Negotiating the Next Climate Change Treaty

Policy Exchange

By Scott Barrett,
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Contents

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Executive Summary

Copenhagen is the new Kyoto, and it may turn out to be little better than its predecessor. While there are demands for a deal all around, the design and content of that deal has received less attention than it deserves.

The approach taken at Kyoto and Copenhagen, of legally binding aggregate targets, is not working. It lacks credible enforcement mechanisms.

The easy way to get countries to participate in a treaty, and to comply with it, is for the treaty to ask countries to change their behaviour very little. This is essentially what Kyoto does. Some countries have hit their targets with little effort and a lot of luck (UK, Australia) while others have massively increased their emissions with no consequences (Canada, New Zealand). Clearly, Kyoto did not change behaviour very much.

There is a better way. The Montreal Protocol, which dealt with ozone-depleting substances, is a model of success. Not only has it phased out substances such as CFCs which damage the ozone layer, it has done more to mitigate climate change than Kyoto even aspired to achieve.

Treaty negotiation is complex and difficult. Yet if we are not to end up with a lowest-common-denominator treaty which achieves nothing, several key things need to be in place. Montreal worked because it established permanent obligations rather than short-term targets. It targeted consumption as well as production and included developing countries, albeit with more generous timescales, from the start. Most importantly, it had credible sanctions – so credible, in fact, that they never had to be used. Compliance with Montreal has been near-perfect.

If we are to achieve the scale of emissions cuts all countries are aiming for, we need to break the problem up. Gas-by-gas, sector-by-sector approaches will deliver more than grand targets can alone. Looking beyond Copenhagen should mean looking back to Montreal.

Introduction

Copenhagen is the new Kyoto, so environmentalists may be disappointed if, as now seems likely, a "legally binding" agreement will not be signed in Copenhagen. But the Kyoto negotiations continued for years after politicians agreed on targets and timetables in Kyoto. And after those negotiations were finally concluded, and Kyoto eventually entered into force, very little changed; global emissions of greenhouse gases and atmospheric concentrations of greenhouse gases kept on rising. There is a lesson here. More important than having an agreement ready for leaders to sign in Copenhagen is having an agreement that will change how states behave – an agreement that will control emissions and ultimately stabilise atmospheric concentrations of greenhouse gases.

Negotiations leading up to Copenhagen have largely sought to build upon the existing treaty arrangements, focusing on the setting of emissions targets and timetables. But this approach, embodied in the Kyoto Protocol, is poorly suited to addressing climate change, which explains its lack of success so far. Perhaps the expected failure of Copenhagen creates an opportunity. Perhaps negotiators can begin to think strategically about the design of the next climate change treaty.

The new approach proposed here would not replace the existing approach; it would add to it. Without complementary agreements that address key sectors in detail, the existing approach will fail to change behaviour.

The recent history of environmental treaties has already shown that a different approach would work better. The Montreal Protocol on Substances that Deplete the Ozone Layer, which entered into force in 1989, has done more to limit climate change than the Kyoto Protocol even aspired to achieve.[1] The Kyoto Protocol limits attention to

1 Velders *et al*. (2007).

greenhouse gases not controlled by the Montreal Protocol. However, even as regards these gases, Montreal has achieved more.

Again, there is a lesson here for the current round of negotiations. Montreal succeeded because it established permanent obligations, not targets for five years. It succeeded because it limited consumption as well as production, avoiding problems of "leakage." It succeeded because it limited the emissions of developing countries from the beginning, albeit with differentiated responsibilities. Most important of all, it succeeded because it incorporated incentives for states to participate in and to comply with the treaty. These incentives include the "carrot" of compensating payments and the "stick" of credible threat of trade restrictions.

Box 1: The case of HFCs

One of the gases controlled by Kyoto but not Montreal is a group of chemicals known as hydrofluorocarbons (HFCs). Kyoto has done little to limit the emission of these gases.[2] Indeed, there is some evidence that Kyoto's Clean Development Mechanism has caused HFC production to *increase*.[3]

By contrast, an adjustment to the Montreal Protocol negotiated in late 2007 will accelerate a global phase out of another class of chemical (HCFCs), the manufacture of which produces HFCs as a byproduct. Even without controlling HFCs directly, this adjustment is expected to achieve at least as much of an emission reduction again as Kyoto aimed to achieve.

We could do better still. A total phase-out of HFCs can and should be negotiated either by amending the Montreal Protocol, or better yet by negotiating an agreement styled after Montreal but incorporated as a separate protocol under the Framework Convention on Climate Change. This agreement could be negotiated now, and implemented in a matter of years. We know it will work because Montreal has worked.

2 Data supplied by the Annex I parties to the Framework Convention on Climate Change (countries subject to emission limits) indicate that the combined emissions of the "industrial gases"—HFCs, perfluorocarbons (PFCs) and sulphur hexafluoride (SF6)—increased 10% from 1990-2006, more than any other greenhouse gas; see http://unfccc.int/resource/docs/2008/sbi/eng/12.pdf.

3 Wara (2007). This increase applies to the non-Annex I countries (countries not subject to emission limits).

4 In a press release dated 14 September 2007, the United Nations Environment Programme said that tighter controls on HCFCs "could represent a cut equal to over 3.5 per cent of all the word's current greenhouse gas emissions. In contrast the Kyoto Protocol, the main greenhouse gas reduction treaty, was agreed with the aim of reducing developed country emissions by just over 5% by 2012" (see http://ozone.unep.org/Publications/20Anniversary-press-release.pdf).

Phasing out HFCs will address an important but small part of the problem. We need to do a lot more than that. But negotiating an agreement on HFCs would change the way we conceptualize the challenge. Rather than try to address it in one grand agreement, as negotiators tried to do for Copenhagen, we would do better to negotiate a system of complementary agreements, each of which addresses just a part of the overall problem.

The Montreal Protocol is not a perfect model for controlling every gas and emissions source. Rather, each gas and sector will have its own best treaty design. The problem with the grand architecture of establishing economy-wide, multi-gas targets and timetables is that it cannot provide the enforcement needed to ensure that these targets are actually achieved. While climate diplomats have been focusing their attention on advancing the Copenhagen process, expecting or at least hoping that countries will accept tough, new "binding emission targets," a different approach succeeded better – almost without anyone noticing. By breaking the problem up, enforcement can be made much more effective. Using this approach we can achieve far better results overall.

This report not only sets out an alternative approach; it also develops the reasoning behind it. While the result will be imperfect and is not, by design, as cost-effective as a Kyoto-style approach would have been if it *had worked*, the approach outlined has a much greater chance of actually delivering significant cuts in greenhouse gas emissions. In fact, as the case of HFCs demonstrates, it already has.

1. What should be the goal of climate change diplomacy?

There are two ways to answer this question. One is qualitative, the other quantitative. We already know the qualitative answer. It is provided by the Framework Convention on Climate Change, which was adopted in 1992, and which has been ratified by nearly every country in the world (the only non-parties are Andorra and the Holy See). Indeed, there are few if any international agreements that represent more of a global consensus than this one. The Framework Convention says:

> *"The ultimate objective of this Convention… is to achieve… stabilisation of 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."*

A quantitative answer is more difficult for various reasons. One approach has been to determine the maximum allowable mean global temperature change. In 1996, the Council of the European Union declared that mean global temperature should not be allowed to increase by more than 2° C above the pre-industrial level. It did so on the basis that, "once global warming exceeds 2° C, climate impacts on food production, water supply and ecosystems are projected to increase significantly and irreversible catastrophic events may occur."[5] Notice that this reasoning is meant to put a number on the qualitative objective already agreed in the Framework Convention.

5 "Questions and Answers on the Commission Communication, *Limiting Global Climate Change to 2 ºC*," Memo/07/17.

Is this the right level to aim for? It might be too high a target. For example, coral reefs are extremely sensitive to temperature, with a 1° C increase commonly mentioned as a threshold.[6] Furthermore, a 2° C warming might trigger positive feedbacks, tipping the world towards "climate catastrophe."

The 2° C target might also be too low. Reducing emissions by the amount needed to achieve this target would be consequential for other reasons. For example, the reduction in emissions needed to limit climate change to 2° C would almost certainly require a radical increase in nuclear power worldwide, posing problems for nuclear waste storage – like climate change, a burden for future generations – and proliferation. Substantial emission reductions will also require the capture of carbon and its storage in geologic deposits, creating another long-term risk. Environmental campaign groups oppose both of these technologies. But they also think that temperature change should be kept *below* 2° C. Unfortunately, we cannot avoid every risk. It is in the nature of this challenge that we face risk-risk tradeoffs.

Another problem is that we do not know the concentration level of carbon dioxide equivalent needed to limit temperature change to 2° C. According to the latest assessment by the Intergovernmental Panel on Climate Change, a concentration of 450 parts per million (ppm) of carbon dioxide (CO_2) equivalent would probably limit temperature increase to 2.1° C, but the likely range is 1.4-3.1° C.[7] Given this uncertainty in climate sensitivity, limiting concentrations to 450 ppm may mean overshooting the 2° C goal. If it is so essential to stay within 2° C, why accept the risk of overshooting?

Treaty design is a complex process, and the significant uncertainty over what concentration level or what temperature change is acceptable makes this challenge much harder. The qualitative goal is more robust but less precise. A quantitative goal would be precise, but agreement of a quantitative goal would be more difficult to reach.

6 Note that a substantial percentage of corals are already severely damaged and there are no more "pristine" coral reefs left, mainly as a result of over-fishing and land-based pollution. Limiting climate change is essential to protecting the coral reefs, but it is not sufficient.

7 Intergovernmental Panel on Climate Change (2007), Table TS-5.

Disaggregating emissions

Notwithstanding the previous discussion, let us suppose that a target for atmospheric concentrations can be agreed. Modelling can then back out trajectories of global emissions that will ensure that this concentration target is met. Further analysis can identify the "best" of these trajectories – for example, the trajectory that minimizes the total cost of keeping within the concentration target.

It may be possible for countries to agree on a collective target such as this. But will it help? Will agreement on a collective target cause behaviour to change? In 1988, at a quasi-political conference held in Toronto, participants concluded that global carbon dioxide (CO_2) emissions should be reduced 20% from the 1988 level by 2005. In the event, however, and despite two climate treaties having entered into force, global emissions increased by one-third over this period.[8] The problem with an aggregate target is that everyone is responsible for meeting it – meaning, of course, that no one is responsible for meeting it.

To make countries individually responsible, overall targets must be disaggregated. According to Lord Stern,

> *"the need for national targets both to add up and to be equitable means that rich countries, including the European Union, Japan and the United States, need to achieve emissions reductions of at least 80% by 2050, compared with 1990. Developing countries, including China and India, also need to limit and decrease their emissions, but in ways that are consistent with their ambitions for continued economic growth and the reduction of poverty."*[9]

Countries have agreed to meet individual targets and timetables before. After the Toronto meeting, for example, Austria, Denmark, Italy, and Luxembourg all pledged to meet the Toronto target individually (by reducing their individual emissions 20% from the 1988 level by 2005). In the end, however, none did so.[10] The Labour Party's 1997 manifesto pledged to reduce Britain's CO_2 emissions

8 See http://cdiac.ornl.gov/ftp/ndp030/global.1751_2006.ems.

9 This quote and the previous one are from Nicholas Stern (2009), "Managing Climate Change and Overcoming Poverty: Facing the Realities and Building a Global Agreement," London School of Economics, p. 25; at http://www.lse.ac.uk/collections/granthamInstitute/publications/MANAGING%20CLIMATE%20CHANGE%20AND%20OVERCOMING%20POVERTYx%20(2).pdf.

10 The targets are summarized in International Energy Agency (1992).

11 See http://www.eea.europa.eu/themes/climate/ghg-country-profiles/extended-country-profiles/united-kingdom-greenhouse-gas-extended-profile.pdf.

20% from the 1990 level by 2010, but a recent projection suggests that UK emissions will fall by about half this amount.[11]

The challenge of cooperation

Why would countries set targets and then fail to meet them? An important reason is that reducing emissions is costly, and promises little benefit to the country that does it unilaterally. Of course, if every country fails to reduce its emissions, atmospheric concentrations will keep on rising (they have been rising steadily since the first measurements were taken in the late-1950s), and all countries will be worse off. But this is why cooperation is needed.

Cooperation changes the calculus of reducing emissions. If a country reduces its emissions by, say 20%, and other countries do

The tragedy of the commons

Reducing emissions worldwide is a collective action problem. Emissions mix quickly and spread uniformly in the atmosphere. If one country reduces its emissions, the benefits are diffused. The country that incurs the cost of abatement gets a small share of the global benefit. The incentive, therefore, is for countries not to reduce their emissions. Collectively, however, all countries would be better off if every country reduced its emissions. This is similar to the parable of "the tragedy of the commons," as told in a famous article by Garrett Hardin.[12] Consider a pasture held in common and used for grazing. Each herdsman has an incentive to increase the number of livestock in his herd, ignoring the effect on other herdsmen. The consequence is that the pasture is overused by everyone, and everyone loses.

How to remedy the tragedy? A common prescription is for government to restrict access to the commons. In the case of climate change, this isn't possible. There is no World Government. There are instead over 190 sovereign states. This is why an agreement is essential and why it is so challenging.

12 Garrett Hardin (1968), "The Tragedy of the Commons," Science 162: 1243-1248.

not, the country may lose out. But if many countries reduce their emissions by 20%, each may be better off compared to a situation in which none reduced its emissions.

This is why a treaty is needed. A treaty imposes obligations on each of its parties, but those obligations apply only if the treaty enters into force. By design, treaties enter into force only after being ratified by *enough* countries. By making every country's obligations contingent, a treaty ensures that each party is better off.

The logic of collective action favours contingent offers in negotiations. For example, in February 2007, the European Union unilaterally set the goal of reducing its emissions 20% from the 1990 level by 2020, while also pledging to reduce its emissions by 30% (again, from the 1990 level), *provided the United States and other industrialised countries agreed to the same target*. If this proposal were accepted, it could be

Creative Accounting and the European Union

The European Union offer has the appearance of treating equal countries equally. But it will be harder for some industrialised countries to meet the 30% target than it will be for others. The European Union consists of 27 countries, and the EU proposal is not that *each* of these 27 countries should reduce their emissions by 30%. The proposal is that the total of all their emissions should fall by this amount. By contrast, Europe is asking that the United States, Japan, and other industrialised countries to meet these targets *individually*.

Under the Kyoto Protocol, the then 15 members of the European Union agreed to reduce their emissions by 8% from the 1990 level by 2008-2012, but Kyoto treated the EU as a "bubble," meaning that none of the individual 15 member states had to reduce their emissions by 8% provided all the EU15 reduced emissions by 8%. Under the EU's burden sharing agreement, which disaggregates the 8% reduction, some countries must reduce their emissions by as much as 28% while allowing others to *increase* their emissions by as much as 27%.

13 In 2005, EU-27 emissions were almost 8% below the 1990 level; see European Environment Agency, *Annual European Community Greenhouse Gas Inventory 1990-2005 and Inventory Report 2007*, Technical Report No. 7, 2007.

Since only total emissions add to atmospheric concentrations, does it matter whether the EU countries must meet the reduction target individually rather than collectively? The answer is yes, it does matter. This is because the emissions of quite a few EU member states have fallen below their 1990 levels for reasons unrelated to climate change policy. Many of the new members are transition states; their emissions have fallen for reasons of economic restructuring. Romania's emissions were 37% below the base year level in 2007. Bulgaria's were 36% below. Emissions of the Baltic states have fallen even more. Estonia's emissions fell 47%, Latvia's 55%, and Lithuania's 50%.[14] Provided that the emissions of at least some of these states remain more than 30% below the base year level by 2020, for reasons unrelated to their climate policies, treating the EU as a bubble means that emissions within the EU will fall by less than if each member state had to reduce emissions 30% relative to the 1990 level.

Added up, the emissions of all the new 12 members of the European Union fell 25% from 1990 to 2007, while the emissions of the original 15 member states fell 4%. Enlargement has thus made meeting an aggregate target, expressed as a reduction in emissions relative to the 1990 level, much easier for the EU.

incorporated in an agreement in which every industrialised country agreed to reduce its emissions by 30% by 2020, provided that the agreement were ratified by all industrialised countries.

Draft legislation in the United States expresses domestic targets and timetables relative to a 2005 base year. It would be harder for Europe to make the same emission cuts relative to this base year than to 1990. That the base year should matter this much highlights a serious problem with the approach to negotiating targets and timetables. Negotiators call it the "comparability" problem.

As difficult as it is for countries to agree what they ought to do, there is an even greater challenge – the need to *enforce* whatever it is that countries agree to do.

14 All these estimates are from Table 2.3 of http://www.eea.europa.eu/publications/european-community-greenhouse-gas-inventory-2009/european-community-ghg-inventory-2014-full-report.pdf.

2. Enforcing a climate agreement

Climate change is a collective action problem, probably the greatest collective action problem in human history. To address it, states must cooperate with the nature of their compact being expressed in a treaty.

To succeed, a climate treaty must do three things: It must create incentives for countries to participate. It must create incentives for parties to comply. And it must do both of these things even as it demands that parties change their behaviour very significantly.

Broad participation is needed not only because all countries emit greenhouse gases but also because, should only some countries reduce emissions, comparative advantage in the carbon-intensive industries will shift to the other countries, causing *their* emissions to increase – a phenomenon known as "trade leakage." How many countries must participate? Not all. For example, it will not matter if the non-parties to the Framework Convention – Andorra and the Holy See – do not participate in an emissions reductions treaty. But certainly all the "major emitters" must participate.

The most important country is the United States, which is why its rejection of Kyoto crippled this agreement from the start. Non-participation by the US may be seen as a failure by the US to behave responsibly, but it may also be seen as a failure by the agreement to make participation attractive for the US – or to punish non-participation.

Compliance

Compliance is essential. It will not help if every country participates in an agreement only to fail to do what the agreement requires. Although there is a requirement in international law that states must comply

with their treaty obligations, mechanisms are often needed to assure compliance. A compliance mechanism for Kyoto was negotiated in Bonn in 2001 after the targets and timetables were already agreed, but it is not binding and has had no effect.

Under this mechanism, a party that fails to meet its emission ceiling in the first control period (2008-2012) has to make up for the shortfall and reduce its emissions by an additional 30% of this amount in the next control period (presumably, 2013-2017). Countries found to be in non-compliance would also be prohibited from making use of the protocol's trading mechanism – an additional penalty.

> "It will not help if every country participates in an agreement only to fail to do what the agreement requires"

One problem with this mechanism is that a country can avoid being punished for failing to comply by threatening not to participate in the next control period, unless it is assigned an emission ceiling so generous that the 30% penalty would not bite.

Another problem is that the threat to restrict trading is not likely to be credible. Suppose the party that fails to comply is a net seller of permits. Then buyers of permits will not want to punish this country, for in doing so their cost of purchasing permits would increase. On the other hand, suppose that the party that fails to comply is a net buyer of permits. Then sellers would not want to see this country punished, because it would result in their revenues from selling permits falling.

A final problem with this mechanism is that, according to Article 18 of the Kyoto Protocol, "any procedures and mechanisms… entailing binding consequences shall be adopted by means of an amendment to this Protocol." Amendments, however, are only binding on the countries that ratify them. Since any party to Kyoto could decline to ratify a compliance amendment, each can avoid being punished for failing to comply. In other words, Kyoto contains no formal mechanism giving parties an incentive to comply. As matters now stand the Kyoto emission limits are more political than legal.

Comply or else?

Canada's situation exemplifies the problem. Kyoto requires that Canada reduce its emissions 6% below the 1990 level by 2008-2012. Up to 2006, however, Canada's emissions were 28% above this target, and Canada's current government has given up on the idea of meeting its obligations.[15] In a recent report, the government estimates that Canada's emissions will exceed its target by about 29%.[16] The government says, "While Canada remains committed to meeting its reporting requirements under the UNFCCC and Kyoto Protocol, the focus of Canadian action on climate change is not on the remaining years of the Kyoto Protocol period. The world is now turning the page on Kyoto and is focused on reaching a new agreement in Copenhagen in December 2009."[17]

Japan's emissions up to 2006 are more than 5% above the 1990 level, while Kyoto requires that they be 6% below it: a gap of 11%. Kyoto allows Japan to comply by purchasing "Assigned Amount Units" from other parties, and Japan has already purchased some from Ukraine.[18] But Ukraine's emissions in 2006 were more than 50% below the 1990 level.[19] The AAUs being purchased by Japan thus constitute "hot air."[20] Japan may technically be able to comply with Kyoto by making such purchases, but doing so will not reduce atmospheric concentrations of greenhouse gases—the reason Kyoto was negotiated in the first place.

Other countries are also at risk of not complying. New Zealand is required to stabilise its emissions at the 1990 level, but by 2006, its emissions were 26% higher. To my knowledge, New Zealand has no plans that will ensure its compliance.[21]

By contrast, Australia is likely to comply or come very close despite not ratifying the protocol until 2007. Like the administration of George W. Bush, Australia's previous government declined to ratify the Kyoto Protocol. The new Labor government reversed this policy immediately upon taking office, but this matters little in substantive terms because Kyoto allowed Australia to increase its emissions 8% above the 1990

15 If emissions from land use and land use change are included, Canada's emissions were 55% above the 1990 level in 2006; see Figures 3 and 4 in http://unfccc.int/resource/docs/2008/sbi/eng/12.pdf.

16 See http://www.ec.gc.ca/doc/ed-es/KPIA2009/s5_eng.htm.

17 See http://www.ec.gc.ca/doc/ed-es/KPIA2009/s1_eng.htm.

18 http://www.alertnet.org/thenews/newsdesk/T12318.htm.

19 See Table 4, http://unfccc.int/resource/docs/2008/sbi/eng/12.pdf.

20 See http://www.bloomberg.com/apps/news?pid=20601101&sid=auYpIlVXDnYY.

21 In April 2009, Nick Smith, the Minister for Climate Change Issues, told Parliament, "no one in this House should doubt the challenge for New Zealand of constraining its emissions and making real progress on climate change." See http://www.parliament.nz/en-NZ/PB/Business/QOA/3/9/8/49HansQ_20090428_00000007-7-Kyoto-Protocol-Compliance.htm.

level by 2008-2012. After taking land use, land use change and forestry into account, Australia's emissions in 2006 were just under this ceiling. Australia may need to do very little to comply with the Kyoto Protocol.

Up to 2007, the emissions of the EU-15 were 5% below the 1990 level, or 3% above their Kyoto limit (an 8% reduction from 1990). The EU expects to comply with Kyoto "by a combination of existing and planned domestic policies and measures, and using carbon sinks and Kyoto mechanisms."[22]

But while the EU-15 may comply overall, many member states are likely to exceed their individual emission limits negotiated under the EU burden sharing agreement (see Table 1). Only 6 of the EU-15 states—a minority overall—were within their limits. As noted previously, under the rules of the Kyoto Protocol, it is only necessary that the total of EU-15 emissions stay within the overall target. But that so many countries should be so far away from their individual targets hints that the problems experienced by countries outside the EU may not be unique.

Table 1. Percentage by which EU+15 countries have exceeded their targets[23]

Austria	24%
Denmark	17%
Finland	10%
Ireland	11%
Italy	13%
Luxembourg	26%
Netherlands	3%
Portugal	9%
Spain	38%

22 See http://www.eea.europa.eu/publications/european-community-greenhouse-gas-inventory-2009/european-community-ghg-inventory-2014-full-report.pdf, p. 12.

23 These data are from http://www.eea.europa.eu/publications/european-community-greenhouse-gas-inventory-2009/european-community-ghg-inventory-2014-full-report.pdf.

Achievable and Enforceable

The easy way to get countries to participate in a treaty, and to comply with it, is for the treaty to ask countries to change their behaviour very little. This is essentially what Kyoto does. It requires that some parties reduce their emissions very slightly, and for a short period of time. It does not require that most countries reduce their emissions at all. If you look at where Kyoto has run into trouble as regards participation and compliance, it is with the countries required to reduce their emissions significantly.

A successful treaty needs to sustain high participation and compliance while at the same time requiring that emissions be cut substantially, and Kyoto has been unable to do all three things at once. As Kyoto has tried to achieve more success in one direction, it has had to give up ground in another.

For example, after the US withdrew support for Kyoto, the emission limits for Canada, Japan, and Russia had to be eased (by a technical renegotiation that made a generous allowance for carbon "sinks") to make ratification by these countries more attractive. Participation was improved, but at the cost of reducing the magnitude of emission cuts. Similarly, participation and compliance were both made easier by a decision to liberalize the treaty's arrangements for emissions trading (previously, countries were to meet their obligations largely through domestic policies). Because of "hot air," however, this change had the effect of weakening the treaty's emissions targets.

The focus of the climate talks continues to be on targets and timetables, not enforcement. This is the wrong way to think about a climate treaty. We should determine the kinds of treaty obligation that can be enforced, and only then negotiate what these obligations ought to be.

Contingent Offers

Margaret Thatcher was the first leader to make a contingent offer. Only a few weeks before leaving office, she pledged to stabilise UK

emissions at the 1990 level by 2005 "as part of an international effort including other leading countries."[24] The appeal in this approach persists. Very recently, Japan's new prime minister, Yukio Hatoyama, said that "Japan will aim to reduce its emissions by 25% by 2020" compared to the 1990 level. However, he also said that the "commitment of Japan to the world is premised on agreement on ambitious targets by all the major economies."[25]

That countries are willing to make such offers suggests that there are gains to collective action. That such offers have not worked, however, suggests that something else is needed. For contingent offers to make a difference, countries must not only be able to deal with the "comparability" problem in negotiations. They must also be able to enforce what they agree. Enforcement is what has been lacking.

The Key Player: The New US Strategy

The Clinton administration negotiated the Kyoto Protocol, hoping that the US Senate would ratify it. This was a doomed strategy, for there was little if any domestic political support for the agreement. The Obama administration has learned from this mistake and is encouraging Congress to pass domestic climate legislation with the intention of later negototiating an international agreement consistent with the laws passed at home. The distinction between these approaches may seem perplexing to an outsider, but the Obama strategy requires 60 Senate votes in favour (to avoid a filibuster), whereas the Clinton administration's strategy required 67 votes to ratify the treaty. The United States is so divided today, including on this issue, that this small difference – just 7 votes – matters a great deal.[26]

The bill that was passed by the United States House of Representatives in June 2009, and the draft Senate bill produced in late September 2009, would reduce emissions by 20% below the 2005

24 http://www.margaretthatcher.org/speeches/displaydocument.asp?docid=108237.

25 http://www.mofa.go.jp/policy/un/assembly2009/pm0922.html.

26 Passage of domestic legislation also requires approval by the House of Representatives.

level by 2020, 42% by 2030, and 83% by 2050.[27] In 2005, U.S. emissions were about 16% above the 1990 level. Relative to 1990, this bill therefore limits US emissions to about 7% below the 1990 level by 2020. This is the same amount required by the Kyoto Protocol (but for the period 2008-2012). It is substantially less than the EU is demanding today. Recall, however, that the 1990 base year is unfavourable to the US (relative, that is, to the EU-27 because of the collapse of Communist regimes which were heavy polluters), and that the long-term target in this bill is very ambitious. It amounts to an 80% reduction in US emissions relative to 1990 – the same level recommended by Stern and others; a level that is also consistent with a pledge made by the United States at the 2008 G8 meetings.

It may seem surprising that the United States would contemplate reducing emissions this much, unilaterally. But that is not what the legislation is promising. The American Clean Energy and Security Act – the bill that was approved by the United States House of Representatives but not (yet) by the Senate – includes provisions to "level the playing field" with respect to other countries. It treats different sectors differently, making trade-sensitive sectors eligible for rebates. In addition, and at the president's discretion, it requires importers of products made in countries that do not have similar emission reduction policies to purchase emission permits. This requirement is equivalent to putting a tariff on these imports. Importantly, the president is given little power in this game. To take effect, his decision must be approved by both houses of Congress.

The concern of the House of Representatives is betrayed in the opening pages of the 1,428 page bill. In Section 3, immediately following the table of contents and definitions, the bill reads:

> *The Administrator, in consultation with the Department of State and the United States Trade Representative, shall*

27 http://www.pewclimate.org/docUploads/Waxman-Markey-short-summary-revised-June26.pdf.

annually prepare and certify a report to the Congress regarding whether China and India have adopted greenhouse gas emissions standards at least as strict as those standards required under this Act. If the Administrator determines that China and India have not adopted greenhouse gas emissions standards at least as stringent as those set forth in this Act, the Administrator shall notify each Member of Congress of his determination, and shall release his determination to the media.

One concern here is that the case for imposing trade restrictions would be determined unilaterally. It would lack legitimacy and could easily trigger a trade war.

A key observation is that policy at the domestic and international levels must be synchronised. In the Clinton administration's second term, international negotiations got ahead of domestic policy. Today, domestic policy threatens to get ahead of the international negotiations.

3. The Montreal Protocol

The Montreal Protocol has succeeded where Kyoto has failed. Participation in the Montreal Protocol is virtually full, compliance is nearly perfect, and the agreement has achieved almost as much as it was technically possible to achieve. Why did Montreal succeed? Part of the reason is that stratospheric ozone depletion is much easier to address than climate change.[28] However, the design of the treaty itself also made a huge difference. Success was not inevitable, so are there lessons to be derived from Montreal that could aid development of a better climate treaty? It will help to understand the differences between Montreal and Kyoto.

28 For example, ozone depletion harms all countries. Catastrophic climate change (such as a break-up of the West Antarctic Ice Sheet) would similarly harm most states, but "gradual" climate change would create winners as well as losers. As well, the damages from ozone depletion are substantial (primarily due to increased deaths from skin cancer) and the costs of substituting for ozone depleting substances modest, whereas for climate change the benefit-cost comparison is less attractive (Barrett 2007). Finally, it also happened that the companies manufacturing ozone-destroying chemicals were best placed for developing and manufacturing their replacements, and the treaty deftly opened new markets for the substitutes as it shut the old markets down. Altogether, the "initial conditions" for addressing ozone depletion were unusually favorable.

The Right Means to a Permanent End

First, the Vienna Convention on the Protection of the Ozone Layer did not specify a goal in terms of the amount of ultraviolet radiation reaching the Earth's surface or stratospheric concentrations of ozone. It directed parties to "take appropriate measures…to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer." The focus of climate negotiations should also be on getting countries to take appropriate measures.

Second, although the Montreal Protocol establishes national level targets and timetables for various ozone depleting substances, these are used as a means, not an end. They are determined with a view to how individual sectors can substitute away from controlled chemicals, and the benefits to be derived from these changes. For example, the adjustments agreed in late 2007 were grounded in a very detailed analysis of individual

sectors, including refrigeration and air conditioning, foams, medical aerosols, and fire protection.[29]

Parties to the Montreal Protocol choose their targets and timetables after taking advice from the Technology and Economic Assessment Panel, the members of which are deeply involved in the industries concerned, the organisations that set standards for these industries, and the agencies that regulate these industries. One advantage of this process is that, when new targets and timetables are agreed, support by the parties who must do the things needed to stay within these limits is assured.

A critical aspect of this process is the assessment of alternatives to the ozone-depleting substances, and the feedback effect this has on innovation. Once alternatives are identified, an ozone-depleting chemical can be phased out; once industry is assured that development of new alternatives will trigger more phase-outs, an incentive is created for industry to discover new substitutes. A focus of climate policy on all gases and entire economies dilutes these incentives. To replicate this process, climate treaties must be more targeted.

Third, Montreal's cuts are *permanent* whereas Kyoto's last only five years. Five-year targets are entirely unsuited to bringing about lasting change. The coal plants being built today will last forty or fifty years. The energy and transportation infrastructure being built now will last even longer. Because of path-dependence, the effects of these investments may endure longer still.

Even more importantly, a technology revolution will only happen if innovators believe that the future will be very different to the past. They must believe that new innovations will have a good chance of being adopted; and to encourage yet more innovation, they must believe that these technologies will eventually be replaced by a newer generation of technology that is better still. An effective climate agreement must impose obligations that are permanent and that can be ratcheted up over time.

29 See http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-TaskForce-HCFC-Aug2007.pdf.

Montreal's targets and timetables could be made permanent because they were determined with a view to replacing one set of chemicals with another. Obligations in a climate treaty should be determined with a view to replacing one set of technologies with another.

> "To create permanent obligations, the focus of these obligations must change. The focus needs to be on technologies."

Why not just extend the life of the targets and timetables being negotiated now? Why not make these permanent? They can be made permanent. The problem is that the threat to enforce permanent emission ceilings would lack credibility. To stimulate innovation, targets must be ambitious. But if the hoped-for innovation and investment is not forthcoming, the costs of meeting these tough targets will exceed the benefits, and enforcement of the ambitious targets will not be credible.[30] To create permanent obligations, the focus of these obligations must change. The focus needs to be on technologies.

The roles of rich and poor countries

Fourth, the Montreal Protocol limits not only the production of CFCs and related chemicals; it also limits the *consumption* of these substances (defined by Montreal as production plus imports minus exports). Targets and timetables for greenhouse gas emissions concern production only. We speak of "Britain's carbon emissions" and "China's carbon emissions" but when China burns fossil fuels to produce goods purchased in Britain, which country should be responsible for the emissions? According to Kyoto, only China. But why should not Britain also be responsible?[31] If participation in a treaty were universal, the distinction would not matter. But when participation is incomplete, limiting consumption as well as production helps to reduce leakage. It reduces the returns that can be earned by being outside the system. For that reason it also promotes participation.

30 Montgomery, W.D. and A.E. Smith (2007). "Price, Quantity, and Technology Strategies for Climate Change Policy." In M. Schlesinger, H. Kheshgi, J. Smith, F. de la Chesnaye, J.M. Reilly, T. Wilson, and C. Kolstad (eds.), *Human-Induced Climate Change: An Interdisciplinary Assessment*, Cambridge: Cambridge University Press.

31 Helm, D (2008) "Credible Energy Policy", Policy Exchange, p28

With a focus on all gases and the emissions of entire economies, consumption limits are impractical to enforce. Narrower arrangements, however, open up new possibilities. For example, the Montreal Protocol could be amended to phase out HFCs. Better yet, a new treaty, styled after Montreal, could limit the production and consumption of this greenhouse gas.

Fifth, the Montreal Protocol requires that *all* countries cut back on their emissions. Developing countries were given easier, initial limits, but they were expected to get to the same final end points as the rich countries (an early example of rich and poor countries having "common but differentiated responsibilities"). Under the Kyoto Protocol, by contrast, the emissions of developing countries are unconstrained – a bizarre situation when you consider that China has added more coal-fired electricity generating capacity in a single year than Britain's entire installed capacity.

The industrialised countries have urged developing countries to limit their emissions, noting that concentrations cannot be stabilised unless they do so. But developing countries have pointed out that they are not responsible for the accumulation of greenhouse gases in the atmosphere and that they cannot permit their development to be constrained. The result, so far, has been a standoff.

The need for all countries to act together is particularly acute for the trade sensitive sectors. The industrialised countries can claim, with some justification, that if they act and developing countries do not, then they will suffer a "competitive disadvantage" in these sectors and global greenhouse gas emissions will fall very little due to trade leakage. Unless the playing field is levelled, industrialised countries will likely do one or more of the following:

- They may cut their emissions by very little, if at all. This has been the main response thus far.
- They may cut their emissions by more than a little but carve out the trade-sensitive sectors in their domestic policies for

implementation. As an illustration, Sweden has cut its emissions significantly. It has a very high carbon tax - €108 per ton of carbon. But Sweden's industry faces only half the tax rate, and energy-intensive industry pays even less. Moreover, the carbon tax was adopted as part of a broader tax reform in which energy taxes were cut. The consequence is that industrial emissions have fallen relatively little. Another consequence is that abatement overall has not been cost-effective.

- They may cut their emissions and impose trade restrictions against countries that do not adopt similar measures (as in the US House of Representatives bill discussed previously). Given the claim that developing countries have made about not being responsible for the accumulation of greenhouse gas concentrations and having other priorities, the threat to restrict trade could create new international tensions.

All these problems can be reduced if not avoided by negotiating a different agreement or set of agreements for the trade-sensitive sectors.

Carrots and Sticks

Sixth, the Montreal Protocol, as amended in 1990, offers carrots for developing countries to participate. Under this agreement, rich countries compensate poor countries for the "agreed incremental costs" of complying with their obligations, with the amounts contributed being determined by the United Nations scale of assessments.[32]

Kyoto's Clean Development Mechanism (CDM) offers limited incentives for developing countries to reduce their emissions. However, CDM "offsets" are project-based, and so involve high transactions costs. Their quantity is also too small to be transformational.[33] The Montreal Protocol used financing by the rich countries to get developing countries onto an ozone-friendly

32 So far, over $2.5 billion has been contributed; see http://www.multilateralfund.org. See Barrett (2007) for a discussion of the United Nations scale of assessments.

development path. An effective climate agreement needs to get poor countries, especially the fast-growing poor countries, onto a climate friendly (carbon free) development path.

Finally, Montreal incorporates sticks to compel all countries to participate and to comply. The main incentive is a trade restriction: Montreal bans trade between parties and non-parties in ozone-depleting substances and products containing these substances. Originally, the treaty also intended to ban trade in products made using these same substances, but experts determined that this was not practicable, and this last ban was never adopted. Fortunately, it was not needed. Importantly, Montreal's trade restrictions have not needed to be imposed. But this is because the threat to impose them was credible. They were credible because signatory governments were very concerned about leakage, and would therefore be prepared to use trade restrictions to solve the problem. This credible threat was sufficient to change behaviour.[33]

Note the importance of the treaty incorporating both sticks and carrots. The offer of carrots, determined according to "agreed incremental costs," ensures that developing countries are no worse off for participating in the agreement, as compared with the alternative of not participating. The threat to use sticks to enforce the agreement ensures that all countries, including developing countries, are worse off for not participating. Sticks are thus used to enforce an agreement that is "fair," reflecting the principle of "common but differentiated responsibilities." Their possible use also has legitimacy, because they emerged from a process giving every party a voice.

A Better Design

The design outlined here is very different from the suggestion that developing countries should take on targets and timetables, that there should be international trading in emission permits, and that participation should be enforced by trade restrictions.

33 This makes Montreal's punishment mechanism better than the WTO's, which has needed to be imposed, as explained previously.

First, while trading would transfer resources from countries with high marginal costs (due, perhaps, to these countries accepting tougher targets) to countries with low marginal costs (due, perhaps, to these countries accepting weaker targets), these transfers would compensate for "incremental costs" only at the margin. Overall, industrialised countries would pay more for emissions reductions than developing countries would be willing to accept. The problem with this is that, because industrialised countries must pay more, they will only agree to take on weak targets.

Second, the trade restrictions in the Montreal Protocol apply only to the ozone depleting substances and products containing those substances. They do not apply to products made using those substances. Trade restrictions intending to enforce participation in a climate treaty with economy-wide, multi-gas targets and timetables, however, would presumably have to be applied to products based on the method of their manufacture, and this would create practical difficulties. For example, two identical products, manufactured in the same country, might have very different carbon footprints, depending among other things on the source of electricity used to make them.

Since trade restrictions can only affect an economy's traded sector, basing these restrictions on a country's overall emissions would fail to promote participation. Why would a country reduce emissions across the board when the trade restriction would harm only a small portion of the economy? It thus seems more likely that trade restrictions would need to be targeted to affect the emissions of the trade-sensitive sectors. But this means that they could only enforce an agreement focusing on these sectors.

A treaty that focuses on economy-wide, multi-gas targets and timetables is poorly suited to addressing climate change. An effective treaty system needs to break the problem up. Delivering significant reductions in specific sectors has worked before and will work again given the chance.

4. Outline of a new approach

Agreements on targets and timetables may be useful in expressing goals and aspirations, but as they cannot be enforced internationally, they will not cause emissions to fall by much – certainly not by enough to stabilise atmospheric concentrations.

Addressing climate change seriously will require agreements that can be enforced internationally to ensure that global emissions fall, leading atmospheric concentrations to be stabilised. These agreements must address pieces of the problem, rather than the whole problem comprehensively.

Different Deals for Different Gases

Different agreements are needed to control different kinds of gases. Because Kyoto cannot be enforced, the agreement has limited the emissions of the HFCs very little if at all. As explained in the introduction, had HFCs been controlled by an amendment to the Montreal Protocol or, better yet, by a new protocol, styled after Montreal but incorporated under the Framework Convention, a lot more would have been achieved.

This same approach would extend naturally to perfluorocompounds (PFCs), emitted primarily by the aluminium and semiconductor industries, and sulphur hexafluoride (SF_6), emitted by the electric power, magnesium smelting, and semiconductor industries. The amount of PFCs emitted by aluminium plants varies dramatically, suggesting that there are opportunities to establish a low emission standard as an overall industry standard.[34]

34 Watson *et al*. (2005: 12).

Nitrous oxide, or N_2O, another greenhouse gas, is emitted by numerous sources. One of these is the production of adipic acid, a feedstock for producing some forms of nylon. In developed countries, these emissions have been reduced 90% through voluntary efforts.[35] As the feasibility of reducing emissions has already been demonstrated, these same standards could be made universal by international agreement. A similar approach could be taken for reducing emissions from other sources, such as the production of nitric acid, used as a feedstock for synthetic commercial fertiliser.

Similar opportunities should also be explored for controlling methane, or CH4, which is emitted by many sources, including waste landfills, fossil fuel systems, wastewater treatment, some industrial processes, livestock, and agriculture.

As with the Montreal Protocol, the parties making decisions to control all these emissions should be advised by Technology and Economic Assessment Panels, comprising members associated with the relevant industries, people who are knowledgeable about the technological possibilities for reducing emissions, and regulators who oversee these industries.

Sectoral Agreements

It is interesting to observe that Kyoto is not fully comprehensive. It excludes emissions from aviation and marine transport; it says that parties should reduce these emissions "working through the International Civil Aviation Organisation and the International Maritime Organisation, respectively." Although these organizations have so far failed to act, the motivation for treating the emissions arising from aviation and marine transport outside of Kyoto is compelling. These organisations were created to provide a forum for

35 Wara 2006

choosing global standards, and such standards are essential for these sectors because the technologies for these sectors are part of a global system. Both organisations should play a role in choosing standards for reducing greenhouse gas emissions.

The aluminium sector is another candidate for a sectoral agreement.[36] It is a concentrated industry: twelve countries account for 82% of global production; ten companies produce more than half of world output. The industry employs just two smelting technologies, and emissions can be reduced substantially by re-melting aluminium scrap which is 95% less greenhouse-gas-intensive than primary aluminium production. Finally, twenty-six companies, making up 80% of world output, belong to the International Aluminium Institute, which has already adopted voluntary intensity targets. There exists a basis here for negotiating new global standards for the industry. For example, an agreement could require that all smelters employ the more efficient Prebake smelting technology (some facilities in developing countries still rely on the less efficient Söderberg technology).

As with Montreal, an agreement of this kind would need to apply globally. Developing countries would be encouraged to participate by industrialised countries offering to pay agreed incremental costs. Industrialised countries would know how much they would be expected to pay, and what they would gain from the transaction.

Participation in these agreements could be enforced by trade restrictions. Since developing countries would be compensated for participating, and since the aim of these agreements would be to create universal standards for a "level playing field," the use of trade restrictions in this context would have legitimacy. The threat to restrict trade would also have a high chance of being credible, since parties to such an agreement would not want non-parties to have an "unfair" advantage in international trade. Moreover, by definition, the trade-sensitive sectors are especially vulnerable to leakage, and trade restrictions applied to non-parties would help to

36 I am drawing here from Bradley *et al.* (2007), especially pp. 37-38

reduce leakage, making credible the threat to apply them.[37] Controls should apply to consumption as well as production. Countries that import aluminium should agree to import only from countries that are parties to the international agreement, and that comply with its standards.

The Importance of Innovation

Ozone depletion was addressed by incremental innovation. Addressing climate change fundamentally will require breakthrough technologies.[38] A new climate agreement must provide greater incentives for R&D, including through multilateral research projects into alternative energy sources. The Carbon Sequestration Leadership Forum, for example, comprises 22 countries plus the European Union and coordinates national research efforts into carbon capture and storage, but does not actually fund this research. A new agreement is needed that provides funding for a substantial research, development, and demonstration effort. This agreement need not have broad participation – the ITER research project on nuclear fusion is supported by China, the European Union, India, Japan, South Korea, Russia, and the United States. A similar group of countries could undertake the research, development, and demonstration needed for carbon capture and storage.

As new technologies are developed and proven to be safe and effective and not unacceptably costly, their use could be encouraged by international agreement. For example, an agreement could establish a plant-level emission standard that could only be met by a coal-fired facility if this facility incorporated carbon capture and storage. An agreement such as this could not be enforced by trade restrictions for various reasons, including the difficulty of measuring accurately the carbon content of a country's exports. But the parties to such an agreement could be required to adopt the standard as a domestic regulation, thereby making use of domestic

37 Barrett, S. (2005). *Environment and Statecraft: The Strategy of Environmental Treaty-Making*, Oxford: Oxford University Press

38 Hoffert *et al.* 2002

institutions for enforcement. To encourage participation, the agreement could enter into force only after being ratified by a minimum number of countries (possibly accounting for a minimum share of global coal-fired electricity generation). To encourage developing country participation, industrialised countries could agree to help co-finance the incremental costs. Of course, other provisions would need to be included to ensure that the technology was used, and used effectively, not only installed.

Conclusions

Kyoto and Copenhagen are important because of the need to cut, drastically and globally, emissions of greenhouse gases. Yet Kyoto did not work because of incomplete participation and poor compliance. Stronger cuts are needed in the future, and Kyoto failed even while aiming to reduce global emissions very little. The new approach proposed here would add solid underpinnings to the grand edifice of this treaty architecture. It would enable us to achieve much more.

The proposal made here is to break the problem of climate change into pieces—to control different gases and sectors separately, with a focus on technologies and innovation rather than targets and timetables.

Kyoto aimed for a cost-effective, comprehensive, and global approach to delivering greenhouse gas emissions reductions, and has failed utterly. While the approach proposed here is less neat and sweeping, it offers much greater likelihood of delivering substantial cuts in emissions. It is important, however, that the sectoral and individual gas agreements proposed are coordinated, and this would be a key role for the Framework Convention in the future. The Convention should also coordinate a wider range of strategies, including adaptation and any proposed geo-engineering.

Kyoto was designed to be cost-effective but it has ended up being ineffective. It has failed to cause countries, companies or individuals to change their behaviour. It has reduced global emissions little if at all; it has stimulated little if any innovation. This is the principal advantage of the proposal for breaking the problem up. By doing so we will be able to sustain greater reductions in emissions, now and in the future.

To return to where this paper started, one clear step that countries could take now would be to negotiate an agreement phasing out HFCs. This would only address a small part of the climate problem, but success in phasing out this gas could inspire negotiation of more agreements addressing other aspects of the problem. Once we conceive of the problem in its parts and not only in its entirety, new avenues will be opened up for negotiation. This is what we need most right now: successes, even smallish ones, and new approaches that promise more successes.

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International efforts to prevent dangerous climate change have seen little progress since the 1990s. The Kyoto protocol has achieved strikingly little compared to its grand ambitions. If we are to achieve anything like the scale of emissions cuts needed, a new approach must be found.

The historical precedents are encouraging. The Montreal Protocol successfully tackled ozone-depleting substances with a combination of credible sanctions, well-designed compliance and enforcement mechanisms and a clear, tangible goal. Strikingly, Montreal has even achieved more in terms of greenhouse gases than Kyoto.

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