
9 Getting serious about global climate change: post-Kyoto international climate policy architecture

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Abstract

I examine some of the challenges the world faces in developing a successor to the Kyoto Protocol to address the threat of global climate change. I begin by highlighting key lessons learned from the Protocol, and then describe the major types of alternative policy architectures that can be employed in a successor international agreement, which may be negotiated at the Fifteenth Conference of the Parties to the Framework Convention on Climate Change in Copenhagen, Denmark, in December 2009. Drawing upon research from the Harvard Project on International Climate Agreements, I identify some of the key design elements of a scientifically sound, economically rational, and politically pragmatic post-2012 international policy architecture. I also examine links between international policy discussions and likely US actions on climate change. I conclude by commenting on an international policy architecture that may already be emerging.

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9.1 Introduction

In this essay, I examine global climate change policy, reflecting both on what is grabbing the headlines and — more important — what is happening behind the scenes in the development of public policy. Many people will remember the mega-disaster film, ‘The Day After Tomorrow’, about the apocalyptic consequences of the greenhouse effect. That film had less scientific basis than ‘The Wizard of Oz’. But reality is disturbing enough. The message from the scientific community is that man-made emissions of greenhouse gases are likely to change the earth’s climate in ways that many people will regret.

Climate concerns have gone mainstream, even in the United States. If this was not obvious from the 2006 *Time* magazine cover story about climate change, featuring a polar bear stranded on an ice flow, then it should be clear from the reality of a cover story in *Sports Illustrated* magazine in 2007, featuring a staged photo of a well-known baseball player, knee-deep in water in his Florida stadium. Both stories were replete with misleading statements, particularly from an economic perspective, but that is not my point. My point is that concerns about global climate change are now widespread, and mainstream.

We have witnessed the galvanizing effect of former US Vice President Albert Gore’s award-winning film, ‘An Inconvenient Truth’. Although the Vice President deserved his Nobel Peace Prize for having raised public awareness of the climate problem, which is what the Nobel citation indicated, from an economic and policy perspective the film was unfortunately misleading. Indeed, it may be said that a striking inconvenient truth is the fact that meaningful reductions of carbon dioxide and other greenhouse gas emissions will be very costly for the United States and many other countries. In the United States it will be approximately equivalent to the cost of complying with all other federal environmental regulations combined. And that is just for the relatively modest, short-term targets of the Kyoto Protocol.

Of course, this does not mean that it is a bad idea to take action, but it does mean that the costs should be recognized if governments are to design meaningful policies that will be environmentally effective, economically sensible, and politically feasible. I will return to that later, but for now I simply wish to reinforce the point that concern about global climate change is mainstream and widespread in many parts of the world.

These concerns have been reflected in international policy actions and domestic policy debates in many countries, and in the statements and actions of prominent business leaders, including calls from some leading corporations for climate regulation (such as the environment-business coalition in the United States known as USCAP). The subject of domestic US climate policy is an interesting and

important one, but climate change is a global commons problem, and unilateral actions by individual countries — no matter how necessary — will never be sufficient, because the benefits to individual countries will always be less than the cost. This means that a cooperative, international, if not global, approach is key. Of course, that is the fundamental logic behind the Kyoto Protocol.

I begin by focusing on the global climate policy challenge, commenting on international policy architecture. Then I turn briefly to the outlook for US climate policy, and then return to the global context.

9.2 The global climate policy challenge

The Kyoto Protocol came into force in February 2005, without participation by the United States. However, even if the United States had participated, the Protocol's direct effects on climate change would be very small to non-existent. At the same time, scientific evidence and economic analysis now point to the need for a credible international approach.

Lessons learned from the Kyoto protocol

It is helpful to reflect on lessons that can be learned from the Kyoto Protocol, examining the Protocol's strengths as well as its weaknesses. First, with regard to the strengths of the Kyoto Protocol, the agreement contains within it provision for a market-based approach, and therefore holds promise, at least, of being cost-effective. I am referring to the well-known flexibility mechanisms which are part of the Kyoto Protocol. First, under Article 17, there is provision for emissions trading among the Annex I countries, which take on targets under the Protocol, whereby these parties to the Protocol — the individual governments — can trade their targets, their 'assigned amounts'. Second, there is Joint Implementation, which provides for project-level trades among the Annex I countries. Third, there is the Clean Development Mechanism (or CDM), which provides for project-level offsets created in non-Annex I countries — the developing countries of the world — to be used by firms in Annex I countries to help achieve their targets.

A second advantage of the Kyoto Protocol is that it provides flexibility for nations to meet their national targets — their commitments — in any way they want. In other words, the Protocol provides for flexibility at the national level, that is, domestic sovereignty. The importance of this provision (Article 2) should not be underestimated in terms of its political importance for the agreement having been reached in Kyoto.

Third, the Kyoto Protocol has the appearance, at least, of fairness, in that it focuses on the wealthiest countries and those most responsible for the current stock of greenhouse gases in the atmosphere. This is consistent with the principle enunciated in the Framework Convention on Climate Change of ‘common but differentiated responsibilities’.

Fourth and finally, the fact that the Kyoto Protocol was signed by more than 175 countries and subsequently ratified by a sufficient number of Annex I countries for it to come into force indicates the political viability of the agreement, if not the feasibility for individual countries to comply with their targets.

In the realm of public policy, as in our everyday lives, we frequently learn more from our mistakes, from our failures, than from our successes. So, too, in the case of the Kyoto Protocol, and therefore, I now examine some of the key weaknesses of the Kyoto Protocol and how those lead to potentially valuable lessons for the path forward.

First, it is well known that some of the largest emitters are not constrained by the Kyoto Protocol. Some of the largest and most rapidly growing economies in the developing world do not take on targets under the agreement. Importantly, China, India, Brazil, South Africa, Korea, and Mexico are not part of Annex I. The rapid rates of economic growth in these countries, and therefore their rapid rates of growth of energy use, and hence CO₂ emissions, result in the fact that the developing world will soon overtake the industrialized world in emissions. Indeed, in 2008, China’s CO₂ emissions exceeded those of the United States for the first time, and thereby China has become the leading emitter in the world (Blanford, Richels, and Rutherford 2008).

In addition, these realities raise the possibility that the Kyoto Protocol does not represent the fairness which was originally intended, at least in today’s world. More than 59 non-Annex I countries — countries of the developing world, as well as others — now have higher per capita incomes than the poorest of the Annex I countries.

A second weakness of the Kyoto Protocol is that the United States — until recently the world’s largest emitter of greenhouse gases — has not ratified, and indeed will not ratify, the agreement. I will return later to some of the reasons for this, but for now this fact must be accepted as one of the weaknesses of the Protocol, as implemented.

A third weakness of the approach of the Kyoto Protocol is associated with the fact that a relatively small set of countries are tasked with taking action — the Annex I countries of the industrialized world. Although this approach may have been well-

intended, the result inevitably is that the costs will be driven up of producing carbon-intensive goods and services within the coalition of countries taking action; indeed, that is the intention of the Protocol, and it is fully appropriate. However, that means that through the forces of international trade, comparative advantage in the production of carbon-intensive goods and services — directly in proportion to their carbon intensity — will shift from the participating nations (the industrialized world) to the other countries of the world, that is, developing nations.

The result is that as greenhouse gas emissions are reduced under the Protocol within the coalition countries, we simultaneously will witness an increase in economic activity to produce carbon-intensive goods and services outside of the coalition countries. This means that at the same time that emissions are being reduced by the Annex I countries, there will be an increase in emissions by the non-Annex I countries, leading to so-called ‘emissions leakage’. This leakage will not be one-for-one, but nevertheless, it results in a reduction of cost-effectiveness, reduces the environmental performance of the agreement, and perhaps worst of all, pushes developing countries onto a more carbon-intensive growth path than they otherwise would have been, rendering it even more difficult for these countries to join the agreement later.

A fourth weakness of the Kyoto Protocol concerns the nature of emissions trading. For reasons I have written about in detail elsewhere, the provision in Article 17 for international emissions trading is unlikely to be effective, if indeed it is utilized at all (Hahn and Stavins 1999). The entire theory behind the claim that a cap-and-trade system is likely to be cost effective depends upon the participants being cost-minimizing entities. In the case of private-sector firms, this is a sensible assumption, because if firms do not seek to and indeed succeed in minimizing their costs, they will eventually disappear, given the competitive forces in the market. But nation states can hardly be thought of as simple cost minimizers; many other objectives obviously affect their decision making. Furthermore, even if nation states sought to minimize costs, they do not have sufficient information about marginal abatement costs at the multitude of sources within their borders to carry out cost-effective trades with other countries.

There is also great concern regarding the Clean Development Mechanism in the Kyoto Protocol. This is not a cap-and-trade approach, but rather is an emissions-reduction-credit system. That is, when an individual project results in emissions below what they would have been in the absence of the project, a credit — that may be sold to a source within a cap-and-trade system — is generated. But inevitably, this system raises the challenge inherent in the necessary comparison of actual emissions with what they would have been otherwise. The baseline is unobserved and fundamentally unobservable: what would have happened had the project not

been put in place. In fact, there is a natural tendency, because of economic incentives, to claim credits precisely for those projects which are most profitable, and hence would have been most likely to have been executed with or without the promise of credits. This is the so-called ‘additionality problem’. It is a serious issue. Although there are ways of reducing this problem through restructuring and reform of the Clean Development Mechanism in the future (Keeler and Thompson 2008), this surely must be taken as one of the weaknesses of the Kyoto Protocol.

Finally, the Kyoto Protocol — with its five year time horizon (2008 to 2012) — represents a relatively short-term approach for what is fundamentally a long-term problem. This is because greenhouse gases have lag times in the atmosphere of decades to centuries. Furthermore, in order to encourage the magnitude of technological change that will be required to address seriously the threat of climate change, it will be necessary to send long-term signals to the private market for investment and significant technological change (Newell 2008).

Can the Kyoto protocol provide the way forward?

So, the Kyoto Protocol has been criticized. The overall costs are much greater than need be, due to the virtual exclusion of developing countries. By conservative estimates, the costs are four times the cost-effective level. Second, the agreement will generate trivial short-term climate benefits over the period 2008 to 2012, and fail to provide a long-term solution for this long-term, stock — not flow — environmental problem. Third, it is ironic that these insufficient short-term targets are actually excessively ambitious, in that they would foster premature capital obsolescence. They are particularly ambitious and costly for the United States, because of the Kyoto Protocol’s base year of 1990 and the remarkable economic growth that took place in the United States subsequent to that year. The result is that the United States’ apparently modest 7 per cent reduction target translates into an actual target of reducing emissions by 35 per cent compared with business-as-usual emissions. Thus, the Kyoto Protocol is too little, too fast. Not a very pleasing combination.

Alternative policy architectures for the post-Kyoto period

Despite its deficiencies, can the structure — the architecture — of the Kyoto Protocol provide the way forward? After all, the Protocol also has some very positive attributes, as I noted above. Whether one thinks the Kyoto Protocol was a good first step or a bad first step, everyone agrees that a second step is required. A way forward is required for the post-2012 period. With this in mind, we launched the Harvard Project on International Climate Agreements, which I co-direct with

Dr. Joseph Aldy of Resources for the Future, a think-tank located in Washington, DC. The Harvard Project is a global, multi-disciplinary effort to help identify the key design elements of a scientifically sound, economically rational, and politically pragmatic post-2012 international policy architecture.²

We are drawing upon leading thinkers from academia, private industry, government, and non-governmental organizations around the world. Indeed, we have 28 research teams operating in Europe, the United States, China, India, Japan, and Australia. In addition to carrying out research, the Harvard Project has important outreach elements, which include our role as technical consultant to the Danish Prime Minister in his role as Incoming President of the Fifteenth Conference of the Parties to the Framework Convention on Climate Change, which will take place in Copenhagen in December 2009, where most people think — or at least hope — the post-Kyoto agreement will be struck or initiated.

Three categories of international policy architecture

In our book, *Architectures for Agreement: Addressing Global Climate Change in the Post-Kyoto World*, published by Cambridge University press in 2007, we describe potential post-Kyoto international policy architectures as falling within three principal categories: targets and timetables; harmonized national policies; and coordinated and unilateral national policies (Aldy and Stavins 2007). I will say a few words about each of these in turn.

This first category — targets and timetables — is the most familiar. At its heart is a centralized international agreement, top-down in form. This is the basic architecture underlying the Kyoto Protocol: essentially country-level quantitative emissions targets established over specified time frames. An example of an approach that would be within this realm of targets and timetables, but would address some of the perceived deficiencies of the Kyoto Protocol would be establishing targets that are formulas rather than numbers. With so-called ‘growth targets’, an individual country’s target is a function of its gross domestic product (GDP) per capita, for example. As countries become more wealthy, their targets become more stringent. When and if countries face difficult economic periods, the stringency of their targets is automatically reduced.

² The Harvard Project consists of three stages: (1) discuss among key international policy constituencies the proposition that the nations of the world ought to explore a range of options for a successor to Kyoto; (2) conduct economic modelling and policy analysis to develop a small set of promising policy frameworks and key design elements; and (3) explore key design principles and alternative international policy architectures with domestic and international audiences.

Such an approach does not divide the world simply into two categories of countries, as in the Kyoto Protocol, but rather allows for a continuous differentiation among the countries of the world, thereby including all countries, and hence reducing if not eliminating the problem of emissions leakage, but still addressing the key criterion of distributional equity, and doing so in a more careful, more sophisticated manner than is done under the Kyoto Protocol.³

The second category, harmonized domestic policies, focuses more on national policy actions than on goals, and is less centralized than the first set of approaches. In this case, countries agree on similar domestic policies. One example of this, frequently discussed by academics, but receiving little favorable attention from policymakers, is a set of harmonized national carbon taxes.⁴ With this approach, each participating country sets a domestic tax on the carbon content of fossil fuels, thereby achieving cost-effective control within its borders. The taxes are set by nations, and the revenue from taxes stays within the respective nations. The taxes could be revenue neutral, that is, returned to the economy through proportional cuts in other, presumably distortionary, taxes, such as those on labour and capital. In order to achieve global cost-effectiveness, the taxes would need to be set at the same level in all countries. This would presumably not be acceptable to the poorer countries of the world, and therefore significant financial transfers, that is, side payments, from the industrialized world to the developing world would need to accompany such a system of harmonized carbon taxes to make it distributionally equitable and hence politically feasible.⁵

The third and final category into which we sort potential post-Kyoto climate policy architectures is coordinated and unilateral national policies. These are the least centralized approaches of the three. They are essentially bottom-up approaches which rely on domestic politics to drive incentives for participation and compliance. Although these approaches are the least centralized, they should not be thought of as necessarily the least effective. Indeed, later in this paper, I describe one example of such a bottom-up approach — linking independent national and regional tradable permit systems — which holds promise of being a potentially effective approach.

³ In the Harvard Project on International Climate Agreements, one of the research initiatives focuses precisely on this approach, namely Frankel (2008).

⁴ Cooper (2008) has made such a proposal in the Harvard Project on International Climate Agreements.

⁵ For further discussion of equity considerations in the post-Kyoto climate regime, see Posner and Sunstein (2008). Issues of political feasibility are examined by Keohane and Raustiala (2008).

Summary of Kyoto and post-Kyoto architecture

The Kyoto Protocol has come into force without US participation, and without compliance by other countries, such as Canada, which likely will miss its Kyoto target by more than 30 per cent. In any event, the effect of the Kyoto Protocol on climate change would be trivial to nonexistent. At the same time, scientific and economic consensus point to the need for a credible international agreement that is scientifically sound, economically rational, and politically pragmatic. Various alternative policy architectures exist — some more promising than others — and some of these alternatives will be thrashed out in Copenhagen in December 2009 at the Fifteenth Conference of the Parties to the Framework Convention on Climate Change.

9.3 US climate policy outlook

While international discussions continue, a topic of great interest is how will the United States respond when it takes action to reduce net emissions of greenhouse gases. What means — what instruments of public policy — will the United States government use to bring about greenhouse gas reductions? Because of their great advantages in this realm, most attention has been focused on market-based instruments. Most proposals have featured tradable permit systems, in particular, cap-and-trade systems. This is partly because of theory, but mostly because of experience.

Market-based policy instruments in the United States

Cap-and-trade systems are an effective approach that can achieve environmental targets at minimum cost and send price signals for long-term technological change, which is absolutely key in the case of climate change policy. This is the approach used in the United States in the 1980s to phase out leaded gasoline from the market at savings of approximately \$250 million per year, compared with a conventional command-and-control approach (Stavins 2003). It is also the approach used in the United States since 1995, to cut sulfur dioxide emissions by half, saving about \$1 billion per year in compliance costs (Carlson et al. 2000). Likewise, this is the approach used by the European Union and its path-breaking emission trading scheme to reduce CO₂ emissions across the continent (Ellerman and Buchner 2007).⁶ It is also the approach used by the northeastern states in the United States to control CO₂ emissions from power plants in the Regional Greenhouse Gas Initiative

⁶ See, also, Ellerman (2008), for an examination of the implications of the European system to a potential global regime.

(Stavins 2007). Finally, it is the same approach being considered in California to implement the aggressive climate goals of Assembly Bill 32 (Market Advisory Committee 2007).

Another market-based approach to climate change is a carbon tax, which has some real merits compared with the trading approach, but also some real disadvantages.⁷ Also, importantly, there are hybrids of taxes and permits, which combine some of the positive elements of each (Stavins 2007). The political attention in the United States, however, has been focused almost exclusively on the cap-and-trade approach.

A US cap-and-trade system

The key merits of a well-designed cap-and-trade system for climate change in the United States are as follows.⁸ First, this approach can provide cost effectiveness, while achieving meaningful reductions in greenhouse gas emissions levels. Second, it offers an easy means of compensating for the inevitably unequal burdens imposed by a climate policy. This can be done through free allocation of allowances or through returning revenues generated by an auction of allowances. Third, the overall performance of a cap-and-trade system is unlikely to be degraded by political forces, in contrast to carbon taxes. Fourth, this approach has a history of successful adoption and implementation. And fifth and very importantly, it provides a straightforward means to harmonize with other countries' climate policies.

There are a considerable number of proposals for cap-and-trade systems of various design in both the Senate and the House of Representatives of the US Congress. The most prominent of these — the Lieberman-Warner legislation in the Senate — utilizes a fundamentally upstream, economy-wide cap-and-trade system with a set of targets over time which are approximately equivalent to meeting the US Kyoto Protocol target level in 2020, rather than in 2008–2012, as intended under the Protocol itself. The new Presidential administration and the new Congress in 2009 may move in this direction or some other, although real action may be delayed to 2010 or even later, due to US and world economic conditions. But, in any event, further action in the United States will not mean anything in the absence of some sort of meaningful global action, and so I return to the global policy context.

⁷ For a comparison of taxes and cap-and-trade for CO₂, see Stavins (2007).

⁸ For further discussion of a meaningful, upstream, economy-wide cap-and-trade system for the United States, see Stavins (2007), produced for the Hamilton Project at the Brookings Institution.

What will the future hold for US participation in an international climate agreement?

The Bush administration's announced plan of 'slow, stop, and reverse' emissions makes basic sense, but dates and targets are required for the 'stop and reverse'. Also, the plan's embrace — in principle — of market-based instruments is positive, but a real cap-and-trade system is required, not simply voluntary programs. What has been missing most from the Bush administration's approach to climate change has been action, if not leadership, in the international domain. President Bush appropriately criticized the Kyoto Protocol as a flawed international approach, but what was absent for many years was the administration's proposed alternative. In its final years in office, the administration has made movements in that direction with its series of meetings among the major economies of the world, although this process appears to have been too little, too late.

What about a future Democratic administration? First of all, it is important to keep in mind the vote in the United States Senate on the Byrd-Hagel Resolution in the summer of 1997 leading up to the Kyoto Protocol. Many people, particularly outside of the United States, seem to think that opposition to the approach embodied in the Kyoto Protocol has been partisan in the United States. But the Byrd-Hagel Resolution, which indicated that the United States Senate would not ratify an agreement which did not provide for meaningful action by key developing countries, was passed by a vote of 95 to 0. President Clinton did not submit the Kyoto Protocol to the US Senate for ratification, nor would Vice President Gore had he been elected President, nor would Senator Kerry had he been elected President. Likewise, this year's Democratic candidate for President, Senator Barack Obama, has indicated that he is not supportive of the Kyoto Protocol (as has Senator John McCain, the Republican candidate).

Thus, no matter who occupies the White House in the coming years, a Kyoto Protocol type treaty will not be submitted to the United States Senate for ratification (and if it were, it would not be ratified). State and regional initiatives in the United States will advance, and we are likely to see a meaningful national program — a cap-and-trade system — by 2010 or 2011 that will be endorsed and signed into law by the President.

The key remaining question is when will the United States begin to work with others on a better international agreement, and the answer is that this will happen in 2009 no matter who is elected President. Two important caveats, however, should be added to this claim. If the economy is mired in a deep and prolonged recession, or if there is a major — or even minor — terrorist incident on US soil, then

consideration both of domestic climate policy, as well as US activity on the international front will be decreased and delayed.

9.4 An emerging post-Kyoto climate policy architecture

Interestingly, the new international policy architecture may be evolving on its own, based upon the undeniable reality that tradable permit systems are emerging worldwide as the favored national and regional approach.⁹ Among the greenhouse gas tradable permit systems that have emerged are: the European Union's emission trading scheme; the Regional Greenhouse Gas Initiative in the northeastern United States; and systems in Norway, Switzerland, and other nations; plus a global emission-reduction-credit system, the Clean Development Mechanism.

Furthermore, cap-and-trade systems now appear highly likely to emerge as the chosen approach to reducing greenhouse gas emissions in an additional set of industrialized countries. Even before the change of government in late 2007, Australia had set itself on a course to develop a cap-and-trade system to achieve ambitious reductions in carbon dioxide emissions. Canada, which is likely to miss its Kyoto target, will most likely adopt a cap-and-trade approach when and if it attempts to move towards its Kyoto targets, or at least for the post-Kyoto years. Also, Japan, which had long indicated its interests lie in a sectoral approach to lowering greenhouse gas emissions, indicated in the summer of 2008, that it will develop a cap-and-trade system to reduce greenhouse gas emissions. And finally, within the United States, it appears likely that the United States Congress will adopt a comprehensive, upstream cap-and-trade system for carbon dioxide and possibly other greenhouse gas emissions in 2009, 2010, or at the latest, 2011. In addition, in California, a cap-and-trade system is being developed as a central part of the state's portfolio of approaches it will use to achieve the ambitious targets set out in Assembly Bill 32 (AB 32).

International linkage — incentives, merits, and concerns

Because of the emergence of this diverse set of cap-and-trade systems and emission-reduction-credits systems around the world, there is now increased attention and increased pressure — both from governments and from the business community — to link these systems. For example, in late August 2008, Australian Prime Minister Rudd and New Zealand Prime Minister Clark agreed that it was

⁹ This section of the paper draws on Jaffe and Stavins (2008), prepared for the Harvard Project on International Climate Agreements.

important for both countries to design their respective climate policies (cap-and-trade systems) so that ‘there are no barriers to linking the schemes’.

By linkage, I refer to direct or indirect connections among tradable permit systems through unilateral or bilateral recognition of allowances or permits. The benefits of linkage are, first of all, significant cost savings. These cost savings are brought about by linkage in the same way that a cap-and-trade system reduces costs, compared with separate regulation of sources. In addition, linkage across countries of one tradable permit system with another reduces overall transaction costs, reduces market power (which can be a problem in such systems), and reduces overall price volatility.

There are also some legitimate concerns about linkage, and some of these are very reasonable concerns. Most important is the automatic propagation of cost-containment design elements, that is, banking, borrowing, and safety valves. If one cap-and-trade system has a safety valve, for example, and another system does not have a safety valve, and the two systems are directly linked, then the result will be that both systems will now share the safety valve. Given that the European Union seems opposed to using a safety valve in its emissions trading scheme, and given that it appears quite likely that a safety valve will be a key element of the future emissions trading system in the United States, this automatic propagation of cost containment design elements is a serious concern.

More broadly, as a result of linkage, nations have reduced control over allowance prices, emissions impacts, and other consequences of their systems. However, it is important to recognize that this loss of control over domestic prices and other effects as a result of linking is simply a special case of the general proposition that as a result of engaging in international trade through an open economy, nations lose some degree of control over domestic prices. Indeed, the only way for a nation to have complete control over the prices within its borders, whether those be the prices of shoes or emissions allowances, is to close a country’s borders to international trade, thereby impoverishing one’s own economy and citizens.

Nevertheless, concerns about automatic propagation of design elements are significant, and these mean that advance harmonization of some design elements will be necessary prior to direct linking of cap-and-trade systems across international borders. Such requirements to harmonize systems before linking mean that two-way, direct links between cap-and-trade systems will be challenging.

An emerging post-Kyoto architecture

Interestingly, there are ways to gain the benefits from linkage of cap-and-trade systems, but without the downside of requiring advance harmonization. If a cap-and-trade system links with an emission-reduction-credit system, such as the Clean Development Mechanism, that linkage is of necessity a one-way link, since an emission-reduction-credit system has no use for allowances. If two cap-and-trade systems both link with the same emission-reduction-credits system, then the two cap-and-trade systems are indirectly linked with one another. All of the benefits of linkage occur: cost-effectiveness for the pair or set of cap-and-trade systems; and more liquid markets that reduce transaction costs, market power, and price volatility. But the downside of automatic propagation of key design elements from one cap-and-trade system to another does not occur when the linkage between the systems is indirect through an emission-reduction-credit system.

Such indirect linkage of cap-and-trade systems through the CDM is already occurring, because virtually all cap-and-trade systems that are in place, as well as those that are planned or contemplated, allow for offsets (to some degree) from the CDM to be used to meet domestic obligations. Thus, this kind of linkage among the world's cap-and-trade systems may already be evolving into the *de facto*, if not the *de jure*, post-Kyoto international climate policy architecture.

Let me emphasize that I am not recommending this particular post-Kyoto architecture as the best approach. Rather, I highlight it because it is an interesting departure from the typical centralized, targets-and-timetables approach that we typically think of as serving as the logical successor to the Kyoto Protocol, and because it may be evolving spontaneously. It is being examined in just one of the 28 research initiatives of the Harvard Project on International Climate Agreements (Jaffe and Stavins 2008).

9.5 Conclusions

National governments are pursuing a variety of individual climate policies. Europe has called for emissions to be 20 per cent below the 1990 level by the year 2020. The target likely to emerge in the United States by 2010 is 6 per cent to 7 per cent below 1990 emissions by the year 2020, which is similar to current European Union action, although it is less than stated European aspirations.

Cap-and-trade systems are clearly emerging as the preferred approach to address climate change in most countries of the industrialized world. And there is continued, very strong interest from developing countries in the Clean Development Mechanism. The United States will likely be much more aggressive in 2009 with a

new Presidential administration and Congress in place, both with regard to domestic action and with regard to US participation, indeed, leadership, in international negotiations regarding the post-Kyoto climate regime.

Even if the post-Kyoto international policy agreement is not decided in Copenhagen in December 2009, serious negotiations will at least be initiated at that time. Although it is not clear what all of the elements of that agreement will be, some key features are beginning to emerge. The key question, of course, is what architecture and what circumstances will bring China and other key developing countries into the coalition of action.

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