INTERGOVERNMENTAL PANEL ON climate change
Working Group III – Mitigation of Climate Change

Chapter 13

International Cooperation: Agreements and Instruments

Chapter:	13	
Title:	International Cooperation: Agreements & Instruments	
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Chapter 13: International Cooperation: Agreements & Instruments

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Executive Summary

This chapter critically examines and evaluates the ways in which agreements and instruments for international cooperation to address global climate change have been and can be organized and implemented, drawing upon evidence and insights found in the scholarly literature. The retrospective analysis of international cooperation in the chapter discusses and quantifies what has been achieved to date and surveys the literature on explanations of successes and failures.

International cooperation is necessary to significantly mitigate climate change impacts *(robust evidence, high agreement)*. This is principally due to the fact that greenhouse gases (GHGs) mix globally in the atmosphere, making anthropogenic climate change a global commons problem. International cooperation has the potential to address several challenges: multiple actors that are diverse in their perceptions of the costs and benefits of collective action; emissions sources that are unevenly distributed; heterogeneous climate impacts that are uncertain and distant in space and time; and mitigation costs that vary [13.2.1.1, 13.15]

International cooperation on climate change has become more institutionally diverse over the past decade *(robust evidence, high agreement)*. The United Nations Framework Convention on Climate Change (UNFCCC) remains a primary international forum for climate negotiations, but other institutions have emerged at multiple scales: global, regional, national, and local, as well as public-private initiatives and transnational networks. [13.3.1, 13.12] This institutional diversity arises in part from the growing inclusion of climate change issues in other policy arenas (e.g., sustainable development, international trade, and human rights). These and other linkages create opportunities, potential co-benefits, or harms that have not yet been thoroughly examined. Issue linkage also creates the possibility of forum shopping and increased negotiation costs, which could distract from or dilute the performance of international cooperation toward climate goals. [13.3, 13.4, 13.5]

Existing and proposed international climate agreements vary in the degree to which their authority is centralized *(robust evidence, high agreement)*. The range of centralized formalization spans: strong multilateral agreements (such as the Kyoto Protocol targets), harmonized national policies (such as the Copenhagen/ Cancún pledges), and decentralized but coordinated national policies (such as planned linkages of national and sub-national emissions trading schemes). [13.4.1, 13.4.3] Additionally, potential agreements vary in their degree of legal bindingness [13.4.2.1]. Three other design elements of international agreements have particular relevance: goals and targets, flexible mechanisms, and equitable methods for effort-sharing. [13.4.2]

The UNFCCC is currently the only international climate policy venue with broad legitimacy, due in part to its virtually universal membership *(robust evidence, medium agreement)*. The UNFCCC continues to develop institutions and systems for governance of climate change. [13.2.2.4, 13.3.1, 13.4.1.4, 13.]

Non-UN forums and coalitions of non-state actors, such as private businesses and city-level governments, are also contributing to international cooperation on climate change *(medium evidence, medium agreement)*. These forums and coalitions address issues including deforestation, technology transfer, adaptation, and fossil fuel subsidies. However, their actual mitigation performance is unclear. [13.5.1.3, 13.13.1.4]

International cooperation may have a role in stimulating public investment, financial incentives, and regulations to promote technological innovation, thereby more actively engaging the private sector with the climate regime *(medium evidence, medium agreement)*. Technology policy can help lower mitigation costs, thereby increasing incentives for participation and compliance with international cooperative efforts, particularly in the long-run. Equity issues can be affected by domestic intellectual property rights regimes which can alter the rate of both technology transfer and the development of new technologies. [13.3, 13.9, 13.12]

In the absence of — or as a complement to — a binding, international agreement on climate change, policy linkages among existing and nascent regional, national, and sub-national climate policies offer potential climate benefits *(medium evidence, medium agreement)* [13.3.1, 13.5.1.3]. Direct and indirect linkages between and among sub-national, national, and regional carbon markets are being pursued to improve market efficiency. Yet integrating climate policies raises a number of concerns about the performance of a system of linked legal rules and economic activities. [13.6, 13.7] Linkage between carbon markets can be stimulated by competition between and among public and private governance regimes, accountability measures, and the desire to learn from policy experiments. [13.5.3]

While a number of new institutions are focused on adaptation funding and coordination, adaptation has historically received less attention than mitigation in international climate policy, but inclusion of adaptation is increasingly important to reduce damages and may engage a greater number of countries *(robust evidence, medium agreement)*. Other possible complementarities and trade-offs between mitigation and adaptation, particularly the temporal distribution of actions, are not well understood. [13.2, 13.3.3, 13.5.1.1, 13.1]

Participation in international cooperation on climate change can be enhanced by monetary transfers, market-based mechanisms, technology transfer, and trade-related measures *(robust evidence, medium agreement)*. These mechanisms to enhance participation, along with compliance, legitimacy, and flexibility, affect the institutional feasibility of international climate policy. [13.2.2.4, 13.3.3, 13.8.1, 13.9.2]

International trade can offer a range of positive and negative incentives to promote international cooperation on climate change *(robust evidence, medium agreement)*. Three issues are key to developing constructive relationships between international trade and climate agreements: how existing trade policies and rules can be modified to be more climate friendly; whether border adjustment measures or other trade measures can be effective in meeting the goals of international climate agreements; whether the UNFCCC, WTO, hybrid of the two, or a new institution is the best forum for a trade-and-climate architecture. [13.8]

Climate change policies can be evaluated using four criteria: environmental effectiveness, aggregate economic performance, distributional impacts, and institutional feasibility. These criteria are grounded in several principles: maximizing global net benefits; equity and the related principles of distributive justice and common but differentiated responsibilities and respective capabilities; precaution and the related principles of anticipation, and prevention of future risks; and sustainable development. These criteria may at times conflict, forcing tradeoffs among them. [13.2.1, 13.2.2]

International cooperation has produced political agreement regarding a long-term goal of limiting global temperature increase to no more than 2°C above pre-industrial levels, but the overall level of mitigation achieved to date by cooperation appears inadequate to achieve this goal *(robust evidence, medium agreement)*. Mitigation pledges by individual countries in the Copenhagen-Cancún regime, if fully implemented, will help reduce emissions to below the business-as-usual level in 2020, but are unlikely to attain an emission level by 2020 consistent with a trajectory that achieves the long-term 2°C goal. The contribution of international cooperation outside of the UNFCCC is largely not quantified. [13.2.2.1, 13.13.1]

The Kyoto Protocol was the first binding step toward implementing the principles and goals provided by the UNFCCC, but it has not been as successful as intended *(medium evidence, low agreement)*. While the Kyoto Protocol surpassed its collective emission reduction target, the Protocol's environmental effectiveness has been less than it could have been. The Protocol's limited environmental effectiveness can be explained by the incomplete participation and compliance of Annex I countries and crediting for emissions reductions that would have occurred without the

Protocol in economies in transition. Additionally, the design of the Kyoto Protocol does not directly regulate the emissions of non-Annex I countries, which have grown rapidly over the past decade. [13.13.1.1]

The flexibility mechanisms under the Kyoto Protocol have generally helped to improve its economic performance, but their environmental effectiveness is less clear *(medium evidence, medium agreement)*. The Clean Development Mechanism (CDM) created a market for emissions offsets from developing countries and has been used to generate credits equivalent to over 1.3 billion tCO2-e, many of which have been generated by low-cost mitigation technologies. The CDM showed institutional feasibility of a project-based market mechanism under widely varying circumstances. The CDM's environmental effectiveness has been mixed due to concerns about the additionality of projects, the validity of baselines, the possibility of emissions leakage, and recent price decreases. Its distributional impacts were limited due to the concentration of projects in a limited number of countries. Joint Implementation and International Emissions Trading have been undertaken both by governments and private market participants, but have raised concerns related to government sales of emission units. [13.7.2, 13.13.1]

More recent negotiations under the UNFCCC have sought to include more ambitious mitigation commitments from countries listed in Annex B of the Kyoto Protocol, mitigation commitments from a broader set of countries than those under Annex B, and substantial new funding mechanisms *(medium evidence, low agreement)*. Voluntary pledges of quantified, economy-wide emission reduction targets by developed countries and voluntary pledges to mitigation actions by many developing countries were formalized in the 2010 Cancún Agreement. The distributional impacts of the Agreement will depend, in part, on sources of financing for developing-country emission plans, including the successful fulfilment by developed countries of their expressed joint commitment to mobilize $100 billion per year by 2020 for climate action in developing countries. [13.5.1.1, 13.11, 13.13.1.3]

The Montreal Protocol, aimed at protecting the stratospheric ozone layer, has also achieved significant reductions in global greenhouse gas emissions *(robust evidence, high agreement)*. The Montreal Protocol set limits on emissions of ozone-depleting gases that are also potent GHGs, such as CFCs and HCFCs. Substitutes for those ozone-depleting gases (such as HFCs, which are not ozone-depleting) may also be potent GHGs. Lessons learned from the Montreal Protocol, for example, the effect of financial and technological transfers on broadening participation in an international environmental agreement, could be of value to the design of future international climate change agreements. [13.3.3, 13.3.4, 13.13.1.4]

Assessment of proposed cooperation structures reinforces the finding that there will likely be tradeoffs between the four criteria, as they will inevitably conflict in some elements of any agreement *(medium evidence, high agreement)*. Assessment of proposed climate policy architectures reveals important tradeoffs that depend on the specific design elements and regulatory mechanisms of a proposal. For example, there is a potential tradeoff between broad participation and the institutional feasibility of an ambitious environmental performance goal. The extent of this tradeoff may depend on financial transfers, national enforcement mechanisms, and the distribution and sharing of mitigation efforts. [13.2.2.5, 13.3.3, 13.13.1.4, 13.13.2].

Increasing interest in solar radiation management (SRM) and carbon dioxide removal (CDR) as strategies to mitigate the harms of climate change, pose new challenges for international cooperation *(medium evidence, high agreement)*. Whereas emissions abatement poses challenges of engaging multilateral action to cooperate, SRM may pose challenges of coordinating research and restraining unilateral deployment of measures with potentially adverse side effects. [13.4.4]

Gaps in knowledge and data: (1) comparisons among proposals in terms of aggregate and country-level costs and benefits per year, with incorporation of uncertainty; (2) assessment of the overall effect of emerging intergovernmental and transnational arrangements, including "hybrid" approaches; (3) understanding of complementarities and trade-offs between policies affecting mitigation and adaptation; (4) understanding how international cooperation on climate change can help achieve co-benefits and development goals, including capacity building approaches; (5) understanding the factors that affect national decisions to join and form agreements.

13.1 Introduction

Due to global mixing of greenhouse gases (GHGs) in the atmosphere, anthropogenic climate change is a global commons problem. For this reason, international cooperation is necessary to achieve significant progress in mitigating climate change. Drawing on published research, this chapter critically examines and evaluates the ways in which agreements and instruments for international cooperation have been and can be organized and implemented. The retrospective analysis of international cooperation in the chapter quantifies and discusses what has been achieved to date, and surveys the literature on explanations of successes and failures.

The scope of the chapter is defined by the range of feasible international agreements, and other policy instruments for cooperation on climate-change mitigation and adaptation. The disciplinary scope spans the social sciences of economics, political science, international relations, law, public policy, psychology, and sociology; relevant humanities, including history and philosophy; and – where relevant to the discussion – the natural sciences. Where appropriate, the chapter synthesizes literature that utilizes econometric modelling, integrated assessment modelling, game theory, comparative case studies, legal analysis, and political analysis. This chapter focuses on research and policy developments since the Fourth Assessment Report of the IPCC, published in 2007.

13.2 Framing concepts for an assessment of means for international cooperation

This section introduces the concept of a global commons problem to frame the challenge of international cooperation on climate change, principles for designing effective international climate policy, and criteria for evaluating these policies.

13.2.1 Framing concepts and principles

13.2.1.1 The global commons and international climate cooperation

Climate change is a global commons problem, meaning reduction in emissions by any jurisdiction carries an economic cost, but the benefits (in the form of reduced damages from climate change) are spread around the world—although unevenly—due to GHG emissions mixing globally in the atmosphere. Mitigation of climate change is non-excludable, meaning it is difficult to exclude any individual or institution from the shared global benefits of emissions reduction undertaken by any localized actor. Also, these benefits are non-rival, meaning they may be enjoyed by any number of individuals or institutions at the same time, without reducing the extent of the benefit any one of them receives. These public good characteristics of climate protection (non-excludability and non-rivalry) create incentives for actors to "free ride" on other actors' investments in mitigation. Therefore, lack of ambition in mitigation and overuse of the atmosphere as a receptor of GHGs are likely.

Incentives to free ride on climate protection have been analysed extensively and are well-understood (Gordon, 1954; Hardin, 1968; Stavins, 2011). The literature suggests that in some cases, effective common property management of local open-access resources can limit or even eliminate overuse (Ostrom, 2001; Wiener, 2009). Effective common property management of the atmosphere would require applying such management at a global level, by allocating rights to emit and providing disincentives for overuse through sanctions or pricing emissions (Byrne and Glover, 2002; Wiener, 2009).

Enhancing production of public goods may be achieved by internalising external costs (i.e., those costs not incorporated into market prices) or through legal remedies. Economic instruments can incorporate external costs and benefits into prices, providing incentives for private actors to more optimally reduce external costs and increase external benefits (Baumol and Oates, 1988; Nordhaus, 2006; Buchholz et al., 2012). Legal remedies may include seeking injunctive relief or compensatory payments (IPCC, 2007, chap. 13; Faure and Peeters, 2011; Haritz, 2011)

International cooperation is necessary to significantly mitigate climate change because of the global nature of the problem (WCED, 1987; Kaul et al., 1999, 2003; Byrne and Glover, 2002; Barrett, 2003; Stewart and Wiener, 2003; Sandler, 2004) Cooperation has the potential to address several challenges: multiple actors that are diverse in their perceptions of the costs and benefits of collective action; emissions sources that are unevenly distributed; heterogeneous climate impacts that are uncertain and distant in space and time; and mitigation costs that vary (IPCC, 2001, pp. 607–608).

In the absence of universal collective action, smaller groups of individual actors may be able to organize schemes to supply public goods, particularly if actors know each other well, expect repeated interactions, can exclude non-members, and can monitor and sanction non-compliance in the form of either overconsumption or underproduction (Eckersley, 2012; McGee, 2011; Nairn, 2009; Ostrom, 1990, 2010a; b, 2011; Weischer et al., 2012). Some authors are optimistic regarding such “minilateralism” (e.g (Keohane and Victor, 2011); on the term, see (Eckersley, 2012)), and others are more sceptical (e.g. (Depledge and Yamin, 2009; Winkler and Beaumont, 2010)). (Section 13.3 discusses the literature on coalitions in more detail.)

Because there is no world government, each country must voluntarily consent to be bound by any international agreement. If these are to be effective, the agreements must be attractive enough to gain broad participation (Barrett, 2003, 2007; Stewart and Wiener, 2003; Schmalensee, 2010; Brousseau et al., 2012). Considering the relationship between mitigation costs and climate benefits discussed above, there is insufficient incentive for actors at any level to reduce emissions significantly in the absence of international cooperation. Behavioural research, however, indicates that individuals are sometimes motivated to cooperate (and to punish those who do not) to a degree greater than strict rational choice models predict (Camerer, 2003; Andreoni and Samuelson, 2006). This may explain some of the observed policies being adopted to reduce greenhouse gas emissions at the national, subnational, firm, and individual level. Moreover, even if one assumes rational action, some emission reductions can occur without cooperation due to positive externalities of otherwise self-beneficial actions, or co-benefits, such as actions to reduce energy expenditures, enhance the security of energy supply, reduce local air pollution, improve land use, and protect biodiversity (Seto et al., 2012). Co-benefits of climate protection are receiving increasing attention in the literature (Rayner, 2010; Dubash, 2009; UNEP, 2013b). However, policies designed to address greenhouse gas mitigation may also have adverse side-effects. See Section 4.8 provides an overview of the discussion of co-benefits and adverse side-effects throughout this report.

13.2.1.2 Principles

Several principles have been advanced to shape international climate change policies. The IPCC Third Assessment Report (AR3) (IPCC, 2001) discusses principles and mentions some criteria for evaluation of policies, whereas the Fourth Assessment Report (AR4) (IPCC, 2007), clearly differentiates principles from criteria. Principles serve as guides to design climate policies, while criteria are specific standards by which to evaluate them. The roles and applications of principles and criteria are further elaborated in Chapter 3 of this report.

Sets of principles are enumerated and explained in multiple international climate change fora, including the Rio Declaration on Environment and Development (UNEP, 1992) and the UN Framework Convention on Climate Change (UNFCCC, 1992). In the latter, the principles listed explicitly include: "equity" and "common but differentiated responsibilities and respective capabilities" (Article 3(1)), relative needs, vulnerability, burdens in countries of differing wealth (Article 3(2)), precaution and "cost-effective[ness] so as to ensure global benefits at the lowest possible cost" (Article 3(3)), "sustainable development" (Article 3(4)), and cooperation (Article 3(5)).

Principles of climate change policy relevant for international cooperation can be grouped into several broad categories. First, the principle of maximising global net benefits makes the trade-off between aggregate compliance costs and aggregate performance benefits explicit. The principle also incorporates the notion of maximising co-benefits of climate action (Stern, 2007; Nordhaus, 2008; Bosetti et al., 2010; Rayner, 2010; Dubash, 2009). (See also Chapter 3.6.3). A related concept is that of cost-effectiveness, which allows for policies with the same level of performance in terms of aggregate benefits to be compared on the dimension of aggregate cost (IPCC, 2001, 2007, chap. 13). See Section 6.6.2.7 for applied scenario studies.

Second, equity is a principle that emphasizes distributive justice across and within countries and across and within generations (Vanderheiden, 2008; Baer et al., 2009; Okereke, 2010; Posner and Sunstein, 2010; Posner and Weisbach, 2010; Somanathan, 2010; Cao, 2010c). It includes evaluating the procedures used to reach an agreement as well as the achieved outcomes. This principle may also apply in a broader assessment of well-being (Sen, 2009; Cao, 2010a). The principle of "common but differentiated responsibilities and respective capabilities" (CBDRRC) has been central in international climate negotiations (Rajamani, 2006, 2011a; Gupta and Sanchez, 2013). The literature refers to the varied historic responsibility—and current capability and capacity—of countries with regard to impacts of and action to address climate change (Jacoby et al., 2010; Rajamani, 2006, 2012b; Höhne et al., 2008; Dellink et al., 2009; den Elzen, Olivier, et al., 2013). Some literature assesses how the principle might be applied to actors' diverse needs (Jonas, 1984; Dellink et al., 2009), including the specific needs and vulnerabilities of developing countries(Rong, 2010; Smith et al., 2011; Bukovansky et al., 2012). Recent literature suggests that this principle's application may be more nuanced as patterns of development, emissions, and impacts evolve (Bukovansky et al., 2012; Deleuil, 2012; Müller and Mahadev, 2013; Winkler and Rajamani, 2013). The literature describes competing views regarding the meaning of this principle in terms of its legal status, operational significance, and the obligations it may entail (Höhne et al., 2006; Halvorssen, 2007; O'Brien, 2009; Winkler et al., 2009; Winkler, 2010; Hertel, 2011). CBDRRC is further analysed in Sections 3.3 and 4.6.

Third, the principle of precaution emphasizes anticipation and prevention of future risks, even in the absence of full scientific certainty about the impacts of climate change (Bodansky, 2004; Wiener, 2007; Urueña, 2008). Some see precaution as a strategy for effective action across diverse uncertain scenarios (Barrieu and Sinclair-Desgagné, 2006; World Bank, 2010, pp. 54–55), although the application of precaution varies across risks and countries (Hammitt, 2010). A key ongoing debate concerns whether or not this principle implies the need for stringent climate change policies as an insurance against potentially catastrophic outcomes, even if they may have very low probability (Weitzman, 2007, 2009, 2011; Pindyck, 2011; Nordhaus, 2011). The application of the precautionary principle to climate risk is further discussed in Section 2.5.5.

Fourth, the principle of sustainable development, broadly defined, emphasizes consideration of the socioeconomic needs of future generations in making decisions about current resource use (IPCC, 2007, chap. 12; World Bank, 2010, pp. 39–48). For a detailed discussion of the literature on sustainable development, see Section 4.2.1.

13.2.2 Potential criteria for assessing means of international cooperation

The principles elaborated above can be translated into criteria to evaluate forms of international cooperation, thereby assisting in the design of a distribution of efforts intended to solve the collective action problem of climate protection. The IPCC's AR4 put forth one set of criteria: environmental effectiveness, cost-effectiveness, distributional considerations, and institutional feasibility (IPCC, 2007, pp. 751–752). As "metrics of success," these evaluation criteria can be applied in the context of both ex-post evaluations of actual performance and ex-ante assessments of proposed cooperation (Hammitt, 1999; Fischer and Morgenstern, 2010). Below, this section describes four evaluation criteria which are applied in Section 13.13 to assess existing and proposed forms of international cooperation to address climate change mitigation. These criteria are subject to caveats, which are detailed in Section 13.13.

13.2.2.1 Environmental effectiveness

The environmental effectiveness of a climate change mitigation policy is the extent to which it achieves its objective to reduce the causes and impacts of climate change. Environmental effectiveness can be achieved by reducing anthropogenic sources of GHG emissions, removing GHGs from the atmosphere, or reducing the impacts of climate change directly through increased resilience. A primary objective of international cooperation has been to stabilise GHG concentrations at levels sufficient to "prevent dangerous anthropogenic interference with the climate system," in the words of the United Nations Framework Convention on Climate Change (UNFCCC) Article 2 (1992). This would require action within a time-frame sufficient to "allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" ((UNFCCC, 1992), Article 2). The Kyoto Protocol established specific emission-reduction targets for developed countries, while the Copenhagen Accord and Cancún Agreements expressed the environmental objective in terms of global average temperature increase. In addition to endorsing mitigation targets by developed countries and mitigation actions by developing countries, the Copenhagen and Cancún agreements recognized a goal of limiting increases in average global temperature to 2° C above pre-industrial levels (UNFCCC, 2009a, 2010, 2011a).

13.2.2.2 Aggregate economic performance

Measuring the aggregate economic performance of a climate policy requires considering both its economic efficiency and its cost-effectiveness. Economic efficiency refers to the maximization of net benefits, the difference between total social benefits and total social costs (Stern, 2007; Nordhaus, 2008; Bosetti et al., 2010).

Cost effectiveness refers to the ability of a policy to attain a prescribed level of environmental performance at least cost, taking into account impacts on dynamic efficiency, notably technological innovation (Jaffe and Stavins, 1995). Unlike net benefit assessment, cost-effectiveness analysis takes the environmental performance of a policy as given and seeks the least-cost strategy to attain it (Hammitt, 1999). While analysis of a policy in terms of its cost effectiveness still requires environmental performance of the policy to be quantified, it does not require environmental performance benefits to be monetized. Thus, analysis of a policy's cost-effectiveness may be more feasible than analysis of a policy's economic efficiency in the case of climate change, as some social benefits of climate-change mitigation are difficult to monetize.

13.2.2.3 Distributional and social impacts

Distributional equity and fairness may be considered important attributes of climate policy because of their impact on measures of well-being (Posner and Weisbach, 2010) and political feasibility (Jacoby et al., 2010; Gupta, 2012). Distributional equity relates to burden- and benefit-sharing across countries and across time. Section 4.2 puts forward three justifications for considering distributional equity – legal, environmental effectiveness, and moral (see Section 4.2.2). The framing in Section 4.2 also identifies a relatively small set of core equity principles: responsibility, capacity, the right to sustainable development, and equality. These may be modeled with quantitative indicators, as discussed in Section 6.3.6.6. The moral justification draws on ethical principles, which are reflected in the principles of the Convention (see Section 13.2.1.2; and detailed treatment of the literature on ethics in Section 3.2).

Another dimension of distributional equity is the possibility for mitigation actions in one jurisdiction to have positive or negative consequences in another jurisdiction. This phenomenon, sometimes referred to as “response measures” or as “spillover effects” (as in AR4 – see glossary), can lead to an unequal distribution of the impacts of climate change mitigation actions themselves. A plausible example of a spillover effect is the impact of emissions reductions in developed countries lowering the demand for fossil fuels and thus decreasing their prices, leading to more use of such fuels and greater emissions in developing nations, partially off-setting the original cuts (Bauer et al., 2013) This dynamic can also be important for countries with large endowments of conventional oil and gas that depend on export revenues. These countries may lose energy export revenue as a result of climate policies enacted in other countries (Kalkuhl and Brecha, 2013; Bauer et al., 2013). Additionally, climate policies could also reduce international coal trading (Jewell et al., 2013). (See also Sections 6.3.6.6., 14.2, 14.4.2, 15.5.2).

13.2.2.4 Institutional feasibility

The institutional feasibility of international climate policy may depend upon agreement among national governments and between governments and intergovernmental bodies (Wiener, 2009; Schmalensee, 2010). Institutional feasibility is closely linked to domestic political feasibility, because domestic political conditions affect participation in, and compliance with, international climate policies. This has been addressed in the literature on “two-level” games (Kroll and Shogren, 2009; Hafner-Burton et al., 2012). Four sub-criteria of institutional feasibility can also be considered: **participation**, **compliance**, **legitimacy**, and **flexibility**.

First, **participation** in an international climate agreement might refer to the number of parties, geographical coverage, or the share of global GHG emissions covered. Participating parties might vary with regard to the nature and specificity of their commitments (e.g., actions versus quantitative emissions-reduction targets). Sovereign states are not bound by an international treaty or other arrangement unless they consent to participate. The literature has examined a broad array of incentives to promote breadth of participation in international agreements (Barrett, 2003; Barrett and Stavins, 2003; Stewart and Wiener, 2003; Hall et al., 2010; Victor, 2010; World Bank, 2010, pp. 55–58; Olmstead and Stavins, 2012). These incentives can be positive (e.g. financial support or technology transfers) or negative (e.g. trade sanctions). Some authors have suggested that participation limited to countries with the highest emissions enhances institutional feasibility (Leal-Arcas, 2011) and that incentive-based emissions-permit allocations, or rules requiring participation of key players, may enable larger coalitions (Dellink et al., 2008; Dellink, 2011).

Second, institutional feasibility is also partly determined by the **compliance** of participating countries with an agreement’s provisions. Mechanisms to ensure compliance, in turn, affect decisions to participate, as well as long-term performance (Barrett, 2003). Incentives for encouraging compliance can be built into flexible mechanisms, such as tradable permit systems (Wiener, 2009; Ismer and Neuhoff, 2009; Keohane and Raustiala, 2010). Compliance is fundamentally problematic in international agreements, as it is difficult to establish an authority that can legitimately and effectively impose sanctions upon sovereign national governments. Despite that, indirect negative consequences of non-compliance can arise within the regime established by the agreement, or in other regimes, for example adverse voting behaviour in international forums or reduction in foreign aid (Heitzig et al., 2011).

Third, **legitimacy** is a key component of institutional feasibility. Parties to a cooperative agreement must have reason to accept and implement decisions made under the agreement, meaning they must believe that the relevant regime represents them fairly. Legitimacy depends on the shared understanding both that the substantive rules (outputs) and decision-making procedures (inputs) are fair, equitable, and beneficial (Scharpf, 1999), and thus that other regime members will continue to cooperate (Ostrom, 1990, 2011). In practice, the legitimacy of substantive rules is typically based on whether parties evaluate positively the results of an authority's policies, while procedural legitimacy is typically based on the existence of proper input mechanisms of participation and consultation for the parties participating in an agreement (Stevenson and Dryzek, 2012).

Finally, the institutional feasibility of international climate policy depends in part on whether the institutions relevant for a policy can develop **flexibility** mechanisms—which typically requires that the institutions themselves are flexible or adjustable. It may be important to be able to adapt to new information or to changes in economic and political circumstances. The institutionalization of learning among actors, which is referred to as "social learning" in the literature of environmental governance (Pahl-Wostl et al., 2007), is an important aspect of success, enabling adaptation to changing circumstances. While institutional arrangements that incorporate a purposive process of experimentation, evaluation, learning, and revision may be costly, policies that do not incorporate these steps may be overly rigid in the face of change and therefore potentially even more costly (Greenstone, 2009; Libecap, 2011). Another area of current debate and research is the question of whether increased flexibility in designing obligations for states helps them align their international obligations more readily with domestic political constraints (von Stein, 2008; Hafner-Burton et al., 2012). This suggests that designing international climate policies involves a balance between the benefits of flexibility and the costs of regulatory uncertainty (Goldstein and Martin, 2000; Brunner et al., 2012). Chapter 2, for example in Section 2.6.5.1, goes into more depth on problems related to regulatory uncertainty.

13.2.2.5 Conflicts and complementarities

Criteria may be mutually reinforcing (Cao, 2010a; c), but there may also be conflicts, forcing tradeoffs between and among them. For example, maximizing global net benefits or attaining cost-effectiveness may lead to actions that decrease distributional equity (van Asselt and Gupta, 2009), which could lead to low participation. Posner & Weisbach (2010) and Baer (2009) argue that efficiency and distribution can be reconciled by either normatively adjusting the net benefit or cost calculations to account for changes in relative utility, or by adopting redistributive policy in addition to cost-effective climate policy.

Different approaches to meet the same criteria (for example, equity) may also conflict with each other when operationalized (Fischer and Morgenstern, 2010) or lead to different results (Dellink et al., 2009). Simultaneously, there are relations among sub-criteria: excessive flexibility may undermine incentives to invest in long-term solutions, and may also increase the likelihood of participation. Compromises to enable institutional feasibility of an agreement may weaken performance along other dimensions. The environmental performance of an international agreement depends largely on trade-offs among the ambition of an agreement with regards to mitigation goals and participation, and compliance (Barrett, 2003; Bodansky, 2011a; Rajamani, 2012a). For further discussion of potential tradeoffs between participation and environmental effectiveness, see Section13.3.3.

Box 13.1. International Agreements and Developing Countries

The United Nations Framework Convention on Climate Change is a statement of aspirations, principles, goals, and the means to meet commitments. The Kyoto Protocol of the UNFCCC included, for the first time, binding mitigation commitments—for nations listed in its Annex B. Other countries may assist Annex B Parties in meeting their mitigation commitments via the Clean Development Mechanism, under the Protocol's Article 12.

Annex I countries under the UNFCCC, which include all Annex B countries under the Kyoto Protocol, are largely the wealthiest countries and largest historical emitters of GHGs. However, Annex I countries' share of historical cumulative GHG emissions in 2010 is close to the share of the non-Annex I countries (13.13.1.1). Thus, the Kyoto Protocol's mitigation commitments were initially consistent with the UNFCCC principle of "common but differentiated responsibilities and respective capabilities." However, since the UNFCCC divided countries into two categories in 1992, both income patterns and the distribution of GHG emissions have changed significantly, even as variations in income and per-capita responsibility for emissions remain substantial both within and between countries. Between COP-13 (Bali) in 2007 and COP-16 (Cancún) in 2010, many developing countries put forward quantifiable mitigation **actions** (as contrasted with quantified, economy-wide emissions reductions **targets** assumed by Annex B parties under the Kyoto Protocol) and agreed to more frequent reporting and enhanced transparency of those actions. Further pledges of actions have been made since Cancún. (13.13)

For many developing countries, adaptation has comparable priority with mitigation—either because countries are especially vulnerable to climate-change damages, they lack confidence in progress with mitigation, or both. These countries are often the least able to finance adaptation, leaving cooperative agreements to attempt to identify sources of support. (See Chapter 16 for detail.)

International collaboration regarding public climate finance under the UNFCCC dates back to 1991, when the Climate Change Program of the Global Environment Facility (GEF) was established. The literature reflects mixed evidence on the scale and environmental effectiveness of such funding. Funding for reporting and mitigation flows through four primary vehicles: the GEF, which focuses on mitigation; the Least Developed Country Fund (LDCF) and Special Climate Change Fund (SCCF), created in 2001 for adaptation purposes and operated by the GEF; the Adaptation Fund set up in 2008; and the Green Climate Fund (GCF), established in 2010 for mitigation and adaptation. (13.11, see also Section 16.2) The Copenhagen Accord set a goal to jointly mobilize USD 100 billion per year by 2020 to address the needs of developing countries. (13.11) Article 4.5 of the UNFCCC also calls for technology transfer from developed to developing countries. The Technology Mechanism, with an Executive Committee and Climate Technology Centre and Network, is seeking to fulfil this goal.

Research indicates that adaptation assistance, such as that provided by the Kyoto Protocol's Adaptation Fund, can be crucial for inclusion of developing countries in international climate agreements. Further research into the distribution of adaptation finance across countries from both UNFCCC and non-UNFCCC sources is required to assess the equity, efficiency, effectiveness, and environmental impacts of the Adaptation Fund and other funding mechanisms. Many developing countries have created institutions to coordinate adaptation finance from domestic and international funding sources. (13.3, 13.5)

The literature identifies several models for equitable burden sharing—among both developed and developing countries in international cooperation for climate change mitigation. The principles on which burden-sharing arrangements may be based are described in Section 4.6.2, and the implications of these arrangements are discussed in Section 6.3.6.6. Distributional impacts from agreements will depend on the approach taken, criteria applied to operationalise equity, and the manner in which developing countries' emissions plans are financed; studies suggest potential approaches (13.4, UNFCCC Secretariat 2007b, 2008). A major distributional issue is how to account for emissions from goods produced in a developing country, but consumed in an industrialized country. Such emissions have increased rapidly since 1990, as developed countries have typically been importers of embodied emissions, while many developing countries have large shares of emissions embodied in exports. (13.8, 14.3.4)

New and existing coalitions of countries have engaged in the UNFCCC negotiations, each presenting coordinated positions. Several distinct coalitions of developing countries have formed to negotiate their divergent priorities. Examples include the G77 & China, which contains sub-groups such as the African Group, the Least Developed Countries, and the Arab Group; the Alliance of Independent Latin American and Caribbean states; and a "like-minded developing country" group that included China, India, and Saudi Arabia. Other coalitions organized to influence UNFCCC negotiations include the Alliance of Small Island States (AOSIS; various groupings of industrialized countries, including the Umbrella Group; the Environmental Integrity Group; the BASIC countries (Brazil, South Africa, India and China); the Coalition of Rainforest Nations; and other active coalitions not limited to the climate context, for example the Comision Centroamericana de Ambiente y Desarollo and the Bolivarian Alliance for the Americas.

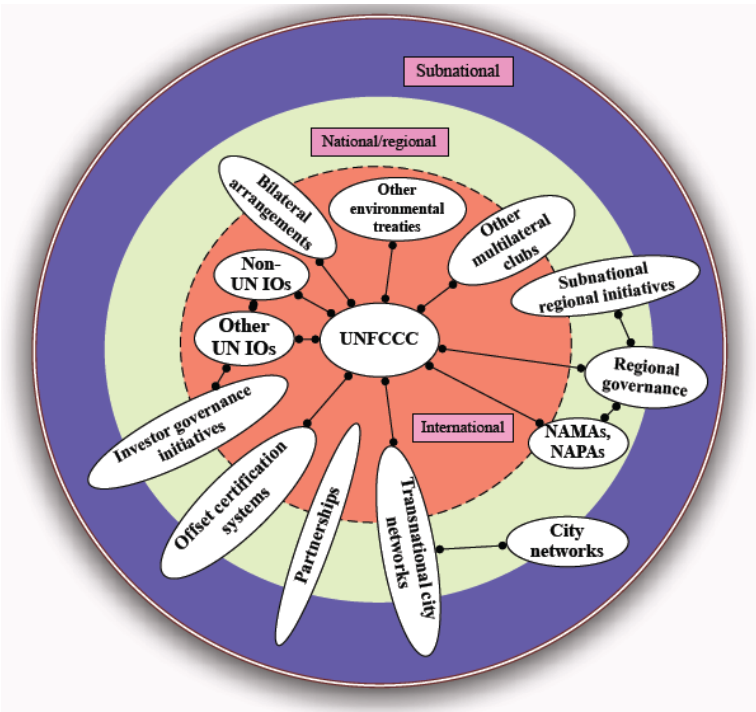
13.3 International agreements: Lessons for climate policy

Several lessons from research on existing international agreements, as well as game-theoretic models of such agreements, can be applied to climate change institutions. This section briefly summarizes some of the key lessons, which are addressed in more detail in subsequent sections of this chapter.

13.3.1 The landscape of climate agreements and institutions

Since the publication of IPCC AR4 in 2007, the landscape of international institutions related to climate policy has become significantly more complex. Climate change is addressed in a growing number of fora and institutions and across a wider range of scales (Keohane and Victor, 2011; Bulkeley et al., 2012; Biermann et al., 2009, 2010; Barrett, 2010; Abbott, 2011; Hoffmann, 2011; Zelli, 2011; Rayfuse and Scott, 2012).

Figure 13.1 illustrates the variety of international, transnational, regional, national, sub-national, and non-state agreements and other forms of cooperation, many of which have emerged since the mid-2000s. Some regimes that previously focused on other issues, e.g. trade (see Section 13.8), energy (see Chapter 7), biodiversity, and human rights have begun to address climate change. For a more detailed discussion of these initiatives, see also Section 13.5.



UNFCCC	Kyoto Protocol, Clean Development Mechanism, International Emissions Trading
Other UN Intergovernmental organizations	Intergovernmental Panel on Climate Change, UN Development Programme, UN Environment Programme, UN Global Compact, International Civil Aviation Organization, International Marine Organization, UN Fund for International Partnerships
Non-UN IOs	World Bank, World Trade Organization
Other environmental treaties	Montreal Protocol, UN Conference on the Law of the Sea, Environmental Modification Treaty, Convention on Biological Diversity
Other multilateral "clubs"	Major Economies Forum on Energy and Climate, G20, REDD+ Partnerships
Bilateral arrangements	e.g. US-India, Norway-Indonesia
Partnerships	Global Methane Initiative, Renewable Energy and Energy Efficiency Partnership, Climate Group
Offset certification systems	e.g. Gold Standard, Voluntary Carbon Standard
Investor governance initiatives	Carbon Disclosure Project, Investor Network on Climate Risk
Regional governance	e.g. EU climate change policy
Subnational regional initiatives	Regional Greenhouse Gas Initiative, California emissions-trading system
City networks	US Mayors' Agreement, Transition Towns
Transnational city networks	C40, Cities for Climate Protection, Climate Alliance, Asian Cities Climate Change Resilience Network
NAMAs, NAPAs	Nationally Appropriate Mitigation Actions (NAMAs) of developing countries; National Adaptation Programmes of Action (NAPAs)

Figure 13.1. The landscape of agreements and institutions on climate change

Future efforts for international cooperation on climate policy will need to account for this wide variety of agreements and institutions. Careful design of linkages and cooperative arrangements will be needed to manage the increasingly fragmented regime complex to prevent conflicts among institutions (Biermann et al., 2010; Keohane and Victor, 2011; Zelli, 2011), avoid gaps or loopholes (Downs, 2007), and maximise potential institutional synergies (Hoffmann, 2011; Rayfuse and Scott, 2012).

13.3.2 Insights from Game Theory for Climate Agreements

Game theory provides insights into international cooperation on climate policy, from research communities in environmental economics (Ward, 1993; Finus, 2001, 2003; Wagner, 2001; Barrett, 2003, 2007) and in the rationalist school of political science (Sjostedt, 1992; Downs et al., 1996; Underdal, 1998; Koremenos et al., 2001; Avenhaus and Zartman, 2007; Hafner-Burton et al., 2012). These researchers analyse the incentives and motivations of actors to join and comply with international environmental agreements (IEAs).

The game-theoretic literature on climate change agreements has grown substantially in the last two decades (Barrett, 2007; Rubio and Ulph, 2007; Chambers, 2008; Froyn and Hovi, 2008; Bosetti, Carraro, De Cian, et al., 2009; Asheim and Holtsmark, 2009; Dutta and Radner, 2009; Muñoz et al., 2009; Carbone et al., 2009; Weikard et al., 2010; Bréchet et al., 2011; Wood, 2011; Heitzig et al., 2011; Dietz and Zhao, 2011; Bréchet and Eyckmans, 2012; Pittel and Rübbelke, 2012). It is important, however, to treat with caution any general conclusions from recent game theory literature on climate change agreements, as many have been criticized for their simplicity. In this section, we refrain from listing assumptions in detail, and restrict attention to the most general and policy-relevant discussions. See Finus (2001, 2003) for a more detailed review of the relevant game theory literature.

By and large, the game-theoretic literature assumes actors to be states that are maximising the welfare of their citizens (Ward, 1993; Carraro and Siniscalco, 1998; Grundig, 2006). A central premise is that there is currently no supranational institution that can impose an IEA on governments and subsequently enforce it (see Section 13.2.1.1). Thus, IEAs must be self-enforcing to engage and maintain participation and compliance (Finus, 2001; Barrett, 2007; Dutta and Radner, 2009; Rubio and Casino, 2005; Heitzig et al., 2011). Nevertheless, in theory and practice, international institutions can help to promote, negotiate and administer an IEA. They can do so by serving to coordinate and moderate negotiations and implementation, reducing transaction costs of negotiations and generating trust (Keohane, 1984, 1989; Finus and Rundshagen, 2006), changing the interests of actors by providing new information or building capacity (Haas et al., 1993; Bernauer et al., 2013), enlisting actors in domestic politics within and across states (Abbott and Snidal, 2010; Hafner-Burton et al., 2012), and inculcating norms (Bodansky, 2010a).
Alternative perspectives on game theory weaken the assumption of rationality and emphasize the roles of legitimacy, norms, and acculturation in shaping behaviour under international law and institutions (Goodman and Jinks, 2004; March and Olsen, 2008; Brunnée and Toope, 2010; Bernauer et al., 2010; Hafner-Burton et al., 2012, pp. 54–60). See Chapter 2 for a discussion of behavioural approaches in the literature.

13.3.3 Participation in climate agreements

Greater participation in climate change agreements, all else equal, improves environmental effectiveness by covering a larger share of global emissions and reducing potential leakage to non-participating areas. Greater participation may also improve aggregate economic performance by enabling lower-cost emissions abatement and reducing leakage. An international climate agreement regime might achieve depth (ambition of emissions reduction) and breadth (of participation) in different sequence. Schmalensee (1998) argues for breadth of participation first, with less emphasis on ambition. He argues that this approach allows time to develop correspondingly broad-based institutions that can potentially facilitate substantial aggregate emissions reductions over time (Schelling, 1992; Barrett, 2003). Conversely, pursuing an arrangement with depth before breadth can be motivated by the urgency of the climate-change problem. However, such an approach may make broadening participation more difficult later on (Schmalensee, 1998), and this type of agreement could induce emissions leakage, undermining effectiveness (Babiker, 2005).

In the theoretical literature, the trade-off between the level of abatement by a sub-set of actors and participation in an IEA has been analysed as a comparison between an "ambitious versus a modest treaty" (Finus and Maus, 2008; Courtois and Haeringer, 2011) or between a focal (deep and narrow) versus a consensus (broad but shallow) treaty (Barrett, 2002; Hafner-Burton et al., 2012). Scholars conclude that, overall, a consensus treaty may achieve more in terms of emission reductions and global welfare than a focal treaty. Further analysis has investigated the trade-off between breadth and depth, and how broad participation can increase environmental effectiveness (by covering more emissions and reducing leakage), and reduce costs (by encompassing more low-cost abatement options in a larger market). Through these plausible mechanisms, greater breadth enables greater ambition (subject to the costs of attracting participants) (Battaglini and Harstad, 2012).

While most existing IEAs feature open membership, some theoretical literature finds that exclusive membership can help to stabilize IEAs, prevent defection, and lead to better environmental outcomes, even in the context of a global public good such as climate protection (Carraro and Marchiori, 2003; Eyckmans and Finus, 2006; Finus, 2008a; Finus and Rundshagen, 2009). In practice, exclusive membership may reduce supply of a public good such as global emissions abatement, may increase emissions leakage (unless non-members are covered by their own coalition in a system of multiple agreements), and may conflict with norms of institutional legitimacy. Multiple agreements (i.e. multiple coalitions) may be a pragmatic, short- to mid-term strategy for achieving more effective cooperation if a universal treaty of all countries to limit emissions is not stable or attainable in the short-run (Stewart and Wiener, 2003; Asheim et al., 2006; Eyckmans and Finus, 2006; Bosetti, Carraro, Duval, et al., 2009; Bréchet and Eyckmans, 2012)(Finus and Rundshagen, 2003). Multiple coalition agreements involving all major emitters could potentially achieve better environmental effectiveness than a partial coalition acting while other countries do not act at all. However, for protecting a global public good, separate coalitions could forego some of the cost-effectiveness gains of a broader regime, and they could face questions of legitimacy (Karlsson-Vinkhuyzen and McGee, 2013). It remains unclear whether partial coalitions for climate policy will accelerate momentum for a more universal global agreement in the future, or undermine such momentum (Brewster, 2010).

International transfers can also attract participation in climate agreements, balancing the asymmetric gains from cooperation. These transfers can either be direct monetary transfers (e.g. contributions to a fund from which developing countries can draw), in-kind transfers (e.g. technology transfer), or indirect transfers via market-based mechanisms (e.g. through the initial allocation of tradable emission permits) (Carraro et al., 2006; Barrett, 2007; Bosetti, Carraro, De Cian, et al., 2009; Fuentes-Albero and Rubio, 2010; Bréchet and Eyckmans, 2012; Stewart and Wiener, 2003). Historically, transfers have been important for building participation in past international agreements (Hafner-Burton et al., 2012, p. 91; Bernauer et al., 2013). The experience of the Montreal Protocol illustrates how transfers can engage participation by major developing countries through financial and technological assistance (Sandler, 2010; Kaniaru, 2007; Zhao, 2005, 2002; Andersen et al., 2007). The role of technology transfer in international cooperation is discussed in greater detail in Section 13.9, and the role of finance is discussed in Section 13.11. Linkages across issues may also help encourage participation. Many linkages exist between climate change and other issues, such as energy, water, agriculture, sustainable development, poverty alleviation, public health, international trade, human rights, foreign direct investment, biodiversity, and national security (see Sections 3.5.3, 5.10, 6.6, and Section 13.2.1.1). Such linkages may create opportunities, co-benefits, or adverse side-effects, not all of which have been thoroughly examined. However, the advantages of issue linkage may diminish as the number of parties and issues increase, raising the transaction costs of negotiations (Weischer et al., 2012).

A different instrument to encourage participation is trade sanctions against non-parties to an IEA. The threat of trade sanctions can motivate participation (Barrett, 2003; Victor, 2011), as exemplified

by the Montreal Protocol. However, since participation in an international treaty is voluntary, sanctions for non-participation may be difficult to justify (see Section 13.3.4). Similar to trade sanctions are "offsetting border adjustment measures (BAMs)" (see section 13.8 for further discussion).
Particularly vulnerable countries may be more likely to participate in agreements that address and fund adaptation activities (Huq et al., 2004; Mace, 2005; Ayers and Huq, 2009; Denton, 2010; Smith et al., 2011). Benefits of adaptation are often local, and these local benefits may be more effective incentives for countries vulnerable to climate damages to participate in an IEA relative to the benefits of GHG mitigation and support for technological development or deployment. Both of these alternative possible incentive mechanisms are less-excludable and are of potentially less value to lower emitting countries, compared with adaptation benefits. Recent game theoretic analyses suggest that private co-benefits from mitigation actions may not substantially increase participation in international climate agreements (Pittel and Rübbelke, 2008; Finus and Rübbelke, 2012).

A final key issue related to participation is the role played by uncertainty. Earlier research suggested that reducing uncertainty about the benefits and costs of mitigation can render IEAs less effective, showing that as parties learn of the actual costs and benefits of mitigation, their incentive to participate may shrink (Na and Shin, 1998; Kolstad, 2005; Kolstad and Ulph, 2008). However, more recent work (Na and Shin, 1998; Kolstad, 2005; Kolstad and Ulph, 2008)(Dellink and Finus, 2011) has qualified this conclusion by showing that removing uncertainty only has a negative impact on cooperation in certain cases. Recent experimental evidence suggests that if there is uncertainty in the likelihood of tipping points of disastrous climate change impacts, this may reduce the success of cooperation (Dannenberg et al., 2011); conversely, reducing uncertainty about the likelihood of tipping points can increase prospects for collective action (Barrett and Dannenberg, 2012).

13.3.4 Compliance

As noted in Section 13.2.1.1, in the absence of a supranational authority, compliance with international agreements must be verified by parties to the agreement or through a related collaborative body they perceive as legitimate. Barrett (2003) sees compliance as a dimension of participation, in the sense that incentives to comply are incentives to continue participating in the agreement. The reputational costs of being a non-compliant party may differ from those of withdrawing altogether, but the magnitude of the difference is not clear. For example, there is only one case of withdrawal from the Kyoto Protocol, that of Canada in December, 2011, but more than one case in which countries have not met their agreed emission targets (see Section 13.13.1.1).

Compliance does not necessarily equate with success: because countries choose whether to become party to an agreement, compliance may only reflect what countries would have done without the agreement (Downs et al., 1996). One measure of effectiveness is the extent to which the agreement changed countries' behaviour, compared to what they would have done in the absence of the agreement (the counterfactual baseline scenario) (Hafner-Burton et al., 2012). Evaluating an agreement's effectiveness is difficult because the counterfactual is not observed (Simmons and Hopkins, 2005; Mitchell, 2008; Hafner-Burton et al., 2012).

A necessary condition for successful compliance strategies is an independent and effective regime of "measurement (or monitoring), reporting and verification" (MRV) with a high frequency of reporting (as documented in the IPCC AR3; see also Section 2.4.3.3). Provisions for greater transparency in MRV are being developed with regard to: (a) countries' greenhouse gas emissions; and (b) international financial flows from developed countries to developing countries for mitigation and adaptation measures (Winkler, 2008; Breidenich and Bodansky, 2009; Ellis and Larsen, 2008; Ellis and Moarif, 2009; Clapp et al., 2012). Lessons on MRV from other multilateral regimes – such as International Monetary Fund (IMF) consultations, OECD economic policy reviews, World Trade Organization (WTO) trade policy reviews, and arms control agreements – include attention to accuracy, evolution over time, combining self-reporting with third-party verification, including independent technical assessment as well as some form of political or peer review, the potential use of remote sensing or other technical means, and public domain outputs (Cecys, 2010; Pew Center, 2010; Bell et al., 2012).

Technical capabilities for monitoring emissions now include remote sensing from satellites - which themselves pose new issues about the availability, diffusion, and governance of MRV capabilities for greater transparency. Greater transparency about financial flows requires detailed analysis of donor government budgeting in their legislative and administrative processes. (Clapp et al., 2012; Falconer et al., 2012; Brewer and Mehling, 2014)

MRV may be beneficially complemented by enforcement strategies, which are comprised of positive inducements—such as international transfers, financing, capacity-building, and technology transfer—and credible threats of sanctions for violating emissions commitments or reporting requirements. From a rationalist perspective, compliance will occur if the discounted net benefits from cooperation (including direct climate benefits, co-benefits, reputation, transfers, and other elements) exceed the discounted net benefits of defection (including avoided mitigation costs, avoided adverse side effects, and expected sanctions). The institutional and behavioural reality of ensuring compliance can be more complicated. Moreover, the theoretical literature has stressed the difficulty of designing credible sanctions that are renegotiation-proof (Finus, 2001, 2003; Barrett, 2002; Asheim et al., 2006; Froyn and Hovi, 2008).

Some research suggests that the Kyoto Protocol is unusual among IEAs in that it established an “elaborate and multifaceted” compliance system, which has been successful in assuring compliance with reporting (MRV) requirements (Finus, 2008b; Oberthür and Lefeber, 2010; Brunnée et al., 2012), while many other IEAs rely on self-reporting of domestic actions. Compliance with MRV requirements can in turn improve detection of other forms of noncompliance. Even if the Kyoto Protocol compliance regime has been imperfect, it can offer lessons for future regimes, in particular with regard to MRV. The design of sanction mechanisms currently in place under the Kyoto Protocol, however, has also been criticized for not being fully credible (Halvorssen and Hovi, 2006; Barrett, 2009; Vezirgiannidou, 2009), though possibilities for improvement through modification have been identified (Finus, 2008b). For example, a sanction could take the form of a temporary suspension of monetary and technological transfers if recipient countries are found in non-compliance (Finus, 2008b). It has also been shown that a deposit system can be effective to enforce compliance: treaty members lodge a deposit into a fund from which they receive interest as long as they comply. In case of non-compliance, parts of the deposit are forfeited to compliant countries (Gerber and Wichardt, 2009, 2013).

Trade sanctions, such as those employed under the Montreal Protocol, are frequently put forward as a possible compliance mechanism. (Barrett, 2003; Victor, 2011) (See Section 13.8 for institutional details and further discussion). A general reservation about trade sanctions is that they often not only affect the agreement-violator but also compliant countries, and hence this threat is not credible. Barrett (2009), Victor (2010), and others argue that trade sanctions are neither a feasible nor a desirable option for enforcing compliance with a climate agreement because trade sanctions may not be compatible with WTO rules. A WTO-compatible design may be feasible in the case of border adjustments with obligations to buy allowances (Ismer and Neuhoff, 2007; Monjon and Quirion, 2011a). Meanwhile, imposition of trade sanctions would pose some risks of reducing cooperation by undermining capacity for compliance in targeted countries and could be burdensome to low-income populations in targeted countries (Murase, 2011). Especially if applied to embedded carbon (carbon from energy used to produce traded goods), the number of goods affected by the sanctions could be large, potentially fuelling a trade war that may negatively affect even those countries that intend to be the punishers (McKibbin and Wilcoxen, 2009). (See Sections 13.8 and 5.4.1 for further discussion)

Finally, there is a considerable literature on the potential use of legal remedies (such as civil liability) to address climate damages (Penalver, 1998; Grossman, 2003; Allen, 2003; Gillespie, 2004; Hancock, 2004; Burns, 2004; Verheyen, 2005; Jacobs, 2005; Smith and Shearman, 2006; Lord et al., 2011; Farber, 2011; Faure and Peeters, 2011). There has been little suggestion that such liability remedies be formally incorporated into climate agreements as compliance mechanisms, and there would be significant obstacles to doing so (including the lack of a robust international civil liability system). Nonetheless, this is a potential avenue for encouraging compliance, perhaps indirectly. The IPCC AR4 (IPCC, 2007) reported on evidence from various legal actions and potential actions that have been considered in the theoretical literature. Haritz (2011) has argued, based on an analysis of the literature and court cases, that it is theoretically possible to link the IPCC scale of likelihood with a scale based on legal standards of proof required for various kinds of legal action. Liability for climate change damage at the supranational level (de Larragán, 2011; Gouritin, 2011; Peeters, 2011), and at the national level in the United Kingdom (Kaminskaite-Slaters, 2011), the United States (Kosolapova, 2011), and the Netherlands (van Dijk, 2011), has been explored. Climate litigation and legal liability may put additional pressure on corporations and governments to be more accountable (Smith and Shearman, 2006; Faure and Peeters, 2011). However, there are key analytical hurdles to establishing important legal facts, such as causation and who is to be held liable (Gupta, 2014). While not framed in terms of liability or compensation, the UNFCCC negotiations in Doha decided to establish institutional arrangements associated with Loss and Damage (UNFCCC, 2013a).

13.4 Climate policy architectures

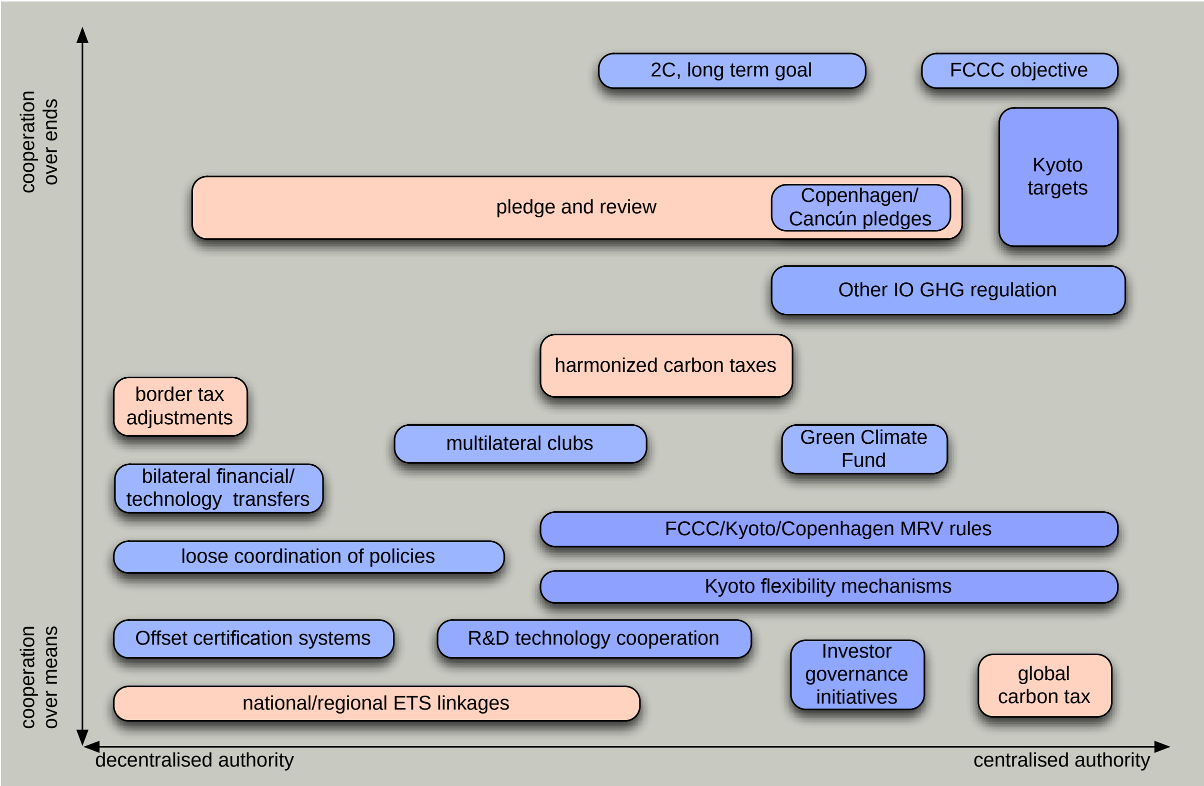
"Policy architecture" for global climate change refers to "the basic nature and structure of an international agreement or other multilateral (or bilateral) climate regime." (Aldy and Stavins, 2010a, pp. 1–2) The term includes the sense of durability, with regard to both policy structure and the institutions to implement and support that structure (Schmalensee, 1998, 2010), which is appropriate to the long-term nature of the climate-change problem.

13.4.1 Degrees of centralized authority

Absent the emergence of a global authority that has the capacity to impose an allocation of emissions rights on countries, as advocated by (Tickell, 2008), approaches to international cooperation all arise out of negotiated agreements among independent participants. However, they vary in the degree to which they confer authority on multilateral institutions to manage the rules and processes agreed to. On one end of the spectrum of possible approaches, referred to by some as "top-down" (Dubash and Rajamani, 2010), actors agree to a high degree of mutual coordination of their actions, with, for example, fixed targets and a common set of rules for specific mechanisms, such as emissions trading. On the other end of the spectrum, sometimes known as "bottom-up" (Victor et al., 2005; Dubash and Rajamani, 2010), national policies are established that may or may not be linked with one another.

Figure 13.2 illustrates how existing and proposed international agreements can be placed on this spectrum (see (IPCC, 2007, pp. 770–773). for a detailed list of many proposals that could be placed in this grid.) The level of centralization refers to the authority an agreement confers on an international institution, not the process of negotiating the agreement. It shows that many proposals can be more or less centralized depending on the specific design. It also shows that the three idealized types discussed in the following sections have more blurred boundaries than their titles suggest. The figure also divides them into agreements focused on specific ends (emissions targets, for example) – and those that focus on means (specific policies, or technologies, for example). Finally, it should be understood that these are idealized types, and in practice there will be considerable additional complexity in how the basic design of agreements connect the actions of the various actors that make them up. There are distinct limits to what can be gleaned from the "top-down vs bottom-up" metaphor or the degrees-of-centralization notion employed here (Dai, 2010) as for example emphasized in Ostrom's (2012) accounts of "polycentric governance".

As one prominent example, the Cancún Agreements are a "hybrid" of top-down and bottom-up. They include voluntary mitigation pledges from many (but not all) UNFCCC parties, together with additional or elaborated common goals and centralized UNFCCC functions (e.g., with regard to adaptation, see Part II of the Cancún Agreements (UNFCCC, 2010, pp. 4–7)). It is quite possible that the agreement mandated by the Durban Platform on Enhanced Action, to be completed by 2015, will also be such a hybrid.



Legend: Loose coordination of policies: examples include transnational city networks or NAMAs; R&D technology cooperation: examples include the MEF, GMI or REEEP; Other international organization (IO) GHG regulation: examples include the Montreal Protocol, ICAO, IMO; See Figure 13.1 for the details of these examples.

Figure 13.2. International cooperation over ends/means and degrees of centralized authority. Examples in blue are existing agreements. Examples in pale pink are proposed structures for agreements. The width of individual boxes indicates the range of possible degrees of centralization for a particular agreement. The degree of centralization indicates the authority an agreement confers on an international institution, not the process of negotiating the agreement.

13.4.1.1 Centralized architectures and strong multilateralism

A centralized architecture, such as that generated by strong commitments to multilateral processes and institutions, is an agreement that establishes goals, targets, or both which are generally binding, for participating countries, within a specific time-frame, and establishes collective processes for monitoring progress towards meeting those goals. The Kyoto Protocol adopted targets and timetables for participating Annex B countries, one realisation of strong multilateralism (Bodansky, 2007). Other centralized approaches to international cooperation could expand on targets-and-timetables by also specifying the mechanism for implementation of the goals and/or targets of the agreement. Such an approach could establish, for example, a global cap-and-trade system or global carbon tax.

In the literature, targets-and-timetables have been coupled with specific notions of fairness, prospective conditions for political acceptance, or both—to establish quantitative targets and timetables for all countries and all years in a potential international agreement (Agarwala, 2010; Frankel, 2010; Höhne et al., 2008; Bosetti and Frankel, 2011; Cao, 2010c; IPCC, 2007, chap. 13).

13.4.1.2 Harmonized national policies

A less-centralized approach would be to structure international cooperation around policies that would be harmonized, such as via collective monitoring, but where relatively little centralized authority is established or employed. In this class of approaches, aspects of national policies are made similar or even equivalent to one another. Examples include the G20 and APEC agreement in 2009 to phase out fossil fuel subsidies that encourage wasteful consumption (Barbier, 2010); the EU's use of private certification schemes for biofuels to link to its import policies for such fuels; efforts to harmonize private carbon-accounting systems, such as in the Carbon Disclosure Standards Board (Lovell and MacKenzie, 2011); hypothetical national carbon taxes that would be harmonized internationally (Cooper, 2010); adjusting design details of cap and trade schemes that are to be linked; and implementation of similar technology or performance standards. Many of these involve—or would involve— relatively limited numbers of actors, compared to UNFCCC agreements, reflecting the "minilateralism" discussed in Section 13.2.1.1.

The so-called "pledge and review" approach, exemplified to some degree by the Copenhagen Accord and the Cancún Agreements, is an architecture in which a participating nation or region voluntarily registers to abide by its stated domestic reduction targets or actions (pledges). The degree of centralization generated by this approach could vary considerably (see Figure 13.2), depending on the particular arrangement. If a pledge and review system, such as that represented by the Cancún Agreements, involved cooperation in forging an agreement that provided some centralized administration or monitoring (in addition to the voluntary announcement of pledges by individual countries), it could be considered an example of strong multilateralism, although perhaps with less centralized authority than the Kyoto Protocol or of coordinated national policies.

13.4.1.3 Decentralized approaches and coordinated policies

Finally, even more decentralized architectures may arise out of different regional, national, and sub-national policies, and subsequently vary in the extent to which they are connected internationally (Victor et al., 2005; Hoffmann, 2011). One form of decentralized architecture is linked regional, national, or sub-national tradable permit systems (Jaffe et al., 2009; Ranson and Stavins, 2012; Mehling and Haites, 2009). In such a system, smaller-scale tradable permit systems can be linked directly (e.g. through mutual recognition of the permits from other systems) or indirectly (e.g. through mutual recognition of an emission-reduction credit system such as the Kyoto Protocol's Clean Development Mechanism [CDM]). In practice, such a system of linkage is already emerging. However, there remains the challenge of harmonising the design details of the various trading systems, as discussed above (e.g. emissions reductions requirements; proportions of target emissions that may be covered by offset credits; use of ceiling or floor prices; and accounting units (Jaffe et al., 2009; Bernstein et al., 2010).

Similarly, heterogeneous regional, national, or sub-national policies could be linked either directly or indirectly (e.g., cap and trade in one jurisdiction linked with a tax in another) (Metcalf and Weisbach, 2012). Linkage of heterogeneous policies can occur through trade mechanisms (e.g., import allowance requirements or border adjustments) or via access to a common emission reduction credit system (e.g., the CDM, as with indirectly linked tradable permit systems).

13.4.1.4 Advantages and disadvantages of different degrees of centralization

Some authors conclude, particularly post-Copenhagen, that attempts to develop a comprehensive, integrated climate regime have failed, due to resistance to costly policies in both developed and developing countries and lack of political will (Michonski and Levi, 2010; Keohane and Victor, 2011), or alternatively because of the complexity that characterises the problem (Hoffmann, 2011). Other analyses emphasise the legitimacy of the UN, particularly citing its universal membership (Hare et al., 2010; Winkler and Beaumont, 2010; Müller, 2010; La Viña, 2010) and noting that fragmentation of the climate regime could create opportunities for forum shopping, a loss of transparency, and reduced ambition (Biermann et al., 2009; Hare et al., 2010; Biermann, 2010). Other studies have examined: 1) the evolution of multilateralism (Bodansky and Diringer, 2010) and possible transitional arrangements from fragmentation to a comprehensive agreement (Winkler and Vorster, 2007), and 2) how to manage fragmentation so that it may become synergistic rather than prone to conflict (Biermann et al., 2009; Oberthür, 2009).

13.4.2 Current features, issues, and elements of international cooperation

The policy architecture for climate change raises a number of specific questions about the structure of international cooperation. Four specific elements are of particular contemporary relevance: legal bindingness; goals, actions, and metrics; flexibility mechanisms; and participation, equity and effort-sharing methods. These four elements deal with the key questions of how much an agreement insists on compliance with its obligations; what obligations it establishes; how flexible the implementation of the obligations may be; and how the obligations may vary across actors and situations. The discussion below focuses on mitigation of GHG emissions, but the four key elements apply as well to adaptation, financing, and other potential topics of international agreements on climate change. For example, UNFCCC Article 4(1)(b) (UNFCCC, 1992, p. 10) calls on "all parties" to formulate and implement both "measures to mitigate climate change" by reducing net GHG emissions, and "measures to facilitate adequate adaptation to climate change." Understanding what is meant by such obligations requires examining these four key elements.

13.4.2.1 Legal bindingness

States choose whether to join an agreement, and can withdraw from an agreement, so international agreements exist by consent of the parties (Waltz, 1979; Thompson, 2006). Having said this, international agreements among states (national governments) may be more or less "legally binding" on their parties. The degree of "bindingness" depends on both the legal form of the agreement and the costs to the state of noncompliance.

Among the indicators of legal bindingness in the agreement itself are: (1) legal type (e.g., treaty, protocol to a treaty, decision of the UNFCCC Conference of the Parties, political declaration); (2) mandatory commitments, that is whether a commitment is "expressed in obligatory language" (e.g. "shall" or "must," vs. "should" or "aim"); (3) specificity, i.e. "…whether [commitments] are expressed in sufficient detail to accurately assess compliance"; and (4) the type of enforcement procedures, mechanisms, and sanctions designed to implement an agreement by monitoring, reviewing, and encouraging compliance with commitments (Werksman, 2010).

International agreements may be labelled "hard law" (such as treaties, their protocols, and contracts) that are legally binding on the parties, or "soft law" (such as declarations, resolutions, and guidelines) that are not legally binding. But the reality is more complex(Baxter, 1980; Abbott et al., 2000; Bodansky, 2010a; Guzman and Meyer, 2010). Across types of agreements, commitments may be more or less legally binding: for example, although treaties often contain mandatory commitments, a treaty may also contain hortatory provisions, such as aims and pledges, which are understood to be aspirational; while a political declaration may nonetheless contain provisions that raise strong expectations and consequences for failure (Raustiala, 2005). Some commitments may be specific and subject to monitoring and accountability, while others are vague and difficult to verify (Abbott and Snidal, 2000). Further, across types of agreements, the enforcement mechanism may be weak or rigorous, ranging from inaction to admonishments to trade sanctions to military force.

The bindingness of an agreement depends on the costs to a state of nonparticipation, noncompliance, or withdrawal – as well as to legal form. These costs include, as discussed above (see Section 13.3.4), not only the costs of sanctions imposed by the agreement's enforcement mechanism, but also the costs incurred from the state's loss of reputation and from the loss of mutual cooperation by other states. Reputational costs and lost-cooperation costs can influence states to adhere to (initially informal) norms; hence strong norms with high costs of violation are sometimes called "binding" (Hoffmann, 2005, 2011; MacLeod, 2010).

Table 13.1 provides a taxonomy the bindingness of international agreements (Bodansky, 2003, 2009). The usage of "mandatory" in the table refers to the specific wording of the commitment—not to a state's choice of whether to participate or not.

Table 13.1: Taxonomy of legal bindingness: examples of commitments in international agreements for climate change

Legal character (noting relevance of indicators 1-4 discussed in the text)	Description	Example
Mandatory provision in a legally-binding agreement with enforcement mechanisms. (1)-(4)	A legally-binding commitment can be subject to a compliance regime, with authority to sanction non-compliant parties. Enforcement can also come in the form of reciprocity for non-compliant actions.	The targets and timetables in the Kyoto Protocol (UNFCCC, 1998) and the Marrakech Accords (UNFCCC, 2001), with specific quantitative emissions limits, a compliance system that sanctions non-compliance, and flexibility mechanisms. (Outside the climate arena, the World Trade Organization is the most prominent example of this type.)
Mandatory provision in a legally-binding agreement without enforcement mechanism. (1) and (2); possibly (3); but not (4)	"Legally binding," but subject only to self-enforcement.	Article 4.1 of the UNFCCC (1992), mandating, *inter alia*, national emissions inventories, measures to mitigate, and measures to facilitate adaptation.
Non-mandatory provision in a legally-binding agreement. (1), but not (2)-(4)	Such a provision does not demand compliance, but carries somewhat more weight than a political agreement.	Article 4.2 (a) and (b) of the UNFCCC (1992) commit developed countries to adopt policies and measures to limit their net GHG emissions (a mandatory provision); 4.2(a) then "recognizes" that returning these emissions to earlier levels by the year 2000 would be desirable, and 4.2(b) provides the "aim" of returning to 1990 levels (both non-mandatory provisions).
Mandatory provision in a non-legally-binding ("political") agreement. (2), possibly (3); but not (1) or (4)	Such a provision may induce the party to act, through norms, reputation, and reciprocity.	The pledges on targets and actions submitted by states pursuant to the Copenhagen Accord (UNFCCC, 2009a) and Cancún Agreements (UNFCCC, 2010). (Outside the climate arena, the moratorium on high seas driftnet fishing is treated as binding by many states, even though UNGA resolutions are not binding.)
Non-mandatory provision in a non-legally-binding ("political") agreement. None of (1)-(4)	An aim or aspiration, expressed in hortatory, non-binding language. This type of provision typically includes one or more statements of principles or norms.	Targets set in the Noordwijk Declaration (1989), at a ministerial conference on climate change held prior to the 1992 Rio summit.

Research has not resolved whether or under what circumstances a more binding agreement elicits more effective national policy. In general, a more legally-binding commitment is more subject to monitoring and enforcement (both internationally and domestically), is more likely to require ratification by domestic institutions, and signals a greater seriousness by states (Bodansky, 2003; Rajamani, 2009). These factors increase the costs of violation (through enforcement and sanctions at international and domestic scales, the loss of mutual cooperation by others, and the loss of reputation and credibility in future negotiations).

On the other hand, there may be situations where there is a trade-off between legal bindingness and ambition (stringency of commitments). Because greater legal bindingness implies greater costs of violation, states may prefer more legally binding agreements to embody less ambitious commitments, and may be willing to accept more ambitious commitments when they are less legally binding (Rajamani, 2009; Raustiala, 2005; Guzman and Meyer, 2010) (See also Sections 13.2.2.5 and 13.3.3) (Albin, 2001; Grasso and Sacchi, 2011; Bodansky, 1999; Bernstein, 2005).

13.4.2.2 Goals and targets

Most agreements that advance international cooperation to address climate change incorporate goals. "Goals" are "long-term and systemic" (as contrasted with absolute emissions-reduction "targets," which may flow logically from the goals but which are "near-term and specific") (IPCC, 2007, chap. 13). The goals of an international agreement might include, for example, stabilization levels (or a reduction in a previously-agreed stabilization level) of atmospheric concentrations of GHGs—or reductions in impacts of climate change.

Targets can be classified according to whether they require absolute GHG cuts relative to a historical baseline, or reductions relative to economic output, population growth, or business-as-usual projections (intensity targets). In recent literature on targets´ metrics, there has been a focus on whether or not intensity targets are superior to fixed ones when there is uncertainty about the future (Jotzo and Pezzey, 2007; Marschinski and Edenhofer, 2010; Sue Wing et al., 2009; Conte Grand, 2013). There are trade-offs between reduced uncertainty about the cost of abatement, associated with intensity targets, and reduced uncertainty about environmental effectiveness, associated with absolute targets (Ellerman and Wing, 2003; Herzog, Timothy et al., 2006).

In the UNFCCC climate negotiations, examples of fixed targets are Kyoto Annex B country-emission reductions by 2008-2012 with respect to 1990 levels, and Copenhagen pledges. (Some of the developed countries propose emissions reductions by 2020 with respect to some base year - 1990, 2000 or 2005 - while some of the developing economies suggest reductions by 2020 with respect to their business-as-usual trends.) On the other hand, intensity targets have been proposed by China and India: their pledge is a reduction of carbon intensity (i.e., emissions/GDP) between 40 and 45% and 20 and 25% respectively by 2020 with respect to 2005 (Steckel et al., 2011; Zhang, 2011; Yuan et al., 2012; Cao, 2010b; Government of India, 2012). Another carbon target linked to GDP was the one planned by Argentina in 1999 (Barros and Conte Grand, 2002).

13.4.2.3 Flexible mechanisms

One focus of international negotiations has been enabling states to have flexibility in meeting obligations. In principle, there are numerous ways this could be achieved. For example, there could be provisions for renegotiating targets. The most often-cited benefit of flexibility is reduction in the costs associated with GHG-emissions reductions. However, Hafner-Burton et al. (2012) explore whether increased flexibility in designing obligations for states helps them align their international obligations more readily with domestic political constraints.

In existing interstate agreements, flexibility has been pursued principally through mechanisms that create markets. The rationale for these is to lower the cost of reducing emissions, relative to traditional regulatory regimes, as they direct investments in emissions reductions toward lower-cost abatement opportunities available in various jurisdictions. Such flexible mechanisms can involve trading emissions allowances under a fixed overall cap, generating offset credits, or combinations of the two. Generally, offset credits can be generated through project-based mechanisms or crediting of policies and sectoral actions. The former have been developed since the mid-1990s, with the CDM as by far the largest program. (Michaelowa and Buen, 2012); The literature assessing the CDM is reviewed in Section 13.13.1.1.) The latter are still being discussed with regards to post-2012 climate policies in the context of "new market mechanisms" related to mitigation policies in developing countries (Nationally Appropriate Mitigation Actions, or NAMAs). Additionally, inter-temporal flexibility may be added to an allowance-trading regime through banking and borrowing of allowances, by which regulated entities may transfer current obligations to the future or vice versa. However, the environmental effectiveness and distributional impact of carbon markets have also raised concerns (Lohmann, 2008; Böhm and Dabhi, 2009).

The Kyoto Protocol provides three flexible mechanisms: Joint Implementation (JI), the CDM, and international emissions trading (IET)(in Articles 6, 12 and 17, respectively). JI and CDM both generate offset credits from projects that reduce GHG emissions, and IET allows for government-to-government trading of Kyoto emissions allowances. Most attention in the research on these mechanisms has focused on the CDM, in part because of the volume of trading compared to the others (on the relatively small volume in Kyoto emissions trading, see (Aldrich and Koerner, 2012)).

The credits from JI and CDM may be used by Annex B countries to meet their emissions-reduction obligations. In practice, the key driver of investment in CDM projects has been the European Union Emission Trading Scheme (EU ETS), which allows regulated entities (companies or installations) to use credits from the CDM (referred to as "Certified Emission Reductions" or "CERs") and from JI (referred to as "Emissions Reduction Units" or "ERUs") to meet a portion of their ETS obligations. (See Sections 13.6.1 and 14.4.2.1 for details.) The EU ETS has accounted for about 84% of demand for CERs and ERUs from 2008-2012. The next largest source of demand for CERs and ERUs comes from Japan, at 15% of demand (Kossoy and Guigon, 2012, p. 71).

Market-based flexibility mechanisms are evolving. Japan is pursuing bilateral crediting approaches under its Joint Crediting Mechanism/Bilateral Offset Crediting Mechanism (Ministry of the Environment, Government of Japan, 2012). COP-17 in Durban in 2011 mandated two approaches be pursued in the UNFCCC negotiations leading to a new international agreement in late 2015: one top-down, operating under authority of the COP ("new market-based mechanism"), which, as noted, focuses in large part on sectoral crediting; and one bottom-up, developed by countries "in accordance with their national circumstances" ("framework for various approaches"), which attempts to coordinate heterogeneous policies across countries. COP-18 in Doha, Qatar, in 2012 reiterated and developed further details regarding these two approaches (UNFCCC, 2013b, pp. 8–10).

13.4.2.4 Equitable methods for effort-sharing

While universal participation might be desirable in principle, actors participate in a context of heterogeneity in both economic capacity and emissions levels. Variations in both wealth and emissions have evolved over time; for example, many countries classified in the 1992 UNFCCC as developing (non-Annex I) have since experienced increasing incomes and increasing emissions (in some cases exceeding the incomes and/or emissions of some countries classified in 1992 as developed (Annex I)). These variations and continued differences are discussed further in Section 4.1.2.2. As to participation in international agreements, in general, a country is less likely to participate in an international agreement the more the country perceives the agreement to be unfair to its own economic and environmental interests. Addressing climate change equitably can thus be central to pursuing broad participation in climate agreements.

There is disagreement, however, about how to put equity principles into practice in international agreements. The UNFCCC adopted the principle of "common but differentiated responsibilities and respective capabilities" (CBDR) of parties (Article 3.1) (UNFCCC, 1992, p. 9). Several different approaches have been advanced for putting this principle into practice. Deleiul (2012) argues that CBDR initially facilitated agreement and participation in the UNFCCC, but has become more contentious as national variations in income and emissions have evolved over time (hence Deleiul sees promise in the Durban Platform, which calls for mitigation contributions from all parties in a new treaty concluded by 2015, to take effect by 2020).

Section 4.6.2 elaborates these different approaches in detail, and suggests they can be broadly divided into those that start with the status quo of emissions, that thus focus on the question of "effort-sharing" or "burden-sharing," and those that start with a specific account of "rights" to greenhouse gas emissions (such as equal per capita or equal per GDP emissions) and derive targets for countries from that formula (known as "resource-sharing"). Rao (2011) refers to these as burden-sharing vs. resource-sharing equity principles. Burden-sharing methods are reviewed in (Jotzo and Pezzey, 2007; den Elzen and Höhne, 2008, 2010; Winkler et al., 2009; Chakravarty et al., 2009; Mearns and Norton, 2010; Frankel, 2010; Ekholm et al., 2010; Marschinski and Edenhofer, 2010; Cao, 2010c; Tavoni et al., 2013; den Elzen, Olivier, et al., 2013; Höhne et al., 2013). "Resource-sharing" approaches are examined in (Höhne et al., 2006; Chakravarty et al., 2009; Baer et al., 2009; Kanitkar et al., 2010; Jayaraman et al., 2011; Rao, 2011; Kartha et al., 2012).

Section 6.3.6.6 elaborates a wide range of possible approaches and quantifies them in terms of levels of emissions reductions for various world regions. One recent example is Winkler et al. (2013), which evaluates several approaches for mitigation of and adaptation to climate change, and suggests that these call for more mitigation in wealthier countries. Recent research is also comparing various measures of equity for climate policy within developing countries (Casillas and Kammen, 2012). Section 13.13 assesses existing and proposed agreements in light of these criteria.

13.4.3 Recent proposals for future climate change policy architecture

An extensive literature has examined what options could be pursued "post-2012", after the end of the first commitment period (CP1) of the Kyoto Protocol. The literature now contains several surveys of diverse proposals (see summaries of pre-2007 literature in (Höhne et al., 2008; Moncel et al., 2011; Aldy and Stavins, 2010b; Rajamani, 2011b, 2012a; IPCC, 2007, chap. 13). Table 13.2 describes recent proposals for climate policy architectures. Qualitative and quantitative performance assessments of these proposals, where available, are surveyed in Section 13.13.

Table 13.2: Description of recent proposals for climate change policy architectures

Proposed Architecture (recent references)	Description
Strong multilateralism	
Indicator-linked national participation and commitments (Baer et al., 2009; Chakravarty et al., 2009; Frankel, 2010; Bosetti and Frankel, 2011; WBGU, 2009; Cao, 2010c; BASIC Project, 2007; Winkler et al., 2011)	All countries adopt emissions targets and timetables, with time of participation and/or target levels based on one or more indicators (per capita income, economic cost as percentage of national income, historical emissions). Targets can both be reductions in emissions growth rates as well as absolute reductions.
Per capita commitments (Agarwala, 2010)	Countries implement equal per-capita emissions targets, resulting in significant emissions increases for many developing countries, and significant decreases for industrialized countries.
Top-down burden sharing (Baer et al., 2009; Kartha et al., 2012; Cao, 2010c; Kanitkar et al., 2010; Jayaraman et al., 2011)	Emissions targets based on: equal per capita emissions; mitigation burden proportional to cumulative emissions and ability to pay; countries with similar economic circumstances have similar burdens; and poorest countries and individuals exempt from obligations.
Sectoral approaches (Sawa, 2010; Schmidt et al., 2008; Barrett, 2010; den Elzen et al., 2008)	Countries develop national emissions targets by sector, and governments make international commitments to implement policies to achieve targets (Sawa, 2010) or based on staged sectoral approach (den Elzen et al., 2008); can be developed in a portfolio of treaties (Barrett, 2010). Alternatively, developing countries pledge to meet voluntary sectoral targets; reductions beyond targets can be sold to industrialized countries (Schmidt et al., 2008).
Portfolio system of treaties (Barrett, 2010; Stewart et al., 2012)	Separate international treaties concluded for different sectors, different greenhouse gases. Treaty obligations apply globally, and developing countries offered financial assistance to aid compliance and induce participation. Trade restrictions used to enforce agreements in trade-sensitive sectors.
Harmonized national policies	
Global emissions permit trading system (Ellerman, 2010)	The EU ETS serves as prototype for a global emissions trading system. Design informed by EU ETS experience, which has a central coordinating institution (the European Commission), mechanisms to expand participation to new Member States, and effective financial flows resulting from trading. Distributional impacts addressed by specific design features.
International carbon tax (Cooper, 2010; Nordhaus, 2008; Metcalf and Weisbach, 2009)	A common charge levied on all global GHG emissions, most practically upstream (at oil refineries, gas pipelines, mine mouths, etc.). Each country collects and keeps its own revenues. Charges rise over time according to schedule to induce cost-effective technological change. Distributional impacts addressed by allocation of revenues.
Hybrid market-based approaches (Fell et al., 2012)	A tradable emissions permit system includes a price ceiling, a price floor, or a combination of the two (a price collar). System functions like a hybrid of a tax and a tradable permit system. The price ceiling (often called a "safety valve") can take the form of unlimited allowances sold at a fixed price or a limited allowance reserve.
Decentralized architectures and coordinated national policies	
Linked domestic cap-and-trade systems (Jaffe and Stavins, 2010; Jaffe et al., 2009; Bernstein et al., 2010; Metcalf and Weisbach, 2012; Ranson and Stavins, 2013)	Domestic and international emissions trading and emissions reduction credit systems linked, directly or indirectly, to achieve cost savings. Direct linkages require more coordination, while indirect linkages (of cap-and-trade systems through a common credit system, for example) require less. Linkage achieved independently (as a bottom-up architecture), as a transition to a new top-down architecture, or as an element of a broader climate agreement.

Linked heterogeneous policy instruments (Metcalf and Weisbach, 2012)	Domestic and international emissions trading systems linked with carbon tax systems, allowing emissions permits from one country to be remitted as tax payments, and/or allowing payments in excess of the tax in one country to satisfy the requirement to own a permit in another. Alternatively, fixed emissions standards (or even technology standards) linked with taxes or tradable permit systems across countries or regions.
Technology-oriented agreements (Newell, 2009, 2010a; de Coninck et al., 2008)	International climate change agreements to cover issues such as knowledge sharing and coordination, joint research and development, technology transfer, and/or technology deployment mandates or incentives. Distributional impacts affected by intellectual property sharing rules.

13.4.4 The special case of international cooperation regarding carbon dioxide removal (CDR) and solar radiation management (SRM)

Since the publication of AR4, carbon dioxide removal (CDR) and solar radiation management (SRM) have received increasing attention as a means to address climate change, distinct from mitigation and adaptation. These two approaches are often collectively referred to as “geoengineering” or “climate engineering” (For more detail see WGI 6.5 and 7.7). CDR refers to techniques to extract GHGs directly from the atmosphere and store them in sinks, or to directly enhance such sinks. SRM aims to reduce the amount of solar radiation absorbed by the Earth’s surface. Proposed SRM projects can be atmospheric (e.g. cloud brightening or adding reflective sulphate particles to the lower stratosphere), terrestrial (e.g. enhancing the albedo of the ground, or painting pavements and roof materials white to reflect solar radiation) and space-based (e.g. placing mirrors in space). See Working Group I report, Section 7.7, for details of these.

Some SRM options (e.g. injecting sulphate particles into the lower stratosphere) may be inexpensive enough for individual states (Barrett, 2008a) and even non-state actors, such as wealthy individuals, to undertake (Barrett, 2008a; Victor, 2008; Victor et al., 2009; Bodansky, 2011b)(Crutzen, 2007; Lin, 2009). CDR and other SRM approaches might need to be implemented by numerous countries in order to be effective (Humphreys, 2011). Some SRM options may also have specific regional impacts (e.g. regional temperature and precipitation effects, leaf albedo enhancement, or ocean circulation modification), providing direct and perhaps excludable benefits to actors undertaking them (Millard-Ball, 2012) and external costs to others (Ricke et al., 2010, 2013). See also WGII 19.5.4 for detailed discussion of the risks of SRM.

Smaller-scale actors that are particularly vulnerable to climate change impacts may perceive advantages to be first-movers with SRM, in order to ensure both global climate protection and a favourable distribution of regional impacts from their selected SRM projects (Ricke et al., 2010; Millard-Ball, 2012). Hardly any cooperation might be needed for SRM’s development and deployment—indeed, countries facing severe impacts might rush to launch a preferred SRM project (Millard-Ball, 2012). If the benefits of such an SRM project outweigh the adverse side effects, and its costs are indeed low, then such an SRM project might be desirable. But such unilateral action could also produce significant adverse side effects and costs for other actors, if the SRM option chosen is one that secures climate benefits for one part of the world while creating climate or other damages in other parts (Lin, 2009). SRM may also be ineffective in mitigating some climate impacts, for example the acidification of oceans from absorption of excessive CO_2 (Humphreys, 2011). Further, SRM does not reduce concentrations of atmospheric GHGs, and interrupting SRM after concentrations have risen significantly could allow temperatures to rise rapidly (see also Smith and Rasch, 2012).

SRM poses the converse of the collective action and governance challenges arising from emissions-reduction efforts: rather than mobilizing hesitant action to limit emissions, SRM governance involves restraining hasty unilateral action (Victor, 2008; Victor et al., 2009; Virgoe, 2009; House of Commons Science and Technology Committee, 2010; Lloyd and Oppenheimer, 2014; Millard-Ball, 2012; Bodansky, 2011b). One of the main issues for international cooperation will be to develop institutions and norms to address potential negative consequences of SRM in other social or environmental fields, or for parts of the world either not protected or negatively affected by the SRM option chosen. Thus, some analysts have recommended that international governance be organized for SRM research and testing, in order to learn about the benefits and side effects of SRM options, to develop institutions to decide if and when to deploy SRM, to learn how to maintain SRM capabilities, and to monitor and evaluate this research and its use (Victor et al., 2009; Blackstock and Long, 2010; Lin, 2009; Solar Radiation Management Governance initiative, 2011).

Some existing international agreements may be relevant to geoengineering. The UNFCCC already includes a provision, Article 4.1(f), requiring assessment of the adverse impacts of climate mitigation measures. The UN Convention on Law of the Sea contains important provisions on environmental protection (Redgwell, 2006), and may have increased significance with regards to the governance of marine-based carbon sequestration or geo-engineering options (Virgoe, 2009). Under the London Convention and Protocol, the International Maritime Organization (IMO) held that, given the uncertainty surrounding negative impacts, ocean fertilisation other than "legitimate scientific research" ought not be permitted (Reynolds, 2011) (resolutions LC-LP.1 (2008) and LC-LP.2 (2010). Several multilateral fora have recently taken up the issue of SRM. The 1992 Convention on Biological Diversity (CBD) adopted a decision calling for a moratorium on "geo-engineering activities that may affect biodiversity" (Convention on Biological Diversity, 2010; Tollefson, 2010). Other existing multilateral treaties and agreements that may relate to geo-engineering include: the 1977 UN Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques (the ENMOD Convention) (though it restricts only "hostile" actions); the convention on Environmental Impact Assessment in a Transboundary Context (UNECE, 1991); the 1959 Antarctic Treaty System (US Department of State, 2002); and ongoing developments in human rights law and in environmental law (Reynolds, 2011; Convention on Biological Diversity, 2012). Further, the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (United Nations, 2002) may apply to the use of sun-deflecting mirrors in space.

13.5 Multilateral and bilateral agreements and institutions across different scales

This section builds on the description of the climate policy landscape in section 13.3.1 and plausible climate policy architectures in section 13.4. It considers the experience and evolution of international and transnational cooperation on climate change between states and non-state actors since 2007 when the Fourth Assessment Report of the IPCC was published.

13.5.1 International cooperation among governments

13.5.1.1 Climate agreements under the UNFCCC

The UNFCCC's universal membership provides it with a high degree of legitimacy among parties around the world (Karlsson-Vinkhuyzen and McGee, 2013). Steps taken under the Convention and its Kyoto Protocol have led to more extensive action than under other forms of international cooperation on climate change.

Evolution of the multilateral climate regime since AR4

At COP-13 in Bali in 2007, discussions on long-term cooperative action under the Convention turned into negotiations under the Bali Action Plan (UNFCCC, 2007a). Also in Bali, countries agreed to measurement, reporting, and verification (MRV) of mitigation commitments or actions by developed countries and mitigation actions by developing countries and support for those. Under the Copenhagen Accord (UNFCCC, 2009a) and Cancún Agreements (UNFCCC, 2010), Forty-two developed countries (including the 27 EU member states) submitted absolute reduction commitments against various base years in the form of quantified economy-wide emissions targets for 2020. Fifty-five developing countries and the African Union submitted information on NAMAs to the UNFCCC (as of May 2013), which are subject to domestic and international MRV. These 55 developing countries expressed their proposed goals in a variety of ways (e.g. relative emission reductions, deviation below business as usual, absolute reductions, and goals related to carbon neutrality); 16 proposed economy-wide goals for mitigation of greenhouse gas emissions. Since 2010, no major economy has significantly changed its emission reduction proposal under the UNFCCC, though some countries have clarified their assumptions and business-as-usual emission levels (UNEP, 2010, 2011, 2012, 2013b; den Elzen, Hof, et al., 2013; Sharma and Desgain, 2013; UNFCCC, 2013c) Figure 13.3 displays the different categories of actions and pledges taken by countries under the Cancún Agreements and the Kyoto Protocol as of September 2013.

COP-17 in Durban in 2011 produced the Durban Platform for Enhanced Action (UNFCCC, 2011a), in which the delegates agreed “to launch a process to develop a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all Parties” (UNFCCC, 2011a) and “complete its work as early as possible but no later than 2015 in order to adopt this protocol, another legal instrument or an agreed outcome with legal force at the twenty-first session of the Conference of the Parties and for it to come into effect and be implemented from 2020.”(UNFCCC, 2011a).

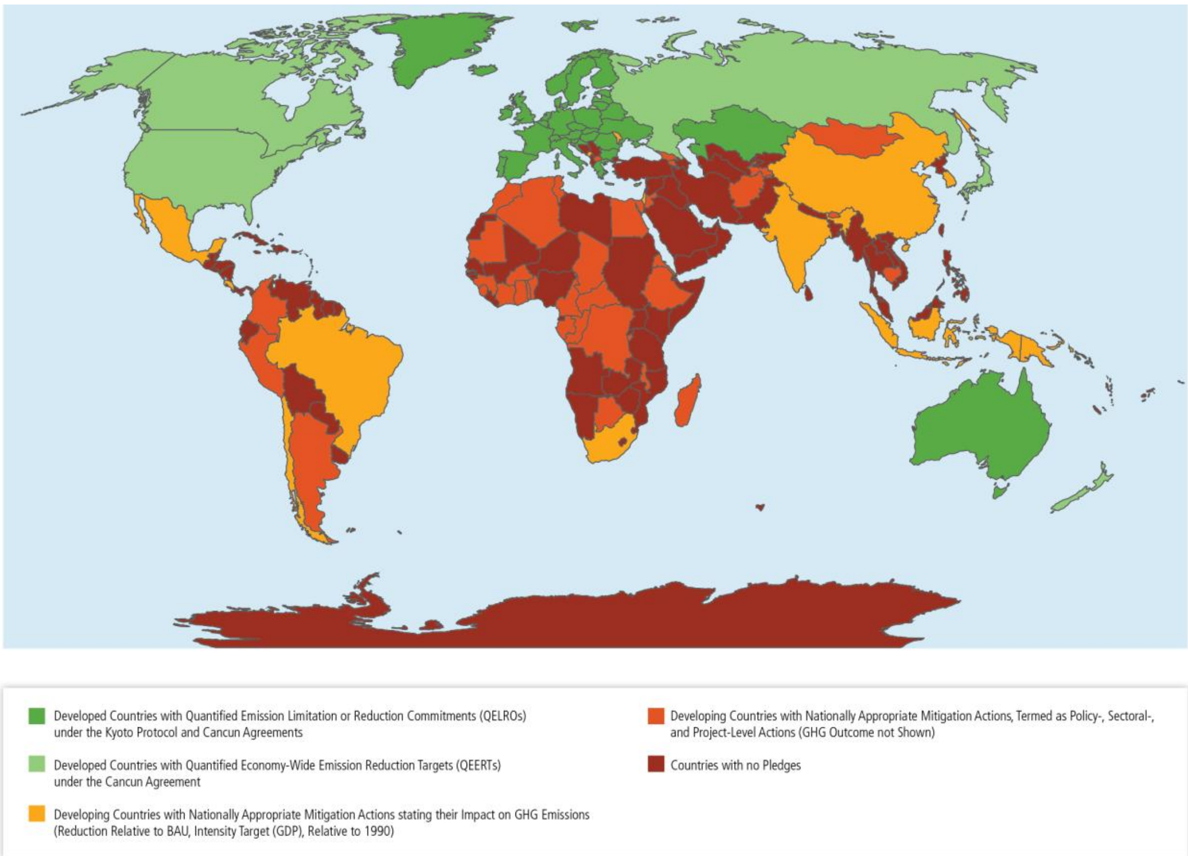


Figure 13.3. Global map showing the different categories of reduction proposals or commitments for 2020 under the Cancún Agreements and Kyoto Protocol, based on UNEP (2012, 2013b) with underlying data supported by UNFCCC (2011b, 2012d, 2013c).

Evolution of coalitions among UNFCCC Parties

New and existing coalitions of countries have engaged in the UNFCCC negotiations, each presenting coordinated positions. Several distinct coalitions of developing countries have formed to negotiate their divergent priorities. Examples include the G77 & China, which represents 131 developing countries operating in the UNFCCC and the UN system more broadly and which contains sub-groups such as the African Group, the Least Developed Countries, and the Arab Group; the Alliance of Independent Latin American and Caribbean states; and a "like-minded developing country" group that included China, India, and Saudi Arabia (Grubb, 2013). Other coalitions organized to influence UNFCCC negotiations include the Alliance of Small Island States (AOSIS), which has played a significant role in UNFCCC negotiations since the early 1990s; various groupings of industrialized countries, including the Umbrella Group; the Environmental Integrity Group, which was the first coalition to include both industrialized and developing countries; the BASIC countries (Brazil, South Africa, India and China) (Olsson et al., 2010; Rong, 2010; Nhamo, 2010); the Coalition of Rainforest Nations, which has increased the salience of forests in climate negotiations; and other active coalitions not limited to the climate context, for example the Comision Centroamericana de Ambiente y Desarollo and the Bolivarian Alliance for the Americas.

Negotiations under the Kyoto Protocol

Negotiations on a second commitment period (CP2) of the Kyoto Protocol were launched in Montréal in 2005. These negotiations concluded in late 2012 at COP-18 in Doha, Qatar with a decision and amendment establishing the second commitment period of the Protocol for 2013 - 2020. However, a number of Annex I countries (Belarus, Canada, Japan, New Zealand, Russia, the United States, and Ukraine) decided not to participate in the second commitment period. The other Annex I countries (Australia, the EU and its member states, Iceland, Liechtenstein, Monaco, New Zealand, Norway, Switzerland, and Ukraine) adopted quantified emission reduction commitments (Figure 13.3), covering 13 percent of global GHG emissions at 2010 emission levels (UNFCCC, 2012d; European Commission, Joint Research Centre, 2012). At COP-18 in Doha in 2012, parties also agreed upon rules for transferring surplus Kyoto emissions allowances from the first to the second period. These rules are assessed in Section 13.13.1.1, and the evolution of market-based flexibility mechanisms in the UNFCCC negotiations is discussed in section 13.4.2.3.

New institutions under the UNFCCC and the Kyoto Protocol

The UNFCCC and its Kyoto Protocol have brought about a number of new institutions focused on adaptation (funding and coordination), finance, and technology. The Adaptation Fund was established to provide direct access to financing for developing countries and is governed by a majority of developing countries. The Adaptation Committee was established to coordinate previously fragmented aspects of adaptation policy under the Convention, with modalities and linkages to other institutions to be defined (UNFCCC, 2011c) (See Section 13.11.1.1). The Green Climate Fund is accountable to the Conference of the Parties, and, when it is fully operational, may be a major channel for the provision of climate finance (Brown et al., 2011). The Standing Committee on Finance supports the parties in coordinating and providing accountability for the financial mechanism of the Convention. The Climate Technology Centre and Network (CTCN), together with the Technology Executive Committee (TEC), was established to exchange information regarding technology development and transfer for adaptation and mitigation (UNFCCC, 2011c).

13.5.1.2 Other UN climate-related forums

Acting on climate change may require functions other than negotiation under the UNFCCC or other forms of high-level cooperation, such as analytical support and implementation assistance for mitigation and adaptation efforts. A diverse set of forums both within and outside the UN system has taken up the issue of climate change since AR4, possibly contributing to broader institutional learning and effectiveness (Depledge, 2006; Stewart et al., 2012).

The United Nations Environment Programme (UNEP) has had a natural concern with climate change for many years, given its mission, and it collaborates closely with the UNFCCC. Since AR4, UNEP has provided increasingly significant analytical support to the international process, in part through its emissions-gap reports (UNEP, 2010, 2012, 2013b; Höhne, Taylor, et al., 2012; Hof et al., 2013), but also through a wide range of other analytical efforts and support for institution building.

UN forums beyond the UNFCCC are increasingly addressing funding for adaptation and mitigation. Fragmentation in the various objectives, conditions, and eligibility requirements of the different funds may make it difficult for developing countries to identify and access appropriate funding (Czarnecki and Guilanpour, 2009). The literature examines the relationship between adaptation and development finance, including concerns about measuring official development assistance (ODA) and how much adaptation funding is "new and additional" (Stadelmann et al., 2010; Smith et al., 2011). A number of developing countries have established "national funding entities to coordinate domestic and international funding for adaptation with development funding" (Smith et al., 2011).

Other UN agencies have also addressed the connections of climate change with human development (UNDP, 2007; UNDESA, 2009), the CO_2 emissions gap (Convention on Biological Diversity, 2012; Höhne, Taylor, et al., 2012), finance (AGF, 2010), and human rights (see Section 13.5.2.2).

The Montreal Protocol on Substances that Deplete the Stratospheric Ozone Layer (concluded in 1987 under UN auspices)—and the Protocol's subsequent amendments, adjustments, and decisions—have also contributed to reductions in greenhouse gas emissions. One notable proposed amendment would accelerate the phase out of substitutes of ozone depleting substances that are also strong greenhouse gases (Mauritius & Micronesia, 2009; Velders et al., 2012).

13.5.1.3 Non-UN forums

Climate change is increasingly addressed in forums for international cooperation outside of the UN. The IPCC (2007, chap. 13) assessed several partnerships focused on particular themes, technologies, or regions.

Some international partnerships have defined themselves as complements to the UNFCCC rather than as alternatives. For example, the REDD+ Partnership helps coordinate measures for reducing emissions from deforestation and degradation (REDD) in the UNFCCC process. The Partnership focuses on conservation, sustainable forest management, and forest carbon stock enhancement. In 2010, more than 50 countries signed a non-binding agreement to pledge more than $4 billion to REDD+ (Bodansky and Diringer, 2010). Michaelowa (2012a) and Stewart el al. (2009) describe multiple avenues for climate change financing to assist transitions to low-carbon technologies, such as through the International Renewable Energy Agency (IRENA). Established in 2009, IRENA seeks to advance the development and transfer of renewable energy technologies, with a focus on financing renewable energy in its 163 member and signatory states (plus the European Union) (Florini, 2011, pp. 47–48; International Renewable Energy Agency, 2013).

The Major Economies Forum on Energy and Climate (MEF), organized by the United States, provides a forum for informal consultation. Its members – Australia, Brazil, Canada, China, the European Union, France, Germany, India, Indonesia, Italy, Japan, the Republic of Korea, Mexico, Russia, South Africa, the United Kingdom, and the United States – together account for about 70 percent of global GHG emissions (European Commission, Joint Research Centre, 2012). Its meetings are intended to advance discussion of international climate change agreements (MEF, 2009), and it has generated a related Clean Energy Ministerial. MEF participants recognize the group as a venue for discussion rather than a forum for negotiating binding agreements. MEF's produces a Chairs' summary instead of formally agreed text (Leal-Arcas, 2011). The existence of the MEF may be evidence of an overall increase in the fragmentation of global environmental governance (Biermann and Pattberg, 2008; Biermann, 2010). Some may also be concerned about a small set of large countries reaching even informal decisions that affect a much larger set, and some may not be comfortable with a process chaired by a single nation (Stavins, 2010).

The Group of Twenty (G20) finance ministers from industrialized and developing economies could have the capacity to address climate finance, building on its core mission to discuss economic and finance policy. The make-up of the G20 is similar to that of the MEF, with the addition of Argentina, Saudi Arabia, and Turkey. Houser (2010) finds that the G20 might help to accelerate the deployment of clean energy technology, help vulnerable countries adapt to climate change impacts, and help phase out inefficient fossil-fuel subsidies. At its meeting in Pittsburgh in 2009 (G20, 2009), the G20 gave considerable attention to climate change policy issues, in particular to fossil-fuel subsidies. Likewise, since 2005, the smaller Group of Eight (G8) heads of state and government have held a series of meetings relating to climate change and recognized the broad scientific view that the increase in global average temperature above pre-industrial levels ought not exceed 2°C (G8, 2009). Van de Graaf and Wsetphal (2011) explore both opportunities for and constraints on the G20 and G8 with regard to climate.

Two forums of growing importance, providing analytical support for international cooperation on climate change, are the International Energy Agency (IEA) and the Organisation for Economic Co-operation and Development (OECD). While the IEA has limited its membership to industrialized oil-importing countries (Scott, 1994; Goldthau and Witte, 2011), the OECD has granted membership to advanced developing countries. Both institutions have received increasingly strong mandates by their members to provide analytical support for climate change mitigation decisions. The OECD has a unit for economic analysis of climate policy and impacts, and already plays a role in building knowledge (OECD, 2009). The IEA could play a key role to reduce uncertainty about countries' performance by collecting, analysing, and comparing energy and industry-related emissions data (Harvard Project on Climate Agreements, 2010). The IEA and OECD have formed and jointly manage the Climate Change Expert Group, whose explicit mission is to provide analytical support on technical issues to the international negotiations.

The Cartagena Dialogue for Progressive Action includes around 30 industrialized and developing countries, which have met both during and between formal sessions since 2009. The Dialogue is open to countries working toward an ambitious, comprehensive, and legally binding regime in the UNFCCC, and who are committed to domestic policy to reduce emissions. The aim of the Dialogue is to openly discuss positions, to increase understanding, and to explore areas where convergence and enhanced joint action could emerge (Oberthür, 2011).

In February, 2012, a group of seven partners (Bangladesh, Canada, Ghana, Mexico, Sweden, and the United States, together with the UN Environment Programme) launched a new "Climate and Clean Air Coalition" as a forum for dialogue among state and non-state actors outside the UNFCCC process. The goal of the Coalition is to reduce levels of black carbon, methane, and HFCs among its 34 state members (including the European Commission) in collaboration with 9 international organizations and 29 non-state partners (as of September 2013). The Coalition has received funding from a number of countries, including Canada, Japan, and the United States to implement projects (Blok et al., 2012, p. 474; UNEP, 2013a).

New initiatives on international cooperation for adaptation and its funding have also been created, such as the World Bank's Pilot Program on Climate Resilience, and the European Commission-established Global Climate Change Alliance (GCCA), which pledges regional and country-specific finance.

13.5.2 Non-state international cooperation

13.5.2.1 *Transnational cooperation among sub-national public actors*

A prominent development since AR4 is the emergence of a large number of international agreements between non-state entities (den Elzen, Hof, Mendoza Beltran, et al., 2011; Höhne, Taylor, et al., 2012; Hare et al., 2012). These are most commonly referred to as "transnational climate governance initiatives" (Biermann and Pattberg, 2008; Pattberg and Stripple, 2008; Andonova et al., 2009; Bulkeley et al., 2012). In the most comprehensive survey, (Bulkeley et al., 2012) document 60 of these initiatives, which can be grouped into four principal types: public-private partnerships, private sector governance initiatives, NGO transnational initiatives, and sub-national transnational initiatives. The first two, involving private actors, are discussed in section 13.12.

NGO transnational initiatives attempt to influence the activities of corporations directly through transnational partnerships, some of which involve collaboration with the private sector. They have set up certification schemes for carbon offset credits, such as the Gold Standard, which is limited to renewable energy and demand-side energy efficiency projects, and the Community Carbon and Biodiversity Association standard, which aims to increase the quality of forestry credits (Bayon et al., 2007; Bumpus and Liverman, 2008). Certified offset credits have commanded a price premium above other ("standard") credits (Sterk and Wittneben, 2006; Ellis et al., 2007; Nussbaumer, 2009; Newell and Paterson, 2010). These certification schemes have been used for the Voluntary Carbon Market as well as for the CDM (Conte and Kotchen, 2010).

Sub-national transnational initiatives involve sub-national actors, such as city-level governments, collaborating at an international scale. One example of this form of cooperation is the ICLEI – Local Governments for Sustainability network. This organization has taken action through its Cities for Climate Protection program from 1993 and more recently through a partnership the C40 Cities Climate Leadership Group (Kern and Bulkeley, 2009; Román, 2010; Bulkeley et al., 2012). A World Mayors Summit in November 2010 had participation from 138 cities and agreed on a Global Cities Covenant on Climate, otherwise known as the Mexico City Pact. A related initiative, the carbonn Cities Climate Registry, is an effort of local governments to regularly measure, report, and verify cities' actions on climate change mitigation and adaptation (Chavez and Ramaswami, 2011; Ibrahim et al., 2012; Otto-Zimmermann and Balbo, 2012; Richardson, 2012). Recognition of local governments as governmental stakeholders in paragraph I.7 of the Cancún Agreements is a reflection of the growing role of sub-national transnational cooperation in the UNFCCC processes.

Larger sub-national units have developed transnational collaborative schemes. Most notable are the North American sub-federal cap and trade schemes, including the Western Climate Initiative (WCI). The WCI was originally envisaged to link state and provincial cap-and-trade systems in seven western U.S. states and four Canadian provinces beginning in 2012. The original aim of the initiative was reducing GHG emissions by the member states and provinces to 15 percent below 2005 levels by 2020 (Rabe, 2007; WCI, 2007; Selin and VanDeveer, 2009; Bernstein et al., 2010). While the U.S. state of California's ETS began operating in January 2013, the launch of the WCI system has been delayed. WCI currently includes only California and Québec, although Ontario, British Columbia, and Manitoba are considering accession.

13.5.2.2 *Cooperation around Human Rights and Rights of Nature*

Human rights law could conceivably frame an approach to climate change (Bodansky, 2010b; Bell, 2013; Gupta, 2014). Some recent literature argues that a human rights framing helps "to counteract gross imbalances of power" between states and individuals (Sinden, 2007; Bratspies, 2011; Akin, 2012). The human rights approach to climate change has been acknowledged by the UN Human Rights Council in its Resolution 7/23 and the Office of the United Nations High Commissioner for

Human Rights (UNHRC, 2008; Limon, 2009; OHCHR, 2009). The literature discusses a variety of specific issues, including the implications for climate adaptation; the impacts of climate change on human rights to water, food, health, and development; obligations to undertake mitigation actions; and whether human rights law implies an obligation to receive climate refugees.

Refugees displaced from their homes due to climate change may strain the capacity of existing institutions (Biermann and Boas, 2008). However, policies to address climate refugees face legal hurdles, including the issue of causality: who is to be held responsible, who is the rights-bearer, and the issue of standing (Limon, 2009). Proposals have been made in the literature for a new protocol to the UNFCCC, a new convention, and funding mechanisms to address the issues associated with climate refugees (Biermann and Boas, 2008; Docherty and Giannini, 2009). Such efforts could build on the 1951 Geneva Convention Relating to the Status of Refugees. In the absence of coordinated efforts, the Special Procedures and the Universal Periodic Review of the Human Rights Council are advancing the human rights and climate change agenda (Cameron and Limon, 2012).

In 2010, the government of Bolivia convened government and non-government representatives in the World People's Conference on Climate Change and the Rights of Mother Earth, which culminated in a People's Agreement (WPCCC and RME, 2010). The participation of social movements in international cooperation on climate change may enhance recognition of "radical climate justice" (Roberts, 2011) and an approach to law that seeks to establish "rights of nature" (Cullinan, 2002; Sandberg and Sandberg, 2010; Aguirre and Cooper, 2010).

13.5.3 Advantages and disadvantages of different forums

The literature has considered the strengths and weaknesses of negotiating climate policy across multiple forums and institutions. Some studies suggest that, in addition to its own action, the UNFCCC effect of catalysing efforts by others and providing coherence to multiple initiatives may result in greater aggregate impact (Moncel and van Asselt, 2012). Other literature suggests that "regime complexes" may emerge from smaller "clubs" and then expand (Keohane and Victor, 2011; Victor, 2011). Regimes need (external) incentives for participation and (internal) incentives for compliance (Aldy and Stavins, 2010c). A key advantage of smaller forums or "clubs" may be greater efficiency in the negotiation process, as emphasised in the general political science literature on negotiations (for example, Oye, 1985). But the literature also reflects key disadvantages, including that such clubs lack universality and hence legitimacy (Moncel et al., 2011), and that the environmental effectiveness of clubs may be undercut by leakage of emissions sources to other countries outside the club (Babiker, 2005). Some have suggested clubs as a way forward outside the UNFCCC, while others suggest they could contribute to the UNFCCC, for example by assisting in catalyzing greater ambition (Weischer et al., 2012). Several smaller "clubs" that cut across categories (e.g. public / private) and scales (from international to local) are assessed in 13.5.1.2. Flexibility is another advantage cited for smaller clubs. Climate mitigation through "clubs" is not necessarily superior (Keohane and Victor, 2011) and action through this form of cooperation has to date not brought about high levels of participation and action. Smaller clubs must address conflicts where the climate change regime intersects with other major policy regimes (Michonski and Levi, 2010). Analysis of existing clubs suggests they enable incremental change and suggests that a set of incentives (related to trade, investment, labour mobility, or access to finance) could turn these into "transformational clubs" (Weischer et al., 2012).

In a fragmented world, linking multiple agreements into a coherent whole is a major challenge. The aggregate effectiveness (in terms of the criteria discussed in 13.2) of the landscape of climate agreements and related institutions (Figure 13.1) can be enhanced by coordinated linkages among multiple elements. The actual forms and effects of policy linkages, existing or future, must be evaluated in each context. Policy linkages across the landscape of agreements on climate change might take several forms, such as mandated action and reporting by subsidiary bodies, agreed links between institutions (e.g. memoranda of understanding), loose coordination, information sharing, and delegation. The literature on transnational governance acknowledges a gap in that "interactions are understudied in all areas of transnational governance" (Weischer et al., 2012). Some characteristics of potential linkages may stimulate their formation, for example, competition among public and private governance regimes (Helfer and Austin, 2011), accountability (Bäckstrand, 2008; Ballesteros et al., 2010), learning (Kolstad and Ulph, 2008), and experimentation. Related literatures suggest that other important characteristics of linkages across regime components may be reciprocity (Saran, 2010), relationships of conflict or interpretation (ILC, 2006), collaboration (Young, 2011), the catalytic role of the UNFCCC (UNFCCC, 2007a), NGOs as norm entrepreneurs (Finnemore and Sikkink, 1998), evaluation of policy approaches (Stewart and Wiener, 2003; Greenstone, 2009), and delegation to other institutions (Green, 2008).

13.6 Linkages between international and regional cooperation

13.6.1 Linkages with the European Union Emissions Trading Scheme (EU ETS)

Due to the scale effects that occur when carbon markets are enlarged, market-based mechanisms may be an important means of regional policy integration. The largest carbon market is the EU Emissions Trading Scheme (EU ETS), which began operating in 2005 and now includes all 28 European Union member states and is linked with the Norwegian system. The EU ETS is described and evaluated in detail in Section 14.4.2.1.

The EU ETS interacts with international carbon markets through the project-based Kyoto Mechanisms. Import of units through international emissions trading is not allowed, but companies covered by the EU ETS can import CDM and JI credits. A relatively liberal import regime for the pilot phase was established in a "Linking Directive" approved in 2004 (Flåm, 2009). Forestry credits were banned and additional criteria for large hydro power projects were set. For the EU ETS's second phrase, which corresponded to the Kyoto Protocol's first commitment period, 2008-2012, countries proposed import thresholds; several proposals were adjusted downwards by the Commission. For the third phase, 2013 to 2020, imports were limited to credits from CDM projects registered before 2013 in the absence of an international climate change agreement. New (2013 inception or later) CDM projects can only be used in the EU ETS if located in least developed countries (Skjærseth, 2010; Skjærseth and Wettestad, 2010). However, CDM credits from new projects in non-LDCs can be accepted after 2013 if the EU has concluded a bilateral agreement with the country in question regulating their level of use.

The European Union could potentially link the EU ETS to other schemes, and legislation for the period until 2020 allows negotiation of such bilateral treaties. The EU and Australia have already agreed to a one-way indirect link to commence on 1 July 2015, meaning that EU credits will be allowed for compliance under the Australia system (European Commission, 2012). This agreement will transition to a two-way direct link by no later than 1 July 2018, provided that the Australian system goes forward.

13.6.2 Linkages with other regional policies

The Asia-Pacific Partnership for Clean Development and Climate, which was time-limited and has now concluded, involved about 50 percent of the world population, GHG emissions, and world economic output (Kelly, 2007, p. 163). The partnership included countries that had not ratified the Kyoto Protocol, and while it was "soft" in terms of legal bindingness, it may have had a modest impact on governance (Karlsson-Vinkhuyzen and van Asselt, 2009; McGee and Taplin, 2009) and encouraged voluntary action (Heggelund and Buan, 2009). After the end of the Partnership, the Global Superior Energy Performance Partnership (GSEP) Clean Energy Ministerial took over some of the Partnership's activities.

In addition to coordination by international organizations, such as ICLEI - Local Governments for Sustainability, voluntary mitigation action of cities is taking a regional/global character (Kern and Bulkeley, 2009). In Europe, the Climate Alliance has about 1700 member cities from a number of countries. The Climate Alliance has supported rainforest conservation projects in the Amazonian region (Climate Alliance, 2013).

13.7 Linkages between international and national policies

As the landscape of multilateral and other international agreements on climate has become more complex, the interactions between international and national levels have become more varied.

13.7.1 Influence of international climate policies on domestic action

International policy may trigger more ambitious national policies. Treaties provide greater certainty that others will act, thus addressing key concerns that countries will free ride. International climate policy can shape domestic climate discourse, even if it may not be the main inspiration for proactive action (Tompkins and Amundsen, 2008).

National policies also affect the effectiveness of international policies. The implementation of international policy is affected by national political structure. Examples of studies on how varying domestic political structures affect the implementation of international policies include studies in: Italy (Massetti et al., 2007), France (Mathy, 2007), Canada (Harrison, 2008), China (Teng and Gu, 2007), the UK (Barry and Paterson, 2004; Compston and Bailey, 2008) and the Netherlands (Gupta et al., 2007). National and sub-national settings, where actions may be less risky or more politically feasible, may also provide useful “laboratories” to test policy instruments before implementation at the international level (Michaelowa et al., 2005; Moncel et al., 2011; Zelli, 2011).

13.7.2 Linkages between the Kyoto mechanisms and national policies

Linking national policies with international policies may provide flexibility by allowing a group of parties to meet obligations in the aggregate. The Kyoto Protocol (Article 4) provides for such inter-regional flexibility, and the European Union has taken advantage of the Protocol’s provision through its internal burden-sharing decision. This decision allowed the EU’s Kyoto commitment of an 8 percent emissions reduction below 1990 for the 2008-2012 period to be redistributed among EU-15 member states; commitments of these states range from -28 percent (Luxembourg) to +27 percent (Portugal) (Michaelowa and Betz, 2001; Hunter et al., 2011).

Use of the CDM and JI Kyoto mechanisms has been driven by national mitigation policies to achieve developed countries’ emissions commitments. While governments of some developed countries buy emissions credits directly, others introduce instruments with emissions commitments for private companies, like the EU Emissions Trading Scheme (EU ETS); some countries, such as Denmark, have done both. These companies can then use emissions credits generated under the Kyoto Protocol to satisfy part of their commitments (Michaelowa and Buen, 2012). Another example is Japan’s Industry Voluntary Action Plan that includes diverse sectors, each of which has its own target set either in absolute terms, in emissions´ intensity, or in terms of energy consumption (Mitsutsune, 2012).

Many industrialized countries limit imports of credits generated by the Kyoto mechanisms for various reasons; two have been posited in the literature: (1) to keep the domestic carbon price high to induce technological diffusion and possibly innovation; and (2) to avoid diminishing environmental effectiveness by allowing required emissions-reduction to occur in other jurisdictions because of concerns about the quality of credits (“additionality”). For example, the European Union has prohibited the import of Assigned Amount Units (AAU) into the EU-ETS in order to prevent the use of surplus units from countries in transition, colloquially called “hot air” (Michaelowa and Buen,

2012) Japanese companies have used AAUs from Green Investment Schemes for meeting their targets (Tuerk et al., 2010). In 2011, credits from certain CDM project types were banned for use in the EU-ETS from 2013 onwards (Schneider, 2011). The ban includes CERs generated from projects involving destruction of trifluoromethane (HFC-23) and nitrous oxide (N_2O) from adipic acid production.

The Kyoto mechanisms also interact with the national policies of countries in which projects are implemented. However, the CDM Executive Board decided that the effects of new policies implemented in host countries that reduce emissions should not be considered when assessing the additionality of new projects to avoid perverse incentives not to adopt mitigation policies (Winkler, 2004; Michaelowa, 2010). Instead, countries may subsidize renewable energy while generating CDM credits. There are indications that the availability of CDM credits has accelerated the introduction of feed-in tariffs in China (Schroeder, 2009). Freeing emission units for sale under international emissions trading requires national mitigation policies unless there is a surplus of units in a business-as-usual situation, as in countries in transition (Böhringer et al., 2007).

Investment law, defined through private international law and more than 3,000 multilateral and bilateral investment treaties (UNCTAD, 2013), applies to the CDM and emissions trading contracts. Proposed standardised contracts link the CDM to investment law by covering the choice of language and the process and forum for dispute resolution. These contracts could expose contractors to the costs associated with international arbitration (Gupta, 2008; Klijn et al., 2009).

13.7.3 International linkage among regional, national, and sub-national policies

International linkages can be established among regional, national, or sub-national policies. These can be direct or indirect. Under direct linkage, the same units are valid throughout the linked systems. Under indirect linkage, a unit in a certified emission reduction credit system is accepted by multiple systems. Figure 13.4 shows sub-national, national, and regional greenhouse gas cap and trade schemes and existing and planned linkages between them. The only formal direct linkage between two trading schemes is that arranged between the Australian Emission Trading Scheme and the EU ETS, which was officially announced in August 2012. A strong indirect linkage between carbon markets exists through the CDM, whose credits are accepted under the EU-ETS, the Australian Carbon Pricing Mechanism, and the New Zealand ETS. Nazifi (2010) finds that EU demand has driven the price for CDM credits.

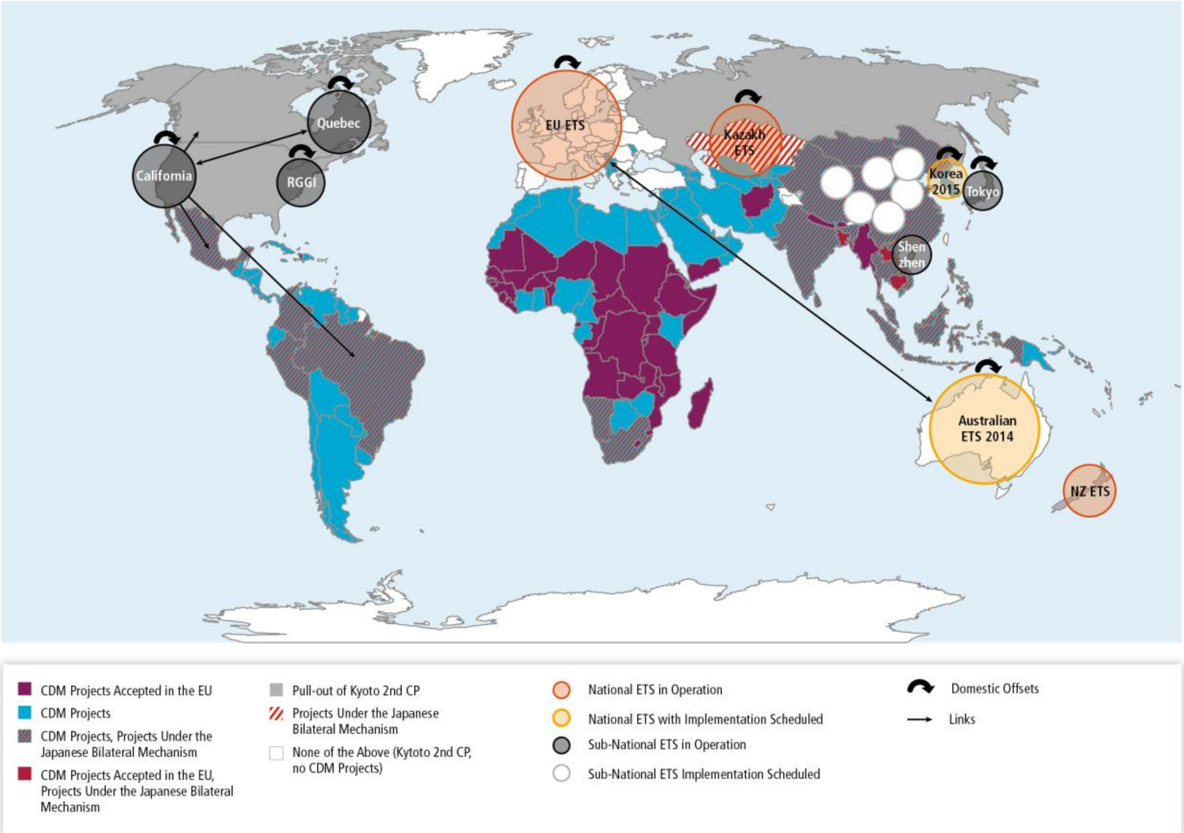


Figure 13.4. Cap and trade schemes with existing and planned linkages

Review of unilateral and bilateral direct linkages demonstrates that bilateral direct linkage reduces mitigation costs, increases credibility of the price signal, and expands market size and liquidity (Anger, 2008; Flachsland et al., 2009; Jaffe et al., 2009; Dellink et al., 2010; Cason and Gangadharan, 2011; Lanzi et al., 2012). However, direct linkage also raises a variety of concerns (Jaffe et al., 2009), including that linking can lead to a dilution of mitigation achieved through trading schemes, as linked systems are only as environmentally effective as the weakest among them (e.g. the one that allows imports of offsets with the lowest standards). Grubb (2009) also warns that countries may be unwilling to accept an increase of carbon prices that would result from linking with a more ambitious system.Tuerk et al. (2009) see the biggest challenges to linking in differential stringencies of targets in each system, varying degrees of enforcement, differences in eligible project-based credits, and the existence of cost containment measures, such as price ceilings. Haites and Mehling (2009) highlight that only bilateral links (or reciprocal unilateral links) yield the full benefits of linkage. Bilateral links often face lengthy adoption procedures as well as legal and procedural constraints, whereas reciprocal unilateral links, possibly framed by an informal agreement, are often easier to implement and provide more flexibility for almost the same benefits.

Also attractive are indirect linkages among regional, national, or sub-national cap-and-trade systems, an approach that maintains the benefits of linkage without much of the downside. Such indirect linkages achieve cost savings and avoid risk diversification without the need for deliberative harmonization of emerging and existing cap-and-trade systems. Indirect linkage is attractive because de facto linkages limit potential distributional concerns and preserve a high degree of national control over allowance markets (Jaffe et al., 2009).

In addition, both direct and indirect linkages can occur among heterogeneous regional, national, and sub-national policy instruments (Metcalf and Weisbach, 2012). Some such linking would be relatively straightforward, such as forming a link between a cap-and-trade system and a carbon tax. Other links would be more challenging, such as between a cap-and-trade system and a quantity standard. Others would be even more difficult, such as between a cap-and-trade system and a technology mandate, and some linkages between heterogeneous policy instruments would simply not be possible (Metcalf and Weisbach, 2012).

13.8 Interactions between climate change mitigation policy and trade

Research on interactions between climate change mitigation policy and trade indicates a diversity of compatibilities, synergies, conflicts, and cooperative arrangements (Brewer, 2003, 2004, 2010; Cosbey, 2007; ICTSD, 2008; Cottier et al., 2009; Epps and Green, 2010; Rao, 2012; Leal-Arcas, 2013) Consideration of these and other issues and options needs to take into account the context of the provisions of the principal existing multilateral climate change framework (Yamin and Depledge, 2004) and multilateral trade framework (Hoekman and Kostecki, 2009). Negotiators acknowledged the opportunities for international cooperation on interactions between climate change and trade in both the UNFCCC (1992) and in a Ministerial Decision at the time of the negotiations of the Marrakech Agreement establishing the World Trade Organization (1994). But there is also a potential for conflict between climate and trade issues. According to Article 3.5 of the UNFCCC, "Measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade." The Kyoto Protocol notes in Article 2.3 that Annex I Parties “shall strive to implement policies and measures under this Article in such a way as to minimize adverse effects, including … effects on international trade.”

Trade and climate policy interact at many levels (Copeland and Taylor, 2005; Tamiotti et al., 2009; UNEP, 2009; UNCTAD, 2010; World Bank, 2010). For instance, on the one hand, according to (Peters and Hertwich, 2008), “almost one-quarter of carbon dioxide released to the atmosphere is emitted in the production of internationally-traded goods and services” (see also (Peters et al., 2011)). Transportation associated with trade is another related issue (Conca, 2000). On the other hand, various climate change policies currently in place affect the relative prices of goods and services, which thereby affect trade flows and the total volume of traded goods (Whalley, 2011). Moreover, trade barriers and obligations regarding intellectual property rights of “green technology” as well as many other World Trade Organization obligations impinge on climate policy (Thomas, 2004; Khor, 2010a; Johnson and Brewster, 2013). Victor (1995) suggested that lessons from the trade regime could be used in the development of the climate regime, but comparative governance studies of the trade and climate regimes have not been thoroughly utilized to gain insights into how the two regimes might address trade-climate interactions (Bell et al., 2012 an exception).

The production of internationally traded goods gives rise to a “labelling” issue, a problem for accounting purposes and also for possible policy intervention. The issue arises because a proportion of a country’s greenhouse gas emissions resulting from the production of goods and services in one country may be “embedded” in traded products which are consumed in other countries. At issue is whether to attribute the emissions to the producing (exporting) country or consuming (importing) country (Kainuma et al., 2000; Peters and Hertwich, 2008) (See also Sections 5.4.1 and 14.3.4.1). There is an ethical and equity issue about how to define climate responsibility and allocate climate mitigation costs (discussed in detail in Sections 3.3, 4.1, and 4.2). There is also a political and economic issue whether climate policy instruments ought to address production- or consumption-induced greenhouse gases ((Droege, 2011a; b); see also Chapter 14.3.4). Finally, there is a technical issue as territorial measurement is the current greenhouse gas accounting practice under the UNFCC, and switching to consumption-induced measurement may be technically more difficult (Droege, 2011a; b; Peters et al., 2011; Caldeira and Davis, 2011).

There are significant differences among researchers and policymakers in their perspectives on the relationship between climate change and trade. These differences include fundamental empirical assumptions and policy preferences concerning the roles of markets and governments (Bhagwati, 2009), specifically concerning whether government measures are required to address market failures that produce climate change (Stern, 2007), or government regulations tend to create inefficiencies and distort trade (Krugman, 1979; Rodrik, 2011). Trade measures (e.g. trade sanctions, trade enticements, and trade-relevant domestic product standards; see section 13.8.1 below) could be used to address free-rider problems of international agreements, specifically participation and/or compliance problems (Victor, 2010), and some (e.g. (Victor, 2011)) suggest these may be useful in achieving an effective climate agreement. However, there are also some who conclude that trade measures are an inappropriate tool to pursue climate change policy objectives, pointing to the possibility of "green protectionism" (Khor, 2010a; Johnson and Brewster, 2013). The potential use of trade measures to enhance participation and/or compliance poses major institutional design questions (See section 13.4).

13.8.1 WTO-related issues

A central issue for WTO members is whether policies are consistent with principles of non-discrimination. Most Favoured Nation Treatment prohibits favourable treatment of the goods, services, or corporations of any one member as compared with other members, while National Treatment prohibits less favourable treatment of foreign relative to domestic goods, services or corporations. Of the more than 60 WTO agreements that apply these principles, many are pertinent to climate change, including the General Agreement on Tariffs and Trade (GATT), the General Agreement on Trade in Services (GATS), the Agreement on Trade Related Intellectual Property Rights (TRIPs), the Agreement on Technical Barriers to Trade (TBT), the Agreement on Trade Related Investment Measures (TRIMs) and the Dispute Settlement Understanding (DSU), as well as agreements on subsidies, government procurement, and agriculture (Brewer, 2003, 2004, 2010; Cottier et al., 2009; Hufbauer et al., 2009; Epps and Green, 2010). Studies have suggested that emissions trading systems can be designed to be compatible with WTO obligations (Werksman, 1999; Petsonk, 1999).

Trade issues concerning CDM projects have received special attention (Werksman et al., 2001; Rechsteiner et al., 2009; Werksman, 2009). Although no trade or investment disputes have arisen yet in connection with CDM projects, there is the possibility that they will in the future as the number and economic significance of CDM projects continues to increase. Significant attention has also been given to product labelling and standards issues that can arise in relation to the WTO Agreement on Technical Barriers to Trade (Appleton, 2009), which could be pertinent to the use of labels concerning "food miles" (ICTSD, 2007; World Bank, 2010). Although long-distance air transport of agricultural products itself is GHG-intensive, the agricultural practices of many exporting countries are less GHG-intensive than those of the importing countries, and determining the relative GHG emissions levels of imported versus domestic products thus requires complete life-cycle analyses of individual products and specific pairs of exporting-importing countries.

Government procurement policies that entail buy-local practices concerning climate-friendly goods and services have emerged as an issue under the principle of non-discrimination in the context of national economic stimulus programs. The applicability of the WTO Agreement on Government Procurement to such trade issues is limited because many countries have not agreed to it; among those that have, there are many government agencies whose programs are not covered (van Asselt et al., 2006; Hoekman and Kostecki, 2009; Malumfashi, 2009; van Calster, 2009).

Government subsidies for renewable energy and energy-efficiency goods and services have also become issues in relation to the WTO Agreement on Subsidies and Countervailing Measures, as well as the Trade Related Investment Measures (TRIMs) agreement. Such issues have prompted WTO dispute cases, including one involving subsidies for producers of wind turbines (WTO, 2010) and another involving feed-in tariffs (WTO, 2011). The application of WTO subsidy rules could slow the development and diffusion of climate-friendly technologies, but it is not yet clear whether this has or will have an effect (see Bigdeli, 2009; Howse and Eliason, 2009; Howse, 2010 on subsidy issues).

There are WTO-related issues related to tariffs and non-tariff barriers resulting from climate change policy. In general, non-tariff barriers tend to be more important barriers than tariffs at the climate-trade interface, but tariffs are still high in some industries and countries (Steenblik, 2006; World Bank, 2008a). Countries may seek to limit competitive disadvantage introduced by domestic climate policy by raising tariffs and introducing non-tariff barriers that restrict imports, or by other border adjustment measures (BAMs). One example of a BAM would be a country that has imposed a domestic carbon tax also (1) imposing the carbon tax on imported goods and services at a rate proportional to the emissions associated with their production and (2) offering reimbursement to domestic exporters who sell a good or service outside of the jurisdiction of the carbon tax (Wooders et al., 2009; Elliott et al., 2010; Monjon and Quirion, 2011b). Barriers to transfers of technologies identified by (IPCC, 2011) as potential contributors to climate change mitigation have been issues in the on-going WTO Doha Round negotiations (Tamiotti et al., 2009). Domestic subsidies such as those for biofuels have also been at issue in the Doha Round.

Border adjustment measures (BAMs) to offset international differences in costs—and thus possible international leakage (see Section 5.4.1) arising from international differences in mitigation policy—have become one of the most contentious and researched points of interaction (Babiker, 2005; de Cendra, 2006; Cosbey and Tarasofsky, 2007; Ismer and Neuhoff, 2007; Genasci, 2008; Frankel, 2008; Tamiotti and Kulacoglu, 2009; O'Brien, 2009; van Asselt and Brewer, 2010; Tamiotti, 2011; Zhang, 2012). This issue draws particular attention to differences between production-based and consumption-based emissions in both developed and developing countries (Figure 1.5 in Chapter 1). BAMs include policy options ranging from: (1) tariffs on imports or subsidies on exports based on the amount of greenhouse gases released in their production to (2) "compensatory measures," as for instance the free-allocation emission permits in the EU ETS or export rebates to energy-intensive sectors. Theoretical arguments in favour of BAMs can be grouped into three classes, each discussed below: the **reduction of economic inefficiencies** in the context of an externality, the reduction of **carbon leakage**, and increasing **participation and compliance** in a climate agreement.

The economic research on BAMs stresses that the inclusion of more countries in climate policy, e.g. by linking permit trading schemes and including more sectors and countries, **reduces economic inefficiencies** relative to unilateral BAMs. While, BAMs can enhance the competitiveness of greenhouse gas- and trade-intensive industries within a given climate regime (Kuik and Hofkes, 2010; Böhringer, Balistreri, et al., 2012; Balistreri and Rutherford, 2012; Lanzi et al., 2012), welfare effects may be negative for consumers and countries facing BAMs on their exports. Overall welfare effects accounting for externalities are mainly perceived to be positive at an abstract theoretical level (Gros and Egenhofer, 2011); the evidence is more blurred at an empirical level and is sensitive to assumptions (Tackling carbon leakage, 2010; Fischer and Fox, 2012; Lanzi et al., 2012). Export rebates, the exclusion of energy and CO_2-intensive industries from regulation, or the free-allocation of permits to these industries are recognized as causing efficiency losses (Lanzi et al., 2012). Most empirical studies also do not confirm a need at the macro-economic level for BAMs in the first place: they tend to find that climate policy is not a significant trade issue at the macro-economic level of national economies, though there are competitiveness and leakage issues for a few industries which are both greenhouse gas-intensive and trade-intensive. They hold that the main channel of impact of climate policies is through world energy prices and not through manufactured goods (Grubb and Neuhoff, 2006; Houser et al., 2008; Aldy and Pizer, 2009; Tackling carbon leakage, 2010).

The economic modelling literature on the effectiveness of BAMs to reduce carbon leakage finds that **carbon leakage** rates tend to decline by 2-12% following the introduction of a border adjustment tax

(Böhringer, Balistreri, et al., 2012). The political literature on the appropriateness of using BAMs to address carbon leakage, on the other hand, tends to be divided into two perspectives. Developed countries and/or countries with some form of mitigation policy either already in place or considering this for the future argue that BAMs are necessary to avoid carbon controls driving production abroad. Arguments along this line have emerged in the EU and the USA for instance. See (Veel, 2009; Tackling carbon leakage, 2010; Fischer and Fox, 2012). Developing countries tend to oppose BAMs, as many are concerned about negative welfare effects for their countries and what they see as a violation of the principle of CBDR as agreed under the UNFCCC (Khor, 2010a; Droege, 2011a; Scott and Rajamani, 2012). Nevertheless, the technical difficulties of measuring production-induced or consumption-induced greenhouse gas emissions are significant (Droege, 2011a), and addressing them may be associated with high administrative costs, possibly outweighing the potential benefits (McKibbin and Wilcoxen, 2009).

Participation and compliance in climate agreements might be enhanced by BAMs. However, conceptual thinking on the question does not reveal a consensus, and direct evidence on the point is insufficient to reach definitive conclusions (see (Barrett, 2003, 2009, 2010; Victor, 2010, 2011)). Because BAMs affect the distribution of abatment costs across countires, enacting a BAM could result in welfare loss, particularly for exporting developing countries, and even retaliatory countermeasures (de Cendra, 2006; Mattoo et al., 2009; Böhringer, Carbone, et al., 2012; Balistreri and Rutherford, 2012). For more discussion on the topic, see section 13.3.3 on participation and section 13.3.4 on compliance.

From the research on legal issues related to BAMs, four major conclusions emerge. First, BAMs may clash with WTO obligations, a point which is emphasized by many observers (Wooders et al., 2009; Condon, 2009; ICTSD, 2009; Holzer, 2010, 2011; Tamiotti, 2011; Du, 2011). Second, it is possible to design BAMs to be compatible with these obligations, according to other observers (Condon, 2009; Droege, 2011a; b), particularly when BAMs are targeted to countries based on their production technology efficiency (Ismer and Neuhoff, 2007). Third, WTO obligations and their legal interpretation have evolved over time, allowing for the possibility to bring trade and climate policy goals more in line in the future (Kelemen, 2001; Neumayer, 2004). Finally, the use of BAMs for climate change purposes may be politically controversial (Khor, 2010a).

A final WTO-related issue concerns the distinction between products and “production or process methods” (PPMs). The legal notion of PPMs, as applied in the WTO, can be based on several aspects of production processes and can have a variety of effects on climate change-related policies. (For extensive discussions of the technical legal issues and their relevance to climate change issues, see (Cottier et al., 2009).

13.8.2 Other international venues

Two greenhouse-gas-emitting industries that are centrally involved in international trade as modes of transportation are covered by separate international agreements outside the WTO system (see also Chapter 8). International aviation issues are covered by the Chicago Convention and the International Civil Aviation Organisation (ICAO), while international maritime shipping issues have been addressed by the International Maritime Organisation (IMO). (See Section 13.13.1.4 for performance assessments of the ICAO and IMO.)

There has been increasing interest in recent years in both ICAO and IMO in industry practices concerning greenhouse gas emissions, with some efforts at international cooperation to address them. However, there has been international conflict about the European Union’s inclusion of international aviation within the EU ETS. The Kyoto Protocol in Article 2.2 recognized ICAO as the venue for negotiations on matters concerning international aviation emissions, but in the absence of what was seen in the EU as adequate progress in the ICAO, the EU decided to include aviation in the EU ETS. This unilateral decision prompted strong reactions (Mueller, 2012; Scott and Rajamani, 2012), and flights in and out of the EU were temporarily exempted in April 2013 through the ICAO General Assembly scheduled for September-October 2013. Among the concerns expressed about the inclusion of aviation in the EU ETS has been the assertion that it represents a violation of the principle of CBDR of the UNFCCC (Scott and Rajamani, 2012; Ireland, 2012), though this concern only applies to developing countries. There are also legal issues about the relationship of the EU ETS to the Chicago Convention, which has traditionally been the international legal basis for aviation policies. Though studies indicate that the economic impacts of the EU ETS provisions are small relative to other airline expenses and ticket prices and that much of the cost can be passed on to consumers (Scheelhaase and Grimme, 2007; Anger and Köhler, 2010), political and legal issues have nevertheless made international cooperation difficult. The International Maritime Organization (2009) concluded that a significant potential for CO_2 reduction exists through technical and operational measures, many of which appear to be cost-effective; the IMO adopted an energy efficiency design index (International Maritime Organization (IMO), 2011). A link of carbon controls of aviation and shipping to the EU ETS and/or a possible U.S. emission trading scheme is suggested by (Haites, 2009) with the view that carbon offsets under the CDM could also be used.

There are other international institutional contexts within which climate change-trade interaction issues have been addressed, namely, the World Bank, G8, G20, International Energy Agency, Major Economies Forum, and Organisation for Economic Cooperation and Development (section 13.5).

13.8.3 Implications for policy options

In terms of WTO and/or UNFCCC involvement, there are logically four possible sets of options for institutional architectures at the multilateral level for addressing climate change-trade interactions: WTO-based, UNFCCC-based, joint UNFCCC-WTO, and stand-alone. In addition, there could be hybrid arrangements involving combinations of these four types. For instance, proposals for Sustainable Energy Trade Agreements (SETAs) could be addressed in a variety of venues (ICTSD, 2011).

Of the four options, WTO-based architectures have received the most attention in the literature. Alternatives include making revisions in existing WTO arrangements or undertaking new arrangements (Epps and Green, 2010). Possible changes in existing WTO arrangements include a “peace clause” (Hufbauer et al., 2009) or waiver agreement (Howse and Eliason, 2009; Howse, 2010), whereby WTO members would agree – within some limits – not to challenge on WTO grounds, respectively, climate policies in general or climate-related subsidies in particular. An extensive list of other possible changes to existing WTO arrangements has been discussed by Epps and Green (2010), whose suggestions include: change GATT Article XX (which allows exceptions to members’ obligations, including measures for the “conservation of exhaustible natural resources”) so that climate measures are explicitly identified as qualifying for exceptional treatment; add a similar provision to the Subsidies Agreement; change the burden of proof or standard of review for the scientific evidence presented in climate change cases to Dispute Settlement panels; change Dispute Appellate Body rules to take into account the scientific uncertainties in climate change cases; establish a notification process for members to inform other members of the adoption of climate policies with trade implications; and establish a Climate Change Committee, which could facilitate conflict resolution without resorting to the Dispute Resolution process.

Many possibilities for a new Climate Change Agreement at the WTO have also been discussed by (Epps and Green, 2010). The elements of such an agreement could include: establishment of a Climate Change Committee (as above); establishment of a notification procedure for climate change measures (as above); establishment of climate change mitigation as a legitimate objective; development of a ”non-aggression clause” that would prohibit unilateral actions, such as border adjustment measures; adoption of transparency requirements for national climate change policymaking processes to determine their legitimacy in relation to climate change concerns and protect against disguised trade protectionism; adoption of environmental rationales for subsidies;

reviews of members' trade-related climate measures to insure that they are substantive responses to climate issues; and clarification of the potential application of "process and production methods" (PPMs) questions to climate change disputes. Although these ideas have been mentioned in the literature, they have not been formulated as specific proposals to the WTO.

UNFCCC-based options have been discussed in the literature (Werksman et al., 2009) relating to the possible creation of a "level" playing field, such as through border charges on imports, or border rebates for exports, though views differ greatly, as indicated above in the discussion of BAMs.

A potential joint UNFCCC-WTO agreement has not yet received much attention in the published literature (Epps and Green, 2010). However, there are already in effect arrangements whereby the UNFCCC secretariat is an observer in meetings of the WTO Committee on Trade and Environment (CTE) and is invited on an ad hoc basis to meetings of the Committee overseeing the specific trade and environment negotiations (CTESS) (Cossey and Marceau, 2009). In addition, WTO Secretariat staff members attend the annual UNFCCC COP meetings. Finally, a stand-alone arrangement could be developed (Epps and Green, 2010), a possibility that has not yet been analysed in the published literature.

There are numerous and diverse unexplored opportunities for greater international cooperation in trade-climate policy interactions. While mutually destructive conflicts between the two systems have thus far been largely avoided, pre-emptive cooperation could protect against such developments in the future. Whether such cooperative arrangements can be most effectively devised within the existing institutional architectures for trade and for climate change or through new architectures is an unsettled issue (section 13.4).

13.9 Mechanisms for technology and knowledge development, transfer, and diffusion

Technology-related policies could conceivably play a significant role in an international climate regime (de Coninck et al., 2008). These policies have the potential to lower the cost of climate change mitigation and increase the likelihood that countries will commit to reducing their GHG emissions. By lowering the relative cost of more environmentally sound technologies, technology policy can increase incentives for countries to comply with international climate obligations and could therefore play an important role in increasing the robustness of long-run international frameworks (Barrett, 2003). Such policies might generate incentives for participation in international climate agreements by facilitating access to climate-change-mitigating technologies or funding to cover the additional costs of such technologies.

The role of international cooperation in facilitating technological change, including access to, facilitation of, and transfer of technology, is explicitly recognized in Article 4(1)(c) and (h), 4(5), 4(7), 4(8), and 4(9) of the UNFCCC. Article 4.5 states that "The developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties…." The performance of international institutional arrangements and the adequacy of financing are subject to a variety of interpretations. (See Section 14.3.6.2 for a discussion of the UNFCCC Climate Technology Center and Network, and see Section 15.12 for a discussion of financial issues).

Although international technology transfer issues for climate change mitigation or adaptation have become concerns in numerous countries, these concerns have been especially acute in developing countries. Concerns over technology transfer in developing countries are frequently embedded in broader capacity building, sustainable development, and other equity issues. (For discussions of the broader issues of CBDR and equity, see respectively Sections 13.2.1.2 and 13.4.2.4, and also Chapter 3 and Sections 4.1 and 4.2.) (Brewer, 2008; GEA, 2012, pp. 1699–1700; Ockwell and Mallett, 2012).

Technology-oriented agreements could include activities across the technology life-cycle for knowledge sharing, coordinated or joint research and development of climate-change-mitigating technologies, technology transfer, and technology deployment policies (such as technology or performance standards and incentives for technology development or adoption). International technology policy may play an important role in improving the efficiency of existing research and development (R&D) activities by increasing the international exchange of scientific and technical knowledge and by reducing duplicated R&D effort that could be shared across nations. (Newell, 2010a).

13.9.1 Modes of international incentive schemes to encourage technology-investment flows

Absent additional market failures, underinvestment in innovative activity relative to socially-optimal levels can occur due to several well-understood general properties of innovation. (See Section 15.6.) At a global level, international carbon markets and the flexibility mechanisms they may employ, such as international linkage of domestic emission programs, offsets, and the Clean Development Mechanism (CDM), may be used to finance emission reductions in developing countries and transferring technology between nations and regions (See section 13.13, and (Haščič and Johnstone, 2011)). Clear rules for these markets and their associated flexibility mechanisms may be established under international agreements and domestic policies to aid the removal of unnecessary barriers to technology transfer and to facilitate investment flows.

Because private-sector investments constitute more than 85 percent of global financial flows (UNFCCC, 2007b, p. 170), international trade and foreign direct investment are the primary means by which new knowledge and technology are transferred between countries (World Bank, 2008b). While domestic actions can improve the conditions to enable technology transfer investments (e.g. through regulatory flexibility, transparency, and stability), international actions can also contribute. In particular, the literature has identified tariffs and non-tariff trade barriers as impediments to energy technology transfer (World Bank, 2008b). An existing example is OECD regulation of export credits, with specific conditions to foster technology transfer for climate change mitigation (OECD, 2013).

In summary, national and supra-national policies that provide incentives for climate change mitigation will likely play an essential role in stimulating public investment, financial incentives, and regulations to promote innovation in the necessary new technologies for climate mitigation goals. Reducing fossil-fuel subsidies may have a similar effect (UNEP, 2008).

13.9.2 Intellectual property rights and technology development and transfer

The strength of intellectual property (IP) right protection, together with other conditions related to the rule of law, regulatory transparency, and market openness affect technology transfer rates (Newell, 2010a) (See also Sections 3.11 and 16.8.)

The goal of IP protection is to foster both the development of new technologies (innovation), and the diffusion of new technologies across countries (technology transfer) and within countries (technology adoption). In theory, such protection achieves these ends by increasing and/or maintaining the private economic incentive to create and transfer technology. At the same time, protection of IP also works to slow the diffusion of new technologies, because it raises their cost and potentially limits their availability. To the extent that IP protection raises the cost and limits the availability around the world of mitigating technologies, the potential for new technologies to reduce the cost of GHG mitigation will be hampered. Concern by developing countries that intellectual property protection for low carbon technology will make climate action excessively costly has been a contentious issue in the climate negotiations (Government of India, 2013). On the other hand, IP protection may encourage firms to innovate more than they otherwise would, thus potentially increasing the supply and reducing the cost of new technology.

In order to balance the possible incentive effects of IP protection against the adverse impact of such protection on costs and availability, it is important to assess the empirical significance of the incentive effects, both with respect to innovation and technology diffusion. The empirical evidence regarding the effect of IP policy on innovation is discussed in Section 15.6.2.1.

Even if stronger IP protection does not foster creation and development of new technologies, it may be beneficial for mitigation if it fosters transfer of technologies from developed to less developed countries. Theoretically, strong IP protection in developing countries may be necessary to limit the risk for foreign firms that transfer of their technology will lead to imitation and resulting profit erosion. Looking at technology transfer in general, empirical literature finds a role for strong IP protection in receiving countries in facilitating technology transfer from advanced countries through exports, foreign direct investment (FDI), and licensing for: transfers from the OECD (Maskus and Penubarti, 1995); FDI to 16 countries originating in the U.S., Germany and Japan (Lee and Mansfield, 1996; Mansfield, 2000); and transfers from the U.S. (Smith, 1999). Regarding recipients, (Awokuse and Yin, 2010) find evidence for transfers to China, and (Javorcik, 2004) for FDI to twenty-four Eastern European transition economies. Branstetter et al. (2006) assessed FDI to sixteen middle income countries after those countries strengthened their IP protection and found indicators for U.S. technology transfer increasing subsequently.

The empirical evidence suggests that the effects of IP strength on technology licensing parallel those for FDI. The (Branstetter et al., 2006) results discussed above included royalty payments among the measures of technology transfer that increased after IP strengthening. (Smith, 2001) finds that the association between strong IP and licenses is stronger than the relationship between IP and exports. In general, the evidence indicates a systematic impact of IP protection on technology transfer through exports, FDI, and technology licensing for middle-income countries for which the risk of imitation in the absence of such protection is relatively high. It is unclear whether or not these effects extend to the least developed countries whose absorptive capacity and ability to appropriate foreign technology in the absence of strong IP protections is less (Hall and Helmers, 2010). It is also important to note that IP rules are but one of many factors affecting FDI decisions. Others, particularly more general aspects of the legal and institutional environment that affect the riskiness of investments, may be more significant (Fosfuri, 2004).

Literature on the role of IP rights in the development of low-carbon technologies remains limited (Reichman et al., 2008). For example, (Barton, 2007) analyzes existing solar, wind, and biofuel technologies, and (Lewis, 2007, 2011; Pueyo et al., 2011) find that IP protection has induced innovation in wind technologies without compromising technology transfer. However, problems could arise if new, very broad patents were granted that impede the development of future, more efficient technologies (though even then, IP rights may provide flexibility). Compulsory licensing has been proposed as a mechanism to encourage technology transfer. Such an action would compensate a patent holder while overcoming market power inhibitions on voluntary licensing (Reichman and Hasenzahl, 2003). Despite short-run technology transfer benefits, compulsory licensing of mitigation technologies may not be desirable in the long-run, and current international law may limit the circumstances under which compulsory licensing can be used to achieve climate change mitigation objectives (Fair, 2009; Maitra, 2010).

In summary, there is inadequate evidence in the literature regarding the impact of IP policy on transfer of GHG-mitigating technologies to draw robust conclusions. If the experience from other technology sectors is indicative, maintenance of effective protection of IP may be a factor in determining the transfer of mitigation technology to middle-income countries, although other aspects of the legal and institutional environments are likely to be at least as important. There is little empirical evidence that protection of IP rights is a major factor affecting technology transfer to the least developed countries.

13.9.3 International collaboration to encourage knowledge development

International cooperation on climate mitigation has been linked to technology transfer policy, as transferring knowledge and equipment internationally, and ensuring that technologies are deployed in appropriate national contexts, may require additional international action (Newell, 2010a). International cooperation on climate-relevant technology policy can include efforts to share technological knowledge, collaborate or coordinate R&D, and directly facilitate and finance technology transfer.

13.9.3.1 Knowledge sharing, R&D coordination, and joint collaboration

International cooperation on knowledge-sharing and R&D coordination can include information exchange, coordinated or harmonized research agendas, measurement and technology standards, and coordinated or cooperative R&D (IEA, 2008; de Coninck et al., 2008; GEA, 2012, chap. 22). Examples of such existing forms of cooperation include the Carbon Sequestration Leadership Forum, the former Asia Pacific Partnership on Clean Development and Climate, the U.S.-China Clean Energy Research Center, and the International Partnership for a Hydrogen Economy. Empirically, a higher degree of collaboration has been more frequently observed in research areas of more fundamental science without larger commercial interests (for example the ITER fusion reactor and the CERN supercollider) (de Coninck et al., 2008). In addition to enhancing the cross-border flow of scientific and technical information, joint R&D can increase the cost-effectiveness of R&D through complementary expertise and reduced duplication of effort (Newell, 2010a).

The IEA has coordinated the development of more than 40 Implementing Agreements. Under these agreements, IEA member countries may engage either in task-sharing programs pursued within participating countries and funded by individual country contributions, or in cost-sharing programs funded by countries but performed by a single contractor. All existing Implementing Agreements incorporate some degree of task sharing while about half incorporate cost sharing (Newell, 2010a).

13.9.3.2 International cooperation on domestic climate technology R&D funding

Public sector investment in energy- and climate-related R&D has decreased since the early 1980s, although there has been a relative increase in recent years (Newell, 2010a, 2011). Newell (2010a), using the precedent of European Union cooperation on setting R&D spending goals, has proposed an international agreement that would increase domestic R&D funding for climate technologies (either in absolute terms, percentage increases from historic levels, or relative to GDP) in an analogous fashion to internationally-agreed emission targets. Also, at a G-8 meeting, in the context of a consideration of how to address climate change, there was agreement to seek to double public investment in R&D between 2009 and 2015 (G8, 2009) (See (Torvanger and Meadowcroft, 2011; Fischer et al., 2012), on issues in the design and support of climate friendly technologies). International coordination of R&D portfolios may reduce the duplication of R&D effort, cover a broader technological base, and enhance the exchange of information gained through national-level R&D processes. This coordination could cover the allocation of effort by government scientists and engineers, the targeting of extramural research funding to specific projects, and public-private partnerships. Engaging developing economies in developing and deploying new technologies may require further technology development to meet the needs of domestic institutions and norms.

Bringing newly-developed technologies to full commercialization often presents challenges, and for some technologies, such as carbon capture and storage (de Coninck et al., 2009), the private sector may not have sufficient incentives to commercialize new technologies in the absence of international cooperation. Since some of the economic risk the private sector faces reflects uncertainty about the incentives that future climate policies would create, governments may have a role in financing technology demonstration projects (Newell, 2007). The case for such demonstration projects may be stronger in developing and emerging economies, where incomplete capital markets may undermine investment in commercializing these technologies.

13.10 Capacity building

Several Articles in the UNFCCC (4.1(i), 4.5, 6 and 9.2(d)) and the Kyoto Protocol (Article 10(e)) acknowledge the role of capacity building in promoting collective action on climate change. While the texts give special attention to building capacity in developing countries, they also recognize a general need for all countries to improve policy, planning, and education on climate issues.

A variety of public, private, and NGO initiatives have undertaken capacity building efforts both within and outside of the UNFCCC, focusing primarily on three issues: 1) adaptation policy and planning; 2) mitigation policy and planning; and 3) measurement, reporting, and verification of mitigation actions. Capacity building efforts with respect to technology transfer are addressed in Section 13.9. Section 4.6.1 considers adaptive capacity and mitigative capacity jointly as dimensions of "response capacity" and Section 15.10 considers capacity building in a national context.

Capacity building for adaptation includes (i) risk management approaches to address adverse effects of climate change; (ii) maintenance and revision of a database on local coping strategies; and (iii) maintenance and revision of the adaptation practices interface (Yohe, 2001; UNFCCC, 2009b). The process of preparing the National Adaptation Programmes of Action (NAPAs) for and by least developed countries (LDCs) identifies their most "urgent" adaptation needs. However, capacity building for adaptation is likely insufficient because the costs in such regards are rarely estimated (Smith et al., 2011; see also WGII, 3.6.4). At the community level, adaptation projects require time and patience and can be successful if they raise awareness, develop and use partnerships, combine reactive and anticipatory approaches, and are in line with local culture and context (Engels, 2008)(Damaru, 2010).

Capacity building for mitigation includes technical assistance and policy planning support. In CDM, capacity building has focused on the establishment of Designated National Authorities (DNAs), the training of private and public personnel, and project support (Michaelowa, 2005; Winkler et al., 2007; Okubo and Michaelowa, 2010). Efforts aimed at capacity building for Nationally Appropriate Mitigation Actions (NAMAs) and REDD-plus are expected (Bosetti and Rose, 2011). NAMAs are a potentially important means of action by developing countries that emerged in the negotiations under the Bali Roadmap (UNFCCC, 2007); and have been assessed in the literature (Wang-Helmreich, Hanna et al., 2011; Upadhyaya,, 2012; Tyler et al., 2013). NAMAs are discussed in detail in Section 15.2.1.

Monitoring and evaluation activities are important to ensure effective implementation of a capacity-building framework, helping to understand gaps and needs in capacity building, share best practices, and promote resource efficiency(UNFCCC, 2009c). There are few empirical assessments of current capacity building approaches in relation to climate change (Virji et al., 2012).

13.11 Investment and finance

Since AR4, international cooperation on climate policy has increasingly focused on mobilizing public and private investment and finance for mitigation and adaptation activities. Such cooperation has included the setup of market mechanisms to generate private investment as well as public transfers through dedicated institutions (Michaelowa, 2012b). The Copenhagen Accord of 2009 included a provision to jointly mobilize USD 100 billion per year by 2020 to address the needs of developing countries, in the context of meaningful mitigation actions and transparency of implementation

(UNFCCC, 2009a). In order to reach this goal, the (AGF, 2010) identified four potential sources of finance: public sources (funds mobilized under the UNFCCC); development bank instruments, carbon market finance, and private capital.

In the follow-up to the Copenhagen conference, the term "climate finance" has been coined for financial flows to developing countries, but there exists no internationally agreed definition (Buchner et al., 2011). Stadelmann (2011) provide a discussion of what could be counted and how the baseline for international climate finance could be set in order to provide "new and additional" funds (see also 16.1). See Section 16.2.2 for a description of the potential financing need and Section 16.5 for a description of possible public funding sources.

13.11.1 Public finance flows

13.11.1.1 Public funding vehicles under the UNFCCC

The largest share of UNFCCC-organized climate finance goes to mitigation: (Abadie et al., 2012) provide reasons for this, such as the differences between mitigation and adaptation regarding public good characteristics and the lack of information regarding context-specific climate impacts. The UNFCCC mobilizes financial flows to developing countries and countries in transition through four primary vehicles: (1) the GEF, which focuses on mitigation (GEF, 2011); (2) the Least Developed Country Fund (LDCF) and Special Climate Change Fund (SCCF), which focus on adaptation; (3) the Adaptation Fund, which also focuses on adaptation; and (4) the Green Climate Fund (GCF), which will focus on both mitigation and adaptation when it becomes operational. The GEF is the secretariat for all funds other than the GCF. This section reviews the literature on these four mechanisms (see also Chapter 16.5; (UNFCCC, 2012a).

The Adaptation Fund is financed through a 2 percent in-kind levy on emissions credits generated by CDM projects, though parties to the Kyoto Protocol have contributed additional funding (Liverman and Billett, 2010; Horstmann, 2011; Ratajczak-Juszko, 2012). All other UNFCCC funding vehicles are based on voluntary government contributions that can be counted as official development assistance. Ayers and Huq (2009) maintain that the Adaptation Fund's governance structure avoids many of the issues of ownership and accountability faced by other funds. Harmeling and Kaloga (2011) examine the influence of competing interests on funding decisions by the Adaptation Fund Board. Under the Fund, Multilateral Implementing Entities (MIEs) have had the most success in securing funding, followed by National Implementing Entities (NIEs), but none by Regional Implementing Entities (RIEs). This disparity has led to calls for transparency in project assessment (Harmeling and Kaloga, 2011). Grasso and Sacchi (2011) discuss issues of justice in Adaptation Fund financing decisions to date. Further research into the distribution of adaptation finance across countries, sectors and communities is required to assess the equity, efficiency, effectiveness and environmental impacts of the operation of the Adaptation Fund (Persson, 2011).

The Conference of the Parties to the UNFCCC has decision making power regarding the representation of country groups on the governing boards of the UNFCCC's funding vehicles, voting rules, the choice of secretariat and the choice of trustee (e.g., who oversees the finances and ensures funds go where they are supposed to go). Due to its complex structure, the GEF faces challenges coordinating with UNFCCC decisions (COWI and IIED, 2009; Ayers and Huq, 2009). Recipient countries have a majority on the board of the Adaptation Fund, while the decision making bodies for the other UNFCCC financing institutions have equal representation for developing and industrialized countries. The Adaptation Fund has allowed the possibility of "direct access" by host country institutions, which has been used sparingly to date (Ratajczak-Juszko, 2012). The GEF is also starting to experiment with this approach (GEF, 2011, p. 4).

Funding per country eligible under the Adaptation Fund is limited to 10 million USD, essentially leading to a situation where each country gets financing for a single project. Stadelmann, et al.

(2013) show that this does not lead to projects ranking high on equity and efficiency criteria. The GEF operates funding floors and caps for each country (currently 2 million USD and 11 percent of the total volume available, respectively) (GEF, 2010). Between these thresholds, a complex allocation formula is used whose variables consist of GDP, project portfolio performance, country environmental policy and institutional performance, greenhouse gas emissions level, development of carbon intensity, forestry emissions, and changes in deforestation.

A step change with regards to the international coordination of public finance flows was the collective commitment by industrialized countries in the Copenhagen Accord of 2009 to provide resources approaching 30 billion USD as “Fast Start Finance” (FSF) during the period 2010-2012 for mitigation and adaptation in developing countries (UNFCCC, 2009a). FSF was to provide “new and additional” resources, flowing through existing multilateral, regional, and bilateral channels. Although few countries disclose details of their FSF, studies show that FSF ranges from small grants to large loans for infrastructure development (Fransen et al., 2012; Nakhooda and Fransen, 2012; Kuramochi et al., 2012). While the FSF commitment for 2010-2012 has been exceeded, transparency regarding allocation criteria and actual disbursement is low (Ciplet et al., 2013). Official development assistance (ODA) made up a large share of total funding (Ballesteros et al., 2010) and several studies argue that the use of ODA as a substitute for new climate finance mechanisms could divert funding away from other important imperatives (Michaelowa and Michaelowa, 2007; Ayers and Huq, 2009; Gupta and van der Grijp, 2010, p. 347). (See also Section 16.2.1.1.)

13.11.1.2 Multilateral Development Banks (MDBs)

Multilateral development banks have played a significant role in mobilizing, coordinating, and overseeing the growth of climate-related financial flows. The World Bank provides services as trustee or interim trustee for all the UNFCCC-related funds noted above. A group of MDBs manages and governs the Climate Investment Funds (CIFs), which were set up in 2008, are not supervised by the UNFCCC, and are financed through voluntary government contributions. The Clean Technology Fund supports investments in low carbon technologies, and the Strategic Climate Fund is an umbrella for improving resilience against climate change, reducing deforestation and renewable energy support for low-income countries.

(Tirpak and Adams, 2008) see increases in MDBs’ funding and shifts to low greenhouse gas technologies being fragile owing to variability and low levels of funding. (Bowen, 2011) proposes expansion of the capital base of multilateral financial institutions in order to increase concessional financing (finance made available at lower than market costs) of mitigation and adaptation activities.

Over the last two decades, recipients have gained more decision making power in the institutions under the UNFCCC, while multilateral financial institutions have not followed this trend. Financing is typically not given directly to the project recipients but provided through implementing agencies, mostly multilateral financial institutions or UN agencies that fulfil predefined fiduciary standards. Direct access, as implemented by the Adaptation Fund, is seen by some as the most appropriate model for climate finance (UNDP, 2011). However, peer-reviewed literature comparing the effectiveness of the two approaches is lacking. At the same time, national development banks (e.g. China Development Bank, Brazilian Development Bank [BNDES]), Bilateral Finance Institutions, and a planned multilateral fund of the BRICS countries have also provided or may provide substantial funding (Höhne, Khosla, et al., 2012; Robles, 2012)

13.11.2 Mobilizing private investment and financial flows

Another emerging focus of international climate cooperation is on mobilizing private investment to finance mitigation and adaptation. As discussed in section 13.4.1.4 and 13.13.1.1, carbon credits from market mechanisms generate revenues for private sector players, thus leveraging potentially large investments in mitigation. Such leverage is seen as important by (Urpelainen, 2012), who presents a game-theoretical model where capacity building leverages private mitigation investment. A number of international initiatives have supported capacity building for market mechanisms (Okubo and Michaelowa, 2010). Also, the multilateral financing institutions discussed in section 13.11.1 will “leverage” private finance to complement their public funding.

The potential for leveraging to lead to double- and multiple-counting has led to suggestions that internationally agreed methodologies to account for leveraging are needed (Clapp et al., 2012), which would be of help in consistent reporting of finance against the goal agreed under the UNFCCC. Stadelmann, et al. (2011) find that the leverage factors, that is the ratio between mobilized private funding and mobilized public finance, for the Climate Technology Fund under the CIFs and the GEF reach self-reported levels of 8.4 and 6.2, respectively. However, an analysis of over 200 CDM and close to 400 GEF projects, Stadelmann, et al. (2011) find a leverage ratio of just 3 to 4.5. Moreover, high leverage factors may mean that the underlying project is not additional, i.e. not contributing to mitigation. Finally, instead of leveraging in the private sector through capacity building, the World Bank engagement in the Kyoto mechanisms has at least partially crowded out private sector activities, as shown empirically by (Michaelowa and Michaelowa, 2011).

Besides market mechanisms, other instruments such as grants, loans at concessional rates, provision of equity through financial institutions, or guarantees can mobilize private funds. This can happen directly on the company level or be channelled through national governments (Neuhoff et al., 2010). While they can be implemented on any level of aggregation, the level of incentive provided could be coordinated internationally, e.g. by basing it on a previously agreed “social cost of carbon” (Hourcade et al., 2012). The success of the Multilateral Investment Guarantee Agency (MIGA) shows that costs of guarantees are likely to be low if multilateral and bilateral financial institutions with strong financial ratings provide them (Brown et al., 2011; Buchner et al., 2011, p. 41).

13.12 The role of public and private sectors and public-private partnerships

International responses to climate change ultimately depend on private sector action. Large multinational corporations produce about half of the global world product and global GHG emissions (Morgera, 2004). Hence, private companies will need to generate investment and innovation necessary to pursue a low carbon economy (Forsyth, 2005). Given that damages from climate change are a (negative) externality, a gap remains between the need for GHG reduction and the commitments of the largest international companies (Knox-Hayes and Levy, 2011, p. 97). While some business sectors may have an interest advancing policy to mitigate climate change (Pulver, 2007; Falkner, 2008; Pinkse and Kolk, 2009; Meckling, 2011), in practice the public sector typically guides, supports, and motivates private sectors to contribute to a low carbon economy. These types of public sector interactions with the private sector can operate through government regulations (whether market-based or conventional), but may also be facilitated through public-private partnerships, the focus of this section.

13.12.1 Public-private partnerships

One channel for such guidance is through public-private partnerships (PPPs) focused on climate change, which have multiplied and grown in recent years (Bäckstrand, 2008; Pattberg, 2010; Andonova, 2010; Kolk et al., 2010). PPPs involve governments, businesses, and sometimes NGOs. Examples include: the Renewable Energy and Energy Efficiency Partnership (Parthan et al., 2010); the Methane to Markets initiative (now renamed the Global Methane Initiative) (de Coninck et al., 2008); the former Asia Pacific Partnership on Climate and Energy (which was largely organized through sector-specific PPPs (Karlsson-Vinkhuyzen and van Asselt, 2009; McGee and Taplin, 2009; Okazaki and Yamaguchi, 2011); the Global Superior Energy Performance Partnership (taking sector-specific activities from the regional scale to the global scale (Fujiwara, 2012; Okazaki et al., 2012) (see also Section 14.4.3); the CDM (where some projects can take the character of PPPs (Streck, 2004; Green, 2008; Newell, 2009); the World Bank Prototype Carbon Fund (Lecocq, 2003; Andonova, 2010); the UN Fund for International Partnerships (39 percent of whose environmental partnerships are in energy- or climate change-related projects (Andonova, 2010, pp. 45–47); the UN Global Compact's "Caring for Climate" initiative (Abbott, 2011) ; the Green Power Market Development Group (Andonova, 2009); and the Munich Climate Insurance Initiative (Pinkse and Kolk, 2011). These partnerships can facilitate development and commercial deployment of low carbon technologies as governments remove barriers to the entry and provide stakeholders with new business frameworks. Industries also demonstrate leadership through active involvement with regards to their technologies, investments and know-how (IEA, 2010, p. 52 and 469).

Some international PPPs concentrate on the development of specific technologies. Others focus on rural renewable energy or low-carbon energy development in general. Others center their attention on carbon market development. Few focus on adaptation, although the insurance sector is involved in such initiatives (Pinkse and Kolk, 2011). Effective partnerships are institutionalized with representatives of major stakeholders, a permanent secretariat, resources and a dedicated mission (Pattberg et al., 2012, pp. 241–246). Company willingness to engage in adaptation depends on their capacity, their past exposure to disasters, and the link between their business planning horizons and climate impact uncertainty (Agrawala et al., 2011). Some also need to ensure that they are able to adapt to changing climatic circumstances (Linnenluecke and Griffiths, 2010; Vine, 2012).

13.12.2 Private sector led governance initiatives

Private sector actors have also engaged in direct attempts to govern aspects of climate change transnationally. First, some institutional investors now ask companies to report on their greenhouse gas emissions, strategies to reduce them, and more broadly on climate risk exposures (Kolk et al., 2008; Newell and Paterson, 2010; Harmes, 2011; MacLeod and Park, 2011). The most important example of this is the Carbon Disclosure Project, whose signatories controlled US$70 trillion in assets in 2011 (Carbon Disclosure Project, 2011). The private sector is playing a role in developing systems for carbon accounting (Lovell and MacKenzie, 2011).

Second, like NGOs (see section 13.5.2), private sector actors have developed initiatives to govern voluntary carbon markets, either through certification standards for offset markets or by developing trading exchanges, registries, and protocols for reporting GHGs (Green, 2010, 2013; Hoffmann, 2011). Many of the certification schemes are either developed by private sector actors (such as the Voluntary Carbon Standard, developed by the International Emissions Trading Association, the Climate Group, and the World Business Council for Sustainable Development) or by such actors in collaboration with environmental NGOs (such as the Social Carbon standard).

13.12.3 Motivations for public-private sector collaboration and private sector governance

For private sector actors, partnerships with governments or NGOs on climate may create direct economic benefits through financial support, learning opportunities, risk sharing, or market access (Pinkse, 2007; Perusse et al., 2009). Since direct regulation of firms at the international level is unavailable, states have incentives to pursue partnerships in order to affect transnational private sector activities. International organizations pursue partnerships for similar reasons (Andonova, 2010). Partnerships or private governance may create club goods for participants (Andonova, 2009). Sometimes, firms are motivated more by concerns for public relations (Pinkse and Kolk, 2009, pp. 55–56). Private sector finance can be stimulated by a five step approach: strategic goal setting and policy alignment, an enabling process and incentives for low-carbon and climate resilient (LCR) investment, financial policies and instruments, harnessing resources and building capacity for a LCR economy, and promoting green business and consumer behaviour (Corfee-Morlot et al., 2012).

13.13 Performance assessment on policies and institutions including market mechanisms

This section surveys and synthesizes quantitative and qualitative assessments of existing and proposed forms of international cooperation to address climate change mitigation that have appeared in the literature since AR4. Adaptation is not treated here, as there have been few international cooperative initiatives focused on adaptation, although these are now starting to emerge (section 13.5.1.1).

Existing cooperation is considered in section 13.13.1 with reference to: the UNFCCC; its Kyoto Protocol; the CDM; agreements under the UNFCCC pertaining to the post-2012 period; and agreements and other forms of international cooperation outside of the UNFCCC. Section 13.13.2 considers the literature that assesses various proposed forms of future international cooperation described in Section 13.4.3. Throughout, we synthesize assessments in terms of the four criteria discussed in Section 13.2: environmental effectiveness, aggregate economic performance, distributional impacts, and institutional feasibility. Table 13.3 summarizes the key findings of this section's performance assessment.

In applying the evaluation criteria to evaluate existing and proposed forms of international cooperation, five general caveats apply. First, an ex-ante evaluation of a policy may overestimate the costs and/or the benefits of that policy for several reasons, such as overestimating the extent of its implementation (Harrington et al., 2000; Harrington, 2006), failing to account for over-reporting by regulated parties (Bailey et al., 2002), and underestimating learning related to technological development (Norman et al, 2008). Second, ex-ante evaluation may over- or under-estimate the effectiveness of proposed cooperation, because interactions between proposed policies and other existing policies may be difficult to predict. These interactions can be counterproductive, inconsequential, or beneficial (Fankhauser et al., 2010; Goulder and Stavins, 2011; Levinson, 2012). Third, while evaluation of proposed policies can be informed by lessons learned from regime complexes in other contexts (see Section 13.5), such lessons may come with extrapolation bias, since it may not be appropriate to generalize to climate change findings from other contexts. Fourth, in comparing existing policies using these criteria, it can be helpful to keep in mind that as institutions evolve, the performance of particular policies may also change. Fifth and finally, the overall performance of the international regime depends also on national and regional policies (see Chapters 14 and 15, in particular Sections 14.4.2 and 15.5).

Table 13.3: Summary of Performance Assessments of Existing Cooperation of Proposed Cooperation

	Mode of International Cooperation		Assessment Criteria			
			Environmental Effectiveness	Aggregate Economic Performance	Distributional Impacts	Institutional Feasibility
	UNFCCC		Aggregate GHG emissions in Annex I countries declined by 6.0 to 9.2 percent below 1990 levels by 2000, a larger reduction than the apparent "aim" of returning to 1990 levels by 2000.	Authorized joint implementation (JI) of commitments, multi-gas approach, sources and sinks, and domestic policy choice. Cost and benefit estimates depend on baseline, discount rate, participation, leakage, co-benefits, adverse effects, and other factors.	Commitments distinguish between Annex I (industrialized) and non-Annex I countries. Principle of "common but differentiated responsibility." Commitment to "equitable and appropriate contributions by each [party]."	Ratified (or equivalent) by 195 countries and regional organizations. Compliance depends on national communications.
Existing Cooperation (13.13.1)	The Kyoto Protocol		Aggregate emissions in Annex I countries were reduced by 8.5 to 13.6 percent below 1990 levels by 2011, more than the CP1 collective reduction target of 5.2 percent. Reductions occurred mainly in EITs; emissions; increased in some others. Incomplete participation in CP1 (even lower in CP2).	Cost-effectiveness improved by flexible mechanisms (JI, CDM, IET) and domestic policy choice. Cost and benefit estimates depend on baseline, discount rate, participation, leakage, co-benefits, adverse effects, and other factors.	Commitments distinguish between developed and developing countries, but dichotomous distinction correlates only partly (and decreasingly) with historical emissions trends and with changing economic circumstances. Intertemporal equity affected by short term actions.	Ratified (or equivalent) by 192 countries and regional organizations, but took 7 years to enter into force. Compliance depends on national communications, plus KP compliance system. Later added approaches to enhance measurement, reporting, and verification (MRV).
	The Kyoto Mechanisms		About 1.4 billion tCO_2e credits under the CDM, 0.8 billion under JI, and 0.2 billion under IET (through July 2013). Additionality of CDM projects remains an issue but regulatory reform underway.	CDM mobilized low cost options, particularly industrial gases, reducing costs. Underperformance of some project types. Some evidence that technology is transferred to non-Annex I countries.	Limited direct investment from Annex I countries. Domestic investment dominates, leading to concentration of CDM projects in few countries. Limited contributions to local sustainable development.	Helped enable political feasibility of Kyoto Protocol. Has multi-layered governance. Largest carbon markets to date. Has built institutional capacity in developing countries.
	Further Agreements under the UNFCCC		Pledges to limit emissions made by all major emitters under Cancun Agreements. Unlikely sufficient to limit temperature change to 2°C. Depends on treatment of measures beyond current pledges for mitigation and finance. Durban Platform calls for new agreement by 2015, to take effect in 2020, engaging all parties.	Efficiency not assessed. Cost-effectiveness might be improved by market-based policy instruments, inclusion of forestry sector, commitments by more nations than Annex I countries (as envisioned in Durban Platform).	Depends on sources of financing, particularly for actions of developing countries.	Cancún COP decision; 97 countries made pledges of emission reduction targets or actions for 2020.
	Agreements outside the UNFCCC	G8, G20, MEF	G8 and MEF have recommended emission reduction by all major emitters. G20 may spur GHG reductions by phasing out of fossil fuel subsidies.	Action by all major emitters may reduce leakage and improve cost-effectiveness, if implemented using flexible mechanisms. Potential efficiency gains through subsidy removal. Too early to assess economic performance empirically.	Has not mobilized climate finance. Removing fuel subsidies would be progressive but have negative effects on oil-exporting countries and on those with very low incomes unless other help for the poorest is provided.	Lower participation of countries than UNFCCC, yet covers 70 percent of global emissions. Opens possibility for forum-shopping, based on issue preferences.
		Montreal Protocol on Ozone-Depleting Substances (ODS)	Spurred emission reductions through ODS phase outs approximately 5 times the magnitude of Kyoto CP1 targets. Contribution may be negated by high-GWP substitutes, though efforts to phase out HFCs are growing.	Cost-effectiveness supported by multi-gas approach. Some countries used market-based mechanisms to implement domestically.	Later compliance period for phase-outs by developing countries. Montreal Protocol Fund provided finance to developing countries.	Universal participation. but the timing of required actions vary for developed and developing countries
		Voluntary Carbon Market	Covers 0.13 billion tCO_2-e, but certification remains an issue	Credit prices are heterogeneous, indicating market inefficiencies	[No literature cited.]	Fragmented and non-transparent market.

Proposed Cooperation (13.13.2)	Proposed architectures	Strong multilateralism	Tradeoff between ambition (deep) and participation (broad).	More cost effective with greater reliance on market mechanisms.	Multilateralism facilitates integrating distributional impacts into negotiations and may apply equity-based criteria as outlined in Ch. 4	Depends on number of parties; degree of ambition
		Harmonized national policies	Depends on net aggregate change in ambition across countries resulting from harmonization.	More cost effective with greater reliance on market mechanisms.	Depends on specific national policies	Depends on similarity of national policies; more similar may support harmonization but domestic circumstances may vary. National enforcement.
		Decentralized architectures, coordinated national polices	Effectiveness depends on quality of standards and credits across countries	Often (though not necessarily) refers to linkage of national cap and trade systems, in which case cost effective.	Depends on specific national policies	Depends on similarity of national policies. National enforcement.
	Effort (burden) sharing arrangements		Refer to Sections 4.6.2 for discussion of the principles on which effort (burden) sharing arrangements may be based, and Section 6.3.6.6 for quantitative evaluation.			

13.13.1 Performance assessment of existing cooperation

13.13.1.1 Assessment of the UNFCCC, the Kyoto Protocol, and its Flexible Mechanisms

The UNFCCC established a framework and a set of principles and goals for the international response to climate change. Under Article 2, the parties agreed to the objective of "prevent[ing] dangerous anthropogenic interference with the climate system," an objective which was not quantified and was subject to several caveats. Under Article 4(2)(a), the Annex I parties committed to adopt measures (which could be implemented jointly) to limit net emissions (covering both sources and sinks of all GHGs not controlled by the Montreal Protocol), "recognizing that the return by the end of the present decade [the year 2000] to earlier levels" would contribute to modifying long-term trends consistent with the treaty's objective. Under Article 4(2)(b), Annex I parties committed to periodically communicate information on their emissions, "with the aim of returning individually or jointly to their 1990 levels."

According to UN data, aggregate GHG emissions in Annex I countries declined by 9.2 percent from 1990-2000 (if land use and forestry are included; or by 6.0 percent if they are not; the base year for some countries is in the mid- or late 1980s) (UNFCCC, 2013c, Profile for Annex I Parties). This is a larger reduction than the apparent two-step "aim" implied in Article 4(2)(a) and (b) of the UNFCCC to return emissions to 1990 levels by the year 2000. Much of this reduction, however, was due to factors other than measures adopted under the UNFCCC, such as the economic downturn in Annex I "economies in transition" (EITs)—Russia, former Soviet Republics, and Eastern Europe—during the 1990s.

The 1997 Kyoto Protocol adopted the first binding, quantitative emissions-mitigation commitments for developed countries. The 38 countries listed in its Annex B (industrialized countries, EITs, and the European Union separately from its member states) made aggregate commitments to collectively reduce their GHG emissions by 4.2 percent relative to 1990 levels (5.2 percent relative to the country-specific base years used for establishing national committments) by the Protocol's first commitment period, 2008-2012 (UNFCCC, 1998, 2012b). Other parties to the Kyoto Protocol are not constrained (but can participate in other ways; in particular, see discussion of CDM in 13.13.1.2). The Protocol also contained a number of new mechanisms, including International Emissions Trading (IET), Joint Implementation (JI), and the Clean Development Mechanism (CDM), that aimed to help reduce GHG emissions cost-effectively.

The aggregate emissions by Annex I countries have been reduced below the Kyoto Protocol's collective 5.2 percent reduction target, but, as with the UNFCCC, much of the reduction was due to factors other than Kyoto Protocol. (The list of countries in the Protocol's Annex B is nearly identical to the list of countries in the Convention's Annex I during the historical periods referenced in this section, and the difference in aggregate emissions between the two does not affect the analysis here.) According to UNFCCC GHG inventories, aggregate GHG emissions from all Annex I countries were reduced by 13.6 percent from 1990-2011 (if land use and forestry-sector changes are taken into account, and 8.5 percent if they are not). Not counting the US – because it was not a party to the Kyoto Protocol – the reduction from 1990-2011 in the remaining Annex I aggregate GHG emissions was 22.9 percent if land use and forestry sectors changes are taken into account and 16.6 percent if they are not. Not counting the EITs, the remaining Annex I countries' aggregate GHG emissions increased by 2.1 percent and 3.2 percent from 1990 to 2011 (with and without land use and forestry, respectively). (UNFCCC, 2012b).

Although emissions have decreased among Annex B parties, the environmental effectiveness of the Protocol's first commitment period has been less than it could have been, for several reasons. First, not all Annex B parties have participated. The United States, until recently the country with the largest share of global emissions (Gregg et al., 2008), did not ratify the Protocol. (See also section 13.3.1.) Therefore, its target emissions reduction of 7 percent, which would have amounted to over 40% of the difference in total Annex B committed emissions commitments and base year emissions levels (UNFCCC, 2012b), was not binding. In addition, Canada withdrew from the Protocol in December 2011 (effective December 2012). Russia, Japan, and New Zealand opted not to participate in the second commitment period (2013-2020).

Second, the Annex B "economies in transition" (EITs) were credited for emissions reductions that would have occurred without the Protocol due to their significant economic contraction during the 1990s. These loose targets may have been necessary to engage them as parties (Stewart and Wiener, 2003). In principle, these countries were allowed to sell resultant surplus emissions-reduction credits to other Annex B parties, which might have further reduced environmental effectiveness. However, in practice, other parties bought few AAUs relative to the stock available from EITs during the first commitment period (perhaps because the US decision not to ratify reduced demand for such allowances), and thus environmental effectiveness was not affected as much as it could have been (Brandt and Svendsen, 2002; Böhringer, 2003; IPCC, 2007, p. 778; Crowley, 2007; Aldrich and Koerner, 2012).

Current model projections imply that emission reductions achieved by Annex B parties during the first and second commitment periods of the Kyoto Protocol are not likely to be sufficient to achieve environmental performance that limits global average temperature increases to 2°C above pre-industrial levels (Rogelj et al., 2011; Höhne, Taylor, et al., 2012). (See also Section 6.4 for a discussion of scenarios that relate short-term environmental performance to long-term GHG stabilization and tempterature change goals). A key reason is that, since 1990, the Annex B countries' share of global GHG emissions has declined significantly, from approximately 56 percent of global emissions in 1990 to approximately 39 percent in 2010. Simultaneously, overall global GHG emissions have risen significantly; global emissions in 2010 were approximately 31 percent higher than in 1990 (European Commission, Joint Research Centre, 2012) (see Section 5.2).

The criterion of economic performance encompasses both efficiency and cost-effectiveness. (See Sectuin 2.6 and Section 13.2.) Assessments of the efficiency of the Kyoto Protocol depend on respective estimates of the costs and benefits of mitigation and assumptions regarding the appropriate discount rate (see Section 2.4.3.2 and 3.6.2 on discounting). Contrasting assumptions regarding these values are the key determinants in explaining the differences between assessments that have found the Protocol inefficient (e.g. (Nordhaus, 2007)), and those that find it cost-effective, but insufficient (e.g. (Stern, 2007; Weitzman, 2007). These latter researchers also tend to emphasize the non-zero probability of catastrophic climate outcomes. The Kyoto Protocol also fostered monitoring and reporting of emissions, and capacity building in developing countries, which may facilitate further cost-effective action in the future (Hare et al., 2010).

With respect to cost-effectiveness, the Kyoto Protocol's three market-based instruments (the CDM, JI, and International Emissions Trading) intended to lower the cost of the global regime (see 13.4.2.3 for a description of these mechanisms). Most research on the Kyoto mechanisms has focused on the CDM, primarily because transaction volumes of CDM credits have been so much greater than JI credits or AAUs. Performance assessment of the CDM is discussed separately in Section 13.13.1.2.

International Emissions Trading (IET) could, in theory, reduce abatement costs by as much as 50 percent if trades took place among Annex B countries (Blanford et al., 2010; Bosetti et al., 2010; Jacoby et al., 2010). However, in practice, trading under this mechanism has been limited, partly due to the surplus problem discussed above (Aldrich and Koerner, 2012) and the absence of the United States. As of July 2013, 0.2 billion tCO_2-e have been traded through IET (Point Carbon, 2013). The few trades that were made generally required reinvestment of the revenues into projects that reduce greenhouse gas emissions, under so-called "Green Investment Schemes." The economic performance of IET also depends on what type of actor is doing the trading. Early expectations were that the main traders would be states (national governments), and that states would not operate as efficient traders, because they are not cost-minimizers (e.g. Hahn and Stavins, 1999). In practice, increasing shares of trades have been made by private sector firms, which may increase cost-effectiveness (Aldrich and Koerner, 2012).

JI also has the potential to improve the cost-effectiveness of Annex B countries' activities under the Protocol (Böhringer, 2003; Vlachou and Konstantinidis, 2010). A large majority of JI projects have been in the transition economies, especially Russia and Ukraine, given the low cost of emissions reductions there relative to other Annex B countries (Korppoo and Moe, 2008). From 2008 through July 2013, JI had led to the issuance of over 0.8 billion emission reduction unit (ERU) credits (UNFCCC, 2013d), each equivalent to one tCO_2-e of reported emission abatement. Over half of this volume was issued by Ukraine and Russia, especially in 2012 in response to the limitation on carrying over surplus AAUs to the second commitment period. The actual distribution of JI projects is not consistent with the theoretical potential, as some countries, such as Ukraine, proactively supported JI, while in others, including Russia, JI lacked political support, and efficient frameworks took several years to establish. In Western Europe, a number of companies in the chemical industry generated emission credits for their own use in the EU ETS, demonstrating the cost-reduction potential (Shishlov et al., 2012). Countries without a surplus of emission units usually applied strict rules to capture part of the emission reductions achieved by JI projects (Michaelowa and O'brien, 2006; Shishlov et al., 2012).

In addition to the three Kyoto flexibility mechanisms, the Protocol provides flexibility with regard to how Annex B parties may achieve their targets; they may employ domestic or regional policies of their own choice. One result has been the development of domestic emissions trading programs in several countries and regions (Paterson et al., 2014). Regional and national emissions trading programs include those in the EU (the EU ETS), Australia, and New Zealand, as well as subnational trading programs in the US (RGGI and California/WCI) and in China (seven regional pilot programs launched in 2013). See Figure 13.4 above and Sections 14.4 and 15.5; (Convery and Redmond, 2007; Ellerman and Buchner, 2007; Ellerman and Joskow, 2008; Ellerman, 2010; Ellerman et al., 2010; Olmstead and Stavins, 2012; Newell et al., 2013).

Distributional impacts of the Kyoto Protocol have been examined both cross-sectionally (mainly geographically) and temporally. Income patterns and trends as well as distribution of GHG emissions have changed significantly since the 1990s, when the UNFCCC and Kyoto Protocol listed Annex I/Annex B countries; some countries outside these lists have become wealthier and larger emitters than some countries on these lists (U.S. Department of Energy, 2012; WRI, 2012; Aldy and Stavins, 2012). For example, in 1990, China's total CO_2 emissions were about half of US emissions, but by 2010, China emitted more than 50 percent more CO_2 than the US. Over this same time period, China's per capita CO_2 emissions experienced an almost three-fold increase, rising to nearly equal the level in the EU, but still about 36 percent of the US level (IPCC Historic Database: JRC/PBL 2012; IEA 2012; UN)(Olivier et al., 2012, Figs. 2-2 and 2-3). Non-Annex I countries as a group have a share in the cumulative global greenhouse emissions for the period 1850 to 2010 close to 50 percent, a share that is increasing (den Elzen, Olivier, et al., 2013). (See Section 5.2.1 for more detail on historical emissions.)

Meanwhile, income inequality and variations in capacity remain substantial both within and across countries. While GDP per capita in some non-Annex I countries has increased and some have joined the OECD, incomes of G8 countries remain higher than those of major emerging economies such as the BASIC countries (World Bank, 2013). Poverty is much more extensive and income at lower absolute levels in the latter, compared to the former (Milanovic, 2012). Inequality in income remains related to inequalities in emissions (Padilla and Serrano, 2006; Chakravarty et al., 2009).

More broadly, although the Kyoto Protocol's quantitative mitigation requirements are limited to Annex B countries, the economic impacts of these requirements may spill over to non-Annex B countries (Böhringer and Rutherford, 2004). In terms of intertemporal distributional equity, some have noted that climate change mitigation that requires emissions reductions in the short term for uncertain long-term benefits, also involves inter-generational distributional impacts (Schelling, 1997; Leach, 2009).

Among Annex B countries, the Kyoto Protocol's emissions-target allocation is generally progressive, one common measure of distributional equity, exhibiting positive correlation between gross domestic product per capita and the degree of targeted emissions reduction below business-as-usual levels. For a 10 percent increase in per-capita GDP, Annex B countries' emissions reduction targets are, on average, about 1.4 percent more stringent (Frankel, 1999, 2005).

In terms of institutional feasibility, it is notable that the Kyoto Protocol has been ratified (or the equivalent) by 191 countries (plus the EU separately) (Falkner et al., 2010). As noted above, participation among Annex I countries in emissions-reduction commitments dropped significantly from the first (2008-2012) to the second (2013-2020) commitment periods, though the stringency of the emission-reduction commitments of those countries still participating increased for the second period. More broadly, the high rate of ratification is likely due in part to the lack of emissions-reduction commitments asked of non-Annex B countries (Lutter, 2000).

Allowing Annex B countries the flexibility to choose policies to meet their national emissions commitments may have contributed to institutional feasibility. However, compromises made during the negotiation of the Protocol that enabled its institutional and political viability may have reduced its environmental effectiveness (Victor, 2004; Helm, 2010; Falkner et al., 2010). This serves as an example of the trade-off across ambition, participation, and compliance discussed in Section 13.2.2.5.

Additionally, obstacles for enforcement have hurt the Protocol's institutional feasibility. Despite the Kyoto Protocol's compliance system (Oberthür and Ott, 1999; Hare et al., 2010; Brunnée et al., 2012), it is difficult in practice to enforce the Kyoto Protocol's targets because of the lack of a legal authority with enforcement powers, and the weakness of possible sanctions relative to the costs of compliance. This is, of course, true of most international agreements (van Kooten, 2003; Böhringer, 2003; Barrett, 2008b). (See also sections 13.3.2 and 13.4.2.1.)

13.13.1.2 Assessment of the Kyoto Protocol's Clean Development Mechanism

The CDM aims to reduce mitigation costs for Annex B countries and contribute to sustainable development in non-Annex B countries (UNFCCC, 1998) (Article 12). This mechanism led to the issuance of nearly 1.4 billion emission credits from over 7,300 registered projects by October 2013 (See section 13.5.1.1 and http://cdm.unfccc.int/). This performance was surprising, given that the

CDM suffered from many disadvantages relative to the other flexibility mechanisms (Woerdman, 2000).

The environmental effectiveness of the CDM depends on three key factors: whether a credited project actually reduces more emissions than would have been reduced in its absence (which may depend on whether the project developers are indeed motivated primarily by expected revenue from the sale of the emission credits) (“**additionality**”); the validity of the **baseline** from which emission reductions are calculated; and indirect emissions impacts (“**leakage**”) caused by the projects.

The issue of **additionality** (IPCC, 2007, pp. 779–780) continues to generate controversy, despite an increasing elaboration of additionality tests by CDM regulators (Michaelowa et al., 2009). On the one hand, (Schneider, 2009) found that key assumptions regarding additionality were often not substantiated with credible, documented evidence, in a sample of 93 projects. On the other hand, (Lewis, 2010) finds a clear contribution of the CDM to the rapid upswing of the renewable energy sector in China.

CDM projects in energy efficiency, transport and buildings have faced challenges in **baseline** determination, monitoring, and transaction costs (Sirohi and Michaelowa, 2008; Michaelowa et al., 2009; Millard-Ball and Ortolano, 2010). (Kollmuss et al., 2010) suggest that it may be possible to prevent baseline gaming through a clear regulatory framework. Heeding this advice, CDM regulators have increased the conservativeness of approved methodologies, after rejecting a significant share of baseline methodology proposals (Michaelowa et al., 2009; Millard-Ball and Ortolano, 2010). Recent attempts by CDM regulators to standardize baselines have triggered a debate regarding their impacts on environmental effectiveness and transaction costs. Making the choice between standardized and project-specific baselines voluntary (Spalding-Fecher and Michaelowa, 2013), as well as “simple, highly aggregated performance standards” (Hayashi and Michaelowa, 2013) could reduce environmental effectiveness.

With regard to **leakage**, (Vöhringer et al., 2006) argue that emission leakage due to market price effects is unavoidable (as it is for mitigation within Annex B countries), while (Kallbekken et al., 2007) stress that regardless of the baseline used, the CDM will reduce carbon leakage through the reduction in the difference in marginal mitigation costs between countries. (Schneider, 2011) shows that for HFC-23 reduction projects, baseline gaming enabled production of the underlying commodity to shift from industrialized to developing countries (Wara, 2008).

With regard to cost-effectiveness, the CDM offers the potential for cost savings where abatement costs are lower in developing countries. The large volume of credits and projects in the CDM indicates its cost-saving potential. Still, (Castro, 2012) found that many low-cost opportunities had not been taken up by CDM projects.

The long-term contribution of the CDM to cost-effectiveness depends in part on its ability to promote technological change in developing countries either through technology transfer from industrialized to developing countries (see Chapter 16.8 for an overview of the technology transfer component of CDM), or by stimulating innovation within developing countries (Reichman et al. 2008). Roughly a third of CDM projects involve technology transfer (Haites et al., 2006). Dechezleprêtre, et al. (2008) find that the likelihood of technology transfer is higher for CDM projects operated by subsidiaries of companies from industrialized countries. (Seres et al., 2009) find that 36 percent of 3,296 registered and proposed projects accounting for 59 percent of the annual emission reductions claim to involve technology transfer, confirming Dechezleprêtre, et al.’s (2008) results. But all of these technology transfer studies limit themselves to assessment of project documents, which are not subject to rigorous and independent verification. Project developers have an incentive to overstate technology transfer. (Wang, 2010) is an exception, and underpins his analyses of many project documents with background interviews and assesses government policies.

He finds that in all but one of the industrial gas projects in China, technology transfer occurred, but only in about a quarter of wind and coal mine methane projects. Okazaki and Yamaguchi (2011) fear that transactions costs, imposed by additionality criteria and Executive Board delays, can discourage technology transfer through the CDM.

Distributional impacts of the CDM relate to contributions to sustainable development, as well as the distribution of rents generated by the sale of emission credits. (Olsen, 2007) provides a summary of the early literature that did not find significant support for sustainable development induced by CDM projects. Several researchers (Sutter and Parreño, 2007; Gupta et al., 2008; Headon, 2009; Boyd et al., 2009; Alexeew et al., 2010) see the process of host country responsibility for sustainable development and competition between host countries for CDM investment as a reason for the lack of sustainability benefits of CDM projects in some countries, as Designated National Authorities (national CDM-management bodies) may not adequately scrutinize the environmental or social benefits of projects. Parnphhumeesup and Kerr (2011) find that experts and the local population weight sustainability criteria differently in the context of biopower projects in Thailand. Ellis et al. (2007) found wide variation in the contribution to local sustainable development by project type, with greater contributions in small-scale renewable energy and energy efficiency than in large-scale industrial CDM projects. Using a sample of 39 projects, Nussbaumer (2009) finds that CDM projects certified by "The Gold Standard"—referring both to the organization and the certification scheme by that name—slightly outperform other CDM projects with respect to sustainable-development benefits. A similar result is found by (Drupp, 2011) for a sample of 18 Gold Standard projects compared with 30 projects certified through other means. Torvanger et al. (2013) propose dividing the CDM into two tracks, one for GHG offsets and one for sustainable development (though investors in the second track would need some new incentive).

The distribution of CDM projects has been concentrated in a relatively small number of developing countries (Yamada and Fujimori, 2012 see also Section 14.3.7.1). Given that companies in developing countries finance CDM projects out of their own resources and eventually sell the credits as a new export product, with the CDM consultant receiving a share (Michaelowa, 2007), a substantial amount of the rents remain in the host country. At the same time, the demand for CERs is evidence that it reduces costs compared to domestic reductions by developed countries. The fear, even if unfounded, of losing this export revenue may be a deterrent against taking up national emissions commitments (Castro, 2012), although in practice many such countries are developing policies aimed at emissions limitations. Therefore, it has been proposed to discount CDM credits in order to provide an incentive for taking up stricter national targets (Schneider, 2009).

In terms of institutional feasibility, baselines, additionality, and emissions-reductions are subject to third-party audit. However, due to the inadequate quality of many audits, regulators have been forced to introduce multi-layered procedures that have led to high transaction costs. Flues et al. (2010) show econometrically that regulatory decisions about project registration and baseline methodology approval have been influenced by political economy considerations.

There is ongoing debate in the literature about the efficacy of CDM governance (Green, 2008; Lund, 2010; Michaelowa, 2011; Okazaki and Yamaguchi, 2011; Böhm and Dhabi, 2011; Newell, 2012, p. 136). The UNFCCC commissioned an evaluation of the CDM in the CDM Policy Dialogue, which issued a report in September 2012 recommending several reforms of CDM governance (CDM Policy Dialogue, 2012). Michaelowa (2009) and Schneider (2009) propose a shift from the current 1:1 offsetting system to a system that only credits part of the reductions. This would improve additionality on the aggregate level and provide an incentive for advanced developing countries to accept their own emission reduction commitments. Giving preferential treatment in procedures and methodology to certain project categories, certain sectors, notably forestry (Thomas et al., 2010; CDM Policy Dialogue, 2012), or certain regions (Nguyen et al., 2010; Bakker et al., 2011) might expand the reach of CDM.

The price of CDM credits has declined, due largely to decreased demand from the EU ETS and others, following the 2008 recession, as well as changes in EU ETS rules regarding the use of CDM credits (see above). In response, (CDM Policy Dialogue, 2012) proposed creation of a central bank for carbon markets to bolster credit prices, as well as further standardization of baseline and additionality determination to reduce transaction costs. The benefits of these two recommendations are disputed in the literature (Hayashi and Michaelowa, 2013; Spalding-Fecher and Michaelowa, 2013).

13.13.1.3 Assessment of further agreements under the UNFCCC

As discussed in 13.5.1.1, since AR4, negotiations under the UNFCCC have produced the system of pledges in the Copenhagen Accord and the Cancún Agreements, as well as the development of the Green Climate Fund and an agreement to negotiate a new agreement by 2015. In terms of environmental performance, these agreements acknowledged that deep reductions in GHG emissions would be required to limit global average temperature increases to 2°C above pre-industrial levels, and recognized the possibility strengthening this target to 1.5°C (UNFCCC, 2010). Different goals will imply different reductions in climate change impacts (see AR5 WGII report on Impacts, Adaptation, and Vulnerability) and different mitigation costs (see Section 6.3).

There is broad agreement in the literature that global emissions reductions through 2020 implied by the Cancún pledges are insufficient to achieve a 2°C target, resulting in a so-called “2°C emissions gap” (Rogelj et al., 2010; Dellink et al., 2011; den Elzen, Hof, and Roelfsema, 2011; Höhne, Taylor, et al., 2012). However, these analyses exhibit substantial differences in quantitative results, owing in part to uncertainties in current and projected emissions estimates and interpretations of reduction proposals, and in part to different methodologies (UNEP, 2010, 2011, 2012, 2013b; Höhne, Taylor, et al., 2012) (Figure 13.5). For example, one source of differences in analyses is due to changing rules: At COP-17 in Durban in 2011, parties agreed to new rules for using land use credits for the Kyoto Protocol’s Second Commitment Period (UNFCCC, 2012c; Grassi et al., 2012), and at COP-18 in Doha in 2012, for surplus Kyoto allowances (Chen et al., 2013; UNFCCC, 2012d).

Studies suggest that the emissions gap between current Cancún pledges and a trajectory consistent with the 2°C target could be narrowed by implementing more stringent pledges, applying stricter accounting rules for credits from forests (Grassi et al., 2012) and surplus emission units (den Elzen et al., 2012), avoiding double-counting of offsets for both developed-country commitments and developing countries’ Cancún pledges (UNEP, 2013b), increasing support for action in developing countries (Winkler et al., 2009), and implementing measures beyond current pledges (den Elzen, Hof, and Roelfsema, 2011; Blok et al., 2012; Weischer et al., 2012; UNEP, 2013b).

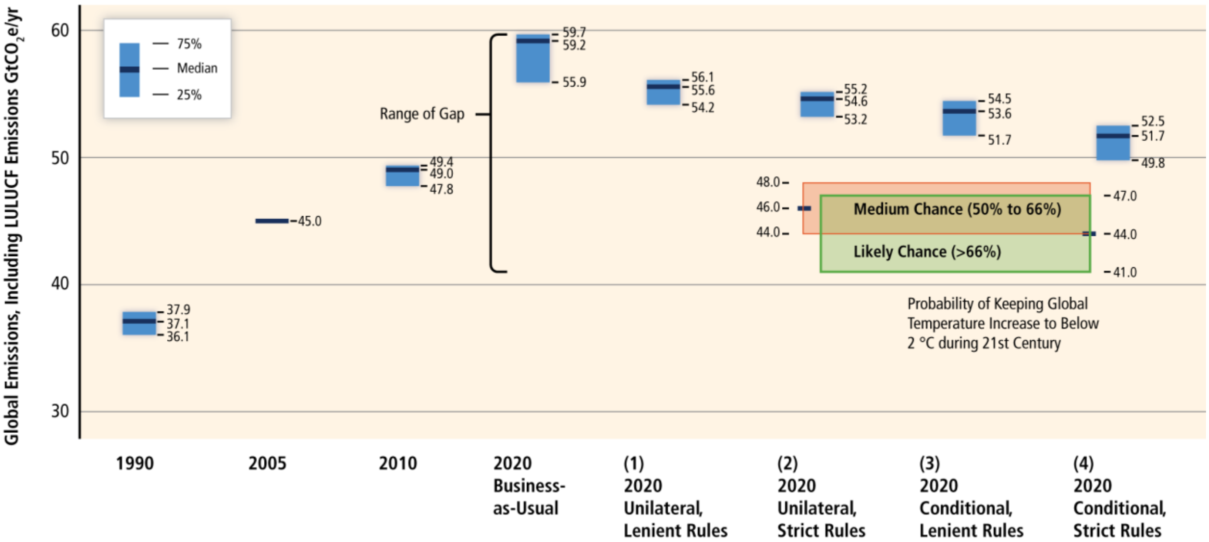


Figure 13.5. Global greenhouse gas emissions by 2020 expected from the business-as-usual projections and pledges found by various modelling groups. Four cases are considered which combine assumptions about pledges (unconditional or conditional) and rules for complying with pledges (lenient or strict)[1]. Source: (UNEP, 2012).

In terms of aggregate economic performance, some analyses have estimated the direct costs of the Cancún pledges (den Elzen, Hof, Mendoza Beltran, et al., 2011), as well as broader economic effects (Mckibbin et al., 2011; Dellink et al., 2011; Peterson et al., 2011). For example, (Dellink et al., 2011) estimate costs of action at around 0.3 percent of GDP for both Annex I and non-Annex I countries and 0.5–0.6 percent of global real income. However, there have been no published comparisons of the benefits and costs of the Cancún pledges, and thus no quantitative assessments of economic efficiency.

In terms of cost-effectiveness, the Cancún Agreements endorsed an on-going role for domestic and international market-based mechanisms, among various approaches, to improve cost-effectiveness. They also made a potential step forward on the cost-effectiveness criterion by emphasizing the role of mitigation actions in the forestry sector (UNFCCC, 2010; Grassi et al., 2012), which could be integrated with other actions through market mechanisms. Including forestry in market mechanisms could reduce global mitigation costs by taking advantage of low-cost mitigation opportunities in that sector (Eliasch, 2008; Busch et al., 2009; Bosetti et al., 2011; UNEP, 2013b).(See also Section 13.5.1.1.)

Assessing distributional impacts accurately depends both on the mitigation costs for developing-country emission reductions and the sources of financing for such reductions. The distributional equity of recent emission-reduction pledges could be increased through financing of reductions in non-Annex I countries. By one study's estimate, between 2.1 – 3.3 GtCO2e could be reduced in non-Annex I countries with $50 billion in financing, half of the financing agreed to under the Copenhagen Accord (Carraro and Massetti, 2012). Studies of the climate change mitigation "financing gap" have suggested potential approaches to providing financial resources (Ballesteros et al., 2010; AGF, 2010; Haites, 2011). (See also Sections 16.2 and 13.11.)

[1] Figure 13.5 illustrates results from modelling of pledges by various research groups. Note that the analysis reconciles pledges for all countries against a business-as-usual counterfactual based on what has been described in the literature, even though developed country pledges for 2020 are absolute (against a historical base year) and developing country pledges relative (with rare exceptions; see section 13.5.1).

Assessments of climate agreements following the Copenhagen, Cancún, and Durban UN climate conferences reflect differing interpretations of recent negotiations with regard to institutional feasibility (Dubash, 2009; Rajamani, 2010, 2012a; Werksman and Herbertson, 2010; Müller, 2010). Copenhagen (2009) was assessed as a failure by those who expected a new climate treaty and a second commitment period of the Kyoto Protocol. Others saw the political agreement reached among a small group of world leaders (eventually espoused by more than fifty) as a major step forward, even though not legally binding, especially because it moved toward a future agreement on emissions reductions by all major emitting countries, rather than continuing to divide developed from developing countries (Ladislaw, 2010). Others noted more specific effects, such as the change in the organization of carbon markets (Bernstein et al., 2010). The literature suggests that views diverge on the Cancún Agreements: some see them as a step forward in the multilateral process (Grubb, 2011) potentially towards a subsequent legal agreement (Bodansky and Diringer, 2010), while others suggest that the move to a voluntary pledge system has weakened the multilateral climate regime (Khor, 2010b). The participation of 97 countries in the form of emission reduction pledges (42 countries) or mitigation actions (55 countries) speaks to the institutional feasibility of the Cancún Agreements. (See Section 13.5.1.1.) The Durban Platform in 2011 further de-emphasized the distinction between developing and developed countries, with regard to mitigation commitments, and mandated a new treaty by 2015, to take effect by 2020, mobilizing emissions reductions by all countries (UNFCCC, 2011a).

13.13.1.4 Assessment of envisioned international cooperation outside of the UNFCCC

A wide variety of international institutions outside of the UNFCCC have some role in international climate change policy. These are described in Section 13.5 and depicted graphically in Figure 13.1, above. They include activities at the international, regional, national, subnational, and local scales, and they include public, private and civil society actors. Here, we discuss those institutions for which there exist published assessments of performance for at least one of the criteria from Section 13.2.2.

The breadth of group membership poses a potential tradeoff between global participation and other aspects of institutional feasibility (See Sections 13.2.2.4, 13.3.3, and 13.5.1). To the extent that a group's membership includes only a subset of countries, this may facilitate negotiations and implementation (institutional feasibility) Houser (2010), but reduce environmental and economic performance due to incomplete global coverage (omitting others' emissions, yielding leakage, and forgoing low-cost opportunities for abatement) Wiener (1999) (see Sections 13.13.1 and 13.5.1.2). Moreover, bringing climate discussions into smaller international forums has been criticized by some as attempts to circumvent the UNFCCC and reduce its legitimacy (Hurrell and Sengupta, 2012). Because the UNFCCC's Kyoto Protocol provides for emissions commitments only by Annex B countries (which account for a declining share of global emissions, with increased risk of leakage), some of the smaller groups discussed in this subsection have tried to engage major developing countries as well, to reduce leakage and increase environmental effectiveness.

The G8

The G8 includes eight major industrialized countries (US, UK, Canada, France, Germany, Italy, Japan and Russia), plus the EU. At the 2007 G8 summit, member countries agreed (though without a binding commitment) to set a goal of a 50 percent reduction in GHG emissions below 1990 levels by 2050, conditional on major developing countries making significant reductions. A comparison of four models of global emission pathways (including the G8 plus China, India, and other major developing countries, a group which resembles the MEF or G20 more than the G8), to achieve concentration levels of 550, 450 or 400 ppm by 2100, found that aggregate global costs through 2100 would be below 0.8 percent of global GDP to achieve 550 ppm and about 2.5 percent for 400 ppm (but highly sensitive to the availability of CCS and biofuels) (Edenhofer et al., 2010); see also Section 6.3.6.

Analysts have examined the economic impacts of achieving reductions approximating the G8 pledge on individual countries, such as the United Kingdom (Dagoumas and Barker, 2010) and the United States (Paltsev et al., 2008).The former finds no simple trade-off between emission reductions and economic growth in the UK. Of the more aggressive reductions modelled for the US, Paltsev et al. (2008) finds carbon prices rising to between $120 and $210 by 2050, a level of cost that "would not seriously affect US GDP growth but would imply large-scale changes in its energy system." Paltsev et al. (2009) found somewhat higher costs, noting moreover that the details of policy design and incomplete sectoral coverage could raise these costs further. Meanwhile, actions by the G8 countries alone (excluding major developing countries) would address a declining share of global emissions and would be subject to leakage to non-G8 members.

The Major Economies Forum on Energy and Climate Change

The Major Economies Forum on Energy and Climate Change (MEF), described in section 13.5.1.3, is a forum for the discussion of policy options and international collaboration with regard to climate and energy, not a forum for negotiation. There are no published assessments of the MEF's effectiveness. (Massetti, 2011) considers a scheme that achieves the MEF's informal, aspirational objective of "50 percent by 2050" (similar to the G8 goal, described above) through hypothetical 80 percent reductions by high-income MEF countries and 25-30 percent reductions by low-income countries, and finds costs would exceed 1.5 percent of GDP.

The G20

The G20, described in section 13.5.1.3, came to a political agreement at its 2009 Pittsburgh meeting to "phase out and rationalize over the medium term inefficient fossil fuel subsidies while providing targeted support for the poorest" (G-20, preamble, pt. 24). This was not followed by a legally binding agreement. In terms of environmental effectiveness, this effort could significantly affect GHG emissions, if countries in fact implemented it; by one modelled estimate, complete phase-out of such subsidies by 2020, could reduce CO_2 emissions by 4.7 percent (IEA, 2011). Analysis suggests that, of the economies identified by the IEA as having fossil-fuel consumption subsidies, almost half had either implemented fossil-fuel subsidy reforms or announced related plans by 2011 (IEA et al., 2011). However, other analysts suggest that progress towards this goal can be attributed to changes in reporting and subsidy estimation, and that no fossil fuel subsidies have been eliminated under this pledge (Koplow, 2012).

Studies have confirmed that countries reforming fossil fuel consumer subsidies would realize positive economic benefits (IEA et al., 2011). However, "these economic benefits would be offset by trade impacts if other countries also removed their subsidies and thus reduced their demand for fossil-fuel imports" (IEA et al., 2011). The G20 initiative on fossil fuel subsidies could have positive distributional impacts within some countries, however. Since fossil fuel subsidies tend to benefit high-income households more than the poor in developing countries, their removal would be progressive in such nations (World Bank, 2008c).

Some note that the creation of the G20 and its elevation to a premier global international economic forum during the financial crisis in 2008 (Houser, 2010) has led to more open and dynamic negotiations between industrialized and developing countries (Hurrell and Sengupta, 2012), suggesting a potentially positive route forward.

The Montreal Protocol

The Montreal Protocol is one agreement outside of the UNFCCC that has achieved nearly universal participation and has made a significant contribution to reducing GHG emissions (Molina et al., 2009; Velders et al., 2007). (The UNFCCC does not address GHGs already controlled by the Montreal Protocol.) In its effort to reduce emissions of ozone-depleting substances (ODS), the Montreal Protocol initially phased down chlorofluorocarbons (CFCs), which harm the ozone layer and also have very high global warming potential (GWP), and in 2007 decided to accelerate the phase-down schedule for HCFCs—an interim replacement for CFCs with a somewhat lower, but still very significant, GWP. The latter decision was affected by climate considerations (Bodansky, 2011a). Even before the HCFC decision, one estimate suggested that the Montreal Protocol's overall net contribution to climate change mitigation had been approximately 5 times what the Kyoto Protocol would achieve under its first commitment period (Velders et al., 2007, 2012). However, this comparison may be unfair because the progress in reducing ozone depleting gases relative to GHGs may be due to the major ozone depleting gases being less central to economic activities than the major GHGs. In addition, the time-periods in which the two agreements have been operating makes comparison difficult.

Hydrofluorocarbons (HFCs) are being widely adopted as a longer-term substitute for CFCs. Many of these have extremely high GWP, and their use will partially negate climate gains otherwise achieved by the Montreal Protocol (Moncel and van Asselt, 2012). Zaelke et al. (2012) suggest that a combination of reductions of HFCs and significant cuts in CO_2, the largest contributor to climate change, can significantly increase the chances of remaining below the 2°C limit. Proposals have been made in the Montreal Protocol process to phase down HFCs (even though these gases are not ozone-depleting substances), but as of mid-2013, parties to the Montreal Protocol had not agreed to an HFC phase-down. However, in June 2013 the presidents of the USA and China announced a joint initiative to phase down HFCs.

In terms of distributional equity, unlike the Kyoto Protocol, which placed no restrictions on developing country emissions, the Montreal Protocol applied equally-stringent emission requirements on all countries. However, the Montreal Protocol allowed for a ten-year "grace period" for countries with low per-capita CFC consumption to meet their implementation requirements, consistent with the principle of CBDR. The Montreal Protocol also established mechanisms for financing and provided technical support to assist developing countries in reducing their ODS emissions; the most notable mechanism is the Multilateral Fund, which has transferred more than $3 billion to assist developing country ODS mitigation. (Molina et al., 2009)

The International Maritime Organization and the International Civil Aviation Organization

Under the Kyoto Protocol's Article 2.2, Annex I parties agreed to pursue GHG limitations from maritime and air transport through the International Maritime Organization (IMO) and International Civil Aviation Organization (ICAO).

Approximately 3.3 percent of global CO2 emissions in 2007 were attributable to shipping (International Maritime Organization, 2009, p. 3). In 2011, the IMO adopted the first mandatory standards for a sector relating to GHG emissions, instituting a performance-based energy-efficiency regulation for large ships "for which the building contract is placed on or after January 1, 2013" (Bodansky, 2011c). This regulation applies uniformly to all countries, extending participation in GHG emissions regulation. These standards were adopted by majority vote (over some objections), and include a provision to promote technical cooperation and assistance, especially for developing countries (Bodansky, 2011c), to address equity concerns, enhancing institutional feasibility.

The ICAO adopted a resolution on climate change in 2010. In contrast to the IMO, the ICAO's climate change goals are "voluntary and aspirational." Perceived inadequate progress by the ICAO toward aviation emissions reduction goals may have prompted the inclusion of aviation emissions in the EU-ETS in January 2012 (Bodansky, 2011c) (see section 13.8.2).

Agreements among non-state actors and agreements among sub-national actors

It is unclear whether agreements among non-state (NGOs, private sector) or sub-national actors (transnational city networks) have been effective in reducing emissions. Partly this is because of their novelty and partly because the units of measurement for such effectiveness are considerably more complex than for interstate agreements (Pinkse and Kolk, 2009). For subnational efforts, the question of attribution requires better disaggregation, to understand whether reductions are additional to national effort, or only contribute to delivering national pledges. While these sub-national efforts may make a small contribution to climate action, they may be valuable in influencing nation states or helping them meet commitments (Osofsky, 2012).

Other measures of impacts do exist. In private sector initiatives, the Carbon Disclosure Project has high rates of reporting, with about 91 percent of Global 500 companies surveyed in 2011 disclosing GHG emissions (Carbon Disclosure Project, 2011, p. 7). There is little evidence of substantial changes in investor behaviour, with disagreement as to the potential for such changes in the future (Kolk et al., 2008; Harmes, 2011; MacLeod and Park, 2011). Some assessments have focused on how transnational city initiatives promote technology uptake within cities (Hoffmann, 2011, pp. 103–122) or on how they create a combination of competition and learning among member cities.

The voluntary carbon market (VCM) (see 13.5.2) had grown to 131 million tCO2-e (about 1/10th of the size of the CDM), with a value of US $424 million, by 2010 (Peters-Stanley et al., 2011). In 2004, virtually no VCM projects underwent third party verified certification, but by 2010, this figure had reached 90 percent and the VCM has created a varied landscape of emission-offset providers, registries, and standards (Peters-Stanley et al., 2011).

For some, the VCM is complementary to the CDM, and provides for learning about new ways of developing emissions reduction projects (Benessaiah, 2012). However, (Dhanda and Hartman, 2011) find that the voluntary market is not transparent and suffers from large swings of demand for specific project types. Offset prices for the same project type differ by up to two orders of magnitude. As noted, competing registries and standard providers proliferate, and additionality of a significant share of projects is doubtful. Some regard voluntary certification systems as primarily public relations exercises (Bumpus and Liverman, 2008). An earlier assessment by (Corbera et al., 2009) concluded that the voluntary market does not perform better than the CDM. However, performance in the VCM seems to improve with the increased use of third-party certification systems (Hamilton et al., 2008; Capoor and Ambrosi, 2009; Newell and Paterson, 2010).

There is evidence that the importance of partnerships between the private sector and government depends on their relationship to more traditional state-led governance. Partnerships may work once government regulations send strong signals to investors (Pfeifer and Sullivan, 2008). Rules developed in private sector agreements may then become incorporated in government regulations (Knox-Hayes and Levy, 2011), and private carbon market offset standards may be introduced into regulated carbon markets (Hoffmann, 2011, pp. 123–150).

13.13.2 Performance assessment of proposed international climate policy architectures

This section describes proposed global climate policy architectures (surveyed in section 13.4), focusing on those that have been described for the first time since AR4, and older proposals for which new research on anticipated performance is available. Earlier proposals are listed in Table 13.1 of (Gupta et al., 2007). The performance assessment of proposed architectures is difficult because it depends on both the architecture and the specific design elements of its regulatory targets and mechanisms.

We classify proposals using the taxonomy developed in Section 13.4.3 and Table 13.2: (a) strong multilateralism; (b) harmonized national policies; and (c) decentralized architectures and coordinated national policies. Combinations of these categories have also been proposed and assessed. For example, strong multilateralism can be advanced by “clubs” of selected ambitious countries (Weischer et al., 2012)or by non-state actors (Blok et al., 2012).

13.13.2.1 Strong multilateralism

The anticipated performance of various proposals for strong multilateralism has been assessed in the literature. In addition, another body of research has examined the ends (but not the policy architecture) associated with various aggregate goals in terms of country- or region-level emission targets based on specific notions of distributional equity, so-called "burden-sharing approaches". (See Section 13.2, as well as Sections 4.6.1 and Section 6.3.6.6 for quantitative assessments.)

Comprehensive proposals for strong multilateralism have in some cases been closely related to the targets-and-timetables approach of the Kyoto Protocol. This approach aims to be based on the UNFCCC principle of CBDR while introducing a more nuanced differentiation and broader base of participation, along with some details of the means of implementation. This is well reflected in the literature on reduction proposals with national emission targets and emissions trading (see Table 13.1 in (Gupta et al., 2007)), in particular gradually-increasing emission-reduction commitments linked to indicators such as per capita income (literature since AR4 including (Cao, 2010a; Frankel, 2010; Bosetti and Frankel, 2011), differentiating groups of countries (den Elzen et al., 2007; Rajamani, 2013), common but differentiated convergence (Höhne et al., 2006; Luderer et al., 2012), and per capita targets (Agarwala, 2010).

Distributional impacts vary significantly with underlying criteria for effort sharing. For example, proposals that use "responsibility and capability" as a criterion for allocating effort would result in relatively more stringent implied actions for "early" emitters, assigning them lower allocations. Proposals based on the criterion of "mitigation potential" would be less stringent for "early" emitters, capturing the mitigation potential in developing countries, assumed to be relatively low-cost (Höhne et al., 2013). Especially for low stabilization levels, the approaches differ in the extent to which they rely on contributions from all countries, from emissions reductions within their borders, and on international assistance between countries. Section 4.6.2.2 details many more possible criteria for effort sharing, and Section 6.3.6.6 quantifies the implications of these various effort sharing criteria in terms of regional emission allocations and costs.

Sectoral approaches are generally not anticipated to perform optimally in terms of environmental effectiveness or economic performance when compared with economy-wide approaches; therefore, sectoral approaches can be thought of as second-best policies (Bradley et al., 2007; Schmidt et al., 2008; den Elzen et al., 2008; Meckling and Chung, 2009). Sectors that are homogenous and already globally integrated, such as aviation, may lend themselves better to international cooperation than those that are heterogeneous. Omitting some sectors makes it more difficult to achieve emissions or stabilization goals and also reduces cost-effectiveness, relative to economy-wide approaches, as required emissions reductions must be made within-sector, failing to take advantage of the lower of heterogeneous marginal abatement costs across sectors. Transaction costs may also be higher with sectoral approaches, including, for example, greater challenges to negotiation (Bradley et al., 2007).

However, these approaches could potentially help mitigate leakage within particular industries (Bradley et al., 2007; Sawa, 2010). In terms of institutional feasibility, sectoral approaches may encourage the participation of a wider range of countries than economy-wide approaches, because sectoral agreements can be more politically manageable in domestic policy processes (Bradley et al., 2007; Sawa, 2010). Developing countries may also be more likely to participate meaningfully in sectoral processes than economy-wide agreements limiting emissions (Meckling and Chung, 2009).

Several researchers have suggested that a "regime complex" is emerging (see section 13.3 and 13.5), with the strong implication that component regimes may display a range of architectures—from strong multilateralism through more decentralized systems (Carraro et al., 2007; Biermann et al., 2009; Barrett, 2010; Keohane and Victor, 2011). The portfolio of treaties approach is similar in some ways to the sectoral approaches described above. However, the approach described in (Barrett,

2010) includes much more significant enforcement possibilities, potentially increasing environmental effectiveness, while potentially reducing institutional feasibility.

13.13.2.2 Harmonized national policies

In principle a wide variety of national climate policies can be harmonized across countries. This holds for cap-and-trade systems (e.g. a global emissions permit trading system (Ellerman, 2010)), as we discuss in the context of linkage below, as well as for national carbon or other greenhouse gas taxes. The most studied approach in terms of performance assessments has been harmonized carbon taxes. Their environmental performance would depend upon the level of the tax, but relative to non-market-based approaches, this approach would be cost-effective. The impact of a carbon tax on economic efficiency will depend, in part, on how tax revenues are used (Bovenberg and de Mooij, 1994; Parry, 1995; Bovenberg and Goulder, 1996; Cooper, 2010).

Estimates in the recent literature of the environmental effectiveness and economic performance of proposed carbon taxes vary dramatically depending upon assumptions (Edmonds et al., 2008; Clarke et al., 2009; van Vuuren et al., 2009; Bosetti et al., 2010; Luderer et al., 2012). The distributional impacts of a carbon tax include negative impacts on the fossil fuel industry as a whole, with stronger impacts for fuels with higher carbon emissions per unit of energy. For example, impacts on coal would be much greater than on natural gas (Cooper, 2010). Impacts of national carbon taxes on consumers would likely be somewhat regressive in high-income countries but progressive in low-income countries. (See Section 15.5 for detail). Tax revenues could be used by individual countries to address these domestic distributional concerns. (See e.g.,Winkler and Marquard, 2011; Alton et al., 2012).

Under a harmonized national carbon tax regime, fossil-fuel-exporting countries might experience negative impacts, and net importers could experience decreasing prices due to reduced demand, while some regions could experience increased bio-energy exports (Persson et al., 2006; OECD, 2008; Cooper, 2010; Leimbach et al., 2010). International transfers drawing on revenues of such a tax could, in theory, be used to address these concerns or to encourage participation by developing countries (Nordhaus, 2006). As with emissions trading (Frankel, 2010), the extent of developing country participation in an international carbon tax scheme could be based upon income thresholds (Nordhaus, 2006).

The institutional feasibility of a global carbon tax has not been thoroughly considered in the literature. The relatively large number of studies on a global carbon tax is at least partly due to the fact that economic modellers often model a global carbon tax as a proxy for other mitigation policy instruments that would impose shadow prices on the carbon content of fossil fuels and/or CO2 emissions.

Many hybrid market-based approaches to emissions mitigation, combining tradable emissions permits with some characteristics of a carbon tax, have been proposed and examined in the recent literature (Pizer, 2002; Murray et al., 2009; FELL et al., 2010; Webster et al., 2010; Grüll and Taschini, 2011). In principle these hybrid approaches can provide better aggregate economic performance, lowering compliance costs and reducing price volatility, at the potential expense of environmental effectiveness in the form of uncertain changes in aggregate emissions (Grüll and Taschini, 2011). However, recent research suggests that “soft” price collars, which provide a modest reserve of additional emission allowances at the price ceiling, may achieve most of the expected compliance cost savings provided by “hard” collars (unlimited supplies of additional allowances), while maintaining a more predictable cap on emissions (Fell et al., 2012). In terms of distributional equity, hybrid systems may reduce expected compliance costs for regulated firms, though they may increase regulatory costs (Grüll and Taschini, 2011). This characteristic may also increase political feasibility.

13.13.2.3 Decentralized architectures and coordinated national polices

In principle, many types of national climate policies could be linked to each other. In the literature to date, most discussion is of linked carbon markets. The recent literature on these suggests that economic performance of existing GHG allowance trading systems could be enhanced through linkage, which would reduce abatement costs and improve market liquidity (Haites and Mehling, 2009; Mehling and Haites, 2009; Sterk and Kruger, 2009; Anger et al., 2009; Jaffe et al., 2009; Jaffe and Stavins, 2010; Grüll and Taschini, 2011; Metcalf and Weisbach, 2012; Ranson and Stavins, 2013). In terms of environmental performance, linkage can increase or reduce emissions leakage, depending on the stringency of caps, and the quality of offset credits within linked systems.

Linkages among cap-and-trade systems as well as linkages with and among emission-reduction-credit systems would create winners and losers, generating distributional impacts relative to un-linked systems, depending upon impacts on allowance prices and whether participating entities are net buyers or net sellers of emissions (Jaffe and Stavins, 2010). While it does preserve the ability of countries to meet their commitments through means of their own choice, consistent with the Kyoto Protocol, linkage also poses some challenges for institutional feasibility, since it reduces domestic control over prices, emissions, and other aspects of policy design and impact (Buchner and Carraro, 2007; Jaffe et al., 2009; Jaffe and Stavins, 2010; Ranson and Stavins, 2013). Linking may not benefit all participating countries due to potential market distortions and the rebalancing of production and consumption patterns in multiple markets (i.e. general equilibrium effects) (Marschinski et al., 2012). In one analysis that modelled the heterogeneous costs and benefits of participation in a climate coalition using a game-theoretic framework, incentives to deviate from cooperation could not be compensated by transfers (Bosetti et al., 2013).

Institutional-feasibility challenges may be more significant for linked heterogeneous policy instruments (such as taxes and emissions permit systems, or taxes and technology standards) relative to linked regimes that use similar instruments (Metcalf and Weisbach, 2012). For example, unrestricted linkage would effectively turn a permit trading system into a tax, pegging the permit price to the other country's tax rate, and allowing aggregate emissions above the permit system's established cap (Metcalf and Weisbach, 2012).

Climate policy architectures that can be characterized as technology-oriented agreements may seek to share and coordinate knowledge and enhance technology research, development, demonstration, and transfer. Some literature suggests that such agreements may increase the efficiency and environmental effectiveness of international climate cooperation, but will have limited environmental effectiveness operating alone (de Coninck et al., 2008). Though technology-oriented policies can promote the development of new technologies, environmental effectiveness hinges on the need for other policies to provide incentives for adoption (Fischer, 2008; Newell, 2010b). For example, (Bosetti, Carraro, Duval, et al., 2009) show that R&D alone is insufficient to stabilize CO_2 levels without an accompanying carbon tax or functionally equivalent policy instrument. See section 13.9.3 for details of international cooperation on technology.

13.14 Gaps in knowledge and data

- comparisons among proposals in terms of any or all of the four criteria used in this report; particularly useful would be comparisons of aggregate cost, or disaggregated regional- or country-level costs per year, with incorporation of uncertainty
- assessment of the emerging range of new intergovernmental and transnational arrangements, including "hybrid" approaches and approaches that interact across the landscape of climate agreements, which might enable better assessment of the sum of efforts

- understanding of complementarities and trade-offs between policies affecting mitigation and adaptation
- understanding how international cooperation on climate change can help achieve co-benefits and development goals of countries; what works and does not work in capacity building projects
- a better understanding of the factors that affect national decisions to join and form international agreements; how international cooperation can directly influence achievement of various performance criteria

13.15 Frequently Asked Questions

FAQ 13.1 Given that GHG emissions abatement must ultimately be carried out by individuals and firms within countries, why is international cooperation necessary?

International cooperation is important to achieve significant emissions reductions for a number of reasons. First, climate protection is a public good that requires collective action, because firms and individuals will not otherwise bear the private costs needed to achieve the global benefits of abatement (see 13.2.1.1). Second, because greenhouse gases (GHGs) mix globally in the atmosphere, anthropogenic climate change is a global commons problem. Third, international cooperation helps to give every country an opportunity to ascertain how responsibilities are to be divided among them, based on principles adopted in international agreements (see 13.3). This is important because individual countries are the entities with jurisdiction over individuals and firms, whose actions ultimately determine if emissions are abated. Fourth, international cooperation allows for linkages across policies at different scale, notably through harmonizing national and regional policies, as well as linkages across issues, and through enhanced cooperation may reduce mitigation costs, create opportunities for sharing the benefits of adaptation, increase credibility of price signals, and expand market size and liquidity. Fifth, international cooperation may help bring together international science and knowledge, which may improve the performance of cooperatively-developed policy instruments.

FAQ 13.2 What are the advantages and disadvantages of including all countries in international cooperation on climate change (an "inclusive" approach) and limiting participation (and "exclusive" approach)?

The literature suggests that there are trade-offs between "inclusive" approaches to negotiation and agreement (i.e., approaches with broad participation, as in the UNFCCC) and "exclusive" approaches (i.e., limiting participation according to chosen criteria—for example, including only the largest emitters, or groups focused on specific issues). Regarding an "inclusive" approach, the universal membership of the UNFCCC is an indicator of its high degree of legitimacy among states as a central institution to develop international climate policy. However, the scholarly literature offers differing views over whether or not the outcomes of recent negotiations strengthen or weaken the multilateral climate regime (13.13.1.3). A number of other multilateral forums have emerged as potentially valuable in advancing the international process through an "exclusive" approach. These smaller groups can advance the overall process through informal consultations, technical analysis and information sharing, and implementation of UNFCCC decisions or guidance (e.g., with regard to climate finance). They might also be more effective in advancing agreement among the largest emitters, but so far have not been able to do so. Examples include the Major Economies Forum on Energy and Climate (MEF), the Group of Twenty (G20) and Group of Eight (G8) Finance Ministers, and the city-level C-40 Climate Leadership Group. Section 13.5 goes into more detail, and Figure 13.1 illustrates the overall landscape of climate change-relevant agreements and institutions.

FAQ 13.3 What are the options for designing policies to make progress on international cooperation on climate change mitigation?

There are a number of potential structures for formalized international cooperation on climate change mitigation, referred to in the text as policy "architectures" (see Section 13.4). Architectures vary by the degree to which their authority is centralized and can be roughly categorized into three groups: strong multilateralism; harmonized national policies; and decentralized architectures (see section 13.4.1). An example of strong multilateralism is a targets-and-timetables approach, which sets aggregate quantitative emissions-reduction targets over a fixed period of time and allocates responsibility for this reduction among countries, based on principles jointly accepted. The UNFCCC's Kyoto Protocol is an example of a strong multilateral approach. The second architecture is harmonized national policies. An example in principle (though not put into practice) might be multilaterally harmonized domestic carbon taxes. An example of the third architecture, decentralized approaches and coordinated national policies, would be linkage among domestic cap-and-trade systems, driven not through a multilateral agreement but largely by bilateral arrangements. The literature suggests that each of the various proposed policy architectures for global climate change has advantages and disadvantages with regard to four evaluation criteria: environmental effectiveness, aggregate economic performance, distributional equity, and institutional feasibility. Section 13.4.1.4 goes into more detail.

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