22 Creating a Global Price for Carbon

Key Messages

A shared understanding of long-term goals must be at the centre of international frameworks to support large reductions in greenhouse gas emissions reductions around the world.

A broadly similar price of carbon is necessary to keep down the overall costs of making these reductions, and can be created through tax, trading or regulation. Creating a transparent and comparable carbon price signal around the world is an urgent challenge for international collective action.

Securing broad-based and sustained co-operation requires **an equitable distribution of effort across both developed and developing countries.** There is no single formula that captures all dimensions of equity, but calculations based on income, per capita emissions and historic responsibility all point to developed countries taking responsibility for emissions reductions of at least 60% from 1990 levels by 2050.

The Kyoto Protocol has established valuable institutions to underpin international emissions trading. There are strong reasons to build on and learn from this approach. There are also opportunities to use the UNFCCC dialogue and the review of the effectiveness of the Kyoto Protocol to explore ways to improve.

Private sector trading schemes are now at the heart of international flows of carbon finance. Linking and expanding regional and sectoral emissions trading schemes, including sub-national and voluntary schemes, requires greater international co-operation and the development of appropriate new institutional arrangements.

Common but differentiated responsibilities should be reflected in future international frameworks, including through a greater range of commitments and multi-stage approaches.

Carbon pricing and other measures should be extended to international aviation and shipping.

22.1 Introduction

At a national and regional level, as described in Chapter 14, approaches to mitigation include taxation, emissions trading and regulation. International collective action can build on these national approaches. As we have established in Chapter 23, such arrangements will be most successful if they take into account the underlying interests of the participants.

This chapter explains how international frameworks could be guided by long-term quantity goals and the corresponding global carbon price trajectory, and how they might also allow flexibility for national policy approaches.

The chapter considers how to build on and learn from the experience of the Kyoto Protocol so far. It also examines how the costs of mitigation can be minimised by international coordination and shared equitably, and the role of commitments and quota allocations. Finally we examine the challenges of expanding and linking regional and sectoral markets for carbon, and expanding carbon pricing to aviation and shipping.

22.2 Reducing the costs of mitigation through an efficient international framework

Very large reductions in greenhouse gas emissions are required around the world. A shared understanding of long-term goals, including for stabilisation of greenhouse gas concentrations in the atmosphere, is essential.

We set out in Chapter 14 the two key requirements for achieving efficiency for climate change mitigation. The first requirement is that greenhouse gas (GHG) emissions are reduced until the marginal cost of abatement[1] is equal to the marginal social cost of carbon (SCC) [2]. Defining the social cost of carbon requires a framework built around a shared understanding of long-term stabilisation goals.

A shared understanding of the scale of the challenge for both mitigation and adaptation can lead to a broad consensus on long-term goals for the stabilisation of GHGs in the atmosphere, as well as more medium-term considerations on appropriate pathways for global emissions, such as the depth of emissions reductions to be made by 2050. These goals can help to provide clarity and facilitate the development of national and international policies that minimise the costs and maximise the benefits of mitigation and adaptation. Policy-makers can then adjust national policy to operate in the context of a shared commitment to international collective action. Without this, there are risks that a series of fragmentary or short-term commitments would lead to inconsistent policies that raise the costs of action and fail to make a significant impact in reducing emissions.

It may not be essential to negotiate a single number for a long-term goal. As we have discussed in Chapter 21, declarations by political leaders and scientific and economic authorities can establish strong standards for responsible attitudes to the climate. Recognition of the dangers associated with different stabilisation levels together with an understanding of what is feasible are likely to point to a fairly narrow range of goals for consideration. We argued in Chapter 13 that this range lies between 450ppm and 550ppm CO2e, given that the lower level could impose high adjustment costs in the near term for small gains given where we are now, and the upper level would substantially increase risks of very harmful impacts.

The scientific and economic evidence on climate change will continue to accumulate, including on the potential for dangerous climate change and future technologies. It is important that new information is reflected in international norms for climate protection, and that policy-makers are clear about how they will adjust their goals in the light of new evidence. The Intergovernmental Panel on Climate Change (IPCC) plays a vital part in assessing the scientific evidence and providing clear non-technical summaries that allow the issues to be widely debated. Long-term goals should be regularly revised in the light of the IPCC findings and other robust research.

A broadly similar global carbon price is an urgent challenge for international collective action. A global carbon price can, in theory, be created through internationally harmonised taxation or intergovernmental emissions trading, but neither is straightforward in practice.

The second requirement for efficiency discussed in Chapter 14 is that reductions in different countries are carried out as far as possible to the point where the marginal or incremental costs of further abatement across countries are just equal. Although the science tells us that the 'social

[1] As we have emphasised throughout, risk and uncertainty are of the essence in climate change and we should really be speaking here in terms of mathematical expectations. But to avoid heavy language we keep it simple.

[2] The social cost of carbon and carbon price discussed here are convenient short-hand for the social cost (and corresponding price) for each individual greenhouse gas. Their relative social costs, or 'exchange rate', depend on their relative global warming potential (GWP) over a given period and when that warming potential is effective, as the latter determines the economic valuation of the damage done. Suppose there were a gas with a life in the atmosphere one tenth that of CO2 but with ten times the GWP while it is there. The social cost of that gas today would be less than the social cost of CO2, because it would have its effect on the world while the total stock of greenhouse gases was lower on average, so that its marginal impact would be less in economic terms.

cost' of emitting a tonne of GHGs is independent of where in the world it is emitted, there are currently significant differences in marginal abatement costs around the world, due to differences in rates of output and emissions growth, as well as differences in the structure of economies and energy sectors and levels of technical efficiency and differences in income. If the carbon price across countries is not broadly similar, there will be unexploited opportunities to abate an extra tonne of GHG more cheaply in one country compared with another, so the overall cost of abatement will be higher.

A similar carbon price around the world can be created in a number of ways, including through harmonised levels of net carbon taxes as part of national policy frameworks, intergovernmental emissions trading or expanding the use of private sector emissions trading; and/or using regulation to create an implicit price for carbon[3].

An internationally harmonized emissions tax – where all countries agree to set the same domestic carbon price across their economies – provides one model for an efficient approach to mitigation. Several analysts have argued that taxes have, on balance, advantages relative to quantitative limits at the international level[4].

A co-ordinated tax-based approach has the advantage that countries can take their tax decisions individually. It thus does not require elaborate structures and institutions, the construction of which can take time and effort. It allows compliance and monitoring to focus on the levels of net carbon tax in addition to monitoring of emissions. There are methodological challenges here, in untangling the multiple objectives of existing taxes, levels of direct and indirect subsidy applied and taking account of exchange rates. But they are not necessarily more complex than the existing monitoring of other policy areas carried out by institutions such as the International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD) or World Trade Organisation (WTO)[5].

Proponents of an internationally harmonised tax argue that it would also avoid difficulties associated with choosing baselines for trading. Efforts would be judged by the level of carbon tax rather than against an arbitrarily chosen historical base year of emissions. This would eliminate the asymmetry between early and late joiners, and remove the opportunity to create 'hot air'[6]. It would also avoid exceptionally large international transfers of wealth that could be generated by the initial allocation of emission rights under international trading regimes[7]. Under a tax-based approach, developing countries would retain all relevant tax revenue within their own borders. Crucially, any assistance from rich to poor countries would be made through direct public transfers tied to specific policy reform or programmes of action, and would be linked to the incremental cost of the action taken. This was the model for co-operation under the Montreal Protocol for Ozone Depleting Substances[8].

However, the international harmonisation of carbon taxes can be extremely difficult in practice. At a European level countries have previously failed to agree on a common carbon tax. Even the relatively homogenous group of four Scandinavian countries that sought to implement a uniform tax from the early 1990s ended up with a complex patchwork of partial application and exemptions between and within the countries[9]. Seeking an internationally uniform tax would preclude national discretion about ways of implementing environmental goals; and this may conflict with national sovereignty and the practical politics of domestic policy formation. There are

[3] Therefore, when we refer to a 'carbon price' hereafter we mean an 'effective' carbon price that can be cumulatively generated by these sorts of instruments and schemes.
[4] These include Cooper (1998); Mckibben and Wilcoxen (2002); Pizer (2002); and Nordhaus (2005).
[5] Such as the OECD's Consumer and Producer Subsidy Equivalent statistics in the area of agriculture or the WTO's trade statistics.
[6] 'Hot air' can be described as quotas allocated to countries in excess of their requirements as a result of the negotiating process.
[7] Olmstead and Stavins (2006), p. 6 and Cooper (2001).
[8] We discussed the Montreal Protocol in Box 21.2.
[9] We illustrated the development of Norway's carbon tax in Chapter 15.

also practical and political challenges in creating large-scale flows to poor countries, to support an equitable distribution of effort, through public budgets alone.

We argued in Chapter 14 that in the long-term, a global quantity constraint is the appropriate guide for policy-making. A global quantity constraint can be used to drive intergovernmental trading of emissions quotas, and this has already been adopted within the current multilateral framework, the Kyoto Protocol. Moreover, as we explained in Chapter 14, a key benefit of trading schemes for emissions quotas is that they allow the cost-effectiveness (via a common price) and distributional equity of action (via flows based on quota allocations) to be managed separately but simultaneously[10]. In a global and comprehensive system of quota trading, the initial allocation of national limits on emissions affects the distributional equity of the scheme, but not the equilibrium distribution of emissions reductions, the market-determined carbon price or the costs of abatement[11]. Therefore these allocations represent the overall level of responsibility that each country undertakes, rather than the emissions reductions that are required to physically occur within its borders.

Nevertheless, some countries are currently unwilling to participate in intergovernmental emissions trading – including the USA and Australia, and there are real difficulties in enforcing quota allocations between governments under international law. The lessons of the Kyoto Protocol will be explored in more detail in Section 22.4 below.

In practice, a combination of approaches can achieve a similar price for carbon globally by building on existing national tax, trading and regulatory frameworks, but co-ordination is necessary.

Different sectors and countries have differing preferences, institutions and traditions. These affect the choices that governments make between policy instruments such as taxes, trading, regulation, and subsidies, and between mandatory and voluntary approaches. These issues were explored in Chapter 15. A key challenge for international frameworks is to allow for multilateral and parallel action in different countries, to manage and co-ordinate the interactions between different national approaches. This is because if policies adopted in different countries result in different effective carbon prices, the allocation of emission reductions will be inefficient.

The outcomes from using tax or trading schemes that create a price for carbon – such as their effectiveness in reducing domestic emissions – can also be influenced by their interaction with other instruments internationally, even if they are not explicitly linked. This is because, in theory, firms can relocate to different regions and market competition can eliminate high cost products[12]. For example, if one country chooses an emissions trading scheme and another a carbon tax, and if relocation is costless and there is perfect product market competition, arbitrage will occur so that the carbon price is capped by the tax rate[13]. However, the allocation of revenues will be determined by the quantity of allowances issued. This means that the country with the trading scheme has an incentive to increase the quantity of allowances to obtain more revenue – which can then be distributed to its firms or public. Overall, the environmental effectiveness of the instruments will be reduced.

Even if both countries choose to implement taxes, the tax base can make a difference. If taxes are levied on final goods on the basis of the emissions they produce (which is a relatively complex task), there is no incentive to relocate or benefits to competitors in other countries. However, if taxes are levied on domestic emissions, or on carbon content at the beginning of the

[10] This may not hold if there are high transactions costs, and/or participants (governments or firms) can exercise market power to influence the buying and selling of permits within a trading scheme (Olmstead and Stavins (2006), p. 5).
[11] This statement abstracts from any 'income effects' that might shift demand patterns as a result of shifts in income or wealth associated with the allocation of limits. Olmstead and Stavins (2006).
[12] Tse (2006).
[13] It is possible for the carbon price to be below the tax rate if sufficiently many allowances are issued. This is unlikely in most cases.

supply chain, relocation and competition are more likely. In reality, as suggested in Chapter 11, these kinds of impacts are likely to be substantially mitigated by costs of relocation and many other factors that influence the degree of competitiveness firms face – such as the degree of international exposure, price elasticity of demand for products, as well as market structure.

A uniform carbon price acts as a bedrock to efficient policy. But accommodating a range of dimensions of effort within international frameworks for mitigation is important.

We suggested some important caveats to the general conclusion on a single carbon price in Part 4. For example, we acknowledged that a wide set of complementary measures relating to the removal of subsidies, and removing behavioural barriers to energy efficiency can be useful. The process of managing the transition to a stable and predictable framework for carbon pricing may justify additional carefully targeted measures, for a specified duration, to overcome the numerous obstacles to the development and deployment of new low-carbon technologies. Moreover, given the contrast between short-term capital markets and the long-term nature of the climate problem, there may be a case for additional measures that could deter construction of long-lived carbon-intensive stock in favour of lower carbon options. We discuss these issues further in Chapters 23 and 24.

International frameworks designed to recognise and build on diverse national approaches require a shared understanding of long-term goals, and they must also allow countries to benchmark and compare action across a range of dimensions of effort. These include emissions reductions, the scope and level of carbon prices and policies, national investment in R&D and deployment support, approaches to standards and regulation, commitments to international co-operation on the deployment and diffusion of relevant technology, as well as international support for adaptation.

22.3 Sharing the costs of mitigation

Securing broad-based and sustained participation in international co-operation to tackle climate change depends upon finding an approach widely understood as equitable.

As set out in Part III, any particular long-term quantity constraint can be met by different paths, and the costs involved will be kept down by increasing the flexibility about 'what, where and when' emissions are reduced. Scaling up action to reduce GHG emissions will require reductions to take place in both developed and developing countries. Given the ability to bear costs and historical responsibility for the stock of GHGs, equity requires that rich countries pay a greater share of the costs.

Box 22.1 Empirical work shows that perceived fairness is important

It is important for any co-operation that those involved feel that the terms agreed are fair. An empirical demonstration of this idea is illustrated by the 'ultimatum game'. In the ultimatum game, 'a proposer' proposes to the other player, 'the receiver', how they should allocate $100. If the other player accepts, both parties divide the $100 as proposed by the proposer. If the receiver rejects the proposal, both parties receive nothing. Although it would be rational for the other player to accept low allocations rather than receive nothing, empirical experiments across different cultures have found that players consistently reject allocations below $30 because they believe they are unfair, while proposers tend to offer between $20 and $50[14].

[14] Güth et al. (1982).

Frameworks for international collective action that recognise a global long-term quantity constraint on emissions must distribute responsibility for meeting the overall limit to nation states.

Both developed and developing countries can gain from mitigation policy, both because it will reduce the risks of dangerous climate change described in Part II and it because it can be designed to support the range of co-benefits described in Chapter 12. This does not mean that poor countries must bear the full costs of their participation. The incidence of imposing a global price of carbon is ultimately on the consumers of carbon-intensive goods and services, including consumers in rich countries who import those goods and services. Nevertheless, equity requires that poor countries should be compensated for some of the costs that they do bear. Emissions trading and similar mechanisms offer an effective route to achieving this.

In the case of climate change, a system of unco-ordinated national goals will not lead to an efficient or equitable distribution of effort. A major advantage of emissions trading schemes is that they enable efficiency and equity to be considered separately[15]. In the absence of trading, the allocation of responsibility for mitigation efforts requires considering efficiency and equity simultaneously.

The UNFCCC contains key principles for an equitable approach to sharing the costs of reducing global GHG emissions that remain relevant to further co-operation on climate change.

Concepts of equity suggest taking into account several aspects of a country's position or actions – which mostly complement each other[16]. The United Nations Framework Convention on Climate Change (UNFCCC) established that co-operation on climate change should recognise the 'common but differentiated responsibilities' of all countries, based upon their respective capabilities. This principle reflects several aspects of equity. First, it reflects the notion that, on the grounds of ability to pay, wealthier, more developed countries should support poorer countries in their efforts to adjust to climate change. Second, it acknowledges that the largest share of historic and current global emissions has originated in developed countries, and thereby applies historical responsibility or the 'polluter pays' principle[17]. Third, it accounts for the relative size of per capita emissions in developing countries and the requirement to allow their relative share of emissions to rise to accommodate their aspirations for growth and poverty reduction (as recognised, for example, in the Millennium Development Goals (MDGs))[18]. Developed countries therefore took on a range of obligations under the Convention, including showing leadership in tackling their own emissions, transferring technology, supporting capacity building and financing the agreed incremental cost of emissions reductions in poorer nations, and supporting adaptation to the adverse impacts of climate change.

These three arguments all point to rich countries taking a greater share of the costs of mitigation, but they do not necessarily point to the same arrangements or rules for sharing those costs[19]. For example, the ability-to-pay approach suggests that the sharing of costs should be directly correlated to GDP or per capita GDP[20]. The 'growth-needs' approach applied simplistically

[15] Rose and Stevens (1998) p. 336.
[16] Chapter 2 of this Review considers the issue of equity and climate change.
[17] See the Appendix to Chapter 2 for a discussion of the basis for this principle in terms of economic efficiency and jurisprudence.
[18] The Convention expressed this as "Recognizing the special difficulties of those countries, especially developing countries, whose economies are particularly dependent on fossil fuel production, use and exportation, as a consequence of action taken on limiting greenhouse gas emissions".
http://unfccc.int/essential_background/convention/background/items/2853.php.
[19] It is also possible to account for the distribution of the impacts of climate change under burden sharing. However, to avoid the implication that the victims of climate change should pay more because they will benefit most from mitigating climate change, we suggest it is probably the difference between those who bear the brunt of the impacts and their ability to pay to mitigate that should be taken account of. Hence, funding for adaptation to the impacts of climate change, is discussed separately in Chapter 26.
[20] Ringius *et al*. (2000) p 10.

suggests distribution on an equal per capita basis, whereas the historical approach might suggest that countries with similar economic circumstances have similar emissions rights and responsibilities.

There is no single formula that is likely to capture in a satisfactory way all relevant aspects of an equitable distribution of effort between countries across the various dimensions and criteria[21] – but the criteria tend to point in similar directions.

The correlation between income or wealth and current or past emissions is not exact, but it is strong. This means that equity criteria tend to lead to fairly similar policy approaches: as Ringius *et al* note, "we are in the fortunate situation that all the …equity principles to a large extent point in the same direction"[22]. This can be demonstrated empirically.

Box 22.2 describes the work of Höhne (2006), who show that the impact of the methodology used to distribute initial mitigation obligations tends to be overridden by the powerful influence of the stabilisation goal on the level of effort required within an international framework for emissions reductions. The results indicate that emissions reductions of 60-90% on 1990 levels by developed countries would be required to meet a stabilisation range between 450 and 550ppm CO2e.

In the end what matters is that total global effort matches the scale of the problem, that the parties perceive the distribution of effort to be fair, the accompanying goal of efficiency is not prejudiced, and public opinion across a wide range of countries is able to sustain co-operation on those terms over a long period.

Box 22.2 The effect of stabilisation goals and allocation formulae

Höhne (2006) has compared the effect of the choice of stabilisation goal against different allocation methodologies on the distribution of quotas for emissions reductions between countries. They consider four allocation methodologies:

Convergence and contraction: Emissions in developed countries contract over time to allow emissions from developing countries to converge to a global equal per capita emissions level. This reflects the 'growth-needs' approach.

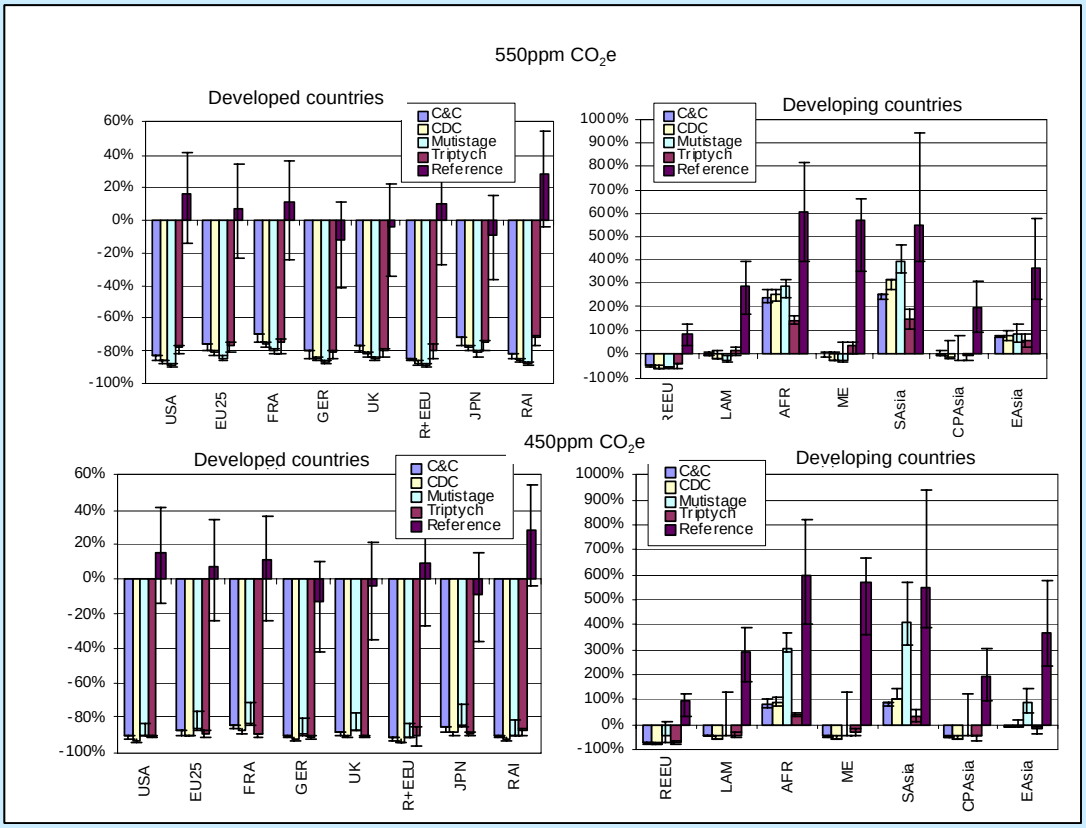
Common but differentiated convergence: Developed countries' per capita emissions converge to a low level. Developing countries' per capita emissions converge to the same level over the same time period – for example with no commitments or no-lose targets, but decrease after their per capita emissions are a certain percentage above or below the (time dependent) global average. This also reflects a combination of the 'growth-needs' and 'ability-to-pay' approaches.

Triptych: This takes into account differences in national circumstances relevant to emissions and emission reduction potentials. It was the model used for the EU's burden sharing agreement. It could be designed to reflect the 'growth-needs' approach, but it could equally compensate heavy emitters that might have difficulties in adjusting to mitigation policy.

Multi-stage approach: Countries would start at and move between different types and levels of commitment, depending on indices such as per capita emissions levels, income, and so on. For example, here 4 stages are used: 1) no commitments; 2) incorporating climate change objectives within sustainable development policies, 3) commitments to moderate absolute limits on emissions – e.g. set above the starting year but below business as usual, and 4) absolute reduction limits.

[21] Ashton and Wang (2003).
[22] Ringius *et al* (2000) p. 29.

The four graphs below show the results for both developed and developing countries or regions of 450ppm CO_2e and 550ppm CO_2e stabilisation goals combined with the four methods for sharing out the emissions reductions – here illustrated relative to 1990 levels alongside a reference scenario of business as usual emissions[23]. They do not incorporate international emissions trading. The results show that for developed countries, it is the overall stabilisation goal that is the main driver of the effort required – for all developed countries, action to meet a 450ppm CO_2e goal would require quotas to be set in line with a reduction in emissions of 70-90% on 1990 levels by 2050, and for a 550ppm CO_2e goal the reduction would be at least 60%. It is a similar story for the middle-income economies of Latin America, Central and East Asia and the Middle East, where all methodologies allow for a modest increase or very small decrease over current emissions by 2050. For Africa and South Asia, where both income and per capita emissions are currently very low, the allocation methodology makes a significant difference. Africa and South Asia have the greatest allocation under the methodologies that most closely relate to the 'ability-to-pay' equity criterion.



22.4 Putting efficiency and equity together: The experience of Kyoto

A global carbon price applied to emissions from all countries and sectors allows for efficient mitigation, and flows between countries allow for an equitable division of effort. Creating a framework that provides for both an efficient and equitable response is an urgent challenge for international collective action. This section explores how economic analysis might guide the development of such a framework for mitigation, starting with an evaluation of the current multilateral framework.

[23] Error bars show the spread using different reference scenarios.

There is much to learn from the experience of implementing the Kyoto Protocol, and important opportunities to go beyond it in designing future international co-operation.

The Kyoto Protocol is an innovative attempt to apply emissions trading in the context of international collective action between sovereign states. Participating countries from Annex 1 (developed nations) have agreed to differentiated, legally binding commitments to reducing their overall emissions of a basket of six greenhouse gases by at least 5 per cent below 1990 levels over the first commitment period from 2008 to 2012. As such, an overall quota, or quantity ceiling, has emerged. Within their national limits, countries are free to choose how best to deliver emission reductions nationally.

The Protocol created flexible mechanisms to enable Annex 1 Parties to meet their commitments efficiently. International Emissions Trading (IET) allows trading of national quotas or allowances between countries. The Kyoto Protocol has provided the framework within which the EU has developed its cross-border private sector Emissions Trading Scheme (the EU ETS[24]), allowing over 11,000 energy-intensive installations in 25 countries to co-operate in reducing emissions.

Two further mechanisms, Joint Implementation (JI) and the Clean Development Mechanism (CDM), allow credits from emission reducing projects in one country to be used to meet another country's Kyoto commitment. Under JI, projects can be hosted in developed countries, and under CDM, in developing countries. Governments in Japan and Europe, for example, are expected to purchase CDM credits, and the EU ETS allows private sector participants to purchase credits generated from CDM and JI activities. In the period to 2012, projects generating credits for over 1 billion tons CO_2e are already in the pipeline, meaning the CDM is likely to provide between $5 and $15 billion in additional funding for mitigation in developing countries. CDM finance can also leverage new private and public investment, estimated at 6 to 8 times the amount of CDM finance[25].

The Protocol has also established the institutional basis for monitoring, reporting and verifying emissions, as detailed in Box 22.3. It also has a formal compliance mechanism to discourage free-riding, containing three specific sanctions to be enforced by all Parties to the Protocol. First, there is a requirement to make up the amount required by the first commitment and incur a penalty of an additional 30% limit on top of their second commitment – this is essentially an interest rate on borrowing. Second, there is a requirement to develop a compliance plan of action – which provides an opportunity for international and national scrutiny of the adequacy of policy measures in place to identify ways of coming back into compliance in future periods. Third, there is suspension of eligibility for trading – which makes it harder for a country to meet its objectives in a cost-effective way, and may create difficulties for governments where businesses have invested in trading and parliamentary majorities are in favour of action to reduce emissions.

[24] Discussed in detail in Chapter 15
[25] Ellis et al. (2004).

Box 22.3 The institutions and processes set up under the Kyoto Protocol

- The Kyoto Protocol provides for detailed reporting and accounting for emissions and emissions allowance allocations within Annex I, and less onerous reporting and review obligations for non-Annex I parties.

- Prior to each 'commitment' period over which emissions reductions will be made, parties are required to submit initial reports establishing their 'Assigned Amount' – the emissions a country will be expected to emit over that period. If they exceed this they will have to purchase credits (allowances) from others that have emitted less than their assigned amount. Establishing an emissions inventory is crucial for this. International review teams review the reports and fix the amounts.

- Annex I parties must submit detailed annual emissions data on an annual basis in national inventory reports, with supplementary information on allowance holdings and transactions. Failure to submit annual reports and inaccuracy in reports can lead to suspension of eligibility to participate in the Kyoto mechanisms.

- Allowance holdings and transactions are monitored in real time by an electronic registry system comprising national registries, which are required to hold and record assigned amount information, as well as enforce detailed trading rules. Registries are linked to an international transaction log, which enforces transaction rules, and may suspend the operation of registries where consistent breaches of the rules have occurred. The CDM registry accounts for credits from projects in developing countries. Reports of the international transaction log are available to review teams in reviewing assigned amount information.

- At the end of the commitment period, following review of the inventory report for the final year, parties have a period of 100 days to ensure their assigned amount matches their emissions during the commitment period. Information on reconciliation, compilation of annual emissions and assigned amounts are forwarded to the compliance committee for final assessment.

The Kyoto Protocol has been criticised on several grounds. However, Kyoto has, to its credit, established an aspiration to create a single global carbon price and implement equitable approaches to sharing the burden of action on climate change.

Criticisms of the multilateral approach adopted through Kyoto can be organised around three particular issues – incentive compatibility, the time horizons and ambition of commitments, and limited participation.

Analyses of international collective action, including those discussed in Chapter 21, point to the weakness of international law in enforcing obligations between sovereign states[26]. Governments can, if they choose, easily renege on their commitments, and they are more likely to do so if these commitments are not in line with widely adopted norms of international behaviour and with the commitments of key trading partners. International agreements that are not compatible with the underlying incentives of the participants are unlikely to succeed in creating significant changes in national action.

[26] For example, Victor (2001); Schelling (2002); and Barrett (in press).

The Kyoto Protocol has a number of specific sanctions for non-compliance, but these are enforceable only where a government chooses to remain within the framework of the Protocol[27]. A country that exceeds its quota of emissions in the first commitment period can be suspended from eligibility for trading, and is required to make up its commitment and pay a penalty within the following commitment period. The suspension of eligibility to trade would be a significant concern for countries that wish to remain within the trading system and have a small variance from their limits to account for[28]. However, the second sanction creates an incentive for those countries that are not in compliance with their first phase limits to seek an alternative basis for any arrangements for future action[29]. Furthermore, the ratification threshold for the Kyoto Protocol is sufficiently high that a very small number of key countries can block the agreement of a second commitment period.

We discussed both the role of compliance mechanisms and how to build credibility in Chapter 21.

The second issue concerns the time horizons for action under the Kyoto Protocol. Stavins (2005) has recently repeated criticisms that the Protocol aims to do "too little, too fast"[30], aiming for excessively costly short-term reductions in emissions, without determining what should be done over longer timeframes - where there is more flexibility to make reductions in line with normal cycles of capital stock replacement. At the time the first commitment period for the Kyoto Protocol was set as 2008 to 2012, in 1997, it provided a 15 -year window for action. However, the Protocol does not provide any guidance or formulae linking the action required in the first commitment period to an overall global quantity constraint or to long-term term timetable for emissions reductions. Coupled with the incentive compatibility problem described above, these issues mean that the Kyoto framework is not currently providing a sufficiently credible, long signal for countries or businesses to make long-term investments[31].

Finally, the Kyoto Protocol has been heavily criticised in some quarters for creating quantitative obligations only for the rich countries, without placing any constraints on emissions from the fast-growing emerging economies. The US and Australia have subsequently declined to ratify the Protocol, and a number of other countries are not taking strong steps to implement it. The developing countries did in fact take on obligations under the Kyoto Protocol, but these were unquantified and allowed climate change to be addressed as part of wider national policies on sustainable development. The CDM has been the mechanism by which non-Annex 1 countries have participated in formal action on climate change mitigation, but many non-Annex 1 countries already have policies in place – taxes, renewable energy and energy efficiency goals - that discourage carbon emissions that are not recognised as climate change commitments in the framework. Furthermore, the CDM has important limitations that are considered further in Chapter 23 – not least that credits are currently generated by offsetting against a business as usual baseline rather than by reductions below the baseline. Given the limited nature of participation in the first commitment period, the Kyoto Protocol has not in practice introduced a global price for carbon.

Nevertheless, the concepts underlying the Protocol – in particular, the aspiration to create a single, efficient carbon price across countries through the use of emissions trading and the recognition that mechanisms are required to make finance and technology available to poor countries on the basis of equity – are very valuable. These are elements to be strengthened within any future regime for action on climate change.

[27] Alternative approaches to compliance were considered, such as the option of a compliance fund, but they also have drawbacks. See Wang and Wiser (2002) and Rolfe (2000).
[28] Going even further, Hovi & Kallbekken (2004) suggest that where a country may have a major role in supplying credits in the system, their suspension from trading would create perverse incentives, by raising the price of permits for the countries that must enforce the sanction. If the latter countries would suffer significant harm by doing so, suspension may not be credible.
[29] On the other hand others such as Rolfe (2000) have suggested the implied 30% interest rate on borrowing is low, so it is not a sufficient deterrent to non-compliance.
[30] Stavins (2005).
[31] Barrett (in press): p 6.

There are strong practical reasons to build on the achievements of Kyoto in the next round of negotiations, whilst exploring ways to learn from other approaches and to increase the breadth and depth of international co-operation for climate change.

The Kyoto Protocol can be seen as a first stepping-stone on the path to international co-operation on climate change, given political, economic and scientific realities[32]. The institutions, mechanisms and guidelines developed under Kyoto represent an enormous investment of negotiating capital. They reflect a fine balance between the interests of over 130 countries. It is not obvious that starting from scratch with an entirely new approach would produce a more effective regime, and it could take many years for the shape of a new approach to emerge. Building on existing principles and established institutions, for example those described in Box 22.3, also helps to reduce uncertainty for investors about the intended direction of international climate policy, as well as to enhance trust between parties.

For countries that are willing to work within Kyoto, the institutions provide the framework within which to negotiate on future ambition that supports deep and liquid cross-border carbon markets. However, given the scale of action required to mitigate climate change, as we have emphasises throughout this Review and clearly demonstrated in Chapter 21, action taken by those countries that have signed up to Kyoto is necessary but is not sufficient. There are two aspects of the solution to this issue. First, as we have suggested in Chapter 21, transparent and comparable frameworks provide a way to benchmark a range of dimensions of effort between countries that prefer to work outside and within Kyoto. Second, it is important to build the kinds of institutions that enable Kyoto and non-Kyoto Parties as well as sub-sovereign bodies to engage in mitigation. We explore these types of institutions further below.

22.5 Building on national, regional and sectoral carbon markets

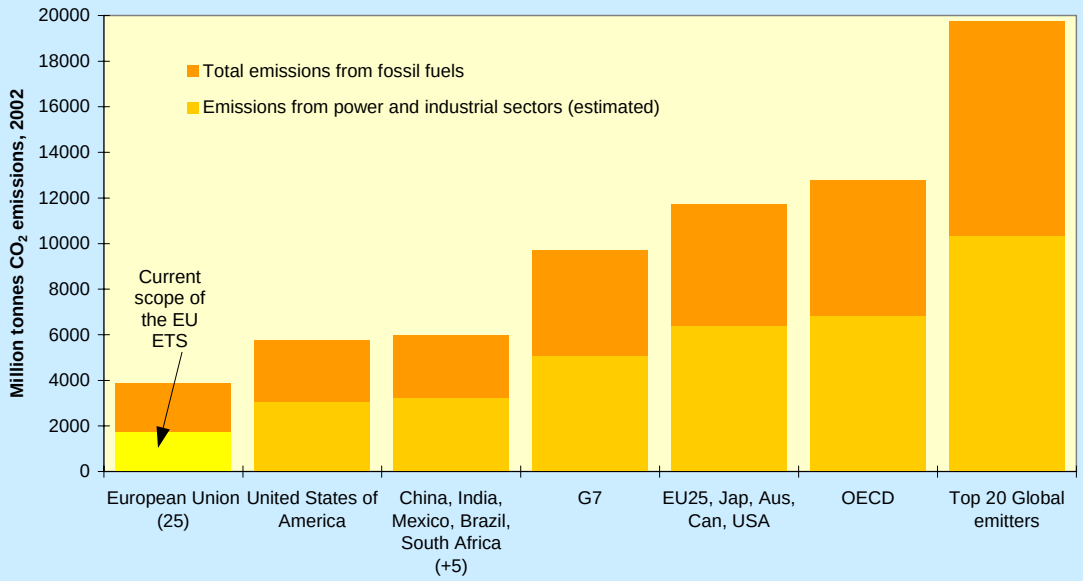
The scope for expanding private sector emissions trading markets is high, and can generate large flows globally.

Only a small portion of global emissions are currently covered by emissions trading schemes. The largest existing emissions trading scheme is the EU ETS. If trading expanded in future, for example, to cover the power and industrial sectors[33] in Australia, Canada, the EU, Japan and the USA, emissions trading would grow to 2.5 times the size of the current EU ETS. Expanding further to include all of the top 20 global emitters – a relatively small number of jurisdictions, which together account for almost 80% of global CO_2 emissions – would raise coverage by almost 5 times. This is shown in Figure 22.1[34].

An emissions trading market of the size of 5 times the current EU ETS would create allowances that could be worth between US$87 and US$350 billion[35]. These values are a function of the carbon price – which, as explained in Chapter 14, is determined by both marginal abatement costs in the covered sectors and the scarcity of allowances within schemes (i.e. the stringency of the overall cap on emissions within the scheme).

[32] Frankel (in press).
[33] These are the sectors currently covered by the EU ETS.
[34] This figure shows energy emissions only. We examine GHG emissions from land use change in Chapter 25.
[35] Assuming carbon prices of between $10 and $40. World Bank and IETA (2006).

Figure 22.1 Scope of an international trading market in energy CO_2 emissions[36]



Expanding and linking regional emissions trading schemes globally will raise the scope for cost-effective emissions reductions.

As discussed in Chapter 15, an efficient and equitable framework for international collective action requires a broad, deep and liquid market for carbon, covering the major emitters and operating with transparent rules. This emphasises the importance of an increase in the size and scope of emissions trading markets globally. This can occur when an existing scheme expands to incorporate new regions, through the merger of separate schemes, or through various approaches to linking, whereby several existing schemes may meet key criteria or develop harmonised rules for mutual compatibility.

Chapter 15 introduced several emissions trading schemes that have already been established or are planned in countries and regions across the globe. They vary in size, scope and characteristics. For example, the Chicago Climate Exchange (CCX) is a voluntary scheme. The proposed Regional Greenhouse Gas Initiative (RGGI) will only cover emissions from the power sector. The current UK Emissions Trading Scheme covers non-CO_2 and both direct and indirect CO_2 emissions. Some schemes may apply price caps, others may have differing penalties for compliance. The time periods for commitments also vary, often to reflect national circumstances. Creating a single scheme would entail considerable changes to harmonise these conditions.

Linking, although less efficient than a single global scheme, can nevertheless be very useful. For example, a small new scheme may see linking to an established scheme as a short-cut to establishing credibility and price stability. Links are already being made between existing schemes. For example, the EU ETS allows the use of project credits created by the Kyoto Protocol, and some non-Kyoto parties, including the CCX, also permit purchases of these credits. Box 22.4 describes another recent development.

[36] Data taken from the World Resources Institute CAIT database.

Box 22.4 UK-California announcement on climate change and clean energy collaboration

On 31 July 2006, the UK and California issued an announcement on climate change and clean energy. The mission statement includes a commitment to "evaluate and implement market-based mechanisms that spur innovation … (and) evaluate the potential for linkages between our market-based mechanisms that will better enable the carbon markets to accelerate the transition to a low carbon economy".

California is currently developing specific proposals for a cap-and-trade scheme as part of its goal to reduce emissions 25% by 2020. The EU Linking Directive does not currently allow the EU ETS to be directly linked to schemes in countries that have not ratified the Kyoto Protocol or to sub-sovereign schemes. In the interim, one-way linking could occur through access to a common pool of offset credits from the Kyoto project mechanisms.

The key issue for efficient markets when expanding and linking schemes is that caps are stringent and in line with shared international goals.

There are a number of policy issues that, although they may not have to be clarified in order to physically or feasibly link, tend to affect the desirability of linking, and therefore are important to overcome first[37]. The expansion or linking of trading schemes is particularly suited to situations when countries are willing to agree overall emissions limits as part of a negotiated international framework, since this encourages transparency and compatibility of emissions trading caps and provides the building blocks for key harmonisation criteria[38]. As Chapter 15 has suggested, the experience of implementing the EU ETS suggests that agreement on overall national emissions limits that are broader than the scope of the trading scheme allows governments considerable flexibility in determining the stringency of national allocations for sectors covered by emissions trading schemes. This can result in concerns about competitiveness and gaming that may undermine the effectiveness of the scheme. It could therefore be effective for international negotiations to focus directly on the stringency of emissions trading schemes.

In terms of harmonisation criteria, it is possible to link even if there are different *types* of emissions caps (such as absolute targets, or relative intensity targets[39]), safety valves, differing permitted use of offset credits, allocation methodologies, and differing financial penalties for non-compliance. However, such differences can make the environmental effectiveness of the schemes difficult to compare as well as lead to unintended transfers between countries. Significant shifts in exchange rates could also impact on the price of allowances, increasing volatility. There are solutions to these issues such as allocating *ex-post* rather than *ex-ante*, but these tend to increase the complexity and reduce the efficiency of schemes.

If expansion or linking is not well managed there may be negative impacts. For example, a scheme with an uncertain or unconstrained volume of allowances that can be purchased from outside the trading scheme's coverage over a relatively short time may cause price volatility. The process of linking schemes itself may cause price instability because of the introduction of uncertainty about the impacts of linking. Expansion and linking therefore require transparent negotiations and terms of agreement in advance of trading periods. This means new trading schemes should consider compatibility carefully, ideally mirroring, and influencing, as many of the features of existing schemes they wish to adjoin.

[37] Ellis & Tirpak (in press).
[38] Blyth and Bosi (2004).
[39] These are discussed further below.

Sectoral approaches can introduce carbon pricing in sectors that are appropriate for early trading, to accelerate the movement towards global carbon markets, as well as overcome perceived competitiveness impacts.

Sectoral approaches can be used as a transition to introducing carbon markets throughout the global economy, and Chapter 15 has suggested some important reasons why certain sectors might be particularly suited to early trading. They can incorporate different levels of commitment and can be used at the multilateral or national level. Emissions intensities within sectors often vary greatly across the world, so a focus on transferring and deploying technology through sectoral approaches could reduce intensities relatively quickly, and could make it easier to fund the gap between technologies that developing countries can afford and existing cleaner technologies that the developed world is already adopting. Also, global coverage of particular sectors that are internationally exposed to competition and produce relatively homogenous products can reduce the impact of mitigation policy on competitiveness. Box 22.5 describes a global initiative already in place in the cement sector.

Box 22.5 Cement Sustainability Initiative[40]

Cement is one of the most energy-intensive industries. The World Business Council for Sustainable Development has developed the Cement Sustainability Initiative, with the participation of 17 companies with manufacturing facilities in Europe, the USA, India, SE Asia and Latin America. They are responsible for more than 50% of cement manufactured in the world outside China. Variations of energy use between countries shows clear scope for emissions reductions.

Through the CSI, the companies have developed common standards for monitoring and reporting CO2 emissions, and pledged to set their own targets for reducing emissions per unit of output, and make progress reports available to the public. They have also developed guidelines to spread best practice throughout the industry. The CSI includes companies from countries not covered by targets under the Kyoto Protocol. Some have expressed strong support for a worldwide sectoral approach for their industry. Participation allows companies to explore how such a scheme would work.

There are two important drawbacks to sectoral approaches. First, focusing on a few sectors may neglect emissions from other sectors that have lower abatement costs, thereby sacrificing 'where' flexibility. It may also lead to inefficiency by having different implicit carbon prices across sectors. This is more likely if just a few sectoral agreements are adopted. Second, there is potential for 'leakage' of emissions to sectors not included in such agreements if sectors are poorly defined, for example, if the agreements cover particular products but not their close substitutes. But even narrow coverage can make a large difference. For example, the Center for Clean Air Policy proposal for a sectoral scheme for power and industrial emissions from the ten highest emitting developing countries would cover around 30% of developing countries emissions[41].

Several variants of sectoral approaches are possible, and include harmonised sectoral taxes and sectoral trading. The latter, as for other trading schemes, requires agreement of an initial goal or cap for the sector, with *ex-ante* provision of allowances at this cap, accompanied by a compliance mechanism to create a penalty for underachievement. The development of sectoral benchmarks – more generalised baselines or standards applicable to multiple projects in the same sector – can also be used to generate credits by sectors that beat performance against the agreed benchmarks. Sectoral approaches could also be designed around the phase-out of old technologies or phase-in of new, low-carbon or efficient technologies. Developing countries may

[40] www.wbcsdcement.org.
[41] Excluding emissions from land use, land use change and forestry. Schmidt et al. (2006).

be particularly interested in participating in such schemes where they offer an effective way to attract large-scale financing for sectoral reform, or incentives such as voluntary or no-lose targets.

A key issue is the degree of international negotiation that may be required to determine appropriate benchmarks, but sectoral agreements may offer the opportunity for firms in sectors to agree on emissions caps, taxes, benchmarks or standards amongst themselves. There are also methodological issues to consider, such as determining sector boundaries and baselines, but the approach itself can encourage development of relevant data and provide a step towards global sectoral trading. Some benchmarks for best available technologies in the electricity and industrial sectors have already been established by EU Member States for the purposes of the EU ETS, especially for new plant[42].

22.6 Building on common but differentiated responsibilities

Several types of commitment could be used to take into account equity concerns and widen participation in the international framework. Many are particularly applicable to developing countries.

In general, approaches to setting international emissions reductions obligations for trading schemes can be used to take account of countries' aspirations alongside key uncertainties. Emissions quotas can be set in relation to absolute emissions levels or per capita emissions levels, and these can be set in line with appropriately revised, credible long-term goals alongside rolling revision rules for flexibility. However, as explained in Section 22.4, and as the discussion in Box 22.2 illustrated, the methodology used to distribute emissions quotas has important implications for equity. Under a system based on trading of emissions permits, initial allocations reflect the level of responsibility that each country undertakes, rather than the actual emissions reductions required to be made by that country.

Pizer (2005) makes a case for emissions intensity targets indexed to economic growth. He suggests that relative or dynamic goals are more easily adjusted to levels that stop, slow or reverse emissions growth than absolute goals. As long as their limits are not revised, they can avoid penalising unexpectedly low economic growth and the decoupling of emissions from economic growth they aim at. Pizer also suggests that intensity targets are particularly suited to developing countries because they can alleviate concerns that economic growth will be stunted by taking on obligations to reduce emissions, and may reward middle income countries such as China that have high emissions intensity levels from which to descend.

There have been a number of proposals to build on equity considerations by taking into account developing countries' emissions reductions potentials, capacity to take action and development goals, and to provide positive incentives for their further participation in climate change mitigation.

As described in Box 22.2, a multi-stage or multi-track approach allows different types of participation depending on national circumstances[43]. Under these approaches, least developed countries would not be required to make reductions in their emissions in the near-term, but could be supported in making the transition to low carbon development paths either through direct financial flows, the use of flexible mechanisms, or allocations of quotas in excess of likely requirements. For middle-income and rich countries, a range of graduation criteria have been proposed that rely on indices including per capita income and emissions. Graduation criteria can allow countries to make the transition from, for example, project-based mechanisms to eligibility to participate in international emissions trading. This can also provide a useful compliance mechanism – for example, eligibility for project mechanisms could be withdrawn if a country does

[42] For example, UK benchmarks developed for over 20 categories of new entrants to Phase II of the EU ETS are available at: http://www.dti.gov.uk/energy/environment/euets/phase2/new-entrants/benchmarks-review/page29366.html.
[43] See Hohne (2006) and Den Elzen *et al.* (2006).

not introduce its own mandatory national policy frameworks for emissions trading once it has passed a graduation threshold[44].

Participation in emissions trading can also begin from 'no-lose' commitments. These are 'one way' commitments that provide a clear incentive for developing counties to make efforts to reduce their GHG emissions. They would allow developing countries to benefit from selling the emissions credits they generate for performance beyond an agreed limit (which could be either absolute or relative), but there would be no penalty for under-achievement. The concept could also be applied on a sectoral basis. However, it remains essential that some countries or sectors within the system have binding limits, in order to generate demand for surplus credits.

Positive recognition of developing country policies that generate emissions reductions alongside other goals may build trust.

The concept of giving formal recognition to sustainable development policy and measures (SD-PAMs) has attracted increasing attention from developing and developed countries alike. An SD-PAM would be a voluntary or mandatory commitment to implement a policy or measure that makes the development path of a country more sustainable, with the co-benefit of lowering GHG emissions, many of which were identified in Chapter 12. In this way it fits well with a development-centred approach to climate change mitigation[45].

SD-PAMs would increase the visibility of a wide variety of policies that are already being implemented in developing countries that tackle both sustainable development and climate change mitigation objectives, and this is something that has been missing from the international framework so far. The approach therefore provides a quantifiable alternative to emissions reductions obligations. Quantification of sustainable development and mitigation benefits of policies would help countries to identify future strategic opportunities for those PAMs that will reduce the growth of GHG emissions and meet their own national goals, as well as to compare effort across their peers. The World Resources Institute[46] has already begun to develop a database to record SD-PAMs. This might also facilitate international exchange of expertise and best practice, linking well to wider system of measures of effort suggested in Chapter 21.

Incentives to encourage the take up of SD-PAMs may be necessary, although that would intensify the importance of demonstrating that SD PAMs do provide emissions reductions over and above the emissions that would have occurred without the measure[47], as well as defining to whom they may apply, and making efficient links to existing carbon markets. SD-PAMs could also be a key method of combining and enhancing other funding sources that were previously devoted exclusively to climate or non-climate policies or measures, and attracting public as well as private investment.

There will be important issues to overcome before SD-PAMs are acceptable by developed and developing countries. Most importantly, numerous types of national policies could be covered by such an approach, and they could be complex. It would also be important to create a monitoring or review process to assess progress made against SD-PAM objectives. Pilot schemes would help clarify their applicability to key policy areas as well as the methodological issues.

[44] Michelowa et al. (2005).
[45] See Winkler et al. (2002) and Bradley and Baumert (2005).
[46] The World Resource Institute has a work program to explore and define the SD-PAMs approach; look at specific SD-PAMs in detail; provide tools and analysis to assist those working on such policies and measures; and outreach activities to help policymakers incorporate SD-PAMs into international negotiations. A pilot database of SD-PAMS is available on-line at www.wri.org.
[47] I.e. some level of 'additionality'.

22.7 Challenges of extending international co-operation to aviation and shipping

Extending the coverage of carbon pricing and other measures to international aviation will become increasingly important

Globally, international aviation emissions – defined as emissions from any aircraft leaving one country and landing in another – are about twice as great as domestic aviation emissions. As set out in Chapter 15, the impact of aviation on climate change is also higher than the impact of its CO2 emissions alone. Aviation has negative local impacts on noise, local air quality, biodiversity, and local climate impacts, for which local policy interventions (such as regulation on noise levels) can be used.

However, there is currently no incentive to reduce international aviation emissions, as only emissions from domestic flights are currently allocated to any country within national emissions inventories. Furthermore, many large international markets are outside the current Kyoto obligations framework. However, the industry is growing fast, and people with lower incomes, especially in developed countries, are now able to travel globally due to low-cost flights. Many national policy measures such as landing charges tend to be blunt instruments for cutting carbon emissions. However, differentiating them, for example, by length of flight or distance travelled, could improve their effects on reducing emissions.

International coordination on reducing emissions from aviation is important, for example, to avoid leakage of mitigation policies from travellers switching to different carriers, or air carriers changing their routes, or practices such as 'tankering' (i.e. carrying excess fuel on planes to avoid refuelling at airports where fuel taxes are levied). The UNFCCC has requested the International Civil Aviation Organisation (ICAO) to take action on aviation emissions, recognising that a global approach is essential. ICAO has established a Committee on Aviation Environmental Protection (CAEP), part of whose work plan relates to climate change emissions. Current tasks include developing guidance for states wishing to take forward emissions trading schemes, and developing a better understanding of the potential trade-offs between improvements in CO2 emissions and the effect on other environmental impacts. However, these measures do not, of themselves, regulate emissions.

The issue of aviation causing higher climate change impacts than simply that from its CO_2 emissions could be tackled by setting high carbon taxes on aviation. However, we noted the particular difficulty of co-ordinating international taxes in Chapter 15. The ICAO has recently endorsed the concept of an ETS for aviation, while the EU is currently developing a draft Directive to include aviation in the EU ETS. The EU Environment Council has suggested some preliminary guiding principles to be taken into account for its inclusion, so that it is a workable model that can be replicated worldwide. For example, coverage must be clear (options include domestic, intra-EU, all flights leaving or landing in the EU), trading entities should be air carriers and aircraft operators, and the allocation methodology should be harmonised at EU level. As suggested in Chapter 15, auctioning allowances would also raise revenue and increase the speed of adjustment to carbon markets. To account for the complete impacts of aviation within an ETS, some form of discounting could be used, analogous to the global warming potential factors that are used to convert GHG emissions to CO_2 equivalent emissions. Alternatively, combining emissions trading with a tax could provide extra revenue. This could provide strong incentives to innovate to reduce emissions within the sector, including in airframe efficiency, engine manufacture, airport operations, and air traffic management.

The international co-ordination of standards, including through voluntary approaches, is also an important measure. Existing international co-operation under the Advisory Council for Aeronautics Research in Europe (ACARE) requires new aircraft produced in 2020 to be 50% more fuel efficient per seat kilometre relative to their equivalents in 2000. As the target refers to new

aircraft produced in 2020, it will take time for the fuel efficiency of the whole fleet to improve because of the long lifetime of aircraft. The ACARE target does provide some degree of challenge – in order to meet it, some technological breakthroughs will have to be achieved. The targets are broadly on track to being met. ACARE is an EU body, but the target is likely to have a significant impact on fuel efficiency internationally because aircraft manufacturers will want to keep up with fuel efficiency standards. In the US, the National Aeronautics and Space Administration (NASA) have set similar goals.

Complementary measures to trading and standard setting include co-operation on technology, sharing best practice in ground operations, and realising the potential to reduce emissions through enhanced air traffic management improvements.

Extending the coverage of carbon pricing to international shipping has been slow, but is likely to increase in momentum

Discussions on tacking the climate change impact of the international maritime industry are at a very early stage. The International Maritime Organisation (IMO) Assembly in December 2003 urged its Maritime Environmental Protection Committee (MEPC) to identify and develop the mechanism or mechanisms that can achieve the limitation or reduction of GHG emissions from international shipping, and asked for the evaluation of technical, operational and market-based solutions to limiting the GHG output of maritime transport.

The UK, under the lead of the domestic Maritime and Coastguard Agency (MCA), has been pushing the IMO to consider a full range of technical, methodological and market-based options for controlling maritime transport's emissions of GHGs, particularly CO2. Discussions are continuing on the feasibility of the EU incorporating this sector into the EU ETS as a demonstration not only of the seriousness with which the EU views this issue but also of the effectiveness of emissions trading as a control measure.

22.8 Interactions with the international trade regime

The international trade regime offers one route to handle large disparities in levels of carbon pricing between major economies.

Some economists[48] have analysed the potential to use the international trade regime to respond to significant differences in the level of carbon prices applied in different economies. Countries could in theory impose a border tax on imports from countries with lower carbon prices – to correct for the under pricing of carbon in the country of origin. This could overcome carbon leakage or competitiveness concerns by reducing the incentive for domestic production to relocate abroad, and could increase the incentives for other countries to adopt similar measures to reduce GHG emissions. There is a clear logic here.

There has been a long-standing debate about whether border tax adjustments in response to carbon price differentials would be legal under World Trade Organisation (WTO) rules. Since the early 1980s, several cases have been brought to the General Agreement on Trade and Tariffs (GATT) and the WTO that have implications for environmental measures or human health-related measures[49]. In particular, the 1998 ruling on the 'shrimp-turtle' case[50] can be used to suggest that, as long as border adjustments or regulations on greenhouse gas intensity of the production process are carried out in a non-discriminatory way, they are likely to be permitted.

[48] For example, Brack (1998), Frankel (2004) and Stiglitz (2006).
[49] They are listed and described at http://www.wto.org/english/tratop_e/envir_e/edis00_e.htm.
[50] United States—Import Prohibition of Certain Shrimp and Shrimp Products, WTO Doc. WT/DS58/R (panel report May 15, 1998), excerpted in 37 ILM 832 (1998); United States—Import Prohibition of Certain Shrimp and Shrimp Products, WTO Doc. WT/DS58/AB/R (Appellate Body Oct. 12, 1998), 38 ILM 118 (1999).

Adjustments to take account of carbon price differentials could also occur if exporter countries voluntarily impose export restraints within bilateral or multilateral agreements. For example, after the abolition of a global quota system, China had offered to raise its export tariffs and reduce export tax rebate rates to help manage the entry of their textiles into the EU and US markets. Under this arrangement, the revenues would have been paid to the Chinese government but EU and US producers would have been protected from high competition from abroad[51].

Notwithstanding the logic of trade measures, their potential misuse could have serious consequences for international relations and future co-operation.

As we have demonstrated in Chapter 12, the competitiveness impacts that underlie these arguments for adjustments should not be overplayed. Those findings also mean that, for many goods, given their cost structures, such border adjustments may not change patterns and trends of international trade significantly. However, border tariffs or similar measures to adjust for carbon price differentials could be undesirable for the following reasons:

- Barriers to trade are inefficient. The removal of trade barriers allows countries to develop comparative advantage in production. Therefore, even if effective, they are clearly second best to implementing a similar carbon price across the global economy.

- There would be technical challenges, whether border adjustments are set nationally or multilaterally, as the current structures of cross-border levies and subsidies are extremely complex.

- If the measures are effective, they could have detrimental effects on developing countries with high export dependency on carbon-intensive goods. In Chapter 23 we examine the transition to low-carbon economies in developing countries.

- The measures could become a pretext for other measures that are essentially protectionist and support inefficient industries. This has been the danger of imposing non-tariff barriers, such as phytosanitary standards, that can be used to deny entry of exports from developing countries into rich countries.

- Such measures could make it considerably more difficult to build the trust necessary for future international co-operation.

Nevertheless, there remains the risk that in the face of significant and long-running divergences in levels of carbon pricing across borders, industry will lobby for the implementation of these measures. Chapter 23 explores how the *removal* of trade barriers could be used to encourage mitigation, particularly in developing countries.

22.9 Conclusions

A broadly similar global carbon price is an essential element of international collective action to reduce greenhouse gas emissions. Creating this price signal, through international frameworks and through a range of regional and national policy instruments, is an urgent challenge.

The most important test for the international community will be to reflect the scale of action required sufficiently within their commitments. Approaches to equity can aid this process, but action from all countries is pressing.

[51] See Mueller and Sharma (2005), at http://www.scidev.net/content/opinions/eng/trade-tactic-could-unlock-climate-negotiations.cfm.

Some elements of a potential future framework are becoming clear. The early formation and experience gained from the EU ETS, and the decisions by California and others to establish regional trading schemes strongly suggest that deep and liquid global carbon markets are likely to be at the core of future co-operation on climate change. Stronger international coordination as these schemes emerge, incorporating new sectors globally, will greatly increase their capacity to support an efficient and equitable response to climate change.

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