Approach to policymaking	Shifting incentives	'Direct mitigation focus' *(Section 13.6; 2.8)* *Objective:* reduce GHG emissions now *Literature:* how to design and implement policy instruments, with attention to distributional and other concerns *Examples:* carbon tax, cap and trade, border carbon adjustment, disclosure policies	'Co-benefits' *(Sections 17.3; 5.6.2; 12.4.4)* *Objective:* synergies between mitigation and development *Literature:* scope for and policies to realise synergies and avoid trade-offs across climate and development objectives *Examples:* appliance standards, fuel taxes, community forest management, sustainable dietary guidelines, green building codes, packages for air pollution, packages for public transport
	Enabling transition	'Socio-technical transitions' *(Sections 1.7.3; 5.5; 10.8; 6.7; Cross-Chapter Box 12 in Chapter 16)* *Objective:* accelerate low-carbon shifts in socio-technical systems *Literature:* understand socio-technical transition processes, integrated policies for different stages of a technology 'S-curve' and explore structural, social and political elements of transitions *Examples:* packages for renewable energy transition and coal phase-out; diffusion of electric vehicles, process and fuel switching in key industries	'System transitions to shift development pathways' *(Sections 11.6.6; 7.4.5; 13.9; 17.3.3; Cross-Chapter Box 5 in Chapter 4; Cross-Chapter Box 9 in Chapter 13)* *Objective:* accelerate system transitions and shift development pathways to expand mitigation options and meet other development goals *Literature:* examines how structural development patterns and broad cross-sector and economy-wide measures drive ability to mitigate while achieving development goals through integrated policies and aligning enabling conditions *Examples:* packages for sustainable urbanisation, land-energy-water nexus approaches, green industrial policy, regional just transition plans

Figure 13.6 | Mapping the landscape of climate policy.

Second, since AR5 there is growing attention to enabling transitions over time. Literature on socio-technical transitions, rooted in innovation studies, highlights the need for different policy focus at different stages of a transition (Geels et al. 2017b,a; Köhler et al. 2019) (Section 1.7.3). Other literature examines how broad patterns of development drive both social and mitigation outcomes through shifts in policies and a re-alignment of enabling conditions (Chapter 4). Explicit efforts to shift development pathways, for example by shifting patterns of energy demand and urbanisation, therefore offer broader mitigation opportunities (Cross-Chapter Box 5 in Chapter 4). Common to both approaches is an emphasis beyond the short term, and attention to enabling longer-term structural shifts in economies and societies.

Taking these trends into account, Figure 13.6 outlines the climate policy landscape, and how it maps to different parts of this Working Group III report. One axis of variation captures alternative framings of desired outcomes in national policymaking – mitigation versus multiple objectives, while the second captures the shift in policymaking from an initial focus on shifting incentives through largely individual policy instruments, to explicit consideration of how policies and economy-wide measures, including those that shift incentives, can combine to enable transitions. As a result, Figure 13.6 represents interconnected policy ideas, but backed by distinct strands of literature. Notably, each of these categories is salient to climate policymaking, although the balance may differ depending on country context.

This section particularly focuses on climate policymaking for transition – both socio-technical transitions and shifts in development pathways, while direct climate policies and co-benefits are addressed in other parts of the report, as indicated in Figure 13.6. This section focuses in particular on lessons for designing policy packages for transitions, and is complemented by discussion in Section 13.8 on integration between adaptation and mitigation, and Section 13.9 on economy-wide measures and the broader enabling conditions necessary to accelerate mitigation.

13.7.1 Policy Packages for Low-carbon Sustainable Transitions

Since AR5 an emergent multidisciplinary literature on policy packages, or policy mixes, has emerged that examine how policies may be combined for sustainable low-carbon transitions (Rogge and Reichardt 2016; Kern et al. 2019). This literature covers various sectors including: energy (Rogge et al. 2017); transport (Givoni et al. 2013); industry (Scordato et al. 2018); agri-food (Kalfagianni and Kuik 2017); and forestry (Scullion et al. 2016).

A central theme in the literature is that transitions require policy interventions to address system level changes, thereby going beyond addressing market failures in two ways. First, structural system changes are needed for low-carbon transitions, including building low-carbon infrastructure (or example aligning electricity grids and storage with the requirements of new low-carbon technology), and adjusting existing institutions to low-carbon solutions (for example by reforming electricity market design) (Bak et al. 2017; Patt and Lilliestam 2018). Second, explicit transformational system changes are necessary, including efforts at directing transformations, such as clear direction setting through the elaboration of shared visions, and coordination across diverse actors across different policy fields, such as climate and industrial policy, and across governance levels (Uyarra et al. 2016; Nemet et al. 2017).

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There are some specific suggestions for policy packages: Van den Bergh et al. (2021) suggest that innovation support and information provision combined with a carbon tax or market, or adoption subsidy leads to both effective and efficient outcomes. Others question the viability of universally applicable policy packages, and suggest packages need to be tailored to local objectives (del Río 2014) Consequently, much of the literature focuses on broad principles for design of policy packages and mixes, as discussed below.

Comprehensiveness, balance and consistency are important criteria for policy packages or mixes (*robust evidence*, *high agreement*) (Rogge and Reichardt 2016; Scobie 2016; Carter et al. 2018; Santos-lacueva and González 2018). Comprehensiveness assesses the extensiveness of policy packages, including the breadth of system and market failures it addresses (Rogge and Reichardt 2016). For example, instrument mixes that include only moderate carbon pricing, but are complemented by policies supporting new low-carbon technologies and a moratorium on coal-fired power plants may not only be politically more feasible than stringent carbon pricing alone, but may also limit efficiency losses and lower distributional impacts (Bertram et al. 2015b). Balance captures whether policy instruments are deployed in complementary ways given their different purposes, combining for example technology-push approaches such as public R&D with demand-pull approaches such as an energy tax. A combination of technology-push and demand-pull approaches has been shown to support innovation in energy efficient technologies in OECD countries (Costantini et al. 2017). Consistency addresses the alignment of policy instruments among each other and with the policy strategy, which may have multiple and not always consistent objectives (Rogge 2019). Consistency of policy mixes has been identified as an important driver of low-carbon transformation, particularly for renewable energy (Lieu et al. 2018; Rogge and Schleich 2018). Box 13.14 summarises the economics literature on how policies interact, to inform design of packages.

Box 13.14 | Policy Interactions of Carbon Pricing and Other Instruments

The economics literature provides insights on policy interactions among the multiple overlapping policies that directly or indirectly affect GHG emissions, including when different levels of government are involved. Multiple mitigation policies can be theoretically justified if there are multiple objectives or market failures or to achieve distributional objectives and increase policy effectiveness (Stiglitz 2019). Examples include the coexistence of the EU ETS with vehicle emission standards and energy efficiency standards (Rey et al. 2013), and the fact that 85% of the emissions covered by California's ETS are also subject to other policies (Bang et al. 2017; Mazmanian et al. 2020). Policy interactions are also widespread among energy efficiency policies (Wiese et al. 2018).

Interactive effects can influence the costs of policy outcomes. With multiple overlapping and possibly non-optimal policies, the effect on total cost is not clear. A modelling study of USA mitigation policy finds the costs of using heterogeneous sub-national policies to achieve decarbonisation targets is 10% higher than national uniform policies (Peng et al. 2021). When multiple policy goals are sought, such as mitigation and R&D, a portfolio of optimal policies achieves the goals at significantly lower cost (Fischer and Newell 2008). In some cases, overlapping mitigation policies can raise the cost of mitigation (Böhringer et al. 2016) while lowering the cost of achieving other goals, such as energy efficiency improvements and expansion of renewable energy (Rosenow et al. 2016; Lecuyer and Quirion 2019). It is possible that one or more of the policies is made redundant (Aune and Golombek 2021).

While overlapping policies may raise the cost of mitigation, they increase the likelihood of achieving an emission reduction goal. Policy overlap will lead to different optimal carbon prices across jurisdictions (Bataille et al. 2018b). The existence of overlapping policies will usually increase administrative and compliance costs. However, *ex post* analysis shows that transaction costs of mitigation policies are low and are not a decisive factor in policy choice (Joas and Flachsland 2016).

The effectiveness, as well as economic and distributional effects, of a given mitigation policy will depend on the interactions among all the policies that affect the targeted emissions. Because a market instrument interacts with every other policy that affects the targeted emissions, interactions tend to be more complex for market instruments than for regulations that mandate specific emission reduction actions by targeted sources independent of other policies.

An ETS scheme implemented with existing mitigation policies may be subject to the 'waterbed effect' – emission reductions undertaken by some emitters may be offset by higher emissions by other ETS participants due to overlapping mitigation policies (Schatzki and Stavins 2012). This reduces the impact of the ETS and lowers carbon trading prices (Perino 2018). However *ex post* assessments find net emissions reductions. ETS design features such as a price floor and 'market stability reserve' can limit the waterbed effect (Edenhofer et al. 2017; Kollenberg and Taschini 2019; Narassimhan et al. 2018; FSR Climate 2019).

A carbon tax, unlike the allowance price, does not change in response to the effect of overlapping policies but those policies may reduce emissions by sources subject to the tax and so lower the emission reductions achieved by the tax (Goulder and Stavins 2011).

Box 13.14 (continued)

Policy interactions often occur with the introduction of new mitigation policy instruments. For example, in China several sub-national ETSs exist alongside policies to reduce emission intensity, increase energy efficiency and expand renewable energy supplies (Zhang 2015). These quantity-based ETSs interact with many other policies (Duan et al. 2017), for example price-based provincial carbon intensity targets (Qian et al. 2017). They also interact with the level of market regulation; for example, full effectiveness of emissions pricing would require electricity market reform in China (Teng et al. 2017).

Policy packages aimed at low-carbon transitions are more effective when they include elements to enhance the phase out of carbon-intensive technologies and practices – often called exnovation – in addition to supporting low-carbon niches (Kivimaa and Kern 2016; David 2017). Such policies include stringent carbon pricing; changes in regime rules such as design of electricity markets; reduced support for dominant regime technologies such as removing tax deductions for private motor transport based on internal combustion engines; and changes in the balance of representation of incumbents versus new entrants in deliberation and advisory bodies. For example, CGE modelling for China's fossil fuel subsidy reform found that integrating both creation and destabilisation policies is able to reduce rebound effects and make the policy mix more effective (Li et al. 2017). Sweden's pulp and paper industry shows that destabilisation policies including deregulation of the electricity market and a carbon tax were an important complement to support policies (Scordato et al. 2018), and other studies show complementary results for Finland's building sector (Kivimaa et al. 2017b) and Norway's transport and energy sector (Ćetković and Skjærseth 2019).

Policy packages for low-carbon transitions are more successful if they take into account the potential for political contestation and resistance from incumbents who benefit from high-carbon systems (*medium evidence*, *high agreement*) (Geels 2014; Roberts et al. 2018; Kern and Rogge 2018; Rosenbloom 2018). To do so, policies can be sequenced so as to address political obstacles, for example, by initially starting with policies to facilitate the entry of new firms engaged in low-carbon technologies (Pahle et al. 2018). Such policies can generate positive feedbacks by creating constituencies for continuation of those policies, but need to be designed to do so from the outset (Edmondson et al. 2019, 2020). For example, supporting renewable energies through feed-in tariffs can buttress coalitions for more ambitious climate policy, such as through carbon pricing (Meckling et al. 2015). However, negative policy feedback may also arise from ineffective policy instruments that lose public support, or create concentrated losses that arouse oppositional coalitions (Edmondson et al. 2019). Feedback loops can operate through changes in resources available to actors; changes in expectations; and changes in government capacities (Edmondson et al. 2019).

Another promising strategy is to design short-term policies which might help to provide later entry points for more ambitious climate policy (Kriegler et al. 2018) and supportive institutions. The sequencing of policies can build coalitions for climate policy, starting with green industrial policy (e.g. supporting renewable energies through feed-in tariffs) and introducing or making carbon pricing more stringent when supportive coalitions of stringent climate policy have been formed (Meckling et al. 2015). Similarly, investing in supportive institutions, with competencies compatible with low-carbon futures, are a necessary supportive element of transitions (Pahle et al. 2018; Rosenbloom et al. 2019; Domorenok et al. 2021).

13.7.2 Policy Integration for Multiple Objectives and Shifting Development Pathways

This sub-section assesses policy integration and packages required to enable shifts in development pathways, with a particular focus on sectoral scale transitions. However, because shifting development pathways requires broad transformative change, it complements discussion on broader shifts in policymaking such as fiscal, educational, and infrastructure policies (Cross-Chapter Box 5 in Chapter 4) and to the alignment of a wide range of enabling conditions required for system transitions (Section 13.9).

In many countries, and particularly when climate policy occurs in the context of sustainable development, policymakers seek to address climate mitigation in the context of multiple economic and social policy objectives (*medium evidence*, *robust agreement*) (Halsnæs et al. 2014; Campagnolo and Davide 2019; Cohen et al. 2019). Studies suggest that co-benefits of climate policies are substantial, especially in relation to air quality, and can yield better mitigation and overall welfare, yet these are commonly overlooked in policymaking (*robust evidence*, *robust agreement*) (Nemet et al. 2010; Ürge-Vorsatz et al. 2014; von Stechow et al. 2015; Mayrhofer and Gupta 2016; Roy et al. 2018; Bhardwaj et al. 2019; Karlsson et al. 2020). Other studies have shown the existence of strong complementarities between the SDGs and realisation of NDC pledges by countries (McCollum et al. 2018). An explicit attention to development pathways can enhance the scope for mitigation, by paying explicit attention to development choices that lock-in or lock-out opportunities for mitigation, such as around land use and infrastructure choices (Cross-Chapter Box 5 in Chapter 4). While the pay-offs are considerable to an approach to mitigation that takes into account linkages to multiple objectives and the opportunity to shift development pathways, there are also associated challenges with implementing this approach to policymaking.

First, spanning policy arenas and addressing multiple objectives places considerable requirements of coordination on the policymaking process (Howlett and del Rio 2015; Obersteiner et al. 2016). Climate policy integration suggests several steps should precede actual policy formulation, beginning with a clear articulation of the policy frame or problem statement (Adelle and Russel 2013; Candel and Biesbroek 2016). For example, a greenhouse gas limitation framework versus a co-benefits framing would likely yield different policy approaches. It is then useful to identify the range of actors and institutions involved in climate governance – the policy subsystem, the goals articulated, the level at which goals are articulated and the links with other related policy goals such as energy security or energy access (Candel and Biesbroek 2016). The adoption of specific packages of policy instruments should ideally follow these prior steps that define the scope of the problem, actors and goals.

In practice, integration has to occur in the context of an already existing policy structure, which suggests the need for finding windows of opportunity to bring about integration, which can be created by international events, alignments with domestic institutional procedures, and openings created by policy entrepreneurs (Garcia Hernandez and Bolwig 2020). Integration also has to occur in the context of existing organisational routines and cultures, which can pose a barrier to integration (Uittenbroek 2016). Experience from the EU suggests that disagreements at the level of policy instruments are amenable to resolution by deliberation, while normative disagreements at the level of objectives require a hierarchical decision structure (Skovgaard 2018). As this discussion suggests, the challenge of integration operates in two dimensions: horizontal – between sectoral authorities such as ministries or policy domains such as forestry – or vertical – either between constitutional levels of power or within the internal mandates and interactions of a sector (Howlett and del Rio 2015; Di Gregorio et al. 2017). There are also important temporal dimensions to policy goals, as policy and benchmarks have to address not just immediate success but also indications of future transformation (Dupont and Oberthür 2012; Dupont 2015).

Second policymaking for shifting development pathways has to account for inherent uncertainties in future development paths (Moallemi and Malekpour 2018; Castrejon-Campos et al. 2020). These uncertainties may be greater in developing countries that are growing rapidly and where structural features of the economy including infrastructure and urbanisation patterns are fluid. For example, reviews of modelling studies of Chinese (Grubb et al. 2015) and Indian emissions futures (Spencer and Dubash 2021) find that differences in projections can substantially be accounted for by alternative assumptions about future economic structural shifts. Consequently, an important design consideration is that policy packages should be robust, that is, perform satisfactorily for all key objectives under a broad range of plausible futures (Kwakkel et al. 2016; Maier et al. 2016; Castrejon-Campos et al. 2020). Such an approach to decision-making can be contrasted with one that tries to design an optimal policy package for the 'best guess' future scenario (Maier et al. 2016). Moreover, policy packages can usefully be adapted dynamically to changing circumstances as part of the policy process (Haasnoot et al. 2013; Hamarat et al. 2014; Maier et al. 2016) including by using exploratory modelling techniques that allow comparison of trade-offs across alternative future scenarios (Hamarat et al. 2014). Another approach is to link quantitative models with a participatory process that enables decision-makers to test the implications of alternative interventions (Moallemi and Malekpour 2018). Rosenbloom et al. (2019) suggest that because policy mixes should adapt to changing circumstances, instead of stability of a particular mix, transitions require embedding policies within a long-term orientation toward a low-carbon economy, including a transition agenda, social legitimacy for this agenda, and an appropriate ecosystem of institutions.

Third, achieving changes in development pathways requires engaging with place-specific context. It requires attention to existing policies, political interests that may gain or lose from a transition, and locally specific governance enablers and disablers. As a result, while there may be approaches that carry over from one context to another, implementation requires careful tailoring of transition approaches to specific policy and governance contexts. Cross-Chapter Box 9 in this chapter summarises case studies of sectoral transitions from other chapters in this report (Chapters 5 to 12) to illustrate this complexity. Broader macroeconomic transformative shifts are discussed in more detail in Section 13.9.

Common to all the sectoral cases in Cross-Chapter Box 9 is a future-oriented vision of sectoral transition often focused on multiple objectives, such as designing tram-based public transport systems in Bulawayo, Zimbabwe to simultaneously stimulate urban centers, create jobs and enable low-carbon transportation. Sectoral transitions are enabled by policy mixes that bring together different combinations of instruments – including regulations, financial incentives, convening, education and outreach, voluntary agreements, procurement and creation of new institutions – to work together in a complementary manner. The effectiveness of a policy mix depends on conditions beyond design considerations and also rests on the larger governance context within which sector transitions occur, which can include enabling and disabling elements. Enabling factors illustrated in Cross-Chapter Box 9 include strong high level political support, for example to address deforestation in Brazil despite powerful logging and farmer interests, or policy design to win over existing private interests, for example, by harnessing distribution networks of kerosene providers to new LPG technology in Indonesia. Disabling conditions include local institutional contexts, such as the lack of tree and land tenure in Ghana, which, along with the monopoly of the state marketing board, posed obstacles to Ghana's low-carbon cocoa transition. These examples emphasise the importance of attention to local context if policy integration and the design of policy mixes are to effectively lead to transitions guided by multiple climate and development objectives.

Cross-Chapter Box 9 | Case Studies of Integrated Policymaking for Sector Transitions

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Real world sectoral transitions reinforce critical lessons on policy integration: a high-level strategic goal (Column a in Cross-Chapter Box 9, Table 1), the need for a clear sector outcome framing (column B), a carefully coordinated mix of policy instruments and governance actions (column C), and the importance of context-specific governance factors (column D). Illustrative examples, drawn from sectors, help elucidate the complexity of policymaking in driving sectoral transitions.

Cross-Chapter Box 9, Table 1 | Case studies of integrated policymaking for sector transitions.

A. Illustrative case	B. Objective	C. Policy mix	D. Governance context	
			Enablers	Barriers
Shift in mobility service provision in Kolkata, India *[Box 5.8]*	– Improve system efficiency, sustainability and comfort – Shift public perceptions of public transport	– Strengthen coordination between modes – Formalise and green auto-rickshaws – Procure fuel efficient, comfortable, low-floor AC buses – Ban cycling on busy roads – Deploy policy actors as change-agents, mediating between interest groups	– Cultural norms around informal transport sharing, linked to high levels of social trust – Historically crucial role of buses in transit – App-cab companies shifting norms and formalising mobility sharing – Digitalisation and safety on board	– Complexity: multiple modes with separate networks and meanings – Accommodating and addressing legitimate concerns from social movements about the exclusionary effects of 'premium' fares, cycling bans on busy roads
LPG Subsidy ('Zero Kero') Program, Indonesia *[Box 6.3]*	Decrease fiscal expenditures on kerosene subsidies for cooking	– Subsidise provision of Liquefied Petroleum Gas (LPG) cylinders and initial equipment – Convert existing kerosene suppliers to LPG suppliers	– Provincial government and industry support in targeting beneficiaries and implementation – Synergies in kerosene and LPG distribution infrastructures	– Continued user preference for traditional solid fuels – Reduced GHG benefits as subsidy shifted between fossil fuels
Action Plan for Prevention and Control of Deforestation in the Legal Amazon, Brazil *[Box 7.9]*	Control deforestation and promote sustainable development	– Expand protected areas; homologation of indigenous lands – Improve inspections, satellite-based monitoring – Restrict public credit for enterprises and municipalities with high deforestation rates – Set up a REDD+ mechanism (Amazon Fund)	– Participatory agenda-setting process – Cross-sectoral consultations on conservation guidelines – Mainstreaming of deforestation in government programmes and projects	– Political polarisation leading to erosion of environmental governance – Reduced representation and independence of civil society in decision-making bodies – Lack of clarity around land ownership
Climate Smart Cocoa (CSC) production, Ghana *[Box 7.12]*	– Promote sustainable intensification of cocoa production – Reduce deforestation – Enhance incomes and adaptive capacities	– Distribute shade tree seedlings – Provide access to agronomic information and agrochemical inputs – Design a multi-stakeholder programme including MNCs, farmers and NGOs	– Local resource governance mechanisms ensuring voice for smallholders – Community governance allowed adapting to local context – Private sector role in popularising CSC	– Lack of secure tenure (tree rights) – Bureaucratic and legal hurdles to register trees – State monopoly on cocoa marketing, export
Coordination mechanism for joining fragmented urban policymaking in Shanghai, China *[Box 8.3]*	Integrate policymaking across objectives, towards low-carbon urban development	– Combine central targets and evaluation with local flexibility for initiating varied policy experiments – Establish a local leadership team for coordinating cross-sectoral policies involving multiple institutions – Create a direct programme fund for implementation and capacity-building	– Strong vertical linkages between Central and local levels – Mandate for policy learning to inform national policy – Experience with mainstreaming mitigation in related areas (e.g. air pollution)	– Challenging starting point – low share of RE, high dependency on fossil fuels – Continued need for high investments in a developing context

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Cross-Chapter Box 9 (continued)

A. Illustrative case	B. Objective	C. Policy mix	D. Governance context	
			Enablers	Barriers
Policy package for building energy efficiency, EU *[Box 9.SM.1]*	Reduce energy consumption, integrating RE and mitigating GHG emissions from buildings	– Energy performance standards, set at nearly zero energy for new buildings – Energy performance standards for appliances – Energy performance certificates shown during sale – Long-term renovation strategies	– Binding EU-level targets, directives and sectoral effort sharing regulations – Supportive urban policies, coordinated through city partnerships – Funds raised from allowances auctioned under ETS	– Inadequate local technical capacity to implement multiple instruments – Complex governance structure leading to uneven stringency
African electromobility – trackless trams with solar in Bulawayo and e-motorbikes in Kampala *[Box 10.4]*	– Leapfrog into a decarbonised transport future – Achieve multiple social benefits beyond mobility provision	– Develop urban centres with solar at station precincts – Public-private partnerships for financing – Sanction demonstration projects for new electric transit and new electric motorbikes (for freight)	– 'Achieving SDGs' was an enabling policy framing – Multi-objective policy process for mobility, mitigation and manufacturing – Potential for funding through climate finance – Co-benefits such as local employment generation	– Economic decline in the first decade of the 21st century – Limited fiscal capacity for public funding of infrastructure – Inadequate charging infrastructure for e-motorbikes
Initiative for a climate-friendly industry in North Rhine Westphalia (NRW), Germany *[Box 11.3]*	Collaboratively develop innovative strategies towards a net zero industrial sector, while securing competitiveness	– Build platform to bring together industry, scientists and government in self-organised innovation teams – Intensive cross-branch cooperation to articulate policy/infrastructure needs	– NRW is Germany's industrial heartland, with an export-oriented industrial base – Established government–industry ties – Active discourse between industry and public	Compliance rules preventing in-depth cooperation
Food2030 Strategy, Finland *[Box 12.2]*	– Local, organic and climate friendly food production – Responsible and healthy food consumption – A competitive food supply chain	– Target funding and knowledge support for innovations – Apply administrative means (legislation, guidance) to increase organic food production and procurement – Use education and information instruments to shift behaviour (media campaigns, websites)	– Year-long deliberative stakeholder engagement process across sectors – Institutional structures for agenda-setting, guiding policy implementation and reflexive discussions	– Weak role of integrated impact assessments to inform agenda-setting – Monitoring and evaluation close to ministry in charge – Lack of standardised indicators of food system sustainability

13.8 Integrating Adaptation, Mitigation and Sustainable Development

There is growing consensus that integration of adaptation and mitigation will advance progress towards sustainable development, and that ambitious mitigation efforts will reduce the need for adaptation in the long term (*robust evidence*, *high agreement*) (IPCC 2014a). There is no level of mitigation, however, that will completely erase the need for adaptation to climate change (*robust evidence*, *high agreement*) (Mauritsen and Pincus 2017). It is therefore urgent to design and implement a multi-objective policy framework for mitigation, adaptation, and sustainable development that considers issues of equity and long-term developmental pathways across regions (*robust evidence*, *high agreement*) (Jordan et al. 2018; Mills-Novoa and Liverman 2019; Wang and Chen 2019). This section explores the logic behind the integration of adaptation and mitigation in practice (Section 13.8.1), the approaches to this integration including climate-resilient pathways, ecosystem-based solutions, and a nexus approach (Section 13.8.2); examples of the adaption and mitigation relationships and linkages (Section 13.8.3); and enabling and disabling factors for governance of mitigation and adaption.

13.8.1 Synergies Between Adaptation and Mitigation

Integrated climate-development actions require a context-specific understanding of synergies and trade-offs with other policy priorities (Figure 13.6) with the aim of implementing mitigation/adaptation policies that reduce GHG emissions while simultaneously strengthening resilience and reducing vulnerability (*robust evidence*, *high agreement*) (Klein et al. 2005; IPCC 2007; Zhao et al. 2018; Mills-Novoa and Liverman 2019; Solecki et al. 2019). Efficient, equitable and inclusive policies which also acknowledge and contribute directly to other pressing priorities such reducing poverty, improving health, providing access to clean water, and fostering sustainable consumption and production practices are helpful for mitigation/adaptation goals (*robust evidence*, *high agreement*) (Landauer et al. 2019; Grafakos et al. 2020).

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Box 13.15 | Adaptation and Mitigation Synergies in Africa

Synergies between mitigation and adaptation actions and sustainable development that can enhance the quality and pace of development in Africa exist at both sectoral and national levels. Available data on NDCs show the top mitigation priorities in African countries include energy, forestry, transport and agriculture and waste, and adaptation priorities focus on agriculture, water, energy and forestry. The energy sector dominates in mitigation actions and the agricultural sector is the main focus of adaptation measures, with the latter sector being a slightly larger source of greenhouse gases than the former (Mbeva et al. 2015; African Development Bank 2019; Nyiwul 2019).

Renewable energy development can support synergies between mitigation and adaptation by stimulating local and national economies through microenterprise development; providing off-grid affordable and accessible solutions; and contributing to poverty reduction through increased locally available resource use and employment and increased technical skills (Nyiwul 2019; Dal Maso et al. 2020). The Paris Agreement's technology transfer and funding mechanisms could reduce renewable energy costs and providing scale economics to local economies.

Barriers to achieving these synergies include the absence of suitable macro-and micro- level policy environments for adaptation and mitigation actions; coherent climate change policy frameworks and governance structures to support adaptation; institutional and capacity deficiencies in climate and policy research such as on data integration and technical analysis; and the high financial needs associated with the cost of mitigation and adaptation (African Development Bank 2019; Nyiwul 2019). Strengthening of national institutions and policies can support maximising synergies and co-benefits between adaptation and mitigation to reduce silos and redundant overlaps, increase knowledge exchange at the country and regional levels, and support engagement with bilateral and multilateral partners and mobilising finance through the mechanisms available (African Development Bank 2019).

Adaptation and mitigation are deeply linked in practice – at the local level, for instance, asset managers address integrated low-carbon resilience to climate change impacts and urban planners do the same (Ürge-Vorsatz et al. 2018; Grafakos et al. 2020) (Table 13.3). Similarly, ecosystem-based (or nature-based) solutions, may generate co-benefits by simultaneously sinking carbon, cooling urban areas through shading, purifying water, improving biodiversity, and offering recreational opportunities that improve public health (Raymond et al. 2017). Accurately identifying and qualitatively or quantitatively assessing these co-benefits (Stadelmann et al. 2014; Leiter and Pringle 2018; Leiter et al. 2019) is central to an integrated adaptation and mitigation policy evaluation.

Some studies press the need to consider the complex ways that power and interests influence how collective decisions are made, and who benefits from and pays for these decisions, of climate policy and to be aware of unintended consequences, especially for vulnerable people living under poor conditions (Mayrhofer and Gupta 2016; De Oliveira Silva et al. 2018). The specific adaptation and mitigation linkages will differ by country and region, as illustrated by Box 13.15.

13.8.2 Frameworks That Enable the Integration of Adaption and Mitigation

The IPCC's *Fifth Assessment Report* (AR5) emphasised the importance of climate-resilient pathways – development trajectories that combine adaptation and mitigation through specific actions to achieve the sustainable development goals (Prasad et al. 2009; Lewison et al. 2015; Fankhauser and McDermott 2016; Romero-Lankao et al. 2016; Solecki et al. 2019) – from the household to the state level, since risks and opportunities vary by location and the specific local development context (*robust evidence*, *high agreement*) (IPCC 2014b; Denton et al. 2015).

Synergies between adaptation and mitigation are included in many of the NDCs submitted to the UNFCCC, as part of overall low-emissions climate-resilient development strategies (UNFCCC Secretariat 2016). a majority of developing countries have agreed to develop National Adaptation Plans (NAPs) in which many initiatives contribute simultaneously to the SDGs (Schipper et al. 2020) as well to mitigation efforts (Hönle et al. 2019; Atteridge et al. 2020). For example, developing countries recognise that adaptation actions in sectors such as agriculture, forestry and land-use management can reduce GHGs. Nevertheless, other more complex trade-offs also exist between bioenergy production or reforestation and the land needed for agricultural adaptation and food security (African Development Bank 2019; Hönle et al. 2019; Nyiwul 2019) (Chapter 7). For some of the Small Islands Development States (SIDS), forestry and coastal management, including mangrove planting, saltmarsh and seagrass are sectors that intertwine both mitigation and adaptation (Duarte et al. 2013; Atteridge et al. 2020). Integrated efforts also occur at the city level, such as the Climate Change Action Plan of Wellington City, which includes enhancing forest sinks to increase carbon sequestration while at the same time protecting biodiversity and reducing groundwater runoff as rainfall increases (Grafakos et al. 2019).

To fully maximise their potential co-benefits and trade-offs of integrating adaptation and mitigation, these should be explicitly sought, rather than accidentally discovered (Spencer et al. 2017; Berry et al. 2015), and policies designed to account for both (*robust*

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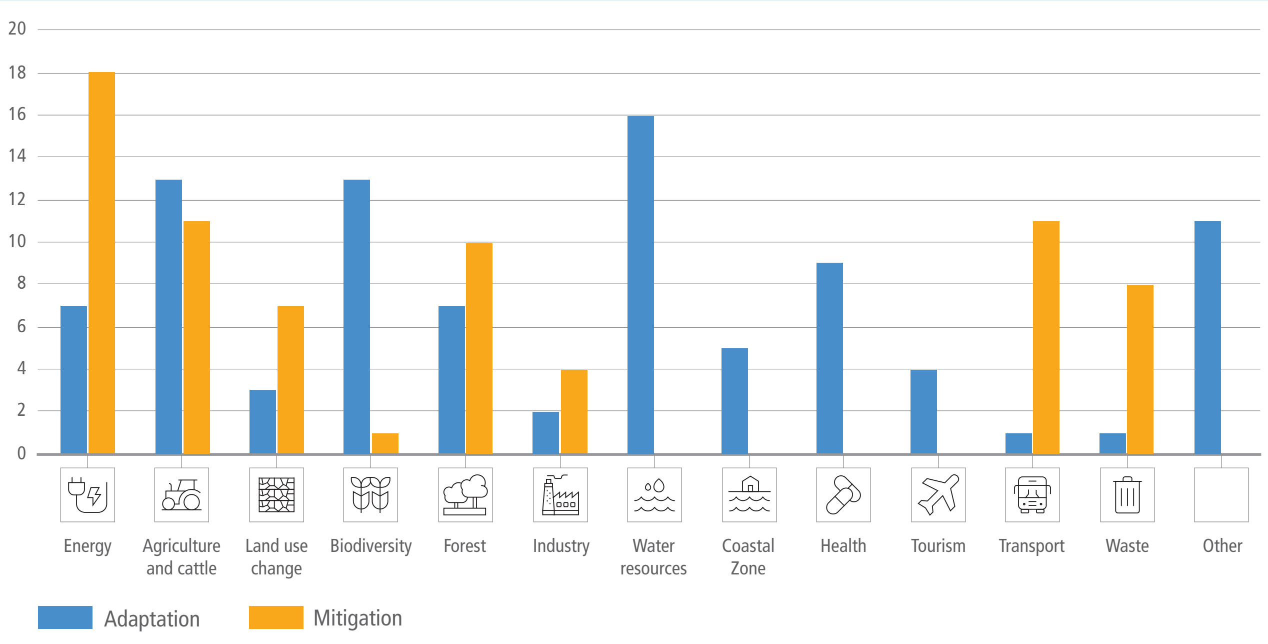
Box 13.16 | Latin America Region Adaptation Linking Mitigation: REDD+ Lessons

Thirty-three countries in the Latin American region have submitted their NDCs, and 70% of their initiatives have included mitigation and adaptation options focusing on sustainable development (Bárcena et al. 2018; Kissinger et al. 2019). However, most of these policies are disconnected across sectors (Loaiza et al. 2017; Locatelli et al. 2017). National governments have identified their relevant sectors as: energy, agriculture, forestry, land-use change, biodiversity, and water resources (see Figure 1 below). The region houses 57% of the primary forest of the planet. REDD+ aims to reduce GHG while provide ecosystems services to vulnerable communities (Bárcena et al. 2018). Lessons from successful REDD+ programmes include the benefits of a multilevel structure from international to national down to strong community organisation, as well as secure resources funding, with most of the projects relying on external sources of funding (*medium evidence*, *high agreement*) (Loaiza et al. 2017; Kissinger et al. 2019). However, there is limited evidence of effective adaptation co-benefits, which may be related to the lack of provision of forest standards; a disproportionate focus on mitigation and lack of attention to the well-being of the population in rural and agricultural areas (Kongsager and Corbera 2015).

Conflicts have emerged over political views, government priorities of resources (oil, bioenergy, hydropower), and weak governance among national and local authorities, indigenous groups and other stakeholders such as NGOs which play a critical role in the technological and financial support for the REDD+ initiative (Reed 2011; Kashwan 2015; Gebara et al. 2014; Locatelli et al. 2011, 2017). a more holistic approach which recognises these social, environmental and political drivers would appear to have benefits but assessment is needed to allow evidence-based actionable policy statements.



Box 13.16, Figure 1 | Latin America and Caribbean: high priority sectors for mitigation and adaptation. Number of countries that name the following sector in their national climate change plans and/or communications. The purple and green bars represent adaptation and mitigation respectively. Source: reproduced with permission from Bárcena et al. (2018).

evidence, *high agreement*) (Caetano et al. 2020). For example, the REDD+ initiative focus on mitigation by carbon sequestration was set up to provide co-benefits such as: nature protection, political inclusion, monetary income, economic opportunities. However, some unintended trade-offs may have occurred such as physical displacement, loss of livelihoods, increased human–wildlife conflicts, property claims, food security concerns, and an unequal distribution of benefits to local population groups (Bushley 2014; Duguma et al. 2014a; Gebara et al. 2014; Kongsager and Corbera 2015; Anderson et al. 2016; Di Gregorio et al. 2016, 2017). Ultimately, ecosystem (or nature-based) strategies, such as the use of wetlands to create accessible recreational areas that improve public health while improving biodiversity, sinking carbon and protecting neighbourhoods from extreme flooding events, may lead to more efficient and cost-effective policies (Klein et al. 2005; Locatelli et al. 2011; Kongsager et al. 2016; Mills-Novoa and Liverman 2019).

The 'nexus' approach is another widely used framework that describes the linkages between water, energy, food, health and other socio-economic factors in some integrated assessment approaches (Rasul and Sharma 2016). The Food-Energy-Water (FEW)nexus, for example, considers how water is required for energy production and supply

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(and thus tied to mitigation), how energy is needed to treat and transport water, and how both are critical to adaptable and resilient food production systems (Mohtar and Daher 2014; Biggs et al. 2015). Climate change impacts all these dimensions in the form of multi-hazard risk (Froese and Schilling 2019). Although integrative, the FEW nexus faces many challenges including: limited knowledge integration; coordination between different institutions and levels of government; politics and power; cultural values; and ways of managing climate risk (Leck and Roberts 2015; Romero-Lankao et al. 2017; Mercure et al. 2019). More empirical assessment is needed to identify potential overlaps between sectoral portfolios, as this could help to delineate resources allocation for synergies and to avoid trade-offs.

13.8.3 Relationships Between Mitigation and Adaptation Measures

There are multiple ways that mitigation and adaptation may be integrated. Table 13.3 sets out those relationships broken down into four areas: adaptation that contributes to mitigation; mitigation that contributes to adaptation; holistic, sustainability first strategies; and trade-offs. The table shows that more holistic and sustainability-oriented policies can open up the possibility for accelerated transitions across multiple priority domains (*robust evidence*, *high agreement*).

Table 13.3 | Relationships between adaptation and mitigation measures.

Policy/action	Interrelation explained	Reference
	Adaptation that contributes to mitigation	
Coastal adaptation and blue carbon; developing strategies for conservation and restoration of blue carbon ecosystems generating resilient communities and landscapes. **– Contributes to carbon storage and sequestration.**	Conservation of habitats and ecosystems, protect communities from extreme events, increase food security, and provide ecosystem services. At the same time, restoration of mangroves, tidal marshes, and seagrasses have high rates of carbon sequestration, act as long-term carbon sinks, and are contained within clear national jurisdictions. **Example:** conservation programmes on Brazilian mangroves, Spanish seagrass meadows, the Great Barriers Reef in Australia, and Coastal Management Strategy in New Zealand.	Andresen et al. (2012); Herr and Landis (2016); Duarte (2017); Doll and Oliveira (2017); Howard et al. (2017); Gattuso et al. (2018); Cooley et al. (2019); Karani and Failler (2020); Lovelock and Reef (2020)
Nature-Based Solutions (Nbs); Nature-based solutions are interventions that use the natural functions of healthy ecosystems to protect the environment but also provide numerous economic and social benefits. **– Contributes to carbon storage and sequestration using individual and clustered trees.**	NbS complement and shares common elements with a wide variety of other approaches to building the resilience of social-ecological systems. Policies at national and sub-national level include community-based adaptation, ecosystem-based disaster risk reduction, climate-smart agriculture, and green infrastructure, and often place emphasis on using participatory and inclusive processes and community/stakeholder engagement. **Examples:** Mexico and the United Kingdom provide support for NbS in their national biodiversity strategies and action plans some related to water management. UK launched the Green Recovery Challenge Fund to create jobs with a focus on tree planting and the rehabilitation of peatlands.	Doswald and Osti (2011); Secretariat of the Convention on Biological Diversity (2019); Ihobe – Environmental Management Agency (2017); Zwierzchowska et al. (2019); Seddon et al. (2020); Choi et al. (2021); OECD (2021b)
Ecosystem-based Adaptation (Eba); use biodiversity and ecosystem services to help people to adapt to the adverse effects of climate change, aiming to maintain and increase the resilience and reduce the vulnerability of ecosystems and people. **– Contributes to carbon storage and sequestration.**	EbA involves the conservation, sustainable management and restoration of ecosystems, such as forests, grasslands, wetlands, mangroves or coral reefs to reduce the harmful impacts of climate hazards including shifting patterns or levels of rainfall, changes in maximum and minimum temperatures, stronger storms, and increasingly variable climatic conditions. **Examples:** some NDCs include EbA and NbS harmonising national policies (for example: National Adaptation Plan) with other national climate and development policy processes, such as: water resources management plan, disaster risk reduction strategies, land planning codes.	IPBES (2019); Doswald et al. (2014); Secretariat of the Convention on Biological Diversity (2009); McAllister (2007); Colls et al. (2009); Rubio (2017); Raymond et al. (2017); Duarte (2017); Gattuso et al. (2018)
Urban Greening; urban forestry, planting in road reserves and tree planting along main streets. **– Contributes to carbon storage and sequestration.** **– Energy use reduction.**	Urban afforestation and reforestation produce cooling effect and water retention while helping to reducing carbon dioxide from the atmosphere. Green walls and rooftops increase energy efficiency of buildings and decrease water runoff and provide insulation for the buildings. **Examples:** Wellington City Council and other entities must comply with the New Zealand Emission Trading System regulatory framework that provides guidance and requirements of climate change planning and implementation for both mitigation and adaptation (M&A).	Santamouris (2014); Sharifi and Yamagata (2016); Grafakos et al. (2018); Pasimeni et al. (2019); Anderson et al. (2016)
Climate adaptation plans at city level; sub-national policies that would lead to carbon reduction to support climate mitigation. Contribution to mitigation: **– Carbon storage and sequestration.** **– Energy use reduction.** **– Renewable energy.**	Cities with Climate Actions Plans include urban spatial planning and capacity-building initiatives. Some cities with adaptation and mitigation combined climate change action plans are: Bangkok, Chicago, Montevideo, Wellington, Durban, Paris, Mexico City, and Melaka. And cities with A&M actions are: Los Angeles, Vancouver, Barcelona, London, Accra, Santiago de Chile, Bogota, Curitiba, and other. **Co-benefits generated by climate actions at cities**: heat stress reduction; water scarcity, stormwater and flood management; air quality improvement, human health and well-being, aesthetic/amenity, recreation/tourism, environmental justice, real estate value, food production, green jobs opportunities.	Garcetti (2019); Horne (2020); Barcelona City Council (2018); Greater London Authority (2018); Accra Metropolitan Assembly (2020); Choi et al. (2021); Grafakos et al. (2019); Nakano et al. (2017); Peng and Bai (2018); Zen et al. (2019); Bai et al. (2018)

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Policy/action	Interrelation explained	Reference
Mitigation that contributes to adaptation		
Green Infrastructure; policies to support the design and implementation of a hybrid network of natural, semi-natural, and engineered features within, around, and beyond urban areas at all scales, to provide multiple ecosystem services and benefits. **– Carbon storage and sequestration.** **– Reduced energy consumption.**	Adaptation benefits: flood management, heat stress reduction individually, or jointly, coastal protection, water scarcity management, groundwater resources, ecosystem resilience improvement, air quality, water supply, flood control, water quality improvement, groundwater recharge. Social co-benefits: aesthetic, recreation, environmental education, improved human health/well-being, social cohesion, and poverty reduction. Policy examples: national building code guidelines, flood safety standards, local land-use plans, local building codes, integrated water management for flood control.	Atchison (2019); Conger and Chang (2019); Schoonees et al. (2019); De la Sota et al. (2019); Choi et al. (2021); Zwierzchowska et al. (2019)
REDD+ Strategies; an incentive for developing countries to increase carbon sinks, to protect their forest resources and coastal wetlands. Mostly are national strategies led by the state with contribution of international donors. **– Contributes to carbon storage and sequestration.** **– Renewable energy.**	REDD+ strategies aim to generate social benefits such as poverty reduction, and ecological services such as water supply, water quality enhancement, conserves soil and water by reducing erosion. For example, indigenous communities of Socio Bosque in Ecuador have sustained livelihoods and maintaining ties to land, place, space, and *cosmovision*. While in Cameroon, upfront contextual inequities with respect to technical capabilities, power, gender, level of education, and wealth have been barriers to individuals' likelihood of participating in and benefiting from the projects.	McBurney (2021); Tegegne et al. (2021); Anderson et al. (2016); Busch et al. (2011); Bushley (2014); Dickson and Kapos (2012); Froese and Schilling (2019); Gebara et al. (2014); Pham et al. (2014); Jodoin (2017)
Household energy-efficiency and renewable energy measures; energy policies may improve socio-economic development. **– Energy use reduction.**	Energy Efficiency (EE) emerges as a feasible and sustainable solution in Latin America, to minimise energy consumption, increase competitiveness levels and reduce carbon footprint. Achieving high levels of EE in the building sector requires new policies and strengthening their legal framework. Microenterprise development contributes to poverty reductions as renewable energy stimulate local and national economies.	Chan et al. (2017); Silvero et al. (2019); Zabaloy et al. (2019); Alves et al. (2020); Nyiwul (2019); Dal Maso et al. (2020)
Sustainability first: holistic approaches		
Integrated community sustainability plans.	Climate change mitigation and adaptation are embedded in a plan to improve affordability, biodiversity, public health, and other aspects of communities.	Burch et al. (2014); Shaw et al. (2014); Stuart et al. (2016); Dale et al. (2020)
Inclusive future visioning using social-ecological systems or socio-technical systems thinking.	Participatory processes that highlight the cultural and social dimensions of climate change responses and synergies/trade-offs between priorities rather than an exclusive focus on technical aspects of solutions.	Gillard et al. (2016); Krzywoszynska et al. (2016)
Climate Resilience Cities; integrating New Urban Agenda (NUA), SDGs, climate actions for A&M, and Disaster Risk Reduction (DRR) for local and sub-national governments, and DRR within a multi-hazard approach based on Sendai Framework.	Resilient cities are including SDGs, targets, A&M options and DRR to build a resilient plan for urban planning, health, life quality and jobs creation. Climate mitigation and sustainable energy actions adopted at the local level are interconnected. For instance, cities with Sustainable Energy and Climate Action Plan, which required the establishment of a baseline emission inventory and the adoption of policy measures, are already showing a tangible achievement regarding sustainable goals.	Barcelona City Council (2018); Garcetti (2019); Accra Metropolitan Assembly (2020); Blok 2016; Giampieri et al. (2019); Gomez Echeverri (2018); Long and Rice (2019); Pasimeni et al. (2019); Romero-Lankao et al. (2016)
Trade-offs		
Land-use strategies; for mitigation or adaptation considered in isolation, may cause a conflict in land planning. **– Carbon storage and sequestration.** **– Energy use reduction.** **– Renewable energy.**	Increasing density of land use, land-use mix and transit connectivity could increase climate stress and reduce green open spaces. It may increase the urban heat island impacting human health, and expose population to coastal inundation. Some of the policies and strategies to minimise this are: land-use planning, zoning, land-use permits, mobilising private finance in the protection of watersheds, integrated coastal zone management, flood safety standards, and other. More assessment is needed prior to new land use to reduce or prevent actions which negatively alter ecosystem services and environmental justice.	O'Donnell (2019); Bush and Doyon (2019); Grafakos et al. (2019); Landauer et al. (2015); Viguié and Hallegatte (2012); Floater et al. (2016); Xu et al. (2019); Landauer et al. (2019)
Low-carbon, net zero and climate change resilient building codes that fail to account for affordability. **– Energy reduction.** **– Renewable energy.**	Low-carbon or net zero emissions have multi-objective strategies, integrated policies, regulations, and actions at the national and sub-national levels. Trade-offs may be related to policy mechanisms that must be implemented comprehensively, not individually. However, different administrative levels and institutions may create a barrier to inter-sectoral coordination. For example: 'Greening' programmes may produce positive mitigation and adaptation outcomes but may also accelerate displacement and gentrification at city level.	Chaker et al. (2021); del Río and Cerdá (2017); Choi et al. (2021); Papadis and Tsatsaronis (2020); Wolch et al. (2014); Garcia-Lamarca et al. (2021); Haase et al. (2017); Sharifi (2020); Viguié and Hallegatte (2012); del Río (2014)

13.8.3.1 Governing the Linkages Between Mitigation and Adaptation at the Local, Regional, and Global Scales

International policy frameworks, such as the 2015 Paris Agreement, the Sendai Framework for Disaster Disk Reduction, and the New Urban Agenda for sustainable urban systems, provide an integrated approach for both adaptation and mitigation, while promoting sustainable development and climate resilience across scales (from global, regional, to local government actions (*robust evidence*, *high agreement*) (Duguma et al. 2014b; Heidrich et al. 2016; Di Gregorio et al. 2017; Locatelli et al. 2017; Nachmany and Setzer 2018; Mills-Novoa and Liverman 2019). Even so, the specific ways that these linkages are governed vary widely depending on institutional and jurisdictional scale, competing policy priorities, and available capacity (Landauer et al. 2019).

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Supranational levels of action such as the EU climate change policy have influenced the development and implementation of Climate Change Action Plans (CCAPs) at the sub-national level (Heidrich et al. 2016; Villarroel Walker et al. 2017; Reckien et al. 2018). While adaptation is gaining prominence and is increasingly included in the NDCs of EU nations, the implementation of adaptation and mitigation by EU states are at different stages (Fleig et al. 2017). Fleig et al. (2017) found that all EU states, with the exception of Hungary, have adopted a framework of laws tackling mitigation and adaptation to climate change. However, an assessment of climate legislation in Europe pointed out that there has been little coordination between mitigation and adaptation, and that implementation varies according to different national conditions (Nachmany et al. 2015). More recently, however, integrated adaptation/mitigation plans have been prepared in Europe under the Covenant of Mayors, in which synergies and trade-offs can be better revealed and assessed (Bertoldi et al. 2020).

Local governments and cities are increasingly emerging as important climate change actors (Gordon and Acuto 2015) (Section 13.5). While cities and local governments are developing Climate Change Action Plans (CCAPs), plans that explicitly integrate the design and implementation of adaptation and mitigation are a minor percentage, with few cities establishing inter-relationships between them (Nordic Council of Ministers 2017; Grafakos et al. 2018). Compared to national climate governance, local governments are more likely to develop and advance climate policies, generating socio-economic or environmental co-benefits, and improve communities' quality of life (Gill et al. 2007; Bowen et al. 2014; Duguma et al. 2014b; Mayrhofer and Gupta 2016; Deng et al. 2017; Hennessey et al. 2017). There may be a disconnect, however, between the responsibility that a particular jurisdiction has over mitigation and adaptation (city officials, for instance) and the scale of resources or capacities that they have available to bring to bear on the problem (regional to national provision of energy and transport) (Di Gregorio et al. 2019; Dale et al. 2020).

13.8.4 Integrated Governance Including Equity and Sustainable Development

Climate policy integration carries implications for the pursuit of the SDGs, given that it is nearly impossible to achieve the desired socio-economic gains if fundamental environmental issues, such as climate change, are not addressed (Gomez-Echeverri 2018). Research on climate resilient development pathways (Roy et al. 2018), for instance, argues for long-term policy planning that combines the governance of national climate and SD goals, builds institutional capacity across all sectors, jurisdictions, and actors, and enhances participation and transparency (*robust evidence*, *high agreement*) (Chapter 4 and 17).

In the Global South, climate change policies are often established in the context of sustainable development and of other pressing local priorities (e.g., air pollution, health, and food security). National climate policy in these countries tends to give prominence to adaptation based on country vulnerability, climatic risk, gender-based differences in exposur to that risk, and the importance of local/traditional and indigenous knowledge (Beg et al. 2002; Duguma et al. 2014b). Despite the evidence that integrated mitigation and adaptation policies can be effective and efficient (Klein et al. 2005) and can potentially reduce trade-offs, there is still limited evidence of how such integrated policies would specifically contribute to progress on the SDGs (*robust evidence*, *high agreement*) (Kongsager et al.2016; Di Gregorio et al. 2017; Antwi-Agyei et al. 2018; De Coninck et al. 2018; Campagnolo and Davide 2019).

Where mainstreaming of environmental concerns has been attempted through national plans, they have had success in some cases when backed by strong political commitments that support a vertical coordination structure rather than horizontal structures led by the focus ministry (Nunan et al. 2012). Such political commitments are therefore crucial to success but insufficient in and of themselves (Runhaar et al. 2018; Wamsler et al. 2020). Integration of the budget process is particularly important, as are aligned time frames across different objectives (Saito 2013). Recognition of the functional interactions across policy sectors is improved by a translation of long-term policy objectives into a plan that aligns with integration goals (Corry 2012; Oels 2012; Dupont 2019).

There are important links between inequality, justice and climate change (Ikeme 2003; Bailey 2017). Many of these operate through the benefits, costs and risks of climate action (distributive justice), while others focus on differential participation and recognition of sub-national actors and marginalised groups (procedural justice) (Bulkeley and Castán Broto 2013; Bulkeley et al. 2013; Hughes 2013; Reckien et al. 2018; Romero-Lankao and Gnatz 2019).

Justice principles are rarely incorporated in climate change framing and action (Sovacool and Dworkin 2015; Genus and Theobald 2016; Heikkinen et al. 2019; Romero-Lankao and Gnatz 2019). Yet, equity is salient to mitigation debates, because climate change mitigation policies can have also negative impacts (Brugnach et al. 2017; Ramos-Castillo et al. 2017; Klinsky 2018), exacerbated by poverty, inequality and corruption (Reckien et al. 2018; Markkanen and Anger-Kraavi 2019). The siting of facilities and infrastructure that advance decarbonisation (such as public transit infrastructure, renewable energy facilities and so on) may have implications for environmental justice. Integrated attention to justice in climate, environment and energy, as well as involvement of host communities in siting assessments and decision-making processes, can help to avoid such conflict (McCord et al. 2020; Hughes and Hoffmann 2020). As a result, successful policy integration goes beyond optimising public management routines, and must resolve key trade-offs between actors and objectives (Meadowcroft 2009; Nordbeck and Steurer 2016).

The potential for transformative climate change policy that delivers both adaptation and mitigation is also shaped by a number of enabling and disabling factors tied to governance processes (*robust evidence*, *high agreement*) (Burch et al. 2014) (Section 13.9).

Box 13.17 | Enabling and Disabling Factors for Integrated Governance of Mitigation and Adaptation

Ensuring participatory governance and social inclusion. Interlinkages in the food-energy-water nexus highlight the importance of inclusive processes (Shaw et al. 2014; Nakano et al. 2017; Cook and Chu 2018; Romero-Lankao and Gnatz 2019). The cultivation of urban grassroots innovations and social innovation may accelerate progress (Wolfram and Frantzeskaki 2016), as may the development of carefully-designed climate and energy dialogues that enable learning among multiple stakeholders (Cashore et al. 2019).

Considering synergies and trade-offs with broader sustainable development priorities. The explicit consideration of synergies and trade-offs will enable more integrated policy making (Dang et al. 2003; von Stechow et al. 2015). Policy frameworks to do so are just emerging, such as analysis of trade-offs between energy and water policies and agriculture (Huggel et al. 2015; Antwi-Agyei et al. 2018).

Employing a diverse set of tools to reach targets. Building codes, land-use plans, public education initiatives, and nature-based solutions such as green ways may impact adaptation and mitigation simultaneously (Burch et al. 2014). Ecological restoration provides another suite of tools, for instance the Brazilian target of restoring and reforesting 0.12 million km^2 of forests by 2030, which can enhance biodiversity and ecosystem services while also sinking carbon (Bustamante et al. 2019). Mandatory retrofits to improve indoor air quality can also increase energy efficiency and resilience to climate change impacts (Friel et al. 2011; Houghton 2011).

Monitoring and evaluating key indicators, beyond only greenhouse gas emissions, such as biodiversity, water quality, and affordability: An integrated approach requires robust process for collecting data on these indicators. Challenges are related to the limited evidence-base on synergies, co-benefits, and trade-offs across sectors and jurisdictions (Di Gregorio et al. 2016; Kongsager et al. 2016; Locatelli et al. 2017; Zen et al. 2019). Moreover, adaptation policies mostly lack measurable targets or expected outcomes increasing the challenge of designing an integrated framework (OECD 2017).

Iterative and adaptive management. Adaptive management helps to address the underlying uncertainty (Kundzewicz et al. 2018) that characterises implementation of integrated approaches to adaptation and mitigation. Policy integration needs to be considered iteratively along the process of development, implementation, and evaluation of climate policies.

Strategic partnerships that coordinate efforts. Strategic partnerships among diverse actors, therefore, bring diverse technical skills and capacities to the endeavour (Burch et al. 2016; Islam and Khan 2017). However, realising strategic approaches for joint adaptation and mitigation require adequate financial, technical and human resources.

Participatory and collaborative planning approaches can help overcome injustices and address power differentials. Participatory and collaborative planning approaches can provide multiple spaces of deliberation where marginalised voices can be heard (Blue and Medlock 2014; UN Habitat 2016; Castán Broto and Westman 2017; Waisman et al. 2019). These tools organise climate and sustainability action by addressing its democratic deficit and facilitating the recognition of multiple perspectives in environmental planning alongside material limits of development (Agyeman 2013).

13.9 Accelerating Mitigation Through Cross-sectoral and Economy-wide System Change

13.9.1 Introduction

Section 13.9 assesses literature related to economy wide and cross – sector systemic change as an approach to accelerate climate mitigation.

It focuses specifically on policy and institutions, as two of the six enabling conditions for economy-wide system change and thus provides a third dimension of the role of policy and institutions to climate mitigation. Enabling conditions in general are discussed in Chapter 4 of the SR1.5 (IPCC 2018), as well as Chapter 4 of this report.

This section follows on from Section 13.6 (single policy instruments) and 13.7 (policy packages). Section 13.9 literature follows closely on from Section 13.7 literature on policy packages, which discusses change within one system, although there remains an overlap.

Section 13.9.2 provides a brief introduction to policy and institutions as two of the six dimensions of enabling conditions, and the importance of enabling conditions to systemic change and climate mitigation. Section 13.9.3 briefly introduces actions for transformative justice, which seek to restructure the underlying system framework that produces mitigation inequalities. Section 13.9.4 provides a brief overview of net zero policies and targets (often no more than aspirational), which imply economy-wide measures and system change. Section 13.9.5 assesses the literature arguing for a system restructuring approach to climate mitigation, based on systemic restructuring. Section 13.9.6 assesses the literature on stimulus packages and green new deals which aim for systemic change, sometimes with value for climate mitigation. And finally, Section 13.9.7 assesses emerging literatures which argues that there are existing challenges to accelerating climate mitigation that may be overcome by systemic change and targeted actions.

13.9.2 Enabling Acceleration

IPCC AR6 WG3, particularly Chapter 4, following on from the IPCC WG3 SR1.5 (IPCC 2018), has highlighted the importance of enabling conditions for delivering successful climate mitigation actions. The AR6 Glossary term for enabling conditions is: 'enabling conditions include *finance, technological innovation*, strengthening policy instruments, *institutional capacity*, *multi-level governance*, and changes in *human behaviour* and lifestyles (*medium evidence*, *high agreement*) (see Glossary). The IPCC SR1.5 report adds to these six dimensions saying enabling conditions also includes 'inclusive processes, attention to power asymmetries and unequal opportunities for development and reconsideration of values' (*medium evidence*, *high agreement*) (IPCC 2018). Not only is the presence of enabling conditions necessary for delivering the successful implementation of single policy instruments and policy packages, but also for delivering systemic change (*medium evidence*, *high agreement*) (de Coninck et al. 2018; IPCC 2018; Waisman et al. 2019). The feasibility of 1.5°C compatible pathways is contingent upon enabling conditions for systemic change (*medium evidence*, *high agreement*) (de Coninck et al. 2018; Waisman et al. 2019).

At the same time, again following on from SR1.5 report, Section 1.8.1 explains that there are six feasibility dimensions of successful delivery of climate goals. These feasibility dimensions include geophysical; environmental and ecological; technological; economic; behaviour and lifestyles and institutional dimensions. The presence or absence of enabling conditions would affect the feasibility of mitigation as well as adaptation pathways and can reduce trade-offs while amplifying synergies between options (Waisman et al. 2019). Policies and institutions, which are two of the six enabling conditions, are therefore central to accelerated mitigation and systemic change. Identifying, and ensuring, the presence of all the enabling conditions for any given goal, including systemic transformation and acceleration of climate mitigation, is an important first step (*medium evidence*, *medium agreement*) (Roberts et al. 2018; Le Treut et al. 2021; Singh and Chudasama 2021).

13.9.3 Transformative Justice Action and Climate Mitigation

Chapter 4 is the lead chapter of this report for justice and climate mitigation issues, and includes an overview of institutions which have been set up to ensure a Just climate transition (Section 4.5). Chapter 13 has sought to integrate justice issues in Section 13.2 in reference to procedural justice and the impact of inequalities on sub-national institutions, Section 13.6 in regard to distribution, and Section 13.8 in relation to integrating mitigation and adaptation policies.

This sub-section introduces the concept of transformative justice as part of measures intending to accelerate mitigation. Fair and effective climate policymaking requires institutional practices to: consider the distributional impacts of climate policy in the design and implementation of every policy (Agyeman 2013; Castán Broto and Westman 2017); align mitigation with other objectives such as inclusion and poverty reduction (Hughes and Hoffmann 2020; Rice et al. 2020; Hess and McKane 2021); represent a variety of voices, especially those of the most vulnerable (Bullard et al. 2008; Temper et al. 2018); and rely on open processes of participation (*robust evidence*, *high agreement*) (Anguelovski et al. 2016; Bouzarovski et al. 2018; Rice et al. 2020).

Distributive approaches to climate justice address injustices related to access to resources and protection from impacts. There is an important difference between affirmative and transformative justice action (Fraser 1995; Agyeman et al. 2016; Castán Broto and Westman 2019): Affirmative action includes policies and strategies that seek to correct inequitable outcomes without disturbing the underlying political framework while transformative action seeks to correct inequitable outcomes by restructuring the underlying framework that produces inequalities.

Transformative action that responds to distributive justice concerns include economy-wide actions via stimulus packages (such as the European Green Deal and the New Green Deal in the USA) (Section 13.9.5). Other examples are the increasing number of climate litigation suits that are transforming the way distributive dimensions of climate justice are understood (Section 13.4.2).

13.9.4 Net Zero Emissions Targets

The last few years have seen a proliferation of net zero emission targets set by national and regional governments, cities as well as companies and institutions (NewClimate Institute and Data Driven EnviroLab 2020; Black et al. 2021; Rogelj et al. 2021) (see also Cross-Chapter Box 3 in Chapter 3). Meeting these targets implies economy-wide systemic change (*medium evidence*, *high agreement*).

The Energy & Climate Intelligence Unit (ECIU) Net Zero Tracker divides countries into those which have net zero emissions achieved, have it in law, have proposed legislation, have it in policy documents or have emission reduction targets under discussion in some form. a recent study estimated that 131 countries have either adopted, announced or are discussing net zero GHG emissions targets, covering 72% of global emissions (Höhne et al. 2021). Out of those, as of 1 October 2021, the ECIU Net Zero Tracker states that Germany, Sweden, the European Union, Japan, United Kingdom, France, Canada, South Korea, Spain, Denmark, New Zealand, Hungary and Luxembourg have net zero targets set in law (ECIU 2021).

Some have argued that the expansion of these emission reduction targets marks an important increase in climate mitigation momentum since the Paris Agreement of 2015 and the 2018 IPCC Special Report on Global Warming of 1.5°C (Black et al. 2021; Höhne et al. 2021). On the other hand net zero emission targets in their current state vary enormously in scope, quality and transparency – with many countries at the discussion stage – and this makes scrutiny and comparison difficult (NewClimate Institute and Data Driven EnviroLab 2020; Black et al. 2021; Rogelj et al. 2021).

In order to realise the mitigation potential of net zero emission targets some areas within the targets might need to be changed. For example, this includes clearer definitions; well defined time frames and scopes; focusing on direct emission reductions within their own territory; minimal reliance on offsets; scrutiny of use and risks of CO_2 removal; attention to equity, near-term action coupled with long-term intent setting; and ongoing monitoring and review (*medium evidence*, *high agreement*) (Levin et al. 2020; NewClimate Institute and Data Driven EnviroLab 2020; Black et al. 2021; Höhne et al. 2021; Rogelj et al. 2021; World Bank 2021b).

13.9.5 Systemic Responses for Climate Mitigation

There is now a significant body of work which explicitly states, or implicitly accepts, that systemic change may be necessary to deliver successful climate mitigation, including net zero targets. Newell phrases this as the difference between 'plug and play' mitigation applications where one aspect of a system is changed while everything in the system remains the same compared to systemic change, with change affecting all the system (Newell 2021a,b). This section highlights an emergent, multidisciplinary literature since IPCC AR5, which suggests that acceleration to decarbonised systems via a sustainable development pathway may be better achieved by moving from a single policy instrument or mix of policies approach to a systemic economy-wide approach (Figure 13.6).

The complexity and multi-facetted challenges of rapidly decarbonising our current interconnected systems (such as energy, food, health) in a just way has led Michaelowa et al. (2018) to conclude that implementation of strong mitigation policy packages that are needed requires a systemic change in policymaking.

Multiple modelling assessments of different development and mitigation pathways are available. Most of these analyses which lead to significant climate mitigation assume significant systemic change across social, technological, and economic aspects of a country for example, India (Gupta et al. 2020); Japan (Sugiyama et al. 2021) and the globe (Rogelj et al. 2015; Dejuán et al. 2020).

UNEP (2020) argued that major, long-term sectoral transformation across multiple systems is needed to reach net zero GHG emissions. Bernstein and Hoffmann (2019) and Rockström et al. (2017) argue that the presence of multi-level, multi-sectoral lock-ins of overlapping and interdependent political, economic, technological and cultural forces mean that a new approach of coordinated, cross-economy, systemic climate mitigation is necessary. Creutzig et al. (2018) propose a resetting of the approach to consumption and use of resources to that of demand side solutions, which would have ongoing economy-wide systemic implications.

Others focus more on single system reconfigurations, such as the energy system (Matthes 2017; Tozer 2020); urban systems (Holtz et al. 2018); or the political system (Somerville 2020; Newell and Simms 2020). Becken (2019) argues that only systemic changes at a large scale will be sufficient to break or disrupt existing arrangements and routines in the tourism industry.

Others argue for thinking about mitigation in even wider ways. O'Brien (2018) posits that sector-focused, or a silo approach, to mitigation may need to give way to decisions and policies which reach across sectoral, geographic and political boundaries and involve a broad set of interrelated processes – practical, political and personal. Gillard et al. (Gillard et al. 2016) argue that a response to climate change has to move beyond incremental responses, aiming instead for a society-wide transformation which goes beyond a system perspective to include learning from social theory; while Eyre et al. (2018) argue that moving beyond incremental emissions reductions will require expanding the focus of efforts beyond the technical to include people, and their behaviour and attitudes. Stoddard et al. (2021) argue that 'more sustainable and just futures require a radical reconfiguration of long-run socio-cultural and political economic norms and institutions'. They focus on nine themes: international climate governance, the vested interests of the fossil fuel industry, geopolitics and militarism, economics and financialisation, mitigation modelling, energy supply systems, inequity, high carbon lifestyles and social imaginaries.

13.9.6 Economy-wide Measures

Economy-wide stimulus packages which have occurred post COVID-19, and in some cases in response to environmental concerns, have the ability to undermine or aid climate mitigation (*medium evidence*, *high agreement*). Attention in the early efforts of their development and design can contribute to shifting sustainable development pathways and net zero outcomes, while meeting short-term economic goals (*medium evidence*, *high agreement*) (Hepburn et al. 2020; Hanna et al. 2020).

Economy-wide packages, as a way to stimulate and/or restructure domestic economies to deliver particular, desired outcomes is a widely accepted tool of government (for example the Roosevelt's New Deal packages in the USA between 1933 and 1939). a number of country-level stimulus package were put in place after the 2008 Global Recession, and there was support for a Global Green New Deal from UNEP (Steiner 2009; Barbier 2010). Cross-economy structural change packages may provide opportunities for another approach to accelerate climate mitigation.

This approach has already been taken up to some degree by a number of countries/blocs. For example, California as well as Germany, through the German *Energiewende*, are early examples of a USA state and a country which have tried to link their economies to a sustainable future through energy-wide efforts of structural change (Morris and Jungjohann 2016; Burger et al. 2020a).

In addition to these economy-wide measures, there have since been cross-economy Green New Deals implemented such as the European Green Deal (Elkerbout et al. 2020; Hainsch et al. 2020; UNEP 2020a) (Box 13.1) with calls for other New Deals, for example a Blue New Deal (Dundas et al. 2020), or deals to bring together climate and justice goals (Hathaway 2020; MacArthur et al. 2020).

The COVID-19 Pandemic has resulted in global economic recession, which many Governments have responded to with economic stimulus programmes. See also Cross-Chapter Box 1 in Chapter 1 on COVID-19. It has also led to more analysis of the potential of cross-economy stimulus packages to benefit climate goals, including what lessons can be learned from the stimulus packages put in place as a result of the 2008–2009 Global Recession.

The United Nations Environment Programme (UNEP) reviewed the green stimulus plans of the G20 following the 2008–2009 recession to examine what worked; what did not; and the lessons which could be learnt (Barbier 2010). This work was updated (Barbier 2020) and concluded that the constituents of successful green stimulus frameworks were long-term commitments in public spending; pricing reform; ensuring concerns about affordability were overcome; and minimising unwanted distributional impacts. Others argue that post-2008 recession stimulus package outcomes benefited both environmental and industrial objectives and that a long-term policy commitment to the transition to a sustainable, low-carbon economy makes sense from both an environmental and industrial strategy point of view (Fankhauser et al. 2013).

With the outbreak of the COVID-19 Pandemic in 2020, past stimulus packages have been further investigated. One study interviewed 231 central bank officials and identified five key policies for both economic multipliers and climate impacts metrics (Hepburn et al. 2020). These were expenditure on clean physical infrastructure; building energy efficiency retrofits; investment in education and training; natural capital investment; and clean R&D. However, the mix of effective policies may differ in lower and middle income countries: rural support spending was more relevant, while clean R&D was less so. The study illuminated that there were different phases to recovery packages: the initial 'rescue' spending but then a second 'recovery' phase that can be more fairly rated green or not green. Recovery phase policies can deliver both economic and climate goals – co-benefits can be captured (i.e. support for EV infrastructure can also reduce local air pollution etc.) – but package design is important (Hepburn et al. 2020).

Others provide a framework which allows a systematic evaluation of options, given objectives and indicators, for COVID-19 stimulus packages (e.g. Dupont et al. 2020; Jotzo et al. 2020; OECD 2021c). Jotzo et al. (2020) conclude that the programmes that most closely match green stimulus are afforestation and ecosystem restoration programmes, energy efficiency upgrades and RE projects. These type of policies provide short-term goals of COVID-19 while also making progress on longer terms objectives (Jotzo et al. 2020). The IMF concluded that a comprehensive mitigation policy package combining carbon pricing and government green infrastructure spending (that is partly debt financed) can reduce emissions substantially while boosting economic activity, supporting the recovery from the COVID-19 pandemic (Jaumotte et al. 2020).

Conversely, other short-term fiscal or recovery measures in stimulus packages may perpetuate high carbon and environmental damaging systems. These include fossil fuel based infrastructure investment; fiscal incentives for high carbon technologies or projects; waivers or roll-backs of environmental regulation; bailouts of fossil fuel intensive companies without conditions for low-carbon transitions or environmental sustainability (UNEP 2020a; O'Callaghan and Murdock 2021; Vivid Economics 2021).

Of the USD17.2 trillion so far spent on stimulus packages, USD4.8 trillion (28% of the total as of July 2021) is linked to environmental outcomes (Vivid Economics 2021). This study relates to 30 countries: the G20 and 10 others. The packages in EU, Denmark, Canada, France, Spain, the UK, Sweden, Finland and Germany (German Federal Ministry of Finance 2020; Vivid Economics 2021) result in net benefits for the environment. a number of studies provide differing conclusions with respect to net benefits or otherwise for the environment for a number of countries (Climate Action Tracker 2020; UNEP 2020a; Vivid Economics 2021). An OECD database found that, as of mid-July 2021, 21% of economic recovery spending in OECD, EU and Key Partners is allocated to environmentally positive measures (OECD 2021c). O'Callaghan and Murdock (2021) reviewed the 50 countries with the greatest stimulus spend in 2020 and find that 13% of the spend is directed to long-term recovery type measures, of which 18% is spent on green recovery. This is a total of 2.5% of total spend or 368 billion USD on green initiatives.

13.9.7 Steps for Acceleration

The multidisciplinary literature exploring how to accelerate climate mitigation and transition to low GHG economies and systems has grown rapidly over the last few years. Acceleration is also confirmed as an important sub-theme of the more specific transition literature (Köhler et al. 2019). While literature focusing on how to accelerate the impact of climate mitigation is derived from empirical evidence, there is very little *ex post* evidence of directed acceleration approaches.

The overlapping discussions of how to accelerate climate mitigation; transition to low-carbon economies; and shift development pathways depends heavily on country-specific dynamics in political coalitions, material endowments, industry strategy, cultural discourses, and civil society pressures (Sections 13.2, 13.3, 13.4, 13.7, and 13.8). Ambition for acceleration at different scales and stringency (whether for cities, country climate policies, country industrial strategies, or national economic restructuring) increase governance challenges, including coordination across stakeholders, institutions, and scales. 'There is therefore no "one-size-fits-all" blueprint for accelerating low-carbon transitions' (*medium evidence*, *high agreement*) (Geels et al. 2017a; Roberts et al. 2018).

Markard et al. (2020) describe the key challenges to accelerating climate mitigation and sustainability transitions as:

1. The ability for low-carbon innovations to emerge in whole systems. Two critical issues need to occur to overcome this challenge (i) complementary interactions between different elements. For example, in an electricity system, the integration of renewable energy requires complementary storage technologies etc. and (ii) changes in system architecture. Thus, in the accelerating phase, policy has to shift from stimulating singular innovations towards managing wider system transformation.
2. The need for greater interactions between adjacent systems: interactions between multiple systems increases the complexity of the transition. Policies are linked to institutions or government departments, and they are often compartmentalised into different policy areas (e.g. energy policy and transport policy). Increasing and coordinating that interaction adds complexity.
3. The resistance from declining industries; acceleration of sustainability transitions will involve the phase out of unsustainable technologies. As a result, acceleration towards a sustainability transition may be resisted – whether business models, or where jobs are involved. Political struggles and conflicts are an inherent part of accelerating transitions, one strategy to deal with this resistance is to accomplish wide societal support for long-term transition targets and to form broad constituencies of actors in favour of those transitions.
4. The need for changes in consumer practices and routines; this challenge relates to changes in social practices that may be required for mainstreaming of sustainable technologies. For example, electric vehicles require changes in trip planning and refuelling practices. Reducing levels or types of consumption is also desirable.
5. Coordination challenges in policy and governance. There is an increasing complexity of governance which can be overcome by stronger vertical and horizontal policy coordination across systems.

The acceleration literature links two over-arching actions: first, a strategic targeting approach to overcoming the challenges to acceleration by a parallel focus on undermining high carbon systems while simultaneously encouraging low-carbon systems; and second, focusing on a coordinated, cross-economy systemic response, including harnessing enabling conditions (*robust evidence*, *high agreement*) (Rogelj et al. 2015; Geels et al. 2017b; Hvelplund and Djørup 2017; Gomez Echeverri 2018; Markard 2018; Tvinnereim and Mehling 2018; O'Brien 2018; Roberts et al. 2018; Hess 2019; Kotilainen et al. 2019; Victor et al. 2019; European Environment Agency 2019; Rosenbloom and Rinscheid 2020; Newell and Simms 2020; Otto et al. 2020; Strauch 2020; Burger et al. 2020a; Hsu et al. 2020b; Rosenbloom et al. 2020).

Strategic targeting, or the identifying of specific intervention points (Kanger et al. 2020), points of leverage (Abson et al. 2017), or upward cascading tipping points (Sharpe and Lenton 2021), broadly means choosing particular actions which will lead to a greater acceleration of climate mitigation across systems. For example, Dorninger et al.(2020) provide a quantitative systematic review of empirical research addressing sustainability interventions. They take 'leverage points' – places in complex systems where relatively small changes can lead to potentially transformative systemic changes – to classify different interventions according to their potential for system-wide transformative change. They argue that 'deep leverage points' – the goals of a system, its intent, and rules – need to be addressed more directly, and they provide analysis of the food and energy systems.

The strategic choosing of policies and points of intervention is linked to the importance of choosing self-reinforcing actions for acceleration (Rosenbloom et al. 2018; Butler-Sloss et al. 2021; Sharpe and Lenton 2021; Jordan and Moore 2020; Bang 2021). Butler-Sloss et al. (2021) explains the types of self-reinforcing actions (or feedback loops) which can encourage or undermine rapid transformation of energy systems.

An example of this first overarching action, the strategic targeting of the challenges to acceleration, is the focus on undermining carbon-intensive systems, thereby reducing opposition to more generalised acceleration policies, including the encouragement of low-carbon systems (*robust evidence*, *high agreement*) (Hvelplund and Djørup 2017; Rosenbloom 2018; Roberts and Geels 2019; Victor et al. 2019; Rosenbloom et al. 2020; Rosenbloom and Rinscheid 2020). Undermining high carbon systems includes deliberately phasing out unsustainable technologies and systems (Kivimaa and Kern 2016; David 2017; European Environment Agency 2019; Johnsson et al. 2019; UNEP 2019b; Carter and McKenzie 2020; Newell and Simms 2020); confronting the issues of incumbent resistance (Roberts et al. 2018); and avoiding future emissions and energy excess by reducing demand (Rogelj et al. 2015; UNEP 2019b; Victor et al. 2019).

Other strategic goals include tackling the equity and justice issues of 'stranded regions' (Spencer et al. 2018); paying greater attention to system architecture to enable increased acceleration to low-carbon electricity supply, in this case in the wind industry (McMeekin et al. 2019); and the importance of maintaining global ecosystem of low-carbon supply chains (Goldthau and Hughes 2020).

Other strategic goals combine national and global action. For example, global NGO coalitions have formed around strategic policy outcomes such as the 'Keep it in the Ground' movement (Carter and McKenzie 2020), and are supported via coordinated networks, such as the Powering Past Coal Alliance (Jewell et al. 2019), and with knowledge dissemination, for example, the 'Fossil Fuel Cuts Database' (Gaulin and Le Billon 2020).

The second overarching point highlighted by the literature is the benefits of focusing on a coordinated, cross-economy systemic response. Coordination is central to this. For example, coordination of actions and coherent narratives across sectors and cross economy, including within and between all governance levels and scales of actions, is beneficial for acceleration (*robust evidence*, *high agreement*) (Zürn and Faude 2013; Hawkey and Webb 2014; Huttunen et al. 2014; Magro et al. 2014; Warren et al. 2016; Köhler et al. 2019; Kotilainen et al. 2019; McMeekin et al. 2019; Victor et al. 2019; Hsu et al. 2020b). Victor et al. (2019) provide a framework of how to prioritise the most urgent actions for climate mitigation and they give practical case studies of how to improve coordination to accelerate reconfiguration of systems for economy-wide climate mitigation in sectors such as power; cars; shipping; aviation; buildings; cement; and plastics.

However, coordination is a necessary but insufficient condition of acceleration. All enabling conditions are required to deliver systemic transformation (Section 13.9.2).

Other disciplines argue that social transformation is likely to be as important as the technical challenges in a coordinated, cross-economy approach to acceleration. For example, some argue for social tipping interventions (STI) alongside other technical and political interventions so that they can 'activate contagious processes of rapidly spreading technologies, behaviours, social norms, and structural reorganisation' (Otto et al. 2020). They argue that these STIs are *inter alia*: removing fossil fuel subsidies and incentivising decentralised energy generation; building carbon neutral cities; divesting from assets linked to fossil fuels; revealing the moral implications of fossil fuels; strengthening climate education and engagement; and disclosing information of GHG emissions (Otto et al. 2020). Others illuminate the importance of narratives and framings in the take-up (or not) of acceleration actions (Sovacool et al. 2020). Others are optimistic about the possibilities of transformation but also highlight the importance of political economy for rapid and just transitions (Newell and Simms 2020; Newell 2021).

In summary, a synthesis of the multidisciplinary, acceleration literature suggests that climate mitigation is a multifaceted problem which spans cross-economy and society issues, and that solutions to acceleration may lie in coordinated systemic approaches to change and strategic targeting of leverage points. Broadly, this literature agrees on a dual approach of non-incremental systemic change and a targeting of specific acceleration challenges, with tailored actions drawing on enabling conditions. The underlying argument of this is that there is a strategic logic to focusing on actions which undermine high carbon systems at the same time as encouraging low-carbon systems. If high carbon systems are weakened then this may reduce the opposition to policies and actions aimed at accelerating climate mitigation, enabling more support for low-carbon systems. In addition, targeting of actions which may create 'tipping point cascades' which increase the rate of decarbonisation may also be beneficial. Finally, new modes of governance may be better suited to this approach in the context of transformative change.

13.10 Further Research

Research has expanded in a number of areas relevant to climate mitigation, yet there is considerable scope to add to knowledge. Key areas for research exist in climate institutions and governance, politics, policies and acceleration of action. In each area there is an overarching need for more *ex post* analysis of impact, more cases from the developing world, and understanding how institutions and policies work in combination with each other.

13.10.1 Climate Institutions, Governance and Actors

- The different approaches to framework legislation, how it can be tailored to country context and evolve over time, how it diffuses across countries, and *ex post* analysis of its impact.
- Approaches to mainstreaming climate governance across sectors and at different scales, and developing governmental and non-governmental capacity to bring about long-term low-carbon transformations and associated capacity needs.
- The drivers of sub-national climate action, the scope for coordination or leakage with other scales of action, and the effect, in practice on GHG outcomes.
- Comparative research on how countries develop NDCs, and whether and how that shapes national policy processes.

13.10.2 Climate Politics

- The full range of approaches that governments and non-governmental actors may take to overcome lock-in to carbon-intensive activities including through addressing material endowments, cultural values, institutional settings and behaviours.
- The factors that influence emergence of popular movements for and against climate actions, and their direct and indirect impacts.
- The role of civic organisations in climate governance, including religious organisations, consumer groups, indigenous communities, labour unions, and development aid organisations.
- The relationship between climate governance approaches and differing political systems, including the role of corruption on climate governance.
- The impacts of media – traditional and social – on climate mitigation, including the role of disinformation.
- The role of corporate actors in climate governance across a broad range of industries.
- Systematic comparative research on the differing role of climate litigation across various juridical systems.

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13.10.3 Climate Policies

- Greater *ex post* empirical studies of mitigation policy outcomes, their design features, the impacts of policy instruments under different conditions of implementation, especially in developing countries. Such research needs to assess the effectiveness, economic and distributional effects, co-benefits and side effects, and transformational potential of mitigation policies.
- Understand how packages of policies are designed and implemented, including with attention to local context and trade-offs.
- Policy design and institutional needs for the explicit purpose of net zero transitions.
- Greater understanding of the differences between, and benefits of, policy packages and economy-wide measures for in-system and cross-system structural change.
- Policies and packages for emissions sources that are unregulated or under-regulated, including industrial and non-CO_2 emissions.
- The existence and extent of carbon leakage across countries, the relative impact of different channels of leakage, and the implications of policy instruments designed to address leakage.

13.10.4 Coordination and Acceleration of Climate Action

- How to ensure a just transition that gains wide popular support through research on actual and perceived distributional effects across countries and contexts.
- How to coordinate and integrate for climate mitigation, between what actors, sectors, governance scale and goals, and how to evaluate.
- Knowledge on the political and policy related links between adaptation and mitigation across sectors and countries.
- Further theoretical and empirical research on the necessary institutional, cultural, social and political conditions to accelerate climate mitigation.
- How to transform developed and developing economies and societies for acceleration, including by shifting development pathways.
- The approaches to, and value of, coordinated, cross economy structural change, including Green New Deal approaches, as a way to accelerate GHG reduction.

Frequently Asked Questions (FAQs)

FAQ 13.1 | What roles do national play in climate mitigation, and how can they be effective?

Institutions and governance underpin mitigation. Climate laws provide the legal basis for action, organisations through which policies are developed and implemented, and frameworks through which diverse actors interact. Specific organisations, such as expert committees, can inform emission reduction targets, inform the creation of policies and packages, and strengthen accountability. Institutions enable strategic thinking, building consensus among stakeholders and enhanced coordination.

Climate governance is constrained and enabled by countries' political systems, material endowments and their ideas, values and belief systems, which leads to a variety of country-specific approaches to climate mitigation.

Countries follow diverse approaches. Some countries focus on greenhouse gases emissions by adopting comprehensive climate laws and creating dedicated ministries and institutions focused on climate change. Others consider climate change among broader scope of policy objectives, such as poverty alleviation, energy security, economic development and co-benefits of climate actions, with the involvement of existing agencies and ministries. See also FAQ 13.3 on sub-national climate mitigation.

FAQ 13.2 | What policies and strategies can be applied to combat climate change?

Institutions can enable creation of mitigation and sectoral policy instruments; policy packages for low-carbon system transition, and economy-wide measures for systemic restructuring. Policy instruments to reduce greenhouses gas emissions include economic instruments, regulatory instruments and other approaches.

Economic policy instruments directly influence prices to achieve emission reductions through taxes, permit trading, offset systems, subsidies, and border tax adjustments, and are effective in promoting implementation of low-cost emissions reductions. Regulatory instruments help achieve specific mitigation outcomes particularly in sectoral applications, by establishing technology or performance requirements. Other instruments include information programmes, government provision of goods, services and infrastructure, divestment strategies, and voluntary agreements between governments and private firms.

Climate policy instruments can be sector-specific or economy-wide and could be applied at national, regional, or local levels. Policymakers may directly target GHG emission reduction or seek to achieve multiple objectives, such as urbanisation or energy security, with the effect of reducing emissions. In practice, climate mitigation policy instruments operate in combination with other policy tools, and require attention to the interaction effects between instruments. At all levels of governance, coverage, stringency and design of climate policies define their efficiency in reducing greenhouse gases emissions.

Policy packages, when designed with attention to interactive effects, local governance context, and harnessed to a clear vision for change, are better able to support socio-technical transitions and shifts in development pathways toward low-carbon futures than individual policies. See also Chapter 14 on international climate governance.

FAQ 13.3 | How can actions at the sub-national level contribute to climate mitigation?

Sub-national actors (for example individuals, organisations, jurisdictions and networks at regional, local and city levels) often have a remit over areas salient to climate mitigation, such as land-use planning, waste management, infrastructure, housing, and community development. Despite constraints on legal authority and dependence on national policy priorities in many countries, sub-national climate change policies exist in more than 120 countries. However, they often lack national support, funding, and capacity, and adequate coordination with other scales. Sub-national climate action in support of specific goals is more likely to succeed when linked to local issues such as travel congestion alleviation, air pollution control.

The main drivers of climate actions at sub-national levels include high levels of citizen concern, jurisdictional authority and funding, institutional capacity, national level support and effective linkage to development objectives. Sub-national governments often initiate and implement policy experiments that could be scaled to other levels of governance.

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References

Aamodt, S., 2018: Environmental Ministries as Climate Policy Drivers: Comparing Brazil and India. *J. Environ. Dev.*, **27(4)**, 355–381, doi:10.1177/1070496518791221.

Aamodt, S. and I. Stensdal, 2017: Seizing policy windows: Policy Influence of climate advocacy coalitions in Brazil, China, and India, 2000–2015. *Glob. Environ. Change*, **46**, 114–125, doi:10.1016/j.gloenvcha.2017.08.006.

Aamodt, S. and E.L. Boasson, 2020: *From Impartial Solutions to Mutual Recognition: Explaining Why the EU Changed its Procedural Climate Justice Preferences*. 1–32 pp, doi:10.2139/ssrn.3541720.

Abbott, K.W., J.F. Green, and R.O. Keohane, 2016: Organizational Ecology and Institutional Change in Global Governance. *Int. Organ.*, **70(2)**, 247–277, doi:10.1017/S0020818315000338.

Abraham-Dukuma, M.C. et al., 2020: Multidisciplinary Composition of Climate Change Commissions: Transnational Trends and Expert Perspectives. *Sustainability*, **12(24)**, 1–23, doi:10.3390/su122410280.

Abson, D.J. et al., 2017: Leverage points for sustainability transformation. *Ambio*, **46(1)**, 30–39, doi:10.1007/s13280-016-0800-y.

Accra Metropolitan Assembly, 2020: *Accra Climate Action Plan: First Five-Year Plan (2020–2025)*. Accra Metropolitan Assembly and C40 Cities, Accra, 70 pp. https://cdn.locomotive.works/sites/5ab410c8a2f42204838f797e/content_entry5ab410faa2f42204838f7990/5ab5605ea2f4220acf45cfa6/files/Accra_Climate_Action_Plan.pdf?1603293785 (Accessed October 17, 2021).

Acuto, M. and S. Rayner, 2016: City networks: breaking gridlocks or forging (new) lock-ins? *Int. Aff.*, **92(5)**, 1147–1166, doi:10.1111/1468-2346.12700.

Adelle, C. and D. Russel, 2013: Climate Policy Integration: a Case of Déjà Vu? *Environ. Policy Gov.*, **23(1)**, 1–12, doi:10.1002/eet.1601.

Affolderbach, J. and C. Schulz, 2016: Mobile transitions: Exploring synergies for urban sustainability research. *Urban Stud.*, **53(9)**, 1942–1957, doi:10.1177/0042098015583784.

African Development Bank, 2019: *Analysis of adaptation components of Africa's Nationally Determined Contributions (NDCs)*. Abidjan, Côte d'Ivoire, 1–46 pp. www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/Analysis_of_Adaptation_Components_in_African_NDCs_2019.pdf (Accessed March 30, 2021).

Agyeman, J., 2013: *Introducing Just Sustainabilities: Policy, Planning, and Practice*. Bloomsbury Publishing, London, UK, 216 pp.

Agyeman, J., D. Schlosberg, L. Craven, and C. Matthews, 2016: Trends and Directions in Environmental Justice: From Inequity to Everyday Life, Community, and Just Sustainabilities. *Annu. Rev. Environ. Resour.*, **41(1)**, 321–340, doi:10.1146/annurev-environ-110615-090052.

Ahmad, I.H., 2009: *Climate Policy Integration: Towards Operationalization.* United Nations Department of Economic and Social Affairs, New York, 18 pp. https://www.un.org/en/desa/climate-policy-integration-towards-operationalization (Accessed August 14, 2021).

Aklin, M. and J. Urpelainen, 2013: Political competition, path dependence, and the strategy of sustainable energy transitions. *Am. J. Pol. Sci.*, **57(3)**, 643–658, doi:10.1111/ajps.12002.

Aklin, M. and M. Mildenberger, 2020: Prisoners of the Wrong Dilemma: Why distributive conflict, not collective action, characterizes the politics of climate change. *Glob. Environ. Polit.*, **20(4)**, 4–26, doi:10.1162/glep_a_00578.

Aldy, J.E. and S. Armitage, 2020: Cost-Effectiveness Implications of Carbon Price Certainty. *AEA Pap. Proc.*, **110**, 113–118, doi:10.1257/pandp.20201083.

Aldy, J.E., M.J. Kotchen, R.N. Stavins, and J.H. Stock, 2021: Keep climate policy focused on the social cost of carbon. *Science*, **373(6557)**, 850–852, doi:10.1126/science.abi7813.

Allcott, H., 2016: Paternalism and Energy Efficiency: An Overview. *Annu. Rev. Econom.*, **8**, 145–176, doi:10.1146/annurev-economics-080315-015255.

Almiron, N. and J. Xifra, eds., 2019: *Climate Change Denial and Public Relations: Strategic communication and interest groups in climate inaction*. Routledge, London, UK, 268 pp.

Altenburg, T., 2011: Building inclusive innovation systems in developing countries: challenges for IS research. In: *Handbook of Innovation Systems and Developing Countries: Building Domestic Capabilities in a Global Setting* [Lundvall B., K.J. Joseph, C. Chaminade, and J. Vang (eds.)]. Edward Elgar Publishing, London, UK, pp. 33–56.

Alves, F. et al., 2020: Climate change policies and agendas: Facing implementation challenges and guiding responses. *Environ. Sci. Policy*, **104**, 190–198, doi:10.1016/j.envsci.2019.12.001.

Amundsen, H., G.K. Hovelsrud, C. Aall, M. Karlsson, and H. Westskog, 2018: Local governments as drivers for societal transformation: towards the 1.5°C ambition. *Curr. Opin. Environ. Sustain.*, **31**, 23–29, doi:10.1016/j.cosust.2017.12.004.

Anderson, Z.R., K. Kusters, J. McCarthy, and K. Obidzinski, 2016: Green growth rhetoric versus reality: Insights from Indonesia. *Glob. Environ. Change*, **38**, 30–40, doi:10.1016/j.gloenvcha.2016.02.008.

Andersson, J.J., 2019: Carbon Taxes and CO_2 Emissions: Sweden as a Case Study. *Am. Econ. J. Econ. Policy*, **11(4)**, 1–30, doi:10.1257/pol.20170144.

Anderton, K. and J. Setzer, 2018: Sub-national climate entrepreneurship: innovative climate action in California and São Paulo. *Reg. Environ. Change*, **18(5)**, 1273–1284, doi:10.1007/s10113-017-1160-2.

Andresen, S., E.L. Boasson, and G. Hønneland, eds., 2012: *International environmental agreements: An introduction*. Routledge, London, UK, 216 pp.

Anguelovski, I. et al., 2016: Equity Impacts of Urban Land-Use Planning for Climate Adaptation. *J. Plan. Educ. Res.*, **36(3)**, 333–348, doi:10.1177/0739456X16645166.

Antonopoulos, I., 2020: Climate Change Effects on Human Rights. In: *Climate Action* [Filho, W.L., A.M. Azul, L. Brandli, P.G. Özuyar, and T. Wall, (eds.)]. Springer, Cham, Switzerland, pp. 159–167.

Antweiler, W., B.R. Copeland, and M.S. Taylor, 2001: Is Free Trade Good for the Environment? *Am. Econ. Rev.*, **91(4)**, 877–908, doi:10.1257/aer.91.4.877.

Antwi-Agyei, P., A.J. Dougill, T.P. Agyekum, and L.C. Stringer, 2018: Alignment between nationally determined contributions and the sustainable development goals for West Africa. *Clim. Policy*, **18(10)**, 1296–1312, doi:10.1080/14693062.2018.1431199.

Arimura, T.H. and T. Abe, 2021: The Impact of the Tokyo Emissions Trading Scheme on Office Buildings: What factor contributed to the emission reduction? *Environ. Econ. Policy Stud.*, **23**, 517–533, doi:10.1007/s10018-020-00271-w.

Armstrong, J.H., 2019: Modeling effective local government climate policies that exceed state targets. *Energy Policy*, **132**, 15–26, doi:10.1016/j.enpol.2019.05.018.

Arndt, C. and F. Tarp, 2017: Aid, Environment and Climate Change. *Rev. Dev. Econ.*, **21(2)**, 285–303, doi:10.1111/rode.12291.

Asensio, O.I. and M.A. Delmas, 2017: The effectiveness of US energy efficiency building labels. *Nat. Energy*, **2(4)**, 17033, doi:10.1038/nenergy.2017.33.

Astuti, R. and A. McGregor, 2015: Governing carbon, transforming forest politics: a case study of Indonesia's REDD+ Task Force. *Asia Pac. Viewp.*, **56(1)**, 21–36, doi:10.1111/apv.12087.

Atchison, J., 2019: Green and Blue Infrastructure in Darwin; Carbon Economies and the Social and Cultural Dimensions of Valuing Urban Mangroves in Australia. *Urban Sci.*, **3(3)**, 86, doi:10.3390/urbansci3030086.

Attari, S.Z. et al., 2009: Preferences for change: Do individuals prefer voluntary actions, soft regulations, or hard regulations to decrease fossil fuel consumption? *Ecol. Econ.*, **68(6)**, 1701–1710, doi:10.1016/j.ecolecon.2008.10.007.

Atteridge, A., C. Verkuijl, and A. Dzebo, 2020: Nationally determined contributions (NDCs) as instruments for promoting national development agendas? An analysis of small island developing states (SIDS). *Clim. Policy*, **20(4)**, 485–498, doi:10.1080/14693062.2019.1605331.

Aune, F.R. and R. Golombek, 2021: Are Carbon Prices Redundant in the 2030 EU Climate and Energy Policy Package? *Energy J.*, **42(3)**, doi:10.5547/01956574.42.3.faun.

aus dem Moore, N., P. Grokurth, and M. Themann, 2019: Multinational corporations and the EU Emissions Trading System: The specter of asset erosion and creeping deindustrialization. *J. Environ. Econ. Manage.*, **94**, doi:10.1016/j.jeem.2018.11.003.

Australian Climate Change Authority, 2017: *Review of the Emissions Reduction Fund*. Commonwealth of Australia, Canberra, 120 pp. https://www.climatechangeauthority.gov.au/sites/default/files/2020-06/CFI%202017%20December/ERF%20Review%20Report.pdf (Accessed March 30, 2021).

Avelino, F. and J.M. Wittmayer, 2016: Shifting Power Relations in Sustainability Transitions: a Multi-actor Perspective. *J. Environ. Policy Plan.*, **18(5)**, 628–649, doi:10.1080/1523908X.2015.1112259.

Averchenkova, A. and S. Guzman Luna, 2018: *Mexico's General Law on Climate Change: Key achievements and challenges ahead*. Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science, London, 29 pp. https://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/11/Policy_report_Mexico's-General-Law-on-Climate-Change-Key-achievements-and-challenges-ahead-29pp_AverchenkovaGuzman-1.pdf (Accessed March 30, 2021).

Averchenkova, A., S. Fankhauser, and M. Nachmany, 2017: Introduction. In: *Trends in Climate Change Legislation* [Averchenkova, A., S. Fankhauser, and M. Nachmany, (eds.)]. Edward Elgar Publishing, Cheltenham, UK and Northampton, MA, USA, pp. 16.

Averchenkova, A., S. Fankhauser, and J. Finnegan, 2018: *The role of independent bodies in climate governance: the UK's Committee on Climate Change*. Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science, London, 28 pp. http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/10/The-role-of-independent-bodies-in-climate-governance-the-UKs-Committee-on-Climate-Change_Averchenkova-et-al.pdf (Accessed March 30, 2021).

Averchenkova, A., S. Fankhauser, and J.J. Finnegan, 2021: The impact of strategic climate legislation: evidence from expert interviews on the UK Climate Change Act. *Clim. Policy*, **21(2)**, 251–263, doi:10.1080/14693062.2020.1819190.

Axsen, J., P. Plötz, and M. Wolinetz, 2020: Crafting strong, integrated policy mixes for deep CO_2 mitigation in road transport. *Nat. Clim. Change*, **10(9)**, 809–818, doi:10.1038/s41558-020-0877-y.

Aydin, C. and Ö. Esen, 2018: Reducing CO_2 emissions in the EU member states: Do environmental taxes work? *J. Environ. Plan. Manag.*, **61(13)**, 2396–2420, doi:10.1080/09640568.2017.1395731.

Aylett, A., 2013: The Socio-institutional Dynamics of Urban Climate Governance: a Comparative Analysis of Innovation and Change in Durban (KZN, South Africa) and Portland (OR, USA). *Urban Stud.*, **50(7)**, 1386–1402, doi:10.1177/0042098013480968.

Aylett, A., 2014: *Progress and Challenges in the Urban Governance of Climate Change: Results of a Global Survey*. MIT, Cambridge, MA, USA, 68 pp. https://climate-adapt.eea.europa.eu/metadata/publications/progress-and-challenges-in-the-urban-governance-of-climate-change-results-of-a-global-survey/mit_iclei_2014_urbanclimategovernancereport.pdf (Accessed December 12, 2019).

Aylett, A., 2015: Institutionalizing the urban governance of climate change adaptation: Results of an international survey. *Urban Clim.*, **14(1)**, 4–16, doi:10.1016/j.uclim.2015.06.005.

Ayling, J., 2017: a Contest for Legitimacy: The Divestment Movement and the Fossil Fuel Industry. *Law Policy*, **39(4)**, 349–371, doi:10.1111/lapo.12087.

Ayling, J. and N. Gunningham, 2017: Non-state governance and climate policy: the fossil fuel divestment movement. *Clim. Policy*, **17(2)**, 131–149, doi:10.1080/14693062.2015.1094729.

Bäckstrand, K. and E. Lövbrand, 2006: Planting trees to mitigate climate change: Contested discourses of ecological modernization, green governmentality and civic environmentalism. *Glob. Environ. Polit.*, **6(1)**, 50–75, doi:10.1162/glep.2006.6.1.50.

Bäckstrand, K. and E. Lövbrand, 2019: The Road to Paris: Contending Climate Governance Discourses in the Post-Copenhagen Era. *J. Environ. Policy Plan.*, **21(5)**, 519–532, doi:10.1080/1523908X.2016.1150777.

Bäckstrand, K., J.W. Kuyper, B.-O. Linnér, and E. Lövbrand, 2017: Non-state actors in global climate governance: from Copenhagen to Paris and beyond. *Env. Polit.*, **26(4)**, 561–579, doi:10.1080/09644016.2017.1327485.

Bae, J.H., D.D. Li, and M. Rishi, 2017: Determinants of CO_2 emission for post-Soviet Union independent countries. *Clim. Policy*, **17(5)**, 591–615, doi:10.1080/14693062.2015.1124751.

Bai, X., B. Roberts, and J. Chen, 2010: Urban sustainability experiments in Asia: Patterns and pathways. *Environ. Sci. Policy*, **13(4)**, 312–325, doi:10.1016/j.envsci.2010.03.011.

Bai, X. et al., 2018: Six research priorities for cities and climate change. *Nature*, **555(7694)**, 23–25, doi:10.1038/d41586-018-02409-z.

Bai, Y., S. Song, J. Jiao, and R. Yang, 2019: The impacts of government R&D subsidies on green innovation: Evidence from Chinese energy-intensive firms. *J. Clean. Prod.*, **233** (October), 819–829, doi:10.1016/j.jclepro.2019.06.107.

Bailey, I., 2017: Spatializing Climate Justice: Justice Claim Making and Carbon Pricing Controversies in Australia. *Ann. Am. Assoc. Geogr.*, **107(5)**, 1128–1143, doi:10.1080/24694452.2017.1293497.

Bak, C., A. Bhattacharya, O. Edenhofer, and B. Knopf, 2017: Towards a comprehensive approach to climate policy, sustainable infrastructure, and finance. *Econ. Open-Access, Open-Assessment E-Journal*, **11(2017–33)**, 1–13, doi:10.5018/economics-ejournal.ja.2017-33.

Baldursson, F.M., N.-H.M. von der Fehr, and E. Lazarczyk, 2021: Electric Vehicles Rollout—Two Case Studies. *Econ. Energy Environ. Policy*, **10(2)**, doi:10.5547/2160-5890.10.2.fbal.

Bang, G., 2021: The United States: conditions for accelerating decarbonisation in a politically divided country. *Int. Environ. Agreements Polit. Law Econ.*, **21(1)**, 43–58, doi:10.1007/s10784-021-09530-x.

Bang, G., A. Underdal, and S. Andresen, eds., 2015: *The Domestic Politics of Global Climate Change: Key Actors in International Climate Cooperation*. Edward Elgar Publishing, Cheltenham, UK and Northampton, MA, USA, 224 pp.

Bang, G., D.G. Victor, and S. Andresen, 2017: California's Cap-and-Trade System: Diffusion and Lessons. *Glob. Environ. Polit.*, **17(3)**, 12–30, doi:10.1162/GLEP_a_00413.

Baranzini, A. et al., 2017: Carbon pricing in climate policy: seven reasons, complementary instruments, and political economy considerations. *Wiley Interdiscip. Rev. Clim. Change*, **8(4)**, e462, doi:10.1002/wcc.462.

Barbier, E.B., 2010: Global Governance: The G20 and a Global Green New Deal. *Econ. Open-Access, Open-Assessment E-Journal*, **4(2010–2)**, 1–35, doi:10.5018/economics-ejournal.ja.2010-2.

Barbier, E.B., 2020: Greening the Post-pandemic Recovery in the G20. *Environ. Resour. Econ.*, **76(4)**, 685–703, doi:10.1007/s10640-020-00437-w.

Barcelona City Council, 2018: *Climate Plan 2018-2030*. Barcelona, Spain, 164 pp. https://www.barcelona.cat/barcelona-pel-clima/sites/default/files/documents/climate_plan_maig.pdf.

Bárcena, A. et al., 2018: *Economics of Climate Change in Latin America and the Caribbean: a graphic view*. Economic Commission for Latin America and the Caribbean (ECLAC), Santiago, Chile, 61 pp. https://www.cepal.org/en/publications/43889-economics-climate-change-latin-america-and-caribbean-graphic-view (Accessed October 25, 2021).

Barritt, E., 2020: Consciously transnational: Urgenda and the shape of climate change litigation: The State of the Netherlands (Ministry of Economic

13

Affairs and Climate Policy) v Urgenda Foundation. *Environ. Law Rev.*, **22(4)**, 296–305, doi:10.1177/1461452920974493.

Barritt, E. and B. Sediti, 2019: The Symbolic Value of Leghari v Federation of Pakistan: Climate Change Adjudication in the Global South. *King's Law J.*, **30(2)**, doi:10.1080/09615768.2019.1648370.

Barton, B. and J. Campion, 2018: Climate Change Legislation: Law for Sound Policy Making. In: *Innovation in Energy Law and Technology: Dynamic Solutions for Energy Transitions* [Zillman, D., M. Roggenkamp, L. Paddock, and L. Godden, (eds.)]. Vol. 1. Oxford University Press, Oxford, UK, pp. 23–37.

Bastos Lima, M.G., U.M. Persson, and P. Meyfroidt, 2019: Leakage and boosting effects in environmental governance: a framework for analysis. *Environ. Res. Lett.*, **14(10)**, doi:10.1088/1748-9326/ab4551.

Bataille, C. et al., 2018a: a review of technology and policy deep decarbonization pathway options for making energy-intensive industry production consistent with the Paris Agreement. *J. Clean. Prod.*, **187**, 960–973, doi:10.1016/j.jclepro.2018.03.107.

Bataille, C., C. Guivarch, S. Hallegatte, J. Rogelj, and H. Waisman, 2018b: Carbon prices across countries. *Nat. Clim. Change*, **8**, 648–650, doi:10.1038/s41558-018-0239-1.

Bataille, C.G.F., 2020: Physical and policy pathways to net-zero emissions industry. *WIREs Clim. Change*, **11(2)**, e633, doi:10.1002/wcc.633.

Båtstrand, S., 2015: More than Markets: a Comparative Study of Nine Conservative Parties on Climate Change. *Polit. Policy*, **43(4)**, 538–561, doi:10.1111/polp.12122.

Bättig, M.B. and T. Bernauer, 2009: National Institutions and Global Public Goods: Are Democracies More Cooperative in Climate Change Policy? *Int. Organ.*, **63(02)**, 281, doi:10.1017/S0020818309090092.

Bauer, N. et al., 2015: CO_2 emission mitigation and fossil fuel markets: Dynamic and international aspects of climate policies. *Technol. Forecast. Soc. Change*, **90(Part A)**, 243–256, doi:10.1016/j.techfore.2013.09.009.

Bauer, N. et al., 2016: Global fossil energy markets and climate change mitigation – an analysis with REMIND. *Clim. Change*, **136(1)**, 69–82, doi:10.1007/s10584-013-0901-6.

Baxter, J., R. Morzaria, and R. Hirsch, 2013: a case-control study of support/opposition to wind turbines: Perceptions of health risk, economic benefits, and community conflict. *Energy Policy*, **61**, 931–943, doi:10.1016/j.enpol.2013.06.050.

Bayer, P. and M. Aklin, 2020: The European Union Emissions Trading System reduced CO_2 emissions despite low prices. *Proc. Natl. Acad. Sci.*, **117(16)**, doi:10.1073/pnas.1918128117.

Baylis, K., D. Fullerton, and D.H. Karney, 2014: Negative Leakage. *J. Assoc. Environ. Resour. Econ.*, **1(1/2)**, 51–73, doi:10.1086/676449.

Bebbington, A. and J. Bury, eds., 2013: *Subterranean Struggles: New Dynamics of Mining, Oil, and Gas in Latin America*. University of Texas Press, Austin, Texas, USA, 361 pp.

Bechtel, M.M., F. Genovese, and K.F. Scheve, 2019: Interests, Norms and Support for the Provision of Global Public Goods: The Case of Climate Co-operation. *Br. J. Polit. Sci.*, **49(4)**, 1333–1355, doi:10.1017/S0007123417000205.

Becken, S., 2019: Decarbonising tourism: mission impossible? *Tour. Recreat. Res.*, **44(4)**, 419–433, doi:10.1080/02508281.2019.1598042.

Beermann, J., A. Damodaran, K. Jörgensen, and M.A. Schreurs, 2016: Climate action in Indian cities: an emerging new research area. *J. Integr. Environ. Sci.*, **13(1)**, 55–66, doi:10.1080/1943815X.2015.1130723.

Beg, N. et al., 2002: Linkages between climate change and sustainable development. *Clim. Policy*, **2(2–3)**, 129–144, doi:10.3763/cpol.2002.0216.

Bel, G. and J.J. Teixidó, 2020: The political economy of the Paris Agreement: Income inequality and climate policy. *J. Clean. Prod.*, **258**, 121002, doi:10.1016/j.jclepro.2020.121002.

Bennett, M., 2018: The role of National Framework Legislation in Implementing Australia's emission reduction commitments under the Paris Agreement. *Univ. West. Aust. Law Rev.*, **43(1)**, 240–263.

Bennett, W.L., 2013: *The Logic of Connective Action: Digital Media And The Personalization Of Contentious Politics*. Cambridge University Press, Cambridge, UK, 256 pp.

Bento, A., R. Kanbur, and B. Leard, 2016: On the importance of baseline setting in carbon offsets markets. *Clim. Change*, **137(3–4)**, 625–637, doi:10.1007/s10584-016-1685-2.

Bergquist, P., S. Ansolabehere, S. Carley, and D. Konisky, 2020: Backyard voices: How sense of place shapes views of large-scale energy transmission infrastructure. *Energy Res. Soc. Sci.*, **63**, 101396, doi:10.1016/j.erss.2019.101396.

Bernard, J.-T. and M. Kichian, 2019: The long and short run effects of British Columbia's carbon tax on diesel demand. *Energy Policy*, **131**(August 2019), 380–389, doi:10.1016/j.enpol.2019.04.021.

Bernard, J.-T. and M. Kichian, 2021: The Impact of a Revenue-Neutral Carbon Tax on GDP Dynamics: The Case of British Columbia. *Energy J.*, **42(3)**, doi:10.5547/01956574.42.3.jber.

Bernhagen, P., 2008: Business and International Environmental Agreements: Domestic Sources of Participation and Compliance by Advanced Industrialized Democracies. *Glob. Environ. Polit.*, **8(1)**, 78–110, doi:10.1162/glep.2008.8.1.78.

Bernstein, S. and M. Hoffmann, 2018: The politics of decarbonization and the catalytic impact of subnational climate experiments. *Policy Sci.*, **51(2)**, 189–211, doi:10.1007/s11077-018-9314-8.

Bernstein, S. and M. Hoffmann, 2019: Climate politics, metaphors and the fractal carbon trap. *Nat. Clim. Change*, **9(12)**, 919–925, doi:10.1038/s41558-019-0618-2.

Berry, P.M. et al., 2015: Cross-sectoral interactions of adaptation and mitigation measures. *Clim. Change*, **128(3–4)**, 381–393, doi:10.1007/s10584-014-1214-0.

Bertoldi, P., 2018: The Paris Agreement 1.5 C goal: what it does mean for energy efficiency? *Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings.* American Council for an Energy-Efficient Economy, Washington, DC, USA. www.aceee.org/files/proceedings/2018/#/paper/event-data/p268 (Accessed September 24, 2021).

Bertoldi, P. et al., 2020: *Covenant of Mayors: 2019 Assessment*. Publications Office of the European Union, Luxembourg, 63 pp. https://publications.jrc.ec.europa.eu/repository/handle/JRC118927.

Bertram, C. et al., 2015a: Carbon lock-in through capital stock inertia associated with weak near-term climate policies. *Technol. Forecast. Soc. Change*, **90**, 62–72, doi:10.1016/j.techfore.2013.10.001.

Bertram, C. et al., 2015b: Complementing carbon prices with technology policies to keep climate targets within reach. *Nat. Clim. Change*, **5(3)**, 235–239, doi:10.1038/nclimate2514.

Besanko, D., 1987: Performance versus design standards in the regulation of pollution. *J. Public Econ.*, **34(1)**, 19–44, doi:10.1016/0047-2727(87)90043-0.

Best, R., P.J. Burke, and F. Jotzo, 2020: Carbon Pricing Efficacy: Cross-Country Evidence. *Environ. Resour. Econ.*, **77(1)**, 69–94, doi:10.1007/s10640-020-00436-x.

Bevan, L.D., T. Colley, and M. Workman, 2020: Climate change strategic narratives in the United Kingdom: Emergency, Extinction, Effectiveness. *Energy Res. Soc. Sci.*, **69**, 101580, doi:10.1016/j.erss.2020.101580.

Bhagavathy, S.M. and M. McCulloch, 2020: *Electric Vehicle transition in the UK*. arXiv, Oxford, UK, 7 pp. https://arxiv.org/ftp/arxiv/papers/2007/2007.03745.pdf (Accessed November 28, 2020).

Bhamidipati, P.L., J. Haselip, and U. Elmer Hansen, 2019: How do energy policies accelerate sustainable transitions? Unpacking the policy transfer process in the case of GETFiT Uganda. *Energy Policy*, **132**, 1320–1332, doi:10.1016/j.enpol.2019.05.053.

Bhardwaj, A., M. Joshi, R. Khosla, and N.K. Dubash, 2019: More priorities, more problems? Decision-making with multiple energy, development and climate objectives. *Energy Res. Soc. Sci.*, **49**, 143–157, doi.org/10.1016/j.erss.2018.11.003.

Bhardwaj, C., J. Axsen, F. Kern, and D. McCollum, 2020: Why have multiple climate policies for light-duty vehicles? Policy mix rationales, interactions and research gaps. *Transp. Res. Part a Policy Pract.*, **135**, 309–326, doi:10.1016/j.tra.2020.03.011.

Biggs, E.M. et al., 2015: Sustainable development and the water-energy-food nexus: a perspective on livelihoods. *Environ. Sci. Policy*, **54**, 389–397, doi:10.1016/j.envsci.2015.08.002.

Black, R. et al., 2021: *Taking Stock: a global assessment of net zero targets*. The Real Press, London, UK, 30 pp. https://ca1-eci.edcdn.com/reports/ECIU-Oxford_Taking_Stock.pdf (Accessed October 20, 2021).

Blok, A., 2016: Assembling urban riskscapes. *City*, **20(4)**, 602–618, doi:10.1080/13604813.2016.1194000.

Blondeel, M. and T. Van de Graaf, 2018: Toward a global coal mining moratorium? a comparative analysis of coal mining policies in the USA, China, India and Australia. *Clim. Change*, **150(1–2)**, 89–101, doi:10.1007/s10584-017-2135-5.

Blondeel, M., J. Colgan, and T. Van de Graaf, 2019: What Drives Norm Success? Evidence from Anti–Fossil Fuel Campaigns. *Glob. Environ. Polit.*, **19(4)**, 63–84, doi:10.1162/glep_a_00528.

Blue, G. and J. Medlock, 2014: Public Engagement with Climate Change as Scientific Citizenship: a Case Study of World Wide Views on Global Warming. *Sci. Cult.*, **23(4)**, 560–579, doi:10.1080/09505431.2014.917620.

Boasson, E.L., 2015: *National Climate Policy: a Multi-field Approach*. 1st ed. Routledge, New York, NY, USA, 250 pp.

Boasson, E.L., 2019: Constitutionalization and Entrepreneurship: Explaining Increased EU Steering of Renewables Support Schemes. *Polit. Gov.*, **7(1)**, 70–80, doi:10.17645/pag.v7i1.1851.

Boasson, E.L. and J. Wettestad, 2013: *EU Climate Policy: Industry, Policy Interaction and External Environment*. 1st ed. Routledge, 236 pp.

Boasson, E.L., M.D. Leiren, and J. Wettestad, eds., 2021: *Comparative Renewables Policy: Political, Organizational and European Fields*. 1st ed. Routledge, London, UK, 278 pp.

Bocklet, J., M. Hintermayer, L. Schmidt, and T. Wildgrube, 2019: The reformed EU ETS – Intertemporal emission trading with restricted banking. *Energy Econ.*, **84**, doi:10.1016/j.eneco.2019.104486.

Bohari, A.A.M., M. Skitmore, B. Xia, and M. Teo, 2017: Green oriented procurement for building projects: Preliminary findings from Malaysia. *J. Clean. Prod.*, **148**, 690–700, doi:10.1016/j.jclepro.2017.01.141.

Böhmelt, T., M. Böker, and H. Ward, 2016: Democratic inclusiveness, climate policy outputs, and climate policy outcomes. *Democratization*, **23(7)**, 1272–1291, doi:10.1080/13510347.2015.1094059.

Böhringer, C., E.J. Balistreri, and T.F. Rutherford, 2012: The role of border carbon adjustment in unilateral climate policy: Overview of an Energy Modeling Forum study (EMF 29). *Energy Econ.*, **34(sup2)**, S97–S110, doi:10.1016/j.eneco.2012.10.003.

Böhringer, C., A. Keller, M. Bortolamedi, and A. Rahmeier Seyffarth, 2016: Good things do not always come in threes: On the excess cost of overlapping regulation in EU climate policy. *Energy Policy*, **94**, 502–508, doi:10.1016/j.enpol.2015.12.034.

Böhringer, C., B. Bye, T. Fæhn, and K.E. Rosendahl, 2017a: Targeted carbon tariffs: Export response, leakage and welfare. *Resour. Energy Econ.*, **50**, 51–73, doi:10.1016/j.reseneeco.2017.06.003.

Böhringer, C., A. Cuntz, D. Harhoff, and E. Asane-Otoo, 2017b: The impact of the German feed-in tariff scheme on innovation: Evidence based on patent filings in renewable energy technologies. *Energy Econ.*, **67**, 545–553, doi:10.1016/j.eneco.2017.09.001.

Böhringer, C., K.E. Rosendahl, and H.B. Storrøsten, 2017c: Robust policies to mitigate carbon leakage. *J. Public Econ.*, **149**, 35–46, doi:10.1016/j.jpubeco.2017.03.006.

Boli, J. and G.M. Thomas, eds., 1999: *Constructing World Culture: International Nongovernmental Organizations Since 1875*. Stanford University Press, Stanford, CA, USA, 380 pp.

Borenstein, S., J. Bushnell, F.A. Wolak, and M. Zaragoza-Watkins, 2019: Expecting the Unexpected: Emissions Uncertainty and Environmental Market Design. *Am. Econ. Rev.*, **109(11)**, 3953–3977, doi:10.1257/aer.20161218.

Borghesi, S., C. Franco, and G. Marin, 2020: Outward Foreign Direct Investment Patterns of Italian Firms in the European Union's Emission Trading Scheme. *Scand. J. Econ.*, **122(1)**, doi:10.1111/sjoe.12323.

Bosetti, V. and D.G. Victor, 2011: Politics and Economics of Second-Best Regulation of Greenhouse Gases: The Importance of Regulatory Credibility. *Energy J.*, **32(1)**, 1–24, doi:10.5547/ISSN0195-6574-EJ-Vol32-No1-1.

Bostrom, A., A.L. Hayes, and K.M. Crosman, 2018: Efficacy, Action, and Support for Reducing Climate Change Risks. *Risk Anal.*, **39(4)**, 805–828, doi:10.1111/risa.13210.

Boudet, H., D. Bugden, C. Zanocco, and E. Maibach, 2016: The effect of industry activities on public support for 'fracking.' *Env. Polit.*, **25(4)**, 593–612, doi:10.1080/09644016.2016.1153771.

Boulianne, S., M. Lalancette, and D. Ilkiw, 2020: 'School Strike 4 Climate': Social Media and the International Youth Protest on Climate Change. *Media Commun.*, **8(2)**, 208–218, doi:10.17645/mac.v8i2.2768.

Boussalis, C. and T.G. Coan, 2016: Text-mining the signals of climate change doubt. *Glob. Environ. Change*, **36**, 89–100, doi:10.1016/j.gloenvcha.2015.12.001.

Bouteligier, S., 2013: Inequality in new global governance arrangements: the North–South divide in transnational municipal networks. *Innov. Eur. J. Soc. Sci. Res.*, **26(3)**, 251–267, doi:10.1080/13511610.2013.771890.

Bouwer, K., 2018: The Unsexy Future of Climate Change Litigation. *J. Environ. Law*, **30(3)**, 483–506, doi:10.1093/jel/eqy017.

Bouzarovski, S., J. Frankowski, and S. Tirado Herrero, 2018: Low-Carbon Gentrification: When Climate Change Encounters Residential Displacement. *Int. J. Urban Reg. Res.*, **42(5)**, 845–863, doi:10.1111/1468-2427.12634.

Bowen, K.J., K. Ebi, and S. Friel, 2014: Climate change adaptation and mitigation: next steps for cross-sectoral action to protect global health. *Mitig. Adapt. Strateg. Glob. Change*, **19(7)**, 1033–1040, doi:10.1007/s11027-013-9458-y.

Bowman, M. and D. Wiseman, 2020: Finance actors and climate-related disclosure regulation: Logic, limits, and emerging accountability. In: *Criminology and Climate: Insurance, Finance and the Regulation of Harmscapes* [Holley, C., L. Phelan, and C. Shearing, (eds.)]. Routledge, London, UK, 26 pp.

Boykoff, M. and J. Farrell, 2019: Climate Change Countermovement Organizations and Media Attention in the United States. In: *Climate Change Denial and Public Relations. Strategic Communication and Interest Groups in Climate Inaction* [Almiron, N. and J. Xifra, (eds.)]. Routledge, London, pp. 121–139.

Boykoff, M. and B. Osnes, 2019: a Laughing matter? Confronting climate change through humor. *Polit. Geogr.*, **68**, 154–163, doi:10.1016/j.polgeo.2018.09.006.

Boykoff, M. et al., 2019: World Newspaper Coverage of Climate Change or Global Warming, 2004-2019. Media and Climate Change Observatory (MECCO) Data Sets. Cooperative Institute for Research in Environmental Sciences, University of Colorado, doi:10.25810/4c3b-b819.20.

Boykoff, M. et al., 2021: World Newspaper Coverage of Climate Change or Global Warming, 2004-2021. Media and Climate Change Observatory (MECCO) Data Sets. Cooperative Institute for Research in Environmental Sciences, University of Colorado, doi:10.25810/4c3b-b819.

Boykoff, M.T., 2011: *Who Speaks for the Climate? Making Sense of Media Reporting on Climate Change*. Cambridge University Press, Cambridge, UK, 240 pp.

Boykoff, M.T., 2013: Public Enemy No. 1? Understanding Media Representations of Outlier Views on Climate Change. *Am. Behav. Sci.*, **57(6)**, 796–817, doi:10.1177/0002764213476846.

Boykoff, M.T. and T. Yulsman, 2013: Political economy, media, and climate change: sinews of modern life. *Wiley Interdiscip. Rev. Clim. Change*, **4(5)**, 359–371, doi:10.1002/wcc.233.

Branger, F. and P. Quirion, 2014: Would border carbon adjustments prevent carbon leakage and heavy industry competitiveness losses? Insights from a meta-analysis of recent economic studies. *Ecol. Econ.*, **99**, 29–39, doi:10.1016/j.ecolecon.2013.12.010.

Branger, F., P. Quirion, and J. Chevallier, 2016: Carbon Leakage and Competitiveness of Cement and Steel Industries Under the EU ETS: Much Ado About Nothing. *Energy J.*, **37(3)**, 109–135, doi:10.5547/01956574.37.3.fbra.

Brannstrom, C. et al., 2017: Is Brazilian wind power development sustainable? Insights from a review of conflicts in Ceará state. *Renew. Sustain. Energy Rev.*, **67**, 62–71, doi:10.1016/j.rser.2016.08.047.

Brattland, C. and T. Mustonen, 2018: How Traditional Knowledge Comes to Matter in Atlantic Salmon Governance in Norway and Finland. *Arctic*, **71(4)**, 375–392, doi:10.14430/arctic4751.

Bratton, W. and J.A. McCahery, 2015: *Institutional Investor Activism: Hedge Funds and Private Equity, Economics and Regulation*. Penn Law: Legal Scholarship Repository, 49 pp. https://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=2646&context=faculty_scholarship.

Brewer, P.R. and J. McKnight, 2015: Climate as Comedy: The Effects of Satirical Television News on Climate Change Perceptions. *Sci. Commun.*, **37(5)**, 635–657, doi:10.1177/1075547015597911.

Broadbent, J. et al., 2016: Conflicting Climate Change Frames in a Global Field of Media Discourse. *Socius Sociol. Res. a Dyn. World*, **2**, 237802311667066, doi:10.1177/2378023116670660.

Bromley-Trujillo, R. and M.R. Holman, 2020: Climate Change Policymaking in the States: a View at 2020. *Publius J. Fed.*, **50(3)**, 446–472, doi:10.1093/publius/pjaa008.

Brown, D.M., 2012: Comparative Climate Change Policy and Federalism: An Overview. *Rev. Policy Res.*, **29(3)**, 322–333, doi:10.1111/j.1541-1338.2012.00562.x.

Brüggemann, M. and S. Engesser, 2017: Beyond false balance: How interpretive journalism shapes media coverage of climate change. *Glob. Environ. Change*, **42**, 58–67, doi:10.1016/j.gloenvcha.2016.11.004.

Brugnach, M., M. Craps, and A. Dewulf, 2017: Including indigenous peoples in climate change mitigation: addressing issues of scale, knowledge and power. *Clim. Change*, **140(1)**, 19–32, doi:10.1007/s10584-014-1280-3.

Brulle, R.J., 2000: *Agency, democracy, and nature: the U.S. environmental movement from a critical theory perspective*. 1st editio. MIT Press, Boston, MA, 360 pp.

Brulle, R.J., 2014: Institutionalizing delay: foundation funding and the creation of U.S. climate change counter-movement organizations. *Clim. Change*, **122(4)**, 681–694, doi:10.1007/s10584-013-1018-7.

Brulle, R.J., 2019: Networks of Opposition: a Structural Analysis of U.S. Climate Change Countermovement Coalitions 1989–2015. *Sociol. Inq.*, **91(3) 603–624**, doi:10.1111/soin.12333.

Brulle, R.J., J. Carmichael, and J.C. Jenkins, 2012: Shifting public opinion on climate change: An empirical assessment of factors influencing concern over climate change in the U.S., 2002-2010. *Clim. Change*, **114(2)**, 169–188, doi:10.1007/s10584-012-0403-y.

Bruninx, K., M. Ovaere, and E. Delarue, 2020: The long-term impact of the market stability reserve on the EU emission trading system. *Energy Econ.*, **89**, 104746, doi:10.1016/j.eneco.2020.104746.

Brunner, S., C. Flachsland, and R. Marschinski, 2012: Credible commitment in carbon policy. *Clim. Policy*, **12(2)**, 255–271, doi:10.1080/14693062.2011.582327.

Buchholz, W., L. Dippl, and M. Eichenseer, 2019: Subsidizing renewables as part of taking leadership in international climate policy: The German case. *Energy Policy*, **129**, 765–773, doi:10.1016/j.enpol.2019.02.044.

Büchs, M., C. Saunders, R. Wallbridge, G. Smith, and N. Bardsley, 2015: Identifying and explaining framing strategies of low-carbon lifestyle movement organisations. *Glob. Environ. Change*, **35**, 307–315, doi:10.1016/j.gloenvcha.2015.09.009.

Buckman, G., J. Sibley, and M. Ward, 2019: The large-scale feed-in tariff reverse auction scheme in the Australian Capital Territory 2012, to 2016. *Renew. Energy*, **132**, 176–185, doi:10.1016/j.renene.2018.08.011.

Buitenzorgy, M. and A.P.J. Mol, 2011: Does Democracy Lead to a Better Environment? Deforestation and the Democratic Transition Peak. *Environ. Resour. Econ.*, **48(1)**, 59–70, doi:10.1007/s10640-010-9397-y.

Bulfin, A., 2017: Popular culture and the 'new human condition': Catastrophe narratives and climate change. *Glob. Planet. Change*, **156**, 140–146, doi:10.1016/j.gloplacha.2017.03.002.

Bulkeley, H., 2000: Discourse Coalitions and the Australian Climate Change Policy Network. *Environ. Plan. C Gov. Policy*, **18(6)**, 727–748, doi:10.1068/c9905j.

Bulkeley, H., 2013: *Cities and Climate Change*. 1st ed. Routledge, London, UK, 280 pp.

Bulkeley, H. and V. Castán Broto, 2013: Government by experiment? Global cities and the governing of climate change. *Trans. Inst. Br. Geogr.*, **38(3)**, 361–375, doi:10.1111/j.1475-5661.2012.00535.x.

Bulkeley, H., J. Carmin, V. Castan Broto, G.A.S. Edwards, and S. Fuller, 2013: Climate justice and global cities: Mapping the emerging discourses. *Glob. Environ. Change*, **23(5)**, 914–925, doi:10.1016/j.gloenvcha.2013.05.010.

Bulkeley, H. et al., 2016: Urban living labs: governing urban sustainability transitions. *Curr. Opin. Environ. Sustain.*, **22**, 13–17, doi:10.1016/j.cosust.2017.02.003.

Bullard, R.D., P. Mohai, R. Saha, and B. Wright, 2008: Toxic Wastes and Race at Twenty: Why Race Still Matters After all of These Years. *Environ. Law*, **38(2)**, 371–411.

Burch, S., H. Schroeder, S. Rayner, and J. Wilson, 2013: Novel Multisector Networks and Entrepreneurship: The Role of Small Businesses in the Multilevel Governance of Climate Change. *Environ. Plan. C Gov. Policy*, **31(5)**, 822–840, doi:10.1068/c1206.

Burch, S. et al., 2014: Triggering transformative change: a development path approach to climate change response in communities. *Clim. Policy*, **14(4)**, 467–487, doi:10.1080/14693062.2014.876342.

Burch, S. et al., 2016: Governing and accelerating transformative entrepreneurship: exploring the potential for small business innovation on urban sustainability transitions. *Curr. Opin. Environ. Sustain.*, **22**, 26–32, doi:10.1016/j.cosust.2017.04.002.

Burck, J., U. Hagen, N. Höhne, L. Nascimento, and C. Bals, 2019: *Climate Change Performance Index Results 2020*. Germanwatch, New Climate Institute and Climate Action Network International, 32 pp. https://newclimate.org/wp-content/uploads/2019/12/CCPI-2020-Results_Web_Version.pdf (Accessed October 18, 2021).

Burger, C., A. Froggatt, C. Mitchell, and J. Weimann (eds.), 2020a: *Decentralised Energy: a Global Game Changer*. Ubiquity Press, London, UK, 313 pp.

Burger, M., J. Wentz, and R. Horton, 2020b: The Law and Science of Climate Change Attribution. *Columbia J. Environ. Law*, **45(1)**, 57–240, doi:10.7916/cjel.v45i1.4730.

Burgers, L., 2020: Should Judges Make Climate Change Law? *Transnatl. Environ. Law*, **9(1)**, 55–75, doi:10.1017/S2047102519000360.

Burgers, L. and T. Staal, 2019: Climate Action as Positive Human Rights Obligation: The Appeals Judgment in Urgenda v the Netherlands. In: *Netherlands Yearbook of International Law 2018* [Nijman, J. and W. Werner (eds.)]. Asser Press, The Hague, Netherlands, pp. 223–244.

Burke, P.J., 2016: Undermined by Adverse Selection: Australia's Direct Action Abatement Subsidies. *Econ. Pap. a J. Appl. Econ. policy*, **35(3)**, 216–229, doi:10.1111/1759-3441.12138.

Burke, P.J. and S. Kurniawati, 2018: Electricity subsidy reform in Indonesia: Demand-side effects on electricity use. *Energy Policy*, **116**, 410–421, doi:10.1016/j.enpol.2018.02.018.

Burniaux, J.-M. and J. Chateau, 2014: Greenhouse gases mitigation potential and economic efficiency of phasing-out fossil fuel subsidies. *Int. Econ.*, **140**, 71–88, doi:10.1016/j.inteco.2014.05.002.

Busch, H., L. Bendlin, and P. Fenton, 2018: Shaping local response – The influence of transnational municipal climate networks on urban climate governance. *Urban Clim.*, **24**, 221–230, doi:10.1016/j.uclim.2018.03.004.

Busch, J., F. Godoy, W.R. Turner, and C.A. Harvey, 2011: Biodiversity co-benefits of reducing emissions from deforestation under alternative reference levels and levels of finance. *Conserv. Lett.*, **4(2)**, 101–115, doi:10.1111/j.1755-263X.2010.00150.x.

Bush, J. and A. Doyon, 2019: Building urban resilience with nature-based solutions: How can urban planning contribute? *Cities*, **95**(October), 102483, doi:10.1016/j.cities.2019.102483.

Bush, R.E., C.S.E. Bale, and P.G. Taylor, 2016: Realising local government visions for developing district heating: Experiences from a learning country. *Energy Policy*, **98**, 84–96, doi:10.1016/j.enpol.2016.08.013.

Bushley, B.R., 2014: REDD+ policy making in Nepal: toward state-centric, polycentric, or market-oriented governance? *Ecol. Soc.*, **19(3)**, 34, doi:10.5751/ES-06853-190334.

Bustamante, M.M.C. et al., 2019: Ecological restoration as a strategy for mitigating and adapting to climate change: lessons and challenges from Brazil. *Mitig. Adapt. Strateg. Glob. Change*, **24(7)**, 1249–1270, doi:10.1007/s11027-018-9837-5.

Butler-Sloss, S., K. Bond, and H. Benham, 2021: *Spiralling Disruption: The feedback loops of the energy transition*. Carbon Tracker, 23 pp. https://carbontracker.org/reports/spiralling-disruption/ (Accessed October 28, 2021).

C40 and ARUP, 2015: *Climate Action in Megacities 3.0: Networking works, there is no global solution without local action*. C40 and ARUP, London, 128 pp. https://www.arup.com/perspectives/publications/research/section/climate-action-in-megacities-cam-30 (Accessed March 3, 2021).

Caetano, T., H. Winker, and J. Depledge, 2020: Towards zero carbon and zero poverty: integrating national climate change mitigation and sustainable development goals. *Clim. Policy*, **20(7)**, 773–778, doi:10.1080/14693062.2020.1791404.

Calel, R., 2020: Adopt or Innovate: Understanding Technological Responses to Cap-and-Trade. *Am. Econ. J. Econ. Policy*, **12(3)**, doi:10.1257/pol.20180135.

Calel, R. and A. Dechezleprêtre, 2016: Environmental Policy and Directed Technological Change: Evidence from the European Carbon Market. *Rev. Econ. Stat.*, **98(1)**, 173–191, doi:10.1162/REST_a_00470.

Calzadilla, P.V., 2019: Climate Change Litigation: a Powerful Strategy for Enhancing Climate Change Communication. In: *Addressing the Challenges in Communicating Climate Change Across Various Audiences. Climate Change Management. Climate Change Management* [Leal Filho, W., B. Lackner and H. McGhie (eds.)]. Springer, Cham, Switzerland, pp. 231–246.

Camilleri, A.R., R.P. Larrick, S. Hossain, and D. Patino-Echeverri, 2019: Consumers underestimate the emissions associated with food but are aided by labels. *Nat. Clim. Change*, **9(1)**, 53–58, doi:10.1038/s41558-018-0354-z.

Campagnolo, L. and M. Davide, 2019: Can the Paris deal boost SDGs achievement? An assessment of climate mitigation co-benefits or side-effects on poverty and inequality. *World Dev.*, **122**, 96–109, doi:10.1016/j.worlddev.2019.05.015.

Candel, J.J.L. and R. Biesbroek, 2016: Toward a processual understanding of policy integration. *Policy Sci.*, **49(3)**, 211–231, doi:10.1007/s11077-016-9248-y.

Carattini, S., S. Kallbekken, and A. Orlov, 2019: How to win public support for a global carbon tax. *Nature*, **565**, 289–291, doi:10.1038/d41586-019-00124-x.

Carbone, J.C. and N. Rivers, 2017: The Impacts of Unilateral Climate Policy on Competitiveness: Evidence From Computable General Equilibrium Models. *Rev. Environ. Econ. Policy*, **11(1)**, 24–42, doi:10.1093/reep/rew025.

Carley, S. and D.M. Konisky, 2020: The justice and equity implications of the clean energy transition. *Nat. Energy*, **5(8)**, 569–577, doi:10.1038/s41560-020-0641-6.

Carley, S., L.L. Davies, D.B. Spence, and N. Zirogiannis, 2018: Empirical evaluation of the stringency and design of renewable portfolio standards. *Nat. Energy*, **3(9)**, 754–763, doi:10.1038/s41560-018-0202-4.

Carmichael, J.T. and R.J. Brulle, 2018: Media use and climate change concern. *Int. J. Media Cult. Polit.*, **14(2)**, 243–253, doi:10.1386/macp.14.2.243_7.

Carmichael, J.T., R.J. Brulle, and J.K. Huxster, 2017: The great divide: understanding the role of media and other drivers of the partisan divide in public concern over climate change in the USA, 2001–2014. *Clim. Change*, **141(4)**, 599–612, doi:10.1007/s10584-017-1908-1.

Carrington, D., 2019: School climate strikes: 1.4 million people took part, say campaigners. The Guardian, London, UK, March 19. https://www.theguardian.com/environment/2019/mar/19/school-climate-strikes-more-than-1-million-took-part-say-campaigners-greta-thunberg (Accessed March 30, 2021).

Carroll, J., C. Aravena, M. Boeri, and E. Denny, 2022: "Show Me the Energy Costs": Short and Long-term Energy Cost Disclosure Effects on Willingness-to-pay for Residential Energy Efficiency. *Energy J.*, **43(3)**, doi:10.5547/01956574.43.3.jcar.

Carter, N., 2006: Party Politicization Of The Environment In Britain. *Party Polit.*, **12(6)**, 747–767, doi:10.1177/1354068806068599.

Carter, N., 2013: Greening the mainstream: party politics and the environment. *Env. Polit.*, **22(1)**, 73–94, doi:10.1080/09644016.2013.755391.

Carter, N., 2014: The politics of climate change in the UK. *Wiley Interdiscip. Rev. Clim. Change*, **5(3)**, 423–433, doi:10.1002/wcc.274.

Carter, N. and M. Childs, 2018: Friends of the Earth as a policy entrepreneur: 'The Big Ask' campaign for a UK Climate Change Act. *Env. Polit.*, **27(6)**, 994–1013, doi:10.1080/09644016.2017.1368151.

Carter, S. et al., 2018: Climate-smart land use requires local solutions, transdisciplinary research, policy coherence and transparency. *Carbon Manag.*, **9(3)**, 291–301, doi:10.1080/17583004.2018.1457907.

Carter, A.V. and J. McKenzie, 2020: Amplifying "Keep It in the Ground" First-Movers: Toward a Comparative Framework. *Soc. Nat. Resour.*, **33(11)**, 1339–1358, doi:10.1080/08941920.2020.1772924.

Cashore, B., S. Bernstein, D. Humphreys, I. Visseren-Hamakers, and K. Rietig, 2019: Designing stakeholder learning dialogues for effective global governance. *Policy Soc.*, **38(1)**, 118–147, doi:10.1080/14494035.2019.1579505.

Castán Broto, V., 2017: Urban Governance and the Politics of Climate change. *World Dev.*, **93**, 1–15, doi:10.1016/j.worlddev.2016.12.031.

Castán Broto, V. and H. Bulkeley, 2013: a survey of urban climate change experiments in 100 cities. *Glob. Environ. Change*, **23(1)**, 92–102, doi:10.1016/j.gloenvcha.2012.07.005.

Castán Broto, V. and L. Westman, 2017: Just sustainabilities and local action: evidence from 400 flagship initiatives. *Local Environ.*, **22(5)**, 635–650, doi:10.1080/13549839.2016.1248379.

Castán Broto, V. and L. Westman, 2019: *Urban Sustainability and Justice: Just Sustainabilities and Environmental Planning*. Zed Books Ltd, Bloomsbury Publishing, London, UK, 208 pp.

Castrejon-Campos, O., L. Aye, and F.K.P. Hui, 2020: Making policy mixes more robust: An integrative and interdisciplinary approach for clean energy transitions. *Energy Res. Soc. Sci.*, **64**, 101425, doi:10.1016/j.erss.2020.101425.

Ćetković, S. and J.B. Skjærseth, 2019: Creative and disruptive elements in Norway's climate policy mix: the small-state perspective. *Env. Polit.*, **28(6)**, 1039–1060, doi:10.1080/09644016.2019.1625145.

Chailleux, S., 2020: Making the subsurface political: How enhanced oil recovery techniques reshaped the energy transition. *Environ. Plan. C Polit. Sp.*, **38(4)**, 733–750, doi:10.1177/2399654419884077.

Chaker, M., E. Berezowska-Azzag, and D. Perrotti, 2021: Exploring the performances of urban local symbiosis strategy in Algiers, between a potential of energy use optimization and CO_2 emissions mitigation. *J. Clean. Prod.*, **292**, 125850, doi:10.1016/j.jclepro.2021.125850.

Chamorel, P., 2019: Macron Versus the Yellow Vests. *J. Democr.*, **30(4)**, 48–62, doi:10.1353/jod.2019.0068.

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Chan, G., A.P. Goldstein, A. Bin-Nun, L. Diaz Anadon, and V. Narayanamurti, 2017: Six principles for energy innovation. *Nature*, **552(7683)**, 25–27, doi:10.1038/d41586-017-07761-0.

Chan, N.W. and J.W. Morrow, 2019: Unintended consequences of cap-and-trade? Evidence from the Regional Greenhouse Gas Initiative. *Energy Econ.*, **80**(May 2019), 411–422, doi:10.1016/j.eneco.2019.01.007.

Chan, S. et al., 2015: Reinvigorating International Climate Policy: A Comprehensive Framework for Effective Nonstate Action. *Glob. Policy*, **6(4)**, 466–473, doi:10.1111/1758-5899.12294.

Chandrashekeran, S., B. Morgan, K. Coetzee, and P. Christoff, 2017: Rethinking the green state beyond the Global North: a South African climate change case study. *Wiley Interdiscip. Rev. Clim. Change*, **8(6)**, e473, doi:10.1002/wcc.473.

Charlery, L. and S.L.M. Trærup, 2019: The nexus between Nationally Determined Contributions and technology needs assessments: a global analysis. *Clim. Policy*, **19(2)**, 189–205, doi:10.1080/14693062.2018.1479957.

Chaton, C., A. Creti, and M.-E. Sanin, 2018: Assessing the implementation of the Market Stability Reserve. *Energy Policy*, **118**, 642–654, doi:10.1016/j.enpol.2018.03.027.

Chelminski, K., 2018: Fossil Fuel Subsidy Reform in Indonesia. In: *The Politics of Fossil Fuel Subsidies and their Reform* [Skovgaard, J. and H. Van Asselt, (eds.)]. Cambridge University Press, Cambridge, UK, pp. 193–211.

Chen, X., H. Huang, M. Khanna, and H. Önal, 2014: Alternative transportation fuel standards: Welfare effects and climate benefits. *J. Environ. Econ. Manage.*, **67(3)**, 241–257, doi:10.1016/j.jeem.2013.09.006.

Cherry, E., 2006: Veganism as a Cultural Movement: a Relational Approach. *Soc. Mov. Stud.*, **5(2)**, 155–170, doi:10.1080/14742830600807543.

Cherry, T.L., S. Kallbekken, and S. Kroll, 2012: The acceptability of efficiency-enhancing environmental taxes, subsidies and regulation: An experimental investigation. *Environ. Sci. Policy*, **16**, 90–96, doi:10.1016/j.envsci.2011.11.007.

Chèze, B., J. Chevallier, N. Berghmans, and E. Alberola, 2020: On the CO_2 Emissions Determinants During the EU ETS Phases I and II: a Plant-level Analysis Merging the EUTL and Platts Power Data. *Energy J.*, **41(4)**, doi:10.5547/01956574.41.4.bche.

Choi, C., P. Berry, and A. Smith, 2021: The climate benefits, co-benefits, and trade-offs of green infrastructure: a systematic literature review. *J. Environ. Manage.*, **291**(March), 112583, doi:10.1016/j.jenvman.2021.112583.

Claeys, P. and D. Delgado Pugley, 2017: Peasant and indigenous transnational social movements engaging with climate justice. *Can. J. Dev. Stud./Rev. Can. d'études du développement*, **38(3)**, 325–340, doi:10.1080/02255189.2016.1235018.

Climate Action Tracker, 2020: *Warming Projections Global Update, September 2020. Pandemic recovery: Positive intentions vs policy rollbacks, with just a hint of green*. NewClimate Institute, Cologne and Climate Analytics, Berlin, Germany, 26 pp. https://climateactiontracker.org/documents/790/CAT_2020-09-23_Briefing_GlobalUpdate_Sept2020.pdf (Accessed March 3, 2021).

Cludius, J., S. de Bruyn, K. Schumacher, and R. Vergeer, 2020: Ex-post investigation of cost pass-through in the EU ETS - an analysis for six industry sectors. *Energy Econ.*, **91**, 104883, doi:10.1016/j.eneco.2020.104883.

Clulow, Z., 2019: Democracy, electoral systems and emissions: explaining when and why democratization promotes mitigation. *Clim. Policy*, **19(2)**, 244–257, doi:10.1080/14693062.2018.1497938.

Coady, D., V. Flamini, and L. Sears, 2015: *The unequal benefits of fuel subsidies revisited: Evidence for developing countries*. Fiscal Affairs Department, IMF, 25 pp. https://www.imf.org/external/pubs/ft/wp/2015/wp15250.pdf (Accessed March 30, 2021).

Cobbinah, P.B., M.O. Asibey, M. Opoku-Gyamfi, and C. Peprah, 2019: Urban planning and climate change in Ghana. *J. Urban Manag.*, **8(2)**, 261–271, doi:10.1016/j.jum.2019.02.002.

Cock, J., 2019: Resistance to coal inequalities and the possibilities of a just transition in South Africa. *Dev. South. Afr.*, **36(6)**, 860–873, doi:10.1080/0376835X.2019.1660859.

Cohen, B. et al., 2019: Multi-criteria decision analysis in policymaking for climate mitigation and development. *Clim. Dev.*, **11(3)**, 212–222, doi:10.1080/17565529.2018.1445612.

Cointe, B., 2019: Mutualising sunshine: economic and territorial entanglements in a local photovoltaic project. *Local Environ.*, **24(11)**, 980–996, doi:10.1080/13549839.2018.1436044.

Cole, M.A., 2007: Corruption, income and the environment: An empirical analysis. *Ecol. Econ.*, **62(3–4)**, 637–647, doi:10.1016/j.ecolecon.2006.08.003.

Colgan, J.D., J.F. Green, and T.N. Hale, 2021: Asset Revaluation and the Existential Politics of Climate Change. *Int. Organ.*, **75(2)**, 586–610, doi:10.1017/S0020818320000296.

Colls, A., N. Ash, and N. Ikkala, 2009: *Ecosystem-based Adaptation: A natural response to climate change*. IUCN, Gland, Switzerland, 16 pp. https://portals.iucn.org/library/sites/library/files/documents/2009-049.pdf (Accessed March 3, 2021).

Colombo, E., 2021: From Bushfires to Misfires: Climate-related Financial Risk after McVeigh v. Retail Employees Superannuation Trust. *Transnatl. Environ. Law*, **11(1)**, 173–199, doi:10.1017/S204710252100025X.

Compston, H. and I. Bailey, 2016: Climate policy strength compared: China, the US, the EU, India, Russia, and Japan. *Clim. Policy*, **16(2)**, 145–164, doi:10.1080/14693062.2014.991908.

Conger, T. and S.E. Chang, 2019: Developing indicators to identify coastal green infrastructure potential: The case of the Salish Sea region. *Ocean Coast. Manag.*, **175**(April), 53–69, doi:10.1016/j.ocecoaman.2019.03.011.

Cook, M.J. and E.K. Chu, 2018: Between policies, programs, and projects: How local actors steer domestic urban climate adaptation finance in India. In: *Climate Change in Cities. The Urban Book Series* [Hughes, S., E.K. Chu, and S.G. Mason, (eds.)]. Springer, Cham, Switzerland, pp. 255–277.

Cooley, S.R. et al., 2019: Overlooked ocean strategies to address climate change. *Glob. Environ. Change*, **59** (November), 101968, doi:10.1016/j.gloenvcha.2019.101968.

Cornelis, E., 2019: History and prospect of voluntary agreements on industrial energy efficiency in Europe. *Energy Policy*, **132**, 567–582, doi:10.1016/j.enpol.2019.06.003.

Corner, A. and J. Clarke, 2017: *Talking Climate: From Research to Practice in Public Engagement*. Springer International Publishing, Cham, Switzerland, pp. 146.

Corry, O., 2012: Securitisation and 'Riskification': Second-order Security and the Politics of Climate Change. *Millenn. J. Int. Stud.*, **40(2)**, 235–258, doi:10.1177/0305829811419444.

Cory, J., M. Lerner, and I. Osgood, 2021: Supply Chain Linkages and the Extended Carbon Coalition. *Am. J. Pol. Sci.*, **65(1)**, 69–87, doi:10.1111/ajps.12525.

Coryat, D., 2015: Extractive Politics, Media Power, and New Waves of Resistance Against Oil Drilling in the Ecuadorian Amazon: The Case of Yasunidos. *Int. J. Commun.*, **9**, 3741–3760.

Cosbey, A., S. Droege, C. Fischer, and C. Munnings, 2019: Developing Guidance for Implementing Border Carbon Adjustments: Lessons, Cautions, and Research Needs from the Literature. *Rev. Environ. Econ. Policy*, **13(1)**, 3–22, doi:10.1093/reep/rey020.

Costantini, V., F. Crespi, and A. Palma, 2017: Characterizing the policy mix and its impact on eco-innovation: a patent analysis of energy-efficient technologies. *Res. Policy*, **46(4)**, 799–819, doi:10.1016/j.respol.2017.02.004.

Cox, R., 2016: a climate change litigation precedent: Urgenda Foundation v The State of the Netherlands. *J. Energy Nat. Resour. Law*, **34(2)**, doi:10.1080/02646811.2016.1147887.

Coxhead, I. and C. Grainger, 2018: Fossil Fuel Subsidy Reform in the Developing World: Who Wins, Who Loses, and Why? *Asian Dev. Rev.*, **35(2)**, 180–203, doi:10.1162/adev_a_00119.

Creasy, A., M. Lane, A. Owen, C. Howarth, and D. Van der Horst, 2021: Representing 'Place': City Climate Commissions and the Institutionalisation of Experimental Governance in Edinburgh. *Polit. Gov.*, **9(2)**, 64–75, doi:10.17645/pag.v9i2.3794.

Creutzig, F., 2016: Evolving Narratives of Low-Carbon Futures in Transportation. *Transp. Rev.*, **36(3)**, 341–360, doi:10.1080/01441647.2015.1079277.

Creutzig, F., G. Baiocchi, R. Bierkandt, P.-P. Pichler, and K.C. Seto, 2015: Global typology of urban energy use and potentials for an urbanisation mitigation wedge. *Proc. Natl. Acad. Sci.*, **112(20)**, 6283–6288, doi:10.1073/pnas.1315545112.

Creutzig, F. et al., 2018: Towards demand-side solutions for mitigating climate change. *Nat. Clim. Change*, **8(4)**, 268–271, doi:10.1038/s41558-018-0121-1.

Criqui, P., M. Jaccard, and T. Sterner, 2019: Carbon Taxation: a Tale of Three Countries. *Sustainability*, **11(22)**, 6280, doi:10.3390/su11226280.

Cronin, J.M., M.B. McCarthy, and A.M. Collins, 2014: Covert distinction: how hipsters practice food-based resistance strategies in the production of identity. *Consum. Mark. Cult.*, **17(1)**, 2–28, doi:10.1080/10253866.2012.678785.

Crowley, K., 2017: Up and down with climate politics 2013-2016: the repeal of carbon pricing in Australia. *Wiley Interdiscip. Rev. Clim. Change*, **8(3)**, e458, doi:10.1002/wcc.458.

Culwick, C. et al., 2019: CityLab reflections and evolutions: nurturing knowledge and learning for urban sustainability through co-production experimentation. *Curr. Opin. Environ. Sustain.*, **39**, 9–16, doi:10.1016/j.cosust.2019.05.008.

Dagnachew, A.G., P.L. Lucas, A.F. Hof, and D.P. van Vuuren, 2018: Trade-offs and synergies between universal electricity access and climate change mitigation in Sub-Saharan Africa. *Energy Policy*, **114**, 355–366, doi:10.1016/j.enpol.2017.12.023.

Dal Maso, M., K.H. Olsen, Y. Dong, M.B. Pedersen, and M.Z. Hauschild, 2020: Sustainable development impacts of nationally determined contributions: assessing the case of mini-grids in Kenya. *Clim. Policy*, **20(7)**, 815–831, doi:10.1080/14693062.2019.1644987.

Dale, A. et al., 2020: Meeting the climate change challenge: local government climate action in British Columbia, Canada. *Clim. Policy*, **20(7)**, 866–880, doi:10.1080/14693062.2019.1651244.

Damigos, D., A. Kontogianni, C. Tourkolias, and M. Skourtos, 2020: Behind the scenes: Why are energy efficient home appliances such a hard sell? *Resour. Conserv. Recycl.*, **158**, 104761, doi:10.1016/j.resconrec.2020.104761.

Damsø, T., T. Kjær, and T.B. Christensen, 2016: Local climate action plans in climate change mitigation – examining the case of Denmark. *Energy Policy*, **89**, 74–83, doi:10.1016/j.enpol.2015.11.013.

Dang, H.H., A. Michaelowa, and D.D. Tuan, 2003: Synergy of adaptation and mitigation strategies in the context of sustainable development: the case of Vietnam. *Clim. Policy*, **3**, S81–S96, doi:10.1016/j.clipol.2003.10.006.

David, D. and A. Venkatachalam, 2019: a Comparative Study on the Role of Public–Private Partnerships and Green Investment Banks in Boosting Low-Carbon Investments. In: *Handbook of Green Finance: Energy Security and Sustainable Development* [Sachs, J.D., W.T. Woo, N. Yoshino, and F. Taghizadeh-Hesary (eds.)]. Springer Singapore, Singapore, pp. 261–287.

David, M., 2017: Moving beyond the heuristic of creative destruction: Targeting exnovation with policy mixes for energy transitions. *Energy Res. Soc. Sci.*, **33**, 138–146, doi:10.1016/j.erss.2017.09.023.

Davidovic, D. and N. Harring, 2020: Exploring the cross-national variation in public support for climate policies in Europe: The role of quality of government and trust. *Energy Res. Soc. Sci.*, **70**, 101785, doi:10.1016/j.erss.2020.101785.

Davis, L.W. and G.E. Metcalf, 2016: Does better information lead to better choices? Evidence from energy-efficiency labels. *J. Assoc. Environ. Resour. Econ.*, **3(3)**, 589–625, doi:10.1086/686252.

Davis, L.W. and C.R. Knittel, 2019: Are Fuel Economy Standards Regressive? *J. Assoc. Environ. Resour. Econ.*, **6(S1)**, 7–36, doi:10.1086/701187.

Davis, S.J. et al., 2018: Net-zero emissions energy systems. *Science*, **360(6396)**, eaas9793, doi:10.1126/science.aas9793.

Dawson, N.L. and K. Segerson, 2008: Voluntary Agreements with Industries: Participation Incentives with Industry-Wide Targets. *Land Econ.*, **84(1)**, 97–114, doi:10.3368/le.84.1.97.

de Coninck, H., A. Revi, M. Babiker, P. Bertoldi, M. Buckeridge, A. Cartwright, W. Dong, J. Ford, S. Fuss, J.-C. Hourcade, D. Ley, R. Mechler, P. Newman, A. Revokatova, S. Schultz, L. Steg, and T. Sugiyama, 2018: Strengthening and Implementing the Global Response. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 313–444.

de Graaf, K.J. and J.H. Jans, 2015: The Urgenda Decision: Netherlands Liable for Role in Causing Dangerous Global Climate Change. *J. Environ. Law*, **27(3)**, 517–527, doi:10.1093/jel/eqv030.

De la Sota, C., V.J. Ruffato-Ferreira, L. Ruiz-García, and S. Alvarez, 2019: Urban green infrastructure as a strategy of climate change mitigation. a case study in northern Spain. *Urban For. Urban Green.*, **40**, 145–151, doi:10.1016/j.ufug.2018.09.004.

de Moor, J., M. De Vydt, K. Uba, and M. Wahlström, 2021: New kids on the block: taking stock of the recent cycle of climate activism. *Soc. Mov. Stud.*, **20(5)**, 619–625, doi:10.1080/14742837.2020.1836617.

De Oliveira Silva, R., L.G. Barioni, G. Queiroz Pellegrino, and D. Moran, 2018: The role of agricultural intensification in Brazil's Nationally Determined Contribution on emissions mitigation. *Agric. Syst.*, **161**(January), 102–112, doi:10.1016/j.agsy.2018.01.003.

DEA, 2015: *The National Climate Change Response Monitoring and Evaluation System Framework*. Department of Environmental Affairs (DEA) South Africa, and Climate Action Now, Pretoria, South Africa, 97 pp. https://cer.org.za/wp-content/uploads/2019/07/nationalclimatechangeresponse_MESF.pdf (Accessed October 25, 2021).

DEA, 2019: *South Africa's 3rd Biennial Update Report to the United Nations Framework Convention on Climate Change*. Department of Environmental Affairs (DEA), Pretoria, South Africa, 219 pp. https://unfccc.int/sites/default/files/resource/Final 3rd BUR of South Africa 100.pdf.

Dean, B. et al., 2020: *Chilling prospects: Tracking Sustainable Cooling for All 2020*. Sustainable Energy for All (SEforALL), Vienna, Austria, 59 pp. https://www.seforall.org/system/files/2020-07/CP-2020-SEforALL.pdf.

Dejuán, Ó., F. Portella-Carbó, and M. Ortiz, 2020: Economic and environmental impacts of decarbonisation through a hybrid MRIO multiplier-accelerator model. *Econ. Syst. Res.*, **34 (1)**, 1–21, doi:10.1080/09535314.2020.1848808.

del Río, P., 2014: On evaluating success in complex policy mixes: the casex of renewable energy support schemes. *Policy Sci.*, **47(3)**, 267–287, doi:10.1007/s11077-013-9189-7.

del Río, P. and P. Linares, 2014: Back to the future? Rethinking auctions for renewable electricity support. *Renew. Sustain. Energy Rev.*, **35**, doi:10.1016/j.rser.2014.03.039.

del Río, P. and E. Cerdá, 2017: The missing link: The influence of instruments and design features on the interactions between climate and renewable electricity policies. *Energy Res. Soc. Sci.*, **33**, 49–58, doi:10.1016/j.erss.2017.09.010.

Delpiazzo, E., R. Parrado, and G. Standardi, 2015: *Phase-out of fossil fuel subsidies: implications for emissions, GDP and public budget.* Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), Lecce, Italy, 32 pp. https://www.cmcc.it/wp-content/uploads/2016/06/rp0275-ecip-12-2015.pdf.

Deng, H.-M., Q.-M. Liang, L.-J. Liu, and L.D. Anadon, 2017: Co-benefits of greenhouse gas mitigation: a review and classification by type, mitigation sector, and geography. *Environ. Res. Lett.*, **12(12)**, 123001, doi:10.1088/1748-9326/aa98d2.

Deng, Z., D. Li, T. Pang, and M. Duan, 2018: Effectiveness of pilot carbon emissions trading systems in China. *Clim. Policy*, **18(8)**, 992–1011, doi:10.1080/14693062.2018.1438245.

Dennis, A., 2016: Household welfare implications of fossil fuel subsidy reforms in developing countries. *Energy Policy*, **96**, 597–606, doi:10.1016/j.enpol.2016.06.039.

Denton, F., T.J.Wilbanks, A.C. Abeysinghe, I. Burton, Q. Gao, M.C. Lemos, T. Masui, K.L. O'Brien, and K.Warner, 2015: Climate-resilient Pathways: Adaptation, mitigation, and sustainable development. In: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1101–1131.

Devaney, L., D. Torney, P. Brereton, and M. Coleman, 2020: Ireland's Citizens' Assembly on Climate Change: Lessons for Deliberative Public Engagement and Communication. *Environ. Commun.*, **14(2)**, 141–146, doi:10.1080/17524032.2019.1708429.

DFFE Republic of South Africa, 2021: *South Africa's 4th Biennial Update Report to the United Nations Framework Convention on Climate Change*. UNFCCC, 255 pp. https://unfccc.int/sites/default/files/resource/South%20Africa%20BUR4%20to%20the%20UNFCCC.pdf.

Di Gregorio, M. et al., 2016: *Integrating mitigation and adaptation in climate and land-use policies in Brazil: a policy document analysis*. University of Leeds and CIFOR, Leeds, UK and Bogor, Indonesia, 55 pp. http://eprints.whiterose.ac.uk/96279/ (Accessed July 12, 2019).

Di Gregorio, M. et al., 2017: Climate policy integration in the land-use sector: Mitigation, adaptation and sustainable development linkages. *Environ. Sci. Policy*, **67**, 35–43, doi:10.1016/j.envsci.2016.11.004.

Di Gregorio, M. et al., 2019: Multi-level governance and power in climate change policy networks. *Glob. Environ. Change*, **54**, 64–77, doi:10.1016/j.gloenvcha.2018.10.003.

Di Gregorio, M., K. Massarella, H. Schroeder, M. Brockhaus, and T.T. Pham, 2020: Building authority and legitimacy in transnational climate change governance: Evidence from the Governors' Climate and Forests Task Force. *Glob. Environ. Change*, **64**, (September), 102126, doi:10.1016/j.gloenvcha.2020.102126.

Diaz, G., F.D. Munoz, and R. Moreno, 2020: Equilibrium Analysis of a Tax on Carbon Emissions with Pass-through Restrictions and Side-payment Rules. *Energy J.*, **41(2)**, doi:10.5547/01956574.41.2.gdia.

Dickson, B. and V. Kapos, 2012: Biodiversity monitoring for REDD+. *Curr. Opin. Environ. Sustain.*, **4(6)**, 717–725, doi:10.1016/j.cosust.2012.09.017.

Diehl, T., B. Huber, H. Gil de Zúñiga, and J. Liu, 2021: Social Media and Beliefs about Climate Change: a Cross-National Analysis of News Use, Political Ideology, and Trust in Science. *Int. J. Public Opin. Res.*, **33(2)**, 197–213, doi:10.1093/ijpor/edz040.

Dietz, T., K.A. Frank, C.T. Whitley, J. Kelly, and R. Kelly, 2015: Political influences on greenhouse gas emissions from US states. *Proc. Natl. Acad. Sci.*, **112(27)**, 8254–8259, doi:10.1073/pnas.1417806112.

Dillon, L. et al., 2018: The Environmental Protection Agency in the Early Trump Administration: Prelude to Regulatory Capture. *Am. J. Public Health*, **108(S2)**, S89–S94, doi:10.2105/AJPH.2018.304360.

Dobrotkova, Z., K. Surana, and P. Audinet, 2018: The price of solar energy: Comparing competitive auctions for utility-scale solar PV in developing countries. *Energy Policy*, **118**, 133–148, doi:10.1016/j.enpol.2018.03.036.

Doll, C.N.H. and J.A.P. de Oliveira (eds.), 2017: *Urbanisation and climate co-benefits: Implementation of win-win interventions in cities*. Routledge, London, UK, 348 pp.

Domorenok, E., P. Graziano, and L. Polverari, 2021: Introduction: policy integration and institutional capacity: theoretical, conceptual and empirical challenges. *Policy Soc.*, **40(1)**, 1–18, doi:10.1080/14494035.2021.1902058.

Dorband, I.I., M. Jakob, M. Kalkuhl, and J.C. Steckel, 2019: Poverty and distributional effects of carbon pricing in low- and middle-income countries – a global comparative analysis. *World Dev.*, **115**, doi:10.1016/j.worlddev.2018.11.015.

Dorninger, C. et al., 2020: Leverage points for sustainability transformation: a review on interventions in food and energy systems. *Ecol. Econ.*, **171**, 106570, doi:10.1016/j.ecolecon.2019.106570.

Dorsch, M.J. and C. Flachsland, 2017: a Polycentric Approach to Global Climate Governance. *Glob. Environ. Polit.*, **17(2)**, 45–64, doi:10.1162/GLEP_a_00400.

Dorsch, M.J., C. Flachsland, and U. Kornek, 2020: Building and enhancing climate policy ambition with transfers: allowance allocation and revenue spending in the EU ETS. *Env. Polit.*, **29(5)**, 781–803, doi:10.1080/09644016.2019.1659576.

Doswald, N. and M. Osti, 2011: *Ecosystem-based approaches to adaptation and mitigation – good practice examples and lessons learned in Europe*. Bundesamt für Naturschutz (BfN), Bonn, Germany, 49 pp. https://bfn.bsz-bw.de/frontdoor/deliver/index/docId/491/file/Skript306.pdf (Accessed October 17, 2021).

Doswald, N. et al., 2014: Effectiveness of ecosystem-based approaches for adaptation: review of the evidence-base. *Clim. Dev.*, **6(2)**, 185–201, doi:10.1080/17565529.2013.867247.

Dotson, D.M., S.K. Jacobson, L.L. Kaid, and J.S. Carlton, 2012: Media Coverage of Climate Change in Chile: a Content Analysis of Conservative and Liberal Newspapers. *Environ. Commun.*, **6(1)**, 64–81, doi:10.1080/17524032.2011.642078.

Downie, C., 2018: Ad hoc coalitions in the U.S. energy sector: Case studies in the gas, oil, and coal industries. *Bus. Polit.*, **20(4)**, 643–668, doi:10.1017/bap.2018.18.

Doyle, J., 2016: *Mediating Climate Change*. Routledge, New York, USA 195 pp.

Drews, S. and J.C.J.M. van den Bergh, 2016: What explains public support for climate policies? a review of empirical and experimental studies. *Clim. Policy*, **16(7)**, 855–876, doi:10.1080/14693062.2015.1058240.

Duan, M., Z. Tian, Y. Zhao, and M. Li, 2017: Interactions and coordination between carbon emissions trading and other direct carbon mitigation policies in China. *Energy Res. Soc. Sci.*, **33**, 59–69, doi:10.1016/j.erss.2017.09.008.

Duarte, C.M., 2017: Reviews and syntheses: Hidden forests, the role of vegetated coastal habitats in the ocean carbon budget. *Biogeosciences*, **14(2)**, 301–310, doi:10.5194/bg-14-301-2017.

Duarte, C.M., I.J. Losada, I.E. Hendriks, I. Mazarrasa, and N. Marbà, 2013: The role of coastal plant communities for climate change mitigation and adaptation. *Nat. Clim. Change*, **3(11)**, 961–968, doi:10.1038/nclimate1970.

Dubash, N.K., 2021: Varieties of climate governance: the emergence and functioning of climate institutions. *Env. Polit.*, **30(sup1)**, 1–25, doi:10.1080/09644016.2021.1979775.

Dubash, N.K. and N.B. Joseph, 2016: Evolution of Institutions for Climate Policy in India. *Econ. Polit. Wkly.*, **51(3)**, 44–54.

Dubash, N.K., M. Hagemann, N. Höhne, and P. Upadhyaya, 2013: Developments in national climate change mitigation legislation and strategy. *Clim. Policy*, **13(6)**, 649–664, doi:10.1080/14693062.2013.845409.

Dubash, N.K., R. Khosla, U. Kelkar, and S. Lele, 2018: India and Climate Change: Evolving Ideas and Increasing Policy Engagement. *Annu. Rev. Environ. Resour.*, **43(1)**, 395–424, doi:10.1146/annurev-environ-102017-025809.

Dubash, N.K. et al., 2021: National climate institutions complement targets and policies: Institutions can affect coordination, consensus, and strategy. *Science* (in press).

Duguma, L.A., P.A. Minang, and M. Van Noordwijk, 2014a: Climate change mitigation and adaptation in the land use sector: From complementarity to synergy. *Environ. Manage.*, **5**, 420–432, doi:10.1007/s00267-014-0331-x.

Duguma, L.A., S.W. Wambugu, P.A. Minang, and M. van Noordwijk, 2014b: a systematic analysis of enabling conditions for synergy between climate change mitigation and adaptation measures in developing countries. *Environ. Sci. Policy*, **42**, 138–148, doi:10.1016/j.envsci.2014.06.003.

Duit, A. and V. Galaz, 2008: Governance and Complexity – Emerging Issues for Governance Theory. *Governance*, **21(3)**, 311–335, doi:10.1111/j.1468-0491.2008.00402.x.

Dundas, S.J. et al., 2020: Integrating oceans into climate policy: Any green new deal needs a splash of blue. *Conserv. Lett.*, **13(5)**, doi:10.1111/conl.12716.

Dunlap, R.E. and P.J. Jacques, 2013: Climate Change Denial Books and Conservative Think Tanks. *Am. Behav. Sci.*, **57(6)**, 699–731, doi:10.1177/0002764213477096.

Dunlap, R.E. and A.M. McCright, 2015: Challenging Climate Change. In: *Climate Change and Society* [Dunlap, R. and R. Brulle, (eds.)]. Oxford University Press, Oxford, UK, pp. 300–332.

Dupont, C., 2015: *Climate Policy Integration into EU Energy Policy: Progress and Prospects*. 1st ed. Routledge, London, UK, 208 pp.

Dupont, C., 2019: The EU's collective securitisation of climate change. *West Eur. Polit.*, **42(2)**, 369–390, doi:10.1080/01402382.2018.1510199.

Dupont, C. and S. Oberthür, 2012: Insufficient climate policy integration in EU energy policy: the importance of the long-term perspective. *J. Contemp. Eur. Res.*, **8(2)**, 228–247, doi:10.30950/jcer.v8i2.474.

Dupont, C., S. Oberthür, and I. von Homeyer, 2020: The Covid-19 crisis: a critical juncture for EU climate policy development? *J. Eur. Integr.*, **42(8)**, 1095–1110, doi:10.1080/07036337.2020.1853117.

Dzonzi-Undi, J. and S. Li, 2016: Policy influence on clean coal uptake in China, India, Australia, and USA. *Environ. Prog. Sustain. Energy*, **35(3)**, 906–913, doi:10.1002/ep.12288.

Eberhard, A. and T. Kåberger, 2016: Renewable energy auctions in South Africa outshine feed-in tariffs. *Energy Sci. Eng.*, **4(3)**, 190–193, doi:10.1002/ese3.118.

EC, 2019a: Communication from the commission to the European Parliament, The European Council, The Council, The European Economic and Social Committee and The Committee of the Regions: The European Green Deal. European Commission (EC), Brussels, Belgium, 11.12.2019, COM(2019) 640 final., 24 pp. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019DC0640.

EC, 2019b: Indications of illegal HFC trade based on an analysis of data reported under the F-gas Regulation, Eurostat dataset and Chinese export data. European Commission (EC), Brussels, Belgium, 8 pp. https://ec.europa.eu/clima/system/files/2019-10/report_illegal_trade_hcf_en.pdf.

EC, 2020a: Communication from the commission to the European Parliament, The Council, The Economic and Social Committee and The Committee of the Regions: 'Stepping up Europe's 2030 climate ambition – Investing in a climate-neutral future for the benefit of our people. European Commission (EC), Brussels, Belgium, 26 pp. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0562.

EC, 2020b: Strategic EU Ecolabel Work Plan 2020–2024. European Commission (EC), Brussels, Belgium, 16 pp. https://ec.europa.eu/environment/ecolabel/documents/EU%20Ecolabel%20Work%20plan%202020-2024%20Dec%202020.pdf.

Eccles, R.G. and M.P. Krzus, 2018: Why companies should report financial risks from climate change. *MIT Sloan Management Review*, MIT, October 27.

ECIU, 2019: Countdown to Zero: Plotting progress towards delivering net zero emissions by 2050., London, UK, 16 pp. https://ca1eci.edcdn.com/reports/ECIU_Countdown_to_Net_Zero.pdf (Accessed October 21, 2021).

ECIU, 2021: Net Zero Tracker. https://eciu.net/netzerotracker (Accessed October 1, 2021).

Eckersley, R., 2013: Poles Apart?: The Social Construction of Responsibility for Climate Change in Australia and Norway. *Aust. J. Polit. Hist.*, **59(3)**, 382–396, doi:10.1111/ajph.12022.

Eckersley, R., 2016: National identities, international roles, and the legitimation of climate leadership: Germany and Norway compared. *Env. Polit.*, **25(1)**, 180–201, doi:10.1080/09644016.2015.1076278.

Edenhofer, O. et al., 2017: *Decarbonization and EU ETS Reform: Introducing a price floor to drive low-carbon investments*. MCC, Berlin, Germany, 20 pp. https://www.mcc-berlin.net/fileadmin/data/C18_MCC_Publications/Decarbonization_EU_ETS_Reform_Policy_Paper.pdf (Accessed March 3, 2021).

Edmondson, D.L., F. Kern, and K.S. Rogge, 2019: The co-evolution of policy mixes and socio-technical systems: Towards a conceptual framework of policy mix feedback in sustainability transitions. *Res. Policy*, **48(10)**, 103555, doi:10.1016/j.respol.2018.03.010.

Edmondson, D.L., K.S. Rogge, and F. Kern, 2020: Zero carbon homes in the UK? Analysing the co-evolution of policy mix and socio-technical system. *Environ. Innov. Soc. Transitions*, **35**, 135–161, doi:10.1016/j.eist.2020.02.005.

EEA, 2019: *Fluorinated greenhouse gases 2019: Data reported by companies on the production, import, export, destruction and feedstock use of fluorinated greenhouse gases in the European Union, 2007-2018*. European Environment Agency (EEA), Copenhagen, Denmark, 80 pp. https://www.eea.europa.eu/publications/fluorinated-greenhouse-gases-2019.

Egeberg, M., 1999: The Impact of Bureaucratic Structure on Policy Making. *Public Adm.*, **77(1)**, 155–170, doi:10.1111/1467-9299.00148.

Eilstrup-Sangiovanni, M. and T.N.P. Bondaroff, 2014: From Advocacy to Confrontation: Direct Enforcement by Environmental NGOs. *Int. Stud. Q.*, **58(2)**, 348–361, doi:10.1111/isqu.12132.

Eisenstat, F., 2011: American Electric Power Co. v. Connecticut: How One Less Legal Theory Available in the Effort to Curb Emissions is Actually One Step forward for the Cause. *Tulane Environ. Law J.*, **25(1)**, 221–230.

Ekwurzel, B. et al., 2017: The rise in global atmospheric CO_2, surface temperature, and sea level from emissions traced to major carbon producers. *Clim. Change*, **144(4)**, 579–590, doi:10.1007/s10584-017-1978-0.

Elkerbout, M. et al., 2020: *The European Green Deal after Corona: Implications for EU climate policy*. CEPS, Brussels, Belgium, 12 pp. https://www.ceps.eu/ceps-publications/the-european-green-deal-after-corona/ (Accessed December 13, 2020).

Elliott, T. and J. Earl, 2018: Organizing the Next Generation: Youth Engagement with Activism Inside and Outside of Organizations. *Soc. Media + Soc.*, **4(1)**, 205630511775072, doi:10.1177/2056305117750722.

Ellis, N.R. and P. Tschakert, 2019: Triple-wins as pathways to transformation? a critical review. *Geoforum*, **103**, 167–170, doi:10.1016/j.geoforum.2018.12.006.

Elsharkawy, H. and P. Rutherford, 2018: Energy-efficient retrofit of social housing in the UK: Lessons learned from a Community Energy Saving Programme (CESP) in Nottingham. *Energy Build.*, **172**, 295–306, doi:10.1016/j.enbuild.2018.04.067.

Engels, A., 2018: Understanding how China is championing climate change mitigation. *Palgrave Commun.*, **4(1)**, 101, doi:10.1057/s41599-018-0150-4.

Engels, A., O. Hüther, M. Schäfer, and H. Held, 2013: Public climate-change skepticism, energy preferences and political participation. *Glob. Environ. Change*, **23(5)**, 1018–1027, doi:10.1016/j.gloenvcha.2013.05.008.

EPA, 2017: Voluntary Energy and Climate Programs, Archive. https://19january2017snapshot.epa.gov/climatechange/voluntary-energy-and-climate-programs.html (Accessed December 11, 2019).

EPA, 2019: Global Non-CO2 Greenhouse Gas Emission Projections & Marginal Abatement Cost Analysis: Methodology Documentation. U.S. Environmental Protection Agency, Washington, DC, 287 pp. https://www.epa.gov/sites/production/files/2019-09/documents/nonco2_methodology_report.pdf.

Ergas, C., 2010: a Model of Sustainable Living: Collective Identity in an Urban Ecovillage. *Organ. Environ.*, **23(1)**, 32–54, doi:10.1177/1086026609360324.

Erickson, P., S. Kartha, M. Lazarus, and K. Tempest, 2015: Assessing carbon lock-in. *Environ. Res. Lett.*, **10(8)**, 084023, doi:10.1088/1748-9326/10/8/084023.

Eskander, S., S. Fankhauser, and J. Setzer, 2021: Global Lessons from Climate Change Legislation and Litigation. *Environ. Energy Policy Econ.*, **2**, 44–82, doi:10.1086/711306.

Eskander, S.M.S.U. and S. Fankhauser, 2020: Reduction in greenhouse gas emissions from national climate legislation. *Nat. Clim. Change*, **10(8)**, 750–756, doi:10.1038/s41558-020-0831-z.

Eskjær, M., 2013: The Regional Dimension: How Regional Media Systems Condition Global Climate-Change Communication. *J. Int. Intercult. Commun.*, **6(1)**, 61–81, doi:10.1080/17513057.2012.748933.

European Environment Agency, 2019: *Sustainability transitions: policy and practice*. European Environment Agency, Luxembourg, 184 pp. https://www.eea.europa.eu/publications/sustainability-transitions-policy-and-practice.

European Union, 2014: *Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006*. The European Parliament and the Council of the European Union, Brussels, Belgium, L150/195--230 pp. http://eur-lex.europa.eu/eli/reg/2014/517/oj.

Evans, J. and A. Karvonen, 2014: 'Give Me a Laboratory and I Will Lower Your Carbon Footprint!' - Urban Laboratories and the Governance of Low-Carbon Futures. *Int. J. Urban Reg. Res.*, **38(2)**, 413–430, doi:10.1111/1468-2427.12077.

Evensen, D., 2019: The rhetorical limitations of the #FridaysForFuture movement. *Nat. Clim. Change*, **9(6)**, 428–430, doi:10.1038/s41558-019-0481-1.

Eyre, N., S.J. Darby, P. Grünewald, E. McKenna, and R. Ford, 2018: Reaching a 1.5°C target: socio-technical challenges for a rapid transition to low-carbon electricity systems. *Philos. Trans. R. Soc. a Math. Phys. Eng. Sci.*, **376(2119)**, 20160462, doi:10.1098/rsta.2016.0462.

Fahy, D., 2018: Objectivity as Trained Judgment: How Environmental Reporters Pioneered Journalism for a 'Post-truth' Era. *Environ. Commun.*, **12(7)**, 855–861, doi:10.1080/17524032.2018.1495093.

Fairbrother, M., I. Johansson Sevä, and J. Kulin, 2019: Political trust and the relationship between climate change beliefs and support for fossil fuel taxes: Evidence from a survey of 23 European countries. *Glob. Environ. Change*, **59**, 102003, doi:10.1016/j.gloenvcha.2019.102003.

Falduto, C. and M. Rocha, 2020: *Aligning short-term climate action with long-term climate goals: Opportunities and options for enhancing alignment between NDCs and long-term strategies*. OECD, Boulogne-Billancourt, Paris, France, 50 pp. https://www.oecd.org/environment/cc/LEDS-NDC-linkages.pdf.

Falkner, R., 2008: *Business Power and Conflict in International Environmental Politics*. Palgrave Macmillan, London, UK, 242 pp.

Fankhauser, S. and T.K.J. McDermott, 2016: *The Economics of Climate-Resilient Development*. [Fankhauser, S. and T.K. McDermott, (eds.)]. Edward Elgar Publishing, Cheltenham, UK, 256 pp.

Fankhauser, S. et al., 2013: Who will win the green race? In search of environmental competitiveness and innovation. *Glob. Environ. Change*, **23(5)**, 902–913, doi:10.1016/j.gloenvcha.2013.05.007.

Fankhauser, S., C. Gennaioli, and M. Collins, 2015: The political economy of passing climate change legislation: Evidence from a survey. *Glob. Environ. Change*, **35**, 52–61, doi:10.1016/j.gloenvcha.2015.08.008.

Fankhauser, S., C. Gennaioli, and M. Collins, 2016: Do international factors influence the passage of climate change legislation? *Clim. Policy*, **16(3)**, 318–331, doi:10.1080/14693062.2014.1000814.

Fankhauser, S., A. Averchenkova, and J. Finnegan, 2018: *10 years of the UK Climate Change Act*. The Grantham Research Institute on Climate Change and the Environment and the Centre for Climate Change Economics and Policy, London, UK, 43 pp. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2018/03/10-Years-of-the-UK-Climate-Change-Act_Fankhauser-et-al.pdf.

Farrell, J., 2016a: Network structure and influence of the climate change counter-movement. *Nat. Clim. Change*, **6(4)**, 370–374, doi:10.1038/nclimate2875.

Farrell, J., 2016b: Corporate funding and ideological polarization about climate change. *Proc. Natl. Acad. Sci.*, **113(1)**, 92–97, doi:10.1073/pnas.1509433112.

Farstad, F.M., 2018: What explains variation in parties' climate change salience? *Party Polit.*, **24(6)**, 698–707, doi:10.1177/1354068817693473.

Farstad, F.M., 2019: Does size matter? Comparing the party politics of climate change in Australia and Norway. *Env. Polit.*, **28(6)**, 997–1016, doi:10.1080/09644016.2019.1625146.

Fast, S. et al., 2016: Lessons learned from Ontario wind energy disputes. *Nat. Energy*, **1(2)**, 7, doi:10.1038/nenergy.2015.28.

Fekete, H. et al., 2021: a review of successful climate change mitigation policies in major emitting economies and the potential of global replication. *Renew. Sustain. Energy Rev.*, **137**, doi:10.1016/j.rser.2020.110602.

Feldman, L., P.S. Hart, and T. Milosevic, 2017: Polarizing news? Representations of threat and efficacy in leading US newspapers' coverage of climate change. *Public Underst. Sci.*, **26(4)**, 481–497, doi:10.1177/0963662515595348.

Fenwick, J., K.J. Miller, and D. McTavish, 2012: Co-governance or meta-bureaucracy? Perspectives of local governance 'partnership' in England and Scotland. *Policy Polit.*, **40(3)**, 405–422, doi:10.1332/147084411X581907.

Ferrante, L. and P.M. Fearnside, 2019: Brazil's new president and 'ruralists' threaten Amazonia's environment, traditional peoples and the global climate. *Environ. Conserv.*, **46(4)**, 261–263, doi:10.1017/S0376892919000213.

Ferreira, P.G., 2016: 'Common But Differentiated Responsibilities' in the National Courts: Lessons from Urgenda v. The Netherlands. *Transnatl. Environ. Law*, **5(2)**, 329–351, doi:10.1017/S2047102516000248.

Finnegan, J., 2018: *Changing prices in a changing climate: electoral competitiveness and fossil fuel taxation*. London School of Economics and Political Science, London, UK, 54 pp. http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/10/working-paper-307-Finnegan.pdf (Accessed December 16, 2019).

Finnegan, J., 2019: *Institutions, climate change, and the foundations of longterm policymaking*. London School of Economics and Political Science, London, UK, 55 pp. http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/04/working-paper-321-Finnegan-1.pdf (Accessed March 30, 2021).

Fischer, C., 2008: Comparing flexibility mechanisms for fuel economy standards. *Energy Policy*, **36(8)**, 3116–3124, doi:10.1016/j.enpol.2008.03.042.

Fischer, C. and R.G. Newell, 2008: Environmental and technology policies for climate mitigation. *J. Environ. Econ. Manage.*, **55(2)**, 142–162, doi:10.1016/j.jeem.2007.11.001.

Fischer, C. and A.K. Fox, 2012: Comparing policies to combat emissions leakage: Border carbon adjustments versus rebates. *J. Environ. Econ. Manage.*, **64(2)**, 199–216, doi:10.1016/j.jeem.2012.01.005.

Fisher, D., 2004: *National governance and the global climate change regime*. Rowman & Littlefield Publishers, Washington, DC, 206 pp.

Fisher, D., 2019: *American resistance: From the Women's March to the Blue Wave*. Columbia University Press, New York City, USA, 216 pp.

Fisher, D.R., 2010: COP-15 in Copenhagen: How the Merging of Movements Left Civil Society Out in the Cold. *Glob. Environ. Polit.*, **10(2)**, 11–17, doi:10.1162/glep.2010.10.2.11.

Fisher, D.R., 2019: The broader importance of #FridaysForFuture. *Nat. Clim. Change*, **9(6)**, 430–431, doi:10.1038/s41558-019-0484-y.

Fisher, D.R. and P. Leifeld, 2019: The polycentricity of climate policy blockage. *Clim. Change*, **155(4)**, 469–487, doi:10.1007/s10584-019-02481-y.

Fisher, D.R. and S. Nasrin, 2021a: Shifting Coalitions within the Youth Climate Movement in the US. *Polit. Gov.*, **9(2)**, 112–123, doi:10.17645/pag.v9i2.3801.

Fisher, D.R. and S. Nasrin, 2021b: Climate activism and its effects. *WIREs Clim. Change*, **12(1)**, e683, doi:10.1002/wcc.683.

Fisher, D.R., K. Stanley, D. Berman, and G. Neff, 2005: How Do Organizations Matter? Mobilization and Support for Participants at Five Globalization Protests. *Soc. Probl.*, **52(1)**, 102–121, doi:10.1525/sp.2005.52.1.102.

13

Fisher, E., E. Scotford, and E. Barritt, 2017: The Legally Disruptive Nature of Climate Change. *Mod. Law Rev.*, **80(2)**, 173–201, doi:10.1111/1468-2230.12251.

Fitch-Roy, O., 2016: An offshore wind union? Diversity and convergence in European offshore wind governance. *Clim. Policy*, **16(5)**, 586–605, doi:10.1080/14693062.2015.1117958.

Fitch-Roy, O., D. Benson, and C. Mitchell, 2019a: Wipeout? Entrepreneurship, policy interaction and the EU's 2030 renewable energy target. *J. Eur. Integr.*, **41(1)**, 87–103, doi:10.1080/07036337.2018.1487961.

Fitch-Roy, O.W., D. Benson, and B. Woodman, 2019b: Policy Instrument Supply and Demand: How the Renewable Electricity Auction Took over the World. *Polit. Gov.*, **7(1)**, 81–91, doi:10.17645/pag.v7i1.1581.

Flachsland, C. and S. Levi, 2021: Germany's Federal Climate Change Act. *Env. Polit.*, **30(sup1)**, 118–140, doi:10.1080/09644016.2021.1980288.

Fleig, A., N.M. Schmidt, and J. Tosun, 2017: Legislative Dynamics of Mitigation and Adaptation Framework Policies in the EU. *Eur. Policy Anal.*, **3(1)**, 101–124, doi:10.1002/epa2.1002.

Floater, G. et al., 2016: *Co-benefits of urban climate action: a framework for cities*. London School of Economics and Political Science, London, UK, 86 pp. http://eprints.lse.ac.uk/68876/ (Accessed March 30, 2021).

Flowers, M.E. et al., 2016: Climate impacts on the cost of solar energy. *Energy Policy*, **94**, 264–273, doi:10.1016/j.enpol.2016.04.018.

Foerster, A., 2019: Climate Justice and Corporations. *King's Law J.*, **30(2)**, 305–322, doi:10.1080/09615768.2019.1645447.

Foerster, A., J. Peel, H. Osofsky, and B. McDonnell, 2017: Keeping Good Company in the Transition to a Low Carbon Economy? An Evaluation of Climate Risk Disclosure Practices in Australia. *Co. Secur. Law J.*, **35(3)**, 154–183, doi: 10.1080/09615768.2019.1645447.

Ford, J.D. et al., 2016: Including indigenous knowledge and experience in IPCC assessment reports. *Nat. Clim. Change*, **6(4)**, 349–353, doi:10.1038/nclimate2954.

Fouquet, R., 2016: Path dependence in energy systems and economic development. *Nat. Energy*, **1(8)**, 16098, doi:10.1038/nenergy.2016.98.

Fowlie, M. and M. Reguant, 2018: Challenges in the Measurement of Leakage Risk. *AEA Pap. Proc.*, **108**, 124–129, doi:10.1257/pandp.20181087.

Fowlie, M., M. Greenstone, and C. Wolfram, 2018: Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program. *Q. J. Econ.*, **133(3)**, 1597–1644, doi:10.1093/qje/qjy005.

Fox, J., J. Axsen, and M. Jaccard, 2017: Picking Winners: Modelling the Costs of Technology-specific Climate Policy in the U.S. Passenger Vehicle Sector. *Ecol. Econ.*, **137**, 133–147, doi:10.1016/j.ecolecon.2017.03.002.

Fox, J.A. and L.D. Brown, eds., 1998: *The Struggle for Accountability: The World Bank, NGOs, and Grassroots Movements*. 1st ed. MIT Press, Cambridge, Massachusetts, USA, 548 pp.

Frank, D.J., A. Hironaka, and E. Schofer, 2000: The Nation-State and the Natural Environment over the Twentieth Century. *Am. Sociol. Rev.*, **65(1)**, 96–116, doi:10.2307/2657291.

Franta, B., 2017: Litigation in the Fossil Fuel Divestment Movement. *Law Policy*, **39(4)**, 393–411, doi:10.1111/lapo.12086.

Fraser, N., 1995: From Redistribution to Recognition? Dilemmas of Justice in a 'Post-Socialist' Age. *New Left Rev.*, **0(212)**, 68.

Fredriksson, P.G. and D.L. Millimet, 2004: Electoral rules and environmental policy. *Econ. Lett.*, **84(2)**, 237–244, doi:10.1016/j.econlet.2004.02.008.

Fredriksson, P.G. and E. Neumayer, 2016: Corruption and Climate Change Policies: Do the Bad Old Days Matter? *Environ. Resour. Econ.*, **63(2)**, 451–469, doi:10.1007/s10640-014-9869-6.

Freudenburg, W.R. and V. Muselli, 2010: Global warming estimates, media expectations, and the asymmetry of scientific challenge. *Glob. Environ. Change*, **20(3)**, 483–491, doi:10.1016/j.gloenvcha.2010.04.003.

Friedrichs, J. and O.R. Inderwildi, 2013: The carbon curse: Are fuel rich countries doomed to high CO_2 intensities? *Energy Policy*, **62**, 1356–1365, doi:10.1016/j.enpol.2013.07.076.

Friel, S. et al., 2011: Climate Change, Noncommunicable Diseases, and Development: The Relationships and Common Policy Opportunities. *Annu. Rev. Public Health*, **32(1)**, 133–147, doi:10.1146/annurev-publhealth-071910-140612.

Friman, M. and M. Hjerpe, 2015: Agreement, significance, and understandings of historical responsibility in climate change negotiations. *Clim. Policy*, **15(3)**, 302–320, doi:10.1080/14693062.2014.916598.

Froese, R. and J. Schilling, 2019: The Nexus of Climate Change, Land Use, and Conflicts. *Curr. Clim. Change Reports*, **5(1)**, 24–35, doi:10.1007/s40641-019-00122-1.

Frumhoff, P.C., R. Heede, and N. Oreskes, 2015: The climate responsibilities of industrial carbon producers. *Clim. Change*, **132(2)**, 157–171, doi:10.1007/s10584-015-1472-5.

FSR Climate, 2019: *a literature-based assessment of the EU ETS*. Florence School of Regulation, European University Institute, Florence, Italy, 224 pp.

Fudge, S., M. Peters, and B. Woodman, 2016: Local authorities as niche actors: the case of energy governance in the UK. *Environ. Innov. Soc. Transitions*, **18**, 1–17, doi:10.1016/j.eist.2015.06.004.

Fuhr, H., T. Hickmann, and K. Kern, 2018: The role of cities in multi-level climate governance: local climate policies and the 1.5°C target. *Curr. Opin. Environ. Sustain.*, **30**, 1–6, doi:10.1016/j.cosust.2017.10.006.

Fuller, S. and D. McCauley, 2016: Framing energy justice: perspectives from activism and advocacy. *Energy Res. Soc. Sci.*, **11**, 1–8, doi:10.1016/j.erss.2015.08.004.

Fuso Nerini, F. et al., 2019: Connecting climate action with other Sustainable Development Goals. *Nat. Sustain.*, **2(8)**, 674–680, doi:10.1038/s41893-019-0334-y.

Ganguly, G., J. Setzer, and V. Heyvaert, 2018: If at First You Don't Succeed: Suing Corporations for Climate Change. *Oxf. J. Leg. Stud.*, **38(4)**, 841–868, doi:10.1093/ojls/gqy029.

Gao, J., C. Guan, and B. Zhang, 2020: China's CH4 emissions from coal mining: a review of current bottom-up inventories. *Sci. Total Environ.*, **725**, 138295, doi:10.1016/j.scitotenv.2020.138295.

Garcetti, E., 2019: *L.A.'s Green New Deal: Sustainable City pLAn 2019*. City of Los Angeles, USA, 152 pp. https://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf.

Garcia-Lamarca, M. et al., 2021: Urban green boosterism and city affordability: For whom is the 'branded' green city? *Urban Stud.*, **58(1)**, 90–112, doi:10.1177/0042098019885330.

Garcia Hernandez, A.L. and S. Bolwig, 2020: Understanding climate policy integration in the global South through the multiple streams framework. *Clim. Dev.*, **13(1)**, 68–80, doi:10.1080/17565529.2020.1723471.

Gass, P. and D. Echeverria, 2017: *Fossil fuel subsidy reform and the just transition: Integrating approaches for complementary outcomes*. International Institute for Sustainable Development, Winnipeg, USA, 47 pp. https://www.iisd.org/system/files/publications/fossil-fuel-subsidy-reform-just-transition.pdf (Accessed March 30, 2021).

Gattuso, J. et al., 2018: Ocean Solutions to Address Climate Change and Its Effects on Marine Ecosystems. *Front. Mar. Sci.*, **5**(October), art337, doi:10.3389/fmars.2018.00337.

Gaulin, N. and P. Le Billon, 2020: Climate change and fossil fuel production cuts: assessing global supply-side constraints and policy implications. *Clim. Policy*, **20(8)**, 888–901, doi:10.1080/14693062.2020.1725409.

Gavard, C., S. Voigt, and A. Genty, 2018: *Using Emissions Trading Schemes to Reduce Heterogeneous Distortionary Taxes: the Case of Recycling Carbon Auction Revenues to Support Renewable Energy*. Centre for European Economic Research (ZEW), Mannheim, Germany, 35 pp. http://ftp.zew.de/pub/zew-docs/dp/dp18058.pdf.

Geall, S., W. Shen, and Gongbuzeren, 2018: Solar energy for poverty alleviation in China: State ambitions, bureaucratic interests, and local realities. *Energy Res. Soc. Sci.*, **41**, 238–248, doi:10.1016/j.erss.2018.04.035.

13

Gebara, M.F., L. Fatorelli, P. May, and S. Zhang, 2014: REDD+ policy networks in Brazil: constraints and opportunities for successful policy making. *Ecol. Soc.*, **19(3)**, 53, doi:10.5751/ES-06744-190353.

Geden, O., 2016: The Paris Agreement and the inherent inconsistency of climate policymaking. *Wiley Interdiscip. Rev. Clim. Change*, **7(6)**, 790–797, doi:10.1002/wcc.427.

Geden, O., G.P. Peters, and V. Scott, 2019: Targeting carbon dioxide removal in the European Union. *Clim. Policy*, **19(4)**, 487–494, doi:10.1080/14693062.2018.1536600.

Geels, F.W., 2014: Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. *Theory, Cult. Soc.*, **31(5)**, 21–40, doi:10.1177/0263276414531627.

Geels, F.W., B.K. Sovacool, T. Schwanen, and S. Sorrell, 2017a: Sociotechnical transitions for deep decarbonization. *Science*, **357(6357)**, 1242–1244, doi:10.1126/science.aao3760.

Geels, F.W., B.K. Sovacool, T. Schwanen, and S. Sorrell, 2017b: The Socio-Technical Dynamics of Low-Carbon Transitions. *Joule*, **1(3)**, 463–479, doi:10.1016/j.joule.2017.09.018.

Gençsü, I. et al., 2020: Phasing out public financial flows to fossil fuel production in Europe. *Clim. Policy*, **20(8)**, 1010–1023, doi:10.1080/14693062.2020.1736978.

Genus, A. and K. Theobald, 2016: Creating low-carbon neighbourhoods: a critical discourse analysis. *Eur. Urban Reg. Stud.*, **23(4)**, 782–797, doi:10.1177/0969776414546243.

Gerlagh, R. and O. Kuik, 2007: *Carbon Leakage with International Technology Spillovers*. https://www.econstor.eu/handle/10419/74024 (Accessed October 18, 2021).

Gerlagh, R., R.J.R.K. Heijmans, and K.E. Rosendahl, 2020: COVID-19 Tests the Market Stability Reserve. *Environ. Resour. Econ.*, **76(4)**, 855–865, doi:10.1007/s10640-020-00441-0.

German Federal Ministry of Finance, 2020: Emerging from the crisis with full strength. Federal Ministry of Finance, Germanyza, Berlin, Germany. https://www.bundesfinanzministerium.de/Content/EN/Standardartikel/Topics/Public-Finances/Articles/2020-06-04-fiscal-package.html (Accessed March 30, 2021).

Geroski, P.A., 1995: Markets for technology: knowledge, innovation and appropriability. In: *Handbook of the Economics of Innovation and Technological Change* [Stoneman, P., (ed.)]. Blackwell Publishers, Oxford, UK, pp. 90–131.

Gerrard, M.B., 2021: Climate Change Litigation in the United States: High Volume of Cases, Mostly About Statutes. In: *Climate Change Litigation: Global Perspectives* [Alogna, I., C. Bakker, and J.-P. Gauci, (eds.)]. Koninklijke Brill, Leiden, Netherlands, pp. 33–46.

Ghaleigh, N.S., 2021: Climate Constitutionalism of the UK Supreme Court. *J. Environ. Law*, **33(2)**, 441–447, doi:10.1093/jel/eqab013.

Giampieri, M.A. et al., 2019: Visions of resilience: lessons from applying a digital democracy tool in New York's Jamaica Bay watershed. *Urban Ecosyst.*, **22(1)**, 1–17, doi:10.1007/s11252-017-0701-2.

Gill, S., J. Handley, A. Ennos, and S. Pauleit, 2007: Adapting Cities for Climate Change: The Role of the Green Infrastructure. *Built Environ.*, **33(1)**, 115–133, doi:10.2148/benv.33.1.115.

Gillan, S.L. and L.T. Starks, 2007: The Evolution of Shareholder Activism in the United States. In: *Institutional Investor Activism: Hedge Funds and Private Equity, Economics and Regulation* [Bratton, W. and J. McCahery, (eds.)]. Vol. 19. Oxford University Press, Oxford, UK, pp. 39–72.

Gillard, R., A. Gouldson, J. Paavola, and J. Van Alstine, 2016: Transformational responses to climate change: beyond a systems perspective of social change in mitigation and adaptation. Wiley Interdisciplinary Reviews: Climate Change, **7**(April), 251–265, doi:10.1002/wcc.384.

Giraudet, L.-G. and P. Quirion, 2008: Efficiency and distributional impacts of tradable white certificates compared to taxes, subsidies and regulations. *Rev. d'économie Polit.*, **118**, 885–914.

Givoni, M., J. Macmillen, D. Banister, and E. Feitelson, 2013: From Policy Measures to Policy Packages. *Transp. Rev.*, **33(1)**, 1–20, doi:10.1080/01441647.2012.744779.

Global Covenant of Mayors for Climate and Energy, 2018: *Implementing Climate Ambition: Global Covenant of Mayors 2018 Global Aggregation Report*. Global Covenant of Mayors for Climate and Energy, Brussels, Belgium, 6 pp. https://www.globalcovenantofmayors.org/wp-content/uploads/2018/09/2018_GCOM_report_web.pdf (Accessed December 12, 2019).

Glynn, P., T. Cadman, and T.N. Maraseni, 2017: *Business, Organized Labour and Climate Policy: Forging a Role at the Negotiating Table*. Edward Elgar, Cheltenham, UK, 256 pp.

Goeschl, T., 2019: Cold Case: The forensic economics of energy efficiency labels for domestic refrigeration appliances. *Energy Econ.*, **84**, 104468, doi:10.1016/j.eneco.2019.08.001.

Goldberg, M.H., J.R. Marlon, X. Wang, S. van der Linden, and A. Leiserowitz, 2020: Oil and gas companies invest in legislators that vote against the environment. *Proc. Natl. Acad. Sci.*, **117(10)**, 5111–5112, doi:10.1073/pnas.1922175117.

Goldthau, A. and L. Hughes, 2020: Protect global supply chains for low-carbon technologies. *Nature*, **585**, 3 doi: 10.1038/d41586-020-02499-8.

Gomez-Echeverri, L., 2018: Climate and development: enhancing impact through stronger linkages in the implementation of the Paris Agreement and the Sustainable Development Goals (SDGs). *Philos. Trans. R. Soc. A Math. Phys. Eng. Sci.*, **376(2119)**, doi:10.1098/rsta.2016.0444.

Gomez Echeverri, L., 2018: Investing for rapid decarbonization in cities. *Curr. Opin. Environ. Sustain.*, **30**, 42–51, doi:10.1016/j.cosust.2018.02.010.

Gomez, J., 2013: The limitations of climate change donor intervention as deus ex machina: evidence from Sorsogon, the Philippines. *Int. Dev. Plan. Rev.*, **35(4)**, 371–394, doi:10.3828/idpr.2013.26.

Gordon, D. and M. Acuto, 2015: If Cities Are the Solution, What Are the Problems? The Promise and Perils of Urban Climate Leadership. In: *The Urban Climate Challenge: Rethinking the Role of Cities in the Global Climate Regime* [Johnson, C., N. Toly, and H. Schroeder, (eds.)]. Routledge, London, UK, pp. 63–91.

Gordon, D.J., 2015: An Uneasy Equilibrium: The Coordination of Climate Governance in Federated Systems. *Glob. Environ. Polit.*, **15(2)**, 121–141, doi:10.1162/GLEP_a_00301.

Gössling, S. and R. Buckley, 2016: Carbon labels in tourism: persuasive communication? *J. Clean. Prod.*, **111**, 358–369, doi:10.1016/j.jclepro.2014.08.067.

Gössling, S., A. Humpe, and T. Bausch, 2020: Does 'flight shame' affect social norms? Changing perspectives on the desirability of air travel in Germany. *J. Clean. Prod.*, **266**, 122015, doi:10.1016/j.jclepro.2020.122015.

Goulder, L.H. and R.N. Stavins, 2011: Challenges from State-Federal Interactions in US Climate Change Policy. *Am. Econ. Rev.*, **101(3)**, 253–257, doi:10.1257/aer.101.3.253.

Goulder, L.H., M.A.C. Hafstead, G. Kim, and X. Long, 2019: Impacts of a carbon tax across US household income groups: What are the equity-efficiency trade-offs? *J. Public Econ.*, **175**, 44–64, doi:10.1016/j.jpubeco.2019.04.002.

Gouldson, A. et al., 2016: Cities and climate change mitigation: Economic opportunities and governance challenges in Asia. *Cities*, **54**, 11–19, doi:10.1016/j.cities.2015.10.010.

Grafakos, S. et al., 2018: Integrating mitigation and adaptation: Opportunities and challenges. In: *Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network* [Rosenzweig, C., P. Romero-Lankao, S. Mehrotra, S. Dhakal, and S.A. Ibrahim, (eds.)]. Cambridge University Press, New York, USA, pp. 101–138.

Grafakos, S., K. Trigg, M. Landauer, L. Chelleri, and S. Dhakal, 2019: Analytical framework to evaluate the level of integration of climate adaptation and mitigation in cities. *Clim. Change*, **154(1–2)**, 87–106, doi:10.1007/s10584-019-02394-w.

Grafakos, S. et al., 2020: Integration of mitigation and adaptation in urban climate change action plans in Europe: a systematic assessment.

Renew. Sustain. Energy Rev., **121**(January), 109623, doi:10.1016/j.rser.2019.109623.

Grainger, C.A. and C.D. Kolstad, 2010: Who Pays a Price on Carbon? *Environ. Resour. Econ.*, **46(3)**, doi:10.1007/s10640-010-9345-x.

Grandin, J., H. Haarstad, K. Kjærås, and S. Bouzarovski, 2018: The politics of rapid urban transformation. *Curr. Opin. Environ. Sustain.*, **31**, 16–22, doi:10.1016/j.cosust.2017.12.002.

Granoff, I., J.R. Hogarth, and A. Miller, 2016: Nested barriers to low-carbon infrastructure investment. *Nat. Clim. Change*, **6(12)**, 1065–1071, doi:10.1038/nclimate3142.

Grant, D. and I.B. Vasi, 2017: Civil Society in an Age of Environmental Accountability: How Local Environmental Nongovernmental Organizations Reduce U.S. Power Plants' Carbon Dioxide Emissions. *Sociol. Forum*, **32(1)**, 94–115, doi:10.1111/socf.12318.

Grant, D., A. Jorgenson, and W. Longhofer, 2018: Pathways to Carbon Pollution: The Interactive Effects of Global, Political, and Organizational Factors on Power Plants' CO_2 Emissions. *Sociol. Sci.*, **5**, 58–92, doi:10.15195/v5.a4.

Grashof, K., 2021: Who put the hammer in the toolbox? Explaining the emergence of renewable energy auctions as a globally dominant policy instrument. *Energy Res. Soc. Sci.*, **73**, 101917, doi:10.1016/j.erss.2021.101917.

Grashof, K., V. Berkhout, R. Cernusko, and M. Pfennig, 2020: Long on promises, short on delivery? Insights from the first two years of onshore wind auctions in Germany. *Energy Policy*, **140**, 111240, doi:10.1016/j.enpol.2020.111240.

Greater London Authority, 2018: *London Environment Strategy*. Greater London Authority, London, UK, 452 pp. https://www.london.gov.uk/sites/default/files/london_environment_strategy.pdf (Accessed October 17, 2021).

Green, F., 2018: Anti-fossil fuel norms. *Clim. Change*, **150(1–2)**, 103–116, doi:10.1007/s10584-017-2134-6.

Green, F. and A. Gambhir, 2020: Transitional assistance policies for just, equitable and smooth low-carbon transitions: who, what and how? *Clim. Policy*, **20(8)**, 902–921, doi:10.1080/14693062.2019.1657379.

Green, J.F., 2021: Does carbon pricing reduce emissions? a review of *ex-post* analyses. *Environ. Res. Lett.*, **16(4)**, doi:10.1088/1748-9326/abdae9.

Green, J.F. and T.N. Hale, 2017: Reversing the Marginalization of Global Environmental Politics in International Relations: An Opportunity for the Discipline. *PS Polit. Sci. Polit.*, **50(02)**, 473–479, doi:10.1017/S1049096516003024.

Greiner, S. and A. Michaelowa, 2003: Defining Investment Additionality for CDM projects—practical approaches. *Energy Policy*, **31(10)**, doi:10.1016/S0301-4215(02)00142-8.

Griffin, P.A., 2020: Energy finance must account for extreme weather risk. *Nat. Energy*, **5(2)**, 98–100, doi:10.1038/s41560-020-0548-2.

Grossman, E., 2019: France's Yellow Vests – Symptom of a Chronic Disease. *Polit. Insight*, **10(1)**, 30–34, doi:10.1177/2041905819838152.

Grubb, M. et al., 2015: a review of Chinese CO_2 emission projections to 2030: the role of economic structure and policy. *Clim. Policy*, **15(sup1)**, S7–S39, doi:10.1080/14693062.2015.1101307.

Grubb, M. et al., 2020: Consumption-oriented policy instruments for fostering greenhouse gas mitigation. *Clim. Policy*, **20(sup1)**, S58–S73, doi:10.1080/14693062.2020.1730151.

Guey, A. and A. Bilich, 2019: *Multi-level governance and coordination under Kenya's National Climate Change Act*. GIZ, in cooperation with UNDP, Bonn and Eschborn, Germany, 11 pp. https://transparency-partnership.net/system/files/document/200114_GPD_Kenya_RZ.pdf.

Gugler, K., A. Haxhimusa, and M. Liebensteiner, 2021: Effectiveness of climate policies: Carbon pricing vs. subsidizing renewables. *J. Environ. Econ. Manage.*, **106**, 1–22, doi:10.1016/j.jeem.2020.102405.

Gupta, D., F. Ghersi, S.S. Vishwanathan, and A. Garg, 2020: Macroeconomic assessment of India's development and mitigation pathways. *Clim. Policy*, **20(7)**, 779–799, doi:10.1080/14693062.2019.1648235.

Gurara, D., V. Klyuev, N. Mwase, and A. F. Presbitero, 2018: Trends and Challenges in Infrastructure Investment in Developing Countries. *Int. Dev. Policy Rev. Int. Polit. développement [Online]*, **10.1**, doi:10.4000/poldev.2802.

Guy, S., V. Henshaw, and O. Heidrich, 2015: Climate change, adaptation and Eco-Art in Singapore. *J. Environ. Plan. Manag.*, **58(1)**, 39–54, doi:10.1080/09640568.2013.839446.

Haarstad, H., 2016: Where are urban energy transitions governed? Conceptualizing the complex governance arrangements for low-carbon mobility in Europe. *Cities*, **54**, 4–10, doi:10.1016/j.cities.2015.10.013.

Haase, D. et al., 2017: Greening cities – To be socially inclusive? About the alleged paradox of society and ecology in cities. *Habitat Int.*, **64**, 41–48, doi:10.1016/j.habitatint.2017.04.005.

Haasnoot, M., J.H. Kwakkel, W.E. Walker, and J. ter Maat, 2013: Dynamic adaptive policy pathways: a method for crafting robust decisions for a deeply uncertain world. *Glob. Environ. Change*, **23(2)**, 485–498, doi:10.1016/j.gloenvcha.2012.12.006.

Habib, S., S. Abdelmonen, and M. Khaled, 2020: The Effect of Corruption on the Environmental Quality in African Countries: a Panel Quantile Regression Analysis. *J. Knowl. Econ.*, **11(2)**, 788–804, doi:10.1007/s13132-018-0571-8.

Hadden, J., 2014: Explaining Variation in Transnational Climate Change Activism: The Role of Inter-Movement Spillover. *Glob. Environ. Polit.*, **14(2)**, 7–25, doi:10.1162/GLEP_a_00225.

Hadden, J., 2015: *Networks in Contention: The Divisive Politics of Climate Change*. Cambridge University Press, Cambridge, UK, 224 pp.

Hadden, J. and L. Jasny, 2019: The Power of Peers: How Transnational Advocacy Networks Shape NGO Strategies on Climate Change. *Br. J. Polit. Sci.*, **49(2)**, 637–659, doi:10.1017/S0007123416000582.

Haenfler, R., B. Johnson, and E. Jones, 2012: Lifestyle Movements: Exploring the Intersection of Lifestyle and Social Movements. *Soc. Mov. Stud.*, **11(1)**, 1–20, doi:10.1080/14742837.2012.640535.

Hainsch, K. et al., 2020: *Make the European Green Deal real: Combining climate neutrality and economic recovery*. DIW Berlin: Politikberatung kompakt, Berlin, 77 pp. https://www.econstor.eu/bitstream/10419/222849/1/1701746166.pdf (Accessed March 3, 2021).

Haites, E., 2016: Experience with linking greenhouse gas emissions trading systems. *Wiley Interdiscip. Rev. Energy Environ.*, **5(3)**, 246–260, doi:10.1002/wene.191.

Haites, E., 2018: Carbon taxes and greenhouse gas emissions trading systems: what have we learned? *Clim. Policy*, **18(8)**, 955–966, doi:10.1080/14693062.2018.1492897.

Haites, E. et al., 2018: Experience with Carbon Taxes and Greenhouse Gas Emissions Trading Systems. *Duke Environ. Law Policy Forum*, **29**, 109–182, doi: 10.1002/wene.191.

Hakelberg, L., 2014: Governance by Diffusion: Transnational Municipal Networks and the Spread of Local Climate Strategies in Europe. *Glob. Environ. Polit.*, **14(1)**, 107–129, doi:10.1162/GLEP_a_00216.

Hall, P.A. and D. Soskice, eds., 2001: *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford University Press, Oxford, UK, 560 pp.

Halsnæs, K. et al., 2014: Climate change mitigation policy paradigms—national objectives and alignments. *Mitig. Adapt. Strateg. Glob. Change*, **19(1)**, 45–71, doi:10.1007/s11027-012-9426-y.

Hamarat, C., J.H. Kwakkel, E. Pruyt, and E.T. Loonen, 2014: An exploratory approach for adaptive policymaking by using multi-objective robust optimization. *Simul. Model. Pract. Theory*, **46**, 25–39, doi:10.1016/j.simpat.2014.02.008.

Hamilton, J., R. Mayne, Y. Parag, and N. Bergman, 2014: Scaling up local carbon action: the role of partnerships, networks and policy. *Carbon Manag.*, **5(4)**, 463–476, doi:10.1080/17583004.2015.1035515.

Han, H., 2017: Singapore, a Garden City: Authoritarian Environmentalism in a Developmental State. *J. Environ. Dev.*, **26(1)**, 3–24, doi:10.1177/1070496516677365.

Han, H. and S.W. Ahn, 2020: Youth Mobilization to Stop Global Climate Change: Narratives and Impact. *Sustainability*, **12(10)**, 4127, doi:10.3390/su12104127.

Hanna, R., Y. Xu, and D.G. Victor, 2020: After COVID-19, green investment must deliver jobs to get political traction. *Nature*, **582**, 178–180, doi:10.1038/d41586-020-01682-1.

Hans, F., T. Day, F. Röser, J. Emmrich, and M. Hagemann, 2020: *Making Long-Term Low GHG Emissions Development Strategies a Reality*, GIZ, Bonn and NewClimate Institute, Cologne. https://newclimate.org/2020/05/28/making-long-term-low-ghg-emissions-development-strategies-a-reality/.

Hansen, A. and D. Machin, 2008: Visually branding the environment: climate change as a marketing opportunity. *Discourse Stud.*, **10(6)**, 777–794, doi:10.1177/1461445608098200.

Harbinson, R., 2006: *Whatever the weather Media attitudes to reporting climate change*. Panos Institute, London, UK, 16 pp. http://panoslondon.panosnetwork.org/wp-content/files/2011/03/whatever_weathermjwnSt.pdf (Accessed March 30, 2021).

Harring, N., 2013: Understanding the Effects of Corruption and Political Trust on Willingness to Make Economic Sacrifices for Environmental Protection in a Cross-National Perspective. *Soc. Sci. Q.*, **94(3)**, 660–671, doi:10.1111/j.1540-6237.2012.00904.x.

Harring, N., S.C. Jagers, and S. Matti, 2019: The significance of political culture, economic context and instrument type for climate policy support: a cross-national study. *Clim. Policy*, **19(5)**, 636–650, doi:10.1080/14693062.2018.1547181.

Harrison, K. and L.M. Sundstrom, 2010: Introduction: Global Commons, Domestic Decisions. In: *Global Commons, Domestic Decisions: The Comparative Politics of Climate Change* [Harrison, K. and L.M. Sundstrom, (eds.)]. MIT Press, Cambridge, MA, USA, pp. 328.

Harrison, T. and G. Kostka, 2014: Balancing Priorities, Aligning Interests: Developing Mitigation Capacity in China and India. *Comp. Polit. Stud.*, **47(3)**, 450–480, doi:10.1177/0010414013509577.

Hathaway, J.R., 2020: Climate Change, the Intersectional Imperative, and the Opportunity of the Green New Deal. *Environ. Commun.*, **14(1)**, 13–22, doi:10.1080/17524032.2019.1629977.

Hawkey, D. and J. Webb, 2014: District energy development in liberalised markets: situating UK heat network development in comparison with Dutch and Norwegian case studies. *Technol. Anal. Strateg. Manag.*, **26(10)**, 1228–1241, doi:10.1080/09537325.2014.971001.

Haynes, J., 1999: Power, politics and environmental movements in the Third World. *Env. Polit.*, **8(1)**, 222–242, doi:10.1080/09644019908414445.

Heede, R., 2014: Tracing anthropogenic carbon dioxide and methane emissions to fossil fuel and cement producers, 1854–2010. *Clim. Change*, **122(1–2)**, 229–241, doi:10.1007/s10584-013-0986-y.

Heidrich, O. et al., 2016: National climate policies across Europe and their impacts on cities strategies. *J. Environ. Manage.*, **168**(March 2016), 36–45, doi:10.1016/j.jenvman.2015.11.043.

Heikkinen, M., T. Ylä-Anttila, and S. Juhola, 2019: Incremental, reformistic or transformational: what kind of change do C40 cities advocate to deal with climate change? *J. Environ. Policy Plan.*, **21(1)**, 90–103, doi:10.1080/1523908X.2018.1473151.

Helm, D., C. Hepburn, and R. Mash, 2003: Credible Carbon Policy. *Oxford Rev. Econ. Policy*, **19(3)**, 438–450, doi:10.1093/oxrep/19.3.438.

Hennessey, R., J. Pittman, A. Morand, and A. Douglas, 2017: Co-benefits of integrating climate change adaptation and mitigation in the Canadian energy sector. *Energy Policy*, **111**(December), 214–221, doi:10.1016/j.enpol.2017.09.025.

Hepburn, C., K. Neuhoff, W. Acworth, D. Burtraw, and F. Jotzo, 2016: The economics of the EU ETS market stability reserve. *J. Environ. Econ. Manage.*, **80**(November), 1–5, doi:10.1016/j.jeem.2016.09.010.

Hepburn, C., B. O'Callaghan, N. Stern, J. Stiglitz, and D. Zenghelis, 2020: Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change? *Oxford Rev. Econ. Policy*, **36(sup1)**, S359–S381, doi:10.1093/oxrep/graa015.

Hermwille, L., 2018: Making initiatives resonate: how can non-state initiatives advance national contributions under the UNFCCC? *Int. Environ. Agreements Polit. Law Econ.*, **18(3)**, 447–466, doi:10.1007/s10784-018-9398-9.

Hermwille, L., W. Obergassel, and C. Arens, 2015: The transformative potential of emissions trading. *Carbon Manag.*, **6(5–6)**, 261–272, doi:10.1080/17583004.2016.1151552.

Herr, D. and E. Landis, 2016: *Coastal blue carbon ecosystems: Opportunities for Nationally Determined Contributions*. IUCN, Gland, Switzerland, and TNC, Washington, DC, USA, 28 pp. https://portals.iucn.org/library/node/48422.

Hess, D.J., 2019: Cooler coalitions for a warmer planet: a review of political strategies for accelerating energy transitions. *Energy Res. Soc. Sci.*, **57**, 101246, doi:10.1016/j.erss.2019.101246.

Hess, D.J. and R.G. McKane, 2021: Making sustainability plans more equitable: an analysis of 50 U.S. Cities. *Local Environ.*, **26(4)**, 461–476, doi:10.1080/13549839.2021.1892047.

Hewitt, D. and S. Coakley, 2019: Transforming our buildings for a low-carbon era: Five key strategies. *Electr. J.*, **32(7)**, 106624, doi:10.1016/j.tej.2019.106624.

Hibbard, P.J., S.F. Tierney, P.G. Darling, and S. Cullinan, 2018: An expanding carbon cap-and-trade regime? a decade of experience with RGGI charts a path forward. *Electr. J.*, **31(5)**, 1–8, doi:10.1016/j.tej.2018.05.015.

High-Level Commission on Carbon Prices, 2017: *Report of the High-Level Commission on Carbon Prices*. Carbon Pricing Leadership Coalition, Washington, DC, 68 pp. https://static1.squarespace.com/static/54ff9c5ce4b0a53decccfb4c/t/59244eed17bffc0ac256cf16/1495551740633/CarbonPricing_Final_May29.pdf (Accessed March 30, 2021).

Hill, S.D., J. Knott, and J.K.S Hill, 2010: Too close for comfort: Social controversies surrounding wind farm noise setback policies in Ontario. *Renew. Energy Law Policy Rev.*, **2**, 153–168.

Hilson, C., 2019: Climate Populism, Courts, and Science. *J. Environ. Law*, **31(3)**, 395–398, doi:10.1093/jel/eqz021.

Hindery, D., 2013: *From Enron to Evo: Pipeline Politics, Global Environmentalism, and Indigenous Rights in Bolivia*. 1st edition. The University of Arizona Press, Tucson, USA, pp. 328.

Hirt, L.F., M. Sahakian, and E. Trutnevyte, 2021: What socio-technical regimes foster solar energy champions? Analysing uneven photovoltaic diffusion at a sub-national level in Switzerland. *Energy Res. Soc. Sci.*, **74**, 101976, doi:10.1016/j.erss.2021.101976.

Hmielowski, J.D., L. Feldman, T.A. Myers, A. Leiserowitz, and E. Maibach, 2014: An attack on science? Media use, trust in scientists, and perceptions of global warming. *Public Underst. Sci.*, **23(7)**, 866–883, doi:10.1177/0963662513480091.

Hochstetler, K., 2020: *Political Economies of Energy Transition: Wind and Solar Power in Brazil and South Africa*. 1st ed. Cambridge University Press, Cambridge, UK, 278 pp.

Hochstetler, K., 2021: Climate institutions in Brazil: three decades of building and dismantling climate capacity. *Env. Polit.*, **30(sup1)**, 49–70, doi:10.1080/09644016.2021.1957614.

Hochstetler, K. and G. Kostka, 2015: Wind and Solar Power in Brazil and China: Interests, State–Business Relations, and Policy Outcomes. *Glob. Environ. Polit.*, **15(3)**, 74–94, doi:10.1162/GLEP_a_00312.

Hodson, M. and S. Marvin, 2009: Cities mediating technological transitions: understanding visions, intermediation and consequences. *Technol. Anal. Strateg. Manag.*, **21(4)**, 515–534, doi:10.1080/09537320902819213.

Hodson, M., J. Evans, and G. Schliwa, 2018: Conditioning experimentation: The struggle for place-based discretion in shaping urban infrastructures. *Environ. Plan. C Polit. Sp.*, **36(8)**, 1480–1498, doi:10.1177/2399654418765480.

Hoewe, J. and L. Ahern, 2017: First-Person Effects of Emotional and Informational Messages in Strategic Environmental Communications

Campaigns. *Environ. Commun.*, **11(6)**, 810–820, doi:10.1080/17524032.2017.1371050.

Hoffmann, M.J., 2011: *Climate Governance at the Crossroads: Experimenting with a Global Response after Kyoto*. Oxford University Press, Oxford, UK, 237 pp.

Höhne, N. et al., 2021: Wave of net zero emission targets opens window to meeting the Paris Agreement. *Nat. Clim. Change*, **11(10)**, 820–822, doi:10.1038/s41558-021-01142-2.

Holden, M. and M.T. Larsen, 2015: Institutionalizing a policy by any other name: in the City of Vancouver's Greenest City Action Plan, does climate change policy or sustainability policy smell as sweet? *Urban Res. Pract.*, **8(3)**, 354–370, doi:10.1080/17535069.2015.1051382.

Holland, B., 2017: Procedural justice in local climate adaptation: political capabilities and transformational change. *Env. Polit.*, **26(3)**, 391–412, doi:10.1080/09644016.2017.1287625.

Holland, S.P., J.E. Hughes, C.R. Knittel, and N.C. Parker, 2015: Unintended consequences of carbon policies: Transportation fuels, land-use, emissions, and innovation. *Energy J.*, **36(3)**, 35–74, doi:10.5547/01956574.36.3.2.

Holmberg, A. and A. Alvinius, 2020: Children's protest in relation to the climate emergency: a qualitative study on a new form of resistance promoting political and social change. *Childhood*, **27(1)**, 78–92, doi:10.1177/0907568219879970.

Holmes, D. and C. Star, 2018: Climate Change Communication in Australia: The Politics, Mainstream Media and Fossil Fuel Industry Nexus. In: *Handbook of Climate Change Communication: Vol. 1. Climate Change Management* [Leal Filho, W., E. Manolas, A. Azul, U. Azeiteiro, and H. McGhie (eds.)]. Springer, Cham, Switzerland, pp. 151–170. doi.org/10.1007/978-3-319-69838-0_10.

Hölscher, K., J.M. Wittmayer, and D. Loorbach, 2018: Transition versus transformation: What's the difference? *Environ. Innov. Soc. Transitions*, **27**, 1–3, doi:10.1016/j.eist.2017.10.007.

Holtz, G. et al., 2018: Competences of local and regional urban governance actors to support low-carbon transitions: Development of a framework and its application to a case-study. *J. Clean. Prod.*, **177**, 846–856, doi:10.1016/j.jclepro.2017.12.137.

Hönle, S.E., C. Heidecke, and B. Osterburg, 2019: Climate change mitigation strategies for agriculture: an analysis of nationally determined contributions, biennial reports and biennial update reports. *Clim. Policy*, **19(6)**, 688–702, doi:10.1080/14693062.2018.1559793.

Hoornweg, D., L. Sugar, and C.L. Trejos Gómez, 2011: Cities and greenhouse gas emissions: moving forward. *Environ. Urban.*, **23(1)**, 207–227, doi:10.1177/0956247810392270.

Horne, M., 2020: *Climate Emergency Action Plan – RTS 13199*. City of Vancouver, 371 pp. https://council.vancouver.ca/20201103/documents/p1.pdf.

Horne, R. and S. Moloney, 2019: Urban low-carbon transitions: institution-building and prospects for interventions in social practice. *Eur. Plan. Stud.*, **27(2)**, 336–354, doi:10.1080/09654313.2018.1472745.

Hornsey, M.J., E.A. Harris, and K.S. Fielding, 2018: Relationships among conspiratorial beliefs, conservatism and climate scepticism across nations. *Nat. Clim. Change*, **8(7)**, 614–620, doi:10.1038/s41558-018-0157-2.

Houghton, A., 2011: Health Impact Assessments: a Tool for Designing Climate Change Resilience Into Green Building and Planning Projects. *J. Green Build.*, **6(2)**, 66–87, doi:10.3992/jgb.6.2.66.

Houle, D., E. Lachapelle, and M. Purdon, 2015: Comparative Politics of Sub-Federal Cap-and-Trade: Implementing the Western Climate Initiative. *Glob. Environ. Polit.*, **15(3)**, 49–73, doi:10.1162/GLEP_a_00311.

Howard, J. et al., 2017: Clarifying the role of coastal and marine systems in climate mitigation. *Front. Ecol. Environ.*, **15(1)**, 42–50, doi:10.1002/fee.1451.

Howlett, M. and P. del Rio, 2015: The parameters of policy portfolios: verticality and horizontality in design spaces and their consequences for policy mix formulation. *Environ. Plan. C Gov. Policy*, **33(5)**, 1233–1245, doi:10.1177/0263774X15610059.

Howlett, M.P. and S. Oliphant, 2010: Environmental Organizations and Climate Change Policy Capacity: An Assessment of the Canadian Case. *Can. Polit. Sci. Rev.*, **4(2–3)**, 18–35.

Hsu, A., A.J. Weinfurter, and K. Xu, 2017: Aligning sub-national climate actions for the new post-Paris climate regime. *Clim. Change*, **142(3–4)**, 419–432, doi:10.1007/s10584-017-1957-5.

Hsu, A. et al., 2018: *Bridging the Emissions Gap – The Role of Non- State and Sub-national Actors. In The Emissions Gap Report 2018. a UN Environment Synthesis Report*. UNEP, Nairobi, 27 pp. https://wedocs.unep.org/bitstream/handle/20.500.11822/26093/NonState_Emissions_Gap.pdf?isAllowed=y&sequence=1 (Accessed March 30, 2021).

Hsu, A. et al., 2019: a research roadmap for quantifying non-state and sub-national climate mitigation action. *Nat. Clim. Change*, **9(1)**, 11–17, doi:10.1038/s41558-018-0338-z.

Hsu, A. et al., 2020a: ClimActor, harmonized transnational data on climate network participation by city and regional governments. *Sci. Data*, **7(1)**, 374, doi:10.1038/s41597-020-00682-0.

Hsu, A., N. Höhne, T. Kuramochi, V. Vilariño, and B.K. Sovacool, 2020b: Beyond states: Harnessing sub-national actors for the deep decarbonisation of cities, regions, and businesses. *Energy Res. Soc. Sci.*, **70(3)**, 101738, doi:10.1016/j.erss.2020.101738.

Hsu, A. et al., 2020c: Performance determinants show European cities are delivering on climate mitigation. *Nat. Clim. Change*, **10(11)**, 1015–1022, doi:10.1038/s41558-020-0879-9.

Huang, P., V. Castán Broto, Y. Liu, and H. Ma, 2018: The governance of urban energy transitions: a comparative study of solar water heating systems in two Chinese cities. *J. Clean. Prod.*, **180**, 222–231, doi:10.1016/j.jclepro.2018.01.053.

Huber, R.A., L. Fesenfeld, and T. Bernauer, 2020: Political populism, responsiveness, and public support for climate mitigation. *Clim. Policy*, **20(3)**, 373–386, doi:10.1080/14693062.2020.1736490.

Huggel, C. et al., 2015: a framework for the science contribution in climate adaptation: Experiences from science-policy processes in the Andes. *Environ. Sci. Policy*, **47**, 80–94, doi:10.1016/j.envsci.2014.11.007.

Hughes, L., 2019a: The Rocky Hill decision: a watershed for climate change action? *J. Energy Nat. Resour. Law*, **37(3)**, 341–351, doi:10.1080/02646811.2019.1600272.

Hughes, S., 2013: Justice in urban climate change adaptation: Criteria and application to Delhi. *Ecol. Soc.*, **18(4)**, doi:10.5751/ES-05929-180448.

Hughes, S., 2019b: *Repowering Cities: Governing Climate Change Mitigation in New York City, Los Angeles and Toronto*. Cornell University Press, Ithaca; New York, USA, 224 pp.

Hughes, S. and P. Romero-Lankao, 2014: Science and institution building in urban climate-change policymaking. *Env. Polit.*, **23(6)**, 1023–1042, doi:10.1080/09644016.2014.921459.

Hughes, S. and M. Hoffmann, 2020: Just urban transitions: Toward a research agenda. *WIREs Clim. Change*, **11(3)**, 1–11, doi:10.1002/wcc.640.

Huitema, D. et al., 2011: The evaluation of climate policy: theory and emerging practice in Europe. *Policy Sci.*, **44(2)**, 179–198, doi:10.1007/s11077-011-9125-7.

Hultman, N.E. et al., 2020: Fusing subnational with national climate action is central to decarbonization: the case of the United States. *Nat. Commun.*, **11(1)**, 5255, doi:10.1038/s41467-020-18903-w.

Humby, T.-L., 2018: The Thabametsi Case: Case No 65662/16 Earthlife Africa Johannesburg v Minister of Environmental Affairs. *J. Environ. Law*, **30(1)**, 145–155, doi:10.1093/jel/eqy007.

Hurlstone, M.J., S. Lewandowsky, B.R. Newell, and B. Sewell, 2014: The Effect of Framing and Normative Messages in Building Support for Climate Policies. *PLoS One*, **9(12)**, e114335, doi:10.1371/journal.pone.0114335.

Huttunen, S., P. Kivimaa, and V. Virkamäki, 2014: The need for policy coherence to trigger a transition to biogas production. *Environ. Innov. Soc. Transitions*, **12**, 14–30, doi:10.1016/j.eist.2014.04.002.

Hvelplund, F. and S. Djørup, 2017: Multilevel policies for radical transition: Governance for a 100% renewable energy system. *Environ. Plan. C Polit. Sp.*, **35(7)**, 1218–1241, doi:10.1177/2399654417710024.

Iacobuta, G., N.K. Dubash, P. Upadhyaya, M. Deribe, and N. Höhne, 2018: National climate change mitigation legislation, strategy and targets: a global update. *Clim. Policy*, **18(9)**, 1114–1132, doi:10.1080/14693062.2018.1489772.

IEA, 2015: *Energy and climate change: World energy outlook special report*. International Energy Agency, (IEA) and Organisation for Economic Co-operation and Development (OECD), Paris, France, 200 pp. https://iea.blob.core.windows.net/assets/8d783513-fd22-463a-b57d-a0d8d608d86f/WEO2015SpecialReportonEnergyandClimateChange.pdf (Accessed March 20, 2021).

IEA, 2020: IEA Energy subsidies: Tracking the impact of fossil-fuel subsidies. International Energy Agency, (IEA). https://www.iea.org/topics/energy-subsidies (Accessed December 21, 2020).

IEA, 2021: IEA Policies Database. International Energy Agency, (IEA). https://www.iea.org/policies (Accessed October 28, 2021).

Ihobe – Environmental Management Agency, 2017: *Nature-based solutions for local climate adaptation in the Basque Country: Methodological guide for their identification and mapping*. Ministry of the Environment, Territorial Planning and Housing, Basque Government, Bilbao, 91 pp. https://www.ihobe.eus/Publicaciones/Ficha.aspx?IdMenu=97801056-cd1f-4503-bafa-f54fa80d9a44&Cod=adbf2e51-3d8c-4879-ab8d-9a7ab8d48e45&Idioma=en-GB.

IISD, 2019: *Raising Ambition Through Fossil Fuel Subsidy Reform: Greenhouse gas emissions modelling results from 26 countries*. International Institute for Sustainable Development (IISD), Winnipeg, Canada, and Geneva, Switzerland, 54 pp. https://www.iisd.org/system/files/publications/raising-ambition-through-fossil-fuel-subsidy-reform.pdf (Accessed March 30, 2021).

Ikeme, J., 2003: Equity, environmental justice and sustainability: incomplete approaches in climate change politics. *Glob. Environ. Change*, **13(3)**, 195–206, doi:10.1016/S0959-3780(03)00047-5.

Inderberg, T.H.J., 2019: Climate Change Acts as diffusing governance innovations: adoption and implications of the UK model in Finland and Norway. *Proceeds of 14th Nordic Environmental Social Science (NESS) Conference, Luleå University of Technology, Sweden*, Luleå, Sweden, 9–11.

Inglehart, R. and P. Norris, 2017: Trump and the Populist Authoritarian Parties: The Silent Revolution in Reverse. *Perspect. Polit.*, **15(2)**, 443–454, doi:10.1017/S1537592717000111.

Ingold, K. and M. Fischer, 2014: Drivers of collaboration to mitigate climate change: An illustration of Swiss climate policy over 15 years. *Glob. Environ. Change*, **24**, 88–98, doi:10.1016/j.gloenvcha.2013.11.021.

IPBES, 2019: Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. [Díaz, S., J. Settele, E. S. Brondízio, H.T. Ngo, M. Guèze et al., (eds.)]. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Bonn, Germany, 56 pp.

IPCC, 2007: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. [Parry, M., O. Canziani, J. Palutikof, P. Van der Linden, and C. Hanson, (eds.)]. Cambridge University Press, Cambridge, UK and New York, USA, 976 pp.

IPCC, 2014a: Summary for Policymakers. In: *Climate Change 2014: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, and M.D. Mastrandrea, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, 1–32 pp.

IPCC, 2014b: *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

IPCC, 2018: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA.

IRENA, 2019: *Renewable energy auctions: Status and trends beyond price*. International Renewable Energy Agency (IRENA), Abu Dhabi, 104 pp. https://www.irena.org/publications/2019/Dec/Renewable-energy-auctions-Status-and-trends-beyond-price (Accessed October 27, 2021).

Irwin, A. and B. Wynne, eds., 1996: *Misunderstanding Science?The Public Reconstruction of Science and Technology*. Cambridge University Press, Cambridge, UK, 232 pp.

Islam, S. and M.Z.R. Khan, 2017: a Review of Energy Sector of Bangladesh. *Energy Procedia*, **110**, 611–618, doi:10.1016/j.egypro.2017.03.193.

Ismer, R., K. Neuhoff, and A. Pirlot, 2020: *Border Carbon Adjustments and Alternative Measures for the EU ETS: An Evaluation*. Deutsches Institut für Wirtschaftsforschung (DIW), Berlin, Germany, 23 pp. https://www.diw.de/documents/publikationen/73/diw_01.c.743698.de/dp1855.pdf (Accessed October 18, 2021).

Jaccard, M., R. Murphy, B. Zuehlke, and M. Braglewicz, 2019: Cities and greenhouse gas reduction: Policy makers or policy takers? *Energy Policy*, **134**, 110875, doi:10.1016/j.enpol.2019.07.011.

Jackson, A., 2020: Ireland's Climate Action and Low Carbon Development Act 2015: Symbolic Legislation, Systemic Litigation, Stepping Stone? In: *National Climate Change Acts: The Emergence, Form and Nature of National Framework Climate Legislation* [Muinzer, T.L., (ed.)]. Bloomsbury, London, UK, pp. 129–152.

Jacobs, B. and F. van der Ploeg, 2019: Redistribution and pollution taxes with non-linear Engel curves. *J. Environ. Econ. Manage.*, **95**, 198–226, doi:10.1016/j.jeem.2019.01.008.

Jacques, P.J., R.E. Dunlap, and M. Freeman, 2008: The organisation of denial: Conservative think tanks and environmental scepticism. *Env. Polit.*, **17(3)**, 349–385, doi:10.1080/09644010802055576.

Jaffe, A.B. and R.N. Stavins, 1995: Dynamic Incentives of Environmental Regulations: The Effects of Alternative Policy Instruments on Technology Diffusion. *J. Environ. Econ. Manage.*, **29(3)**, S43–S63, doi:10.1006/jeem.1995.1060.

Jaffe, A.B., R.G. Newell, and R.N. Stavins, 2002: Environmental policy and technological change. *Environ. Resour. Econ.*, **22**, 41–70, doi:10.1023/A:1015519401088.

Jahn, D., 2016: *The Politics of Environmental Performance: Institutions and Preferences in Industrialized Democracies*. Cambridge University Press, Cambridge, UK, 376 pp.

Jakob, M., C. Chen, S. Fuss, A. Marxen, and O. Edenhofer, 2015: Development incentives for fossil fuel subsidy reform. *Nat. Clim. Change*, **5(8)**, 709–712, doi:10.1038/nclimate2679.

Jang, M., J.-A. Kim, and S.-T. Sun, 2010: Development and Evaluation of Laws and Regulation for the Low-Carbon and Green Growth in Korea. *Int. J. Urban Sci.*, **14(2)**, 191–206, doi:10.1080/12265934.2010.9693676.

Jänicke, M. and R.K.W. Wurzel, 2019: Leadership and lesson-drawing in the European Union's multilevel climate governance system. *Env. Polit.*, **28(1)**, 22–42, doi:10.1080/09644016.2019.1522019.

Jasny, L. and D.R. Fisher, 2019: Echo chambers in climate science. *Environ. Res. Commun.*, **1(10)**, 101003, doi:10.1088/2515-7620/ab491c.

Jasny, L., J. Waggle, and D.R. Fisher, 2015: An empirical examination of echo chambers in US climate policy networks. *Nat. Clim. Change*, **5(8)**, 782–786, doi:10.1038/nclimate2666.

Jaumotte, F. et al., 2020: *Mitigating climate change – Growth- and distribution-friendly strategies*. International Monetary Fund, Washington, DC, USA,

13

85–114 pp. https://www.imf.org/en/Publications/WEO/Issues/2020/09/30/world-economic-outlook-october-2020.

Jaumotte, F., W. Liu, and W.J. McKibbin, 2021: *Mitigating Climate Change: Growth-Friendly Policies to Achieve Net Zero Emissions by 2050*. International Monetary Fund, Washington, DC, USA, https://www.imf.org/en/Publications/WP/Issues/2021/07/23/Mitigating-Climate-Change-Growth-Friendly-Policies-to-Achieve-Net-Zero-Emissions-by-2050-462136 (Accessed September 24, 2021).

Jenkins, K., D. McCauley, R. Heffron, H. Stephan, and R. Rehner, 2016: Energy Justice: a conceptual review. *Energy Res. Soc. Sci.*, **11**, 174–182, doi:10.1016/j.erss.2015.10.004.

Jensen, C.B. and J.-J. Spoon, 2011: Testing the 'Party Matters' Thesis: Explaining Progress Towards Kyoto Protocol Targets. *Polit. Stud.*, **59(1)**, 99–115, doi:10.1111/j.1467-9248.2010.00852.x.

Jewell, J. and A. Cherp, 2020: On the political feasibility of climate change mitigation pathways: Is it too late to keep warming below 1.5°C? *Wiley Interdiscip. Rev. Clim. Change*, **11(1)**, e621, doi:10.1002/wcc.621.

Jewell, J. et al., 2018: Limited emission reductions from fuel subsidy removal except in energy-exporting regions. *Nature*, **554(7691)**, 229–233, doi:10.1038/nature25467.

Jewell, J., V. Vinichenko, L. Nacke, and A. Cherp, 2019: Prospects for powering past coal. *Nat. Clim. Change*, **9(8)**, 592–597, doi:10.1038/s41558-019-0509-6.

Joas, F. and C. Flachsland, 2016: The (ir)relevance of transaction costs in climate policy instrument choice: an analysis of the EU and the US. *Clim. Policy*, **16(1)**, 26–49, doi:10.1080/14693062.2014.968762.

Jodoin, S., 2017: *Forest Preservation in a Changing Climate: REDD+ and Indigenous and Community Rights in Indonesia and Tanzania*. 1st ed. Cambridge University Press, Cambridge, UK, 252 pp.

Jodoin, S., S. Snow, and A. Corobow, 2020: Realizing the Right to Be Cold? Framing Processes and Outcomes Associated with the Inuit Petition on Human Rights and Global Warming. *Law Soc. Rev.*, **54(1)**, 168–200, doi:10.1111/lasr.12458.

Joffe, H. and N. Smith, 2016: City dweller aspirations for cities of the future: How do environmental and personal well-being feature? *Cities*, **59**, 102–112, doi:10.1016/j.cities.2016.06.006.

Jogesh, A. and N.K. Dubash, 2015: State-led experimentation or centrally-motivated replication? a study of state action plans on climate change in India. *J. Integr. Environ. Sci.*, **12(4)**, 247–266, doi:10.1080/1943815X.2015.1077869.

Johnsson, F., J. Kjärstad, and J. Rootzén, 2019: The threat to climate change mitigation posed by the abundance of fossil fuels. *Clim. Policy*, **19(2)**, 258–274, doi:10.1080/14693062.2018.1483885.

Johnstone, N., I. Haščič, J. Poirier, M. Hemar, and C. Michel, 2012: Environmental policy stringency and technological innovation: evidence from survey data and patent counts. *Appl. Econ.*, **44(17)**, 2157–2170, doi:10.1080/00036846.2011.560110.

Joltreau, E. and K. Sommerfeld, 2019: Why does emissions trading under the EU Emissions Trading System (ETS) not affect firms' competitiveness? Empirical findings from the literature. *Clim. Policy*, **19(4)**, 453–471, doi:10.1080/14693062.2018.1502145.

Jones, S., 2013: Climate Change Policies of City Governments in Federal Systems: An Analysis of Vancouver, Melbourne and New York City. *Reg. Stud.*, **47(6)**, 974–992, doi:10.1080/00343404.2011.585150.

Jones, S., 2014: Flirting with Climate Change: a Comparative Policy Analysis of Sub-national Governments in Canada and Australia. *J. Comp. Policy Anal. Res. Pract.*, **16(5)**, 424–440, doi:10.1080/13876988.2014.942570.

Jordaan, S.M., A. Davidson, J.A. Nazari, and I.M. Herremans, 2019: The dynamics of advancing climate policy in federal political systems. *Environ. Policy Gov.*, **29(3)**, 220–234, doi:10.1002/eet.1849.

Jordan, A., D. Huitema, H. Asselt and J. Forster, 2018a: *Governing Climate Change: Polycentricity in Action?* Cambridge University Press, Cambridge, UK.

Jordan, A., D. Huitema, H. van Asselt, and J. Forster, eds., 2018: *Governing Climate Change: Polycentricity in Action?* 1st ed. Cambridge University Press, Cambridge, UK, 408 pp.

Jordan, A.J. and B. Moore, 2020: *Durable by Design? Policy Feedback in a Changing Climate*. Cambridge University Press, Cambridge, UK, 276 pp.

Jordan, A.J. et al., 2015: Emergence of polycentric climate governance and its future prospects. *Nat. Clim. Change*, **5(11)**, 977–982, doi:10.1038/nclimate2725.

Jörgensen, K., A. Jogesh, and A. Mishra, 2015a: Multi-level climate governance and the role of the subnational level. *J. Integr. Environ. Sci.*, **12(4)**, 235–245, doi:10.1080/1943815X.2015.1096797.

Jörgensen, K., A. Mishra, and G.K. Sarangi, 2015b: Multi-level climate governance in India: the role of the states in climate action planning and renewable energies. *J. Integr. Environ. Sci.*, **12(4)**, 267–283, doi:10.1080/1943815X.2015.1093507.

Jorgenson, A.K., C. Dick, and J.M. Shandra, 2011: World Economy, World Society, and Environmental Harms in Less-Developed Countries*. *Sociol. Inq.*, **81(1)**, 53–87, doi:10.1111/j.1475-682X.2010.00354.x.

Jost, G.F. and K. Jacob, 2004: The climate change policy network in Germany. *Eur. Environ.*, **14(1)**, 1–15, doi:10.1002/eet.337.

Jotzo, F., T. Jordan, and N. Fabian, 2012: Policy Uncertainty about Australia's Carbon Price: Expert Survey Results and Implications for Investment. *Aust. Econ. Rev.*, **45(4)**, 395–409, doi:10.1111/j.1467-8462.2012.00709.x.

Jotzo, F. et al., 2018: China's emissions trading takes steps towards big ambitions. *Nat. Clim. Change*, **8**, 265–267, doi:10.1038/s41558-018-0130-0.

Jotzo, F., T. Longden, and Z. Anjum, 2020: *Fiscal stimulus for low-carbon compatible COVID-19 recovery: criteria for infrastructure investment*. Crawford School of Public Policy Centre for Climate & Energy Policy, ANU, Canberra, Australia, 43 pp. https://www.energy-transition-hub.org/files/resource/attachment/ccep2005_low-carbon_stimulus_-_jotzo_longden_anjum.pdf (Accessed March 30, 2021).

Jung, J., P. Petkanic, D. Nan, and J.H. Kim, 2020: When a Girl Awakened the World: a User and Social Message Analysis of Greta Thunberg. *Sustainability*, **12(7)**, 2707, doi:10.3390/su12072707.

Kadefors, A., S. Lingegård, S. Uppenberg, J. Alkan-Olsson, and D. Balian, 2020: Designing and implementing procurement requirements for carbon reduction in infrastructure construction – international overview and experiences. *J. Environ. Plan. Manag.*, **64(4)**, 1–24, doi:10.1080/09640568.2020.1778453.

Kahsar, R., 2021: The soft path revisited: Policies that drive decentralization of electric power generation in the contiguous U.S. *Energy Policy*, **156**, 112429, doi:10.1016/j.enpol.2021.112429.

Kalfagianni, A. and O. Kuik, 2017: Seeking optimality in climate change agri-food policies: stakeholder perspectives from Western Europe. *Clim. Policy*, **17**, S72–S92, doi:10.1080/14693062.2016.1244508.

Kamiya, G. and J. Teter, 2019: Shared, automated… and electric? – Analysis. International Energy Agency (IEA), Paris, France, https://www.iea.org/commentaries/shared-automated-and-electric (Accessed March 30, 2021).

Kammerer, M. and C. Namhata, 2018: What drives the adoption of climate change mitigation policy? a dynamic network approach to policy diffusion. *Policy Sci.*, **51(4)**, 477–513, doi:10.1007/s11077-018-9332-6.

Kammerer, M. et al., 2021: What Explains Collaboration in High and Low Conflict Contexts? Comparing Climate Change Policy Networks in Four Countries. *Policy Stud. J.*, **49(4),** 1065–1086, doi:10.1111/psj.12422.

Kanger, L., B.K. Sovacool, and M. Noorkõiv, 2020: Six policy intervention points for sustainability transitions: a conceptual framework and a systematic literature review. *Res. Policy*, **49(7)**, 104072, doi:10.1016/j.respol.2020.104072.

Karani, P. and P. Failler, 2020: Comparative coastal and marine tourism, climate change, and the blue economy in African Large Marine Ecosystems. *Environ. Dev.*, **36**(January), 100572, doi:10.1016/j.envdev.2020.100572.

Karceski, S.M., N. Dolšak, A. Prakash, and T.N. Ridout, 2020: Did TV ads funded by fossil fuel industry defeat the Washington carbon tax? *Clim. Change*, **158(3–4)**, 301–307, doi:10.1007/s10584-019-02626-z.

Karlsson, M., E. Alfredsson, and N. Westling, 2020: Climate policy co-benefits: a review. *Clim. Policy*, **20(3)**, 292–316, doi:10.1080/14693062.2020.1724070.

Kashwan, P., 2015: Forest Policy, Institutions, and REDD+ in India, Tanzania, and Mexico. *Glob. Environ. Polit.*, **15(3)**, 95–117, doi:10.1162/GLEP_a_00313.

Keele, D.M., 2017: Climate Change Litigation and the National Environmental Policy Act. *J. Environ. Law*, **30(2)**, 285–309, doi:10.1093/jel/eqx030.

Keenan, R.J., L. Caripis, A. Foerster, L. Godden, and J. Peel, 2012: Science and the governance of Australia's climate regime. *Nat. Clim. Change*, **2(7)**, 477–478, doi:10.1038/nclimate1608.

Kennedy, C., S. Demoullin, and E. Mohareb, 2012: Cities reducing their greenhouse gas emissions. *Energy Policy*, **49**, 774–777, doi:10.1016/j.enpol.2012.07.030.

Kern, F. and K.S. Rogge, 2018: Harnessing theories of the policy process for analysing the politics of sustainability transitions: a critical survey. *Environ. Innov. Soc. Transitions*, **27**(November 2017), 102–117, doi:10.1016/j.eist.2017.11.001.

Kern, F., K.S. Rogge, and M. Howlett, 2019: Policy mixes for sustainability transitions: New approaches and insights through bridging innovation and policy studies. *Res. Policy*, **48(10)**, 103832, doi:10.1016/j.respol.2019.103832.

Kernecker, T. and M. Wagner, 2019: Niche parties in Latin America. *J. Elections, Public Opin. Parties*, **29(1)**, 102–124, doi:10.1080/17457289.2018.1464014.

Khan, F. and B.K. Sovacool, 2016: Testing the efficacy of voluntary urban greenhouse gas emissions inventories. *Clim. Change*, **139(2)**, 141–154, doi:10.1007/s10584-016-1793-z.

Khan, M., D. Mfitumukiza, and S. Huq, 2020: Capacity building for implementation of Nationally Determined Contributions under the Paris Agreement. *Clim. Policy*, **20(4)**, 499–510, doi:10.1080/14693062.2019.1675577.

Khreis, H., A.D. May, and M.J. Nieuwenhuijsen, 2017: Health impacts of urban transport policy measures: a guidance note for practice. *J. Transp. Heal.*, **6**, 209–227, doi:10.1016/j.jth.2017.06.003.

Kim, E., 2016: The politics of climate change policy design in Korea. *Env. Polit.*, **25(3)**, 454–474, doi:10.1080/09644016.2015.1104804.

Kim, S.E., J. Urpelainen, and J. Yang, 2016: Electric utilities and American climate policy: lobbying by expected winners and losers. *J. Public Policy*, **36(2)**, 251–275, doi:10.1017/S0143814X15000033.

Kinniburgh, C., 2019: Climate Politics after the Yellow Vests. *Dissent*, **66(2)**, 115–125, doi:10.1353/dss.2019.0037.

Kissinger, G., A. Gupta, I. Mulder, and N. Unterstell, 2019: Climate financing needs in the land sector under the Paris Agreement: An assessment of developing country perspectives. *Land-use policy*, **83**, 256–269, doi:10.1016/j.landusepol.2019.02.007.

Kivimaa, P. and F. Kern, 2016: Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions. *Res. Policy*, **45(1)**, 205–217, doi:10.1016/j.respol.2015.09.008.

Kivimaa, P., D. Huitema, A. Jordan, and J. Newig, 2017a: Experiments in climate governance – a systematic review of research on energy and built environment transitions. *J. Clean. Prod.*, **169**, 17–29, doi:10.1016/J.JCLEPRO.2017.01.027.

Kivimaa, P., H.-L. Kangas, and D. Lazarevic, 2017b: Client-oriented evaluation of 'creative destruction' in policy mixes: Finnish policies on building energy efficiency transition. *Energy Res. Soc. Sci.*, **33(SI)**, 115–127, doi:10.1016/j.erss.2017.09.002.

Klausbruckner, C., H. Annegarn, L.R.F. Henneman, and P. Rafaj, 2016: A policy review of synergies and trade-offs in South African climate change mitigation and air pollution control strategies. *Environ. Sci. Policy*, **57**, 70–78, doi:10.1016/j.envsci.2015.12.001.

Klein, R.J.T., E.L.F. Schipper, and S. Dessai, 2005: Integrating mitigation and adaptation into climate and development policy: three research questions. *Environ. Sci. Policy*, **8(6)**, 579–588, doi:10.1016/j.envsci.2005.06.010.

Kleinschmidt, J., 2020: *HFC refrigerant prices fell again in the third quarter of 2019*. Öko_recherche, Frankfurt, 2 pp. https://www.oekorecherche.de/sites/default/files/publikationen/vdkf_jk_preismonitoring_3-2019.pdf (Accessed October 29, 2021).

Klenert, D. et al., 2018: Making carbon pricing work for citizens. *Nat. Clim. Change*, **8(8)**, 669–677, doi:10.1038/s41558-018-0201-2.

Klinsky, S., 2018: An initial scoping of transitional justice for global climate governance. *Clim. Policy*, **18(6)**, 752–765, doi:10.1080/14693062.2017.1377594.

Kluczek, A. and P. Olszewski, 2017: Energy audits in industrial processes. *J. Clean. Prod.*, **142(4)**, 3437–3453, doi:10.1016/j.jclepro.2016.10.123.

Kneese, A.V. and C.L. Schultze, 1975: *Pollution, prices, and public policy*. The Brookings Institution, Washington, DC, USA, 136 pp.

Knodt, M., M. Ringel, and R. Müller, 2020: 'Harder' soft governance in the European Energy Union. *J. Environ. Policy Plan.*, **22(6)**, 787–800, doi:10.1080/1523908X.2020.1781604.

Knox-Hayes, J., 2016: *The Cultures of Markets: The Political Economy of Climate Governance*. 1st ed. Oxford University Press, New York, USA, 352 pp.

Koch, N. and H. Basse Mama, 2019: Does the EU Emissions Trading System induce investment leakage? Evidence from German multinational firms. *Energy Econ.*, **81**, 479–492, doi:10.1016/j.eneco.2019.04.018.

Köhler, J. et al., 2019: An agenda for sustainability transitions research: State of the art and future directions. *Environ. Innov. Soc. Transitions*, **31**, 1–32, doi:10.1016/j.eist.2019.01.004.

Kollenberg, S. and L. Taschini, 2019: Dynamic supply adjustment and banking under uncertainty in an emission trading scheme: The market stability reserve. *Eur. Econ. Rev.*, **118**, 213–226, doi:10.1016/j.euroecorev.2019.05.013.

Kona, A. et al., 2016: *Covenant of Mayors: Greenhouse Gas Emissions Achievements and Projections*. Publications Office of the European Union, Luxembourg, 59 pp. https://op.europa.eu/en/publication-detail/-/publication/ae6b48ff-aa54-11e6-aab7-01aa75ed71a1/language-en.

Kong, N. and S. Hardman, 2019: *UC Davis Research Reports Title Electric Vehicle Incentives in 13 Leading Electric Vehicle Markets*. Plug-in Hybrid & Electric Vehicle Research Center, UC Davis, California, USA, 1–22 pp. https://escholarship.org/uc/item/0fm3x5bh (Accessed March 30, 2021).

Kongsager, R. and E. Corbera, 2015: Linking Mitigation and Adaptation in Carbon Forestry Projects: Evidence from Belize. *World Dev.*, **76**, 132–146, doi:10.1016/j.worlddev.2015.07.003.

Kongsager, R., B. Locatelli, and F. Chazarin, 2016: Addressing Climate Change Mitigation and Adaptation Together: a Global Assessment of Agriculture and Forestry Projects. *Environ. Manage.*, **57(2)**, 271–282, doi:10.1007/s00267-015-0605-y.

Kooij, H.-J. et al., 2018: Between grassroots and treetops: Community power and institutional dependence in the renewable energy sector in Denmark, Sweden and the Netherlands. *Energy Res. Soc. Sci.*, **37**, 52–64, doi:10.1016/j.erss.2017.09.019.

Koplow, D., 2018: Defining and Measuring Fossil Fuel Subsidies. In: *The Politics of Fossil Fuel Subsidies and their Reform* [Skovgaard, J. and H. Van Asselt, (eds.)]. Cambridge University Press, Cambridge, England, UK, pp. 23–46.

Kotilainen, K. et al., 2019: From path dependence to policy mixes for Nordic electric mobility: Lessons for accelerating future transport transitions. *Policy Sci.*, **52(4)**, 573–600, doi:10.1007/s11077-019-09361-3.

Kotze, L. and A. du Plessis, 2019: Putting Africa on the Stand: a Bird's Eye View of Climate Change Litigation on the Continent. *Univ. Oregon's J. Environ. Law Litig.*, **50(3)**, 615–663.

Krause, R.M., H. Yi, and R.C. Feiock, 2016: Applying Policy Termination Theory to the Abandonment of Climate Protection Initiatives by U.S. Local Governments. *Policy Stud. J.*, **44(2)**, 176–195, doi:10.1111/psj.12117.

Kriegler, E. et al., 2018: Short term policies to keep the door open for Paris climate goals. *Environ. Res. Lett.*, **13(7)**, 074022, doi:10.1088/1748-9326/aac4f1.

Krzywoszynska, A. et al., 2016: Co-producing energy futures: impacts of participatory modelling. *Build. Res. Inf.*, **44(7)**, 804–815, doi:10.1080/09613218.2016.1211838.

Kukkonen, A. et al., 2018: International organizations, advocacy coalitions, and domestication of global norms: Debates on climate change in Canada, the US, Brazil, and India. *Environ. Sci. Policy*, **81**, 54–62, doi:10.1016/J.ENVSCI.2017.12.008.

Kulovesi, K. and S. Oberthür, 2020: Assessing the EU's 2030 Climate and Energy Policy Framework: Incremental change toward radical transformation? *Rev. Eur. Comp. Int. Environ. Law*, **29(2)**, 151–166, doi:10.1111/reel.12358.

Kundzewicz, Z.W. et al., 2018: Uncertainty in climate change impacts on water resources. *Environ. Sci. Policy*, **79**(October 2017), 1–8, doi:10.1016/j.envsci.2017.10.008.

Kuramochi, T. et al., 2020: Beyond national climate action: the impact of region, city, and business commitments on global greenhouse gas emissions. *Clim. Policy*, **20(3)**, 275–291, doi:10.1080/14693062.2020.1740150.

Kuusi, T. et al., 2020: *Carbon Border Adjustment Mechanisms and Their Economic Impact on Finland and the EU*. ETLA Economic Research, Helsinki, Finland, https://www.etla.fi/en/publications/carbon-border-adjustment-mechanisms-and-their-economic-impact-on-finland-and-the-eu/ (Accessed October 18, 2021).

Kuzemko, C., M. Lockwood, C. Mitchell, and R. Hoggett, 2016: Governing for sustainable energy system change: Politics, contexts and contingency. *Energy Res. Soc. Sci.*, **12**, 96–105, doi:10.1016/j.erss.2015.12.022.

Kwakkel, J.H., W.E. Walker, and M. Haasnoot, 2016: Coping with the Wickedness of Public Policy Problems: Approaches for Decision-Making under Deep Uncertainty. *J. Water Resour. Plan. Manag.*, **142(3)**, 01816001, doi:10.1061/(ASCE)WR.1943-5452.0000626.

Kyle, J., 2018: Local Corruption and Popular Support for Fuel Subsidy Reform in Indonesia. *Comp. Polit. Stud.*, **51(11)**, 1472–1503, doi:10.1177/0010414018758755.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R.W. Vishny, 1998: Law and Finance. *J. Polit. Econ.*, **106(6)**, 1113–1155, doi:10.1086/250042.

Labeaga, J.M., X. Labandeira, and X. López-Otero, 2021: Energy taxation, subsidy removal and poverty in Mexico. *Environ. Dev. Econ.*, **26(3)**, 239–260, doi:10.1017/S1355770X20000364.

Lachapelle, E. and M. Paterson, 2013: Drivers of national climate policy. *Clim. Policy*, **13(5)**, 547–571, doi:10.1080/14693062.2013.811333.

Lachapelle, E., C.P. Borick, and B. Rabe, 2012: Public Attitudes toward Climate Science and Climate Policy in Federal Systems: Canada and the United States Compared. *Rev. Policy Res.*, **29(3)**, 334–357, doi:10.1111/j.1541-1338.2012.00563.x.

Ladrech, R. and C. Little, 2019: Drivers of political parties' climate policy preferences: lessons from Denmark and Ireland. *Env. Polit.*, **28(6)**, 1017–1038, doi:10.1080/09644016.2019.1625157.

Lægreid, O.M. and M. Povitkina, 2018: Do Political Institutions Moderate the GDP-CO_2 Relationship? *Ecol. Econ.*, **145**, 441–450, doi:10.1016/j.ecolecon.2017.11.014.

Lam, S.-P., 2015: Predicting support of climate policies by using a protection motivation model. *Clim. Policy*, **15(3)**, 321–338, doi:10.1080/14693062.2014.916599.

Lamb, W.F. and J.C. Minx, 2020: The political economy of national climate policy: Architectures of constraint and a typology of countries. *Energy Res. Soc. Sci.*, **64**, 101429, doi:10.1016/j.erss.2020.101429.

Landauer, M., S. Juhola, and M. Söderholm, 2015: Inter-relationships between adaptation and mitigation: a systematic literature review. *Clim. Change*, **131**, 505–517, doi:10.1007/s10584-015-1395-1.

Landauer, M., S. Juhola, and J. Klein, 2019: The role of scale in integrating climate change adaptation and mitigation in cities. *J. Environ. Plan. Manag.*, **62(5)**, 741–765, doi:10.1080/09640568.2018.1430022.

Langpap, C., 2015: Voluntary agreements and private enforcement of environmental regulation. *J. Regul. Econ.*, **47(1)**, 99–116, doi:10.1007/s11149-014-9265-8.

Laurent, B. and D. Pontille, 2018: Towards a study of city experiments. In: *Creating Smart Cities* [Coletta, C., L. Evans, L. Heaphy, and R. Kitchin, (eds.)]. Routledge, Oxfordshire, UK, pp. 90–103.

Le Treut, G., J. Lefèvre, F. Lallana, and G. Bravo, 2021: The multi-level economic impacts of deep decarbonization strategies for the energy system. *Energy Policy*, **156**, 1–16, doi:10.1016/j.enpol.2021.112423.

Leck, H. and D. Roberts, 2015: What lies beneath: Understanding the invisible aspects of municipal climate change governance. *Curr. Opin. Environ. Sustain.*, **13**, 61–67, doi:10.1016/j.cosust.2015.02.004.

Lecuyer, O. and P. Quirion, 2019: Interaction between CO_2 emissions trading and renewable energy subsidies under uncertainty: feed-in tariffs as a safety net against over-allocation. *Clim. Policy*, **19(8)**, doi:10.1080/14693062.2019.1625743.

Lee, T., 2013: Global Cities and Transnational Climate Change Networks. *Glob. Environ. Polit.*, **13(1)**, 108–127, doi:10.1162/GLEP_a_00156.

Lee, T., 2017: The effect of clean energy regulations and incentives on green jobs: panel analysis of the United States, 1998-2007. *Nat. Resour. Forum*, **41(3)**, 145–155, doi:10.1111/1477-8947.12125.

Lee, T., 2019: Network comparison of socialization, learning and collaboration in the C40 cities climate group. *J. Environ. Policy Plan.*, **21(1)**, 104–115, doi:10.1080/1523908X.2018.1433998.

Lee, T. and C. Koski, 2012: Building Green: Local Political Leadership Addressing Climate Change. *Rev. Policy Res.*, **29(5)**, 605–624, doi:10.1111/j.1541-1338.2012.00579.x.

Lee, T. and H.Y. Jung, 2018: Mapping city-to-city networks for climate change action: Geographic bases, link modalities, functions, and activity. *J. Clean. Prod.*, **182**, 96–104, doi:10.1016/j.jclepro.2018.02.034.

Lee, T.M., E.M. Markowitz, P.D. Howe, C.-Y. Ko, and A.A. Leiserowitz, 2015: Predictors of public climate change awareness and risk perception around the world. *Nat. Clim. Change*, **5(11)**, 1014–1020, doi:10.1038/nclimate2728.

Leipold, S., P.H. Feindt, G. Winkel, and R. Keller, 2019: Discourse analysis of environmental policy revisited: traditions, trends, perspectives. *J. Environ. Policy Plan.*, **21(5)**, 445–463, doi:10.1080/1523908X.2019.1660462.

Leiren, M.D. and I. Reimer, 2018: Historical institutionalist perspective on the shift from feed-in tariffs towards auctioning in German renewable energy policy. *Energy Res. Soc. Sci.*, **43**, 33–40, doi:10.1016/j.erss.2018.05.022.

Leiserowitz, A., 2006: Climate Change Risk Perception and Policy Preferences: The Role of Affect, Imagery, and Values. *Clim. Change*, **77(1–2)**, 45–72, doi:10.1007/s10584-006-9059-9.

Leiter, T. and P. Pringle, 2018: *Pitfalls and Potential of Measuring Climate Change Adaptation through Adaptation Metrics*. UNEP DTU Partnership, Copenhagen, Denmark, Denmark, 166 pp. https://resilientcities2018.iclei.org/wp-content/uploads/UDP_Perspectives-Adaptation-Metrics-WEB.pdf. (Accessed September 24, 2021).

Leiter, T. et al., 2019: *Adaptation metrics: current landscape and evolving practices*. UNEP DTU Partnership Global Commission on Adaptation, Rotterdam and Washington, DC, USA, 51 pp.

Lennon, M., 2020: Postcarbon Amnesia: Toward a Recognition of Racial Grief in Renewable Energy Futures. *Sci. Technol. Hum. Values*, **45(5)**, 934–962, doi:10.1177/0162243919900556.

Letnik, T., M. Marksel, G. Luppino, A. Bardi, and S. Božičnik, 2018: Review of policies and measures for sustainable and energy efficient urban transport. *Energy*, **163**, 245–257, doi:10.1016/j.energy.2018.08.096.

Levenda, A.M., J. Richter, T. Miller, and E. Fisher, 2019: Regional sociotechnical imaginaries and the governance of energy innovations. *Futures*, **109**, 181–191, doi:10.1016/j.futures.2018.03.001.

Levi, S., C. Flachsland, and M. Jakob, 2020: Political Economy Determinants of Carbon Pricing. *Glob. Environ. Polit.*, **20(2)**, 128–156, doi:10.1162/glep_a_00549.

Levin, K. et al., 2018: *Long-Term Low Greenhouse Gas Emission Development Strategies: Approaches and Methodologies for Their Design*. World Resources Institute (WRI), Washington DC and UNDP, New York, USA, 52 pp. https://files.wri.org/s3fs-public/long-term-low-greenhouse-gas-emission-development-strategies.pdf.

Levin, K., D. Rich, K. Ross, T. Fransen, and C. Elliott, 2020: *Designing and Communicating Net-Zero Targets*. World Resources Institute (WRI), Washington, DC, USA, 30 pp. https://www.wri.org/research/designing-and-communicating-net-zero-targets (Accessed October 20, 2021).

Levinson, A., 2019: Energy Efficiency Standards Are More Regressive Than Energy Taxes: Theory and Evidence. *J. Assoc. Environ. Resour. Econ.*, **6(S1)**, doi:10.1086/701186.

Lewis, J., D. Hernández, and A.T. Geronimus, 2020: Energy efficiency as energy justice: addressing racial inequities through investments in people and places. *Energy Effic.*, **13(3)**, 419–432, doi:10.1007/s12053-019-09820-z.

Lewison, R. et al., 2015: Dynamic Ocean Management: Identifying the Critical Ingredients of Dynamic Approaches to Ocean Resource Management. *Bioscience*, **65(5)**, 486–498, doi:10.1093/biosci/biv018.

Li, A., Y. Xu, and H. Shiroyama, 2019: Solar lobby and energy transition in Japan. *Energy Policy*, **134**, 110950, doi:10.1016/j.enpol.2019.110950.

Li, H., X. Zhao, Y. Yu, T. Wu, and Y. Qi, 2016: China's numerical management system for reducing national energy intensity. *Energy Policy*, **94**, 64–76, doi:10.1016/j.enpol.2016.03.037.

Li, H. et al., 2017: Reducing rebound effect through fossil subsidies reform: a comprehensive evaluation in China. *J. Clean. Prod.*, **141**, 305–314, doi:10.1016/j.jclepro.2016.09.108.

Li, M. et al., 2018: Air quality co-benefits of carbon pricing in China. *Nat. Clim. Change*, **8(5)**, 398, doi:10.1038/s41558-018-0139-4.

Liang Wong, I. and E. Krüger, 2017: Comparing energy efficiency labelling systems in the EU and Brazil: Implications, challenges, barriers and opportunities. *Energy Policy*, **109**, 310–323, doi:10.1016/j.enpol.2017.07.005.

Liefferink, D., B. Arts, J. Kamstra, and J. Ooijevaar, 2009: Leaders and laggards in environmental policy: a quantitative analysis of domestic policy outputs. *J. Eur. Public Policy*, **16(5)**, 677–700, doi:10.1080/13501760902983283.

Lieu, J. et al., 2018: Evaluating Consistency in Environmental Policy Mixes through Policy, Stakeholder, and Contextual Interactions. *Sustainability*, **10(6)**, 1896, doi:10.3390/su10061896.

Lilliestam, J., A. Patt, and G. Bersalli, 2021: The effect of carbon pricing on technological change for full energy decarbonization: a review of empirical ex-post evidence. *WIREs Clim. Change*, **12(1)**, e681, doi:10.1002/wcc.681.

Lin, J., 2012a: Climate Governance in China: Using the 'Iron Hand'. In: *Local Climate Change Law: Environmental Regulation in Cities and Other Localities* [Richardson, B.J., (ed.)]. Edward Elgar Publishing, Cheltenham, UK and Northampton, MA, USA, pp. 424.

Lin, J., 2012b: Climate change and the courts. *Leg. Stud.*, **32(1)**, 35–57, doi:10.1111/j.1748-121X.2011.00206.x.

Lin, J. and D.A. Kysar, eds., 2020: *Climate Change Litigation in the Asia Pacific*. Cambridge University Press, Cambridge, UK, 428 pp.

Liu, J.-Y. et al., 2019: Identifying trade-offs and co-benefits of climate policies in China to align policies with SDGs and achieve the 2°C goal. *Environ. Res. Lett.*, **14(12)**, 1–11, doi:10.1088/1748-9326/ab59c4.

Liu, T., Q. Wang, and B. Su, 2016: a review of carbon labeling: Standards, implementation, and impact. *Renew. Sustain. Energy Rev.*, **53**, 68–79, doi:10.1016/j.rser.2015.08.050.

Liu, W., W.J. McKibbin, A.C. Morris, and P.J. Wilcoxen, 2020: Global economic and environmental outcomes of the Paris Agreement. *Energy Econ.*, **90**, 104838, doi:10.1016/j.eneco.2020.104838.

Liu, X., E. Lindquist, and A. Vedlitz, 2011: Explaining Media and Congressional Attention to Global Climate Change, 1969-2005: An Empirical Test of Agenda-Setting Theory. *Polit. Res. Q.*, **64(2)**, 405–419, doi:10.1177/1065912909346744.

Lo, A.Y., 2013: Carbon trading in a socialist market economy: Can China make a difference? *Ecol. Econ.*, **87**, 72–74, doi:10.1016/j.ecolecon.2012.12.023.

Lo, A.Y. and R. Cong, 2017: After CDM: Domestic carbon offsetting in China. *J. Clean. Prod.*, **141**, 1391–1399, doi:10.1016/j.jclepro.2016.09.220.

Loaiza, T., M.O. Borja, U. Nehren, and G. Gerold, 2017: Analysis of land management and legal arrangements in the Ecuadorian Northeastern Amazon as preconditions for REDD+ implementation. *For. Policy Econ.*, **83**(June), 19–28, doi:10.1016/j.forpol.2017.05.005.

Locatelli, B., V. Evans, A. Wardell, A. Andrade, and R. Vignola, 2011: Forests and Climate Change in Latin America: Linking Adaptation and Mitigation. *Forests*, **2(1)**, 431–450, doi:10.3390/f2010431.

Locatelli, B. et al., 2017: Research on climate change policies and rural development in Latin America: Scope and gaps. *Sustain.*, **9(10)**, 1–17, doi:10.3390/su9101831.

Lockwood, M., 2013: The political sustainability of climate policy: The case of the UK Climate Change Act. *Glob. Environ. Change*, **23(5)**, 1339–1348, doi:10.1016/j.gloenvcha.2013.07.001.

Lockwood, M., 2021a: a hard Act to follow? The evolution and performance of UK climate governance. *Env. Polit.*, **30(sup1)**, 26–48, doi:10.1080/09644016.2021.1910434.

Lockwood, M., 2021b: Routes to credible climate commitment: the UK and Denmark compared. *Clim. Policy*, **21(9)**, 1–14, doi:10.1080/14693062.2020.1868391.

Lockwood, M., C. Kuzemko, C. Mitchell, and R. Hoggett, 2017: Historical institutionalism and the politics of sustainable energy transitions: a research agenda. *Environ. Plan. C Polit. Sp.*, **35(2)**, 312–333, doi:10.1177/0263774X16660561.

Long, J. and J.L. Rice, 2019: From sustainable urbanism to climate urbanism. *Urban Stud.*, **56(5)**, 992–1008, doi:10.1177/0042098018770846.

Longhofer, W. and A. Jorgenson, 2017: Decoupling reconsidered: Does world society integration influence the relationship between the environment and economic development? *Soc. Sci. Res.*, **65**, 17–29, doi:10.1016/j.ssresearch.2017.02.002.

Longhofer, W., E. Schofer, N. Miric, and D.J. Frank, 2016: NGOs, INGOs, and Environmental Policy Reform, 1970–2010. *Soc. Forces*, **94(4)**, 1743–1768, doi:10.1093/sf/sow031.

Lorenzoni, I. and D. Benson, 2014: Radical institutional change in environmental governance: Explaining the origins of the UK Climate Change Act 2008 through discursive and streams perspectives. *Glob. Environ. Change*, **29**, 10–21, doi:10.1016/j.gloenvcha.2014.07.011.

Loth, M.A., 2016: Climate Change Liability After All: a Dutch Landmark Case. *Tilbg. Law Rev.*, **21(1)**, doi:10.1163/22112596-02101001.

Lovelock, C.E. and R. Reef, 2020: Variable Impacts of Climate Change on Blue Carbon. *One Earth*, **3(2)**, 195–211, doi:10.1016/j.oneear.2020.07.010.

LSE Grantham Research Institute on Climate Change and the Environment, 2021: Climate Change Laws of the World. https://climate-laws.org/ (Accessed March 30, 2021).

Lück, J., H. Wessler, A. Wozniak, and D. Lycarião, 2018: Counterbalancing global media frames with nationally colored narratives: a comparative study of news narratives and news framing in the climate change coverage of five countries. *Journalism*, **19(12)**, 1635–1656, doi:10.1177/1464884916680372.

Lyon, T.P., 2016: Drivers and Impacts of Renewable Portfolio Standards. *Annu. Rev. Resour. Econ.*, **8(1)**, 141–155, doi:10.1146/annurev-resource-100815-095432.

Lyytimäki, J., 2011: Mainstreaming climate policy: the role of media coverage in Finland. *Mitig. Adapt. Strateg. Glob. Change*, **16(6)**, 649–661, doi:10.1007/s11027-011-9286-x.

Ma, S.-C., Y. Fan, and L. Feng, 2017: An evaluation of government incentives for new energy vehicles in China focusing on vehicle purchasing restrictions. *Energy Policy*, **110**(October), 609–618, doi:10.1016/j.enpol.2017.07.057.

MacArthur, J.L., C.E. Hoicka, H. Castleden, R. Das, and J. Lieu, 2020: Canada's Green New Deal: Forging the socio-political foundations of climate resilient infrastructure? *Energy Res. Soc. Sci.*, **65**, 101442, doi:10.1016/j.erss.2020.101442.

Macchi, C. and J. Zeben, 2021: Business and human rights implications of climate change litigation: Milieudefensie et al. vs Royal Dutch Shell. *Rev. Eur. Comp. Int. Environ. Law*, **30(3)**, 409–415, doi:10.1111/reel.12416.

MacNeil, R., 2021: Swimming against the current: Australian climate institutions and the politics of polarisation. *Env. Polit.*, **30(sup1)**, 162–183, doi:10.1080/09644016.2021.1905394.

Madden, N.J., 2014: Green means stop: veto players and their impact on climate-change policy outputs. *Env. Polit.*, **23(4)**, 570–589, doi:10.1080/09644016.2014.884301.

Maestre-Andrés, S., S. Drews, and J. van den Bergh, 2019: Perceived fairness and public acceptability of carbon pricing: a review of the literature. *Clim. policy*, **19(9)**, 1186–1204, doi.org/10.1080/14693062.2019.1639490.

Magro, E., M. Navarro, and J.M. Zabala-Iturriagagoitia, 2014: Coordination-Mix: The Hidden Face of STI Policy. *Rev. Policy Res.*, **31(5)**, 367–389, doi:10.1111/ropr.12090.

Mahdavi, P., C.B. Martinez-Alvarez, and M. Ross, 2020: *Why Do Governments Tax or Subsidize Fossil Fuels?* Center for Global Development, Washington, DC, USA, 72 pp. https://www.cgdev.org/sites/default/files/why-do-governments-tax-or-subsidize-fossil-fuels.pdf (Accessed October 19, 2021).

Maier, H.R. et al., 2016: An uncertain future, deep uncertainty, scenarios, robustness and adaptation: How do they fit together? *Environ. Model. Softw.*, **81**, 154–164, doi:10.1016/j.envsoft.2016.03.014.

Marjanac, S. and L. Patton, 2018: Extreme weather event attribution science and climate change litigation: an essential step in the causal chain? *J. Energy Nat. Resour. Law*, **36(3)**, 265–298, doi:10.1080/02646811.2018.1451020.

Marjanac, S., L. Patton, and J. Thornton, 2017: Acts of God, human influence and litigation. *Nat. Geosci.*, **10(9)**, 616–619, doi:10.1038/ngeo3019.

Markard, J., 2018: The next phase of the energy transition and its implications for research and policy. *Nat. Energy*, **3(8)**, 628–633, doi:10.1038/s41560-018-0171-7.

Markard, J., F.W. Geels, and R. Raven, 2020: Challenges in the acceleration of sustainability transitions. *Environ. Res. Lett.*, **15(8)**, 081001, doi:10.1088/1748-9326/ab9468.

Markell, D. and J.B. Ruhl, 2012: An Empirical Assessment of Climate Change in the Courts: a New Jurisprudence or Business as Usual. *Fla. Law Rev.*, **64(1)**, 15–86.

Markkanen, S. and A. Anger-Kraavi, 2019: Social impacts of climate change mitigation policies and their implications for inequality. *Clim. Policy*, **19(7)**, 827–844, doi:10.1080/14693062.2019.1596873.

Markowitz, E.M. and M.L. Guckian, 2018: Climate change communication: Challenges, insights, and opportunities. In: *Psychology and Climate Change: Human Perceptions, Impacts, and Responses* [Clayton S. and C. Manning (eds.)]. Academic Press, Elsevier, London, UK, pp. 35–63.

Marlon, J.R. et al., 2019: How Hope and Doubt Affect Climate Change Mobilization. *Front. Commun.*, **4**, 20 pp., doi:10.3389/fcomm.2019.00020.

Marlow, T., S. Miller, and J.T. Roberts, 2021: Bots and online climate discourses: Twitter discourse on President Trump's announcement of U.S. withdrawal from the Paris Agreement. *Clim. Policy*, **21(6)**, 765–777, doi:10.1080/14693062.2020.1870098.

Marquardt, J., 2014: a Struggle of Multi-level Governance: Promoting Renewable Energy in Indonesia. *Energy Procedia*, **58**, 87–94, doi:10.1016/j.egypro.2014.10.413.

Marris, E., 2019: Why young climate activists have captured the world's attention. *Nature*, **573(7775)**, 471–472, doi:10.1038/d41586-019-02696-0.

Martin, M. and M. Islar, 2021: The 'end of the world' vs. the 'end of the month': understanding social resistance to sustainability transition agendas, a lesson from the Yellow Vests in France. *Sustain. Sci.*, **16(2)**, 601–614, doi:10.1007/s11625-020-00877-9.

Martinez Romera, B. and R. Caranta, 2017: EU Public Procurement Law: Purchasing beyond Price in the Age of Climate Change. *Eur. Procure. Pub. Priv. Partnersh. L. Rev.*, **12**, 281, doi:10.21552/epppl/2017/3/10.

Martinez, S., S. Kralisch, O. Escolero, and M. Perevochtchikova, 2015: Vulnerability of Mexico City's water supply sources in the context of climate change. *J. Water Clim. Change*, **6(3)**, 518–533, doi:10.2166/wcc.2015.083.

Martiskainen, M., 2017: The role of community leadership in the development of grassroots innovations. *Environ. Innov. Soc. Transitions*, **22**, 78–89, doi:10.1016/j.eist.2016.05.002.

Martiskainen, M. et al., 2020: Contextualizing climate justice activism: Knowledge, emotions, motivations, and actions among climate strikers in six cities. *Glob. Environ. Change*, **65**, 102180, doi:10.1016/j.gloenvcha.2020.102180.

Marvin, S., H. Bulkeley, L. Mai, K. McCormick, and Y. Voytenko Palgan, eds., 2018: *Urban Living Labs: Experimenting with City Futures*. 1st ed. Routledge, Oxfordshire, England, UK, 279 pp.

Mason, C.F. and A.J. Plantinga, 2013: The additionality problem with offsets: Optimal contracts for carbon sequestration in forests. *J. Environ. Econ. Manage.*, **66(1)**, 1–14, doi:10.1016/j.jeem.2013.02.003.

Matsumoto, K., K. Morita, D. Mavrakis, and P. Konidari, 2017: Evaluating Japanese policy instruments for the promotion of renewable energy sources. *Int. J. Green Energy*, **14(8)**, 724–736, doi:10.1080/15435075.2017.1326050.

Matthes, F.C., 2017: Energy transition in Germany: a case study on a policy-driven structural change of the energy system. *Evol. Institutional Econ. Rev.*, **14(1)**, 141–169, doi:10.1007/s40844-016-0066-x.

Mauritsen, T. and R. Pincus, 2017: Committed warming inferred from observations. *Nat. Clim. Change*, **7(9)**, 652–655, doi:10.1038/nclimate3357.

Mayer, A., T.O. Shelley, T. Chiricos, and M. Gertz, 2017: Environmental Risk Exposure, Risk Perception, Political Ideology and Support for Climate Policy. *Sociol. Focus*, **50(4)**, 309–328, doi:10.1080/00380237.2017.1312855.

Mayer, B., 2019: The State of the Netherlands v. Urgenda Foundation: Ruling of the Court of Appeal of The Hague (9 October 2018). *Transnatl. Environ. Law*, **8(1)**, 167–192, doi:10.1017/S2047102519000049.

Mayer, J., 2016: *Dark Money: the Hidden History of the Billionaires Behind the Rise of the Radical Right*. Doubleday, New York, USA, 576 pp.

Mayrhofer, J.P. and J. Gupta, 2016: The science and politics of co-benefits in climate policy. *Environ. Sci. Policy*, **57**, 22–30, doi:10.1016/j.envsci.2015.11.005.

Mazmanian, D.A., J.L. Jurewitz, and H.T. Nelson, 2020: State Leadership in U.S. Climate Change and Energy Policy: The California Experience. *J. Environ. Dev.*, **29(1)**, 51–74, doi:10.1177/1070496519887484.

Mbeva, K., C. Ochieng, J. Atela, W. Khaemba, and C. Tonui, 2015: *Intended Nationally Determined Contributions as a Means to Strengthening Africa's Engagement in International Climate Negotiations*. African Centre for Technology Studies, Nairobi, Kenya 1–28 pp. https://media.africaportal.org/documents/INDC_PaperFin.pdf (Accessed March 30, 2021).

McAdam, D., 2017: Social Movement Theory and the Prospects for Climate Change Activism in the United States. *Annu. Rev. Polit. Sci.*, **20(1)**, 189–208, doi:10.1146/annurev-polisci-052615-025801.

McAdam, D. and H.S. Boudet, 2012: *Putting social movements in their place: Explaining opposition to energy projects in the United States, 2000–2005*. Cambridge University Press, Cambridge, UK, 1–266 pp.

McAllister, L. et al., 2021: Balance as bias, resolute on the retreat? Updates & analyses of newspaper coverage in the United States, United Kingdom, New Zealand, Australia and Canada over the past 15 years. *Environ. Res. Lett.*, **16(9)**, 094008, doi:10.1088/1748-9326/ac14eb.

McAllister, L.K., 2007: Revisiting a Promising Institution: Public Law Litigation in the Civil Law World. *Ga. State Univ. Law Rev.*, **24(3)**, 693–734.

McAllister, R.R.J., R. McCrea, and M.N. Lubell, 2014: Policy networks, stakeholder interactions and climate adaptation in the region of South East Queensland, Australia. *Reg. Environ. Change*, **14(2)**, 527–539, doi:10.1007/s10113-013-0489-4.

McBurney, M., 2021: Paying for Ecological Services in Ecuador: The Socio Bosque Program in Kichwa Communities of Chimborazo, Ecuador. The University of Guelph, Ontario, Canada, 280 pp. https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/59975/IDL – 59975.pdf?sequence=2&isAllowed=y.

McCauley, D. and R. Heffron, 2018: Just Transition: Integrating climate, energy and environmental justice. *Energy Policy*, **119**, 1–7, doi:10.1016/j.enpol.2018.04.014.

McCloskey, M., 1991: Twenty years of change in the environmental movement: An insider's view. *Soc. Nat. Resour.*, **4(3)**, 273–284, doi:10.1080/08941929109380760.

McCollum, D.L. et al., 2018: Connecting the sustainable development goals by their energy inter-linkages. *Environ. Res. Lett.*, **13(3)**, 033006, doi:10.1088/1748-9326/aaafe3.

McCord, G.C., D.R. Kanter, J. Sklarew, G. Wu, and M. Jacobson, 2020: *Chapter 5.5: Accelerating Sustainable Land Use Practices in the U.S*. Sustainable Development Solutions Network, New York, USA, 262–281 pp. https://www.unsdsn.org/Zero-Carbon-Action-Plan (Accessed October 20, 2021).

McCormick, S. et al., 2018: Strategies in and outcomes of climate change litigation in the United States. *Nat. Clim. Change*, **8(9)**, 829–833, doi:10.1038/s41558-018-0240-8.

McCright, A.M. and R.E. Dunlap, 2000: Challenging Global Warming as a Social Problem: An Analysis of the Conservative Movement's Counter-Claims. *Soc. Probl.*, **47(4)**, 499–522, doi:10.2307/3097132.

McCright, A.M. and R.E. Dunlap, 2003: Defeating Kyoto: The Conservative Movement's Impact on U.S. Climate Change Policy. *Soc. Probl.*, **50(3)**, 348–373, doi:10.1525/sp.2003.50.3.348.

McCright, A.M., R.E. Dunlap, and S.T. Marquart-Pyatt, 2016a: Political ideology and views about climate change in the European Union. *Env. Polit.*, **25(2)**, 338–358, doi:10.1080/09644016.2015.1090371.

McCright, A.M., S.T. Marquart-Pyatt, R.L. Shwom, S.R. Brechin, and S. Allen, 2016b: Ideology, capitalism, and climate: Explaining public views about climate change in the United States. *Energy Res. Soc. Sci.*, **21**, 180–189, doi:10.1016/j.erss.2016.08.003.

McGlade, C. and P. Ekins, 2015: The geographical distribution of fossil fuels unused when limiting global warming to 2°C. *Nature*, **517(7533)**, 187–190, doi:10.1038/nature14016.

McGregor, P.G., J. Kim Swales, and M.A. Winning, 2012: a review of the role and remit of the committee on climate change. *Energy Policy*, **41**, 466–473, doi:10.1016/j.enpol.2011.11.007.

Mcguirk, P., R. Dowling, C. Brennan, and H. Bulkeley, 2015: Urban Carbon Governance Experiments: The Role of Australian Local Governments. *Geogr. Res.*, **53(1)**, 39–52, doi:10.1111/1745-5871.12098.

McMeekin, A., F.W. Geels, and M. Hodson, 2019: Mapping the winds of whole system reconfiguration: Analysing low-carbon transformations across production, distribution and consumption in the UK electricity system (1990–2016). *Res. Policy*, **48(5)**, 1216–1231, doi:10.1016/j.respol.2018.12.007.

Meadowcroft, J., 2009: What about the politics? Sustainable development, transition management, and long term energy transitions. *Policy Sci.*, **42(4)**, 323–340, doi:10.1007/s11077-009-9097-z.

Meckling, J., 2011: *Carbon Coalitions: Business, Climate Politics, and the Rise of Emissions Trading*. MIT Press, Cambridge, MA, USA, 264 pp.

Meckling, J. and J. Nahm, 2018: The power of process: state capacity and climate policy. *Governance*, **31(4)**, 741–757, doi:10.1111/gove.12338.

Meckling, J., N. Kelsey, E. Biber, and J. Zysman, 2015: Winning coalitions for climate policy: Green industrial policy builds support for carbon regulations. *Science*, **349(6253)**, 1170–1171, doi:10.1126/science.aab1336.

Mehling, M.A., H. Van Asselt, K. Das, S. Droege, and C. Verkuijl, 2019: Designing Border Carbon Adjustments for Enhanced Climate Action. *Am. J. Int. Law*, **113(3)**, 433–481, doi:10.1017/ajil.2019.22.

Melamed, M.L., J. Schmale, and E. von Schneidemesser, 2016: Sustainable policy—key considerations for air quality and climate change. *Curr. Opin. Environ. Sustain.*, **23**, 85–91, doi:10.1016/j.cosust.2016.12.003.

Mercure, J.F. et al., 2019: System complexity and policy integration challenges: The Brazilian Energy- Water-Food Nexus. *Renew. Sustain. Energy Rev.*, **105**(February), 230–243, doi:10.1016/j.rser.2019.01.045.

Messori, G., F. Brocchieri, E. Morello, S. Ozgen, and S. Caserini, 2020: a climate mitigation action index at the local scale: Methodology and case study. *J. Environ. Manage.*, **260**, 110024, doi:10.1016/j.jenvman.2019.110024.

Metcalf, G.E. and J.H. Stock, 2017: Integrated Assessment Models and the Social Cost of Carbon: a Review and Assessment of U.S. Experience. *Rev. Environ. Econ. Policy*, **11(1)**, 80–99, doi:10.1093/reep/rew014.

Metcalf, G.E. and J.H. Stock, 2020: *The Macroeconomic Impact of Europe's Carbon Taxes*. 53 pp. https://www.nber.org/system/files/working_papers/w27488/w27488.pdf.

Michaelowa, A., M. Allen, and F. Sha, 2018: Policy instruments for limiting global temperature rise to 1.5°C – can humanity rise to the challenge? *Clim. Policy*, **18(3)**, 275–286, doi:10.1080/14693062.2018.1426977.

Michaelowa, A., L. Hermwille, W. Obergassel, and S. Butzengeiger, 2019a: Additionality revisited: guarding the integrity of market mechanisms under the Paris Agreement. *Clim. Policy*, **19(10)**, 1211–1224, doi:10.1080/14693062.2019.1628695.

Michaelowa, A., I. Shishlov, S. Hoch, P. Bofil, and A. Espelage, 2019b: *Overview and comparison of existing carbon crediting schemes*. Nordic Environment Finance Corporation (NEFCO), Helsinki, Finland, 54 pp. https://www.nefco.int/wp-content/uploads/2019/05/NICA-Crediting-Mechanisms-Final-February-2019.pdf (Accessed October 18, 2021).

Michaelowa, K. and A. Michaelowa, 2017: Transnational Climate Governance Initiatives: Designed for Effective Climate Change Mitigation? *Int. Interact.*, **43(1)**, 129–155, doi:10.1080/03050629.2017.1256110.

Middlemiss, L., 2011: The effects of community-based action for sustainability on participants' lifestyles. *Local Environ.*, **16(3)**, 265–280, doi:10.1080/13549839.2011.566850.

Mildenberger, M., 2020: *Carbon Captured: How Business and Labor Control Climate Politics*. MIT Press, Cambridge, Massachusetts, USA, 368 pp.

Mildenberger, M., 2021: The development of climate institutions in the United States. *Env. Polit.*, **30(sup1)**, 71–92, doi:10.1080/09644016.2021.1947445.

Mildenberger, M. and D. Tingley, 2019: Beliefs about Climate Beliefs: The Importance of Second-Order Opinions for Climate Politics. *Br. J. Polit. Sci.*, **49(4)**, 1279–1307, doi:10.1017/S0007123417000321.

Millard-Ball, A. and L. Ortolano, 2010: Constructing carbon offsets: The obstacles to quantifying emission reductions. *Energy Policy*, **38(1)**, 533–546, doi:10.1016/j.enpol.2009.10.005.

Miller, S.M. et al., 2019: China's coal mine methane regulations have not curbed growing emissions. *Nat. Commun.*, **10(1)**, 303, doi:10.1038/s41467-018-07891-7.

Mills-Novoa, M. and D.M. Liverman, 2019: Nationally Determined Contributions: Material climate commitments and discursive positioning in the NDCs. *WIREs Clim. Change*, **10(5)**, e589, doi:10.1002/wcc.589.

Minnerop, P. and F.E.L. Otto, 2020: Climate change and causation: joining law and climate science on the basis of formal logic. *Buffalo Environ. Law J.*, **27**, 49–86.

Minx et al., 2021: A comprehensive and synthetic dataset for global, regional, and national greenhouse gas emissions by sector 1970–2018 with an extension to 2019. *Earth Syst. Sci. Data*, **13**, 5213–5252, doi:10.5194/essd-13-5213-2021.

Mistry, R., 2014: *MAPS Provocateur Briefing Report Forum on Development and Mitigation-Hunger, Poverty, Inequality and Climate Change Mitigation*. Oxfam, South Africa, Johannesburg, 7 pp. https://www.africaportal.org/publications/maps-provocateur-briefing-report-forum-on-development-and-mitigation-hunger-poverty-inequality-and-climate-change-mitigation/.

13

Moallemi, E.A. and S. Malekpour, 2018: A participatory exploratory modelling approach for long-term planning in energy transitions. *Energy Res. Soc. Sci.*, **35**, 205–216, doi:10.1016/j.erss.2017.10.022.

Moe Singh, E., 2012: Structural Change, Vested Interests, and Scandinavian Energy Policy-Making: Why Wind Power Struggles in Norway and not in Denmark. *Open Renew. Energy J.*, **5(1)**, 19–31, doi:10.2174/1876387101205010019.

Mohtar, R.H. and B. Daher, 2014: *A Platform for Trade-off Analysis and Resource Allocation: The Water-Energy-Food Nexus Tool and its Application to Qatar's Food Security*. The Royal Institute of International Affairs, Chatham House, London, UK, 10 pp. https://agrilife.org/wefnexus/files/2015/01/20141216WaterEnergyFoodNexusQatarMohtarDaher.pdf.

Mol, A.P.J., D.A. Sonnenfeld, and G. Spaargaren, eds., 2009: *The Ecological Modernisation Reader: Environmental reform in theory and practice*. 1st ed. Routledge, Oxfordshire, England, UK, 560 pp.

Monasterolo, I. and M. Raberto, 2019: The impact of phasing out fossil fuel subsidies on the low-carbon transition. *Energy Policy*, **124**, 355–370, doi:10.1016/j.enpol.2018.08.051.

Montgomery, L., P.A. McLaughlin, T. Richards, and M. Febrizio, 2019: *Performance Standards vs. Design Standards: Facilitating a Shift toward Best Practices*. Mercatus Center, George Mason University Arlington, VA, USA, 37 pp.

Moreira, P.F. et al., 2019: South–south transnational advocacy: Mobilizing against Brazilian dams in the Peruvian amazon. *Glob. Environ. Polit.*, **19(1)**, 77–98, doi:10.1162/glep_a_00495.

Morris, C. and A. Jungjohann, 2016: *Energy Democracy: Germany's Energiewende to Renewables*. Palgrave Macmillan, London, UK, 437 pp.

Moss, T. and M. Bazilian, 2018: Signalling, governance, and goals: Reorienting the United States Power Africa initiative. *Energy Res. Soc. Sci.*, **39**, 74–77, doi:10.1016/j.erss.2017.11.001.

Mourao, P.R., 2019: The effectiveness of Green voices in parliaments: Do Green Parties matter in the control of pollution? *Environ. Dev. Sustain.*, **21(2)**, 985–1011, doi:10.1007/s10668-017-0070-2.

Mulugetta, Y. and V. Castán Broto, 2018: Harnessing deep mitigation opportunities of urbanisation patterns in LDCs. *Curr. Opin. Environ. Sustain.*, **30**, 82–88, doi:10.1016/j.cosust.2018.03.007.

Mundaca, L. and A. Markandya, 2016: Assessing regional progress towards a 'Green Energy Economy'. *Appl. Energy*, **179**, 1372–1394, doi:10.1016/j.apenergy.2015.10.098.

Muradian, R. and U. Pascual, 2020: Ecological economics in the age of fear. *Ecol. Econ.*, **169**, doi:10.1016/j.ecolecon.2019.106498.

Murray, B. and N. Rivers, 2015: British Columbia's revenue-neutral carbon tax: A review of the latest 'grand experiment' in environmental policy. *Energy Policy*, **86**, 674–683, doi:10.1016/j.enpol.2015.08.011.

Nachmany, M. and J. Setzer, 2018: *Global trends in climate change legislation and litigation: 2018 snapshot*. Grantham Research Institute on Climate Change, London, UK, 8 pp. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2018/04/Global-trends-in-climate-change-legislation-and-litigation-2018-snapshot-3.pdf.

Nachmany, M. et al., 2015: *The 2015 Global Climate Legislation Study: a review of climate change legislation in 99 countries: summary for policy-makers*. Grantham Research Institute on Climate Change and the Environment, GLOBE and Inter-Parliamentary Union, London, UK, 45 pp.

Nago, M. and M. Krott, 2020: Systemic failures in north–south climate change knowledge transfer: a case study of the Congo Basin. *Clim. Policy*, **22 (5)** 1–14, doi:10.1080/14693062.2020.1820850.

Nagorny-Koring, N.C., 2019: Leading the way with examples and ideas? Governing climate change in German municipalities through best practices. *J. Environ. Policy Plan.*, **21(1)**, 46–60, doi:10.1080/1523908X.2018.1461083.

Nagorny-Koring, N.C. and T. Nochta, 2018: Managing urban transitions in theory and practice – The case of the Pioneer Cities and Transition Cities projects. *J. Clean. Prod.*, **175**, 60–69, doi:10.1016/j.jclepro.2017.11.072.

Nakano, R. et al., 2017: Low Carbon Governance in Indonesia and India: A Comparative Analysis with Recommendations. *Procedia Eng.*, **198**, 570–588, doi:10.1016/j.proeng.2017.07.112.

Nalau, J. and J. Handmer, 2015: When is transformation a viable policy alternative? *Environ. Sci. Policy*, **54**, 349–356, doi:10.1016/j.envsci.2015.07.022.

Narassimhan, E., K.S. Gallagher, S. Koester, and J.R. Alejo, 2018: Carbon pricing in practice: a review of existing emissions trading systems. *Clim. Policy*, **18(8)**, 967–991, doi:10.1080/14693062.2018.1467827.

Nascimento, L. et al., 2021: Twenty years of climate policy: G20 coverage increased, but important gaps remain (accepted for publication). *Clim. Policy*, **22(2)**, 158–174, doi.org/10.1080/14693062.2021.1993776.

Nash, S.L. and R. Steurer, 2019: Taking stock of Climate Change Acts in Europe: living policy processes or symbolic gestures? *Clim. Policy*, **19(8)**, 1–14, doi:10.1080/14693062.2019.1623164.

Nasiritousi, N., 2017: Fossil fuel emitters and climate change: unpacking the governance activities of large oil and gas companies. *Env. Polit.*, **26(4)**, 621–647, doi:10.1080/09644016.2017.1320832.

Nemet, G.F., T. Holloway, and P. Meier, 2010: Implications of incorporating air-quality co-benefits into climate change policymaking. *Environ. Res. Lett.*, **5(1)**, 014007, doi:10.1088/1748-9326/5/1/014007.

Nemet, G.F., M. Jakob, J.C. Steckel, and O. Edenhofer, 2017: Addressing policy credibility problems for low-carbon investment. *Glob. Environ. Change*, **42**, 47–57, doi:10.1016/j.gloenvcha.2016.12.004.

Neuhoff, K. and R.A. Ritz, 2019: *Carbon cost pass-through in industrial sectors*. 25 pp. http://www.jstor.org/stable/resrep30282 (Accessed March 30, 2021).

Neumayer, E., 2003: Are left-wing party strength and corporatism good for the environment? Evidence from panel analysis of air pollution in OECD countries. *Ecol. Econ.*, **45(2)**, 203–220, doi:10.1016/S0921-8009(03)00012-0.

Nevens, F., N. Frantzeskaki, L. Gorissen, and D. Loorbach, 2013: Urban Transition Labs: Co-creating transformative action for sustainable cities. *J. Clean. Prod.*, **50**, 111–122, doi:10.1016/j.jclepro.2012.12.001.

Newbery, D., 2018: Evaluating the case for supporting renewable electricity. *Energy Policy*, **120**, 684–696, doi:10.1016/j.enpol.2018.05.029.

NewClimate Institute, Data-Driven Lab, PBL Netherlands, German Development Institute, and Blavatnik School of Government, University of Oxford, 2019: *Global Climate Action from Cities, Regions and Businesses – 2019. Impact of Individual Actors and Cooperative Initiatives on Global an National Emissions.* 94 pp. https://newclimate.org/wp-content/uploads/2019/09/Report-Global-Climate-Action-from-Cities-Regions-and-Businesses_2019.pdf (Accessed March 30, 2021).

NewClimate Institute and Data Driven EnviroLab, 2020: *Navigating the nuances of net-zero targets.* [Day, S.M. et al. (eds.)].

NewClimate Institute, Cologne, Data-Driven Lab, Yale-NUS, Singapore80 pp. https://newclimate.org/2020/10/22/navigating-the-nuances-of-net-zero-targets/ (Accessed October 18, 2021).

Newell, P., 2021a: *Power Shift: The Global Political Economy of Energy Transitions*. 1st ed. Cambridge University Press, Cambridge, UK, 284 pp.

Newell, P., 2021b: The Business of Climate Transformation. *Curr. Hist.*, **120(829)**, 307–312, doi:10.1525/curh.2021.120.829.307.

Newell, P. and M. Paterson, 2010: *Climate Capitalism: Global Warming and the Transformation of the Global Economy*. Cambridge University Press, Cambridge, UK, 205 pp.

Newell, P. and A. Simms, 2020: How Did We Do That? Histories and Political Economies of Rapid and Just Transitions. *New Polit. Econ.*, **25**, 1–16, doi:10.1080/13563467.2020.1810216.

Newell, R.G., W.A. Pizer, and D. Raimi, 2013: Carbon markets 15 years after Kyoto: Lessons learned, new challenges. *J. Econ. Perspect.*, **27(1)**, 123–146, doi:10.1257/jep.27.1.123.

Ney, S. and M. Verweij, 2015: Messy institutions for wicked problems: How to generate clumsy solutions? *Environ. Plan. C Gov. Policy*, **33(6)**, 1679–1696, doi:10.1177/0263774X15614450.

Nogueira, L.P., F.D. Longa, and B. van der Zwaan, 2020: A cross-sectoral integrated assessment of alternatives for climate mitigation in Madagascar. *Clim. Policy*, **20(10)**, 1257–1273, doi:10.1080/14693062.2020.1791030.

Nordbeck, R. and R. Steurer, 2016: Multi-sectoral strategies as dead ends of policy integration: Lessons to be learned from sustainable development. *Environ. Plan. C Gov. Policy*, **34(4)**, 737–755, doi:10.1177/0263774X15614696.

Nordhaus, W., 2013: *The climate casino: Risk, uncertainty, and economics for a warming world*. Yale University Press, New Haven, USA, 392 pp.

Nordic Council of Ministers, 2017: *Mitigation & Adaptation Synergies in the NDCs*. 86 pp. http://norden.diva-portal.org/smash/get/diva2:1097909/FULLTEXT01.pdf (Accessed March 30, 2021).

Nosek, G., 2018: Climate change litigation and narrative: How to use litigation to tell compelling climate stories. *William Mary Environ. Law Policy Rev.*, **42(3)**, 733–804.

Nunan, F., A. Campbell, and E. Foster, 2012: Environmental mainstreaming: The organisational challenges of policy integration. *Public Adm. Dev.*, **32(3)**, 262–277, doi:10.1002/pad.1624.

Nyiwul, L.M., 2019: Climate Change Mitigation and Adaptation in Africa: Strategies, Synergies, and Constraints. In: *Climate Change and Global Development: Market, Global Players and Empirical Evidence* [Sequeira, T. and L. Reis, (eds.)]. Springer, Cham, Switzerland, pp. 219–241.

O'Brien, K., 2018: Is the 1.5°C target possible? Exploring the three spheres of transformation. *Curr. Opin. Environ. Sustain.*, **31**, 153–160, doi:10.1016/j.cosust.2018.04.010.

O'Brien, K., E. Selboe, and B.M. Hayward, 2018: Exploring youth activism on climate change: dutiful, disruptive, and dangerous dissent. *Ecol. Soc.*, **23(3)**, 42, doi:10.5751/ES-10287-230342.

O'Callaghan, B. and E. Murdock, 2021: *Are we building back better? Evidence from 2020 and Pathways to Inclusive Green Recovery Spending*. UNEP Nairobi, Kenya, 60 pp (Accessed October 27, 2021). https://www.unep.org/resources/publication/are-we-building-back-better-evidence-2020-and-pathways-inclusive-green.

O'Donnell, T., 2019: Contrasting land-use policies for climate change adaptation: A case study of political and geo-legal realities for Australian coastal locations. *Land use policy*, **88** (September), 104145, doi:10.1016/j.landusepol.2019.104145.

O'Dwyer, B. and J. Unerman, 2020: Shifting the focus of sustainability accounting from impacts to risks and dependencies: researching the transformative potential of TCFD reporting. *Accounting, Audit. Account. J.*, **33(5)**, 1113–1141, doi:10.1108/AAAJ-02-2020-4445.

O'Neill, S. et al., 2015: Dominant frames in legacy and social media coverage of the IPCC Fifth Assessment Report. *Nat. Clim. Change*, **5(4)**, 380–385, doi:10.1038/nclimate2535.

Obersteiner, M. et al., 2016: Assessing the land resource–food price nexus of the Sustainable Development Goals. *Sci. Adv.*, **2(9)**, e1501499, doi:10.1126/sciadv.1501499.

Oberthür, S., 2019: Hard or Soft Governance? The EU's Climate and Energy Policy Framework for 2030. *Polit. Gov.*, **7(1)**, 17–27, doi:10.17645/pag.v7i1.1796.

OECD, 2017: Insights from national adaptation monitoring and evaluation systems. **3**, OECD Publishing, Paris, France, doi:10.1787/da48ce17-en (Accessed March 30, 2021).

OECD, 2018: *Effective Carbon Rates 2018: Pricing Carbon Emissions Through Taxes and Emissions Trading*. OECD Publishing, Paris, France, 92 pp.

OECD, 2020: OECD Inventory of Support Measures for Fossil Fuels. https://www.oecd.org/fossil-fuels/ (Accessed December 21, 2020).

OECD, 2021a: *Effective Carbon Rates 2021: Pricing Carbon Emissions through Taxes and Emissions Trading*. OECD Publishing, Paris, France, 40 pp.

OECD, 2021b: *Scaling up Nature-based Solutions to Tackle Water-related Climate Risks: Insights from Mexico and the United Kingdom*. OECD Publishing, Paris, France, 84 pp.

OECD, 2021c: *Key findings from the update of the OECD Green Recovery Database*. OECD Publishing, Paris, France, 21 pp. https://www.oecd.org/coronavirus/policy-responses/key-findings-from-the-update-of-the-oecd-green-recovery-database-55b8abba/.

Oei, P.Y. et al., 2020: Coal phase-out in Germany – Implications and policies for affected regions. *Energy*, **196**, 117004, doi:10.1016/j.energy.2020.117004.

Oels, A., 2012: From 'Securitization' of Climate Change to 'Climatization' of the Security Field: Comparing Three Theoretical Perspectives. In: *Climate Change, Human Security and Violent Conflict. Hexagon Series on Human and Environmental Security and Peace, volume 8* [Scheffran, J., M. Brzoska, H.G. Brauch, P.M. Link, and J. Schilling, (eds.)]. Springer, Berlin, Germany, pp. 185–205.

Ohlendorf, N., M. Jakob, J.C. Minx, C. Schröder, and J.C. Steckel, 2021: Distributional Impacts of Carbon Pricing: A Meta-Analysis. *Environ. Resour. Econ.*, **78(1)**, 1–42, doi:10.1007/s10640-020-00521-1.

Okereke, C. et al., 2019: Governing green industrialisation in Africa: Assessing key parameters for a sustainable socio-technical transition in the context of Ethiopia. *World Dev.*, **115**, 279–290, doi:10.1016/j.worlddev.2018.11.019.

Olsen, K.H., 2007: The clean development mechanism's contribution to sustainable development: A review of the literature. *Clim. Change*, **84(1)**, 59–73, doi:10.1007/s10584-007-9267-y.

Olzak, S., S.A. Soule, M. Coddou, and J. Muñoz, 2016: Friends or Foes? How Social Movement Allies Affect the Passage of Legislation in the U.S. Congress. *Mobilization An Int. Q.*, **21(2)**, 213–230, doi:10.17813/1086-671X-21-2-213.

Oreskes, N. and E.M. Conway, 2012: *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*. 1st ed. Bloomsbury Publishing, London, UK, 368 pp.

Ortega Díaz, A. and E.C. Gutiérrez, 2018: Competing actors in the climate change arena in Mexico: A network analysis. *J. Environ. Manage.*, **215**, 239–247, doi:10.1016/j.jenvman.2018.03.056.

Osofsky, H.M., 2007: The Intersection of Scale, Science, and Law in Massachusetts v. Epa. *Proc. ASIL Annu. Meet.*, **101**, 61–65, doi:10.1017/S0272503700025180.

Otto, I.M. et al., 2020: Social tipping dynamics for stabilizing Earth's climate by 2050. *Proc. Natl. Acad. Sci.*, **117(5)**, 2354–2365, doi:10.1073/pnas.1900577117.

Oulu, M., 2015: Climate Change Governance: Emerging Legal and Institutional Frameworks for Developing Countries. In: *Handbook of Climate Change Adaptation* [Leal Filho, W., (ed.)]. Springer, Berlin Heidelberg, Germany, pp. 227–250.

Pahle, M., S. Pachauri, and K. Steinbacher, 2016: Can the Green Economy deliver it all? Experiences of renewable energy policies with socio-economic objectives. *Appl. Energy*, **179**(October 2016), 1331–1341, doi:10.1016/j.apenergy.2016.06.073.

Pahle, M. et al., 2018: Sequencing to ratchet up climate policy stringency. *Nat. Clim. Change*, **8(10)**, 861–867, doi:10.1038/s41558-018-0287-6.

Paiement, P., 2020: Urgent agenda: how climate litigation builds transnational narratives. *Transnatl. Leg. Theory*, **11(1–2)**, 121–143, doi:10.1080/20414005.2020.1772617.

Painter, J., 2019: Climate Change Journalism: Time to Adapt. *Environ. Commun.*, **13(3)**, 424–429, doi:10.1080/17524032.2019.1573561.

Painter, J. and N.T. Gavin, 2016: Climate Skepticism in British Newspapers, 2007–2011. *Environ. Commun.*, **10(4)**, 432–452, doi:10.1080/17524032.2014.995193.

Palermo, V., P. Bertoldi, M. Apostolou, A. Kona, and S. Rivas, 2020a: Data on mitigation policies at local level within the Covenant of Mayors' monitoring emission inventories. *Data Br.*, **32**, 106217, doi:10.1016/j.dib.2020.106217.

Palermo, V., P. Bertoldi, M. Apostolou, A. Kona, and S. Rivas, 2020b: Assessment of climate change mitigation policies in 315 cities in the Covenant of Mayors initiative. *Sustain. Cities Soc.*, **60**, 102258, doi:10.1016/j.scs.2020.102258.

Pals, B., 2021: Taxes v. Torts: Which Will Make Fossil Fuel Producers Share Climate Change Burdens? *N.Y.U Environ. Law J.*, **29**, 235.

Pan, X., M. den Elzen, N. Höhne, F. Teng, and L. Wang, 2017: Exploring fair and ambitious mitigation contributions under the Paris Agreement goals. *Environ. Sci. Policy*, **74**, 49–56, doi:10.1016/j.envsci.2017.04.020.

Papadis, E. and G. Tsatsaronis, 2020: Challenges in the decarbonization of the energy sector. *Energy*, **205**, 118025, doi:10.1016/j.energy.2020.118025.

Papadopoulos, S., B. Bonczak, and C.E. Kontokosta, 2018: Pattern recognition in building energy performance over time using energy benchmarking data. *Appl. Energy*, **221**, 576–586, doi:10.1016/j.apenergy.2018.03.079.

Parks, D., 2019: Energy efficiency left behind? Policy assemblages in Sweden's most climate-smart city. *Eur. Plan. Stud.*, **27(2)**, 318–335, doi:10.1080/09654313.2018.1455807.

Parry, I., S. Black, and N. Vernon, 2021: *Still Not Getting Energy Prices Right: A Global and Country Update of Fossil Fuel Subsidies*. IMF, Washington, DC, USA, 40 pp. https://www.imf.org/en/Publications/WP/Issues/2021/09/23/Still-Not-Getting-Energy-Prices-Right-A-Global-and-Country-Update-of-Fossil-Fuel-Subsidies-466004 (Accessed October 19, 2021).

Parry, I.A.N., C. Veung, and D. Heine, 2015: How Much Carbon Pricing is in the Countries' Own Interests? The Critical Role of Co-Benefits. *Clim. Change Econ.*, **6(4)**, 36 pp., doi:10.1142/S2010007815500190.

Pasimeni, M.R., D. Valente, G. Zurlini, and I. Petrosillo, 2019: The interplay between urban mitigation and adaptation strategies to face climate change in two European countries. *Environ. Sci. Policy*, **95**, 20–27, doi:10.1016/j.envsci.2019.02.002.

Patt, A., 2017: Beyond the tragedy of the commons: Reframing effective climate change governance. *Energy Res. Soc. Sci.*, **34**, 1–3, doi:10.1016/j.erss.2017.05.023.

Patt, A. and J. Lilliestam, 2018: The Case against Carbon Prices. *Joule*, **2(12)**, 2494–2498, doi:10.1016/j.joule.2018.11.018.

Pauw, P., K. Mbeva, and H. van Asselt, 2019: Subtle differentiation of countries' responsibilities under the Paris Agreement. *Palgrave Commun.*, **5(1)**, 1–7, doi:10.1057/s41599-019-0298-6.

Pauw, W.P. et al., 2018: Beyond headline mitigation numbers: we need more transparent and comparable NDCs to achieve the Paris Agreement on climate change. *Clim. Change*, **147(1–2)**, 23–29, doi:10.1007/s10584-017-2122-x.

Pauw, W.P., P. Castro, J. Pickering, and S. Bhasin, 2020: Conditional Nationally Determined Contributions in the Paris Agreement: foothold for equity or Achilles heel? *Clim. Policy*, **20(4)**, 468–484, doi:10.1080/14693062.2019.1635874.

Peel, J. and H.M. Osofsky, 2015: *Climate Change Litigation: Regulatory Pathways to Cleaner Energy*. 1st edition. Cambridge University Press, Cambridge, UK, 352 pp.

Peel, J. and H.M. Osofsky, 2018: A Rights Turn in Climate Change Litigation? *Transnatl. Environ. Law*, **7(1)**, 37–67, doi:10.1017/S2047102517000292.

Peel, J. and J.L. Lin, 2019: Transnational Climate Litigation: The Contribution of the Global South. *Am. J. Int. Law*, **113(4)**, 679–726, doi:10.1017/ajil.2019.48.

Peel, J. and H.M. Osofsky, 2020: Climate Change Litigation. *Annu. Rev. Law Soc. Sci.*, **16(1)**, 21–38, doi:10.1146/annurev-lawsocsci-022420-122936.

Peel, J. and R. Markey-Towler, 2021: A Duty to Care: The Case of Sharma v Minister for the Environment [2021] FCA 560. *J. Environ. Law*, **33(3)**, 727–736, doi:10.1093/jel/eqab022.

Peeters, M., 2016: Urgenda Foundation and 886 Individuals v. The State of the Netherlands: The Dilemma of More Ambitious Greenhouse Gas Reduction Action by EU Member States. *Rev. Eur. Comp. Int. Environ. Law*, **25(1)**, 123–129, doi:10.1111/reel.12146.

Penasco, C., D. Romero-Jordan, and P. del Rio, 2019: The Impact of Policy on the Efficiency of Solar Energy Plants in Spain: A Production-Frontier Analysis. *Econ. Energy Environ. Policy*, **8(2)**, pp. 99–116, -doi:10.5547/2160-5890.8.2.cpen.

Peñasco, C., L.D. Anadón, and E. Verdolini, 2021: Systematic review of the outcomes and trade-offs of ten types of decarbonization policy instruments. *Nat. Clim. Change*, **11(3)**, 257–265, doi:10.1038/s41558-020-00971-x.

Peng, W. et al., 2021: The surprisingly inexpensive cost of state-driven emission control strategies. *Nat. Clim. Change*, **11(9)**, 738–745, doi:10.1038/s41558-021-01128-0.

Peng, Y. and X. Bai, 2018: Experimenting towards a low-carbon city: Policy evolution and nested structure of innovation. *J. Clean. Prod.*, **174**, 201–212, doi:10.1016/j.jclepro.2017.10.116.

Pereira, L. et al., 2019: Transformative spaces in the making: key lessons from nine cases in the Global South. *Sustain. Sci.*, **15**, 161–178, doi:10.1007/s11625-019-00749-x.

Perino, G., 2018: New EU ETS Phase 4 rules temporarily puncture waterbed. *Nat. Clim. Change*, **8**, 262–264, doi:10.1038/s41558-018-0120-2.

Perrow, C. and S. Pulver, 2015: Organizations and Markets. In *Climate Change and Society: Sociological Perspectives*. 1st ed. [Dunlap, R.E. and R.J. Brulle, (eds.)]. Oxford University Press, Oxford, UK, 61–92 pp.

Perry, K.K., 2020: For politics, people, or the planet? The political economy of fossil fuel reform, energy dependence and climate policy in Haiti. *Energy Res. Soc. Sci.*, **63**, 101397, doi:10.1016/j.erss.2019.101397.

Petek, G., 2020: *Assessing California's Climate Policies—Electricity Generation*. 32 pp. https://autl.assembly.ca.gov/sites/autl.assembly.ca.gov/files/CalifLAO-ElectricityEmissions.pdf (Accessed March 3, 2021).

Petersen, J.P., 2016: Energy concepts for self-supplying communities based on local and renewable energy sources: A case study from northern Germany. *Sustain. Cities Soc.*, **26**, 1–8, doi:10.1016/j.scs.2016.04.014.

Pezzey, J.C.V., 2019: Why the social cost of carbon will always be disputed. *WIREs Clim. Change*, **10(1)**, e558, doi:10.1002/wcc.558.

Pham, T.T., M. Di Gregorio, R. Carmenta, M. Brockhaus, and D.N. Le, 2014: The REDD+ policy arena in Vietnam: Participation of policy actors. *Ecol. Soc.*, **19(2)**, pp. 22, doi:10.5751/ES-06389-190222.

Pierson, P., 2004: *Politics in Time: History, Institutions, and Social Analysis*. 1st ed. Princeton University Press, Princeton, NJ, USA, 208 pp.

Pillai, A.V. and N.K. Dubash, 2021: The limits of opportunism: the uneven emergence of climate institutions in India. *Env. Polit.*, **30(sup1)**, 93–117, doi:10.1080/09644016.2021.1933800.

Pizer, W.A., 2002: Combining price and quantity controls to mitigate global climate change. *J. Public Econ.*, **85(3)**, 409–434, doi:10.1016/S0047-2727(01)00118-9.

Poberezhskaya, M., 2015: Media coverage of climate change in Russia: Governmental bias and climate silence. *Public Underst. Sci.*, **24(1)**, 96–111, doi:10.1177/0963662513517848.

Postic, S. and M. Fetet, 2020: *Global Carbon Account in 2020*. Institute for Climate Economics (I4CE), Paris, France, 4 pp. https://www.i4ce.org/download/global-carbon-account-in-2020/ (Accessed March 3. 2021).

Prasad, N. et al., 2009: *Climate Resilient Cities: A Primer on Reducing Vulnerability to Disasters*. World Bank, Washington, DC, USA, 186 pp.

Prendeville, S., E. Cherim, and N. Bocken, 2018: Circular Cities: Mapping Six Cities in Transition. *Environ. Innov. Soc. Transitions*, **26**, 171–194, doi:10.1016/j.eist.2017.03.002.

Pretis, F., 2019: *Does a Carbon Tax Reduce CO2 Emissions? Evidence From British Columbia*. 52 pp. https://link.springer.com/article/10.1007/s10640-022-00679-w (Accessed October 18. 2021).

Prussi, M. et al., 2021: CORSIA: The first internationally adopted approach to calculate life-cycle GHG emissions for aviation fuels. *Renew. Sustain. Energy Rev.*, **150**, 111398, doi:10.1016/j.rser.2021.111398.

Pulver, S., 2007: Importing environmentalism: Explaining Petroleos Mexicanos' cooperative climate policy. *Stud. Comp. Int. Dev.*, **42(3–4)**, 233–255, doi:10.1007/s12116-007-9010-8.

Pulver, S. and T. Benney, 2013: Private-sector responses to climate change in the Global South. *WIREs Clim. Change*, **4(6)**, 479–496, doi:10.1002/wcc.240.

Puppim de Oliveira, J.A., 2013: Learning how to align climate, environmental and development objectives in cities: lessons from the implementation of climate co-benefits initiatives in urban Asia. *J. Clean. Prod.*, **58**, 7–14, doi:10.1016/j.jclepro.2013.08.009.

Purdon, M., 2015: Advancing comparative climate change politics: Theory and method. *Glob. Environ. Polit.*, **15(3)**, 1–26, doi:10.1162/GLEP_e_00309.

Pyrgou, A., A. Kylili, and P.A. Fokaides, 2016: The future of the Feed-in Tariff (FiT) scheme in Europe: The case of photovoltaics. *Energy Policy*, **95**, 94–102, doi:10.1016/j.enpol.2016.04.048.

Qi, Y. and T. Wu, 2013: The politics of climate change in China. *WIREs Clim. Change*, **4(4)**, 301–313, doi:10.1002/wcc.221.

Qian, H., L. Wu, and W. Tang, 2017: 'Lock-in' effect of emission standard and its impact on the choice of market based instruments. *Energy Econ.*, **63**, 41–50, doi:10.1016/j.eneco.2017.01.005.

Qian, H., Y. Zhou, and L. Wu, 2018: Evaluating various choices of sector coverage in China's national emissions trading system (ETS). *Clim. Policy*, **18(sup1)**, 7–26, doi:10.1080/14693062.2018.1464894.

Quak, H., N. Nesterova, and R. Kok, 2019: Public procurement as driver for more sustainable urban freight transport. *Transp. Res. Procedia*, **39**, 428–439, doi:10.1016/j.trpro.2019.06.045.

Rabe, B., 2011: Contested Federalism and American Climate Policy. *Publius J. Fed.*, **41(3)**, 494–521, doi:10.1093/publius/pjr017.

Rabe, B.G., 2007: Beyond Kyoto: Climate Change Policy in Multilevel Governance Systems. *Governance*, **20(3)**, 423–444, doi:10.1111/j.1468-0491.2007.00365.x.

Rabe, B.G., 2018: *Can we price carbon?* MIT Press, Cambridge, MA, USA, 376 pp.

Rafaty, R., 2018: Perceptions of Corruption, Political Distrust, and the Weakening of Climate Policy. *Glob. Environ. Polit.*, **18(3)**, 106–129, doi:10.1162/glep_a_00471.

Rafaty, R., G. Dolphin, and F. Pretis, 2020: *Carbon pricing and the elasticity of CO2 emissions*. Faculty of Economics, University of Cambridge, 76 pp, doi: 10.17863/CAM.62831 (Accessed October 18, 2021).

Raff, Z. and J.M. Walter, 2020: Regulatory Avoidance and Spillover: The Effects of Environmental Regulation on Emissions at Coal-Fired Power Plants. *Environ. Resour. Econ.*, **75(3)**, 387–420, doi:10.1007/s10640-019-00394-z.

Ramos-Castillo, A., E.J. Castellanos, and K. Galloway McLean, 2017: Indigenous peoples, local communities and climate change mitigation. *Clim. Change*, **140(1)**, doi:10.1007/s10584-016-1873-0.

Rashidi, K. and A. Patt, 2018: Subsistence over symbolism: the role of transnational municipal networks on cities' climate policy innovation and adoption. *Mitig. Adapt. Strateg. Glob. Change*, **23(4)**, 507–523, doi:10.1007/s11027-017-9747-y.

Rasul, G. and B. Sharma, 2016: The nexus approach to water–energy–food security: an option for adaptation to climate change. *Clim. Policy*, **16(6)**, 682–702, doi:10.1080/14693062.2015.1029865.

Räthzel, N., J. Cock, and D. Uzzell, 2018: Beyond the nature–labour divide: trade union responses to climate change in South Africa. *Globalizations*, **15(4)**, 504–519, doi:10.1080/14747731.2018.1454678.

Raymond, C.M. et al., 2017: A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environ. Sci. Policy*, **77**(June), 15–24, doi:10.1016/j.envsci.2017.07.008.

Raymond, L., 2019: Policy perspective: Building political support for carbon pricing—Lessons from cap-and-trade policies. *Energy Policy*, **134(C)**, 110986, doi:10.1016/j.enpol.2019.110986.

Reckien, D. et al., 2017: Climate change, equity and the Sustainable Development Goals: an urban perspective. *Environ. Urban.*, **29(1)**, 159–182, doi:10.1177/0956247816677778.

Reckien, D. et al., 2018: How are cities planning to respond to climate change? Assessment of local climate plans from 885 cities in the EU-28. *J. Clean. Prod.*, **191**, 207–219, doi:10.1016/j.jclepro.2018.03.220.

Reed, P., 2011: REDD+ and the Indigenous Question: A Case Study from Ecuador. *Forests*, **2(2)**, 525–549, doi:10.3390/f2020525.

Rennkamp, B., 2019: Power, coalitions and institutional change in South African climate policy. *Clim. Policy*, **19(6)**, 756–770, doi:10.1080/14693062.2019.1591936.

Rentschler, J. and M. Bazilian, 2017: Reforming fossil fuel subsidies: drivers, barriers and the state of progress. *Clim. Policy*, **17(7)**, 891–914, doi:10.1080/14693062.2016.1169393.

Rey, L., A. Markandya, M. González-Eguino, and P. Drummond, 2013: *Assessing interaction between instruments and the 'optimality' of the current instrument mix*. CECILIA250 Project, Brussels, Belgium, 73 pp. https://cecilia2050.eu/publications/171.

Rezessy, S. and P. Bertoldi, 2011: Voluntary agreements in the field of energy efficiency and emission reduction: Review and analysis of experiences in the European Union. *Energy Policy*, **39(11)**, 7121–7129, doi:10.1016/j.enpol.2011.08.030.

RGGI, 2019: *The Investment of RGGI Proceeds in 2017*. Regional Greenhouse Gas Initiative, Inc., New York, USA, 46 pp. https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2017.pdf.

Rhodes, E., J. Axsen, and M. Jaccard, 2017: Exploring Citizen Support for Different Types of Climate Policy. *Ecol. Econ.*, **137**, 56–69, doi:10.1016/j.ecolecon.2017.02.027.

Rice, J.L., D.A. Cohen, J. Long, and J.R. Jurjevich, 2020: Contradictions of the Climate-Friendly City: New Perspectives on Eco-Gentrification and Housing Justice. *Int. J. Urban Reg. Res.*, **44(1)**, 145–165, doi:10.1111/1468-2427.12740.

Richerzhagen, C. and I. Scholz, 2008: China's Capacities for Mitigating Climate Change. *World Dev.*, **36(2)**, 308–324, doi:10.1016/j.worlddev.2007.06.010.

Rickards, L., J. Wiseman, and Y. Kashima, 2014: Barriers to effective climate change mitigation: The case of senior government and business decision makers. *Wiley Interdiscip. Rev. Clim. Change*, **5(6)**, 753–773, doi:10.1002/wcc.305.

Ridzuan, A.R. et al., 2019: The Impact of Corruption on Environmental Quality in the Developing Countries of ASEAN-3: The Application of the Bound Test. *Int. J. Energy Econ. Policy*, **9(6)**, 469–478, doi:10.32479/ijeep.8135.

Roberts, C. and F.W. Geels, 2019: Conditions for politically accelerated transitions: Historical institutionalism, the multi-level perspective, and two historical case studies in transport and agriculture. *Technol. Forecast. Soc. Change*, **140**, 221–240, doi:10.1016/j.techfore.2018.11.019.

Roberts, C. et al., 2018: The politics of accelerating low-carbon transitions: Towards a new research agenda. *Energy Res. Soc. Sci.*, **44**, 304–311, doi:10.1016/j.erss.2018.06.001.

Roberts, D., 2010: *Thinking Globally, Acting Locally: Institutionalising Climate Change within Durban's Local Government*. Cities Alliance Washington, DC, USA, 8 pp. https://www.citiesalliance.org/sites/default/files/CIVIS_3_June2010.pdf.

Roberts, D., 2020: Feed-in tariffs for renewable power and the role of auctions: the Chinese and global experience. *China Econ. J.*, **13(2)**, 152–168, doi:10.1080/17538963.2020.1752494.

Roberts, D. et al., 2016: Durban, South Africa. In: *Cities on a Finite Planet* [Bartlett, S. and D. Satterthwaite, (eds.)]. Routledge, Oxon, UK and New York, USA, pp. 96–115.

Rocha, M. and C. Falduto, 2019: *Key questions guiding the process of setting up long-term low-emissions development strategies*. OECD Publishing, Paris, France, 1–52 pp.

Rockström, J. et al., 2017: A roadmap for rapid decarbonization. *Science*, **355(6331)**, 1269–1271, doi:10.1126/science.aah3443.

Rodríguez-Garavito, C., 2020: Human Rights: The Global South's Route to Climate Litigation. *AJIL Unbound*, **114**, 40–44, doi:10.1017/aju.2020.4.

Roelfsema, M., 2017: *Assessment of US City Reduction Commitments, from a Country Perspective*. The Hague, The Netherlands, 26 pp, https://www.researchgate.net/profile/Mark-Roelfsema/publication/321920191_ASSESSMENT_OF_US_CITY_REDUCTION_COMMITMENTS_FROM_A_COUNTRY_PERSPECTIVE_Note_Mark_Roelfsema/links/5a3983cf458515889d2aca1c/ASSESSMENT-OF-US-CITY-REDUCTION-COMMITMENTS-FROM-A-COUNTRY-PERSPECTIVE-Note-Mark-Roelfsema.pdf (Accessed March 3, 2021).

13

Roelfsema, M., M. Harmsen, J.J.G. Olivier, A.F. Hof, and D.P. van Vuuren, 2018: Integrated assessment of international climate mitigation commitments outside the UNFCCC. *Glob. Environ. Change*, **48**, 67–75, doi:10.1016/j.gloenvcha.2017.11.001.

Rogelj, J. et al., 2015: Energy system transformations for limiting end-of-century warming to below 1.5°C. *Nat. Clim. Change*, **5(6)**, 519–527, doi:10.1038/nclimate2572.

Rogelj, J., O. Geden, A. Cowie, and A. Reisinger, 2021: Three ways to improve net-zero emissions targets. *Nature*, **591(7850)**, 365–368, doi:10.1038/d41586-021-00662-3.

Rogge, K.S., 2019: Policy mixes for sustainable innovation: conceptual considerations and empirical insights. In: *Handbook of Sustainable Innovation* [Boons, F. and A. McMeekin, (eds.)]. Edward Elgar Publishing, Cheltenham, UK and Northampton, MA, USA, pp. 165–185.

Rogge, K.S. and K. Reichardt, 2016: Policy mixes for sustainability transitions: An extended concept and framework for analysis. *Res. Policy*, **45(8)**, 1620–1635, doi:10.1016/j.respol.2016.04.004.

Rogge, K.S. and J. Schleich, 2018: Do policy mix characteristics matter for low-carbon innovation? A survey-based exploration of renewable power generation technologies in Germany. *Res. Policy*, **47(9)**, 1639-1654, doi:10.1016/j.respol.2018.05.011.

Rogge, K.S., F. Kern, and M. Howlett, 2017: Conceptual and empirical advances in analysing policy mixes for energy transitions. *Energy Res. Soc. Sci.*, **33**(September), 1–10, doi:10.1016/j.erss.2017.09.025.

Rogner, H.-H. and K.-K. Leung, 2018: The Effectiveness of Foreign Aid for Sustainable Energy and Climate Change Mitigation. In: *Aid Effectiveness for Environmental Sustainability* [Huang, Y., and U. Pascual (eds.)]. Springer Singapore, Singapore, pp. 81–124.

Rohlinger, D.A. and L.A. Bunnage, 2018: Collective identity in the digital age: thin and thick identities in moveon.org and the Tea Party movement. *Mobilization An Int. Q.*, **23(2)**, 135–157, doi:10.17813/1086-671X-23-2-135.

Romero-Lankao, P. and D. Gnatz, 2019: Risk Inequality and the Food-Energy-Water (FEW) Nexus: A Study of 43 City Adaptation Plans. *Front. Sociol.*, **4**, pp. 31, doi:10.3389/fsoc.2019.00031.

Romero-Lankao, P. and E. Nobler, 2021: *Energy Justice: Key Concepts and Metrics Relevant to EERE Transportation Projects*. 15 pp. https://afdc.energy.gov/files/pdfs/energy-justice-key-concepts.pdf (Accessed October 7, 2021).

Romero-Lankao, P., S. Hughes, A. Rosas-Huerta, R. Borquez, and D.M. Gnatz, 2013: Institutional Capacity for Climate Change Responses: An Examination of Construction and Pathways in Mexico City and Santiago. *Environ. Plan. C Gov. Policy*, **31(5)**, 785–805, doi:10.1068/c12173.

Romero-Lankao, P. et al., 2015: Multilevel Governance and Institutional Capacity for Climate Change Responses in Latin American Cities. In: *The Urban Climate Challenge Rethinking the Role of Cities in the Global Climate Regime* [Johnson, C., N. Toly, and H. Schroeder, (eds.)]. Routledge, New York, NY, USA, pp. 179–204.

Romero-Lankao, P., D. Gnatz, O. Wilhelmi, and M. Hayden, 2016: Urban Sustainability and Resilience: From Theory to Practice. *Sustainability*, **8(12)**, 1224, doi:10.3390/su8121224.

Romero-Lankao, P., T. McPhearson, and D. Davidson, 2017: The food-energy-water nexus and urban complexity. *Nat. Clim Change*, **7**, 233–235, doi:10.1038/nclimate3260.

Romero-Lankao, P. et al., 2018a: Governance and Policy. In: *Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network* [Rosenzweig, C., W.D. Solecki, P. Romero-Lankao, S. Mehrotra, S. Dhakal, and S.A. Ibrahim (eds.)]. Cambridge University Press, Cambridge, UK, pp. 585–606.

Romero-Lankao, P. et al., 2018b: Urban transformative potential in a changing climate. *Nat. Clim. Change*, **8(9)**, 754–756, doi:10.1038/s41558-018-0264-0.

Romero-Lankao, P. et al., 2021: Of actors, cities and energy systems: advancing the transformative potential of urban electrification. *Prog. Energy*, **3(3)**, 032002, doi:10.1088/2516-1083/abfa25.

Romero Lankao, P. et al., 2019: Urban Electrification: Knowledge Pathway Toward an Integrated Research and Development Agenda. *SSRN Electron. J.*, doi:10.2139/ssrn.3440283.

Roppongi, H., A. Suwa, and J.A. Puppim De Oliveira, 2017: Innovating in sub-national climate policy: the mandatory emissions reduction scheme in Tokyo. *Clim. Policy*, **17(4)**, 516–532, doi:10.1080/14693062.2015.1124749.

Rosenbloom, D., 2018: Framing low-carbon pathways: A discursive analysis of contending storylines surrounding the phase-out of coal-fired power in Ontario. *Environ. Innov. Soc. Transitions*, **27**(November 2017), 129–145, doi:10.1016/j.eist.2017.11.003.

Rosenbloom, D. and A. Rinscheid, 2020: Deliberate decline: An emerging frontier for the study and practice of decarbonization. *WIREs Clim. Change*, **11(6)**, e669, doi:10.1002/wcc.669.

Rosenbloom, D., B. Haley, and J. Meadowcroft, 2018: Critical choices and the politics of decarbonization pathways: Exploring branching points surrounding low-carbon transitions in Canadian electricity systems. *Energy Res. Soc. Sci.*, **37**, 22–36, doi:10.1016/j.erss.2017.09.022.

Rosenbloom, D., J. Meadowcroft, and B. Cashore, 2019: Stability and climate policy? Harnessing insights on path dependence, policy feedback, and transition pathways. *Energy Res. Soc. Sci.*, **50**, 168–178, doi:10.1016/j.erss.2018.12.009.

Rosenbloom, D., J. Markard, F.W. Geels, and L. Fuenfschilling, 2020: Opinion: Why carbon pricing is not sufficient to mitigate climate change—and how 'sustainability transition policy' can help. *Proc. Natl. Acad. Sci.*, **117(16)**, 8664–8668, doi:10.1073/pnas.2004093117.

Rosendahl, K.E. and J. Strand, 2011: Carbon Leakage from the Clean Development Mechanism. *Energy J.*, **32(4)**, doi:10.5547/ISSN0195-6574-EJ-Vol32-No4-3.

Rosenow, J., T. Fawcett, N. Eyre, and V. Oikonomou, 2016: Energy efficiency and the policy mix. *Build. Res. Inf.*, **44(5–6)**, 562–574, doi:10.1080/09613218.2016.1138803.

Röser, F., O. Widerberg, N. Höhne, and T. Day, 2020: Ambition in the making: analysing the preparation and implementation process of the Nationally Determined Contributions under the Paris Agreement. *Clim. Policy*, **20(4)**, 415–429, doi:10.1080/14693062.2019.1708697.

Routledge, P., A. Cumbers, and K.D. Derickson, 2018: States of just transition: Realising climate justice through and against the state. *Geoforum*, **88**, 78–86, doi:10.1016/j.geoforum.2017.11.015.

Roy, J., P. Tschakert, H. Waisman, S. Abdul Halim, P. Antwi-Agyei, P. Dasgupta, B. Hayward, M. Kanninen, D. Liverman, C. Okereke, P.F. Pinho, K. Riahi, and A.G. Suarez Rodriguez, 2018: Sustainable Development, Poverty Eradication and Reducing Inequalities. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. Cambridge University Press, Cambridge and New York, NY, USA, pp. 445–538.

Roy, S. and E. Woerdman, 2016: Situating Urgenda v the Netherlands within comparative climate change litigation. *J. Energy Nat. Resour. Law*, **34(2)**, 165–189, doi:10.1080/02646811.2016.1132825.

Rubio, F., 2017: Ecosystem-based adaptation to climate change: concept, scalability and a role for conservation science. *Perspect. Ecol. Conserv.*, **15(2)**, 65–73, doi:10.1016/j.pecon.2017.05.003.

Rucht, D., 1999: The impact of environmental movements in Western Societies. In: *How Social Movements Matter* [Guigni, M., D. McAdam, and C. Tilly, (eds.)]. University of Minnesota Press, Minneapolis, USA, pp. 204–224.

Rumble, O., 2019: Climate change legislative development on the African continent. In: *Law | Environment | Africa: Publication of the 5th Symposium | 4th Scientific Conference | 2018 of the Association of Environmental Law Lecturers from African Universities in cooperation with the Climate Policy and Energy Security Programme for Sub-Saharan Africa of the Konrad-Adenauer-Stiftung and UN Environment* [Kameri-Mbote, P., A. Paterson, O.C. Ruppel, B.B. Orubebe, and E.D. Kam Yogo, (eds.)]. Nomos Verlagsgesellschaft mbH & Co. KG, Baden-Baden, Germany, pp. 31–60.

Runhaar, H., B. Wilk, Å. Persson, C. Uittenbroek, and C. Wamsler, 2018: Mainstreaming climate adaptation: taking stock about 'what works' from empirical research worldwide. *Reg. Environ. Change*, **18(4)**, 201–1210, doi:10.1007/s10113-017-1259-5.

Ryan, D., 2015: From commitment to action: a literature review on climate policy implementation at city level. *Clim. Change*, **131(4)**, 519–529, doi:10.1007/s10584-015-1402-6.

Ryder, S.S., 2018: Developing an intersectionally-informed, multi-sited, critical policy ethnography to examine power and procedural justice in multiscalar energy and climate change decision-making processes. *Energy Res. Soc. Sci.*, **45**, 266–275, doi:10.1016/j.erss.2018.08.005.

Rydin, Y., 2013: *The Future of Planning Beyond Growth Dependence*. Policy Press, Bristol, UK, 208 pp.

Sachs, N., 2012: Can We Regulate Our Way to Energy Efficiency: Product Standards as Climate Policy. *Vanderbilt Law Rev.*, **65(6)**, 1631–1678.

Saelim, S., 2019: Carbon tax incidence on household demand: Effects on welfare, income inequality and poverty incidence in Thailand. *J. Clean. Prod.*, **234**, 521–533, doi:10.1016/J.JCLEPRO.2019.06.218.

Sahli, I. and J. Ben Rejeb, 2015: The Environmental Kuznets Curve and Corruption in the Mena Region. *Procedia – Soc. Behav. Sci.*, **195**, 1648–1657, doi:10.1016/j.sbspro.2015.06.231.

Saito, N., 2013: Mainstreaming climate change adaptation in least developed countries in South and Southeast Asia. *Mitig. Adapt. Strateg. Glob. Change*, **18(6)**, 825–849, doi:10.1007/s11027-012-9392-4.

Sallee, J.M., 2019: *Pigou creates losers: On the implausibility of achieving Pareto improvements from efficiency-enhancing policies*. National Bureau of Economic Research, Cambridge, MA, USA, 49 pp. https://haas.berkeley.edu/wp-content/uploads/WP302.pdf.

Sandover, R., A. Moseley, and P. Devine-Wright, 2021: Contrasting Views of Citizens' Assemblies: Stakeholder Perceptions of Public Deliberation on Climate Change. *Polit. Gov.*, **9(2)**, 76–86, doi:10.17645/pag.v9i2.4019.

Santamouris, M., 2014: Cooling the cities – a review of reflective and green roof mitigation technologies to fight heat island and improve comfort in urban environments. *Sol. Energy*, **103**, 682–703, doi:10.1016/j.solener.2012.07.003.

Santos-lacueva, R. and M.V. González, 2018: Policy coherence between tourism and climate policies: the case of Spain and the Autonomous Community of Catalonia. *J. Sustain. Tour.*, **26(10)**, 1708–1727, doi:10.1080/09669582.2018.1503672.

Sato, I. and J.-C. Altamirano, 2019: *Uncertainty, Scenario Analysis, and Long-Term Strategies: State of Play and a Way Forward*. 1–44 pp. https://files.wri.org/s3fs-public/uncertainty-scenario-analysis-long-term-strategies.pdf (Accessed March 30, 2021).

Saunders, C., M. Grasso, C. Olcese, E. Rainsford, and C. Rootes, 2012: Explaining Differential Protest Participation: Novices, Returners, Repeaters, and Stalwarts. *Mobilization An Int. Q.*, **17(3)**, 263–280, doi:10.17813/maiq.17.3.bqm553573058t478.

Saunders, C., M. Büchs, A. Papafragkou, R. Wallbridge, and G. Smith, 2014: Beyond the Activist Ghetto: A Deductive Blockmodelling Approach to Understanding the Relationship between Contact with Environmental Organisations and Public Attitudes and Behaviour. *Soc. Mov. Stud.*, **13(1)**, 158–177, doi:10.1080/14742837.2013.832623.

Savaresi, A. and J. Auz, 2019: Climate Change Litigation and Human Rights: Pushing the Boundaries. *Clim. Law*, **9(3)**, 244–262, doi:10.1163/18786561-00903006.

Savaresi, A. and J. Setzer, 2021: Rights-based litigation in the climate emergency: mapping the landscape and new knowledge frontiers. *J. Hum. Rights Environ.*, **3(1)**, 7–34.

Schäfer, M.S. and I. Schlichting, 2014: Media Representations of Climate Change: A Meta-Analysis of the Research Field. *Environ. Commun.*, **8(2)**, 142–160, doi:10.1080/17524032.2014.914050.

Schäfer, M.S. and J. Painter, 2021: Climate journalism in a changing media ecosystem: Assessing the production of climate change-related news around the world. *WIREs Clim. Change*, **12(1)**, doi:10.1002/wcc.675.

Schaffitzel, F., M. Jakob, R. Soria, A. Vogt-Schilb, and H. Ward, 2020: Can government transfers make energy subsidy reform socially acceptable? A case study on Ecuador. *Energy Policy*, **137**, 111120, doi:10.1016/j.enpol.2019.111120.

Schatzki, T. and R.N. Stavins, 2012: *Implications of policy interactions for California's climate policy.* Analysis Group, Boston, USA, 23 pp. https://www.analysisgroup.com/globalassets/content/insights/publishing/implications_policy_interactions_california_climate_policy.pdf.

Schifeling, T. and A.J. Hoffman, 2019: Bill McKibben's Influence on U.S. Climate Change Discourse: Shifting Field-Level Debates Through Radical Flank Effects. *Organ. Environ.*, **32(3)**, 213–233, doi:10.1177/1086026617744278.

Schipper, E.L.F., T. Tanner, O.P. Dube, K.M. Adams, and S. Huq, 2020: The debate: Is global development adapting to climate change? *World Dev. Perspect.*, **18**(July 2019), 100205, doi:10.1016/j.wdp.2020.100205.

Schleich, J., C. Schwirplies, and A. Ziegler, 2018: Do perceptions of international climate policy stimulate or discourage voluntary climate protection activities? A study of German and US households. *Clim. Policy*, **18(5)**, 568–580, doi:10.1080/14693062.2017.1409189.

Schlosberg, D., 2012: Climate Justice and Capabilities: A Framework for Adaptation Policy. *Ethics Int. Aff.*, **26(4)**, 445–461, doi:10.1017/S0892679412000615.

Schlozman, K.L., S. Verba, and H.E. Brady, 2012: *The Unheavenly Chorus: Unequal Political Voice and the Broken Promise of American Democracy*. Princeton University Press, Princeton, NJ, USA, 727 pp.

Schmidt, A., A. Ivanova, and M.S. Schäfer, 2013: Media attention for climate change around the world: A comparative analysis of newspaper coverage in 27 countries. *Glob. Environ. Change*, **23(5)**, 1233–1248, doi:10.1016/j.gloenvcha.2013.07.020.

Schmidt, N.M. and A. Fleig, 2018: Global patterns of national climate policies: Analyzing 171 country portfolios on climate policy integration. *Environ. Sci. Policy*, **84**, 177–185, doi:10.1016/j.envsci.2018.03.003.

Schmidt, T.S., T. Matsuo, and A. Michaelowa, 2017: Renewable energy policy as an enabler of fossil fuel subsidy reform? Applying a socio-technical perspective to the cases of South Africa and Tunisia. *Glob. Environ. Change*, **45**, 99–110, doi:10.1016/j.gloenvcha.2017.05.004.

Schmitz, A., M. Flemmen, and L. Rosenlund, 2018: Social class, symbolic domination, and Angst: The example of the Norwegian social space. *Sociol. Rev.*, **66(3)**, 623–644, doi:10.1177/0038026117738924.

Schmitz, H., 2017: Who drives climate-relevant policies in the rising powers? *New Polit. Econ.*, **22(5)**, 521–540, doi:10.1080/13563467.2017.1257597.

Schmitz, H., O. Johnson, and T. Altenburg, 2015: Rent Management – The Heart of Green Industrial Policy. *New Polit. Econ.*, **20(6)**, 812–831, doi:10.1080/13563467.2015.1079170.

Schofer, E. and A. Hironaka, 2005: The Effects of World Society on Environmental Protection Outcomes. *Soc. Forces*, **84(1)**, 25–47, doi:10.1353/sof.2005.0127.

Schoonees, T. et al., 2019: Hard Structures for Coastal Protection, Towards Greener Designs. *Estuaries and Coasts*, **42(7)**, 1709–1729, doi:10.1007/s12237-019-00551-z.

Schreurs, M.A., 1997: Japan's changing approach to environmental issues. *Env. Polit.*, **6(2)**, 150–156, doi:10.1080/09644019708414332.

Schroeder, H., S. Burch, and S. Rayner, 2013: Novel Multisector Networks and Entrepreneurship in Urban Climate Governance. *Environ. Plan. C Gov. Policy*, **31(5)**, 761–768, doi:10.1068/c3105ed.

Schwanen, T., 2021: Achieving just transitions to low-carbon urban mobility. *Nat. Energy*, **6(7)**, 685–687, doi:10.1038/s41560-021-00856-z.

Schwanitz, V.J., F. Piontek, C. Bertram, and G. Luderer, 2014: Long-term climate policy implications of phasing out fossil fuel subsidies. *Energy Policy*, **67**, 882–894, doi:10.1016/j.enpol.2013.12.015.

Schwartz, E., 2019: Autonomous Local Climate Change Policy: An Analysis of the Effect of Intergovernmental Relations Among Sub-national Governments. *Rev. Policy Res.*, **36(1)**, 50–74, doi:10.1111/ropr.12320.

Schwietzke, S. et al., 2016: Upward revision of global fossil fuel methane emissions based on isotope database. *Nature*, **538(7623)**, 88–91, doi:10.1038/nature19797.

Scobie, M., 2016: Policy coherence in climate governance in Caribbean Small Island Developing States. *Environ. Sci. Policy*, **58**, 16–28, doi:10.1016/j.envsci.2015.12.008.

Scordato, L., A. Klitkou, V.E. Tartiu, and L. Coenen, 2018: Policy mixes for the sustainability transition of the pulp and paper industry in Sweden. *J. Clean. Prod.*, **183**, 1216–1227, doi:10.1016/j.jclepro.2018.02.212.

Scotford, E. and S. Minas, 2019: Probing the hidden depths of climate law: Analysing national climate change legislation. *Rev. Eur. Comp. Int. Environ. Law*, **28(1)**, 67–81, doi:10.1111/reel.12259.

Scotford, E., S. Minas, and A. Macintosh, 2017: Climate change and national laws across Commonwealth countries. *Commonw. Law Bull.*, **43(3–4)**, 318–361, doi:10.1080/03050718.2017.1439361.

Scullion, J.J. et al., 2016: Designing conservation-development policies for the forest frontier. *Sustain. Sci.*, **11(2)**, 295–306, doi:10.1007/s11625-015-0315-7.

Secretariat of the Convention on Biological Diversity, 2009: *Connecting Biodiversity and Climate Change Mitigation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change*. Secretariat of the Convention on Biological Diversity, Montreal, Canada, 127 pp. https://www.cbd.int/doc/publications/cbd-ts-41-en.pdf (Accessed October 17, 2021).

Secretariat of the Convention on Biological Diversity, 2019: *Voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction and supplementary information*. Montreal, Canada, 154 pp. https://www.cbd.int/doc/publications/cbd-ts-93-en.pdf (Accessed October 17, 2021).

Seddon, N. et al., 2020: Global recognition of the importance of nature-based solutions to the impacts of climate change. *Glob. Sustain.*, **3** (September), e15, doi:10.1017/sus.2020.8.

Sengers, F., A.J. Wieczorek, and R. Raven, 2019: Experimenting for sustainability transitions: A systematic literature review. *Technol. Forecast. Soc. Change*, **145**, 153–164, doi:10.1016/j.techfore.2016.08.031.

Seok, J.-E., J. Kim, and H.S. Park, 2021: Regulatory and social dynamics of voluntary agreement adoption: The case of voluntary energy efficiency and GHG reduction agreement in South Korea. *Energy Policy*, **148(Part B)**, 111903, doi:10.1016/j.enpol.2020.111903.

Setzer, J., 2015: Testing the boundaries of sub-national diplomacy: The international climate action of local and regional governments. *Transnatl. Environ. Law*, **4(2)**, 319–337, doi:10.1017/S2047102515000126.

Setzer, J., 2017: How Sub-national Governments are Rescaling Environmental Governance: The Case of the Brazilian State of São Paulo. *J. Environ. Policy Plan.*, **19(5)**, 503–519, doi:10.1080/1523908X.2014.984669.

Setzer, J. and L. Benjamin, 2019: Climate Litigation in the Global South: Constraints and Innovations. *Transnatl. Environ. Law*, **9(1)**, 1–25, doi:10.1017/S2047102519000268.

Setzer, J. and R. Byrnes, 2019: *Global trends in climate change litigation: 2019 snapshot*. Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science, London, UK, 14 pp. http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/07/GRI_Global-trends-in-climate-change-litigation-2019-snapshot-2.pdf (Accessed October 25, 2021).

Setzer, J. and L.C. Vanhala, 2019: Climate change litigation: A review of research on courts and litigants in climate governance. *Wiley Interdiscip. Rev. Clim. Change*, **10(3)**, e580, doi:10.1002/wcc.580.

Setzer, J. and C. Higham, 2021: *Global trends in climate litigation: 2021 snapshot*. Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science London, UK, 45 pp. https://www.lse.ac.uk/granthaminstitute/publication/global-trends-in-climate-litigation-2021-snapshot/ (Accessed September 29, 2021).

Shanahan, M., 2009: Time to adapt? Media coverage of climate change in non-industrialised countries. In: *Climate Change and the Media.* Peter Lang Publishing, Bern, Switzerland, pp. 145–157.

Shapiro, J., 2020: *The Environmental Bias of Trade Policy*. National Bureau of Economic Research, Working paper 26845, doi: 10.3386/w26845.

Sharifi, A., 2020: Trade-offs and conflicts between urban climate change mitigation and adaptation measures: A literature review. *J. Clean. Prod.*, **276**, 122813, doi:10.1016/j.jclepro.2020.122813.

Sharifi, A. and Y. Yamagata, 2016: Principles and criteria for assessing urban energy resilience: A literature review. *Renew. Sustain. Energy Rev.*, **60**, 1654–1677, doi:10.1016/j.rser.2016.03.028.

Sharpe, S. and T.M. Lenton, 2021: Upward-scaling tipping cascades to meet climate goals: plausible grounds for hope. *Clim. Policy*, **21(4)**, 421–433, do i:10.1080/14693062.2020.1870097.

Shaw, A., S. Burch, F. Kristensen, J. Robinson, and A. Dale, 2014: Accelerating the sustainability transition: Exploring synergies between adaptation and mitigation in British Columbian communities. *Glob. Environ. Change*, **25(1)**, 41–51, doi:10.1016/j.gloenvcha.2014.01.002.

Sheikh, F.A. and S. Bhaduri, 2021: Policy space for informal sector grassroots innovations: towards a 'bottom-up' narrative. *Int. Dev. Plan. Rev.*, **43(1)**, 115–137, doi:10.3828/idpr.2019.34.

Shen, W., 2015: Chinese business at the dawn of its domestic emissions trading scheme: incentives and barriers to participation in carbon trading. *Clim. Policy*, **15(3)**, 339–354, doi:10.1080/14693062.2014.926263.

Shen, W., 2017: Who drives China's renewable energy policies? Understanding the role of industrial corporations. *Environ. Dev.*, **21**, 87–97, doi:10.1016/j.envdev.2016.10.006.

Shen, W. and L. Xie, 2018: The Political Economy for Low-carbon Energy Transition in China: Towards a New Policy Paradigm? *New Polit. Econ.*, **23(4)**, 407–421, doi:10.1080/13563467.2017.1371122.

Shirky, C., 2010: The Political Power of Social Media: Technology, the Public Sphere, and Political Change. *Foreign Affairs*, **90(1)**, 28–41. http://www.jstor.org/stable/25800379 (Accessed May 10, 2022).

Shishlov, I., R. Morel, and V. Bellassen, 2016: Compliance of the Parties to the Kyoto Protocol in the first commitment period. *Clim. Policy*, **16(6)**, 768–782, doi.org/10.1080/14693062.2016.1164658.

Shwom, R.L., 2011: A middle range theorization of energy politics: The struggle for energy efficient appliances. *Env. Polit.*, **20(5)**, 705–726, doi:10.1080/09644016.2011.608535.

Shwom, R.L. et al., 2015: Public Opinion on Climate Change. In: *Climate Change and Society: Sociological Perspectives* [Dunlap, R.E. and R.J. Brulle, (eds.)]. Oxford University Press, New York, USA, pp. 269–299.

Silvero, F., F. Rodrigues, S. Montelpare, E. Spacone, and H. Varum, 2019: The path towards buildings energy efficiency in South American countries. *Sustain. Cities Soc.*, **44**(April 2018), 646–665, doi:10.1016/j.scs.2018.10.028.

Simon Rosenthal, C., J.A. Rosenthal, J.D. Moore, and J. Smith, 2015: Beyond (and Within) City Limits: Climate Policy in an Intergovernmental System. *Rev. Policy Res.*, **32(5)**, 538–555, doi:10.1111/ropr.12136.

Sims Gallagher, K. and X. Xuan, 2019: *Titans of the Climate: Explaining Policy Process in the United States and China*. 1st ed. The MIT Press, Cambridge, MA, USA, 272 pp.

Sindico, F., M.M. Mbengue, and K. McKenzie, 2021: Climate Change Litigation and the Individual: An Overview. In: *Comparative Climate Change*

Litigation: Beyond the Usual Suspects [Sindico, F. and M.M. Mbengue, (eds.)]. Springer, Cham, Switzerland, pp. 1–33.

Singh, P.K. and H. Chudasama, 2021: Pathways for climate resilient development: Human well-being within a safe and just space in the 21st century. *Glob. Environ. Change*, **68**, 1–14, doi:10.1016/j.gloenvcha.2021.102277.

Skjærseth, J.B., 2017: The European Commission's Shifting Climate Leadership. *Glob. Environ. Polit.*, **17(2)**, 84–104, doi:10.1162/GLEP_a_00402.

Skjærseth, J.B. and T. Skodvin, 2010: *Climate change and the oil industry: Common problem, different strategies*. Manchester University Press, Manchester, UK, 256 pp.

Skovgaard, J., 2012: Learning about Climate Change: Finance Ministries in International Climate Change Politics. *Glob. Environ. Polit.*, **12(4)**, 1–8, doi:10.1162/GLEP_a_00136.

Skovgaard, J., 2018: Policy coherence and organizational cultures: Energy efficiency and greenhouse gas reduction targets. *Environ. Policy Gov.*, **28(5)**, 350–358, doi:10.1002/eet.1821.

Skovgaard, J. and H. van Asselt, eds., 2018: *The Politics of Fossil Fuel Subsidies and their Reform*. Cambridge University Press, Cambridge, UK, pp. 324.

Skovgaard, J. and H. van Asselt, 2019: The politics of fossil fuel subsidies and their reform: Implications for climate change mitigation. *Wiley Interdiscip. Rev. Clim. Change*, **10(4)**, e581, doi:10.1002/wcc.581.

Skurka, C., J. Niederdeppe, R. Romero-Canyas, and D. Acup, 2018: Pathways of Influence in Emotional Appeals: Benefits and Tradeoffs of UsingFear or Humor to Promote Climate Change-Related Intentions and Risk Perceptions. *J. Commun.*, **68(1)**, 169–193, doi:10.1093/joc/jqx008.

Slovic, A.D., M.A. de Oliveira, J. Biehl, and H. Ribeiro, 2016: How Can Urban Policies Improve Air Quality and Help Mitigate Global Climate Change: a Systematic Mapping Review. *J. Urban Heal.*, **93(1)**, doi:10.1007/s11524-015-0007-8.

Smeds, E. and M. Acuto, 2018: Networking Cities after Paris: Weighing the Ambition of Urban Climate Change Experimentation. *Glob. Policy*, **9(4)**, 549–559, doi:10.1111/1758-5899.12587.

Smith, J., 2000: *The daily globe: environmental change, the public and the media*. Earthscan Publications Ltd., London, UK, pp. 280.

Smith, J. et al., 2016: Balancing competing policy demands: the case of sustainable public sector food procurement. *J. Clean. Prod.*, **112**, 249–256, doi:10.1016/j.jclepro.2015.07.065.

Smith, J.M., 2019: Boom to bust, ashes to (coal) dust: the contested ethics of energy exchanges in a declining US coal market. *J.R. Anthropol. Inst.*, **25(S1)**, 91–107, doi:10.1111/1467-9655.13016.

Snell, D. and P. Fairbrother, 2010: Unions as environmental actors. *Transf. Eur. Rev. Labour Res.*, **16(3)**, 411–424, doi:10.1177/1024258910373874.

Sokona, Y., 2021: Building capacity for 'energy for development' in Africa: four decades and counting. *Clim. Policy*, 22 (5) 671–679, doi:10.1080/14693062.2020.1870915.

Solana, J., 2020: Climate Litigation in Financial Markets: A Typology. *Transnatl. Environ. Law*, **9(1)**, 103–135, doi:10.1017/S2047102519000244.

Solarin, S.A., 2020: An environmental impact assessment of fossil fuel subsidies in emerging and developing economies. *Environ. Impact Assess. Rev.*, **85**, 106443, doi:10.1016/j.eiar.2020.106443.

Solecki, W. et al., 2019: Extreme events and climate adaptation-mitigation linkages: Understanding low-carbon transitions in the era of global urbanisation. *Wiley Interdiscip. Rev. Clim. Change*, **10(6)**, 1–16, doi:10.1002/wcc.616.

Somerville, P., 2020: A critique of climate change mitigation policy. *Policy Polit.*, **48(2)**, 355–378, doi:10.1332/030557319X15661682426163.

Sovacool, B.K. and M.H. Dworkin, 2015: Energy justice: Conceptual insights and practical applications. *Appl. Energy*, **142**, 435–444, doi:10.1016/j.apenergy.2015.01.002.

Sovacool, B.K. et al., 2020: Imagining sustainable energy and mobility transitions: Valence, temporality, and radicalism in 38 visions of a low-carbon future. *Soc. Stud. Sci.*, **50(4)**, 642–679, doi:10.1177/0306312720915283.

Spencer, B. et al., 2017: Case studies in co-benefits approaches to climate change mitigation and adaptation. *J. Environ. Plan. Manag.*, **60(4)**, 647–667, doi:10.1080/09640568.2016.1168287.

Spencer, T. and N.K. Dubash, 2021: Scenarios for different 'Future Indias': sharpening energy and climate modelling tools. *Clim. Policy*, **22(1)**, 30– 47, doi:10.1080/14693062.2021.1973361.

Spencer, T. et al., 2018: The 1.5°C target and coal sector transition: at the limits of societal feasibility. *Clim. Policy*, **18(3)**, 335–351, doi:10.1080/14693062.2017.1386540.

Stadelmann, M. and R. Schubert, 2018: How Do Different Designs of Energy Labels Influence Purchases of Household Appliances? A Field Study in Switzerland. *Ecol. Econ.*, **144**, 112–123, doi:10.1016/j.ecolecon.2017.07.031.

Stadelmann, M., A. Michaelowa, S. Butzengeiger-Geyer, and M. Köhler, 2014: Universal Metrics to Compare the Effectiveness of Climate Change Adaptation Projects. In: *Handbook of Climate Change Adaptation* [Leal Filho, W., (ed.)]. Springer Berlin Heidelberg, Berlin, Germany, pp. 1–15.

Stavins, R.N., 2019: *The future of U.S. carbon-pricing policy*. Harvard Environmental Economics Program, Cambridge, MA, USA, 56 pp.

Steffen, B., T.S. Schmidt, and P. Tautorat, 2019: Measuring whether municipal climate networks make a difference: the case of utility-scale solar PV investment in large global cities. *Clim. Policy*, **19(7)**, 908–922, doi:10.1080/14693062.2019.1599804.

Steiner, A., 2009: Global Green New Deal. *New Solut. A J. Environ. Occup. Heal. Policy*, **19(2)**, 185–193, doi:10.2190/NS.19.2.s.

Steinhardt, H.C. and F. Wu, 2016: In the Name of the Public: Environmental Protest and the Changing Landscape of Popular Contention in China. *China J.*, **75**, 61–82, doi:10.1086/684010.

Stevins, D., 2013: Green jobs? Good jobs? Just jobs? US labour unions confront climate change. In: *Trade Unions in the Green Economy: Working for the Environment* [Räthzel, N. and D. Uzzell, (eds.)]. Routledge, London, UK, pp. 179–185.

Stevis, D., 2018: US labour unions and green transitions: depth, breadth, and worker agency. *Globalizations*, **15(4)**, 454–469, doi:10.1080/14747731.2018.1454681.

Stiglitz, J.E., 2019: Addressing climate change through price and non-price interventions. *Eur. Econ. Rev.*, **119**, 594–612, doi:10.1016/j.euroecorev.2019.05.007.

Stoddard, I. et al., 2021: Three Decades of Climate Mitigation: Why Haven't We Bent the Global Emissions Curve? *Annu. Rev. Environ. Resour.*, **46(1)**, 653–689, doi:10.1146/annurev-environ-012220-011104.

Stoddart, M.C.J. and D.B. Tindall, 2015: Canadian news media and the cultural dynamics of multilevel climate governance. *Env. Polit.*, **24(3)**, 401–422, doi:10.1080/09644016.2015.1008249.

Stoerk, T., D.J. Dudek, and J. Yang, 2019: China's national carbon emissions trading scheme: lessons from the pilot emission trading schemes, academic literature, and known policy details. *Clim. Policy*, **19(4)**, 472–486, doi:10.1080/14693062.2019.1568959.

Stokes, L.C., 2016: Electoral Backlash against Climate Policy: A Natural Experiment on Retrospective Voting and Local Resistance to Public Policy. *Am. J. Pol. Sci.*, **60(4)**, 958–974, doi:10.1111/ajps.12220.

Stokes, L.C., 2020: *Short Circuiting Policy: Interest Groups and the Battle Over Clean Energy and Climate Policy in the American States*. Oxford University Press, NY, USA, 337 pp.

Stokes, L.C. and C. Warshaw, 2017: Renewable energy policy design and framing influence public support in the United States. *Nat. Energy*, **2(8)**, 17107, doi:10.1038/nenergy.2017.107.

Stokes, L.C. and H.L. Breetz, 2018: Politics in the U.S. energy transition: Case studies of solar, wind, biofuels and electric vehicles policy. *Energy Policy*, **113**, 76–86, doi:10.1016/j.enpol.2017.10.057.

Strauch, Y., 2020: Beyond the low-carbon niche: Global tipping points in the rise of wind, solar, and electric vehicles to regime scale systems. *Energy Res. Soc. Sci.*, **62**, doi:10.1016/j.erss.2019.101364.

Stuart-Smith, R.F. et al., 2021: Filling the evidentiary gap in climate litigation. *Nat. Clim. Change*, **11(8)**, 651–655, doi:10.1038/s41558-021-01086-7.

Stuart, A., E.F. Thomas, N. Donaghue, and A. Russell, 2013: 'We may be pirates, but we are not protesters': Identity in the Sea Shepherd Conservation Society. *Polit. Psychol.*, **34(5)**, 753–777, doi:10.1111/pops.12016.

Stuart, J., P. Collins, M. Alger, and G. Whitelaw, 2016: Embracing sustainability: the incorporation of sustainability principles in municipal planning and policy in four mid-sized municipalities in Ontario, Canada. *Local Environ.*, **21(2)**, 219–240, doi:10.1080/13549839.2014.936844.

Stucki, T., M. Woerter, S. Arvanitis, M. Peneder, and C. Rammer, 2018: How different policy instruments affect green product innovation: A differentiated perspective. *Energy Policy*, **114**, 245–261, doi:10.1016/j.enpol.2017.11.049.

Sugiyama, M. et al., 2021: EMF 35 JMIP study for Japan's long-term climate and energy policy: scenario designs and key findings. *Sustain. Sci.*, **16(2)**, 355–374, doi:10.1007/s11625-021-00913-2.

Sundström, A., 2016: Understanding illegality and corruption in forest governance. *J. Environ. Manage.*, **181**, 779–790, doi:10.1016/j.jenvman.2016.07.020.

Supran, G. and N. Oreskes, 2017: Assessing ExxonMobil's climate change communications (1977–2014). *Environ. Res. Lett.*, **12(8)**, 084019, doi:10.1088/1748-9326/aa815f.

Sustainable Purchasing Leadership Council, 2021: *Recommendations for climate friendly refrigerant management and procurement*. 42 pp. https://www.sustainablepurchasing.org/wp-content/uploads/2020/09/Climate-Friendly-Refrigerant-Management-and-Procurement-22-September-2021.pdf (Accessed October 18, 2021).

Svoboda, M., 2016: Cli-fi on the screen(s): patterns in the representations of climate change in fictional films. *Wiley Interdiscip. Rev. Clim. Change*, **7(1)**, 43–64, doi:10.1002/wcc.381.

Swim, J.K., N. Geiger, and M.L. Lengieza, 2019: Climate Change Marches as Motivators for Bystander Collective Action. *Front. Commun.*, pp. 4, doi:10.3389/fcomm.2019.00004.

Takahashi, B., 2011: Framing and sources: a study of mass media coverage of climate change in Peru during the V ALCUE. *Public Underst. Sci.*, **20(4)**, 543–557, doi:10.1177/0963662509356502.

Talaei, A., M.S. Ahadi, and S. Maghsoudy, 2014: Climate friendly technology transfer in the energy sector: A case study of Iran. *Energy Policy*, **64**, 349–363, doi:10.1016/j.enpol.2013.09.050.

Tan, H., E. Thurbon, S.-Y. Kim, and J.A. Mathews, 2021: Overcoming incumbent resistance to the clean energy shift: How local governments act as change agents in coal power station closures in China. *Energy Policy*, **149**, 112058, doi:10.1016/j.enpol.2020.112058.

Tan, J., 2018: Wo guo mei kuang wa si zong he li yong fa zhan xian zhuang ji jian yi (Development status and suggestion of comprehensive utilization of coal mine gas in China). *Coal Process. Compr. Util.*, **(8)**, 59-61, 66.

Tao, S., S. Chen, and Z. Pan, 2019: Current status, challenges, and policy suggestions for coalbed methane industry development in China: A review. *Energy Sci. Eng.*, **7(4)**, 1059–1074, doi:10.1002/ese3.358.

Tarrow, S., 2005: *The New Transnational Activism*. Cambridge University Press, New York, USA, 288 pp.

Taylor, M., J. Watts, and J. Bartlett, 2019: Climate crisis: 6 million people join latest wave of global protests. *The Guardian*, https://www.theguardian.com/environment/2019/sep/27/climate-crisis-6-million-people-join-latest-wave-of-worldwide-protests (Accessed March 30, 2021).

Tegegne, Y.T. et al., 2021: REDD+ and equity outcomes: Two cases from Cameroon. *Environ. Sci. Policy*, **124**(April 2020), 324–335, doi:10.1016/j.envsci.2021.07.003.

Temper, L., F. Demaria, A. Scheidel, D. Del Bene, and J. Martinez-Alier, 2018: The Global Environmental Justice Atlas (EJAtlas): ecological distribution conflicts as forces for sustainability. *Sustain. Sci.*, **13(3)**, 573–584, doi:10.1007/s11625-018-0563-4.

Temper, L. et al., 2020: Movements shaping climate futures: A systematic mapping of protests against fossil fuel and low-carbon energy projects. *Environ. Res. Lett.*, **15(12)**, 123004, doi:10.1088/1748-9326/abc197.

Teng, F. and P. Wang, 2021: The evolution of climate governance in China: drivers, features, and effectiveness. *Env. Polit.*, **30(sup1)**, 141–161, doi:10.1080/09644016.2021.1985221.

Teng, F., F. Jotzo, and X. Wang, 2017: Interactions between market reform and a carbon price in China's power sector. *Econ. Energy Environ. Policy*, **6(2)**, doi:10.5547/2160-5890.6.1.ften.

Teske, S., T. Pregger, S. Simon, and T. Naegler, 2018: High renewable energy penetration scenarios and their implications for urban energy and transport systems. *Curr. Opin. Environ. Sustain.*, **30**, 89–102, doi:10.1016/j.cosust.2018.04.007.

Testa, F., E. Annunziata, F. Iraldo, and M. Frey, 2016: Drawbacks and opportunities of green public procurement: an effective tool for sustainable production. *J. Clean. Prod.*, **112**, 1893–1900, doi:10.1016/j.jclepro.2014.09.092.

Thackeray, S.J. et al., 2020: Civil disobedience movements such as School Strike for the Climate are raising public awareness of the climate change emergency. *Glob. Change Biol.*, **26(3)**, 1042–1044, doi:10.1111/gcb.14978.

The Climate Group with CDP, 2020: States and regions: CDP. www.cdp.net/en/cities/states-and-regions (Accessed October 21, 2021).

The European Parliament and the Council of the European Union, 2018: Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. http://data.europa.eu/eli/dir/2018/2001/2018-12-21 (Accessed October 24, 2021).

Thøgersen, J. et al., 2021: Why do people continue driving conventional cars despite climate change? Social-psychological and institutional insights from a survey of Norwegian commuters. *Energy Res. Soc. Sci.*, **79**, 102168, doi:10.1016/j.erss.2021.102168.

Thompson, F.J., K.K. Wong, and B.G. Rabe, 2020: *Trump, the Administrative Presidency, and Federalism*. Brookings Institution Press, Washington, DC, USA, 256 pp.

Thonig, R. et al., 2021: Does ideology influence the ambition level of climate and renewable energy policy? Insights from four European countries. *Energy Sources, Part B Econ. Planning, Policy*, **16(1)**, 4–22, doi:10.1080/15567249.2020.1811806.

Thornton, T.F. and C. Comberti, 2017: Synergies and trade-offs between adaptation, mitigation and development. *Clim. Change*, **140(1)**, 5–18, doi:10.1007/s10584-013-0884-3.

Thunberg, G., 2019: Young people have led the climate strikes. Now we need adults to join us too. *The Guardian*, https://www.theguardian.com/commentisfree/2019/may/23/greta-thunberg-young-people-climate-strikes-20-september (Accessed May 23).

Timilsina, G.R., 2018: *Where is the carbon tax after thirty years of research?* The World Bank, Washington, DC, USA, 88 pp. https://openknowledge.worldbank.org/handle/10986/29946 (Accessed March 30, 2021).

Timperley, J., 2020: What can the world learn from New Zealand on climate? *Lancet Planet. Heal.*, **4(5)**, e176–e177, doi:10.1016/S2542-5196(20)30109-1.

Tindall, D.B., M.C.J. Stoddart, and C. Callison, 2018: The Relationships Between Climate Change News Coverage, Policy Debate, and Societal Decisions. In: *Oxford Research Encyclopedia of Climate Science*, Oxford University Press, Oxford, UK, doi: 10.1093/acrefore/9780190228620.013.370.

Tobin, P., 2017: Leaders and Laggards: Climate Policy Ambition in Developed States. *Glob. Environ. Polit.*, **17(4)**, 28–47, doi:10.1162/GLEP_a_00433.

Tobler, C., V.H.M. Visschers, and M. Siegrist, 2012: Addressing climate change: Determinants of consumers' willingness to act and to support policy measures. *J. Environ. Psychol.*, **32(3)**, 197–207, doi:10.1016/j.jenvp.2012.02.001.

Torabi Moghadam, S., C. Delmastro, S.P. Corgnati, and P. Lombardi, 2017: Urban energy planning procedure for sustainable development in the built

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environment: A review of available spatial approaches. *J. Clean. Prod.*, **165**, 811–827, doi:10.1016/j.jclepro.2017.07.142.

Torney, D., 2017: If at first you don't succeed: the development of climate change legislation in Ireland. *Irish Polit. Stud.*, **32(2)**, 247–267, doi:10.1080/07907184.2017.1299134.

Torney, D., 2019: Climate laws in small European states: symbolic legislation and limits of diffusion in Ireland and Finland. *Env. Polit.*, **28(6)**, 1124–1144, doi:10.1080/09644016.2019.1625159.

Torre-Schaub, M., 2021: Climate Change Litigation in France: New Perspectives and Trends. In: *Climate Change Litigation: Global Perspectives* [Alogna, I., C. Bakker, and J.P. Gauci (eds.)]. Brill, Nijhoff, Leiden, The Netherlands, pp. 124–142.

Torrens, J., J. Schot, R. Raven, and P. Johnstone, 2019: Seedbeds, harbours, and battlegrounds: On the origins of favourable environments for urban experimentation with sustainability. *Environ. Innov. Soc. Transitions*, **31**, 211–232, doi:10.1016/j.eist.2018.11.003.

Tosun, J., 2018: Investigating Ministry Names for Comparative Policy Analysis: Lessons from Energy Governance. *J. Comp. Policy Anal. Res. Pract.*, **20(3)**, 324–335, doi:10.1080/13876988.2018.1467430.

Tosun, J. and A. Lang, 2017: Policy integration: mapping the different concepts. *Policy Stud.*, **38(6)**, 553–570, doi:10.1080/01442872.2017.1339239.

Tosun, J. and J. Schnepf, 2020: Measuring change in comparative policy analysis: concepts and empirical approaches. In: *Handbook of Research Methods and Applications in Comparative Policy Analysis*, Edward Elgar Publishing, Cheltenham, UK, pp. 167–185.

Townshend, T. et al., 2013: How national legislation can help to solve climate change. *Nat. Clim. Change*, **3(5)**, 430–432, doi:10.1038/nclimate1894.

Tozer, L., 2020: Catalyzing political momentum for the effective implementation of decarbonization for urban buildings. *Energy Policy*, **136**, 111042, doi:10.1016/j.enpol.2019.111042.

Treisman, D., 2000: The causes of corruption: A cross-national study. *J. Public Econ.*, **76(3)**, 399–457, doi:10.1016/S0047-2727(99)00092-4.

Trencher, G. and J. van der Heijden, 2019: Instrument interactions and relationships in policy mixes: Achieving complementarity in building energy efficiency policies in New York, Sydney and Tokyo. *Energy Res. Soc. Sci.*, **54**, 34–45, doi:10.1016/j.erss.2019.02.023.

Trencher, G. et al., 2016: Innovative policy practices to advance building energy efficiency and retrofitting: Approaches, impacts and challenges in ten C40 cities. *Environ. Sci. Policy*, **66**, 353–365, doi:10.1016/j.envsci.2016.06.021.

Trihartono, A., N. Viartasiwi, and C. Nisya, 2020: The giant step of tiny toes: youth impact on the securitization of climate change. *IOP Conf. Ser. Earth Environ. Sci.*, **485**, 012007, doi:10.1088/1755-1315/485/1/012007.

Trope, Y., N. Liberman, and C. Wakslak, 2007: Construal levels and psychological distance: Effects on representation, prediction, evaluation, and behavior. *J. Consum. Psychol.*, **17(2)**, 83–95, doi:10.1016/S1057-7408(07)70013-X.

Tsai, W.-T., 2017: Green public procurement and green-mark products strategies for mitigating greenhouse gas emissions—experience from Taiwan. *Mitig. Adapt. Strateg. Glob. Change*, **22(5)**, 729–742, doi:10.1007/s11027-015-9695-3.

Tufekci, Z., 2017: *Twitter and Tear Gas: The Power and Fragility of Networked Protest*. Yale University Press, New Haven, CT, USA, 360 pp.

Turnheim, B., P. Kivimaa, and F. Berkhout, eds., 2018: *Innovating climate governance: moving beyond experiments*. Cambridge University Press, Cambridge, UK, 250 pp.

Tvinnereim, E. and M. Mehling, 2018: Carbon pricing and deep decarbonisation. *Energy Policy*, **121**, 185–189, doi:10.1016/j.enpol.2018.06.020.

Tyler, E. and K. Hochstetler, 2021: Institutionalising decarbonisation in South Africa: navigating climate mitigation and socio-economic transformation. *Env. Polit.*, **30(sup1)**, 184–205, doi:10.1080/09644016.2021.1947635.

Uittenbroek, C.J., 2016: From Policy Document to Implementation: Organizational Routines as Possible Barriers to Mainstreaming Climate Adaptation. *J. Environ. Policy Plan.*, **18(2)**, 161–176, doi:10.1080/1523908X.2015.1065717.

UN Environment, 2018: *Legislative and Policy Options to Control Hydrofluorocarbons*. OzonAction, United Nations Environment Economy Division, Paris, France, 104 pp. https://www.unenvironment.org/ozonaction/resources/publication/legislative-and-policy-options-control-hydrofluorocarbons (Accessed March 30, 2021).

UN Habitat, 2016: *World Cities Report Urbanization and Development: Emerging Futures*. UN-Habitat, Nairobi, Kenya, 262 pp. https://unhabitat.org/world-cities-report (Accessed May 7, 2021).

UNEP, 2018: Bridging the gap: The role of innovation policy and market creation. In: *Emissions Gap Report 2018.* United Nations Environment Programme, Nairobi, Kenya, pp. 52–59.

UNEP, 2019a: *Measuring Fossil Fuel Subsidies in the Context of the Sustainable Development Goals*. United Nations Environment Programme, Nairobi, Kenya, 94 pp. https://www.unep.org/resources/report/measuring-fossil-fuel-subsidies-context-sustainable-development-goals (Accessed October 19, 2021).

UNEP, 2019b: *Emissions Gap Report 2019*. United Nations Environment Programme, Nairobi, Kenya, 1–108. pp. https://wedocs.unep.org/bitstream/handle/20.500.11822/30797/EGR2019.pdf?sequence=1&isAllowed=y (Accessed March 30, 2021).

UNEP, 2020a: *Emissions Gap Report 2020*. United Nations Environment Programme, Nairobi, Kenya, 128 pp. https://www.unenvironment.org/emissions-gap-report-2020 (Accessed March 30, 2021).

UNEP, 2020b: Global Climate Litigation Report: 2020 Status Review. United Nations Environment Programme, Nairobi, Kenya, https://www.unep.org/resources/report/global-climate-litigation-report-2020-status-review, 52 pp.

UNEP DTU Partnership, 2020: CDM Pipeline (1 May 2020 version). http://www.cdmpipeline.org/ (Accessed March 30, 2021).

UNFCCC, 2012: *Annual report of the Executive Board of the clean development mechanism to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol*. United Nations Framework Convention on Climate Change, Bonn, Germany, 20 pp. http://unfccc.int/resource/docs/2012/cmp8/eng/03p01.pdf (Accessed March 30, 2021).

UNFCCC Secretariat, 2016: *Aggregate effect of the intended Nationally Determined Contributions: an update*. United Nations Framework Convention on Climate Change, Marrakech, Morocco, 75 pp. https://unfccc.int/sites/default/files/resource/docs/2016/cop22/eng/02.pdf (Accessed March 30, 2021).

UNFCCC Secretariat, 2021: *Nationally Determined Contributions under the Paris Agreement: Synthesis report by the secretariat*. 42 pp. https://unfccc.int/news/full-ndc-synthesis-report-some-progress-but-still-a-big-concern (Accessed October 7, 2021).

Upadhyaya, P., M.K. Shrivastava, G. Gorti, and S. Fakir, 2021: Capacity building for proportionate climate policy: Lessons from India and South Africa. *Int. Polit. Sci. Rev.*, **42(1)**, 130–145, doi:10.1177/0192512120963883.

Ürge-Vorsatz, D. and K.C. Seto, 2018: Editorial Overview: 1.5°C Climate change and urban areas. *Curr. Opin. Environ. Sustain.*, **30**, iv–vi, doi:10.1016/j.cosust.2018.07.004.

Ürge-Vorsatz, D., S.T. Herrero, N.K. Dubash, and F. Lecocq, 2014: Measuring the Co-Benefits of Climate Change Mitigation. *Annu. Rev. Environ. Resour.*, **39(1)**, 549–582, doi:10.1146/annurev-environ-031312-125456.

Ürge-Vorsatz, Di. et al., 2018: Locking in positive climate responses in cities. *Nat. Clim. Change*, **8(3)**, 174–177, doi:10.1038/s41558-018-0100-6.

Urpelainen, J., 2018: RISE to the occasion? A critique of the World Bank's Regulatory Indicators for Sustainable Energy. *Energy Res. Soc. Sci.*, **39**, 69–73, doi:10.1016/j.erss.2017.10.034.

Uyarra, E., P. Shapira, and A. Harding, 2016: Low carbon innovation and enterprise growth in the UK: Challenges of a place-blind policy mix. *Technol. Forecast. Soc. Change*, **103**, 264–272, doi:10.1016/j.techfore.2015.10.008.

Valentová, M., J. Karásek, and J. Knápek, 2019: *Ex post* evaluation of energy efficiency programs: Case study of Czech Green Investment Scheme. *WIREs Energy Environ.*, **8(2)**, doi:10.1002/wene.323.

Valenzuela, J.M., 2014: Climate Change Agenda at Sub-national Level in Mexico: Policy coordination or policy competition? *Environ. Policy Gov.*, **24(3)**, 188–203, doi:10.1002/eet.1638.

van Benthem, A. and S. Kerr, 2013: Scale and transfers in international emissions offset programs. *J. Public Econ.*, **107**, 31–46, doi:10.1016/j.jpubeco.2013.08.004.

Van Den Berg, L., E. Braun, and J. Van Der Meer, 2018: *National Urban Policies in the European Union*. 1st ed. Routledge, Oxon, UK.

van den Bergh, J. and I. Savin, 2021: Impact of Carbon Pricing on Low-Carbon Innovation and Deep Decarbonisation: Controversies and Path Forward. *Environ. Resour. Econ.*, **80**, 705–715, doi:10.1007/s10640-021-00594-6.

van den Bergh, J. et al., 2021: Designing an effective climate-policy mix: accounting for instrument synergy. *Clim. Policy*, **21(6)**, 745–764, doi:10.1080/14693062.2021.1907276.

van der Heijden, J., 2018: City and Sub-national Governance. In: *Governing Climate Change: Polycentricity in Action?* [Jordan, A., D. Huitema, H. Van Asselt, and J. Forster, (eds.)]. Cambridge University Press, Cambridge, UK, pp. 81–96.

van der Linden, S., E. Maibach, and A. Leiserowitz, 2015: Improving Public Engagement With Climate Change: Five ‘Best Practice’ Insights From Psychological Science. *Perspect. Psychol. Sci.*, **10(6)**, 758–763, doi:10.1177/1745691615598516.

van der Linden, S., A. Leiserowitz, S. Rosenthal, and E. Maibach, 2017: Inoculating the Public against Misinformation about Climate Change. *Glob. Challenges*, **1(2)**, 1600008, doi:10.1002/gch2.201600008.

Vanegas Cantarero, M.M., 2020: Of renewable energy, energy democracy, and sustainable development: A roadmap to accelerate the energy transition in developing countries. *Energy Res. Soc. Sci.*, **70**, 101716, doi:10.1016/j.erss.2020.101716.

Vedung, E., 2005: *Public Policy and Program Evaluation*. Routledge, Boca Raton, Florida, USA, 336 pp.

Venmans, F., J. Ellis, and D. Nachtigall, 2020: Carbon pricing and competitiveness: are they at odds? *Clim. Policy*, **20(9)**, 1070–1091, doi:10.1080/14693062.2020.1805291.

Verde, S.F., 2020: The impact of the EU emissions trading system on competitiveness and carbon leakage: The econometric evidence. *J. Econ. Surv.*, **34(2)**, 320–343, doi:10.1111/joes.12356.

Verschuuren, J., 2019: The State of the Netherlands v Urgenda Foundation: The Hague Court of Appeal upholds judgment requiring the Netherlands to further reduce its greenhouse gas emissions. *Rev. Eur. Comp. Int. Environ. Law*, **28(1)**, 94–98, doi:10.1111/reel.12280.

Vestergren, S., J. Drury, and E.H. Chiriac, 2018: How collective action produces psychological change and how that change endures over time: A case study of an environmental campaign. *Br. J. Soc. Psychol.*, **57(4)**, 855–877, doi:10.1111/bjso.12270.

Vestergren, S., J. Drury, and E. Hammar Chiriac, 2019: How participation in collective action changes relationships, behaviours, and beliefs: An interview study of the role of inter- and intragroup processes. *J. Soc. Polit. Psychol.*, **7(1)**, 76–99, doi:10.5964/jspp.v7i1.903.

Veum, K.C., 2018: *Long-Term Agreements on Energy Efficiency for the non-ETS sector*. 11 pp. https://epatee.eu/system/tdf/epatee_case_study_netherlands_mja3_voluntary_agreements_in_the_non-ets_sectors_ok_0_0.pdf?file=1&type=node&id=155 (Accessed March 3, 2021).

Viardot, E., 2013: The role of cooperatives in overcoming the barriers to adoption of renewable energy. *Energy Policy*, **63**, 756–764, doi:10.1016/j.enpol.2013.08.034.

Victor, D.G., F.W. Geels, and S. Sharpe, 2019: *Accelerating the Low Carbon Transition: The Case for Stronger, More Targeted and Coordinated International Action*. The Brookings Institution, San Diego, CA, USA, The UK Government Department for Business, Energy and Industrial Strategy, London, UK, and The Energy Transitions Commission (ETC), London, UK, 71 pp. https://www.brookings.edu/wp-content/uploads/2019/12/Coordinatedactionreport.pdf.

Viguié, V. and S. Hallegatte, 2012: Trade-offs and synergies in urban climate policies. *Nat. Clim. Change*, **2(5)**, 334–337, doi:10.1038/nclimate1434.

Vihma, A., 2011: India and the Global Climate Governance: Between Principles and Pragmatism. *J. Environ. Dev.*, **20(1)**, 69–94, doi:10.1177/1070496510394325.

Villarroel Walker, R., M.B. Beck, J.W. Hall, R.J. Dawson, and O. Heidrich, 2017: Identifying key technology and policy strategies for sustainable cities: A case study of London. *Environ. Dev.*, **21**(May 2016), 1–18, doi:10.1016/j.envdev.2016.11.006.

Vivid Economics, 2021: *Greenness of Stimulus Index. An assessment of COVID-19 stimulus by G20 countries and other major economies in relation to climate action and biodiversity goals. July 2021.* 93 pp. https://www.vivideconomics.com/wp-content/uploads/2021/07/Green-Stimulus-Index-6th-Edition_final-report.pdf (Accessed October 27, 2021).

Vogt-Schilb, A. and S. Hallegatte, 2017: Climate policies and Nationally Determined Contributions: reconciling the needed ambition with the political economy. *Wiley Interdiscip. Rev. Energy Environ.*, **6(6)**, e256, doi:10.1002/wene.256.

von Stechow, C. et al., 2015: Integrating Global Climate Change Mitigation Goals with Other Sustainability Objectives: A Synthesis. *Annu. Rev. Environ. Resour.*, **40(1)**, 363–394, doi:10.1146/annurev-environ-021113-095626.

von Stechow, C. et al., 2016: 2°C and SDGs: united they stand, divided they fall? *Environ. Res. Lett.*, **11(3)**, 034022, doi:10.1088/1748-9326/11/3/034022.

von Stein, J., 2020: Democracy, Autocracy, and Everything in Between: How Domestic Institutions Affect Environmental Protection. *Br. J. Polit. Sci.*, **52(1)**, 339–357, doi:10.1017/S000712342000054X.

Vonhedemann, N., Z. Wurtzebach, T.J. Timberlake, E. Sinkular, and C.A. Schultz, 2020: Forest policy and management approaches for carbon dioxide removal: Forest Policy and Management for CDR. *Interface Focus*, **10(5)**, doi:10.1098/rsfs.2020.0001.

Voß, J.-P., A. Smith, and J. Grin, 2009: Designing long-term policy: rethinking transition management. *Policy Sci.*, **42(4)**, 275–302, doi:10.1007/s11077-009-9103-5.

Voytenko, Y., K. McCormick, J. Evans, and G. Schliwa, 2016: Urban living labs for sustainability and low carbon cities in Europe: towards a research agenda. *J. Clean. Prod.*, **123**, 45–54, doi:10.1016/j.jclepro.2015.08.053.

Wagner, P. and T. Ylä-Anttila, 2018: Who got their way? Advocacy coalitions and the Irish climate change law. *Env. Polit.*, **27(5)**, 872–891, doi:10.1080/09644016.2018.1458406.

Wahlström, M., M. Wennerhag, and C. Rootes, 2013: Framing ‘The Climate Issue’: Patterns of Participation and Prognostic Frames among Climate Summit Protesters. *Glob. Environ. Polit.*, **13(4)**, 101–122, doi:10.1162/GLEP_a_00200.

Wahlström, M., P. Kocyba, M. De Vydt, de M. Joost (eds), 2019: *Protest for a future: Composition, mobilization and motives of the participants in Fridays For Future climate protests on 15 March, 2019 in 13 European cities*. 120 pp, https://eprints.keele.ac.uk/6571/7/20190709_Protest%20for%20a%20future_GCS%20Descriptive%20Report.pdf (Accessed March 3, 2021).

Waisman, H. et al., 2019: A pathway design framework for national low greenhouse gas emission development strategies. *Nat. Clim. Change*, **9(4)**, 261–268, doi:10.1038/s41558-019-0442-8.

Wakabayashi, M. and T.H. Arimura, 2016: Voluntary agreements to encourage proactive firm action against climate change: An empirical study of industry associations’ voluntary action plans in Japan. *J. Clean. Prod.*, **112**, 2885–2895, doi:10.1016/j.jclepro.2015.10.071.

Walgrave, S., R. Wouters, J. Van Laer, J. Verhulst, and P. Ketelaars, 2012: Transnational Collective Identification: May Day and Climate Change Protesters’ Identification with Similar Protest Events in Other Countries. *Mobilization An Int. Q.*, **17(3)**, 301–317, doi:10.17813/maiq.17.3.3nkh1p041013500q.

Walker, C., J. Baxter, and D. Ouellette, 2014: Beyond Rhetoric to Understanding Determinants of Wind Turbine Support and Conflict in Two Ontario, Canada Communities. *Environ. Plan. A Econ. Sp.*, **43(3)**, 730–745, doi:10.1068/a130004p.

Walter, S., M. Brüggemann, and S. Engesser, 2018: Echo Chambers of Denial: Explaining User Comments on Climate Change. *Environ. Commun.*, **12(2)**, 204–217, doi:10.1080/17524032.2017.1394893.

Walwyn, D.R. and A.C. Brent, 2015: Renewable energy gathers steam in South Africa. *Renew. Sustain. Energy Rev.*, **41**, 390–401, doi:10.1016/j.rser.2014.08.049.

Wamsler, C. et al., 2020: Environmental and climate policy integration: Targeted strategies for overcoming barriers to nature-based solutions and climate change adaptation. *J. Clean. Prod.*, **247**, 119154, doi:10.1016/j.jclepro.2019.119154.

Wang, H. and W. Chen, 2019: Gaps between pre-2020 climate policies with NDC goals and long-term mitigation targets: analyses on major regions. *Energy Procedia*, **158**, 3664–3669, doi:10.1016/j.egypro.2019.01.894.

Wang, P., L. Liu, and T. Wu, 2018a: A review of China's climate governance: state, market and civil society. *Clim. Policy*, **18(5)**, 664–679, doi:10.1080/14693062.2017.1331903.

Wang, P., L. Liu, X. Tan, and Z. Liu, 2019: Key challenges for China's carbon emissions trading program. *Wiley Interdiscip. Rev. Clim. Change*, **10(5)**, e599, doi:10.1002/wcc.599.

Wang, Z., Danish, B. Zhang, and B. Wang, 2018b: The moderating role of corruption between economic growth and CO_2 emissions: Evidence from BRICS economies. *Energy*, **148**, 506–513, doi:10.1016/j.energy.2018.01.167.

Wanvik, T.I. and H. Haarstad, 2021: Populism, Instability, and Rupture in Sustainability Transformations. *Ann. Am. Assoc. Geogr.*, **111(7)**, 1–16, doi:10.1080/24694452.2020.1866486.

Warbroek, B. and T. Hoppe, 2017: Modes of Governing and Policy of Local and Regional Governments Supporting Local Low-Carbon Energy Initiatives; Exploring the Cases of the Dutch Regions of Overijssel and Fryslân. *Sustainability*, **9(1)**, 75, doi:10.3390/su9010075.

Ward, H., J.C. Steckel, and M. Jakob, 2019: How global climate policy could affect competitiveness. *Energy Econ.*, **84**, doi:10.1016/j.eneco.2019.104549.

Warren, B., P. Christoff, and D. Green, 2016: Australia's sustainable energy transition: The disjointed politics of decarbonisation. *Environ. Innov. Soc. Transitions*, **21**, 1–12, doi:10.1016/j.eist.2016.01.001.

Wasim, R., 2019: Corporate (Non)disclosure of Climate Change Information. *Columbia Law Rev.*, **119(5)**, 1311–1354.

Watkiss, P. and R. Klein, 2019: *Long-term Strategies in a Changing Climate*. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Bonn, Germany, 59 pp. https://www.adaptationcommunity.net/wp-content/uploads/2019/10/2019_GIZ_Long-term-Strategies-in-a-Changing-Climate.pdf.

We Are Still In coalition, 2020: We Are Still In. https://www.wearestillin.com/ (Accessed December 21, 2020).

Webb, J., M. Tingey, and D. Hawkey, 2017: *What We Know about Local Authority Engagement in UK Energy Systems: Ambitions, Activities, Business Structures & Ways Forward*. UK Energy Research Centre, London, England, Energy Technologies Institute, Loughborough, England, The University of Edinburgh, Edinburgh, 56 pp, http://www.ukerc.ac.uk/publications/what-we-know-about-local-authority-engagement-in-uk-energy-systems.html (Accessed March 3, 2021).

Wegener, L., 2020: Can the Paris Agreement Help Climate Change Litigation and Vice Versa? *Transnatl. Environ. Law*, **9(1)**, 17–36, doi:10.1017/S2047102519000396.

Weidner, H. and L. Mez, 2008: German Climate Change Policy. *J. Environ. Dev.*, **17(4)**, 356–378, doi:10.1177/1070496508325910.

Weitzel, M. et al., 2019: Model-based assessments for long-term climate strategies. *Nat. Clim. Change*, **9(5)**, 345–347.

Welsch, H., 2004: Corruption, growth, and the environment: A cross-country analysis. *Environ. Dev. Econ.*, **9(5)**, 663–693, doi:10.1017/S1355770X04001500.

Westman, L. and V. Castan Broto, 2018: Climate governance through partnerships: A study of 150 urban initiatives in China. *Glob. Environ. Change*, **50**, 212–221, doi:10.1016/j.gloenvcha.2018.04.008.

Westman, L.K., V. Castán Broto, and P. Huang, 2019: Revisiting multi-level governance theory: Politics and innovation in the urban climate transition in Rizhao, China. *Polit. Geogr.*, **70**(July 2018), 14–23, doi:10.1016/j.polgeo.2019.01.002.

Wettestad, J. and L.H. Gulbrandsen, 2018: *The Evolution of Carbon Markets: Design and diffusion*. [Wettestad, J. and L.H. Gulbrandsen, (eds.)]. Routledge, London, UK, 264 pp.

Wettestad, J. and T. Jevnaker, 2019: Smokescreen Politics? Ratcheting Up EU Emissions Trading in 2017. *Rev. Policy Res.*, **36(5)**, 635–659, doi:10.1111/ropr.12345.

Wewerinke-Singh, M. and D.H. Salili, 2020: Between negotiations and litigation: Vanuatu's perspective on loss and damage from climate change. *Clim. Policy*, **20(6)**, 681–692, doi:10.1080/14693062.2019.1623166.

White, L.V., L. Hughes, C. Lyons, and Y. Peng, 2021: Iterating localisation policies in support of energy transition: The case of the Australian Capital Territory. *Energy Policy*, **158**, 112568, doi:10.1016/j.enpol.2021.112568.

Whitmarsh, L. and A. Corner, 2017: Tools for a new climate conversation: A mixed-methods study of language for public engagement across the political spectrum. *Glob. Environ. Change*, **42**, 122–135, doi:10.1016/j.gloenvcha.2016.12.008.

Whyte, K., 2017: Indigenous Climate Change Studies: Indigenizing Futures, Decolonizing the Anthropocene. *Engl. Lang. Notes*, **55(1–2)**, doi:10.1215/00138282-55.1-2.153.

Whyte, K., 2020: Too late for indigenous climate justice: Ecological and relational tipping points. *WIREs Clim. Change*, **11(1)**, e603, doi:10.1002/wcc.603.

Wieczorek, A.J., R. Raven, and F. Berkhout, 2015: Transnational linkages in sustainability experiments: A typology and the case of solar photovoltaic energy in India. *Environ. Innov. Soc. Transitions*, **17**, 149–165, doi:10.1016/j.eist.2015.01.001.

Wiedenhofer, D., B. Smetschka, L. Akenji, M. Jalas, and H. Haberl, 2018: Household time use, carbon footprints, and urban form: a review of the potential contributions of everyday living to the 1.5°C climate target. *Curr. Opin. Environ. Sustain.*, **30**, 7–17, doi:10.1016/j.cosust.2018.02.007.

Wiese, C., A. Larsen, and L.-L. Pade, 2018: Interaction effects of energy efficiency policies: a review. *Energy Effic.*, **11(8)**, 2137–2156, doi:10.1007/s12053-018-9659-z.

Wilensky, M., 2015: Climate Change in the Courts: An Assessment of Non-U.S. Climate Litigation. *Duke Environ. Law Policy Forum*, **26(1)**, 131–179.

Williams III, R.C., H. Gordon, D. Burtraw, J.C. Carbone, and R.D. Morgenstern, 2015: The Initial Incidence of a Carbon Tax Across Income Groups. *Natl. Tax J.*, **68(1)**, 195–214, doi:10.17310/ntj.2015.1.09.

Williams, S. and A. Doyon, 2019: Justice in energy transitions. *Environ. Innov. Soc. Transitions*, **31**, 144–153, doi:10.1016/j.eist.2018.12.001.

Williamson, V., T. Skocpol, and J. Coggin, 2011: The tea party and the remaking of Republican conservatism. *Perspect. Polit.*, **9(1)**, 25–43, doi:10.1017/S153759271000407X.

Willis, R., 2017: Taming the Climate? Corpus analysis of politicians' speech on climate change. *Env. Polit.*, **26(2)**, 212–231, doi:10.1080/09644016.2016.1274504.

Willis, R., 2018: How Members of Parliament understand and respond to climate change. *Sociol. Rev.*, **66(3)**, 475–491, doi:10.1177/0038026117731658.

Winiwarter, W., L. Höglund-Isaksson, Z. Klimont, W. Schöpp, and M. Amann, 2018: Technical opportunities to reduce global anthropogenic emissions of nitrous oxide. *Environ. Res. Lett.*, **13(1)**, 014011, doi:10.1088/1748-9326/aa9ec9.

Winkler, H. and L. Rajamani, 2014: CBDR&RC in a regime applicable to all. *Clim. Policy*, **14(1)**, 102–121, doi:10.1080/14693062.2013.791184.

Winkler, H., A. Boyd, M. Torres Gunfaus, and S. Raubenheimer, 2015: Reconsidering development by reflecting on climate change. *Int.*

Environ. Agreements Polit. Law Econ., **15(4)**, 369–385, doi:10.1007/s10784-015-9304-7.

Wittmayer, J.M., F. van Steenbergen, A. Rok, and C. Roorda, 2016: Governing sustainability: a dialogue between Local Agenda 21 and transition management. *Local Environ.*, **21(8)**, 939–955, doi:10.1080/13549839.2015.1050658.

Wolch, J.R., J. Byrne, and J.P. Newell, 2014: Landscape and Urban Planning Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'. *Landsc. Urban Plan.*, **125**, 234–244, doi:10.1016/j.landurbplan.2014.01.017.

Wolfram, M., 2016: Conceptualizing urban transformative capacity: A framework for research and policy. *Cities*, **51**, 121–130, doi:10.1016/j.cities.2015.11.011.

Wolfram, M. and N. Frantzeskaki, 2016: Cities and Systemic Change for Sustainability: Prevailing Epistemologies and an Emerging Research Agenda. *Sustainability*, **8(2)**, 144, doi:10.3390/su8020144.

Wong, A., 2018: *The Roots of Japan's International Environmental Policies.* Routledge, New York, USA, 358 pp.

Wonneberger, A. and R. Vliegenthart, 2021: Agenda-Setting Effects of Climate Change Litigation: Interrelations Across Issue Levels, Media, and Politics in the Case of Urgenda Against the Dutch Government. *Environ. Commun.*, **15(5)**, 699–714, doi:10.1080/17524032.2021.1889633.

Wood, P.B. and D.A. Rossiter, 2017: The politics of refusal: Aboriginal sovereignty and the Northern Gateway pipeline. *Can. Geogr.*, **61(2)**, 165–177, doi:10.1111/cag.12325.

World Bank, 2014: *State and Trends of Carbon Pricing 2014*. World Bank Group, Washington, DC, USA, 140 pp.

World Bank, 2019: *State and Trends of Carbon Pricing 2019*. World Bank Group, Washington, DC, USA, 97 pp.

World Bank, 2021a: *State and Trends of Carbon Pricing 2021*. World Bank Group, Washington, DC, USA, 87 pp.

World Bank, 2021b: *Report of the Task Force on Net Zero Goals & Carbon Pricing*. World Bank Group, Washington, DC, USA, 60 pp. https://static1.squarespace.com/static/54ff9c5ce4b0a53decccfb4c/t/614b3a242b48a65e02ccc978/1632320041214/CPLC+_NetZero_Report.pdf.

World Semiconductor Council, 2017: Best Practice Guidance for Semiconductor PFC Emission Reduction. (May 2017), pp. 8, http://www.semiconductorcouncil.org/wp-content/uploads/2017/07/Best-Practice-Guidance-of-PFC-Emission-Reduction.pdf.

WRI, 2020: *A Brief Guide For Reviewing Countries' Long-term Strategies*. World Resources Institute (WRI), Washington, DC, 12 pp. https://www.wri.org/climate/brief-guide-reviewing-countries-long-term-strategies (Accessed March 3, 2021).

Wright, R.A. and H.S. Boudet, 2012: To act or not to act: Context, capability, and community response to environmental risk. *Am. J. Sociol.*, **118(3)**, 728–777, doi:10.1086/667719.

Wurzel, R.K.W., A.R. Zito, and A.J. Jordan, 2013: *Environmental Governance in Europe: A Comparative Analysis of New Environmental Policy Instruments*. Edward Elgar Publishing Limited, Cheltenham, UK and Northampton, MA, USA, 304 pp.

Wynes, S. and K.A. Nicholas, 2017: The climate mitigation gap: Education and government recommendations miss the most effective individual actions. *Environ. Res. Lett.*, **12(7)**, 074024, doi:10.1088/1748-9326/aa7541.

Wynes, S., K.A. Nicholas, J. Zhao, and S.D. Donner, 2018: Measuring what works: Quantifying greenhouse gas emission reductions of behavioural interventions to reduce driving, meat consumption, and household energy use. *Environ. Res. Lett.*, **13(11)**, 113002, doi:10.1088/1748-9326/aae5d7.

Xiang, D. and C. Lawley, 2019: The impact of British Columbia's carbon tax on residential natural gas consumption. *Energy Econ.*, **80**, 206–218, doi:10.1016/j.eneco.2018.12.004.

Xie, L. and L. Xu, 2021: Environmental Public Interest Litigation in China: A Critical Examination. *Transnatl. Environ. Law*, **10(3)**, 441–465, doi:10.1017/S2047102520000448.

Xie, Y. et al., 2018: Co-benefits of climate mitigation on air quality and human health in Asian countries. *Environ. Int.*, **119**, 309–318, doi:10.1016/j.envint.2018.07.008.

Xu, L. et al., 2019: Identifying the trade-offs between climate change mitigation and adaptation in urban land-use planning: An empirical study in a coastal city. *Environ. Int.*, **133**(September), 105162, doi:10.1016/j.envint.2019.105162.

Yamazaki, A., 2017: Jobs and climate policy: Evidence from British Columbia's revenue-neutral carbon tax. *J. Environ. Econ. Manage.*, **83**, 197–216, doi:10.1016/j.jeem.2017.03.003.

Yeh, S., J. Witcover, G.E. Lade, and D. Sperling, 2016: A review of low carbon fuel policies: principles, program status and future directions. *Energy Policy*, **97**, 220–234, doi:10.1016/j.enpol.2016.07.029.

Yildiz, Ö. et al., 2015: Renewable energy cooperatives as gatekeepers or facilitators? Recent developments in Germany and a multidisciplinary research agenda. *Energy Res. Soc. Sci.*, **6**, 59–73, doi:10.1016/J.ERSS.2014.12.001.

Young, D. and J. Bistline, 2018: The costs and value of renewable portfolio standards in meeting decarbonization goals. *Energy Econ.*, **73**, 337–351, doi:10.1016/j.eneco.2018.04.017.

Yu, B., 2021: Bureaucratic Deliberation and China's Engagement with International Ideas: A Case Study on China's Adoption of Carbon Emissions Trading. *J. Contemp. China*, **31 (136)**, 558–573 doi:10.1080/10670564.2021.1985831.

Zabaloy, M.F., M.Y. Recalde, and C. Guzowski, 2019: Are energy efficiency policies for household context dependent? A comparative study of Brazil, Chile, Colombia and Uruguay. *Energy Res. Soc. Sci.*, **52**, 41–54, doi:10.1016/j.erss.2019.01.015.

Zachmann, G., G. Fredriksson, and G. Claeys, 2018: *Distributional Effects of Climate Policies*. Bruegel, Brussels, 110 pp. https://www.bruegel.org/wp-content/uploads/2018/11/Bruegel_Blueprint_28_final1.pdf (Accessed November 27, 2020).

Zangheri, Serrenho, and Bertoldi, 2019: Energy Savings from Feedback Systems: A Meta-Studies' Review. *Energies*, **12(19)**, 3788, doi:10.3390/en12193788.

Zárate-Toledo, E., R. Patiño, and J. Fraga, 2019: Justice, social exclusion and indigenous opposition: A case study of wind energy development on the Isthmus of Tehuantepec, Mexico. *Energy Res. Soc. Sci.*, **54**, 1–11, doi:10.1016/j.erss.2019.03.004.

Zen, I.S., A.Q. Al-Amin, and B. Doberstein, 2019: Mainstreaming climate adaptation and mitigation policy: Towards multi-level climate governance in Melaka, Malaysia. *Urban Clim.*, **30**, 100501, doi:10.1016/j.uclim.2019.100501.

Zeng, S. and Z. Chen, 2016: Impact of fossil fuel subsidy reform in China: estimations of household welfare effects based on 2007–2012 data. *Econ. Polit. Stud.*, **4(3)**, 299–318, doi:10.1080/20954816.2016.1218669.

Zhang, D., Y. Chen, and M. Tanaka, 2018: On the effectiveness of tradable performance-based standards. *Energy Econ.*, **74**, 456–469, doi:10.1016/j.eneco.2018.06.012.

Zhang, D. et al., 2019: Integrity of firms' emissions reporting in China's early carbon markets. *Nat. Clim. Change*, **9(2)**, 164–169, doi.org/10.1038/s41558-018-0394-4.

Zhang, L. and Q. Qin, 2018: China's new energy vehicle policies: Evolution, comparison and recommendation. *Transp. Res. Part A Policy Pract.*, **110**, 57–72, doi:10.1016/j.tra.2018.02.012.

Zhang, X. and X. Bai, 2017: Incentive policies from 2006 to 2016 and new energy vehicle adoption in 2010–2020 in China. *Renew. Sustain. Energy Rev.*, **70**, 24–43, doi:10.1016/j.rser.2016.11.211.

Zhang, Z., 2012: Competitiveness and Leakage Concerns and Border Carbon Adjustments. *Int. Rev. Environ. Resour. Econ.*, **6(3)**, 225–287, doi:10.1561/101.00000052.

Zhang, Z., 2015: Carbon emissions trading in China: the evolution from pilots to a nationwide scheme. *Clim. Policy*, **15(sup1)**, S104–S126, doi:10.1080/14693062.2015.1096231.

Zhang, Z. and Z. Zhang, 2017: Intermediate input linkage and carbon leakage. *Environ. Dev. Econ.*, **22(6)**, 725–746, doi:10.1017/S1355770X17000250.

Zhao, C. et al., 2018: Adaptation and mitigation for combating climate change – from single to joint. *Ecosyst. Heal. Sustain.*, **4(4)**, 85–94, doi:10.1080/20964129.2018.1466632.

Zhao, Y., S. Lyu, and Z. Wang, 2019: Prospects for Climate Change Litigation in China. *Transnatl. Environ. Law*, **8(2)**, 349–377, doi:10.1017/S2047102519000116.

Zhou, X. and H. Mori, 2011: National institutional response to climate change and stakeholder participation: a comparative study for Asia. *Int. Environ. Agreements Polit. Law Econ.*, **11(4)**, 297–319, doi:10.1007/s10784-010-9127-5.

Ziegler, A., 2017: Political orientation, environmental values, and climate change beliefs and attitudes: An empirical cross country analysis. *Energy Econ.*, **63**, 144–153, doi:10.1016/j.eneco.2017.01.022.

Zimmer, A., M. Jakob, and J.C. Steckel, 2015: What motivates Vietnam to strive for a low-carbon economy? — On the drivers of climate policy in a developing country. *Energy Sustain. Dev.*, **24**, 19–32, doi:10.1016/j.esd.2014.10.003.

Ziolo, M., M. Pawlaczyk, and P. Sawicki, 2019: Sustainable Development Versus Green Banking: Where Is the Link? In: *Financing Sustainable Development: Key Challenges and Prospects* [Ziolo, M. and B.S. Sergi, (eds.)]. Springer International Publishing, Cham, Switzerland, pp. 53–81.

Zürn, M. and B. Faude, 2013: Commentary: On Fragmentation, Differentiation, and Coordination. *Glob. Environ. Polit.*, **13(3)**, 119–130, doi:10.1162/GLEP_a_00186.

Zwierzchowska, I., K. Fagiewicz, L. Poniży, P. Lupa, and A. Mizgajski, 2019: Introducing nature-based solutions into urban policy – facts and gaps. Case study of Poznań. *Land use policy*, **85** (April), 161–175, doi:10.1016/j.landusepol.2019.03.025.