

Controlling Climate Change

Bert Metz



CAMBRIDGE

CAMBRIDGE

www.cambridge.org/9780521764032

Controlling Climate Change

BERT METZ



CAMBRIDGE UNIVERSITY PRESS
Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore,
São Paulo, Delhi, Dubai, Tokyo

Cambridge University Press
The Edinburgh Building, Cambridge CB2 8RU, UK

Published in the United States of America by Cambridge University Press, New York

www.cambridge.org

Information on this title: www.cambridge.org/9780521764032

© Bert Metz 2010

This publication is in copyright. Subject to statutory exception and to the provision of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published in print format 2009

ISBN-13 978-0-511-67661-1 eBook (NetLibrary)

ISBN-13 978-0-521-76403-2 Hardback

ISBN-13 978-0-521-74784-4 Paperback

Cambridge University Press has no responsibility for the persistence or accuracy of urls for external or third-party internet websites referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

What is covered in this chapter?

Is international cooperation to address climate change a matter of sharing a common burden between countries or of maximizing the benefits of preventing climate change damages? The perspective taken determines to a large extent the shape of international agreements. This chapter discusses the current international arrangements and how they work. The Climate Change Convention and its Kyoto Protocol in particular. It tries to make the complex international negotiation process and its outcomes understandable for non-specialists. It also discussed the ongoing negotiations on arrangements for the period after 2012, when the agreed actions under the Kyoto Protocol to reduce greenhouse gas emissions expire.

Will these negotiations result in aggressive action to curb emissions worldwide, so that the worst impacts can be avoided? Or will political differences and North–South tensions lead to a delay in ambitious action and serious damages in the long term? What are the key issues and what are the prospects for agreement? These are issues discussed in this chapter.

Why are international agreements needed?

Climate change is a typical example of a ‘global commons’ problem. Everybody on the planet benefits from a stable climate, but that can only be achieved if everybody participates. Not participating, i.e. leaving it to others to reduce greenhouse gas emissions and keep forests intact, is tempting: the contributions from most individual countries are small and no economic sector covers more than 25% of the total emissions (see Chapter 2). Many small contributors together are responsible for a large share of course, so international collaboration is vital. In addition, dealing with the unavoidable impacts of climate change on poor countries and common resources such as ocean ecosystems requires solidarity. International agreements can provide that.

There is another perspective to this however. More and more it becomes obvious that addressing climate change through emission reduction and adaptation is in a country’s self-interest. The damages caused by climate change are in most cases bigger than it

would cost to avoid them (see Chapter 3). And moving towards a low carbon economy provides huge benefits to most countries in terms of lower energy costs, efficient industrial production, improved energy security, cleaner air, and job creation (see Chapter 4 for an elaborate discussion). In that perspective international cooperation is a way to do all this much more effectively and efficiently by doing the cheap things first and by creating bigger markets for low carbon energy and products. Solidarity to deal with climate change impacts and adaptation remains important even in this perspective.

The perspective countries take determines the framing of international negotiations. Is it about sharing a common burden of dealing with climate change (with the incentive to minimize the contribution) or is it about benefiting from the opportunities of joint action (with the incentive to join such an agreement)? To be honest, in today's world the former is still the dominant view. And the dominant attitude is still to minimize contributions. Investments in low-carbon technologies are still seen as costs. Business associations still speak mostly for members that have to adjust their business and much less for companies that produce the efficient products and renewable energy. Politicians still listen predominantly to the voices of those that resist change. Things are changing gradually however. The financial crisis of 2008 may be sparking a rethinking of what sustainable economic development is.

The Climate Change Convention and the Kyoto Protocol: lessons learned

There is now an established set of international agreements to deal with the problem of climate change. In the first place there is the United Nations Framework Convention on Climate Change and its Kyoto Protocol. Related to these, but completely independent, are many other international agreements between states and/or private entities: agreements on R&D in the framework of the International Energy Agency, financial arrangements of multilateral development banks to invest in emission reduction projects, programmes to promote energy efficiency, renewable energy, CO₂ capture and storage and other mitigation technologies, as well as joint regional expert centres.

Climate Change Convention

The Climate Change Convention, officially called the United Nations Framework Convention on Climate Change (UNFCCC), was agreed upon in 1992 at the World Summit of Environment and Development in Rio de Janeiro. It had been negotiated in a period of about 2 years after the concern of scientists about the changing climate and the global impacts of it had convinced political leaders that it was time to act. The first assessment report of the Intergovernmental Panel on Climate Change (IPCC), published

in 1990 and the First World Climate Conference in Sundsvall, Sweden that same year galvanized those concerns. As a result the UN General Assembly in December 1990 decided to set up a negotiating committee to work out an agreement^{1,2}. This led to the UNFCCC that was agreed in 1992 and entered into force in 1994 after 55 Countries (representing 55% of industrialized countries' emissions) had ratified it (i.e. officially approved through their national parliaments or other mechanisms).

The UNFCCC is, as the title says, a framework agreement. It has only limited specific obligations to reduce emissions of greenhouse gases, but formulates principles, general goals, and general actions that countries are supposed to take. It also established institutions and a reporting mechanism, as well as a system for review of the need for further action. Over time it has received almost universal subscription³ (see Box 12.1).

Box 12.1

The United Nations Framework Convention on Climate Change (UNFCCC): key elements

Principles:

- 'common but differentiated responsibility'
- special consideration for vulnerable developing countries
- 'precautionary principle'
- 'polluter pays'
- promote sustainable development

Goals: the ultimate goal (article 2) is to 'stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved 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.'

Participation: almost universal (191 countries and the European Union, 1 September, 2008)

Actions required:

- Minimize emissions and protect and enhance biological carbon reservoirs, so-called 'sinks' (all countries); take action with the aim to stop growth of emissions before 2000 (industrialized, so-called Annex I countries)
- Promote development, application, and transfer of low carbon technologies; Annex I countries to assist developing countries
- Cooperate in preparing for adaptation
- Promote and cooperate in R&D
- Report on emissions and other actions (so-called 'national communications', annually for Annex I countries and less frequently for others)
- Assist developing countries financially in their actions (rich industrialized countries, so-called Annex II countries)

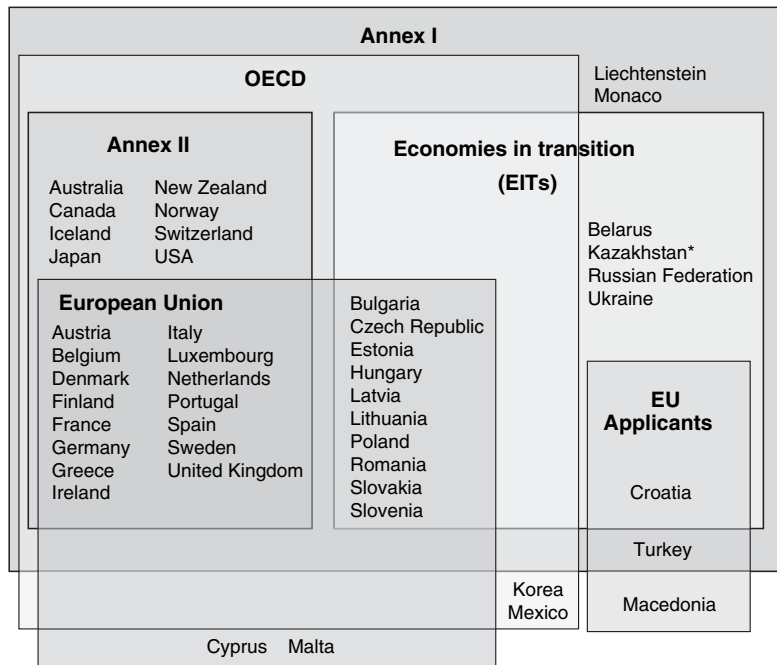
Compliance: Review of reports by the secretariat and by visiting expert review teams

Institutions:

- Conference of the Parties (COP), the supreme decision making body; voting rules for decisions never agreed so de facto decisions only by consensus
- Bureau (officials, elected by the COP, responsible for overall management of the process)
- Two Subsidiary Bodies (for Implementation and for Scientific and Technological Advice) to prepare decisions by the COP
- Financial mechanism, operated by the Global Environment Facility of Worldbank, UNDP and UNEP, filled by Annex II countries on voluntary basis; two special funds: a Least Developed Country Fund and Special Climate Change Fund, mainly to finance adaptation plans and capacity building, but also technology transfer and economic diversification
- Expert groups on Technology Transfer, Developing Country National Communications, Least Developed Country National Adaptation Plans
- Secretariat (located in Bonn, Germany)

Other elements:

- Requirement to regularly review the need for further action



*: Added to Annex I only for the purpose of the Kyoto Protocol at COP7

Figure 12.1

Country groupings under the UNFCCC, OECD, and EU.

Source: IPCC Fourth Assessment Report, Working Group III, figure 13.2.

The Annex I and Annex II countries are listed in Figure 12.1, together with other relevant groupings. Former Eastern European and former Soviet Union countries have a special status under the Convention as so-called ‘countries with economies in transition’.

Kyoto Protocol

At the first Conference of the Parties to the Convention in 1995 a decision was taken that further action was needed to address climate change. It was agreed to start negotiations towards a protocol (an annex to the Convention) that would commit industrialized countries (the so-called Annex I countries) to further reduce their greenhouse gas emissions. The industrialized countries had not yet done much in terms of emission reductions at the time. Therefore developing countries were deliberately exempted from further action in light of the ‘common and differentiated responsibility’ principle of the Convention. The USA explicitly agreed with that as one of the Parties to the Convention.

These negotiations led in 1997 to the agreement of the COP on the so-called Kyoto Protocol. It reaffirms in fact the basic agreement of the Convention and adds a number of elements: quantified emission caps for Annex I countries, so-called flexible mechanisms to allow for cost-effective implementation (emission trading between Annex I countries, a clean development mechanism on projects done in developing countries, and joint implementation on projects in Annex I countries), a compliance mechanism, and a new Adaptation Fund, which gets its funding from a levy on CDM projects (see Box 12.2).

Box 12.2

The Kyoto Protocol

Principles: same as the Convention

Goals: same as the Convention

Participation: 180 countries and the European Union (United States is not a Party)

Actions:

- Annex I countries together reduce emissions to 5% below 1990 level, on average over the period 2008–2012; specific emission caps for individual countries (see footnote 1)
- Option to use flexible mechanisms, i.e international trading of emission allowances (see footnote 2), or using the emissions reductions from projects in developing countries (through the Clean development Mechanism) or other Annex I countries (Joint Implementation)
- Option to develop coordinated policies and measures
- Strengthened monitoring and reporting requirements for countries with reduction obligations

Compliance: Shortage in emission reduction to be compensated in period after 2012, with 30% penalty

Institutions:

- COP of the Convention, acting as the Meeting of the Parties of the Protocol (CMP) as decision making body
- Use all other Convention institutions
- Compliance Committee, with consultative and enforcement branch
- Executive Board for the Clean Development Mechanism
- Joint Implementation Supervisory Committee
- Adaptation Fund, managed by the Adaptation Fund Board; administration by GEF and Worldbank; fund gets its money from a 2% levy on CDM projects

Other elements:

- Requirement to review the need for strengthening the actions

Footnote 1: see http://unfccc.int/kyoto_protocol/items/3145.php

Footnote 2: not to be confused with domestic emission trading systems as discussed in Chapter 11

The negotiating process

You may wonder how a negotiating process with 180 countries could ever produce a result. The secret is that countries operate in blocs. As in every UN negotiation developing countries coordinate positions in the so-called ‘Group of 77 and China’. Now being a group that consists of 130 countries, including China, their joint position on any issue has enormous clout. The country holding the Chair of the G-77 in New York (which rotates every year) often speaks for the G-77 and China as a whole. Because the group is so large and covers countries with widely varying interests, it is not able to formulate common positions on all issues. Then the so-called ‘regional groups’ become important. Under the Climate Convention these are Africa, (developing) Asia, Latin America (including Central America and the Caribbean), Eastern Europe, and the Western Europe and Other Countries Group (USA, Japan, Australia, New Zealand, and Western Europe). These groups are proposing candidates for official functions in the Convention (on a rotational basis) and coordinate positions (except for the Eastern Europe and WEOG groups because they coordinate in different subgroups). Cutting across these regional groups, and often more important when it comes to coordinating positions, there is OPEC (Oil Producing and Exporting Countries), the European Union (the 27 Member States), the Association of Small Island States (Pacific and Caribbean small islands), the Umbrella Group (a loose grouping of Australia, Canada, Iceland, Japan, New Zealand, Norway, the Russian Federation, Ukraine, and the USA), and the Environmental Integrity Group (Mexico, the Republic of Korea, and Switzerland).

In practice, these latter groups and the G77/China and small island states groups are the ones negotiating, reducing the number of players to a manageable number. In addition there are normally ‘friends of the chair’s groups’ on any important piece of negotiation, which allows bringing together the most important players to work out a compromise. By using ‘lead countries’ in the various groups for specific issues that

work in parallel, coordination within the groups and efficiency of the process is managed. And on top of that the practice is now very much to organize much of the actual negotiations through so-called 'contact groups', open meetings where the lead countries and other interested countries try to find compromises. Sometimes these are supplemented with 'informal meetings' that are only open to negotiators if it is important to discuss matters behind closed doors. Bilateral discussions and other ad hoc off line discussions, sometimes at the level of Ministers or Heads of State, complement the range of tools available.

This does not mean the negotiating process is simple. There are many issues to deal with and with a lot of discussions moving in parallel, crosslinks need to be looked after. Things come up that have not been properly coordinated, countries may suddenly go against an earlier coordinated position, and non-governmental organizations try to influence the negotiations by lobbying and by publishing rumours or positions taken.

For the negotiations on a new agreement for the period after 2012, additional arrangements have been made. They will be discussed below.

Why the USA pulled out of Kyoto

The USA agreed with the agreement reached in Kyoto in December 1997 after Vice-president Al Gore came personally to Kyoto to instruct the US negotiators to be more accommodating on the reduction targets for GHG emissions. As a result the USA agreed to reduce its emissions by an average of 7% below 1990 by 2008–2012. The European Union accepted –8% and Japan and Canada –6%. The USA got a lot of what it had asked for: a so-called basket of gases, allowing countries the flexibility to decide what kind of reductions they would prefer to meet their target; inclusion of afforestation and reforestation as a 'sink' for CO₂; and the so-called flexibility mechanisms that allow countries to trade emission allowances between them and to use investments in projects in developing countries to compensate for reductions they would not realize at home (through the so-called Clean Development Mechanism).

But this happened against the background of a strong anti Kyoto sentiment in the US Congress. In July 1997 the US Senate had adopted the so-called Byrd-Hagel resolution with a 95–0 vote, saying that the USA should only be part of a new Protocol if the US economy would not be harmed and, more importantly, also developing countries would take on emissions reduction commitments⁴. This was in direct conflict with the negotiating mandate that was agreed in Berlin in 1995 with US support. As a result there was no chance to get the Kyoto Protocol agreed in the US Congress, because the US Constitution requires international treaties to be approved by a 2/3 majority in the Senate. Nevertheless the Clinton Administration agreed with the outcome in Kyoto.

International negotiations under the UNFCCC continued after the Kyoto meeting on the 'nuts and bolts' of the Kyoto Protocol. The exact way the flexible mechanisms should operate, the amount of credits that countries could take from new forest plantings, the arrangements for technology transfer, and the detailed financial provisions were determined, so that countries would have a clear view of what the Protocol exactly

meant for them⁵. Most countries waited during that period for so-called ‘ratification’ (the formal approval through Parliament or otherwise). President Clinton and vice-president Gore basically kept silent during that period and did not attempt to convince the people or the Congress about the need for and the value of the Kyoto Protocol. They never formally asked the Senate for ratification.

When the Bush administration took office in January 2001, international negotiations on the details of the Kyoto Protocol were still going on and the newly appointed officials of the USA were participating in them. In March 2001 President George Bush, materializing his campaign stance about climate change, announced the USA would not ratify the Protocol. The reasons given were: it would seriously harm the US economy and developing countries were exempt from emission reductions. The economic argument was surprising, because the IPCC’s Third Assessment Report that was about to be published clearly showed the economic costs of implementing the Kyoto Protocol to be very modest⁶. Special interests, i.e. the coal and oil industry, apparently had a lot of influence. The other argument, i.e. that developing countries were exempt from emissions reductions, was a direct consequence of the negotiating mandate of 1995. Australia followed suit in not ratifying the Kyoto Protocol, although it in fact was implementing climate policy to meet its agreed target (of +8% compared to 1990 by 2008–2012).

These withdrawals shocked the international community and disrupted the ongoing negotiations. It is possible that as a result of this shock, agreement was reached in June 2001 among all other countries on the outstanding details of the Kyoto Protocol implementation. Speeches at that meeting frequently mentioned the victory of multilateral approaches to solving global problems. The USA answered by saying it would follow its own policies to tackle the problem, but everybody knew there was no credible US federal policy to reduce greenhouse gas emissions. This situation would continue during the Bush presidency.

How the Kyoto Protocol eventually became a reality

The Kyoto Protocol text says it would become effective after formal approval by 55 countries (‘ratification’ in Convention speak), provided that these countries also represent 55% of the 1990 emissions of CO₂ from industrialized (Annex I) countries. With the USA and Australia out (accounting for 36 and 2% of the Annex I emissions, respectively), it meant Russia (with 17%) was the crucial factor to make the Protocol a reality⁷. But Russia was in no hurry to ratify it.

There were serious voices in Russia claiming that climate change would be beneficial: fewer cold days, longer growing season, higher grain yields. Those voices were strongly embedded in the Russian scientific community. As a remnant from the communist period there was also a tradition for scientists to first come to an agreement on the facts before making recommendations to the government. Three consecutive reports from the UN Intergovernmental Panel on Climate Change (IPCC), the latest from 2001, were not enough to convince the Russian scientific community. Worse, the Russian vice-chairman of the IPCC and Member of the Russian Academy of Ecology, Professor Yuri Izrael, actively

lobbied against the Kyoto Protocol on the grounds that it was not justified by science. At the World Climate Conference in Moscow in October 2003, top scientists and policy makers from all over the world strongly pleaded for Russian ratification. The conference itself however was dominated by Russian sceptics and chaired by the same Professor Izrael. Presidential economic advisor Illarionov was sent to undermine the conclusions of the IPCC and to argue that Russia could not afford to reduce its emissions. He made use of an error in the Russian translation of the IPCC's latest report where the costs of controlling climate change were shown to be 100 times as high as in the original IPCC report. The conference culminated in a speech by president Putin as part of a high level panel session. It was a short non-committal speech, where he gave no indication whatsoever about Russian ratification. He was about to leave when the then Head of the UNFCCC Secretariat, Ms Joke Waller, made a strong appeal to him to ratify the Protocol in the interest of humanity. Then, very unusually, he sat down again and gave a long personal response, showing his concern about the problem of climate change and outlining that Russia would carefully consider the ratification of the Kyoto Protocol. Something had touched him. It took high level talks with European leaders, amongst others, about Russia's interest to join the World Trade Organization and the EU support for it, to get Russia's ratification in November 2004⁸.

Are countries meeting their emission reduction obligations?

The countries that ratified Kyoto are collectively on track to meet the agreed emissions reduction of 5% below 1990 by 2008–2012. In 2005 their emissions were 15% below the 1990 level⁹ (see Figure 12.2). There are large differences however: the countries with economies in transition were about 35% below and the non-EIT countries 3% above. Individual countries show even greater differences: Latvia was 59% below its 1990 level (with a 2008–2012 target of –8%), while Spain was 53% above (with a target of +15%¹⁰). Including land use changes does not change this picture radically, except for Latvia, which had negative overall emissions, i.e. fixation of CO₂ in forests was bigger than the emissions of GHGs to the atmosphere from all other sources. It is striking that Canada's emissions were 54% above 1990 in 2005 (with a target of –6%), while the USA, which is not part of Kyoto, only saw a 16% increase above 1990 in 2005¹¹. It confirms the complete lack of implementation of the Kyoto Protocol obligations in Canada. For comparison: China and India roughly doubled their emissions over that same period¹². Projections for the period 2008–2012 show that the overall picture will roughly remain the same¹³. Figure 12.3 shows the performance of individual countries.

These numbers do not necessarily mean countries will not meet their obligations. The Kyoto Protocol has provisions to trade emission allowances, or in other words, to buy emission allowances on the carbon market in case of a domestic shortfall. That can be done through 'country-to-country' deals (say Russia selling part of its surplus to Japan or Canada), or through Clean Development Mechanism projects in developing countries and Joint Implementation projects in other Annex I countries. So in theory any country could

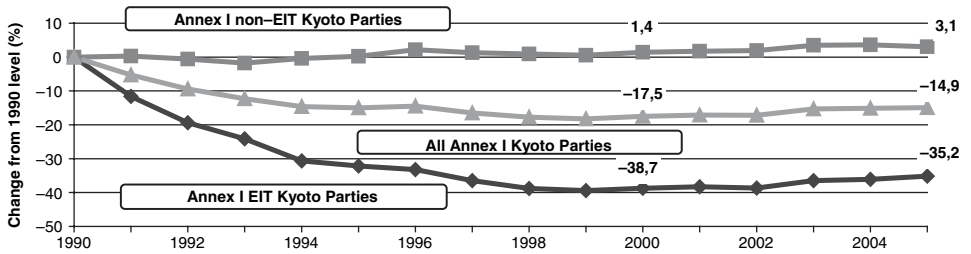


Figure 12.2 Greenhouse gas emissions from Annex I Kyoto Parties 1990–2005; excluding sinks and sources from land use and land use change.

Source: UNFCCC greenhouse gas emission trends 1990–2005.

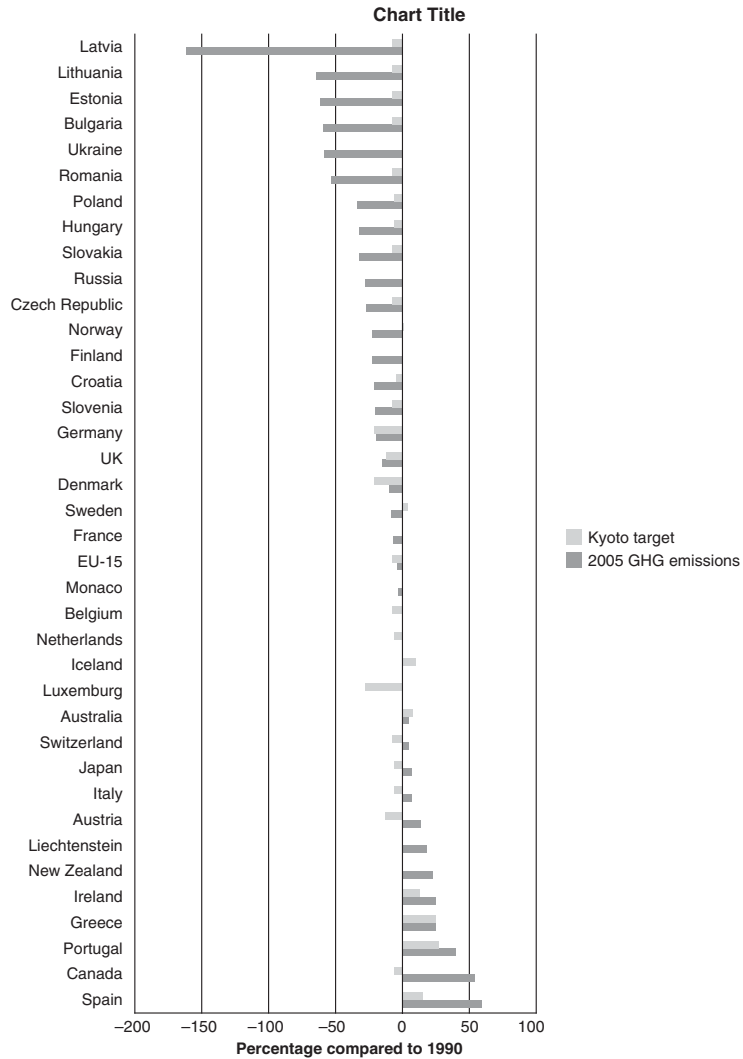


Figure 12.3 Performance of the 36 individual Kyoto Annex I parties until 2005 and their Kyoto Protocol obligations; total net GHG emissions, including from land use and land use change.

Source: UNFCCC greenhouse gas emission trends 1990–2005.

still meet its obligations by making the required purchases in time for the 2008–2012 targets. For most countries that seems a realistic prospect, but for some, such as Canada, it would require a very big political change.

Global emissions have continued to rise: they grew about 25% between 1990 and 2005. While the Kyoto countries are now 15% below 1990, the USA (good for about 25% of global emissions) is 16% above and all non-Annex I countries together increased their emissions by about 75% over the period 1990–2005.

Clean Development Mechanism

One of the successes of the Kyoto Protocol is the Clean Development Mechanism. It creates the possibility for Annex I countries to meet part of their commitments through emissions reductions from projects in developing countries. These projects would at the same time contribute to sustainable development in developing countries (the so-called ‘host countries’). The principle is simple: any emission reduction project in a developing country that otherwise would not have happened is lowering global emissions and could therefore replace a comparable action in an industrialized country. It is a market mechanism. If it is cheaper to realize reductions in developing countries, it lowers the costs for industrialized countries. The clause ‘that otherwise would not have happened’ is of course crucial. If projects would have happened anyway, trading the resulting emission reductions no longer is a net global reduction. So the effectiveness of the CDM depends strongly on this so-called ‘additionality’ issue.

The CDM process

The CDM process is fairly complex. It consists of a project development phase and a project implementation phase (see Figure 12.4). The project development phase has several steps, including approval of the so-called Designated National Authority (DNA) of the country where the project is taking place and validation by an independent organization. It results in the registration of a project with the UNFCCC CDM Executive Board, meaning that also the method of calculating the emission reduction from the project is approved. Issuance of so-called Certified Emission Reduction units (CER, the ‘currency’ of the CDM, equivalent to 1 tonne of CO₂-eq avoided) only happens when an independent organization has indeed certified the actual reductions¹⁴.

How has the CDM developed?

As of January 1 2009 there were 4474 CDM projects in the pipeline (i.e. either submitted to or registered by the CDM Executive Board). Out of these, 1370 were registered and for

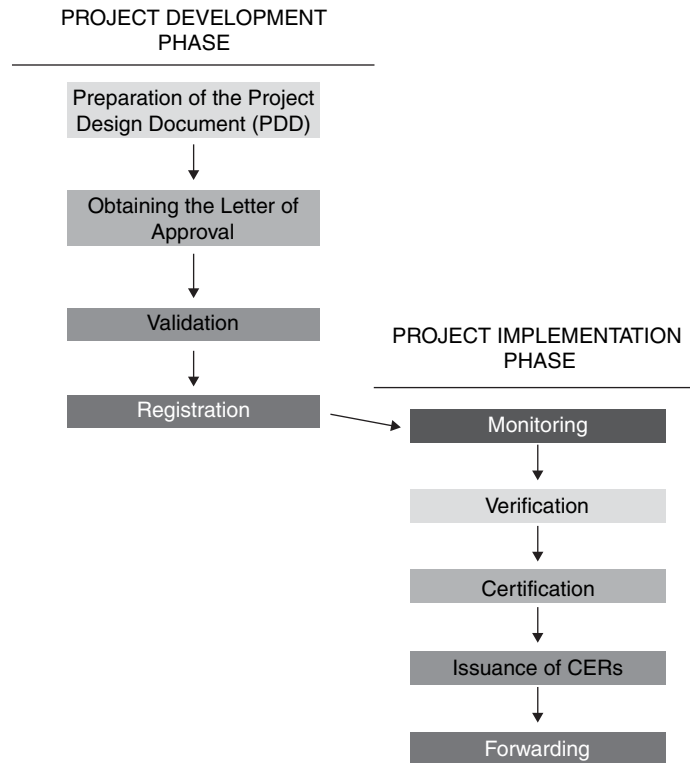


Figure 12.4

Simplified diagram of CDM process.

Source: BakerMcKenzie CDM Rulebook, <http://cdmrulebook.org/PageId/305>.

465 CERs were issued¹⁵. Together they are good for a reduction of about 0.3GtCO₂-eq per year in the period 2008–2012 and about 0.7GtCO₂-eq per year from 2013 to 2020. Given their relatively low price, the CDM CERs are very likely to be bought by Annex I countries to meet their obligations. To put things in perspective: the 0.3GtCO₂-eq/year is about 50% of the total reduction that Kyoto Annex I countries are supposed to realize¹⁶. In other words, domestic emission reductions in these countries will be only half of what they would have been without the CDM, if indeed all available CERs are bought. The rest of the required reductions is offset by CDM credits.

CDM projects are covering a wide range of mitigation activities. The number of projects on renewable energy is the highest, with much smaller numbers for landfill gas (methane) recovery and destruction of HFC-23 at HCFC plants and N₂O at chemical plants (see Chapter 8 for a more detailed discussion). In terms of tonnes of CO₂-eq reduction expected before the end of 2012, renewable energy projects represent 36% and HFC-23 and N₂O projects 26%, reflecting the high Global Warming Potential of HFC-23. Figures 12.5 and 12.6 give an impression of the strong growth of the CDM (number of projects registered) and the relative contributions of various types of projects.

Projects are concentrated in a limited number of countries. Figure 12.7 shows that China, India, Brazil, and Mexico together host about 70% of all CDM projects. These countries

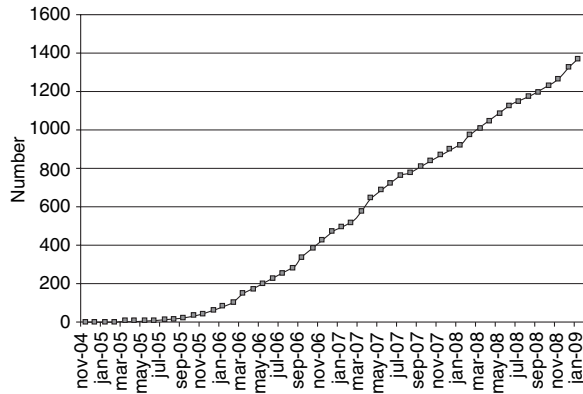


Figure 12.5

Number of registered CDM projects over time.

Source: UNEP Risoe CDM/JI Pipeline Overview, <http://www.cdmpipeline.org/overview.htm#4>.

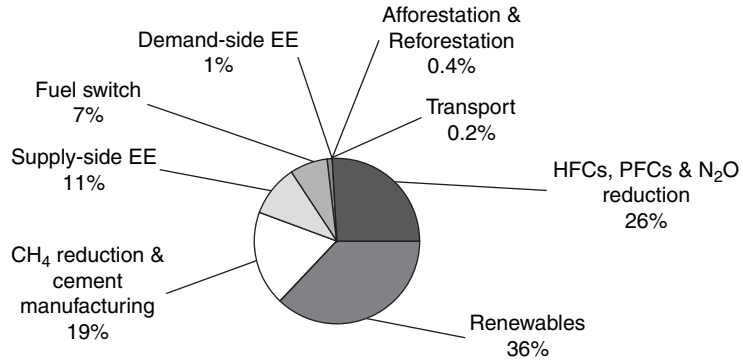


Figure 12.6

CERs expected until 2012 from CDM projects in each sector.

Source: UNEP Risoe CDM/JI Pipeline Overview, <http://www.cdmpipeline.org/overview.htm#4>.

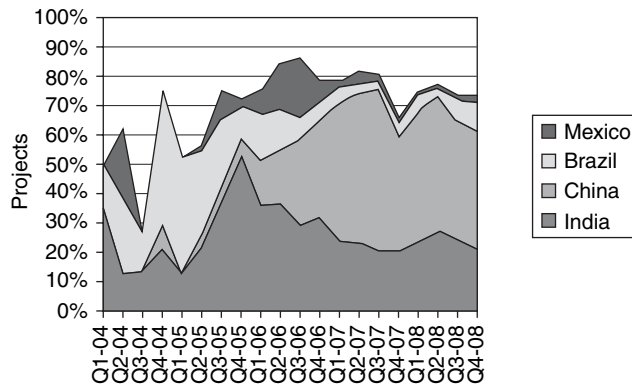


Figure 12.7

CDM Projects in the pipeline in Brazil + Mexico + India + China as a fraction of all projects.

Source: UNEP Risoe CDM/JI Pipeline Overview, <http://www.cdmpipeline.org/overview.htm#4>.

have organized their CDM activities well, making it easier for foreign buyers to get substantial tonnage without excessive administrative efforts. This also means that many countries hardly benefit from the CDM. All African countries together for instance only host 2% of the projects.

If we look at who the buyers of CDM CERs are we see that in 2007 about 80% of all CER acquisitions were made by the private sector; that means companies that fall under the EU ETS and brokers that are in the business of selling these CERs again to companies or countries that need them to comply with their Kyoto obligations. Direct government purchases of CERs for compliance purposes only covered 4% of all sales and the rest was bought by carbon funds operated by international development banks, such as the Worldbank. The total volume of the trade in CERs in 2007 had a value of about US\$ 12 billion, including both the primary (sale of CERs from project) and secondary (resale of CERs to other entities) market. Prices of CERs varied between US\$ 15 and 25 per tonne of CO₂-eq avoided, with secondary CERs and CERs from 'gold standard'¹⁷ CDM projects fetching the highest prices¹⁸.

How much of the projected CDM emission reductions are additional to what otherwise would have occurred?

According to the CDM rules emission reductions from CDM should be 100% additional. There is even a specific requirement to demonstrate that additionality in applying for an approval of a CDM project. But what is the real situation? This depends on what is considered to be the business as usual (or baseline) development. A number of hydropower projects have been approved under the CDM, many of which were already under development before the CDM came into being. Hydropower has been commercially attractive in many places for a long time. So why would certain hydropower projects be considered additional? A possible justification would be that the economic profitability (in terms of the time it takes to recoup the investment) might be less than what investors find acceptable. The CDM revenues can then make the difference between an unattractive and an attractive investment. But this is unlikely to be the case for most of the hydropower projects registered under CDM, given prior approval and comparable projects that were realized without CDM money¹⁹.

Another interesting case is the destruction of HFC-23 from HCFC-22 production facilities. It is technically feasible to destroy HFC-23 in off-gas by using incinerators. The cost of this destruction, including investment and operating costs, is less than US\$0.20 per tonne of CO₂-eq destroyed²⁰. A number of HCFC-22 plants in the world have installed these devices. It is thus very hard to argue that this is something that cannot be seen as 'state of the art'. Nevertheless, HFC-23 destruction at 10 existing plants in China, India, and Korea was approved as a CDM project. Worse still is that the CERs from these projects were sold at market prices of up to US\$15–20 per tonne of CO₂-eq avoided, meaning a substantial profit was made. And even worse is that attempts are being made to get CDM approval also for HFC destruction at newly built HCFC-22 plants. The counterargument from proponents of these CDM projects is that new HCFC-22 plants in developing countries are simply not

being equipped with HFC destructors, because there is no economic or regulatory reason to do so.

Really worrisome is the CDM situation in China. Basically all new investments in hydropower, wind energy, and natural gas fired power plants are co-funded through the sale of CERs. Also the building of more efficient (so-called 'supercritical') coal fired power plants has now been accepted as eligible for CDM²¹. This means that almost anything China is doing to reduce its dependency on coal (which it is now also importing), reduce air pollution, and to improve efficiency of power plants is now done through CDM²². In other words, the assumption is that nothing of this would have been done in the absence of the CDM. That is hard to believe, since many of these installations have been built before without CDM funding and the self interest of China makes most of these projects completely viable. Given that such projects in other developing countries also will be eligible and the huge role of China and India in the CDM, this is a serious blow to the additionality of the CDM.

This issue is therefore on the table at the ongoing negotiations for a new international agreement for the period after 2012 (see below). There are strong voices calling for a serious reform of the CDM to repair these weaknesses.

Institutional infrastructure

Another key achievement of the Climate Change Convention and the Kyoto Protocol is that an elaborate institutional infrastructure has been built to deal with climate change. Apart from a carbon market with a wide range of players and institutions, there is a whole machinery of reporting on emissions, vulnerabilities to climate change, and planning and implementation of adaptation and mitigation activities (mandated by the Convention and the Protocol). Countries have implemented registries of greenhouse gas emissions and policies to control emissions. Because of the CDM many developing countries have done that as well.

The infrastructure however goes much further. A series of international public-private partnerships has been established to promote the development and diffusion of low carbon technologies and practices (see Box 12.3). Pure private initiatives have sprung up around the world where private sector companies work together to promote actions or NGOs collaborate with private companies (see Box 12.4).

Box 12.3

Public private partnerships

International Partnership for a Hydrogen Economy: Announced in April 2003, the partnership consists of 15 countries and the EU, working together to advance the global transition to the hydrogen economy, with the goal of making fuel cell vehicles commercially available by 2020. The Partnership will work to advance the research, development, and deployment of hydrogen and fuel cell technologies and to develop common codes and standards for hydrogen use. See: <http://www.iphe.net>

Carbon Sequestration Leadership Forum: This international partnership was initiated in 2003 and has the aim of advancing technologies for pollution free and GHG free coal fired power plants that can also produce hydrogen for transportation and electricity generation. See: <http://www.cslforum.org>

Generation IV International Forum: This is a multilateral partnership fostering international cooperation in research and development for the next generation of safer, more affordable, and more proliferation resistant nuclear energy systems. This new generation of nuclear power plants could produce electricity and hydrogen with substantially less waste and without emitting any air pollutants or GHG emissions. See: <http://nuclear.energy.gov/genIV/neGenIV1.html>

Renewable Energy and Energy Efficiency Partnership: Formed at the World Summit on Sustainable Development in Johannesburg, South Africa, in August 2002, the partnership seeks to accelerate and expand the global market for renewable energy and energy-efficiency technologies. See <http://www.reeep.org>

Asia-Pacific Partnership on Clean Development and Climate: Inaugurated in January 2006, the aim of this partnership between Australia, China, India, Japan, Republic of Korea, and the USA is to focus on technology development related to climate change, energy security, and air pollution. Eight public/private task forces are to consider: (1) fossil energy, (2) renewable energy and distributed generation, (3) power generation and transmission, (4) steel, (5) aluminium, (6) cement, (7) coal mining, and (8) buildings and appliances. See: <http://www.asiapacificpartnership.org>

IEA Implementing Agreements: Since its creation in 1974, the IEA has provided a structure for international cooperation in energy technology research and development and deployment. Its purpose is to bring together experts in specific technologies who wish to address common challenges jointly and share the fruit of their efforts. Within this structure, there are currently some 40 active programmes, known as the IEA Implementing Agreements. Almost three decades of experience have shown that these Agreements are contributing significantly to achieving faster technological progress and innovation at lower cost. They help to eliminate technological risks and duplication of effort, while facilitating processes like harmonization of standards. Special provisions are applied to protect intellectual property rights. The focus is on technologies for fossil fuels, renewable energies, efficient energy end-use, and fusion power. Effective dissemination of results and findings is an essential part of the mandate of each Implementing Agreement. See http://www.iea.org/textbase/techno/framework_text.pdf (Source: IPCC Fourth Assessment Report, Working Group III, ch 13)

Box 12.4

Private initiatives

Business Leader Initiative on Climate Change (BLICC): Under this initiative, five European companies monitor and report their GHG emissions and set a reduction target. See <http://www.respecteurope.com/rt2/BLICC/>

Carbon Disclosure Project: Under this project, 940 companies report their GHG emissions. The project is supported by institutional investors controlling about 25% of the global stock markets. See <http://www.cdproject.net>

Carbon Trust: The Carbon Trust is a not-for-profit company set up by the UK government to reduce carbon emissions. The Trust provides technical assistance, investment funds, and

other services to companies on emission reduction strategies and for the development of new technologies. See <http://www.thecarbontrust.co.uk/default.ct>

Cement Sustainability Initiative: Ten companies have developed 'The Cement Sustainability Initiative' for 2002–2007 under the umbrella of the World Business Council for Sustainable Development. This initiative outlines individual or joint actions to set emissions targets and monitor and report emissions

Chicago Climate Exchange: The Chicago Climate Exchange is a GHG emission reduction and trading pilot programme for emission sources and offset projects in the USA, Canada, and Mexico. It is a self-regulatory, rules-based exchange designed and governed by the members who have made a voluntary commitment to reduce their GHG emissions by 4% below the average of their 1998–2001 baseline by 2006. See <http://www.chicagoclimatex.com>

Offset programmes: There are many organizations that offer services to offset the emissions of companies, communities, and private individuals. These organizations first calculate the emissions of their participants and then undertake emission reduction or carbon sequestration projects or acquire and retire emission reduction units or emission allowances. See http://ecosystemmarketplace.com/pages/article.news.php?component_id=5794&component_version_id=8505&language_id=12

Pew Center on Climate Change Business Environmental Leadership Council: Under this initiative, 41 companies establish emissions reduction objectives, invest in new, more efficient products, practices and technologies, and support actions to achieve cost-effective emission reductions. See: http://www.pewclimate.org/companies_leading_the_way_belc/

Top 10 consumer information system: This NGO-sponsored programme provides consumers with information on the most efficient consumer products and services available in local markets. The service is available in 10 EU countries, with plans to expand to China and Latin America. See <http://www.topten.info>

WWF Climate Savers: The NGO World Wide Fund of Nature (WWF) has built partnerships with individual leading corporations that pledge to reduce their global warming emissions worldwide by 7% below 1990 levels by the year 2010. Six companies have entered this programme. See http://www.panda.org/about_wwf/what_we_do/climate_change/our_solutions/business_industry/climate_savers/index.cfm

(Source: IPCC Fourth Assessment Report, Working Group III, ch 13)

New agreements beyond 2012

It is obvious that further steps are needed to curb global emissions after the Kyoto Protocol's commitments for 2008–2012 expire. The Kyoto protocol has a provision that says such an agreement should be ready before the start of the first commitment period, i.e. not later than 2007. We did not make that deadline. The reason was the unwillingness of the USA to start negotiating. The best possible outcome of the Conference of the Parties in December 2005 in Montreal was a decision that the Kyoto Annex I countries (i.e. without the USA) would start negotiations on further reductions for Annex I countries after 2012 under the Kyoto Protocol, while a general dialogue would start

amongst all countries about possible next steps under the Convention – quite a complex structure that was invented to circumvent the USA resistance to real negotiations. Surprisingly, the dialogue went well during the years 2006 and 2007 and by COP13 in Indonesia in December 2007 the pressure to start real negotiations on a new agreement had increased dramatically. Climate change concerns were at the top of the political agenda, not least because of the new report of the IPCC that was published in 2007 and the Nobel Peace Prize given to the IPCC and Al Gore.

It led to decisions to establish a new negotiation group, in addition to the already existing Ad-Hoc Group on the Kyoto Protocol. This became the Ad-Hoc Group on Long Term Cooperation. The mandate of this group was a hard fought result that is known as the Bali Action Plan (Box 12.5). It is a carefully balanced text that sets the stage for negotiations on a new agreement with new commitments by developed and developing countries, dropping the rigid distinction between Annex I and non-Annex I countries from the current Kyoto Protocol. It covers mitigation, adaptation, technology, and financial support to developing countries. Of course this negotiating mandate does not specify the outcome. That has to emerge from the actual negotiations. What are the most contentious issues?

Box 12.5

Summary of the Bali Action Plan

Main aim: to launch a comprehensive process to enable the full, effective, and sustained implementation of the Convention through long term cooperative action

Timeframe: agreement to be reached at COP15 in Copenhagen, December 2009

Main elements of what should be part of the eventual agreement:

- (a) A shared vision for long term cooperative action, including a long term global goal for emission reductions, to achieve the ultimate objective of the Convention
- (b) Enhanced national/international action on mitigation of climate change, through:
 - (i) Measurable, reportable, and verifiable nationally appropriate mitigation commitments, or actions, including quantified emission limitation and reduction objectives, by all developed country Parties, while ensuring the comparability of efforts among them
 - (ii) Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing, and capacity-building, in a measurable, reportable, and verifiable manner
 - (iii) Reducing emissions from deforestation and forest degradation; and conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
 - (iv) Cooperative sectoral approaches
 - (v) Opportunities for using markets, to enhance the cost-effectiveness of mitigation actions
 - (vi) Economic and social consequences of response measures
 - (vii) Strengthening the catalytic role of the Convention towards multilateral bodies, the public and private sectors and civil society

- (c) Enhanced action on adaptation through:
 - (i) International cooperation to support urgent implementation of adaptation actions, including through technical and financial support, specific projects, integration into national planning, and other ways to enable climate-resilient development and reduce vulnerability of all Parties
 - (ii) Risk management and risk reduction strategies, including insurance
 - (iii) Disaster reduction strategies in developing countries that are particularly vulnerable to the adverse effects of climate change
 - (iv) Economic diversification to build resilience
 - (v) Strengthening the catalytic role of the Convention
- (d) Enhanced action on technology development and transfer to support action on mitigation and adaptation through:
 - (i) Removal of obstacles to, and provision of financial and other incentives for, scaling up of the development, diffusion and transfer of technology to developing country Parties
 - (ii) Cooperation on research and development of current, new, and innovative technology
 - (iii) Mechanisms and tools for technology cooperation in specific sectors
- (e) Enhanced action on the provision of financial resources and investment through:
 - (i) Improved access to adequate, predictable, and sustainable financial resources and financial and technical support, and the provision of new and additional resources
 - (ii) Positive incentives for developing country Parties for the enhanced implementation of national mitigation strategies and adaptation action
 - (iii) Implementation of adaptation actions on the basis of sustainable development policies
 - (iv) Mobilization of public- and private-sector funding and investment
 - (v) Financial and technical support for capacity-building in the assessment of the costs of adaptation in developing countries

(Source: <http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf#page=3>)

How much should emissions be reduced?

The long term goal of the Climate Convention is to stabilize greenhouse gas concentrations in the atmosphere at 'safe' levels (see Chapter 3). There is growing support amongst the G8 countries to translate that into a reduction of global emissions by 50% by 2050. But there is still a difference of opinion about the base-year. Is it compared to 1990, which would be just about consistent with a road to stabilization at about 450 ppm CO₂-eq, or an average global temperature increase in the long term of 2–2.4°C, or is it compared to 2005, which would make it more like a 3°C scenario?

The other important point is the interim target for 2020. To keep the possibility open of staying on a 2 degree course, global emissions should start declining not later than about 2015 (see Chapter 3). That is a serious additional constraint on the longer term

emission reduction goal. And it is only for global emissions. What would it mean for emission reductions of developed and developing countries?

Who does what?

Table 12.1 shows the summary from IPCC²³ of the various studies that looked into that question, with different assumptions about what is an equitable distribution of the effort. For the 450ppm CO₂-eq scenario the resulting numbers for allowable emissions fall in a fairly narrow band: 25–40% below 1990 level for developed (Annex I) countries by 2020 and 80–95% by 2050. For developing countries in Latin America, the Middle-East, and East Asia a deviation from the baseline emissions is needed. Since the deviation for all developing countries together is about 15–30%²⁴, for the more advanced regions mentioned it will be about one third higher: 20–40%. This is a deviation from the baseline, so growth of emissions would still be possible. China for instance could under this regime still increase its emissions between 1990 and 2020 by 2–3 times instead of 3–4 times if it did not take any action. For higher stabilization levels of 650ppm CO₂-eq action is less urgent and applying fairness criteria then means developing countries can continue on a business as usual trajectory for some time. Under no circumstance can developed countries alone reduce emissions sufficiently to achieve stabilization at any level, since emissions eventually have to go down to almost zero.

This immediately raises concerns about the ability of China to do this without harming its social and economic development. Is it fair to ask such an effort from China and other developing countries? The numbers mentioned above do come from studies where equity was an explicit requirement, so the answer in principle should be ‘yes’. However, this ignores practical problems of access to the latest technology, capacity in the country to organize drastic change, and financial resources to do the necessary investments. International assistance from developed countries would therefore be needed.

Another big issue is how the efforts should be distributed amongst developed and amongst developing countries. The Kyoto Protocol has differentiated emission reduction targets for individual countries (see above). There was no particular system behind these numbers. They came about in pretty much an ad hoc manner. For a new agreement it would be better to have an agreed formula that could be applied over time as countries’ situations change. Many proposals have been made for such formulas. Emissions per capita (responsibility for the problem), income per capita (ability to pay for the solution), and relative costs or easiness of taking action (opportunity to contribute to the solution) are the most frequently used principles. Generally speaking, formulas that use a combination of those principles have the best chance of being acceptable, because feelings about fairness principles are often very strong.

Within the European Union some experience has been gained. The distribution of efforts under the Kyoto Protocol was based on a combination of ability to pay (lower income Member States were allowed to increase their emissions) and opportunities for action (Member States with the worst energy efficiency were asked to do more)²⁵.

Table 12.1. Range of allowed emissions,^a compared to 1990 for stabilization at different levels for Annex I and non-Annex I countries, as reported by studies with different assumptions on fair sharing efforts

Scenario category	Region	2020	2050
A 450ppm CO ₂ -eq ^b	Annex I	–25% to –40%	–80% to –95%
	Non-Annex I	Substantial deviation from baseline in Latin America, the Middle East, East Asia, and Centrally-Planned Asia ^c	Substantial deviation from baseline in all regions
B 550ppm CO ₂ -eq	Annex I	–10% to –30%	–40% to –90%
	Non-Annex I	Deviation from baseline in Latin America and the Middle East, East Asia	Deviation from baseline in most regions, especially in Latin America and the Middle East
C 650ppm CO ₂ -eq	Annex I	0% to –25%	–30% to –80%
	Non-Annex I	Baseline	Deviation from baseline in Latin America and the Middle East, East Asia

^a The aggregate range is based on multiple approaches to apportion emissions between regions (contraction and convergence, multistage, Triptych and intensity targets, among others). Each approach makes different assumptions about the pathway, specific national efforts, and other variables. Additional extreme cases – in which Annex I undertakes all reductions, or non-Annex I undertakes all reductions – are not included. The ranges presented here do not imply political feasibility, nor do the results reflect cost variances.

^b Only the studies aiming at stabilization at 450ppm CO₂-eq assume a (temporary) overshoot of about 50ppm (See Den Elzen and Meinshausen, 2006).

^c Later calculations put this deviation at 15–30% below baseline on average for developing countries (see note 24).

Source: IPCC Fourth Assessment Report, Working Group III, ch 13.

Recently EU Member States together have agreed to reduce GHG emissions by 20% below 1990 levels by 2020 unilaterally. It included a table for sharing out the reductions for the small emitters (the big emitters being under the EU Emission Trading System). For an average reduction of about 10% between 2005 and 2020, contributions from Member States vary between a growth of 20% to a reduction of 20%. Ability to pay has played a strong role as can be seen from Figure 12.8.

Amongst developing countries a differentiation is also needed. Incomes per capita and emissions per capita are so different that treating all countries as equal would be unfair²⁶.

Many proposals have been tabled for a fair distribution across developed and developing countries²⁷. Four approaches have received a lot of attention:

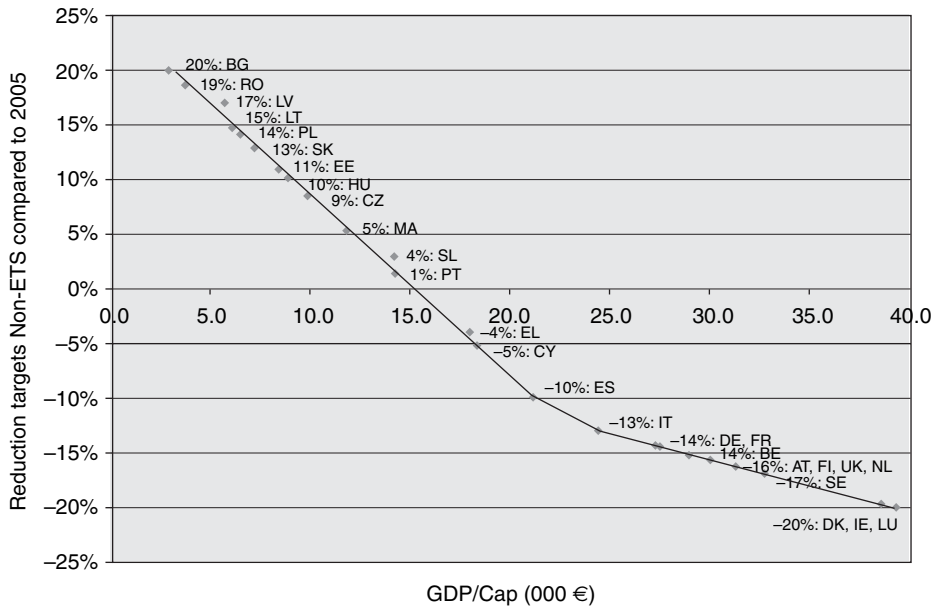


Figure 12.8

Effort sharing between EU27 Member States as agreed in the Energy and Climate Change Package, showing income per capita to be the dominant criterion. BG=Bulgaria, RO=Rumania, LV=Latvia, LT=Lithuania, PL=Poland, SK=Slovakia, EE=Estonia, HU=Hungary, CZ=Czech Republic, MA=Malta, SL=Slovenia, PT=Portugal, EL=Greece, CY=Cyprus, ES=Spain, IT=Italy, DE=Germany, FR=France, BE=Belgium, AT=Austria, FI=Finland, UK=United Kingdom, NL=Netherlands, SE=Sweden, DK=Denmark, IE=Ireland, LU=Luxemburg.

Source: European Commission, Staff working document, Impact assessment, document accompanying the Package of Implementation measures for the EU's objectives on climate change and renewable energy for 2020, Brussels, January 2008.

- *Equal emissions per capita*: A convergence of per capita emissions at a low level, consistent with the desired stabilization level of atmospheric concentrations; countries with high per capita emissions go down to the common low level over a period of say 50 years and low per capita emissions countries can increase their emissions to the common level
- *Multi-stage*: A system of 'graduation' to stronger contributions to emission reductions over time as incomes and emissions of countries increase; this is usually called a 'multi-stage approach'
- *Triptych*: applying different principles to the three different parts of countries' economies: for industry a convergence of carbon efficiency; for energy supply making use of low carbon opportunities; and for the rest (transport, buildings, agriculture, and small business) per capita emission conversion. This approach played a constructive role in the process of distributing Kyoto targets amongst EU member states as indicated above
- *Greenhouse development rights*: Contribution of countries according to the 'luxury emissions' of the high income part of the population; this approach takes the income and emission distribution in a country as the basis; the more high emission people, the bigger the effort a country is required to make²⁸

Most of these approaches are based on the idea of sharing ‘pain’; that is why these exercises are often called ‘burden sharing’. The Triptych approach has elements that look at things more from an opportunity point of view (improving energy efficiency, applying low carbon energy options). True opportunity sharing approaches are not available, reflecting that discussions are still predominantly about sharing ‘burden’.

With the exception of the Greenhouse Development Rights approach, most formulas give similar outcomes, when averaged over regions²⁹. That is the very reason for the relatively narrow ranges reported in Table 12.1. It must be pointed out though that in all approaches specific assumptions have to be made. Changing those assumptions can alter the results. In specific versions of the GDR approach emission reductions shift strongly to developed countries, leading to reduction percentages for Annex I countries of about 55% compared to 1990 in 2020³⁰.

Figure 12.9 shows an example of a ‘multi-stage’ calculation for a 450ppm CO₂-eq stabilization scenario that is fairly representative of outcomes for that stabilization level. In this version of multi-stage countries are grouped in three categories: Category I: countries with a high per capita income and high per capita emissions; they reduce their emissions in absolute terms; Category II: middle income/middle emission countries: they slow down the growth of their GHG emissions; Category III: low income/low emission countries: they are exempt from taking action. Over time countries move to a higher category, when their income and/or emission level reaches the ‘trigger’ for graduation. In this example the trigger is set at a combination of income per capita and emissions per capita. As is shown in the figure, by 2020 South Asia (mainly India and Pakistan) are still exempt from taking action, Africa is supposed to take very limited action, while Latin America, the Middle East, and East Asia need to deviate from their baseline. All those regions however are still able to increase their emissions considerably compared to 1990. For 2050 emissions reductions become much bigger of course. But even then countries in Africa and South Asia (e.g. India) would still have room for much higher emissions than in 1990.

At present (mid 2009) the negotiations are difficult. The new US president Obama has announced he wants to reduce US GHG emissions to their 1990 level by 2020 and legislation is being discussed in Congress, which is a drastic change from the US positions thus far. However, it is still far from what the EU has indicated it is willing to do (20–30% below 1990 by 2020) and far from what is needed to stay on course for limiting warming to less than 2°C. At the same time there is still cautiousness of other developed countries to announce an ambitious reduction target ahead of advanced developing countries stating their position³¹. There is also strong resistance amongst developing countries to adopt a new classification system that would replace the Annex I versus non-Annex I system under the Convention. This makes it unlikely that a ‘formula’ can be agreed in Copenhagen that would govern the graduation of countries to more ambitious commitments as they develop. The debate seems to be shifting to a system of ‘differentiation through actions’, meaning that specific developing country action plans could be tailored to their development stage, without creating a classification system. The ambition level of these country action plans would then have to be consistent with the overall reduction compared to baseline as indicated in Table 12.1.

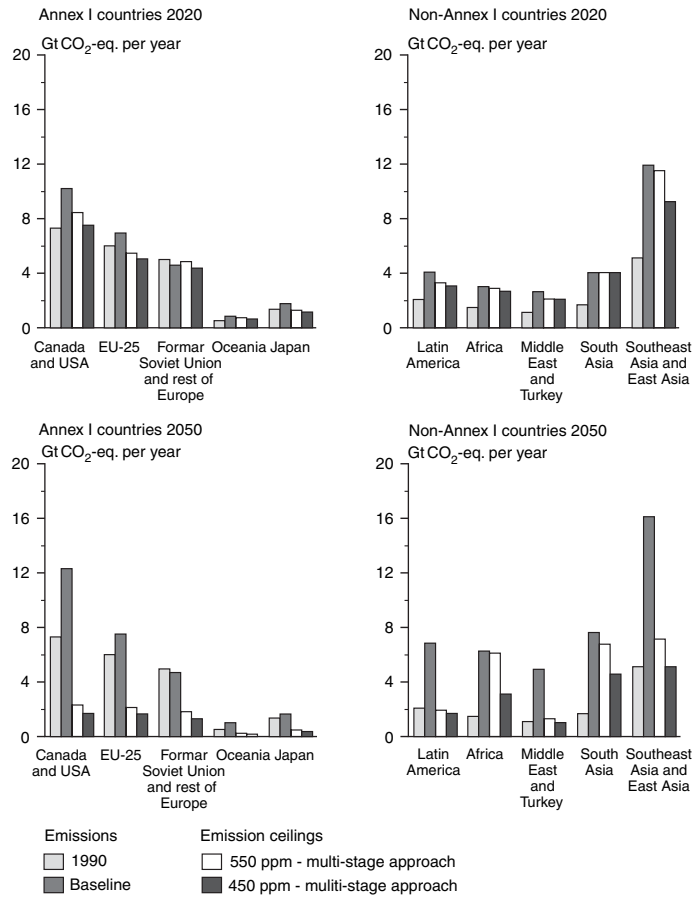


Figure 12.9

Emission ceilings for developed and developing countries under a 'multi-stage' equity distribution for stabilization levels of 450 and 550 ppm CO₂-eq.

Source: from climate objectives to emission reduction; overview of the opportunities for mitigating climate change, Netherlands Environmental Assessment Agency, 2006.

What kind of actions can countries commit to?

Emission ceilings are the simplest form of commitment to action. That is the way things were done under the Kyoto Protocol (see above). Absolute ceilings can however be problematic for countries with strongly varying economic growth rates and the costs of meeting them cannot be predicted accurately. Alternatives exist in the form of emissions per unit of production, for instance per unit of GDP for a country as a whole or per tonne of steel or per kWh electricity produced for a sector. Moving to such targets of course means the resulting emissions are no longer certain. With strong economic growth or growth of production, emissions come out higher. Nevertheless such relative or dynamic targets are being considered for developing countries, where uncertainties of growth are

high and increasing costs can be problematic. Emission trading systems can handle such dynamic targets, although the system becomes more complex.

As already mentioned, sectoral targets are also being considered for developing countries. The rationale is that for sectors that are large emitters and for which information on emissions from individual plants are available, commitments on limiting their emissions might be feasible, while such a commitment for a country as a whole might be seen as too risky. If for instance the electricity sector, the steel, cement and fertilizer industry, and the transport sector were covered under sector targets, more than 40% of the emissions on average would be controlled.

Another way is to commit to the use of the cleanest technology, for instance by requiring minimum fuel efficiency standards for cars, and energy efficiency standards for washing machines, refrigerators, TVs, computers, and other products. This can also be applied to steel, glass, and cement making processes and other manufacturing processes. These so-called ‘best available technology’ approaches have been used widely in controlling other environmental problems (see also Chapter 11). Technology commitments could also be in the form of information sharing or joint demonstration programmes, although the impact of those on emission reductions would be hard to measure.

Yet another approach is to commit to implementing policies and measures. When doing that the result in terms of GHG emissions would not be exactly known, but could be estimated roughly. In fact, the Kyoto Protocol has an almost forgotten article 2 that creates the possibility for coordinated action on policies and measures (Box 12.6). This would make sense to make standards for traded products more effective. One interesting option that is being discussed for a new post-Kyoto agreement is a so-called ‘Sustainable Development Policies and Measures’ (SDPAM) approach. In this approach policies to enhance the sustainability of development are the starting point and reduction of greenhouse gas emissions is a co-benefit³². In Chapter 4 many examples of this thinking were presented, such as improving energy security by improving the efficiency of energy use and replacing imported fossil fuels with domestic renewable energy sources.

Box 12.6**Coordinated policies and measures: the revival of article 2 of the Kyoto protocol?**

The history of Kyoto Protocol article 2.1.b and 2.4 is interesting. At the time of the negotiation of the Kyoto Protocol the USA was only interested in an emission ceilings approach with maximum flexibility of how to realize such a target. They did not want to specify any common action on policies and measures. The European Union however felt that both targets and common measures (such as on taxes or product standards) would be useful instruments and insisted on a provision in the Protocol (often derided by the other players at the negotiating table). As a result the Kyoto Protocol now has articles 2.1.b and 2.4 that explicitly create the opportunity for common policies and measures. It has remained a

completely dead letter so far. More recently the thinking in the USA has changed. Proposals for a joint carbon tax have been made and coordinated policies on product standards are no longer taboo. They mostly come from economists who argue that a joint tax is the most economic, efficient way of reducing emissions. At the same time taxes remain unpopular in most countries and in particular in the USA. In light of the need to come up with ways for developing countries to contribute to global emission reduction and the realization that R&D on low carbon energy and products needs to be strengthened, a renewed interest in policies and measures is visible and a new life of the policies and measures article might be upon us.

Finance

To get a meaningful agreement for the period after 2012, substantial financing will be needed to assist developing countries with mitigation and adaptation measures and to promote technology development and diffusion. There is however no good idea of how much is needed. What is available is rough estimates of the additional investments needed.

For mitigation in a scenario where global emissions are back at 2005 levels by 2030 (more or less equivalent to stabilization at 450–500ppm CO₂-eq) additional investments of about 200 billion US\$/year in 2030 will be needed, according to estimates of the UNFCCC secretariat. For adaptation the amount needed will be about 50–180 billion US\$/year, in this scenario where the most serious damages from climate change are avoided. Together we talk about 250–400 billion US\$/year by 2030. More recent numbers from the IEA suggest this amount might be twice as high³³. This looks like a huge number. Compared to the total annual investments in the world it is however only 1–2% (2–4% if IEA is right). As a percentage of world GDP it is even lower: less than 1%, even for the higher numbers.

Developing countries will need about 40–50% of the additional investment. And that is where financing problems exist. So what are the prospects of finding 100–200 billion US\$/year (or maybe twice as much) in additional investments for these countries? To put things in perspective it is good to look at current investment flows in developing countries. Investment for energy and transportation through Official Development Assistance (ODA) was about 13 billion US\$ in the year 2005. Foreign Direct Investment (FDI) in developing countries was about 380 billion US\$ on average in 2006, while domestic investment in developing countries was about 1300 billion³⁴. In 2030 these numbers are estimated to be three times as high. So the additional investment in developing countries by 2030 would be in the order of 5–10% of total investment by 2030. Not a very big number, but nevertheless additional international funding is needed if we do not want badly needed development investments to suffer. If we assume that all of the additional investment will have to come from international sources, then there are several possibilities: more ODA, loans from Development Banks, and FDI, supplemented with Climate Change Funds.

Direct carbon market finance (through CDM or International Emissions trading) is left out of the equation. The reason is that the carbon market is an offsetting mechanism. In other words: what is paid for (by the developed countries) for reductions in developing

Table 12.2. Financial flows relevant to the need for assisting developing countries to address climate change

Source	Approximate current and potential financial flows (billion US\$/yr)
Domestic investment developing countries	1300
FDI developing countries	380
ODA for energy and transportation	13
Oil exporting country investments	500
Auctioning air/marine allowances	40
Auctioning all industrialised country allowances	hundreds
Tax on air travel	15
Tax on currency transactions	20

Source: UNFCCC, http://unfccc.int/cooperation_and_support/financial_mechanism/items/4053.php; Tirpak, D., Adams, H., Climate Policy, vol 8 (2008), pp 135–151; Miller A., Climate Policy vol 8 (2008), pp. 152–169.

countries is directly subtracted from the reductions in the developed countries themselves. It is a zero sum game. To stay on track towards a 450 ppm CO₂-eq stabilization, developing countries will have to deviate from their baseline emissions by 15–30% (see above). The realization of that contribution can therefore not be financed through the carbon market. Unless of course developed countries take a deeper reduction than the 25–40% below 1990 by 2020 that is consistent with their share of the global effort. But that seems unrealistic.

Investment is not the same as costs. A considerable part of the investments in emission reductions has benefits that make these investments profitable (through saved energy, improved air quality and lower health care costs, reduced oil imports, or otherwise). It means the net incremental costs of these investments are much lower. For the 2010–2020 period on average an estimate is 100–140 billion US\$/year in incremental costs for emission reductions, adaptation and technology research, development, and demonstration together³⁵.

Climate change funds will therefore have to provide substantial amounts of money. Current flows from Climate Change Funds under the Climate Change Convention and the Kyoto Protocol are very modest: Adaptation Fund: US\$80–300 million/year, Least Developed Country Fund and Special Climate Change Fund together something like US\$15 million/year. Huge increases in these and other funds will be needed. One potentially interesting new source is the revenue from auctioning emission allowances in developed countries. As discussed in Chapter 11, the tendency in domestic emission trading systems is to move towards full auctioning of allowances to companies. That will generate hundreds of billions of dollars each year if generally applied, depending of course on the stringency of climate policy. It does not mean of course that countries will transfer all those revenues to international funds³⁶. Domestic needs may get priority. That has triggered ideas to auction a certain percentage of allowances directly under the UNFCCC, so that the money does not go through national treasuries of individual countries. Other sources of funding may have to

be found. Various proposals have been made, for instance a tax on international currency transactions, on air travel, or on fuels for international shipping (see [Table 12.2](#)).

Technology

Modern low carbon technology is essential for controlling climate change. We know that a large part of the opportunities for emissions reduction can be found in developing countries. We also know that there are many barriers to the use of these modern low carbon technologies in these countries (Chapter 10). Removing these barriers is therefore critical. This is commonly called the problem of ‘technology transfer’.

What can international agreements do to remove these barriers? It is helpful to make a distinction between diffusion of existing technologies and the development of new ones. Existing technologies, such as energy efficient cars, appliances and industrial equipment, are readily available in developed countries (although they may not be universally applied there). But these technologies are much rarer in developing countries. Exceptions are recently built large scale manufacturing plants for steel, cement, or fertilizer, where often the most modern and efficient technology is being used³⁷. Lack of knowledge of investors, high initial investments, insufficient maintenance expertise, banks that shy away from investments they are not familiar with, and absence of government regulations are some of the most important reasons for this³⁸.

International agreements can do something about creating the need for investments (in the form of countries committing to action), making it easier to access international financing (see the discussion above) and sharing the experience of countries by creating databases and best practice examples³⁹. Much of the international action to assist countries in implementing modern low carbon technology is happening outside the Climate Change Convention. The IEA operates a series of so-called Implementing Agreements that allow IEA member and non-member countries and other organizations to engage in sharing information about implementing specific low carbon technologies⁴⁰. There are currently 42 of these cooperative arrangements. There are also many public-private partnerships active in this field, such as the Renewable Energy and Energy Efficiency Partnership (REEEP), funded by national governments, businesses, development banks and NGOs⁴¹, and the Renewable Energy Network for the 21st Century (REN21), connecting governments, international institutions, non-governmental organizations and industry associations⁴². See also [Box 12.3](#).

Development of low carbon technology is different from diffusion. Development means scaling up of promising results from research and demonstrating it at semi-commercial scale. It also means technology improvements based on R&D that can significantly reduce costs.

Traditionally, new technology was developed in industrialized countries and then diffused to developing countries. Although that is still happening, it is no longer the only mechanism. Technology is now also developed in more advanced developing countries. Japan moved from a country good at copying and cheaply producing electronic products in the 1960s to the place where much of the innovation in these products is taking place

today⁴³. China is following that pattern and has already become the producer of the best and lowest cost supercritical coal fired power plants, the main manufacturer of electric bikes, solar water heaters, and solar panels (see also Chapters 5 and 6). It is set to take the number 1 position in wind turbine manufacturing in 2009⁴⁴. Innovation capacity is rising fast, reflected by the tripling of R&D expenditures from 0.5% to 1.5% of GDP since 1990⁴⁵. In India, Suzlon, one of the world's biggest wind turbine manufacturers, acquired a German firm, strengthening its market power and its innovative capacity.

What does this mean for the role of international agreements in promoting the development of new low carbon technologies? This role is probably limited. Arrangements such as the IEA Implementing Agreements can help share information. In the pre-competitive research stage, higher government R&D budgets can help. Doubling or tripling global energy related R&D budgets (aiming at low carbon technologies and energy efficiency) could be made part of the financial arrangements of a new agreement. Providing support to developing countries to build up their innovation capacity should be part of that effort. The model of the CGIAR, the Consultative Group on International Agricultural Research, might be useful. It is a network of 16 international research centres, spread over all regions of the world, aiming at providing food security to all people. It is funded by bilateral and multilateral donors and private foundations⁴⁶.

When technologies enter the stage of development, scaling up, and market introduction, commercial interest will dominate and the role of governments changes. International cooperation (not necessarily within the UNFCCC) could speed up the market introduction of new low carbon technologies by setting up larger demonstration programmes, with supporting government funding (this could also be one of the purposes of a new funding system).

Measuring, reporting, and verifying

The accountability for commitments in a new agreement has received a lot of attention during the negotiations on the Bali Action Plan. It is captured in the so-called 'MRV clause': actions committed to should be *measurable, reportable, and verifiable* (see Box 12.5). Since this applies to both developed and developing countries, this is certainly a step up from the current arrangements in the Convention and the Kyoto Protocol. There we do have a system of so-called national communications and review, but the requirements for developing countries are not very stringent. What is also important is that the MRV requirement for a new agreement applies to financial and technical support by developed countries as well. It is likely that a new system of reporting of those actions will be set up. This was seen by developing countries as a major step forward.

How these MRV clauses are going to be implemented is as yet unclear. It is likely reporting systems will build on the existing system of national communications, by making them more frequent and provide more direct guidance on what they should contain. An obvious improvement would be to have frequent inventories of greenhouse gas emissions from developing countries (currently not required and most developing

countries have only submitted one inventory that is completely outdated by now). Frequent reporting on actions already taken in developing countries (see Chapter 4) would ensure that such actions can be taken into account when discussing appropriate actions by developing countries.

The ‘measurable’ clause will have an impact on the form of agreed actions, because they should indeed be measurable, ruling out vague, non-committal formulations.

The ‘verification’ part gets us to the discussion on review and compliance. The current review requirements for developed countries require an administrative and a so-called ‘in-depth review’, involving a team of experts visiting the country. This is still a relatively soft review process. It is also increasingly difficult to find qualified experts for such country visits. For developing country national communications there is only a limited administrative review. Upgrading the system of review, by a more rigorous administrative review, as well as by a professionalized country visit programme, would make a lot of sense.

Contours of a Copenhagen Protocol

As discussed above, a new global agreement for the period after 2012 (when the emission reduction commitments under the Kyoto Protocol expire) is very important. Between 2012 and 2020 global emissions have to start going down if we want to avoid the most serious climate change impacts. In line with the Bali Plan of Action and the discussion above, the following elements are good candidates to end up in an agreement in Copenhagen, at the end of 2009, or later:

- *A long term orientation* in the form of a non-binding agreement to have global greenhouse gas emissions in 2050 50% below the 1990 level and developed countries (the current ones listed under Annex I of the Convention plus a few new ones) indicating a reduction of 80–95% over that timeframe.
- *Mitigation arrangements* for developed and developing countries, including on forest preservation, that are composed of the following elements:
 - Developed countries have absolute caps on their emissions for 2020, consistent with at least 25–30% reduction of their 1990 levels on average
 - Developing countries (except the least developed) have committed to low carbon development plans and specific (sectoral) action plans, in conjunction with technical and financial assistance from newly established funds (replacing CDM for those countries)
 - Least developed countries participate in mitigation activities through a (revised) CDM
 - Developing countries that protect their forests (as part of their low carbon development plan) receive funding for implementing appropriate policies and creating incentives for forest owners
 - Strengthened reporting and review

- Provisions on financing and implementing *adaptation actions*, particularly in vulnerable countries, through integration in national development planning and policy. Countries would prepare a climate resilient development plan that is integrated with the low carbon development plan.
- *Technology development* arrangements that strengthen R&D efforts in developed countries and set up cooperative R&D mechanisms on low carbon technologies in developing countries. Internationally coordinated demonstrations of emerging low carbon technologies would be an important part of this⁴⁷. Technology diffusion and transfer would be part of the mitigation arrangements and focus on information exchange and financing investments, including intellectual property rights payments, where needed.
- A solid *system of financing* mitigation, adaptation, and technology actions in developing countries. The backbone of this system will have to be formed by substantial new international funds, but the system as a whole will consist of a multitude of bilateral, multilateral, and private funding. The carbon market will play an important role in moving capital to low cost mitigation options, but it will not replace the basic funding for developing country actions.
- A *legal form* that links it to the Climate Convention or the Kyoto Protocol. Given the resistance of the USA against the Kyoto Protocol it is likely to become a new Protocol under the Convention or even a more complex set of separate decisions by the Parties to the Climate Convention and the Kyoto Protocol (if for instance the USA is unable to get a two thirds majority in the US Senate to approve a new Protocol). Useful elements of the Kyoto Protocol will then be copied into this new legal instrument.

Hopefully the notion of new opportunities created by a low carbon economy will have spread sufficiently to make such an agreement attractive for all countries.

Notes

1. <http://www.un.org/documents/ga/res/45/a45r212.htm>.
2. Bolin B. A History of the Science and Politics of Climate Change: The Role of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2007.
3. <http://unfccc.int/resource/docs/convkp/conveng.pdf>.
4. <http://www.nationalcenter.org/KyotoSenate.html>.
5. This was eventually laid down in the Marrakesh accords in 2001, unfccc.int/cop7/documents/accords_draft.pdf.
6. The IPCC Working Group III Report of 2001 estimated the economic cost of implementing the Kyoto Protocol for the USA at a GDP reduction of less than 0.5% by 2010 in a system of global emissions trading, compared to what it otherwise would have been; in other words the economy would not grow by say 25% over the period 2000–2010, but by something like 24.5%
7. <http://www.climnet.org/EUenergy/ratification/1990sharestable.htm>.
8. http://english.pravda.ru/main/18/88/354/14495_kyoto.html.
9. Excluding land use change emissions (relatively small); see http://unfccc.meta-fusion.com/kongresse/071120_pressconference07/download/201107_pressconf_sergey_konokov.pdf.

10. The 15 EU Member States redistributed their collective –8% target amongst individual Member States to allow for specific national circumstances; see http://reports.eea.europa.eu/eea_report_2007_5/en/Greenhouse_gas_Emission_trends_and_projections_in_Europe_2007.pdf.
11. http://unfccc.int/ghg_data/ghg_data_unfccc/time_series_annex_i/items/3814.php.
12. <http://cait.wri.org/>.
13. http://unfccc.meta-fusion.com/kongresse/071120_pressconference07/download/201107_pressconf_katia_simeonova_part1.pdf.
14. <http://cdm.unfccc.int/index.html>.
15. <http://www.cdmpipeline.org/overview.htm#4>.
16. <http://www.feem.it/NR/rdonlyres/2C130D3B-124F-427E-9FAE-E958F0E83263/838/0800.pdf>.
17. The ‘gold standard’, developed by the World Wildlife Fund and other NGOs sets strict requirements for CDM projects in terms of their additionality and contribution to sustainable development in the host countries; see <http://www.cdmgoldstandard.org/index.php>.
18. See Point Carbon 2008 report at http://www.pointcarbon.com/polopoly_fs/1.912721!Carbon_2008_dfgrt.pdf.
19. Haya B. Failed mechanism: how the CDM is subsidizing hydro developers and harming the Kyoto Protocol, *International Rivers*, 2007, see <http://internationalrivers.org/en/climate-change/carbon-trading-cdm/failed-mechanism-hundreds-hydros-expose-serious-flaws-cdm>; see also <http://www.indiatogether.org/2008/jul/env-cdm.htm>.
20. IPCC Special Report on Safeguarding the Ozone Layer and the Global Climate System, 2000.
21. The acceptance of the methodology for supercritical coal fired power plants was limited to a maximum of 15% of a country’s power supply, see <http://cdm.unfccc.int/index.html>.
22. Wara M, Victor D. A realistic policy on international carbon offsets, Stanford University Programme on Energy and Sustainable Development, Working paper no. 74, April 2008, http://iis-db.stanford.edu/pubs/22157/WP74_final_final.pdf.
23. IPCC AR4, WG III, chapter 13.
24. den Elzen M., Hoehne N. Reductions of greenhouse gas emissions in Annex I and non Annex I countries for meeting concentration stabilisation targets, *Climatic Change*, vol 91 (2008), pp 249–274.
25. The allocations were based on the so-called Trytich approach, see Phylipssen et al, *Energy Policy*, vol 26(12) (1998), pp 929–943.
26. There is strong political resistance amongst the G77 and China Group to differentiate amongst them.
27. IPCC Fourth Assessment Report, WG III, Chapter 13, table 13.2.
28. <http://www.ecoequity.org/docs/TheGDRsFramework.pdf>.
29. The GDR approach was not covered in the ranges reported by IPCC.
30. Hoehne N., Moltmann S. Distribution of emission allowances under the Greenhouse Development Rights and other effort sharing approaches, Heinrich Boell Foundation, Berlin, 2008.

31. Some announcements for 2020: Australia 15–25% below 2000, Canada 20% below 2006, Japan 25% below 1990, Russia 10–15% below 1990.
32. Winkler et al. *Climate Policy*, vol 8 (2008), pp 119–134.
33. IEA, WEO 2008.
34. http://unfccc.int/cooperation_and_support/financial_mechanism/items/4053.php; Tirpak D, Adams H. Bilateral and multilateral financial assistance for the energy sector of developing countries, *Climate Policy*, vol 8 (2008), pp 135–151.
35. ClimateWorks Foundation, project Catalyst results, <http://www.project-catalyst.info>.
36. <http://www.euractiv.com/en/climate-change/experts-warn-eu-climate-change-trade-war/article-175426>.
37. See chapter 8.
38. IPCC, Special Report on Methodological and Technological Aspects of Technology Transfer, 2000.
39. <http://unfccc.int/ttclear/jsp/index.jsp>.
40. <http://www.iea.org/textbase/techno/index.asp>.
41. <http://www.reeep.org/31/home.htm>.
42. <http://www.ren21.net/>.
43. Patent applications from Canon multiplied 10-fold between the 1960s and the 1980s/1990s, see Suzuki J, Kodama F. *Research Policy* 33 (2004), pp 531–549.
44. <http://www.climatechangecorp.com/content.asp?contentid=5344>.
45. <http://www.oecd.org/dataoecd/54/20/39177453.pdf>.
46. <http://www.cgiar.org/>.
47. De Conink H, Stephens JC, Metz B. Global learning on carbon capture and storage: a call for strong international cooperation on CCS demonstration, *Energy Policy* (2009), doi:10.1016/j.enpol.2009.01.020.