

After Kyoto: Approaches to Climate Change Mitigation Post-2012

A study for public dissemination

By Climate Change Capital Ltd.

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Purpose of Study

This study has been performed by the Policy and Markets Research team of Climate Change Capital to inform both internal and external parties.

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Executive Summary

The Kyoto Protocol was the first agreement to establish an international trading scheme to reduce greenhouse gas (GHG) emissions. It represents an expression of the collective will of industrialised governments to mitigate climate change and simultaneously to promote investment in low-carbon technologies in both industrialised and developing countries. But Kyoto failed in one key regard; to encourage full participation from the major-emitting countries, especially the two largest emitters of GHGs in the world: the US and China (or any other developing country for that matter). It is also set to expire in 2012. Kyoto has therefore failed to provide the level and certainty of demand for emissions reductions to stimulate investment of the scale necessary to replace conventional carbon-emitting technologies over the long-term.

Hence, as the start of the obligations imposed by the Kyoto Protocol draws near, attention is already focusing on the period after the existing obligations end in 2012. If climate change is to be avoided at least cost, mitigation (through the development of low carbon technologies) will probably need to be accelerated and intensified beyond current efforts. Therefore the EU and other Kyoto participants are looking for ways to engage the US and rapidly developing (industrialising) countries like China in a post-2012 agreement. But this is not without its difficulties. The most important of these is a universal concern over the magnitude (and uncertainty) of abatement costs imposed by a substantive agreement. There is also unease in the US about possible “free-riding” by developing countries on the efforts of the industrialised world, and related notions of fairness on the part of developing countries concerning the industrialised world’s supposed responsibility for the climate change problem. Compounding these problems is a particular strand of scepticism in the current Bush Administration regarding the merits of climate change mitigation, although this is not shared by many other Republican (and most Democrat) politicians in the US.

This paper argues that there are in fact ways and means by which these various obstacles may be overcome. In the US, significant measures to limit GHG emissions are already being undertaken at the state-level, with major developments planned for the near-term (such as the Regional Greenhouse Gas Initiative in North-East and Mid-Atlantic states), which may lead to the establishment of a federal emissions trading scheme during the course of the next Presidency. Furthermore, the new Administration in 2008 may be less ideological than the current Bush Administration and more willing to commit to international obligations to mitigate climate change. The adoption by the US (and other industrialised countries) of emissions reduction targets as part of an international scheme may be made more likely through the use of price caps to limit the costs of abatement to an acceptable level (such as €20 per tonne of carbon dioxide equivalent emissions reductions). This would act to encourage industrialising countries to undertake emissions reductions, by adopting flexible targets, like targets linked to GDP growth, or positively-binding targets that reward abatement over and above the target level but do not punish under-achievement. Such commitments by industrialising countries would satisfy (to some extent) the concerns of federal policymakers in the US and make emissions reduction targets there more palatable, so closing the virtuous circle.

Alongside these efforts, the Clean Development Mechanism, which incentivises investment in developing countries, may be expanded (and the associated bureaucracies reduced) to deliver further development in less economically developed nations and so reveal more opportunities for least-cost abatement. In addition, a multistage approach to the allocation of emissions reduction targets, which determines a range of different commitments for different countries depending upon their relative state of economic development, could be used to help expand the international emissions trading scheme established under the Kyoto Protocol. Individual sectoral commitments across categories of nations could be informed by a sectoral approach that assesses the relative extent of development and the capability for emissions reductions within these economic sectors.

The fundamental aim of a post-2012 agreement is to achieve maximum emissions reductions at least cost. It will therefore require full participation of the world's major-emitting countries, but especially the US (and China thereafter). The solutions presented in this paper show that it is possible to achieve this by assigning realistic targets that are acceptable to as wide a range of countries as possible. They assume that small steps now will be followed by bigger steps later and that political resolve will strengthen with time.

This assumption of political resolve is perhaps the easiest prediction for this paper to make. The explanation is that the scientific evidence for climate change keeps getting stronger. With it, the certainty of further and more comprehensive government action grows. This study has investigated the means by which an agreement regarding post-2012 commitments may be reached. It has found that the Kyoto Protocol is not simply a "one-off". Rather it is the start of an inevitable transition to a low-carbon economy.

Introduction

The evidence for climate change is increasingly undeniable. The ten warmest years on record have all occurred since 1990. The IPCC found in 2001 that average global surface temperatures had risen by 0.6°C over the course of the last century, a rise in the Northern Hemisphere greater than at any other time in the last 1000 years¹. Using a variety of economic growth scenarios the IPCC projects that temperatures could increase within a range of $1.4\text{-}5.8^{\circ}\text{C}$ over the period 1990 to 2100. As a result sea levels are forecast to rise almost 1m by 2100, threatening 100m people globally. But sea levels could rise as much as 7m if the Greenland ice-cap disappears. Economic losses associated with climate change are likely to be huge; Swiss Re (an insurer) has estimated that the economic costs of global warming could double to \$150bn each year in the next 10 years, hitting insurers with \$30-40bn in claims.

The cause is the anthropogenic emission of greenhouse gases (GHGs). Figure 1 shows that CO_2 concentrations are now higher than at any other time in the last 400,000 years:

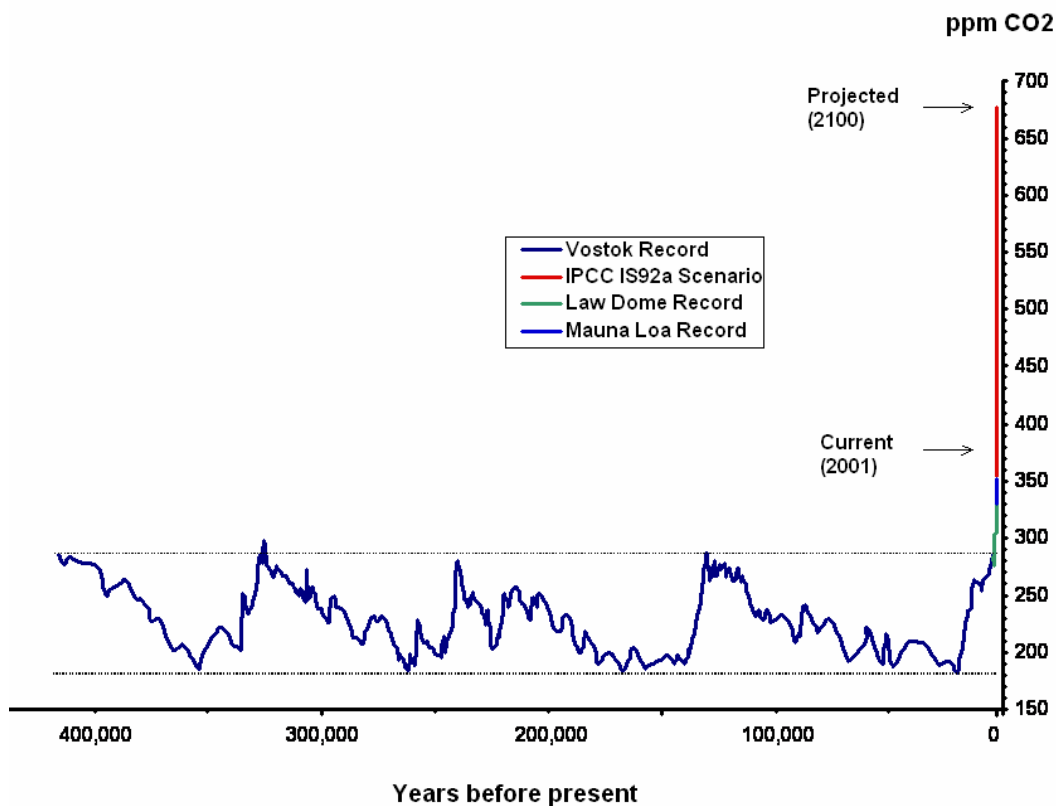


Figure 1: Historic Atmospheric CO_2 concentrations (from ice-core samples) and projected until 2100. (Source: Undisclosed)

The scientific consensus is that the inexorable growth in CO₂ and other GHG concentrations must be halted if dangerous climate change is to be avoided. Many governments have responded to this consensus by taking action to limit GHG emissions, first through the adoption of the United Nations Framework Convention on Climate Change, and second with the implementation of the Kyoto Protocol from 2008 (Box 1).

However, the future of the international climate change regime following expiration of the Kyoto Protocol in 2012 is unclear at present. Article 3.9 of the Protocol requires negotiations on the second commitment period of emissions reductions to begin, at the latest, by 2005. Yet negotiations taking place under the framework of Kyoto would preclude the US from participating as a party (since it has not ratified the Kyoto Protocol), relegating it instead to the status of an observer. Given the importance of the US to international affairs in general, and to global GHG emissions in particular, it is likely negotiations will take place under the auspices of the UNFCCC, to which the US acceded in 1992 at the Rio convention (Box 1).

But the US and some developing countries have been making this development difficult. At the tenth Conference of the Parties (COP10) of the UNFCCC in Buenos Aires in December 2004, the US, and large oil-exporting countries like Saudi Arabia, declared they were unwilling even to discuss emissions reduction targets in 2005. They would agree only to a “Seminar of Government Experts” in May 2005, at which there might be “an informal exchange on actions relating to mitigation and adaptation.”² Certain developing countries led by India, China and Brazil also inserted a clause into the COP10 agreement stating explicitly that it “does not open any negotiations leading to new commitments.” Indeed, the head of Brazil’s delegation, Everton Vieira Vargas, is quoted as saying, “We are not prepared to discuss reductions in emissions.”³ So the first objective for proponents of a post-2012 agreement is to ensure “talks about talks” take place, and soon.

One thing on which the parties are agreed is that a second commitment period post-2012 is unlikely to resemble the first Kyoto period, with or without the participation of the US. This is true both for the participation in, and allocation of, emissions reduction targets, and for decisions affecting the design of the emissions trading market, such as the treatment of “hot air”, the definition of “additionality”, provisions on banking, and regulations regarding forestry. These issues are important because ongoing uncertainty reduces the quantity and the value of investments that take place. As 2012 approaches and no agreement is forthcoming, the price of carbon will fall as demand for emissions reductions is seen to decline. The Electric Power Research Institute (EPRI) demonstrates, using “real options” approaches, that policy uncertainty requires the carbon price to be higher than otherwise expected in order to achieve a specific level of investment in low-carbon technologies. Given the policy-driven nature of the carbon market, early decisions regarding emissions reduction targets post-2012 are therefore vitally important.

Box 1: Background to the Kyoto Protocol

International efforts to mitigate climate change first began with the United Nations Framework Convention on Climate Change, signed in 1992 at the Earth Summit in Rio De Janeiro, Brazil. The ultimate objective of the UNFCCC as expressed in Article 2 was the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”. Article 4.2 of the Convention committed “Annex I Parties” (effectively the industrialised world including the EU, US, Russia and other members of the OECD) to the legally-binding aim “of returning individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases... by the end of the present decade [2000]... taking into account their common but differentiated responsibilities”.

As time progressed it became clear that Annex I Parties would fail to live up to their responsibilities. Thus in 1997 the UNFCCC met at COP3 in Kyoto, Japan, to negotiate the Kyoto Protocol. The Protocol was signed and subsequently ratified by almost every Annex I party to the UNFCCC, except for certain notable exceptions, namely the US and Australia. Article 3 of the Protocol (which entered into force in February 2005) obliges participating Annex I countries (“Annex B Parties”) to legally-binding GHG emissions reductions averaging 5% of 1990 levels (typical base year) over the commitment period 2008-2012. Under the EU Burden Sharing Agreement (“BSA”) the EU commitment of an average 8% reduction was distributed among Member States using the Triptych Approach (see page 12); for example, the UK took on a target of a 12.5% reduction in GHGs on 1990 levels, compared with a target for Spain of a 15% increase. Kyoto established an international emissions trading scheme by which Annex B Parties can trade their assigned amount units (“AAUs”, representing the total emissions of CO₂-equivalent (CO₂e) available over the period 2008-2012 as determined by the individual targets adopted) to ensure compliance is achieved at least cost.

The “flexible mechanisms” of the Clean Development Mechanism (“CDM” – Article 12) and Joint Implementation (“JI” – Article 6) were designed to enable Annex B Parties to undertake emissions reduction projects in a non-Annex B country (developing country), or another Annex B country, respectively, to help meet their own targets. Emissions reductions generated by CDM and JI projects are rewarded by the issuance of a corresponding number of credits that may be retired by Annex B Parties to cover an equal amount of emissions within their own jurisdictions (the credits are “fungible” with AAUs). Yet two constraints act to limit the potential for these schemes to achieve emissions reductions; *additionality* – a requirement under Articles 6.1(b) and 12.5(c) that credits may only be earned by CDM and JI projects for reductions that are additional to any that would have occurred in the absence of the project; and *supplementarity* – a restriction under Article 17 of the Protocol limiting the amount of flexible credits that may be used by an Annex B party to achieve compliance with its Kyoto target (this is generally understood to be 50%).

What emissions reductions are required post-2012?

The ultimate objective of the UNFCCC is to achieve “stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”⁴. The EU has interpreted this statement to require a limit of a 2°C global average surface temperature rise by 2100. This limit first originated from the IPCC “Second Assessment Report (SAR) – Climate Change” in 1995, which claimed that the risk of severe climate change impacts would increase markedly at temperatures above this level.

In a recent European Commission communication “Winning the Battle Against Global Climate Change” (2005), the EU cites a study that quotes almost a two in three chance of staying within the 2°C target at current GHG concentrations (around 425 ppm CO₂e and rising 0.5% per year). This decreases to a one in six chance at 550 ppm CO₂e and one in sixteen at 650 ppm CO₂e. The EU considers therefore that “limiting the temperature rise to 2° C will very probably require greenhouse gas concentrations to be stabilised at a level even lower than 550 ppm CO₂e”⁵.

International Energy Agency (IEA) statistics indicate that world energy-related CO₂ emissions in 2002 were 16.4% above their 1990 level. Their increase in 2001 alone was 2%. The IEA forecasts that global emissions of GHGs in 2030, based on existing policies, would be 60% higher than in 2002⁶. Even under an “alternative policy scenario”, in which governments commit to significant environmental action, global emissions would rise 33% by 2030. Recent research by the UK Hadley Centre suggests that emissions must be reduced 54% on 2002 levels by 2100 to stabilise concentrations at 550 ppm⁷. *However, the rates of reduction would need to be many times faster if mitigation were delayed by 20 years.*

Emissions reductions are required most from those countries that emit the most GHGs. The US is currently the world’s single largest emitter of GHGs (the US alone produces 25% of all global CO₂ emissions⁸). Total industrialised world emissions are also greater than those of the developing world, despite vastly lower population levels. However, developing world emissions are expected exceed those of the industrialised world by 2020⁹. In fact, developing world emissions are expected to double between 2002 and 2030 on a “business-as-usual” basis¹⁰ (Figure 2). Already, China is the world’s second largest emitter of GHGs and projections suggest China may overtake the US to be the world’s single largest emitter by 2020 (although emissions per capita will still be far higher in the US). The importance of China, and the developing world as a whole, to efforts to mitigate climate change is therefore clear and growing.

Some consider that a comprehensive agreement committing both industrialised and developing countries to absolute emissions reductions to achieve emissions stabilisation requires a guaranteed convergence at equal per capita emissions by some date in the future (the issue of “fairness” is discussed on page 11). Such convergence would require emissions reductions in the industrialised world that are far greater than in the developing world. The UK national target is based upon a Royal Commission report, “Energy – The

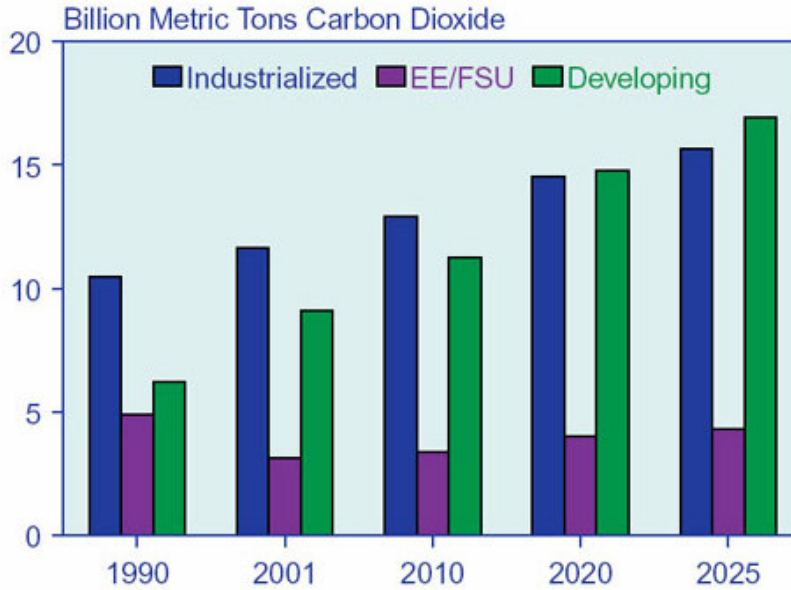


Figure 2: World Energy-Related Carbon Dioxide Emissions by Region, 2001-2025. Source: EIA, *International Energy Outlook* (2004)

Changing Climate”, which calculated that global contraction to 550 ppm CO₂ concentrations, with equal emissions per capita by 2050, would require a UK contribution of a 60% reduction of 1990 CO₂ emissions by 2050. The sheer scale of the challenge ahead is enormous, given that in recent years UK CO₂ emissions have been increasing, and efforts since 1990 by the vociferously pro-Kyoto EU-15 countries resulted in a mere 3% decline in GHG emissions by 2002.¹¹

What is the position of the key international players?

US

The current US federal government is firmly opposed to absolute emissions reductions as mandated by the Kyoto Protocol. President George Bush repudiated the Kyoto Protocol in 2001 claiming it would “harm our [US] economy”¹². Even while the Clinton Administration signed the Protocol in 1998, which required the US to reduce GHG emissions by 7% on 1990 levels over the period 2008-2012, this was against a backdrop of tremendous political hostility to binding emissions reduction targets. The US Senate passed the ‘Byrd-Hagel’ resolution in June 1997 by 95 votes to 0, which required that the US not be party to any protocol negotiated at Kyoto or thereafter that would “mandate new commitments to limit or reduce GHG emissions for the Annex I Parties, unless the protocol... also mandates new specific scheduled commitments to limit or reduce GHG emissions for the developing country Parties within the same compliance period”¹³. This attitude is still common amongst politicians in the US, especially in the current Administration. President Bush’s team are particularly wary of the effects on industrial competitiveness from engaging in emissions reductions without corresponding commitments now (or at least very soon) by rapidly industrializing countries like China and India.

There are a few key reasons for the divergence between the current US position on climate change and those of the other (Annex B) industrialised countries. US economic activity (including the total size of the economy) is higher than in many other industrialised countries, making energy consumption higher. Per capita emissions are therefore far higher than for most other industrialised countries (roughly double the UK’s), which is also partly due to certain cultural and geographical differences. The US also has significant reserves of coal but fewer gas-fired power plants (affecting the ease of fuel switching, the cheapest form of abatement at low levels). And the political system in the US has been more immune to the concerns of scientists predicting climate change than in many other countries, due to philosophical, structural and economic factors.

Yet even the current US Administration admits that climate change is a problem and that “the science” justifies a decline and eventual reverse in GHG emissions growth¹⁴. In February 2002, President Bush launched “The Clear Skies & Global Climate Change Initiative”, aimed at reducing GHG intensity¹ by 18% from 2002 until 2012 (although it appears the Act will find it difficult to pass through Congress). Outside the Administration there are growing efforts to prompt mandatory GHG emissions reductions targets at the federal-level. The bipartisan National Commission on Energy Policy recently called for a national emissions trading system to reduce CO₂ emissions intensity by 2.4% per year from 2010¹⁵. The McCain-Lieberman Climate Stewardship Act is repeatedly testing the determination of the Senate to oppose federal restrictions on GHG emissions. The Act proposes to introduce a “cap-and-trade” system to limit GHG emissions from covered sources (roughly 80% of all US GHG emissions) at 1990 levels by 2010. In October 2003 the Act was narrowly defeated in the Senate by 55 votes to 43

¹ Emissions intensity refers to GHG emissions per unit of economic activity (GDP)

but it was re-submitted in February 2005 and, at the very least, will work to focus political minds at this key stage in international climate change negotiations.

Most importantly there is significant mitigative action underway at the state-levelⁱⁱ. The Pew Center on Global Climate Change reports that 28 states in the US have adopted climate action plans to limit GHG emissions¹⁶, while many more have imposed emissions inventory requirements on industry. The Regional Greenhouse Gas Initiative (RGGI) is a co-operative effort by North-Eastern and Mid-Atlantic states (and could include Eastern Canadian provinces) to create a cap-and-trade system to reduce CO₂ emissions to 1990 levels by 2010, with a further 10% reduction by 2020¹⁷. California and several West coast states are also looking at implementing a cap-and-trade system to achieve their own GHG emissions reduction commitments at least cost¹⁸. On 1 June 2005 Governor Schwarzenegger committed the state of California to reduce GHG emissions to 2000 levels by 2010, with a long-term target of an 80% reduction on 1990 levels by 2050. It seems only a matter of time that either a regional emissions trading scheme linking North-Eastern, Mid-Atlantic and West coast states, or a legislated federal cap-and-trade system as the historical response to differential regulatory systems at the state-level, is established. Mechanisms could be found to encourage the adoption by the US of emissions reduction targets as part of an international agreement (perhaps involving linkage at the regional level in the absence of a federal system), such as the use of price caps (Box 2) to provide greater certainty about the costs of abatement.

EU

EU leaders declared in March 2005 that in order to achieve the ultimate objective of the UNFCCC, “global annual mean surface temperature increase should not exceed 2°C above pre-industrial levels”. Accordingly they determined to work for the “widest possible cooperation... in an effective and appropriate international response”, in which “reduction pathways [of GHG emissions] for the group of industrialised countries in the order of 15-30% by 2020, compared to the baseline envisaged in the Kyoto Protocol... should be considered”. They also called for consideration as to how major emitting countries could be involved, “including those among the emerging and developing countries”¹⁹.

Earlier in March 2005 EU ministers had agreed that a long-term aim for industrialised countries of a 60-80% reduction of GHG emissions on 1990 levels by 2050 should be considered, but this was not specifically endorsed by EU heads of state and government. However, the mere fact that such a target (which appears to be consistent with the contraction and convergence argument – see later) was discussed, provides an indication of the direction EU decision-making is heading. As mentioned previously, the UK government has set a target for a 60% reduction in CO₂ emissions on 1990 levels by 2050, which was based explicitly on a contraction and convergence model. Other Member States have adopted similar targets, with a 75% reduction by 2050 in France and

ⁱⁱ There is further impetus from a variety of sources including emissions limits at the municipal level (like the city of San Francisco’s target of a 20% reduction below 1990 levels by 2012), voluntary actions by the private sector (such as the members of the Chicago Climate Exchange), and continued probing of the judiciary by means of environmental litigation.

Box 2: Price Caps

Price caps act to limit the costs of emissions abatement to a specified level. In an international emissions trading scheme they would determine the price at which governments could issue and sell additional permits. As an example, the Canadian government has set a price cap of CAN\$15 on any allowances bought by Canadian industry in the 2008-2012 Kyoto period.

Price caps act to reduce uncertainty about compliance costs, and limit the actual costs themselves, but this may be at the expense of achieving the absolute emissions reductions intended when agreeing to a particular target. Additional problems include the determination of the price cap such that countries and sectors with the highest compliance costs are not grossly affected by a permit price that is too high, whilst economic incentives to invest in low-carbon technologies are not reduced by a permit price that is too low. However they could be applied at different prices for different levels of obligation (see multistage approach), provided trading above an assigned amount is restricted so that allowances could not be sold on at a higher price.

a 40% reduction by 2020 in Germany^{20,21}. But the position of the European Commission set out in a recent (2005) review of EU climate change policy, “Winning the Battle Against Climate Change”, is more equivocal. It speaks less of specific targets and more about the importance of extending emissions reduction commitments to other major emitting countries.

The EU has been the principal advocate of the Kyoto process and its economic and geopolitical clout make it a strong player in international negotiations. But, in terms of achieving the key EU policy goal of absolute global emissions reductions, it is vital for countries other than the EU (and remaining Annex B countries) to be incorporated in a post-2012 process. Annex B emissions are declining but global emissions are increasing at a steady rate; the EU’s share of global CO₂ emissions is currently just 14% and projected to decline to 8% by 2050^{22,23}.

There is some truth to the claim that the EU was able to adopt significant emissions reduction targets at Kyoto because it had benefited from falling emissions following liberalisation of the electricity sector. But the implementation of measures such as energy efficiency improvements, fiscal incentives and pollution abatement policies (like the Integrated Pollution and Prevention Control Directive) have made a contribution to restricting emissions growth. An additional factor, the rise of the “Green” party in national politics, may have changed the political atmosphere in which climate change policies are constructed. Certainly the effect of non-governmental organisations has been important in promoting the urgency of climate change mitigation in the public consciousness.

In regards of forthcoming negotiations on post-2012 the position of the EU will nevertheless be greatly influenced by the US (and major developing countries). The EU would ideally favour the US to match any commitment to reduce emissions during a putative post-2012 period. However it seems likely that EU negotiators would permit the US to adopt a less stringent obligation (albeit with some restrictions, for example on trading) in the interests of achieving some US commitment rather than none at all. A successful EU ETS and international emissions trading scheme, delivering Kyoto targets at reasonably low cost (or significantly lower than its detractors once predicted), could therefore be important in providing a strong stimulus for US engagement (and to a lesser extent reluctant developing countries) in adopting binding emissions reduction targets.

But it is important not to ignore the possibility that Member States will differ widely in their views about a post-2012 regime and be unable to form a common, or at least collective, position. An indication of this was provided by the Italian Environment Minister Altero Matteoli in December 2004 when he claimed, “It is unthinkable to go ahead [after 2012] without the US, China and India”, suggesting instead, “We must proceed with voluntary accords, bilateral pacts and commercial partnerships”²⁴. Since there is no precedent for the renunciation of an EU Directive there is virtually no possibility that the EU emissions trading scheme (“EU ETS”) would simply cease to exist. Rather allocations might be set at business as usual, or on an *ex post* basis, until the US or developing countries themselves agree to participate.

Developing World

An important principle in international negotiations is equity (or fairness). This is of particular importance to developing countries because of their relative lack of wealth, limited state of development and low historic contribution to global GHG concentrations (CO₂ persists in the atmosphere for around 100 years²⁵). Developing countries typically argue that it is unfair to expect them to pay for emissions reductions when they have made only a limited contribution to the climate change problem, and have not benefited from the economic growth and development associated with fossil fuel combustion in the industrialised world. This explains why the UNFCCC states, in several different instances, that Parties have “common but differentiated responsibilities” and in Article 4.7 makes clear “that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties”.

Indeed, with the exception of the industrialising world (used to refer generally to the major developing countries like China, India and Brazil), developing world (such as Thailand or Namibia) emissions are, by and large, irrelevant with respect to the present need for mitigation. Clearly their economic capacity to implement significant emissions reduction policies is also extremely limited. These least developing countries (LDCs) will therefore not expect, nor reasonably be expected, to engage in absolute emissions reduction targets post-2012. Instead their interests will be focused primarily on attracting foreign investment and overseas aid to assist in fueling economic growth and development (and adaptation to climate change). Expansion of the CDM (Box 5) or a similar investment mechanism, together with assistance to fund adaptation to climate

change impacts, may be the price to pay for guarantees about emissions reduction targets in the long-term.

Far more important with regard to current negotiations is the position of the industrialising countries within the developing world. It is widely accepted that the industrialising world will not accept any binding emissions reduction targets starting in 2012. Developing world emissions are growing rapidly to fuel strong economic growth and increasingly consumerist societies. Nevertheless per capita emissions are still well below those of the industrialised world. This fact is important to developing world governments; the former Indian Prime Minister Atal Behari Vajpayee is quoted as saying, “We do not believe that the ethos of democracy can support any norm other than equal per capita rights to global environmental resources”²⁶. The Brazilian Proposal (see later) for allocating emissions reduction burdens was based explicitly on the basis of the historical responsibility argument and led rapidly to equal per capita emissions between nations, which would require industrialised countries to make extremely large reductions in the short-term.

Hence a plurilateral agreement between the major emitting countries, both industrialised and developing, involving absolute emissions reduction targets post-2012 is extremely unlikely, even with the participation of the US. This leaves the option of including industrialising countries in a global climate change agreement in more imaginative ways. Perhaps they might be enticed by the carrot of positively-binding targets (Box 3) while agreeing that the stick of absolute targets will be applied at some specific point in the future. They may even be persuaded to adopt a moderately stringent level of dynamic target (Box 4) provided the EU, the US and other industrialised countries take on aggressive absolute reduction targets of their own. In essence the developing world requires a “bottom-up” approach to mitigation in which targets (when acceptable to developing governments) are aligned with developmental and policy goals rather than vice versa.

Box 3: Positively-binding targets

A positively-binding target is one which incentivises action to limit GHG emissions by enabling over-achievement of the target to be rewarded with tradeable emissions allowances. If the target is missed there is neither a requirement for the party to buy allowances to make up the difference, nor any other form of penalty.

Positively-binding targets have been proposed as a means of encouraging participation in a post-2012 climate change agreement for developing countries that are unwilling to adopt binding emissions reduction targets. A developing country might agree to an emissions intensity target or absolute emissions reduction target from a specific date in the future, provided any over-achievement of the earlier positively-binding target could provide allowances to help with compliance.

It is widely understood that technology transfer, perhaps mediated through an expansion of the current CDM (or similar mechanism), will be a key issue in determining the level of engagement from industrialising countries in respect of climate change negotiations for post-2012²⁷. The UNFCCC again provides the legal framework that underpins this position; Article 4.7 states that “the extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by industrialised country Parties of their commitments under the Convention related to financial resources and transfer of technology”. The vital point here is that CDM expansion should also be attractive to industries within the industrialised world who would find it cheaper to source emissions reduction credits from developing world projects rather than to implement their own emissions abatement measures. This is because carbon intensity of developing world economies (and the former USSR) is much greater than for industrialised economies (Figure 3), primarily because of the use of older, less efficient technologies.

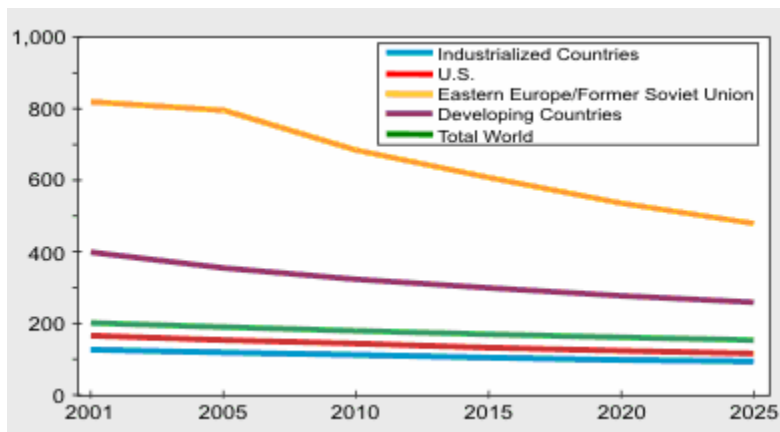


Figure 3: Carbon Intensity by Region, 2001-2025 (Metric Tons of Carbon Equivalent per Million \$1997). Source: EIA, *International Energy Outlook* (2003)

Box 4: Dynamic Targets

Dynamic targets are emissions reduction targets that change in response to another variable. The most common example (and the option considered here) is emissions intensity (or carbon intensity). These have a similar advantage to price caps in that they allow costs of compliance to be minimised in the event of an escalation in abatement costs (providing greater cost certainty), since here the target can adjust in response.

Under such a scheme a participating nation adopts a specific emissions intensity target (or other dynamic target) determined by the allocation methodology (see later). Towards the end of the compliance period national GDP growth is measured and permits are allocated (*ex post*) for international emissions trading (since prior to this point it is not certain what the specific allocation will be). The trading scheme could be designed to accommodate absolute emissions reduction targets for some participants and dynamic targets for others, although there would be procedural complexities.

Difficulties lie in the restricted period for trading, which might lead to increased compliance costs, and forecasting economic growth accurately when determining the level at which dynamic targets are set. Most importantly the targets may not achieve an absolute emissions reduction over the compliance period (depending upon whether the intensity reduction target is greater than the commensurate (forecast) growth rate in GDP). For example, the US Clear Skies Initiative of 2002 proposes an emissions intensity reduction target of 18% over 10 years, but this would nevertheless result in an expected 12% increase in absolute emissions over the same period. However dynamic targets address concerns over unacceptably high abatement costs and (almost paradoxically) could therefore allow more stringent emissions reduction targets to be set than would otherwise be the case.

How should emissions reduction burdens be allocated?

The fundamental aim of any approach is to achieve the maximum emissions reductions possible at least cost, bearing in mind practical constraints and political realities. Given the top 25 emitters in the world are responsible for 83% of global GHG emissions, a plurilateral agreement between as many of these countries as possible is the desirable outcome of post-2012 negotiations. However it is clear that the ideal approach post-2012 may not be the most politically-acceptable and hence realistic option available. This fact will be reflected in the following critique of the possible methodologies to be adopted in determining allocations for a post-2012 agreement.

Kyoto Plus

Kyoto Plus essentially refers to a continuation of the existing Protocol, although possibly with an expanded Annex B component. Obligations are determined by negotiation and restricted to absolute emissions reduction targets, which are most likely to be adopted only by industrialised countries until countries like China and India can be persuaded to join later this century. The opportunity to use the flexibility mechanisms would be retained and possibly enhanced by extending CDM (and JI) eligibility (Box 5). Targets would be based upon a consensus view of the climate change science taken at that moment in time, but a Kyoto Plus approach would avoid calculating individual national targets explicitly on the basis of a long-term GHG concentration target. Targets could be varied for each additional five-year commitment period, allowing responses to emerging scientific evidence to be fed regularly into the target-setting process.

Contraction and Convergence (C&C)

This approach was developed by the Global Commons Institute and presented in 1996 at COP2 of the UNFCCC. It first involves the identification of a long-term target for global emissions stabilisation, for example such that concentrations of CO₂e do not exceed 450 ppm by 2050 (Contraction). The corresponding level of annual emissions required for this stabilisation is then divided between countries on an equal per capita basis by a future date (Convergence), although this need not be the same date as that for Contraction.

There have been many variations on the theme of C&C described. However they all share the same fundamental characteristics of identifying a long-term target and reaching equal per capita emissions. A C&C approach involves the determination of emissions trajectories for each individual nation that must (by and large) be adhered to if contraction and convergence are to be reached by their intended dates. However there is some opportunity to alter the choice of target, such that it may be revised (upwards or downwards) at a later date given new evidence in the scientific case for climate change.

A major problem is that if the target is moved ten years or twenty years into a C&C process, previous emissions reductions (which are likely to be significant for the industrialised world) may have been wholly unnecessary. The imposition of fixed emissions trajectories also limits the flexibility for nations to alter course in the event of excessively high abatement costs. But a key principle behind C&C, that of equal per

capita emissions rights, is fundamentally sound. It seems only fair that access to a finite resource should be divided equally among those who would use it. And it is apparent that C&C may be important in determining future emissions reduction targets, at least as a means of informing negotiations about how to achieve a specific concentration of GHGs in the atmosphere. It is useful here to recall the basis upon which the UK has set its own target of a 60% reduction in GHG emissions by 2050, and that figures discussed generally in the EU tend to be consistent with a C&C approach. However, the likely reality of these targets, and their appropriateness in the light of uncertainties regarding the underlying climate change science (and costs of mitigation), are questionable.

Historical Responsibility

During negotiations for the Kyoto Protocol in 1997 the Brazilian delegation tabled a proposal (the “Brazilian Proposal”) that advocated a reduction of global atmospheric greenhouse gas (“GHG”) emissions of 30% on 1990 levels by 2020. The entitlement for a particular country to emit was determined proportionately by their historic contribution to climate change (known as their “carbon debt”); the U.K. was set a target of a 66% reduction on 1990 levels by 2010 and the US a 23% reduction target on the same basis.

From the perspective of industrialised nations like the UK, these targets are totally unrealistic, and it is no surprise that the historical responsibility approach was largely ignored at Kyoto. However, the core principle of the Brazilian Proposal, which largely reflects the “polluter pays principle”, is relevant to discussions for a future climate change regime, in that it places the obligation for immediate emissions reduction targets on industrialised nations before developing nations are similarly constrained. This argument, which assumes that industrialised countries bear responsibility for their historic emissions, is controversial. On the one hand it would seem unfair to punish present generations for the actions of past generations. But on the other hand it would seem unfair to restrict developing and industrialised country emissions in equal measure given the vast difference in their historic use of a finite resource. Regardless of whichever argument is more favourable, the historical responsibility approach, in a similar way to the C&C approach, is important because it is considered (at least by developing countries) to fulfil the obligations of the UNFCCC for industrialised countries to mitigate before developing countries, in line with their “common but differentiated responsibilities”.

An approach labelled “Common but Differentiated Convergence” (CDC) by the consultancy Ecofys is essentially C&C combined with an element of historical responsibility²⁸. It involves the selection of a contraction target for GHG concentrations, to be achieved by specified emissions trajectories, with an eventual convergence to equal per capita emissions (C&C). The timeframe within which industrialised emissions must contract is shorter than a “pure” C&C approach, in order to enable developing countries to increase their per capita emissions above the global average for a certain period of time. Thus absolute limits for developing countries are delayed depending upon their relative state of development (which could be judged by GDP/capita, for example), although positively-binding targets could be used in the interim to incentivise early mitigation. CDC is an attractive approach from the perspective of the developing world,

but the obligations imposed on industrialised countries are too onerous to be considered politically realistic. Yet CDC, or some other manifestation of the C&C and historical responsibility approaches, may provide a framework within which emissions allocations are decided; and in this sense they could play an important role in climate change negotiations (for good or bad).

Sectoral Approaches

Sectoral approaches can be used to determine either “bottom-up” the total allocation for each nation, or “top-down” the distribution of a defined emissions allocation (calculated by a different methodology) within each nation. By evaluating sectors rather than national totals, sectoral approaches enable differences in national circumstances (namely the relative development of different economic sectors) to be accommodated.

The means of calculating sectoral emissions allocations vary. For example, allocations may be based upon benchmarking against agreed global “standard” or equal per capita emissions. The Triptych approach, used by the EU to determine targets for Member States under the Burden Sharing Agreement, distinguishes three sectors whose (global) long-term targets are based upon the potential for energy efficiency (energy-intensive sectors), GHG intensity (electricity production) and equal per capita emissions (domestic). These sectoral allocations are then totalled to give the national emissions allowance.

The multi-sector convergence approach divides emissions into seven sectors, each sectoral target being consistent with a convergence to equal per capita emissions. Global sectoral targets are then adjusted according to technical emissions reduction potentials (to accommodate different mitigation costs) and totalled for each nation. Modifications to this approach are possible to take account of specific national circumstances (such as limited opportunities for renewable power generation).

Problems with sectoral approaches include the requirement for accurate and detailed emissions inventories and sectoral data (including projections). As such they are somewhat prohibitive to the involvement of many developing countries whose national data systems are often poor and incomprehensive. Benchmarking against an agreed level of emissions may also punish early mitigative action and discourage mitigation beyond the benchmark level.

Multistage Approaches

A multistage approach identifies multiple categories for participation in a post-Kyoto agreement, each with a defined set of entry criteria and a different level of obligation. Entry criteria might be determined on the basis of, for example, GDP per capita, emissions per capita or historical responsibility (and possibly negotiation). In terms of obligations, two notable multistage approaches have been proposed, one by the RIVM in the Netherlands and the other by Climate Action Network.

RIVM identified four categories (based upon GDP per capita) with different levels of obligation: none; intensity targets; emissions stabilisation targets; and absolute emissions

reduction targets. The Climate Action Network approach defined three “tracks”: the Adaptation track, in which countries undertake no targets but receive funds from industrialised countries to adapt to climate change impacts; the Greening (decarbonisation) track, whereby countries adopt low-carbon technologies with assistance from industrialised countries; and the Kyoto track, which commits countries (as in Annex I to the Kyoto Protocol) to mandatory emissions reduction targets.

If industrialising countries such as China and India could be encouraged to mitigate at a lower obligation level than industrialised countries, a multistage approach would thereby satisfy (to some extent) the concerns of the US with regards to economic competitiveness. Indeed, depending upon the type and level of targets and allocations (such as positively-binding intensity targets), developing countries could be incentivised to tackle emissions in order to maximise revenue from sales of any surplus permits to short, negatively-bound industrialised countries. Alternatively a Greening (CDM) track, offering cheap emissions reductions in industrialising and developing countries, could encourage greater industrialised country participation even if the likes of China and India do not take on emissions reduction commitments.

Multistage approaches constitute an attempt to involve a greater number of countries in climate change mitigation efforts than proposals based merely upon absolute emissions reduction targets. Key to these approaches is the idea that developing countries would graduate from one category to another with time (as they meet the entry requirements for different categories) until all countries undertake binding emissions reduction targets. The entry criteria and obligations for each category would likely be set depending upon the choice of long-term target (either for maximum global temperature change or GHG concentration). However it would be perfectly possible to define alternative categories of obligation, for example on the basis of historical responsibility, GDP per capita or emissions per capita.

Box 5: Expansion of the CDM

The CDM incentivises investment by Annex B parties in non-Annex B countries on a project-by-project basis. There is currently a problem with the additionality requirements of the CDM Executive Board, which are acting to limit the development of projects on the basis that they would have happened in the absence of the CDM and should therefore not be able to claim emissions reduction allowances. Clearly this issue needs to be resolved quickly to enable the flow of projects to increase and to promote development in non-Annex B (developing) countries together with the cheap emissions reductions required to minimise mitigation costs globally.

There is a possibility that the CDM may be expanded post-2012 to enable greater investment in developing countries from the industrialised world, for mutual gain. Of particular interest is the possibility that the CDM may enable investment to support government policies to develop low carbon technologies in addition to just individual projects. For example, a government programme to build or to provide assistance for wind farms to generate electricity could be encouraged with investment from the CDM.

It is possible that the EU and industrialising countries like China might move ahead post-2012 with a massive programme of emissions reductions investments and correspondingly low-carbon technology development. In this instance the remaining industrialised world might be encouraged to move quickly to join an agreement (if the costs are relatively low) for fear of being left behind. Alternatively the US could pull China and India away from the Kyoto process by offering its own CDM-like technology investment programme. One factor that may act against this (and indeed CDM expansion) is the political difficulty associated with policy that encourages investment (and enhances competitiveness) in foreign rather than domestic industry.

Conclusion

Negotiation of a post-2012 climate change agreement requires the reconciliation of three disparate needs; a stable long-term regulatory framework for the development of low-carbon technologies to meet long-term environmental goals; medium-term price visibility for corporate investment decisions; and short-term political acceptability for national governments. In reality a compromise must be reached.

This paper is optimistic that such a compromise is possible and that it can be achieved in time for implementation in 2012. Various flexibility mechanisms and measures (such as the use of price caps, flexible and non-binding targets, and multistage/multisectoral approaches) exist to tackle the problems of excessive and uncertain costs and these may be incorporated relatively easily into the design of a comprehensive international emissions trading scheme.

There are also encouraging signs beginning to emerge in the US. The current Administration is appearing increasingly isolated both within the US and internationally. Its climate change policies (or lack thereof) could be described as representing an anomaly that will quickly be reversed after 2008. Thus it is not simply optimistic, but realistic to expect participation by the US, and possibly rapidly industrialising countries like China, in a post-2012 international climate change agreement.

And finally, while there is uncertainty about specific elements of the scientific case for dangerous anthropogenic climate change, the consensus is that the evidence is strong and growing. This can only lead in one direction; towards further and more severe emissions reductions, that will eventually be adopted globally. The conclusion of this study is that the Kyoto Protocol is not simply a “one-off”. It is instead the first of many steps towards a low-carbon economy.

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