

FOIA MARKER

This is not a textual record. This is used as an administrative marker by the William J. Clinton Presidential Library Staff.

Collection/Record Group: Clinton Presidential Records
Subgroup/Office of Origin: Council of Economic Advisers
Series/Staff Member: Judson Jaffe
Subseries:

OA/ID Number: 20746
FolderID:

Folder Title:
Climate - Kyoto

Stack:	Row:	Section:	Shelf:	Position:
S	20	6	3	3

Growth Targets for GHG Emissions from Developing Countries:

Introduction and Summary of Findings

The United States has advocated emissions growth targets for non-Annex I countries. As these countries consider the possibility of adopting such targets, several have solicited assistance from the United States. The tasks of providing technical assistance to these countries and working with the international community to develop an understanding of what constitutes “appropriate non-Annex I targets” require a further refinement of the US position on developing country growth targets. This paper presents some basic principles for growth targets and discusses several proposals.

Principles **Recognizing the interests of developing countries, the United States interest, and the economic and environmental impacts of emissions targets, there are three basic guiding principles for emissions growth targets:**

- * **Targets should result in environmental benefits;**
- * **Targets should be consistent with continued economic development; and**
- * **Targets should be of a form that allows developing countries to participate in international emissions trading, to reduce the economic costs of attaining given targets.**

Findings While there is a general consensus on these basic principles, a further elaboration on some of the key issues involving these principles can help facilitate the effort toward a position on the form, magnitude, and timing of a developing country growth target. In reviewing existing data, ongoing research, and in conducting our own analyses, we have found that:

- * Growth targets even as high as BAU can yield significant reductions in global emissions by forestalling the leakage that would otherwise occur.
- * Targets can result in economic gains from trade for all sides, if they are not too stringent.
- * A “fair” allocation to expect of potential new participants might be a target that fits the apparent pattern among Annex B countries. This approach turns out to imply some degree of “progressivity” -- with richer countries asked to make bigger sacrifices than poor ones.
- * Given uncertainty about the future, to fix the precise quantitative target now would create great risks regarding the ultimate stringency of the target; it would raise concerns that a target unintentionally constrains economic development, on the one hand, or that the target could result in hot air, on the other hand. These risks would be reduced by

indexation approaches.

- * Approaches to index targets to income growth between now and the commitment period have some advantages over carbon efficiency target approaches.
- * CO₂ is the dominant greenhouse gas in developing countries (from fossil fuels and land-use). Measurement of other gases might be too difficult to justify their inclusion.

Guide to Contents

(I) Benefits of Targets-and-Trade A scheme in which non-Annex I countries are invited to adopt binding emission targets in the general vicinity of their BAU paths, and then to trade emission permits internationally, is a scheme that has real potential economic and environmental benefits, not just for Annex I countries, but for the developing countries as well. This gives them a genuine incentive to join, which would otherwise be lacking.

(II) What Should Determine Desired Targets? Non-Annex I countries could be asked to take on targets that make some small reductions relative to BAU, and still benefit. But large cuts would render them worse off, and therefore unlikely to agree to participate. Conversely, large increases relative to BAU are unlikely to be acceptable to the Annex I countries. We explore the range of targets that the developing countries could be expected to take on. A reasonable upper bound is their BAU paths.

Even a target as generous as this would result in global environmental benefits, by forestalling leakage, as shown in **Memo II.1: *Emissions leakage from Annex I to non-Annex I countries***.

A reasonable lower bound is the “indifference target” which entails cuts large enough that participation no longer brings them economic benefits, because the gains from selling permits are fully offset by the losses from a stringent target. (See **Memo II.2: *The Trade-off between target stringency and gains from trade***).

An alternative approach to formulating a “fair” target for developing countries is to estimate statistically what pattern holds among targets already accepted by Annex I countries, and then to extrapolate to developing countries. This statistical approach is explained in **Memo II.3: *Progressivity of existing targets, as a guideline for developing-country targets***. This approach turns out to imply some degree of “progressivity” -- with richer countries asked to make bigger sacrifices than poor ones -- without going nearly so far as the redistribution of wealth that some poor-country representatives seem to be asking for. As an example, when the pattern is extended to China, the implied target is a 5 percent cut relative to BAU. This happens to lie inside the range spelled out in Memo II.2.

(III) Uncertainty of Measurement and Forecasting complicates the analysis further. Because BAU forecasts are uncertain, a given numerical target could turn out to be unintentionally stringent (inflicting economic costs on the country) or unintentionally lax (creating “tropical hot air”).

Memo III.1, *Uncertainty about Target Stringency, and proposed solutions*, explores this problem and approaches to deal with it by indexation.

Another difficulty of extending targets to developing countries is measurement of emissions. **Memo III.2, *What greenhouse gases are necessary to include?***, suggests simple CO₂ targets might be good enough for these countries.

I. Benefits of Targets-and-trade

It would be useful to get developing countries to agree to binding limits, even if they involved only small (or no) cuts below Business as Usual (BAU) in the first budget period. Such targets, with trading, imply gains for their economies, gains for ours, and gains for the environment.

Reasons:

- * We want to forestall increases over BAU, that would occur in response to Annex I cuts if others do not take on targets. (This is leakage, as explained in Memo II.1 below.)
- * The ability for Annex I countries to buy reductions from LDCs would greatly reduce the costs of meeting our targets (as CEA testimony showed). In particular, it is estimated that trading with developing countries would lower U.S. costs more than 80 percent relative to the costs of achieving the Kyoto targets solely through reductions in domestic emissions. (This is as compared to 57 percent savings from trading among Annex I countries alone).
- * With targets close to BAU, the developing countries would benefit from the ability to sell emission permits achieved at costs below the world price. This actually gives them a genuine economic incentive to join, which is otherwise lacking. Illustrative calculations by CEA suggest that China would stand to gain \$3.6 billion/year by joining Annex I, and India to gain \$1.6 billion/year. (See Table 2. The United States would save a preliminary-estimate \$11.6 billion if China joined, or \$2.5 billion if India joined.)
- * Further, when permits are sold, reductions in carbon dioxide emissions generate ancillary air quality benefits in the developing countries through lower particulate matter, sulfur dioxide, and nitrogen oxides emissions.
- * Establishing developing country targets now would meet the requirements of the Byrd-Hagel resolution. Agreement on modest targets in the nearer term is the first step to drawing LDCs into the system, where larger cuts relative to BAU might be possible in the longer term (in some proportion to the cuts made by richer countries that have gone before them).

Pay them to
Join?

II.1 Emissions leakage from Annex I to non-Annex I countries

Even if developing-country targets did no more than to hold developing countries at BAU emission levels, this would be a major environmental benefit. Several economic analyses indicate that for every 3 to 5 tons of carbon abated in Annex I countries, emissions in non-Annex I countries will increase by 1 ton. Often referred to as "leakage," this shifting in emissions reflects two economic impacts of abating emissions in Annex I:

- * **World Oil Market Price Effects.** Abating carbon dioxide in Annex I countries reduces the demand for oil, thereby lowering the price of oil. With lower oil prices, some non-Annex I countries will consume more oil and increase their emissions relative to what they would have without the Annex I abatement policies.
- * **Energy-Intensive Industry Migration.** Annex I abatement policies that increase the price of energy may provide an incentive for energy-intensive firms to relocate to non-Annex I countries.

Leakage is positively correlated with permit prices: higher Annex I permit prices (and higher energy price effects) will likely result in higher rates of leakage.¹ Several modeling teams participating in the Stanford Energy Modeling Forum (EMF-16) have estimated the extent of leakage associated with an Annex I trading regime. These analyses assume that Annex I countries participate in international emissions trading while non-Annex I countries neither adopt targets nor participate through the CDM. While these results represent a wide range, they all reflect significant increases in emissions above BAU for non-Annex I countries. Thus, even if non-Annex I countries' emissions were only capped at business-as-usual levels, without reductions, that would yield significant environmental benefits in that it would forestall leakage.

Table 1. Increase in Non-Annex I Emissions Under Annex I Trading

MERGE (Manne and Richels)	MRT (Charles River Assoc.s)	G ³ (Shackleton et al)
325 MMTCE	115 MMTCE	55 MMTCE

¹ However, international emissions trading can eliminate leakage among all trading participants. An effective trading market that results in equal marginal costs of abatement across all participating countries also results in equal energy price effects in all participating countries. Thus, there is no economic incentive for energy intensive firms to relocate to another country participating in trading. A full global trading system would then eliminate leakage completely. Some economic analysis indicates that while the CDM would lower costs some to Annex I countries, the project-by-project approach does not equalize energy price effects across all participating countries, and would not eliminate leakage to developing countries.

II.2 The trade-off between target stringency and gains from trade

The Administration has stated in bilateral and multilateral meetings, Congressional testimonies, and other public fora that if developing countries adopt emissions growth targets and participate in international emissions trading, they can enjoy economic gains from trade. Among other issues, this conclusion is sensitive to the stringency of the emissions growth target. The environmental gains from emissions reductions below BAU come at the price of economic costs incurred by a developing country that adopts the below-BAU target. In addition, in the cases of large non-Annex I countries, more stringent targets could have economic costs for buyers in international emissions trading. More stringent developing country targets could raise U.S. costs by restricting the supply of permits in world markets and so raising the price of permits relative to less stringent targets.



To assess the magnitude of this effect consider the target which just leaves a country no better off than no target at all. This “indifference” target is where the costs of meeting the target through domestic action just equal the net gains from selling permits in world markets.² Figure 1 illustrates gains from trade for a small country. The upward-sloping curve shows the rising marginal cost of increasingly stringent reductions. For small reductions from BAU, the cost is far less than the price they fetch on the world market. For a target that is equivalent to a reduction of 17 MMTC, net gains from foreign exports are B, and the cost of meeting the target is C. Since $B = C$ in this example, the

² This analysis presumes that non-Annex I countries abate their emissions cost-effectively, e.g., through a tradable permit system or a carbon tax.

³ This hypothetical example assumes that the country in question does not consider participation in the Clean Development Mechanism (CDM). If this country were to participate in CDM if it did not adopt a target, then its indifference target would not be at the level where net gains from trade are zero, but where expected net gains from trade would equal expected net gains from the CDM. The CDM option implies that the indifference target would be less stringent. However, including the ancillary air

net costs from participation are nil.³

As a numerical example of the effects of increasing the stringency of an emissions growth target, we present results from some modeling scenarios of Annex I trading with China. These analyses assume that no other non-Annex I countries participate in international emissions trading or the CDM. If other non-Annex I countries did participate in either flexibility mechanism, the world trading price could be lower, resulting in lower gains from trade and a less stringent indifference target for China.

Table 2 provides an illustration of the effects of emissions targets more stringent than BAU on China with Annex I plus China trading. A small reduction below BAU has no real effect on the Annex I trading price, and thus no economic effects on the U.S. However, as the target becomes more stringent the trading price increases, resulting in higher total costs of compliance for the U.S.

Table 2. Effects of Various Chinese Emissions Targets with Annex I Trading

Emissions Target ¹	Permit Price (1997\$/ton)	Chinese Emissions Reductions (MMTC)	Chinese Emissions Sales (MMTC) ²	Chinese Gains from Trade (1997\$)	Increase in Total U.S. Cost Relative to China BAU Target
BAU	\$26/ton	276	276	\$3.6 billion	not applicable
BAU - 1%	\$26/ton	276	262	\$3.2 billion	~\$0
BAU - 5%	\$29/ton	304	235	\$2.4 billion	\$1.3 billion
Indifference	\$36/ton	343	172	\$0 billion	\$4.2 billion

¹ We employ the SGM BAU for China for the purposes of these calculations.

² Reductions in Chinese emissions less Chinese emissions sales yields net global reductions.

Imposing this “indifference” target on China, given that its participation lowers world permit prices, leads to the following conclusions.⁴

- * An indifference target for China results in it foregoing \$3.6 billion relative to the gains it would obtain if it were to take a BAU target.

quality benefits associated with abating carbon dioxide, especially in countries with significant local air pollution problems, could imply that the indifference targets should be *more* stringent.

⁴ The reason that Chinese participation lowers world permit prices is because BAU or near BAU targets result in more permits available on the world market. *+ b/c of low MC to*

China C ↓.

- * An indifference target for China increases annual U.S. costs by \$4.2 billion or about 33% relative to a BAU target for China.

II.3 Progressivity of existing targets, as a guideline for developing-country targets

It appears reasonable on grounds of fairness that wealthier countries should undertake greater efforts to address climate change than less-wealthy countries. While the emission targets in the Kyoto Protocol reflect the outcome of political negotiations, it is possible to discern systematic economic patterns in them. A fair target for developing countries might one that fits whatever pattern seems to hold among existing targets. In particular, this approach would allow some degree of progressivity, with richer countries making larger reductions than poor ones -- without going nearly so far as the redistribution of wealth that some poor-country representatives seem to ask for.

The Annex B targets (including the EU bubble allocation), when presented in terms of reductions below 2010 BAU, follow a pattern of progressivity (see figure 1). Note that this pattern holds for CO₂ as well as for all greenhouse gas emissions (although data on some non-CO₂ GHG emissions are not available for some Annex I countries; see memo III.2). For the 30 Annex I countries presented in this figure, the average reduction from BAU is 16.1%. For the lower half of Annex I countries by per capita income, the average reduction is 5.2% below BAU.

We conducted statistical analyses to better understand the progressivity of the Annex B targets. We used data on Annex B countries' per capita income, emissions growth projected between 1990 and 2010, coal as a share of total energy consumption, and whether a country is a transition economy, to explain the trend in emissions targets in terms of deviations from BAU. The statistical analyses illustrate a pattern of progressivity among the existing targets: each 1% increase in per capita income implies a 0.11 to 0.17% greater sacrifice, expressed as emissions reductions from BAU. Levels of statistical significance are relatively high, suggesting that the results are meaningful. In absolute terms, an increase in income is associated with an increase in the level of the emission target. But the increase in income also implies an increase in the BAU level. The increase in BAU is *greater* than the increase in the target, implying that richer countries are making greater sacrifices. As an example, when the pattern is extrapolated to

China the implied target is a 5 percent cut relative to BAU. This happens to lie inside the range spelled out in Table 2 of Memo II.2: both China and the rest of the world gain.

This statistical approach certainly has limitations, and the results reported here are preliminary. They are sensitive to decisions about the data used. Per capita income data can change depending on the year and exchange rate used to compare countries. Estimates of BAU emissions can vary too.

III.1 Uncertainty about target stringency and proposed solutions

Some developing countries have claimed that the uncertainty regarding projected economic performance is so great that they cannot risk adopting a binding emissions target for the first commitment period at this time. A natural response to this concern is that international agreements on these countries' targets should be structured to reduce the risk of inadvertent stringency and in particular to reduce the possibility of a target so stringent as to cause large economic losses to the developing countries. In addition to the concern expressed by some developing countries that adopting a binding target now for 2008 risks it being inadvertently stringent and constraining economic development, some have also expressed ~~concern~~ the symmetric concern on the other side, that a target may be too lax, creating "tropical hot air" and thus failing to result in environmental benefits in terms of actual emissions reductions. Thus, it is desirable both to mitigate the risk of inadvertent stringency and also mitigate the risk of inadvertently laxity. The idea is to reduce the variability of the effective stringency of the target without loosening or tightening the intended target, i.e., to reduce the variance without changing the expected value. } Awk

To attempt to address this uncertainty issue, a number of ideas have been forwarded. CEA has called its proposal an indexation or formula approach; EPA has referred to its proposal as efficiency standards. They are all versions of the general notion of agreeing today on a contract under which the numerical emission target is to depend in a specified way on future variables whose values are as yet undetermined. (The analogy is with a cost-of-living adjustment clause in a labor contract, that specifies a given increase in the wage for every cent increase in the Consumer Price Index -- thus reducing uncertainty over *real* wages.) In what follows, we assume that a country's aggregate emissions are indexed to future income alone. (We are thus omitting from past CEA proposals the possibility of including in the formula other variables like population; and are omitting from past EPA proposals the possibility of separate "efficiency standards" for individual sectors within an economy.)

It is useful to distinguish four proposals that appear in earlier memos.

(1) CEA approach (Special-case): **For every percentage point that GDP in 2007 turns out to be higher (or lower) than forecast, the emissions target is raised (or lowered) by 1%.**

(2) CEA approach (General): **For every percentage point that GDP in 2007 turns out to be higher (or lower) than forecast, the emissions target is raised (or lowered) by X%, where X is a number less than 1.** An advantage relative to proposal (1) is that countries that do well over the coming decade are asked to contribute a bit more than those that do not, while not being penalized unduly.

(3) EPA approach (Special-case): **For every percentage point that GDP in the years 2008-2012 turns out to be higher (or lower) than forecast, the emissions target is raised (or lowered) by 1%. (EPA phrases this as setting a number for the ratio of emissions to GDP;**

but that is the same thing.) The advantage relative to the CEA approach is it allows even more uncertainty-protection, with respect to fluctuations in income in the years after 2007. The disadvantage is that the country does not know how many tons it is entitled to until the end of the budget period, which could make trading difficult.

(4) EPA approach (General). **The target ratio of emissions/GDP that is set for the budget period (2008-2012) does not depend only on the country's own past emissions level (such as 1997 or 1990 plus K%, or BAU minus X%) but also on a common standard established for all countries.** It seems to CEA that this approach has two serious drawbacks:

(i) Because emissions/GDP varies widely across countries, a request that countries agree to a common standard would imply far greater sacrifice for some than for others (relative to their current positions, or to BAU). We wouldn't hear of this approach in setting the US target at Kyoto, and neither will many others who would be disadvantaged.

(ii) A comparison of GDPs across countries can easily vary by 100% or more, depending on whether a PPP basis is used or market exchange rates, what year is chosen, and how PPP or the exchange rate is measured; the implied large year-to-year swings in targets (tons of GHG emissions) would be unworkable. Note that approaches (1)-(3) do not have this problem, because measurement problems in yearly growth rates for a given country amount to a couple of percentage points at most.

III.2 What greenhouse gases are necessary to include?

In the Kyoto Protocol, Annex B countries have targets specified in terms of a basket of six types of greenhouse gases. These targets include both emissions sources and sinks. While this comprehensive approach provides more environmental benefits, it does increase the required effort and cost of inventorying greenhouse gas emissions. Many developing countries lack the monitoring infrastructure to assess emissions of all six types of greenhouse gases. Must developing country growth targets include all greenhouse gases, or is a subset of the Annex A list of gases sufficient?

In evaluating this question, it may be useful to consider several issues.

- * **Greater Climate Benefits.** A developing country growth target set below what emissions would be otherwise for only one greenhouse gas (e.g., CO₂) would generate greater environmental benefits relative to a scenario where that country does not adopt a target.
- * **Leakage Across Gases Unlikely.** There appears to be little opportunity in most economies for intergas leakage. For example, most efforts to abate fossil fuel-related carbon emissions would result in efficiency improvements, switching to leaner fossil fuels (e.g., natural gas) and to carbon-free sources of energy (e.g., hydropower, nuclear, wind), none of which have emissions of other types of greenhouse gases. Moreover, efforts to abate carbon dioxide in fossil fuel combustion may have ancillary reductions of energy-related methane.
- * **CO₂ is Significant Majority of Greenhouse Gas Emissions.** In the United States, carbon dioxide ~~comprises~~ comprises 85% of all greenhouse gas emissions (weighted by carbon equivalence). Across Annex I, carbon dioxide is, on average, 80% of each country's emissions. This trend appears to hold for some non-Annex I countries as well. In 1990, carbon dioxide comprised 88% of Korea's emissions, 85% of Mexico's emissions, and 85% of Kazakstan's emissions. In Argentina, carbon dioxide comprised 63% of 1990 emissions, with methane comprising most of the rest. It appears that carbon dioxide dominates most countries' emissions, with methane a distant second (depending on the extent and nature of agriculture). Non-Annex I countries have not reported their emissions of the synthetic gases in their national communications to date. It is not clear how revisions to the N₂O emissions estimation methodology could affect estimates of non-Annex I countries' emissions.
- * **Land Use Change Could be Significant.** Carbon dioxide emissions from land use change in non-Annex I countries appear to be quite significant. Some estimate that by including land use change emissions, non-Annex I emissions exceeded Annex I emissions in 1994 (Panayotou and Sachs 1998). Emissions from land use change in

WC/
constitute?

Close Hold; Do Not Cite; For Use in International Negotiations; 2/8/99 CEA Draft

non-Annex I countries in 1994 were more than one-fifth of global carbon dioxide emissions. Some statistical analysis indicates that countries' land use change activities do not become net sinks, *ceteris paribus*, until per capita income exceeds \$3,600.

Evaluation of EU Trading Constraint Proposal

The European Union has proposed quantitative restrictions on both Annex B buyers and sellers of emissions allowances in international emissions trading, joint implementation, and the Clean Development Mechanism. We analyze the effects of the restriction on Annex B trading and joint implementation. This proposal would significantly increase the costs of compliance without providing any additional climate benefits. For the United States, permit prices would double to quadruple. Moreover, this proposal would create a complicated emissions trading bureaucracy that would likely raise costs further.

Our analysis illustrates three key points:

- * The EU claims that so-called “qualitative” language provides significant additional flexibility. This analysis shows that this language does not do this.
- * Restrictions on sellers prove more onerous than restrictions on buyers. Even if restrictions on buyers were relaxed, there would be little economic impact on buying countries’ compliance costs.
- * If trading rules required sellers to choose between selling “hot air” and “real verified reductions”, costs for all buying countries would remain high.

Below we discuss the following:

I. Description of Trading Constraints¹

II. Annex I Costs with Trading Constraints

III. Transaction Costs with Trading Constraints

IV. No Additional Climate Benefits with Trading Constraints

¹ While we use the term “trading constraint” throughout this paper, we imply a constraint on international emissions trading, joint implementation, and the Clean Development Mechanism.

I. Description of Trading Constraints

Purchase Constraint

The EU proposal provides a formula for net purchases, where the constraint is the higher of:

- 1) 5% of the average of base year emissions and emissions target², or
 - 2) 50% of the difference between highest year's emissions during 1994-2002 period and emissions target.
- * Preliminary analysis for the United States indicates that option 1 would allow us to purchase 13% of the reductions necessary to comply with our target. Option 2 would allow us to purchase close to 40%. Some may be concerned that the second option would create the perverse incentive to increase emissions through 2002 or delay early action to increase the level of the ceiling.
 - * In addition to the formula, the text provides that the ceiling on purchases can increase subject to an evaluation of domestic abatement efforts. If an expert review team can *verify* total domestic reductions in excess of the purchase ceiling, then the ceiling would be adjusted up to the level of domestic abatement. For the United States the ceiling is "flexible" within a range, but hard at 50%. For some countries, however, the ceiling could be greater than 50%.
 - * Evaluating ceilings as a function of emissions reductions is very sensitive to emissions forecasts. The EU's forecasts for its member countries reflect much slower emissions growth than most independent assessments. These forecasts could affect estimates of demand in the international emissions markets, and subsequent permit prices. For example, the EU estimates that its emissions of all 6 greenhouse gases will be 6% above its Kyoto target in 2010 under business as usual, while projections by the Energy Information Administration and the International Energy Agency would imply business as usual carbon dioxide emissions 19 to 26% above the EU target in 2010.

Selling Constraint

The EU proposal provides a constraint on net sales set equal to:

5% of the average of base year emissions and emissions target.

² All constraints are normalized to a common period of time.

- * Most economic analyses find that only former Soviet bloc countries will likely be net sellers during the first commitment period (without developing country participation). This constraint would allow the Former Soviet Union to sell only approximately 20% of its so-called hot air. This formula alone would also provide no incentive for domestic abatement.
- * However, like the purchase constraint, a country can raise its ceiling up to the level of its *verified* domestic abatement. In this case, if a country wanted to sell allowances in excess of its ceiling as specified by this formula, it would not be able to sell any of its so-called hot air. Every sale would have to be backed by a verified reduction. }

II. Annex I Costs with Trading Constraints

Some preliminary analysis of the trading proposals indicates that the costs of all Annex I countries could increase significantly. For the United States, permit prices would double to quadruple, depending on the ability of former Soviet bloc countries to prove and verify actual reductions. Since it is unclear how the trading constraint formulas could apply to as yet unspecified non-Annex I country targets, we have focused these illustrations on Annex I trading only. In addition, given the difficulties in modeling a project-based approach, we have not incorporated the CDM in these analyses. We provide below three scenarios that vary based on the extent that countries can raise their purchase and selling ceilings through “verified emissions reductions.”

- * *Scenario 1: Assuming that neither buyers nor sellers can meet the burden of proof established for increasing their ceilings above the formulas provided in the EU proposal, all buying countries see their resource costs increase by 80 to 170%.* ?

Scenario 1: Annex I Trading, with and without EU Proposal

Country	Permit Price, Unconstrained	Resource Cost, Unconstrained	Permit Price, Constrained	Resource Cost, Constrained
United States	\$51/ton	\$22.7 billion	\$174/ton	\$41.3 billion
Japan	\$51/ton	\$5.1 billion	\$227/ton	\$14.0 billion
Canada	\$51/ton	\$2.7 billion	\$208/ton	\$7.2 billion
EU	\$51/ton	\$11.6 billion	\$174/ton	\$23.9 billion
Australia	\$51/ton	\$0.7 billion	\$154/ton	\$0.8 billion

International Emissions Permit Price with EU Proposal: \$174/ton

In addition to the much higher resource costs for buying countries, selling countries (Former Soviet Union and Eastern European countries) would see their transfers fall by 35 to 55%. The international price for an emissions permit would be so high that

Australia would find it economic to become a net seller.

The high international permit price makes it economic for both the United States and the EU to undertake a vast majority of their emissions reductions at home. The United States only purchases 2% of its reductions abroad, while the EU only purchases 10% of its reductions abroad.

- * *Scenario 2:* Assuming that the buying countries can adjust their purchase ceilings to reflect all their real reductions, but that selling countries cannot meet the burden of proof established for increasing their selling ceilings (the 5% formula on sales is binding), *the international permit price would be almost equivalent to the U.S. permit price under no trading.*

Scenario 2: Annex I Trading, with and without EU Proposal

Country	Permit Price, Unconstrained	Resource Cost, Unconstrained	Permit Price, Constrained	Resource Cost, Constrained
United States	\$51/ton	\$22.7 billion	\$178/ton	\$41.3 billion
Japan	\$51/ton	\$5.1 billion	\$178/ton	\$13.8 billion
Canada	\$51/ton	\$2.7 billion	\$178/ton	\$7.2 billion
EU	\$51/ton	\$11.6 billion	\$178/ton	\$24.0 billion
Australia	\$51/ton	\$0.7 billion	\$178/ton	\$0.7 billion

International Emissions Permit Price with EU Proposal: \$178/ton

Note that in this case, the selling constraint is so stringent, that the United States effectively does not participate in international trading (the United States is estimated to purchase 1.5 MMTCE per year, on net, in this scenario).

Like scenario 1, some of Australia's resource costs are offset because the permit price is high enough for it to switch from being a net buyer to a net seller.

Since buyers can increase their buying constraint through "verified emissions reductions", Japan and Canada are not constrained like they were in scenario 1. (In scenario 1, the buying constraint prevented these countries from bidding on lower priced emissions permits, so their domestic permit price was higher than the international emissions permit price.) Their additional demand for international emissions permits increases the international emissions permit price from \$174/ton in scenario 1 to \$178/ton in this scenario.

- * *Scenario 3:* Assuming that the buying countries can adjust their purchase ceilings to reflect all their real reductions, and that selling countries can do so as well, i.e., selling countries cannot sell any hot air and all reductions can be verified, the international permit price would be more than \$100/ton, and more than double the unconstrained price.

Scenario 3: Annex I Trading, with and without EU Proposal

Country	Permit Price, Unconstrained	Resource Cost, Unconstrained	Permit Price, Constrained	Resource Cost, Constrained
United States	\$51/ton	\$22.7 billion	\$106/ton	\$35.7 billion
Japan	\$51/ton	\$5.1 billion	\$152/ton	\$9.9 billion
Canada	\$51/ton	\$2.7 billion	\$137/ton	\$5.1 billion
EU	\$51/ton	\$11.6 billion	\$106/ton	\$19.5 billion
Australia	\$51/ton	\$0.7 billion	\$106/ton	\$1.0 billion

International Emissions Permit Price with EU Proposal: \$106/ton

III. Transaction Costs with Trading Constraints

Difficulty in Identifying Real Reductions

The EU proposal provides an opportunity to revise upward ceilings (to a limit) based on an evaluation of domestic action taken to reduce emissions through an expert review process. While some may argue that this could make the proposed constraints less stringent, our analysis shows that the costs would still be considerably higher than in an unconstrained system. However, it would be very difficult to operationalize such a procedure.

- * Evaluating whether a specific reduction, or set of reductions, resulted from direct domestic actions (as opposed to simply an economic downturn), requires knowing the counterfactual. However, business as usual can never be known with certainty, so estimating “domestic effort” with sufficient precision to adjust a trading constraint could be very problematic.
- * The process of attempting to identify and verify emissions reductions from domestic activities can be costly, especially for fiscally-constrained countries, like some of the potential Annex I sellers. Some are already concerned that Russia will not have a sufficient monitoring and inventorying system for trading. Adding another layer of requirements for trading may negatively impact their participation.
- * Instead of undertaking real reductions and selling both the real reductions and the so-called hot air as predicted by most economic models, this proposal requires that countries choose between selling hot air and real reductions. Contrary to its stated intent, the EU’s proposal could raise the costs of undertaking real reductions enough that Russia and other countries simply sell the fraction of their hot air they are allowed to with the selling formula and then avoid any further actions.

Problems with Devolution to Private Sector

By constraining both the purchase and sale of permits, the EU proposal would complicate the interaction between domestic trading program involving private firms and international emissions markets. Just as importantly, the limit would create an allocation problem domestically, i.e., how to allocate the "right" to import or export emissions permits. If allocated by some method other than open bidding, the process could create a domestic lobby for perpetuating the limit. Firms could view their allocation as an "entitlement."

* There are a number of ways to implement a limit, but the simplest might be for the government to issue "right-to-import" or "right-to-export" certificates up to the limit through a process of open bidding. If, for example, international purchases were recorded at the national trading registry, then the buyer would have to present one right-to-import certificate along with a foreign permit for it to be officially accepted. Similarly, anyone wanting to sell a permit internationally would have to acquire one right-to-export certificate and combine it with one domestic permit in order to export.

* Arbitrage would equate the price of domestic permits to the international price of permits plus the certificate price. The price of the certificates would fluctuate on the market, depending on whether the limit is binding. Their price would be zero -- i.e., the domestic price and foreign price would be the same -- if the constraint were not binding. Also, $R_c = R_I$

* The additional administrative burden of implementing a dual permit program or some other quota allocation system would raise the costs of trading beyond those reflected in the illustrative quantitative assessment presented here.

$$P = R_c + P_I$$
$$P = R_I + P_I$$

IV. No Additional Climate Benefits with Trading Constraints

Regardless of where a greenhouse gas emission reduction occurs, it has the same effect on total greenhouse gas emissions and the same effect on the climate.

- * In proposing trading constraints, the EU has focused on countries such as Russia, that will have emissions below their Kyoto targets during the commitment period because of the decline in their economic output associated with the transition to market economies. If trading constraints are established that restrict the ability of Russia to sell permits, then emissions during the first commitment period would be lower than in the absence of such constraints.

- * However, Russia would simply bank its allowances and use these allowances in a subsequent commitment period when its emissions exceed its target. While a trading constraint might lower emissions during the first commitment period, the cumulative emissions over several commitment periods from Annex I countries would be the same with and without the trading constraint. Given the long residence times of greenhouse gases (on the order of a 100 or more years), the cumulative effect is what is most relevant in terms of changes in the global climate.

IWG - Jeff Mietke
7/20/99

IPCC Good Practice Guidance Work Effort

- prepare report on good practice on how to estimate Emission estimates of all components of GDP. sector by sector, work, etc.

⇒ 5-10 pg guide on how to develop est of release.

3 Bonn

cap? Complementarity? 677?

5 EU Papers

donner.david@epa.gov

Mechanisms:

JI

φ look like CDM.

dev option of trying to rely on outside body to dev projects + certify.

Capacity Building

Bonn Venezuela looking to work beyond CDM/JI.

OECD Sept 13 meeting

Discussion of price caps.

- See Bob Lawrence.

Env Def

EPA will forward requests for participation.

By Fund Joe Goffman & Annie Petroule

Index targeted to GDP growth.

- David Donner.

**Interagency Working Group
Subgroup on Global Climate
Department of State – Room 1406
July 21, 1999**

AGENDA

1. IPCC Good Practice Initiative (EPA: DKruger)
2. Recent Meetings
 - Debrief on Ukraine trip
 - Debrief on Japanese trip
3. Submissions
 - Mechanisms
 - Capacity Building
 - Others
4. Pre-Bonn Submissions
 - Submission on PAMs due Aug 15 (DOS:Morgenstern)
5. Other Business
 - Mechanisms consultation late August, early September
 - OECD high level meeting, Sept 13
 - Hill briefing on Friday on sinks
 - Loy/Ballentine outreach
 - Working backward from COP-6
 - EDF and indexed targets

Upcoming Interagency Meeting

- IWG Meeting, Wednesday, July 28, Room TBD (Dan's Last!)
- Article 5 meeting, first week of August
- Technical work on mechanisms, first week of August

NEWS

House Appropriations Committee Chairman C.W. Bill Young (R-FL)

Website address: www.house.gov/appropriations

FOR IMMEDIATE RELEASE:

July 21, 1999

RESPONSIBLY FUNDING TAXPAYERS' OVERSEAS INVESTMENTS

Full Committee Passes FY00 Bill

FY00 Chairman's Mark: \$12.624 billion

FY00 President's Request: \$14.572 billion

FY99 Enacted Levels: \$33.3 billion (included \$17.9 billion for IMF)

Major Amendments Adopted in Full Committee:

- (Callahan): Reduces funds for the World Bank's International Development Association by \$200 million.
- (Knollenberg): Prohibits the use of funds for proposing or issuing rules, regulations, decrees, or orders for the purpose of implementing or preparing for implementation of the Kyoto Protocol.
- (Pelosi): Allows up to \$25 million of available funds to be used for the United Nations Population Fund (UNFPA). It specifically prohibits these U.S. funds from being spent on China or being used to fund abortions. Should UNFPA contribute funds to China, the provision requires the U.S. to withhold an equal amount of funding to the UNFPA.

Major Priorities and Initiatives:

- Provides a \$24 million increase for the Child Survival and Disease Programs Fund from FY99, \$22 million above the President's request. Total funding is \$680 million, which includes a \$5 million increase for UNICEF bringing total funding to \$110 million, \$9 million above the President's request.
- Fully funds the President's request for the International Narcotics Control, bringing

funding to \$285 million for FY00, \$24 million more than FY99.

- Israel's economic assistance is reduced from \$1.08 billion in FY99 to \$960 million in FY00, \$30 million above the President's request.
- Israel's military assistance is increased from \$1.86 billion in FY99 to \$1.92 billion in FY00, the same as the President's request.
- Egypt's economic assistance is decreased from \$775 million in FY99 to \$735 million in FY00, \$20 million above the President's request.
- Egypt's military assistance is level funded at \$1.3 billion in FY00, the same as the President's request.
- Provides \$200 million in economic assistance for Jordan in FY00, the same as the President's request.
- Provides \$125 million in military assistance for Jordan in FY00, the same as the President's request.

Major Cuts/Reforms:

- Funds for international family planning assistance are frozen at \$385 million.
- Reduces funding for the Global Environmental Facility by \$93.3 million below the President's request and \$117.5 million below FY99. Total FY00 funding is \$50 million.
- Reduces funding for OPIC from \$50 million in FY99 to \$20.5 million in FY00, \$3.5 million below the President's request.
- No funds for arrearages.
- No funds for the Wye River Agreement for the West Bank/Gaza and Israel.
- Former States of the Soviet Union funding is \$307 million below the President's request and \$76 million below last year, bringing FY00 funding to \$725 million.
(more)
- No funding is provided for the Foreign Military Financing Program for Turkey and Greece, the same as the President's request.
- Voluntary peacekeeping operations are frozen at the FY99 level of \$76.5 million for FY00, \$53.5 million below the President's request.
- Terminates funding for the Urban and Environmental Credit Program, FY99 funding was \$1.5 million. The President's request was \$3 million.
- Terminates funding for the U.S. Community Adjustment and Investment Program, FY99 funding was \$10 million. The President's request was \$17 million.
- Terminates funding for the Multilateral Investment Guarantee Agency, no funds provided in FY99. The President's request was \$10 million.
- Terminates funding for the Inter-American Investment Corporation, no funds provided in FY99. The President's request was \$25 million.
- Terminates funding for the Multilateral Investment Fund. The President's request was \$25.8 million. FY99 funding was \$50 million.
- Terminates the President's \$5.1 million request for capital to the African Development Bank.
- Withholds 50% of the assistance to the government of the Russian Federation unless it ends nuclear and ballistic missile cooperation with Iran.
- Freezes the International Fund for Ireland at \$19.6 million, the same as FY99 and FY98 and the President's request.

Preservations and Other Items of Interest:

- Level funds the Peace Corps at \$240 million for FY00, \$30 million below the President's request.
- Funds the Agency for International Development (AID) Development Assistance at \$1.2 billion for FY00, \$ 24 million below FY99 and \$128 million below the President's request.
- Freezes funds for the Trade and Development Agency at \$44 million for FY00, \$4 million below the President's request.
- Level funds the International Military Education and Training (IMET) program at \$50 million for FY00, \$2 million below the President's request.
- Funds the President's request of \$66 million for Foreign Military Financing activities in Europe for NATO expansion and the Partnership for Peace.
- Funds the Ex-Im Bank at \$759 million for FY00. The President's request was \$839 million for FY00.
- Level funds the Korean Peninsula Economic Development Organization (KEDO) at the FY99 level of \$35 million, \$20 million below the President's request; prohibits funds if North Korea breaks its agreement on freezing nuclear development.
- Fully funds the President's request for anti-terrorism at \$33 million, \$12 million more than last year.
- Level funds the demining account at the FY99 level of \$35 million, \$5 million below the President's request.

Major Amendments Adopted in Subcommittee:

- (Knollenberg): Allows for early disbursement of Economic Support Fund and Foreign Military Financing for Israel.
- (Lowey): Includes report language: "The Committee is concerned about the President's recommended decrease in the U.S. contribution to the United Nations Development Program and urges the Secretary to fund UNDP at the Fiscal Year 1999 level."

###

[Return to News Releases](#)

[Return to House Committee on Appropriations Home Page](#)

Jason Felwman

EPA switch
2602090

~~Donnerly~~

Doniger, David
@epa.gov

The 9th Asia-Pacific Seminar
12-15 July 1999, Hikone, Shiga Prefecture, Japan

Remarks by Tahar Hadj-Sadok
Programme Coordinator, UNFCCC

Taking stock of the UNFCCC process

1. The outcome of COP 4

The Kyoto Protocol, adopted at COP 3 in December 1997, had placed the climate change process on a new track. At the June 1998 sessions of the UNFCCC subsidiary bodies, it was not clear where this track was leading. The Buenos Aires Plan of Action, adopted at COP 4 (November 1998), gave a sense of direction to the process, setting work plans and timetables and restoring a balance between action to implement the Convention and action to lay the ground for the entry into force of the Protocol. This balance responded to an important political message from developing countries at COP 4.

“Classical” Convention issues pursued at and since COP 4 include:

- the orientation of the financial mechanism (guidance to the GEF);
- technical and financial support for initial national communications by non-Annex I (developing country) Parties;
- development and transfer of technologies (through a new “consultative process” conducted by the Chairman of SBSTA);
- analysis of adverse effects of climate change (on vulnerable countries) and of response measures (on vulnerable economies, notably those of energy-exporting countries);
- the pilot phase of “activities implemented jointly” and its transition to the project-based Protocol mechanisms (see below).

“New” Protocol issues on the agenda include:

- improved (more rigorous) methods and strengthened “national systems” for estimating GHG inventories in Annex I (industrialized country) Parties (KP Art. 5); assistance for this purpose to Parties with economies in transition;
- determination of the ways in which the removal and storage of GHGs by “sinks” (land-use, land-use change and forestry) may be accounted for in inventories (KP Art. 3.3, 3.4 & 3.7);

- improved (more rigorous) procedures for reporting and reviewing implementation by Annex I Parties (KP Arts. 7 & 8);
- the design and development of mechanisms for "offshore implementation" by Annex I Parties: joint implementation (Art. 6), the Clean Development Mechanism (Art. 12) and emissions trading (Art. 17) - among which priority is to be given to the CDM, which should assist developing country Parties in achieving sustainable development;
- procedures and mechanisms to determine compliance and non-compliance with the Protocol and to address cases of non-compliance (Art. 18).
- (Among these issues, the fourth promotes "flexibility" in the achievement of emission limitation targets, while the first three seek to define the "credibility" of such achievement, through effective provisions for accounting and accountability. The eventual provisions on non-compliance, which may have to be effected through an amendment to the Protocol, will be the ultimate credibility test.)

Capacity-building - to enable developing and transition Parties to contribute to the implementation of the Convention and the Protocol - emerged as a major cross-cutting concern, though the manner of achieving this aim through the action of the COP remains to be defined. Guidance to the GEF reflected this concern.

The question of the progressive development of emission limitation commitments, to include commitments by developing countries with significant emissions of GHGs, met with no consensus at COP 4.

2. Towards COP 6, via COP 5

The timetables set by the Buenos Aires Plan of Action focus attention on deadlines for action at COP 6. COP 6 will be held in The Hague, either in November 2000 or in early 2001. The COP 6 outcome must include a strong technical component, indicating how the Protocol mechanisms for flexibility and credibility will work in practice. This will increase demand for technical inputs, from government experts and from the Convention secretariat. Parties are still in a negotiating mode on broad issues surrounding the flexibility mechanisms, and much of the work on the nuts and bolts of these mechanisms still lies ahead and will have to be accomplished under intense time pressure if it is to be completed by COP 6. This is an area where it would be important to draw the line between what *must* be achieved at COP 6 and what may be left until later. The same may be said for work on compliance and non-compliance.

Meanwhile, COP 5 (Bonn, 25 October - 5 November 1999) offers a stepping stone for action to boost the chances of success at COP 6. This first COP to be held in Bonn, the city that hosts the secretariat should attract some 5,000 participants. The Minister of Environment of Poland is designated to preside. COP 5 can agree upon pieces of the COP 6 outcome and - more important - enable ministers to reach an understanding on the parameters of a politically sufficient COP 6 package. COP 5 will include a 48-hour high-level segment from 2 to 4 November, when ministers and senior officials are expected to engage in dialogue

but not in negotiation. The COP Bureau will put the finishing touches to plans for the high-level segment at a meeting in Warsaw in September.

The recent sessions of the subsidiary bodies (Bonn, 31 May to 11 June) have not given clear indications of possible political breakthroughs at COP 5. Their outcomes may be summed up as follows:

- Work proceeds well on technical and methodological aspects of accounting and accountability. Revised guidelines for reporting Annex I inventories were agreed.
(These technical topics have important practical ramifications; for example, the methods used for accounting for removals of GHGs by sinks can have a significant impact on the rigour of the Protocol targets for some Annex I Parties.)
- Negotiations are under way on the Protocol mechanisms and have just started in a working group on compliance, which had a smooth start.
(On the mechanisms, the major development has been the tabling of position papers by the Group of 77 and China. Major issues that remain to be resolved include supplementarity and “hot air”, fungibility among mechanisms, eligibility of sink projects under the CDM, application of adaptation levies across all mechanisms... The first of these issues is the subject of debate among Annex I Parties.)
- Work also advances on the “classic” Convention issues listed above, though with unclear time horizons for practical results on technology and adverse effects.
(The pilot phase of AJJ appears to have taken on a new lease of life, if only to ensure a field of project-based activity in case of delays in the entry into force of the Protocol. The pilot phase will be reviewed at COP 5 and a decision taken on its future. Eligibility of AJJ projects under the Protocol mechanisms is under discussion.)
- Consideration of national experiences in implementing the Convention is taking shape as a major topic for next year.
(A workshop on “best practice” in policies and measures used by Annex I Parties will highlight the possibilities for successful domestic implementation - to which “offshore” action must be supplemental. Consideration of non-Annex I communications is being discussed. It could give developing countries an opportunity to improve the quality of the information they provide and perhaps to claim recognition for their achievements, since their economic development policies commonly result in reductions in the emissions intensity of GDP growth.)
- The review of adequacy of commitments will be on the provisional agenda for COP 5. Kazakhstan has proposed an amendment to Annex I to include itself therein.

The programme of work to be carried out by COP 6 in all these areas is a heavy one, bearing in mind that there are only 6 weeks negotiating time until then.

**The IPCC Good Practice
Guidance Work Effort:
Context, Progress,
Upcoming Meetings**

**Dina Kruger, USEPA
July 21, 1999**

Context:

- SBSTA 8 requested that the IPCC:
 - ┆ complete its work on uncertainties
 - ┆ prepare a report on good practice in emission inventory management
 - ┆ submit a report on these issues, if possible by COP5 (Oct. 1999)

Context:

- Based on this request, in October 1998, the IPCC held an expert workshop to develop a workplan
- At this meeting, there were two breakout groups:
 - ┆ uncertainties in inventories
 - ┆ good practice guidance

Good Practice Guidance Overview

- Goal is to improve inventory quality, within the context of the IPCC 1996 Revised Guidelines
- Good practice should describe how to use the methods
 - additional details and supplemental information
 - more recent data
- Address three broad elements: methodology, reporting, and quality assurance

Good Practice Guidance Should be Source-by-Source

- Developed through 4 sector workshops
 - Industrial & New Gases in Washington
 - Agriculture in Wageningen
 - Energy in Prague
 - Waste in Sao Paolo (July 27-29)
- Not addressing land use change & forestry at this time (subject of IPCC Special Report)

Good Practice Must Also Cover General Inventory Issues

- Upcoming expert workshop in Oct. 1999 in the UK
- Topics to be covered include:
 - uncertainty assessment for inventories
 - quality assurance/quality control
 - methodological issues (baseline recalculation, major/minor sources)
 - verification

How Will UK Meeting Work

- 5 technical papers finalized in advance (above topics and glossary)
- Expert groups refine recommendations at meeting
- Within 2 months final good practice recommendations required for IPCC's report
- Key to success is preplanning and clean focus

Overall IPCC Report Process

- Each workshop has meeting report, which forms core of IPCC report
- Draft report ready for government/expert review in December 1999
- Final report done by IPCC XVI (May 2000)

Questions or Information

Contact: Dina Kruger
564-9039

TM(99)225.amf

23 June 1999

Dear Ambassador,

I am pleased to invite representatives from your country to participate in a High Level Meeting on climate change, to be held 13 September 1999, in Paris. The meeting is being held in response to, *inter alia*, a request by the Executive Committee in Special Session (ECSS, 4-5 May) to prepare an informal High-Level Meeting on climate change policies with representatives from both the economic and the environment side.

The objective of the meeting is to enhance the understanding of various positions of Member states on climate change policies, supported by results of the analysis by the OECD Secretariat. This should be accomplished through a structured and open discussion, without aiming at binding conclusions. Three topics will be discussed: meeting the targets of the Kyoto Protocol; involving international business; and the participation by developing countries in future agreements to limit greenhouse gas emissions. A short background document outlining the agenda is enclosed for your information.

For the meeting to be successful, it is important that it be attended by a cross-section of senior economic and environment ministry officials from OECD Member countries. I should therefore be grateful for your assistance in securing the appropriate representation from your country. Owing to space limitations, however, attendance will have to be limited to two officials per country. The meeting will be co-chaired by Ms. E. Nordbø, Chair of the Environmental Policy Committee, and Mr. J.-P. Cotis, Chair of Working Party 1 of the Economic Policy Committee.

Encl.: 1

His Excellency
Mr. Anthony M. Hinton
Head of the Permanent Delegation of Australia
to the OECD
Australia
Paris

- 2 -

It would be greatly appreciated if the names and affiliations of your Government's representatives to the High Level Meeting could be sent to Ms. Dorte Pedersen (telefax: 33-1-45.24.78.76 or email: dorte.pedersen@oecd.org) by 19 July 1999. Short background documentation will be distributed in advance of the meeting to registered participants.

Yours sincerely,

Thorvald Moe

cc: Economic Policy Committee Delegates
Environment Policy Committee Delegates

23 June 1999

HIGH LEVEL MEETING ON CLIMATE CHANGE
 UNDER THE AUSPICES OF THE ECONOMIC POLICY COMMITTEE AND OF THE
 ENVIRONMENT POLICY COMMITTEE

in Paris, 13 September 1999

Background

1. In the context of the OECD sustainable development initiative, the work on climate change has been intensified in order to assist member countries to respond to the challenges of the implementation of the Kyoto Protocol. The *Interim Report on Sustainable Development* provides in chapter 3 the most recent summary of work carried out since the meeting of COP 4 in Buenos Aires (November 1998)¹. It focuses on the economic implications of implementing the Kyoto Protocol, with emphasis on the use of international emission trading, against the background of implementation through domestic policies alone. It draws on a report prepared for Working Party No. 1 of the Economic Policy Committee (EPC): "Taking Action against Climate Change: The Kyoto Protocol", and, to a lesser extent, a report prepared for the Environment Policy Committee (EPOC): "OECD and Climate Change: Domestic Policies to Limit Greenhouse Gas Emissions".

2. The discussion of the *Interim Report* by the Executive Committee in Special Session (ECSS) on 4-5 May, resulted in the following statement by the Chairman of the ECSS:

"Delegates discussed OECD work on sustainable development. The OECD was widely viewed as being the right place for analysing and modelling the respective costs of various Kyoto flexibility mechanisms to address climate change and the multi-disciplinary issues raised by sustainable development in general. Delegates suggested that members of the OECD's Environmental Committee and Economic Policy Committee meet jointly to discuss the most efficient means of meeting Kyoto emissions goals."

3. The analytical work carried out in the OECD provides relevant background material for the negotiation process underway in the context of the UNFCCC. Using the OECD as a forum for open and frank discussions among its member states may facilitate the preparations for the negotiations at COP 5 and COP 6.

4. This proposal is developed in response to the ECSS request. It draws on informal consultations involving the chairmen of EPC, of Working Party 1 of EPC and of EPOC, Deputy Secretary-General Thorvald Moe, the Economics Department and the Environment Directorate.

1. See: "The OECD Three-Year Project on Sustainable Development: A Progress Report". PAC/AFF(99)1, Paris May 1999.

Objective of the meeting

5. The objective of the meeting is to enhance the understanding of various positions of member states on the implementation of the Kyoto Protocol, supported by results of the analysis by the OECD Secretariat. This should be accomplished through a structured and open discussion, without aiming at binding conclusions.

Format and date of the meeting

6. The meeting will bring together high level officials from the economic, finance and environment side of national administrations who influence national positions in climate change negotiations. The meeting will be co-chaired by the chairs of EPOC and of WP No1 of EPC. The meeting will address a selected number of issues (see below). Each of the issues could be introduced by two high level officials, followed by discussion. These introductory statements and short issues papers prepared by the Secretariat will form the basis for the informal discussion.

7. In order to be relevant for the preparations of COP 5, it is proposed to hold the meeting on 13 September. Venue: OECD Headquarters in Paris.

Issues for discussions

8. For the selection of the issues the following criteria were used:

- of sufficient strategic importance to be of interest to high level officials;
- availability of results of OECD analytical work;
- limited in number to allow for meaningful discussion.

9. This led to the selection of the following three topics:

1. Meeting the Kyoto targets.
2. Involving international business: voluntary agreements and competitiveness.
3. Further development of the co-operation with developing countries under the Convention.

Meeting the Kyoto targets

10. Although all countries agree that the aim is to reduce global greenhouse gas emissions, trends in most individual countries show growth in emissions. Domestic policies to limit emissions are under development in most countries but are not yet in place, or sufficient to curb growth and achieve absolute reductions in emissions. Official information (national inventories submitted to the UNFCCC) does not provide up to date insight into how countries intend to reach the Kyoto targets. OECD analysis provides some insight into progress to date and on cost-effective policy options.

11. Discussion could be initiated by presentations from two country representatives who would describe how they intend to bridge the gap between "Business as Usual" emission trends and their targets

under the Protocol. Beyond highlighting the specific national policy challenges behind the implementation of the Protocol, the discussion could also shed some light on the option to cap the use of the flexible mechanisms.

12. The discussion will be introduced by:

- Mr. J. Pronk, Minister of Housing, Spatial Planning and the Environment, The Netherlands; and
- Mr. T. Ide, Vice Minister of International Affairs, Economic Planning Agency, Japan.

Involving international business: voluntary agreements and competitiveness

13. Concern about the international competitiveness of affected enterprises, and the possible "leakage" of emissions to countries not undertaking emission cuts, may be an important constraint on national mitigation action. Voluntary agreements by firms operating in different countries have sometimes been presented as a possibility to overcome these obstacles. At the same time, a number of countries are pursuing voluntary agreements at the national level. The discussion may address the scope for voluntary agreements, for example by sector across a number of countries, to allay the concerns for competitiveness and leakage. At the same time, the advantages and disadvantages of voluntary agreements as a means to achieve cost-effective reductions in emissions could be discussed.

14. The discussion will be introduced by:

- Mr. C. Koch-Weser, State Secretary, Ministry of Finance, Germany; and
- Ms. G. Andrews, Chief Executive Officer, Australian Greenhouse Office, Australia (to be confirmed).

Further development of the co-operation with developing countries under the Convention

15. Developing countries have a crucial role to play if the target of stabilising atmospheric concentrations of greenhouse gases is to be met at some stage. Efforts to reduce their emissions may bring additional benefits, e.g. they can also reduce local air pollution and improve energy efficiency, which will enhance economic and environmental performance. At the same time, these countries have legitimate development needs and can point to low emissions per capita as well as to low historical emissions. Taking into account these circumstances, the discussion could focus on strategies to stimulate country investments in sustainable economic growth and emission reduction.

16. The discussion will be introduced by:

- The Hon. R.Z. Lawrence, Member-Nominee, Council of Economic Advisors, United States; and
- Ms. J. Carabias Lillo, C. Secretario de medio Ambiente, Recursos Naturales y Pesca, Mexico (to be confirmed).

NEWS

House Appropriations Committee Chairman C.W. Bill Young (R-FL)

Website address: www.house.gov/appropriations

FOR IMMEDIATE RELEASE:

July 21, 1999

RESPONSIBLY FUNDING TAXPAYERS' OVERSEAS INVESTMENTS

Full Committee Passes FY00 Bill

FY00 Chairman's Mark: \$12.624 billion

FY00 President's Request: \$14.572 billion

FY99 Enacted Levels: \$33.3 billion (included \$17.9 billion for IMF)

Major Amendments Adopted in Full Committee:

- (Callahan): Reduces funds for the World Bank's International Development Association by \$200 million.
- (Knollenberg): Prohibits the use of funds for proposing or issuing rules, regulations, decrees, or orders for the purpose of implementing or preparing for implementation of the Kyoto Protocol.
- (Pelosi): Allows up to \$25 million of available funds to be used for the United Nations Population Fund (UNFPA). It specifically prohibits these U.S. funds from being spent on China or being used to fund abortions. Should UNFPA contribute funds to China, the provision requires the U.S. to withhold an equal amount of funding to the UNFPA.

Major Priorities and Initiatives:

- Provides a \$24 million increase for the Child Survival and Disease Programs Fund from FY99, \$22 million above the President's request. Total funding is \$680 million, which includes a \$5 million increase for UNICEF bringing total funding to \$110 million, \$9 million above the President's request.
- Fully funds the President's request for the International Narcotics Control, bringing

- funding to \$285 million for FY00, \$24 million more than FY99.
- Israel's economic assistance is reduced from \$1.08 billion in FY99 to \$960 million in FY00, \$30 million above the President's request.
 - Israel's military assistance is increased from \$1.86 billion in FY99 to \$1.92 billion in FY00, the same as the President's request.
 - Egypt's economic assistance is decreased from \$775 million in FY99 to \$735 million in FY00, \$20 million above the President's request.
 - Egypt's military assistance is level funded at \$1.3 billion in FY00, the same as the President's request.
 - Provides \$200 million in economic assistance for Jordan in FY00, the same as the President's request.
 - Provides \$125 million in military assistance for Jordan in FY00, the same as the President's request.

Major Cuts/Reforms:

- Funds for international family planning assistance are frozen at \$385 million.
- Reduces funding for the Global Environmental Facility by \$93.3 million below the President's request and \$117.5 million below FY99. Total FY00 funding is \$50 million.
- Reduces funding for OPIC from \$50 million in FY99 to \$20.5 million in FY00, \$3.5 million below the President's request.
- No funds for arrearages.
- No funds for the Wye River Agreement for the West Bank/Gaza and Israel.
- Former States of the Soviet Union funding is \$307 million below the President's request and \$76 million below last year, bringing FY00 funding to \$725 million.
(more)
- No funding is provided for the Foreign Military Financing Program for Turkey and Greece, the same as the President's request.
- Voluntary peacekeeping operations are frozen at the FY99 level of \$76.5 million for FY00, \$53.5 million below the President's request.
- Terminates funding for the Urban and Environmental Credit Program, FY99 funding was \$1.5 million. The President's request was \$3 million.
- Terminates funding for the U.S. Community Adjustment and Investment Program, FY99 funding was \$10 million. The President's request was \$17 million.
- Terminates funding for the Multilateral Investment Guarantee Agency, no funds provided in FY99. The President's request was \$10 million.
- Terminates funding for the Inter-American Investment Corporation, no funds provided in FY99. The President's request was \$25 million.
- Terminates funding for the Multilateral Investment Fund. The President's request was \$25.8 million. FY99 funding was \$50 million.
- Terminates the President's \$5.1 million request for capital to the African Development Bank.
- Withholds 50% of the assistance to the government of the Russian Federation unless it ends nuclear and ballistic missile cooperation with Iran.
- Freezes the International Fund for Ireland at \$19.6 million, the same as FY99 and FY98 and the President's request.

Preservations and Other Items of Interest:

- Level funds the Peace Corps at \$240 million for FY00, \$30 million below the President's request.
- Funds the Agency for International Development (AID) Development Assistance at \$1.2 billion for FY00, \$ 24 million below FY99 and \$128 million below the President's request.
- Freezes funds for the Trade and Development Agency at \$44 million for FY00, \$4 million below the President's request.
- Level funds the International Military Education and Training (IMET) program at \$50 million for FY00, \$2 million below the President's request.
- Funds the President's request of \$66 million for Foreign Military Financing activities in Europe for NATO expansion and the Partnership for Peace.
- Funds the Ex-Im Bank at \$759 million for FY00. The President's request was \$839 million for FY00.
- Level funds the Korean Peninsula Economic Development Organization (KEDO) at the FY99 level of \$35 million, \$20 million below the President's request; prohibits funds if North Korea breaks its agreement on freezing nuclear development.
- Fully funds the President's request for anti-terrorism at \$33 million, \$12 million more than last year.
- Level funds the demining account at the FY99 level of \$35 million, \$5 million below the President's request.

Major Amendments Adopted in Subcommittee:

- (Knollenberg): Allows for early disbursement of Economic Support Fund and Foreign Military Financing for Israel.
- (Lowey): Includes report language: "The Committee is concerned about the President's recommended decrease in the U.S. contribution to the United Nations Development Program and urges the Secretary to fund UNDP at the Fiscal Year 1999 level."

###

[Return to News Releases](#)

[Return to House Committee on Appropriations Home Page](#)



SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE

Tenth session

Bonn, 31 May - 11 June 1999

Item 12 of the provisional agenda

SUBSIDIARY BODY FOR IMPLEMENTATION

Tenth session

Bonn, 31 May - 11 June 1999

Item 8 of the provisional agenda

**MECHANISMS PURSUANT TO ARTICLES 6, 12 AND 17
OF THE KYOTO PROTOCOL**

**Plan for facilitating capacity-building under decision 7/CP.4:
an initial framework**

Note by the secretariat

CONTENTS

	<u>Paragraphs</u>	<u>Page</u>
I. INTRODUCTION	1 - 8	3
II. ISSUES AND ACTORS	9 - 16	4
III. CAPACITY-BUILDING PRIORITIES BEFORE THE SIXTH SESSION OF THE CONFERENCE OF THE PARTIES	17 - 27	6
IV. RESOURCES	28 - 32	8
V. PROPOSED ACTION	33 - 35	9

Annexes

	<u>Paragraph</u>	<u>Page</u>
I. PROPOSED SCHEDULE OF ACTIVITIES FOR FACILITATING CAPACITY-BUILDING		11
II. EXAMPLES OF CAPACITY-BUILDING FOR THE CLEAN DEVELOPMENT MECHANISM		12

I. INTRODUCTION

1. The Conference of the Parties (COP), at its fourth session, requested the secretariat to prepare, for consideration by the subsidiary bodies at their tenth sessions, a plan for facilitating capacity-building in developing country Parties, especially the small island States and the least developed amongst them, for project activities under the clean development mechanism (CDM), and for facilitating the participation of Parties with economies in transition in the other mechanisms (FCCC/CP/1998/16/Add.1, decision 7/CP.4, para. 4).
2. This request was one element of decision 7/CP.4, which outlines a work programme on mechanisms, including the list of elements in the annex to that decision, to be undertaken with priority given to the clean development mechanism and with a view to taking decisions on all the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol at COP 6, including, where appropriate, recommendations to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its first session (COP/MOP 1) (FCCC/CP/1998/16/Add.1, decision 7/CP.4, para.1).
3. The work programme on mechanisms is part of the Buenos Aires Plan of Action which stressed the need for increased capacity-building in several areas, reflected in decisions on activities implemented jointly (AIJ) under the pilot phase (decision 6/CP.4), additional guidance to the operating entity of the financial mechanism (decision 2/CP.4), development and transfer of technologies (decision 4/CP.4) and initial national communications from Parties not included in Annex I to the Convention (decision 12/CP.4).
4. The plan for facilitating capacity-building related to mechanisms is, therefore, one element of a larger effort to enhance the capacity of Parties and actors at the national, regional and international levels to address climate change issues. In elaborating approaches to capacity-building in any one of these areas, it should, therefore, be borne in mind that benefits can be derived from drawing thematic linkages - for example between capacity-building for effecting CDM project activities, the identification of mitigation and adaptation options in the context of national communications and technology transfer - and from coordinating activities so that maximum use is made of scarce resources. Parties may wish to consider, at an appropriate time, the elaboration of a consolidated approach to capacity-building across all areas addressed in the Buenos Aires Plan of Action.
5. The secretariat considers the following to be an initial framework for systematically discussing capacity-building related to the mechanisms and for identifying initial action to be taken. It is not yet a full-fledged plan which would spell out functional, operational and institutional requirements for facilitating CDM project activities in developing countries, and the participation in Article 6 projects (joint implementation (JI)) and in emissions trading of Parties with economies in transition as spelled out in decision 7/CP.4.
6. This initial framework reflects the fact that the rules, modalities and guidelines for the mechanisms under Articles 6, 12 and 17 will only be decided at the Conference of the Parties, at

its sixth session (COP 6), in the year 2000: capacity-building prior to COP 6 would mainly entail activities which raise awareness on the economic and environmental implications and assist in the elaboration of design options for each of the mechanisms. After COP 6, once the rules have been agreed upon, Parties may wish to shift capacity-building activities towards practical implementation issues and to the review processes. Capacity-building regarding the CDM may be undertaken with priority, as certified emissions reductions derived from CDM projects could be obtained starting in the year 2000.

7. The requirements for capacity-building related to the mechanisms at the national, subregional, regional and international levels are large involving a wide range of actors. The issues are often new and perceived to be complex. In order to make best use of available resources, expertise and experience for addressing the vast task at hand, Parties had, through decision 7/CP.4, called upon United Nations agencies, intergovernmental and non-governmental organizations to make relevant contributions to the intergovernmental process. In this context, the secretariat had, therefore, taken the initiative to invite UNCTAD, UNDP, UNEP and UNIDO to develop a coordinated approach based on the comparative advantage of each agency.

8. Finally, views expressed by Parties in submissions and initial comments by experts on a draft of this framework, presented on the occasion of the Technical Workshop on Mechanisms, held in Bonn from 9-15 April 1999, provided valuable inputs for further elaborating this document. Further inputs from Parties and other actors will be needed to develop this initial framework for discussion into a comprehensive plan for facilitating capacity-building related to the mechanisms.

II. ISSUES AND ACTORS

9. A broad range of human and institutional capacities will be needed by Parties and other actors to effectively participate in the design, development and operation of the mechanisms. A few examples may illustrate the scope of the challenge: Parties, particularly those wishing to participate in the mechanisms, will be faced with a series of technical and methodological issues on which experience has so far been limited and for which practical solutions need to be found. The determination of baselines and additionality for CDM and Article 6 projects (JI) are cases in point. For many Parties, non-Annex I and Annex I Parties alike, the required capacities are not readily available. In addition, operational requirements, such as those for the CDM, imply new development-oriented partnerships where the private sector may play a strong innovative role. Institutional support structures will need to be identified and strengthened.

10. While it may be possible to build, in some cases, on experiences and structures developed during the pilot phase of AIJ, it needs to be recalled that the range of those projects was limited. Even Parties with comparatively broad experience may, therefore, require substantial additional capacity - technical and managerial - to benefit from the project-based mechanisms under Articles 12 and 6. Such capacity-building is all the more required among Parties without activities implemented jointly and with no or limited experience in carrying out greenhouse gas (GHG) mitigation, but also adaptation, projects.

11. Regarding emissions trading under Article 17 of the Protocol, it should be noted that its rules, modalities and guidelines, including design issues such as the tracking of emission reduction units, compliance and liability, are to be decided by the Conference of the Parties. All Parties will, therefore, need to be conversant with the options in this regard. In addition, those Parties with economies in transition wishing to participate in emissions trading may perceive a need for capacity-building with regard to legal and operational requirements as well as the analysis and the management of its economic aspects. Existing institutions may need to be prepared for this unfamiliar challenge.

12. The mix and balance of relevant activities may, therefore, differ among the mechanisms as a function of Parties' needs, the nature of their involvement and design features. For example, while being engaged in the designing of all mechanisms, Parties not included in Annex I may become operationally active only in the CDM.

13. The initial framework shown in the table below presents a structured approach to capacity-building related to the mechanisms by linking actors and issues. The latter range from awareness-raising and support for the elaboration of design options for each of the mechanisms before COP 6 to operationally-oriented capacity-building for the implementation and review process after COP 6.

Table. An initial framework

Phases		Actors	National		Subregional and regional	International community
			Non-Annex I Parties	Annex I Parties		
Issues			Government - Central - Local Business NGO	Government - Central - Local Business NGO	IGO NGO	UNFCCC UN, specialized agencies IGO NGO
pre-COP 6	Design	Awareness-raising				
		Elaboration of options				
post-COP 6	Implementation	Early implementation				
		Operationalization				
		Review				

NGO = non-governmental organization;
IGO = intergovernmental organization

14. The framework reflects that Parties are seen to be the principal actors in the effort to build capacities for the participation in the mechanisms. The extent of engagement of stakeholders such as of central or local government or the business and non-governmental organization communities, will depend on national strategies and priorities as well as on the provisions for each of the mechanisms. Other actors include subregional and regional governmental and non-governmental organizations as well as the international community. The latter may render support on specific issues and in accordance with the priorities established by the intergovernmental process.

15. This general framework could be applied to each of the mechanisms under the Kyoto Protocol to illustrate how actors may get involved and can interact in order to maximize the effectiveness of capacity-building. If a Party uses this framework for performing an analysis of its capacity-building requirements, the 'issues' column would need to be further disaggregated and tailored to fit national characteristics. An illustrative example for a capacity-building framework for the clean development mechanism is given in annex II.

16. While the framework above covers capacity-building issues before and after COP 6, i.e. during the design and implementation phases, capacity-building activities prior to COP 6 should - given the absence of rules - mainly be geared towards the requirements of the design phase and facilitate the participation of Parties therein. In setting this premise, it needs to be borne in mind, however, that, while the rules of operation for the mechanisms are not yet determined, the rule-setting - and thus the capacity needed for the design phase - need to be informed to some extent by the anticipated, likely requirements of the operational phase.

III. CAPACITY-BUILDING PRIORITIES BEFORE THE SIXTH SESSION OF THE CONFERENCE OF THE PARTIES

17. Issues, requirements and priority activities related to the raising of awareness and the requirements for elaborating design options for each of the mechanisms before COP 6 are identified below. Action taken by Parties may be supported by actors at regional and international levels provided resources are available for facilitating such capacity-building efforts.

Awareness-raising

18. The effectiveness of the design - and later of the operation - of the mechanisms is likely to depend on the level of awareness at the highest political level as well as among the range of actors. National governments may assume a variety of important roles in this respect. One such role could be to identify or establish a dedicated national unit, e.g. an institution or an individual expert, as the focal point for issues related to the mechanisms under the Kyoto Protocol. Experience from the AIJ pilot phase suggests that such a unit can be crucial for attracting project-related investment by functioning as a "single window" for information on technical and process issues. It could also be the focal point for promoting capacity-building, organize technical seminars for stakeholders to share experiences and lessons learned, and, at the same

time, gather their inputs for the development of design options. Such stakeholders could include public and private sector entities (e.g. central and local government agencies involved in development finance and investment; and local and transnational companies, business and industry associations) as well as non-governmental organizations (e.g. in the environment and development area; and trade unions). They may be operating at local, national, subregional, regional and international levels.

19. Some examples may indicate the range of awareness-raising activities for the various mechanisms: for the CDM or JI, an initial national information seminar could raise key issues of a technical nature (e.g. on baselines and additionality, reporting and certification) and provide updates on the intergovernmental process and its requirements. Participants may include representatives from those parts of the private sector which are assigned priority in the national development plan, from local governments and non-governmental organizations, from the certifying industry and from national authorities likely to be involved in the approval process for project activities. A national World Wide Web site could be a useful tool for raising awareness and exchanging information.

20. Regarding emissions trading, awareness-raising activities may be important for enhancing public understanding of the intricacies and challenges of such a regime. In addition, technical training in finance, exchange and broker operations may be needed to facilitate the participation of all eligible Parties in the design of emissions trading pursuant to Article 17.

21. In support of national activities, subregional and regional actors, e.g. intergovernmental and non-governmental organizations, could generate knowledge and provide platforms for distributing and exchanging information specific to their region. They could also play an important role in facilitating national activities by providing, upon request, resource persons with technical and institutional expertise. The use of communication technologies such as the Internet could not only support the dissemination of information, but also assist in capacity-building at regional level through the creation of networks of experts and institutions.

22. The international community could facilitate these awareness-raising efforts through the development of standard reference materials. Previous experiences, including the AJJ pilot phase, have demonstrated the importance of common terminology and definitions. Modular information products, such as information kits on design options (pre-COP 6) and on implementation modalities (post-COP 6), could be provided to national focal points for the Convention and to other users. Other means for facilitating capacity-building include regional workshops; networks promoted by United Nations agencies, intergovernmental and international non-governmental organizations; dedicated World Wide Web sites; and the provision of ad hoc advisory services upon request.

Elaboration of options

23. The private sector, non-governmental organizations, local governments and other potential stakeholders in the national process could be involved in identifying options for the

designing of the mechanisms. In the case of the CDM, they could provide inputs on methodological issues, such as baselines and additionality, and on monitoring, reporting, verification and certification procedures. Governments could assist this process by disseminating information which is available internationally. The early involvement of actors in the design stage may significantly facilitate their subsequent engagement in the implementation phase of the mechanism.

24. In designing the adaptation component of the CDM, countries within the same region or with a similar vulnerability profile may collaborate in developing suitable common approaches. The exchange of information between regions and among subregions may facilitate learning, reduce duplicative experimentation and promote the diffusion of options with multiple benefits. These cooperation efforts could provide input to the development of the modalities for accessing the funds generated by the share of the proceeds under the CDM.

25. Regional and subregional actors, for example a centre specializing in any of the mechanisms, could provide, upon request, experts from a regional roster and access to their knowledge base containing state-of-the-art research results. They could also further develop the information kits and tailor them to suit national and regional characteristics.

26. In addition to technical workshops, permanent expert groups at regional level on each of the mechanisms may be useful to help Parties within that region to formulate guidelines, rules and operational modalities and thus to inform the decision-making at national as well as international levels.

27. The international community could assist regional and subregional actors in expanding their technical knowledge base. Especially in the area of adaptation, the international community could also facilitate cross-regional exchanges.

IV. RESOURCES

28. Given the wide range of activities and actors involved, it is not feasible to present an overall assessment of required resources. Activities identified in this framework, linking actors and issues, could be taken up at various levels prior to COP 6. A multitude of stakeholders and proponents from local to global levels may be involved and the scope and nature of activities may vary among and between mechanisms. They could be activities dedicated solely to the mechanisms or related/attached to capacity-building in areas such as technology transfer.

29. As resources become available, they may be drawn from public and private sources, from bilateral and multilateral funds. Parties may wish to invite contributions to the various capacity-building efforts which they themselves and/or other above-mentioned actors may undertake.

30. It is, however, a primary objective of this initial framework for a plan for facilitating capacity-building related to the mechanisms to promote the avoidance of duplication of effort

and utmost use of scarce resources. A schedule for possible capacity-building activities related to the mechanisms until the end of the year 2000 is, therefore, contained in annex I to this document. This schedule seeks to contribute to the rational planning of events and products in support of capacity-building.

31. In this context, Parties may wish to note that the secretariat has invited UNCTAD, UNDP, UNEP and UNIDO to coordinate their activities in this area. This effort has resulted in a first project proposal for 1999-2000 for capacity-building related to the CDM. Its components include enhancing the knowledge base, developing prototype projects for case studies in developing countries, as well as general awareness-raising, training and information activities. This proposal is being submitted to potential donors interested in funding its implementation.

32. Parties may wish to contribute information on their own activities at bilateral, subregional and regional levels and invite relevant contributions to their capacity-building efforts from United Nations agencies, intergovernmental and non-governmental organizations.

V. PROPOSED ACTION

33. Parties may wish to consider:

(a) The desirability of integrating capacity-building related to the mechanisms into a consolidated approach to capacity-building across all areas addressed in the Buenos Aires Plan of Action; and

(b) The scope and objectives of capacity-building activities for the pre-COP 6 design phase, such as the need for a global workshop and regional workshops between COP 5 and COP 6 aimed at raising awareness and at strengthening the capacity to develop design options.

34. For the further elaboration of a plan for facilitating capacity-building related to the mechanisms, Parties may wish to submit views and/or information on:

(a) Priority needs regarding capacity-building for the mechanisms, indicating, as appropriate, possible linkages to capacity-building efforts in other areas; and

(b) Relevant ongoing and completed capacity-building activities at national, subregional and regional, bilateral and multilateral level.

35. Parties may wish to request the secretariat to:

(a) Elaborate further on a plan for facilitating capacity-building for the mechanisms, based on submissions by Parties, to be considered at the next session of the subsidiary bodies;

(b) Continue its efforts to promote the coordination among relevant UN agencies; and

(c) Develop, in cooperation with other actors, modular information kits, as described above, as well as promote a network for developing a knowledge base on design options for the mechanisms.

Annex I

PROPOSED SCHEDULE OF ACTIVITIES FOR FACILITATING CAPACITY-BUILDING

Month/ Year	National	Subregional and regional			International Community			Information/ training products
		CDM	Article 6	ET	CDM	Article 6	ET	
6/99 SB 10					CC FORUM on CDM	CC FORUM on JI	CC FORUM on ET	
7/99								
8/99								
9/99								
10/99								Info Kit, Version 1
11/99 COP 5					CC FORUM on CDM	CC FORUM on JI	CC FORUM on ET	
12/99								Info Kit, Version 2
1/00		WS (UN agencies/ UNFCCC)	WS (UN agencies/ UNFCCC)	WS (UN agencies/ UNFCCC)				
2/00								
3/00								
4/00					WS (UNFCCC)	WS (UNFCCC)	WS (UNFCCC)	
5/00								
6/00 SB 12					CC FORUM on CDM	CC FORUM on JI	CC FORUM on ET	
7/00								Info Kit, Version 3
8/00								
9/00								
10/00								
11/00 COP 6					CC FORUM on CDM	CC FORUM on JI	CC FORUM on ET	
12/00								Info Kit, Version 4

CDM = clean development mechanism; ET = emissions trading; JI = joint implementation;
 WS = Workshop; UN agencies= United Nations agencies (UNCTAD, UNDP, UNEP, UNIDO, as appropriate)

Annex II

**EXAMPLES OF CAPACITY- BUILDING FOR THE
CLEAN DEVELOPMENT MECHANISM**

Phase /issues	Capacity-building needs	Activity / information - training products	Beneficiaries / actors
pre-COP 6/Design			
Awareness-raising.	Increase awareness of climate change issue	Global, regional workshops	Policy makers, senior executives of private sector, non-governmental organizations
	Increase awareness of CDM	Subregional, national workshops	Technical experts of public and private sectors, non-governmental organizations
	Expand information on potential partners	Website, bulletin board	Project developers, investors (public and private)
Elaboration of options	Technical training on options regarding methodological issues (baselines, additionality, certification, etc.)	Modular information kit	Technical experts of public and private sectors, non-governmental organizations
post-COP 6/Implementation			
Early implementation and operationalization	Application of technical guidelines for: <ul style="list-style-type: none"> - baselines - sustainable development benefits - project validation, reporting and certification - adaptation 	National workshops, modular information kit	Policy makers, project developers and operators (public and private), non-governmental organizations, local governments
	Information on project finance options	National workshops, modular information kit	Policy makers, project developers, non-governmental organizations, local governments
	Information on national and international investment law in relation to the CDM	Regional and national workshops	Policy makers, project developers, non-governmental organizations, local governments
Review			
	Structure for monitoring and evaluating implementation	Subregional and regional workshop for comparing experiences	Policy makers, technical experts, project developers and operators

TM(99)225.amf

23 June 1999

Dear Ambassador,

I am pleased to invite representatives from your country to participate in a High Level Meeting on climate change, to be held 13 September 1999, in Paris. The meeting is being held in response to, inter alia, a request by the Executive Committee in Special Session (ECSS, 4-5 May) to prepare an informal High-Level Meeting on climate change policies with representatives from both the economic and the environment side.

The objective of the meeting is to enhance the understanding of various positions of Member states on climate change policies, supported by results of the analysis by the OECD Secretariat. This should be accomplished through a structured and open discussion, without aiming at binding conclusions. Three topics will be discussed: meeting the targets of the Kyoto Protocol; involving international business; and the participation by developing countries in future agreements to limit greenhouse gas emissions. A short background document outlining the agenda is enclosed for your information.

For the meeting to be successful, it is important that it be attended by a cross-section of senior economic and environment ministry officials from OECD Member countries. I should therefore be grateful for your assistance in securing the appropriate representation from your country. Owing to space limitations, however, attendance will have to be limited to two officials per country. The meeting will be co-chaired by Ms. E. Nordbø, Chair of the Environmental Policy Committee, and Mr. J.-P. Cotis, Chair of Working Party 1 of the Economic Policy Committee.

Encl.: 1

His Excellency
Mr. Anthony M. Hinton
Head of the Permanent Delegation of Australia
to the OECD
Australia
Paris

- 2 -

It would be greatly appreciated if the names and affiliations of your Government's representatives to the High Level Meeting could be sent to Ms. Dorte Pedersen (telefax: 33-1-45.24.78.76 or email: dorte.pedersen@oecd.org) by 19 July 1999. Short background documentation will be distributed in advance of the meeting to registered participants.

Yours sincerely,

Thorvald Moe

cc: Economic Policy Committee Delegates
Environment Policy Committee Delegates

23 June 1999

HIGH LEVEL MEETING ON CLIMATE CHANGE
UNDER THE AUSPICES OF THE ECONOMIC POLICY COMMITTEE AND OF THE
ENVIRONMENT POLICY COMMITTEE

in Paris, 13 September 1999

Background

1. In the context of the OECD sustainable development initiative, the work on climate change has been intensified in order to assist member countries to respond to the challenges of the implementation of the Kyoto Protocol. The *Interim Report on Sustainable Development* provides in chapter 3 the most recent summary of work carried out since the meeting of COP 4 in Buenos Aires (November 1998)¹. It focuses on the economic implications of implementing the Kyoto Protocol, with emphasis on the use of international emission trading, against the background of implementation through domestic policies alone. It draws on a report prepared for Working Party No. 1 of the Economic Policy Committee (EPC): "Taking Action against Climate Change: The Kyoto Protocol", and, to a lesser extent, a report prepared for the Environment Policy Committee (EPOC): "OECD and Climate Change: Domestic Policies to Limit Greenhouse Gas Emissions".
2. The discussion of the *Interim Report* by the Executive Committee in Special Session (ECSS) on 4-5 May, resulted in the following statement by the Chairman of the ECSS:

"Delegates discussed OECD work on sustainable development. The OECD was widely viewed as being the right place for analysing and modelling the respective costs of various Kyoto flexibility mechanisms to address climate change and the multi-disciplinary issues raised by sustainable development in general. Delegates suggested that members of the OECD's Environmental Committee and Economic Policy Committee meet jointly to discuss the most efficient means of meeting Kyoto emissions goals."
3. The analytical work carried out in the OECD provides relevant background material for the negotiation process underway in the context of the UNFCCC. Using the OECD as a forum for open and frank discussions among its member states may facilitate the preparations for the negotiations at COP 5 and COP 6.
4. This proposal is developed in response to the ECSS request. It draws on informal consultations involving the chairmen of EPC, of Working Party 1 of EPC and of EPOC, Deputy Secretary-General Thorvald Moe, the Economics Department and the Environment Directorate.

1. See: "The OECD Three-Year Project on Sustainable Development: A Progress Report".
PAC/AFF(99)1, Paris May 1999.

Objective of the meeting

5. The objective of the meeting is to enhance the understanding of various positions of member states on the implementation of the Kyoto Protocol, supported by results of the analysis by the OECD Secretariat. This should be accomplished through a structured and open discussion, without aiming at binding conclusions.

Format and date of the meeting

6. The meeting will bring together high level officials from the economic, finance and environment side of national administrations who influence national positions in climate change negotiations. The meeting will be co-chaired by the chairs of EPOC and of WP No1 of EPC. The meeting will address a selected number of issues (see below). Each of the issues could be introduced by two high level officials, followed by discussion. These introductory statements and short issues papers prepared by the Secretariat will form the basis for the informal discussion.

7. In order to be relevant for the preparations of COP 5, it is proposed to hold the meeting on 13 September. Venue: OECD Headquarters in Paris.

Issues for discussions

8. For the selection of the issues the following criteria were used:

- of sufficient strategic importance to be of interest to high level officials;
- availability of results of OECD analytical work;
- limited in number to allow for meaningful discussion.

9. This led to the selection of the following three topics:

1. Meeting the Kyoto targets.
2. Involving international business: voluntary agreements and competitiveness.
3. Further development of the co-operation with developing countries under the Convention.

Meeting the Kyoto targets

10. Although all countries agree that the aim is to reduce global greenhouse gas emissions, trends in most individual countries show growth in emissions. Domestic policies to limit emissions are under development in most countries but are not yet in place, or sufficient to curb growth and achieve absolute reductions in emissions. Official information (national inventories submitted to the UNFCCC) does not provide up to date insight into how countries intend to reach the Kyoto targets. OECD analysis provides some insight into progress to date and on cost-effective policy options.

11. Discussion could be initiated by presentations from two country representatives who would describe how they intend to bridge the gap between "Business as Usual" emission trends and their targets

under the Protocol. Beyond highlighting the specific national policy challenges behind the implementation of the Protocol, the discussion could also shed some light on the option to cap the use of the flexible mechanisms.

12. The discussion will be introduced by:

- Mr. J. Pronk, Minister of Housing, Spatial Planning and the Environment, The Netherlands; and
- Mr. T. Ide, Vice Minister of International Affairs, Economic Planning Agency, Japan.

Involving international business: voluntary agreements and competitiveness

13. Concern about the international competitiveness of affected enterprises, and the possible "leakage" of emissions to countries not undertaking emission cuts, may be an important constraint on national mitigation action. Voluntary agreements by firms operating in different countries have sometimes been presented as a possibility to overcome these obstacles. At the same time, a number of countries are pursuing voluntary agreements at the national level. The discussion may address the scope for voluntary agreements, for example by sector across a number of countries, to allay the concerns for competitiveness and leakage. At the same time, the advantages and disadvantages of voluntary agreements as a means to achieve cost-effective reductions in emissions could be discussed.

14. The discussion will be introduced by:

- Mr. C. Koch-Weser, State Secretary, Ministry of Finance, Germany; and
- Ms. G. Andrews, Chief Executive Officer, Australian Greenhouse Office, Australia (to be confirmed).

Further development of the co-operation with developing countries under the Convention

15. Developing countries have a crucial role to play if the target of stabilising atmospheric concentrations of greenhouse gases is to be met at some stage. Efforts to reduce their emissions may bring additional benefits, e.g. they can also reduce local air pollution and improve energy efficiency, which will enhance economic and environmental performance. At the same time, these countries have legitimate development needs and can point to low emissions per capita as well as to low historical emissions. Taking into account these circumstances, the discussion could focus on strategies to stimulate country investments in sustainable economic growth and emission reduction.

16. The discussion will be introduced by:

- The Hon. R.Z. Lawrence, Member-Nominee, Council of Economic Advisors, United States; and
- Ms. J. Carabias Lillo, C. Secretario de medio Ambiente, Recursos Naturales y Pesca, Mexico (to be confirmed).



Subject to technical revision

Original: ENGLISH

CONFERENCE OF THE PARTIES
Third session
Kyoto, 1-10 December 1997
Agenda item 5

**KYOTO PROTOCOL TO THE
UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE**

The Parties to this Protocol,

*Being Parties to the United Nations Framework Convention on Climate Change,
hereinafter referred to as “the Convention”,*

In pursuit of the ultimate objective of the Convention as stated in its Article 2,

Recalling the provisions of the Convention,

Being guided by Article 3 of the Convention,

*Pursuant to the Berlin Mandate adopted by decision 1/CP.1 of the
Conference of the Parties to the Convention at its first session,*

Have agreed as follows:

Article 1

For the purposes of this Protocol, the definitions contained in Article 1 of the Convention shall apply. In addition:

1. “Conference of the Parties” means the Conference of the Parties to the Convention.

UKY.97-

2. “Convention” means the United Nations Framework Convention on Climate Change, adopted in New York on 9 May 1992.
3. “Intergovernmental Panel on Climate Change” means the Intergovernmental Panel on Climate Change established in 1988 jointly by the World Meteorological Organization and the United Nations Environment Programme.
4. “Montreal Protocol” means the Montreal Protocol on Substances that Deplete the Ozone Layer, adopted in Montreal on 16 September 1987 and as subsequently adjusted and amended.
5. “Parties present and voting” means Parties present and casting an affirmative or negative vote.
6. “Party” means, unless the context otherwise indicates, a Party to this Protocol.
7. “Party included in Annex I” means a Party included in Annex I to the Convention, as may be amended, or a Party which has made a notification under Article 4, paragraph 2(g), of the Convention.

Article 2

1. Each Party included in Annex I in achieving its quantified emission limitation and reduction commitments under Article 3, in order to promote sustainable development, shall:
 - (a) Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:
 - (i) Enhancement of energy efficiency in relevant sectors of the national economy;
 - (ii) Protection and enhancement of sinks and reservoirs of greenhouse gases not controlled by the Montreal Protocol, taking into account its commitments under relevant international environmental agreements; promotion of sustainable forest management practices, afforestation and reforestation;
 - (iii) Promotion of sustainable forms of agriculture in light of climate change considerations;
 - (iv) Promotion, research, development and increased use of new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies;

- (v) Progressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run counter to the objective of the Convention and apply market instruments;
- (vi) Encouragement of appropriate reforms in relevant sectors aimed at promoting policies and measures which limit or reduce emissions of greenhouse gases not controlled by the Montreal Protocol;
- (vii) Measures to limit and/or reduce emissions of greenhouse gases not controlled by the Montreal Protocol in the transport sector;
- (viii) Limitation and/or reduction of methane through recovery and use in waste management, as well as in the production, transport and distribution of energy;

(b) Cooperate with other such Parties to enhance the individual and combined effectiveness of their policies and measures adopted under this Article, pursuant to Article 4, paragraph 2(e)(i), of the Convention. To this end, these Parties shall take steps to share their experience and exchange information on such policies and measures, including developing ways of improving their comparability, transparency and effectiveness. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as practicable thereafter, consider ways to facilitate such cooperation, taking into account all relevant information.

2. The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively.

3. The Parties included in Annex I shall strive to implement policies and measures under this Article in such a way as to minimize adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties and in particular those identified in Article 4, paragraphs 8 and 9 of the Convention, taking into account Article 3 of the Convention. The Conference of the Parties serving as the meeting of the Parties to this Protocol may take further action, as appropriate, to promote the implementation of the provisions of this paragraph.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol, if it decides that it would be beneficial to coordinate any of the policies and measures in paragraph 1(a) above, taking into account different national circumstances and potential effects, shall consider ways and means to elaborate the coordination of such policies and measures.

Article 3

1. The Parties included in Annex I shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012.

2. Each Party included in Annex I shall, by 2005, have made demonstrable progress in achieving its commitments under this Protocol.

3. The net changes in greenhouse gas emissions from sources and removals by sinks resulting from direct human-induced land use change and forestry activities, limited to afforestation, reforestation, and deforestation since 1990, measured as verifiable changes in stocks in each commitment period shall be used to meet the commitments in this Article of each Party included in Annex I. The greenhouse gas emissions from sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8.

4. Prior to the first session of the Conference of the Parties serving as the meeting of the Parties to this Protocol, each Party included in Annex I shall provide for consideration by the Subsidiary Body for Scientific and Technological Advice data to establish its level of carbon stocks in 1990 and to enable an estimate to be made of its changes in carbon stocks in subsequent years. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as practicable thereafter, decide upon modalities, rules and guidelines as to how and which additional human-induced activities related to changes in greenhouse gas emissions and removals in the agricultural soil and land use change and forestry categories, shall be added to, or subtracted from, the assigned amount for Parties included in Annex I, taking into account uncertainties, transparency in reporting, verifiability, the methodological work of the Intergovernmental Panel on Climate Change, the advice provided by the Subsidiary Body for Scientific and Technological Advice in accordance with Article 5 and the decisions of the Conference of the Parties. Such a decision shall apply in the second and subsequent commitment periods. A Party may choose to apply such a decision on these additional human-induced activities for its first commitment period, provided that these activities have taken place since 1990.

5. The Parties included in Annex I undergoing the process of transition to a market economy whose base year or period was established pursuant to decision 9/CP.2 of the Conference of the Parties at its second session, shall use that base year or period for the implementation of their commitments under this Article. Any other Party included in Annex I undergoing the process of transition to a market economy which has not yet submitted its first national communication under Article 12 of the Convention may also notify the

Conference of the Parties serving as the meeting of the Parties to this Protocol that it intends to use a historical base year or period other than 1990 for the implementation of its commitments under this Article. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall decide on the acceptance of such notification.

6. Taking into account Article 4, paragraph 6, of the Convention, in the implementation of their commitments under this Protocol other than those in this Article, a certain degree of flexibility shall be allowed by the Conference of the Parties serving as the meeting of the Parties to this Protocol to the Parties included in Annex I undergoing the process of transition to a market economy.

7. In the first quantified emission limitation and reduction commitment period, from 2008 to 2012, the assigned amount for each Party included in Annex I shall be equal to the percentage inscribed for it in Annex B of its aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A in 1990, or the base year or period determined in accordance with paragraph 5 above, multiplied by five. Those Parties included in Annex I for whom land use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions minus removals in 1990 from land use change for the purposes of calculating their assigned amount.

8. Any Party included in Annex I may use 1995 as its base year for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, for the purposes of the calculation referred to in paragraph 7 above.

9. Commitments for subsequent periods for Parties included in Annex I shall be established in amendments to Annex B to this Protocol, which shall be adopted in accordance with the provisions of Article 20, paragraph 7. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall initiate the consideration of such commitments at least seven years before the end of the first commitment period mentioned in paragraph 7 above.

10. Any emission reduction units, or any part of an assigned amount, which a Party acquires from another Party in accordance with the provisions of Article 6 and of Article 16 bis shall be added to the assigned amount for that Party.

11. Any emission reduction units, or any part of an assigned amount, which a Party transfers to another Party in accordance with the provisions of Article 6 and of Article 16 bis shall be subtracted from the assigned amount for that Party.

12. Any certified emission reductions which a Party acquires from another Party in accordance with the provisions of Article 12 shall be added to the assigned amount for that Party.

13. If the emissions of a Party included in Annex I during a commitment period are less than its assigned amount under this Article, this difference shall, on request of that Party, be added to the assigned amount for that Party for subsequent commitment periods.

14. Each Party included in Annex I shall strive to implement the commitments mentioned in paragraph 1 above in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties, particularly those identified in Article 4, paragraphs 8 and 9, of the Convention. In line with relevant decisions of the Conference of the Parties on the implementation of those paragraphs, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, consider what actions are necessary to minimize the adverse effects of climate change and/or the impacts of response measures on Parties referred to in those paragraphs. Among the issues to be considered shall be the establishment of funding, insurance and transfer of technology.

Article 4

1. Any Parties included in Annex I that have agreed to jointly fulfil their commitments under Article 3 shall be deemed to have met those commitments provided that their total combined aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of Article 3. The respective emission level allocated to each of the Parties to the agreement shall be set out in that agreement.

2. The Parties to any such agreement shall notify the secretariat of the terms of the agreement on the date of deposit of their instruments of ratification, acceptance, approval or accession. The secretariat shall in turn inform the Parties and signatories to the Convention of the terms of the agreement.

3. The agreement shall remain in operation for the duration of the commitment period specified in Article 3, paragraph 7.

4. If Parties acting jointly do so in the framework of, and together with, a regional economic integration organization, any alteration in the composition of the organization after adoption of this Protocol shall not affect existing commitments under this Protocol. Any alteration in the composition of the organization shall only apply for the purposes of those commitments under Article 3 that are adopted subsequent to that revision.

5. In the event of failure by the Parties to such an agreement to achieve their total combined level of emission reductions, each Party to such an agreement shall be responsible for its own level of emissions set out in the agreement.

6. If Parties acting jointly do so in the framework of, and together with, a regional economic integration organization which is itself a Party to this Protocol, each member State of that regional economic integration organization individually, and together with the regional economic integration organization acting in accordance with Article 23, shall, in the event of failure to achieve the total combined level of emission reductions, be responsible for its level of emissions as notified in accordance with this Article.

Article 5

1. Each Party included in Annex I shall have in place, no later than one year prior to the start of the first commitment period, a national system for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. Guidelines for such national systems, which shall incorporate the methodologies specified in paragraph 2 below, shall be decided upon by the Conference of the Parties serving as the meeting of the Parties to this Protocol at its first session.
2. Methodologies for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol shall be those accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties at its third session. Where such methodologies are not used, appropriate adjustments shall be applied according to methodologies agreed upon by the Conference of the Parties serving as the meeting of the Parties to this Protocol at its first session. Based on the work of, *inter alia*, the Intergovernmental Panel on Climate Change and advice provided by the Subsidiary Body for Scientific and Technological Advice, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall regularly review and, as appropriate, revise such methodologies and adjustments, taking fully into account any relevant decisions by the Conference of the Parties. Any revision to methodologies or adjustments shall be used only for the purposes of ascertaining compliance with commitments under Article 3 in respect of any commitment period adopted subsequent to that revision.
3. The global warming potentials used to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol listed in Annex A shall be those accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties at its third session. Based on the work of, *inter alia*, the Intergovernmental Panel on Climate Change and advice provided by the Subsidiary Body for Scientific and Technological Advice, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall regularly review and, as appropriate, revise the global warming potential of each such greenhouse gas, taking fully into account any relevant decisions by the Conference of the Parties. Any revision to a global warming potential shall apply only to those commitments under Article 3 in respect of any commitment period adopted subsequent to that revision.

Article 6

1. For the purpose of meeting its commitments under Article 3, any Party included in Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy, provided that:
 - (a) Any such project has the approval of the Parties involved;
 - (b) Any such project provides a reduction in emissions by sources, or an enhancement of removals by sinks, that is additional to any that would otherwise occur;
 - (c) It does not acquire any emission reduction units if it is not in compliance with its obligations under Articles 5 and 7; and
 - (d) The acquisition of emission reduction units shall be supplemental to domestic actions for the purposes of meeting commitments under Article 3.
2. The Conference of the Parties serving as the meeting of the Parties to this Protocol may, at its first session or as soon as practicable thereafter, further elaborate guidelines for the implementation of this Article, including for verification and reporting.
3. A Party included in Annex I may authorize legal entities to participate, under its responsibility, in actions leading to the generation, transfer or acquisition under this Article of emission reduction units.
4. If a question of implementation by a Party included in Annex I of the requirements referred to in this paragraph is identified in accordance with the relevant provisions of Article 8, transfers and acquisitions of emission reduction units may continue to be made after the question has been identified, provided that any such units may not be used by a Party to meet its commitments under Article 3 until any issue of compliance is resolved.

Article 7

1. Each Party included in Annex I shall incorporate in its annual inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol, submitted in accordance with the relevant decisions of the Conference of the Parties, the necessary supplementary information for the purposes of ensuring compliance with Article 3, to be determined in accordance with paragraph 4 below.
2. Each Party included in Annex I shall incorporate in its national communication, submitted under Article 12 of the Convention, the supplementary information necessary to

demonstrate compliance with its commitments under this Protocol, to be determined in accordance with paragraph 4 below.

3. Each Party included in Annex I shall submit the information required under paragraph 1 above annually, beginning with the first inventory due under the Convention for the first year of the commitment period after this Protocol has entered into force for it. Each such Party shall submit the information required under paragraph 2 above as part of the first national communication due under the Convention after this Protocol has entered into force for it and after the adoption of guidelines as provided for in paragraph 4 below. The frequency of subsequent submission of information required under this Article shall be determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol, taking into account any timetable for the submission of national communications decided upon by the Conference of the Parties.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall adopt at its first session, and review periodically thereafter, guidelines for the preparation of the information required under this Article, taking into account guidelines for the preparation of national communications by Parties included in Annex I adopted by the Conference of the Parties. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall also, prior to the first commitment period, decide upon modalities for the accounting of assigned amounts.

Article 8

1. The information submitted under Article 7 by each Party included in Annex I shall be reviewed by expert review teams pursuant to the relevant decisions of the Conference of the Parties and in accordance with guidelines adopted for this purpose by the Conference of the Parties serving as the meeting of the Parties to this Protocol under paragraph 4 below. The information submitted under Article 7, paragraph 1, by each Party included in Annex I shall be reviewed as part of the annual compilation and accounting of emissions inventories and assigned amounts. Additionally, the information submitted under Article 7, paragraph 2, by each Party included in Annex I shall be reviewed as part of the review of communications.

2. Expert review teams shall be coordinated by the secretariat and shall be composed of experts selected from those nominated by Parties to the Convention and, as appropriate, by intergovernmental organizations, in accordance with guidance provided for this purpose by the Conference of the Parties.

3. The review process shall provide a thorough and comprehensive technical assessment of all aspects of the implementation by a Party of this Protocol. The expert review teams shall prepare a report to the Conference of the Parties serving as the meeting of the Parties to this Protocol, assessing the implementation of the commitments of the Party and identifying any potential problems in, and factors influencing, the fulfilment of commitments. Such reports shall

be circulated by the secretariat to all Parties to the Convention. The secretariat shall list those questions of implementation indicated in such reports for further consideration by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall adopt at its first session, and review periodically thereafter, guidelines for the review of implementation by expert review teams taking into account the relevant decisions of the Conference of the Parties.

5. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, with the assistance of the Subsidiary Body for Implementation and, as appropriate, the Subsidiary Body for Scientific and Technological Advice, consider:

(a) The information submitted by the Parties under Article 7 and the reports of the expert reviews thereon conducted under this Article; and

(b) Those questions of implementation listed by the secretariat under paragraph 3 above, as well as any questions raised by Parties.

6. Pursuant to its consideration of the information referred to in paragraph 5 above, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall take decisions on any matter required for the implementation of this Protocol.

Article 9

1. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall periodically review this Protocol in the light of the best available scientific information and assessments on climate change and its impacts, as well as relevant technical, social and economic information. Such reviews shall be coordinated with pertinent reviews under the Convention, in particular those required by Article 4, paragraph 2(d), and Article 7, paragraph 2(a), of the Convention. Based on these reviews, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall take appropriate action.

2. The first review shall take place at the second session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. Further reviews shall take place at regular intervals and in a timely manner.

Article 10

All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, without introducing any new commitments for Parties not included in Annex I, but reaffirming existing commitments in Article 4, paragraph 1, of the Convention, and continuing to advance the

implementation of these commitments in order to achieve sustainable development, taking into account Article 4, paragraphs 3, 5 and 7, of the Convention, shall:

(a) Formulate, where relevant and to the extent possible, cost-effective national, and where appropriate regional programmes to improve the quality of local emission factors, activity data and/or models which reflect the socio-economic conditions of each Party for the preparation and periodic updating of national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties, and consistent with the guidelines for national communications adopted by the Conference of the Parties;

(b) Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change and measures to facilitate adequate adaptation to climate change:

- (i) Such programmes would, *inter alia*, concern the energy, transport and industry sectors as well as agriculture, forestry and waste management. Furthermore, adaptation technologies and methods for improving spatial planning would improve adaptation to climate change; and
- (ii) Parties included in Annex I shall submit information on action under this Protocol, including national programmes, according to the guidelines laid down in Article 8; and other Parties shall seek to include in their national communications, as appropriate, information on programmes which contain measures that the Party believes contribute to addressing climate change and its adverse impacts, including the abatement of increase in greenhouse gas emissions, and enhancement of and removals by sinks, capacity building and adaptation measures.

(c) Cooperate in the promotion of effective modalities for the development, application and diffusion of, and take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries, including the formulation of policies and programmes for the effective transfer of environmentally sound technologies that are publicly owned or in the public domain and the creation of an enabling environment for the private sector, to promote and enhance access to, and transfer of, environmentally sound technologies;

(d) Cooperate in scientific and technical research and promote the maintenance and the development of systematic observation systems and development of data archives to reduce uncertainties related to the climate system, the adverse impacts of climate change and the economic and social consequences of various response strategies, and promote the development and strengthening of endogenous capacities and capabilities to participate in international and

intergovernmental efforts, programmes and networks on research and systematic observation, taking into account Article 5 of the Convention;

(e) Cooperate in and promote at the international level, and, where appropriate, using existing bodies, the development and implementation of education and training programmes, including the strengthening of national capacity building, in particular human and institutional capacities and the exchange or secondment of personnel to train experts in this field, in particular for developing countries, and facilitate at the national level public awareness and public access to information on climate change. Suitable modalities should be developed to implement these activities through the relevant bodies of the Convention taking into account Article 6 of the Convention;

(f) Include in their national communications information on programmes and activities undertaken pursuant to this Article in accordance with relevant decisions of the Conference of the Parties; and

(g) Give full consideration, in implementing the commitments in this Article, to Article 4, paragraph 8, of the Convention.

Article 11

1. In the implementation of Article 10, Parties shall take into account the provisions of Article 4, paragraphs 4, 5, 7, 8 and 9 of the Convention.

2. In the context of the implementation of Article 4, paragraph 1, of the Convention, in accordance with the provisions of Article 4, paragraph 3, and Article 11 of the Convention, and through the operating entity or entities of the financial mechanism of the Convention, the developed country Parties and other developed Parties included in Annex II to the Convention shall:

(a) Provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in advancing the implementation of existing commitments under Article 4, paragraph 1(a), of the Convention that are covered in Article 10, subparagraph (a); and

(b) Also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of advancing the implementation of existing commitments in Article 4, paragraph 1, of the Convention that are covered by Article 10 and that are agreed between a developing country Party and the international entity or entities referred to in Article 11 of the Convention, in accordance with that Article.

The implementation of these existing commitments shall take into account the need for adequacy and predictability in the flow of funds and the importance of appropriate burden sharing among developed country Parties. The guidance to the financial mechanism of the Convention in relevant decisions of the Conference of the Parties, including those agreed before the adoption of this Protocol, shall apply *mutatis mutandis* to the provisions of this paragraph.

3. The developed country Parties and other developed Parties in Annex II to the Convention may also provide, and developing country Parties avail themselves of, financial resources for the implementation of Article 10, through bilateral, regional and other multilateral channels.

Article 12

1. A clean development mechanism is hereby defined.

2. The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.

3. Under the clean development mechanism:

(a) Parties not included in Annex I will benefit from project activities resulting in certified emission reductions; and

(b) Parties included in Annex I may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The clean development mechanism shall be subject to the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Protocol and be supervised by an executive board of the clean development mechanism.

5. Emission reductions resulting from each project activity shall be certified by operational entities to be designated by the Conference of the Parties serving as the meeting of the Parties to this Protocol, on the basis of:

(a) Voluntary participation approved by each Party involved;

(b) Real, measurable, and long-term benefits related to the mitigation of climate change; and

(c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

6. The clean development mechanism shall assist in arranging funding of certified project activities as necessary.

7. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, elaborate modalities and procedures with the objective of ensuring transparency, efficiency and accountability through independent auditing and verification of project activities.

8. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall ensure that a share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation.

9. Participation under the clean development mechanism, including in activities mentioned in paragraph 3(a) above and acquisition of certified emission reductions, may involve private and/or public entities, and is to be subject to whatever guidance may be provided by the executive board of the clean development mechanism.

10. Certified emission reductions obtained during the period from the year 2000 up to the beginning of the first commitment period can be used to assist in achieving compliance in the first commitment period.

Article 13

1. The Conference of the Parties, the supreme body of the Convention, shall serve as the meeting of the Parties to this Protocol.

2. Parties to the Convention that are not Parties to this Protocol may participate as observers in the proceedings of any session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. When the Conference of the Parties serves as the meeting of the Parties to this Protocol, decisions under this Protocol shall be taken only by those that are Parties to it.

3. When the Conference of the Parties serves as the meeting of the Parties to this Protocol, any member of the Bureau of the Conference of the Parties representing a Party to the Convention but, at that time, not a Party to this Protocol, shall be substituted by an additional member to be elected by and from amongst the Parties to this Protocol.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall keep under regular review the implementation of this Protocol and shall make, within its mandate, the decisions necessary to promote its effective implementation. It shall perform the functions assigned to it by this Protocol and shall:

(a) Assess, on the basis of all information made available to it in accordance with the provisions of this Protocol, the implementation of this Protocol by the Parties, the overall effects of the measures taken pursuant to this Protocol, in particular environmental, economic and social effects as well as their cumulative impacts and the extent to which progress towards the objective of the Convention is being achieved;

(b) Periodically examine the obligations of the Parties under this Protocol, giving due consideration to any reviews required by Article 4, paragraph 2(d), and Article 7, paragraph 2, of the Convention, in the light of the objective of the Convention, the experience gained in its implementation and the evolution of scientific and technological knowledge, and in this respect consider and adopt regular reports on the implementation of this Protocol;

(c) Promote and facilitate the exchange of information on measures adopted by the Parties to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under this Protocol;

(d) Facilitate, at the request of two or more Parties, the coordination of measures adopted by them to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under this Protocol;

(e) Promote and guide, in accordance with the objective of the Convention and the provisions of this Protocol, and taking fully into account the relevant decisions by the Conference of the Parties, the development and periodic refinement of comparable methodologies for the effective implementation of this Protocol, to be agreed on by the Conference of the Parties serving as the meeting of the Parties to this Protocol;

(f) Make recommendations on any matters necessary for the implementation of this Protocol;

(g) Seek to mobilize additional financial resources in accordance with Article 11, paragraph 2;

(h) Establish such subsidiary bodies as are deemed necessary for the implementation of this Protocol;

(i) Seek and utilize, where appropriate, the services and cooperation of, and information provided by, competent international organizations and intergovernmental and non-governmental bodies; and

(j) Exercise such other functions as may be required for the implementation of this Protocol, and consider any assignment resulting from a decision by the Conference of the Parties.

5. The rules of procedure of the Conference of the Parties and financial procedures of the Convention shall be applied *mutatis mutandis* under this Protocol, except as may be otherwise decided by consensus by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

6. The first session of the Conference of the Parties serving as the meeting of the Parties to this Protocol shall be convened by the secretariat in conjunction with the first session of the Conference of the Parties that is scheduled after the date of the entry into force of this Protocol. Subsequent ordinary sessions of the Conference of the Parties serving as the meeting of the Parties to this Protocol shall be held every year and in conjunction with ordinary sessions of the Conference of the Parties unless otherwise decided by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

7. Extraordinary sessions of the Conference of the Parties serving as the meeting of the Parties to this Protocol shall be held at such other times as may be deemed necessary by the Conference of the Parties serving as the meeting of the Parties to this Protocol, or at the written request of any Party, provided that, within six months of the request being communicated to the Parties by the secretariat, it is supported by at least one third of the Parties.

8. The United Nations, its specialized agencies and the International Atomic Energy Agency, as well as any State member thereof or observers thereto not party to the Convention, may be represented at sessions of the Conference of the Parties serving as the meeting of the Parties to this Protocol as observers. Any body or agency, whether national or international, governmental or non-governmental, which is qualified in matters covered by this Protocol and which has informed the secretariat of its wish to be represented at a session of the Conference of the Parties serving as the meeting of the Parties to this Protocol as an observer, may be so admitted unless at least one third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure, as referred to in paragraph 5 above.

Article 14

1. The secretariat established by Article 8 of the Convention shall serve as the secretariat of this Protocol.

2. Article 8, paragraph 2, of the Convention on the functions of the secretariat, and

Article 8, paragraph 3, of the Convention on arrangements made for the functioning of the secretariat, shall apply *mutatis mutandis* to this Protocol. The secretariat shall, in addition, exercise the functions assigned to it under this Protocol.

Article 15

1. The Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation established by Articles 9 and 10 of the Convention shall serve as, respectively, the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of this Protocol. The provisions relating to the functioning of these two bodies under the Convention shall apply *mutatis mutandis* to this Protocol. Sessions of the meetings of the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of this Protocol shall be held in conjunction with the meetings of, respectively, the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of the Convention.
2. Parties to the Convention that are not Parties to this Protocol may participate as observers in the proceedings of any session of the subsidiary bodies. When the subsidiary bodies serve as the subsidiary bodies of this Protocol, decisions under this Protocol shall be taken only by the Parties to this Protocol.
3. When the subsidiary bodies established by Articles 9 and 10 of the Convention exercise their functions with regard to matters concerning this Protocol, any member of the Bureaux of those subsidiary bodies representing a Party to the Convention but, at that time, not a party to this Protocol, shall be substituted by an additional member to be elected by and from amongst the Parties to this Protocol.

Article 16

The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, as soon as practicable, consider the application to this Protocol of, and modify as appropriate, the multilateral consultative process referred to in Article 13 of the Convention, in the light of any relevant decisions that may be taken by the Conference of the Parties. Any multilateral consultative process that may be applied to this Protocol shall operate without prejudice to the procedures and mechanisms established in accordance with Article 17.

Article 16 bis

The Conference of the Parties shall define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading. The Parties included in Annex B may participate in emissions trading for the purposes of fulfilling their commitments under Article 3 of this Protocol. Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article.

Article 17

The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, approve appropriate and effective procedures and mechanisms to determine and to address cases of non-compliance with the provisions of this Protocol, including through the development of an indicative list of consequences, taking into account the cause, type, degree and frequency of non-compliance. Any procedures and mechanisms under this Article entailing binding consequences shall be adopted by means of an amendment to this Protocol.

Article 18

The provisions of Article 14 of the Convention on settlement of disputes shall apply *mutatis mutandis* to this Protocol.

Article 19

1. Any Party may propose amendments to this Protocol.
2. Amendments to this Protocol shall be adopted at an ordinary session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. The text of any proposed amendment to this Protocol shall be communicated to the Parties by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate the text of any proposed amendments to the Parties and signatories to the Convention and, for information, to the Depositary.
3. The Parties shall make every effort to reach agreement on any proposed amendment to this Protocol by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting. The adopted amendment shall be communicated by the secretariat to the Depositary, who shall circulate it to all Parties for their acceptance.
4. Instruments of acceptance in respect of an amendment shall be deposited with the Depositary. An amendment adopted in accordance with paragraph 3 above shall enter into force for those Parties having accepted it on the ninetieth day after the date of receipt by the Depositary of an instrument of acceptance by at least three fourths of the Parties to this Protocol.
5. The amendment shall enter into force for any other Party on the ninetieth day after the date on which that Party deposits with the Depositary its instrument of acceptance of the said amendment.

Article 20

1. Annexes to this Protocol shall form an integral part thereof and, unless otherwise expressly provided, a reference to this Protocol constitutes at the same time a reference to any annexes thereto. Any annexes adopted after the entry into force of this Protocol shall be restricted to lists, forms and any other material of a descriptive nature that is of a scientific, technical, procedural or administrative character.
2. Any Party may make proposals for an annex to this Protocol and may propose amendments to annexes to this Protocol.
3. Annexes to this Protocol and amendments to annexes to this Protocol shall be adopted at an ordinary session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. The text of any proposed annex or amendment to an annex shall be communicated to the Parties by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate the text of any proposed annex or amendment to an annex to the Parties and signatories to the Convention and, for information, to the Depositary.
4. The Parties shall make every effort to reach agreement on any proposed annex or amendment to an annex by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the annex or amendment to an annex shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting. The adopted annex or amendment to an annex shall be communicated by the secretariat to the Depositary, who shall circulate it to all Parties for their acceptance.
5. An annex, other than Annex A or B, that has been adopted or amended in accordance with paragraphs 3 and 4 above shall enter into force for all Parties to this Protocol six months after the date of the communication by the Depositary to such Parties of the adoption or amendment of the annex, except for those Parties that have notified the Depositary in writing within that period of their non-acceptance of the annex or amendment to the annex. The annex or amendment to an annex shall enter into force for Parties which withdraw their notification of non-acceptance on the ninetieth day after the date on which withdrawal of such notification has been received by the Depositary.
6. If the adoption of an annex or an amendment to an annex involves an amendment to this Protocol, that annex or amendment to an annex shall not enter into force until such time as the amendment to this Protocol enters into force.
7. Amendments to Annexes A and B to this Protocol shall be adopted and enter into force in accordance with the procedure set out in Article 19, provided that any amendments to Annex B shall be adopted only with the written consent of the Party concerned.

Article 21

1. Each Party shall have one vote, except as provided for in paragraph 2 below.
2. Regional economic integration organizations, in matters within their competence, shall exercise their right to vote with a number of votes equal to the number of their member States which are Parties to this Protocol. Such an organization shall not exercise its right to vote if any of its member States exercises its right, and vice versa.

Article 22

The Secretary-General of the United Nations shall be the Depositary of this Protocol.

Article 23

1. This Protocol shall be open for signature and subject to ratification, acceptance or approval by States and regional economic integration organizations which are Parties to the Convention. It shall be open for signature at United Nations Headquarters in New York from 16 March 1998 to 15 March 1999. This Protocol shall be open for accession from the day after the date on which it is closed for signature. Instruments of ratification, acceptance, approval or accession shall be deposited with the Depositary.
2. Any regional economic integration organization which becomes a Party to this Protocol without any of its member States being a Party shall be bound by all the obligations under this Protocol. In the case of such organizations, one or more of whose member States is a Party to this Protocol, the organization and its member States shall decide on their respective responsibilities for the performance of their obligations under this Protocol. In such cases, the organization and the member States shall not be entitled to exercise rights under this Protocol concurrently.
3. In their instruments of ratification, acceptance, approval or accession, regional economic integration organizations shall declare the extent of their competence with respect to the matters governed by this Protocol. These organizations shall also inform the Depositary, who shall in turn inform the Parties, of any substantial modification in the extent of their competence.

Article 24

1. This Protocol shall enter into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55 per cent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession.

2. For the purposes of this Article, “the total carbon dioxide emissions for 1990 of the Parties included in Annex I” means the amount communicated on or before the date of adoption of this Protocol by the Parties included in Annex I in their first national communications submitted in accordance with Article 12 of the Convention.

3. For each State or regional economic integration organization that ratifies, accepts or approves this Protocol or accedes thereto after the conditions set out in paragraph 1 above for the entry into force have been fulfilled, this Protocol shall enter into force on the ninetieth day following the date of deposit of its instrument of ratification, acceptance, approval or accession.

4. For the purposes of this Article, any instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by States members of the organization.

Article 25

No reservations may be made to this Protocol.

Article 26

1. At any time after three years from the date on which this Protocol has entered into force for a Party, that Party may withdraw from this Protocol by giving written notification to the Depository.

2. Any such withdrawal shall take effect upon expiry of one year from the date of receipt by the Depository of the notification of withdrawal, or on such later date as may be specified in the notification of withdrawal.

3. Any Party that withdraws from the Convention shall be considered as also having withdrawn from this Protocol.

Article 27

The original of this Protocol, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

Done at Kyoto this tenth day of December one thousand nine hundred and ninety-seven.

Annex A

Greenhouse gases

Carbon dioxide (CO₂)

Methane (CH₄)

Nitrous oxide (N₂O)

Hydrofluorocarbons (HFCs)

Perfluorocarbons (PFCs)

Sulphur hexafluoride (SF₆)

Sectors/source categories

Energy

Fuel combustion

Energy industries

Manufacturing industries and construction

Transport

Other sectors

Other

Fugitive emissions from fuels

Solid fuels

Oil and natural gas

Other

Industrial processes

Mineral products

Chemical industry

Metal production

Other production

Production of halocarbons and sulphur hexafluoride

Consumption of halocarbons and sulphur hexafluoride

Other

Solvent and other product use

Agriculture

Enteric fermentation

Manure management

Rice cultivation

Agricultural soils

Prescribed burning of savannas

Field burning of agricultural residues

Other

Waste

Solid waste disposal on land

Wastewater handling

Waste incineration

Other

Annex B

<u>Party</u>	<u>Quantified emission limitation or reduction commitment</u> (percentage of base year or period)
Australia	108
Austria	92
Belgium	92
Bulgaria*	92
Canada	94
Croatia*	95
Czech Republic*	92
Denmark	92
Estonia*	92
European Community	92
Finland	92
France	92
Germany	92
Greece	92
Hungary*	94
Iceland	110
Ireland	92
Italy	92
Japan	94
Latvia*	92
Liechtenstein	92
Lithuania*	92
Luxembourg	92
Monaco	92
Netherlands	92
New Zealand	100
Norway	101
Poland*	94
Portugal	92
Romania*	92
Russian Federation*	100
Slovakia*	92
Slovenia*	92
Spain	92
Sweden	92
Switzerland	92
Ukraine*	100
United Kingdom of Great Britain and Northern Ireland	92
United States of America	93

* Countries that are undergoing the process of transition to a market economy.

Kyoto Protocol + the President's Policies to
?'s on Address Climate Change

1. Does the notion of carbon equivalency take into account Ozone depletion by PFC's?

2. Carbon sinks not included in proposal?
(p22 full)

3. What is the difference between a 2012 deadline w/ 5 year averaging + 2008-2012 deadline + averaging? (p23)

4. Banking provisions? (p24)

✓ 5. CDM credits? Certified Development Mech (i.e. ↓ in 3rd world)

5.5 What other TF's were offered? (p23)

Where → 6. Joint implementation (p26 IP3)? Does this mean that if a US based MNC ↓ CO₂ then US gets credit? Yes, ~~initially if they help~~ but does country of location also get credit?

Trade

7. How are cost of Aug factories estimated?

Bovrett (1992) European Economy 1 (sp ed): 3-24

Burniaux (1992) OECD Econ Studies #19

Weyant (1997) "Economic impact of Annex I actions on all countries" Pres @ IPCC/EMF Workshop
Oslo Aug 18-20, 1997

8. Niagara Mohawk / Suncor trade how are they selling rights that don't exist?

9. Under JI, what prevents the LDC from absorbing foreign assistance as a subsidy & building yet another emission source? (i.e. ~~not~~^{total} pollution actually ↑'s) (p35-36)
10. AIJ program? 1992 accords
US IJI?
11. How are voluntary targets set? A country could set a very high target just to claim a large share of the initial property allocation.
"dividing the Carbon Pie".
12. What generates autonomous ↑s in efficiency?
(p47 P1)
13. How is carbon sequestering factored into the sale of Carbon Rights? (p63 P2)

Goals :

EU 1990 - 8%

US 1990 - 7%

Japan 1990 - 6%

Canada 1990 - 6%

Russia 1990

Annex ^I Avg - 1990 - 5.2%

Flexibility :

A. When

1. Realistic T/F
2. Avg over 5 years.
3. banking
4. CDM from 2000-2007 can be used in any future commitment year

B. What

1. Carbon Equivalents
2. Sinks

C. Where

1. Trading
2. JI
3. CDM

V

Technical challenges in designing CDM projects

Jane Ellis, OECD¹

Prepared for presentation at the 9th Asia-Pacific Seminar on Climate Change
Hikone, Japan, July 12-15 1999

Introduction

The Clean Development Mechanism (CDM) was first outlined in the Kyoto Protocol in 1997. The CDM is a project-based mechanism. Certified emission reductions may be generated through the investment in actual projects and are based on measurable and certifiable emission reductions. The Protocol stipulates that "certified emission reductions" (CERs) from CDM projects or activities could be obtained from the year 2000.

The CDM is unique in that:

- it gives Annex I Parties and their private sector entities a strong incentive to finance projects in developing countries that further their sustainable development and the overall objective of the Climate Convention. The CDM also aims to assist Annex I Parties in achieving their emission reduction obligations through facilitating increased deployment of environmentally-friendly technology and know-how.
- the provisions governing the operation of the CDM are relatively complex. The CDM is to be supervised by an executive board, which is likely to be a sub-group of Parties to the Protocol. This board will serve as a means to provide centralised oversight and guidance for implementation of the CDM. Also, credits resulting from CDM projects or activities are to be certified. The Protocol also calls for independent auditing and verification of project activities. These provisions reveal an effort to ensure transparency and credibility in the final results and will require agreement on standardised procedures of performance on which to base certification. Overall these governance provisions imply a rather centralised control over the environmental performance of CDM projects.

Issues that need resolving

There are many technical and political aspects of the CDM that will need to be resolved before any certified emission reductions (CERs) can accrue to investors.

Developers of CDM projects will need answers to practical questions such as:

- Who do I contact to find out about potential CDM projects?
- What are the host country criteria (e.g. for eligibility)? Is the proposed project in accordance with these criteria?
- Which approach should I use to establish a baseline?

¹ 2 rue André Pascal, 75775 Paris Cedex 16, France. Email: jane.ellis@oecd.org. The opinions expressed in this article are those of the author and do not necessarily reflect those of the OECD or of its member countries. The author is grateful to Joke Waller Hunter, Jan Corfee Morlot and Stéphane Willems (OECD), and Martina Bosi (IEA) for their input and advice.

- What data do I need to gather and/or monitor in order to do this?
- How do I report the results?
- For how long should activities be monitored/reported prior to setting up the baseline?
- If the relevant data is not available, how could I obtain a reasonable estimate?
- What other information is needed, and where can I obtain this information?
- How long will this process take me?
- How many CERs am I likely to obtain as a result?
- Are the CERs worth the time, effort and money invested in the project?

This paper highlights issues that need to be addressed for some of the questions above, and will focus on the main technical challenges involved in *setting up* a CDM project. These are: project eligibility; emission baselines; monitoring, reporting and verification; and issues surrounding the environmental effectiveness of a CDM project such as leakage, free riders and "gaming". These issues are all interlinked to a greater or lesser extent. For example, the way that emission baselines are defined will influence the monitoring and reporting activities needed before and during the CDM project; may determine or preclude the eligibility of some project types; and may increase or decrease the importance of leakage, free riders and gaming. (Other technical issues, including monitoring and reporting requirements *during* the CDM project or activity, are important but are not considered further in this paper.) The paper draws on experience with setting up emission mitigation projects during the pilot phase of "activities implemented jointly" (AIJ).

Setting emission baselines for CDM projects

Emission baselines are needed for CDM projects in order to assess environmental additionality, i.e. in order to quantify the real and measurable emission reductions resulting from that project. However, setting emission baselines presents considerable difficulties and uncertainties from both a methodological and a monitoring and reporting standpoint.

Many different data points may be needed to set up one emissions baseline. Which data are needed vary depending on the project type. One of the most important parameters is the length of time over which a CDM project would generate emissions credits (the "emissions timeline"), and is a cross-cutting issue relevant to all baseline-setting methods. The importance of other parameters varies with each project type, but for energy sector projects could include e.g. the characteristics and quantity of fuel inputs and outputs; the performance of different technologies, and the trends in technology performance by sector.

Methods for establishing emission baselines

There are potentially many different ways by which emission baselines could be set up for CDM projects. Possible baseline approaches range from tailored project-specific baselines relying on project-specific data or expert judgement for all data used to establish the emissions baseline, to highly aggregated country top-down baselines where few (if any) data points used to establish the baseline are specific to one particular project. Many other baseline approaches are also possible on this continuum, and are outlined in table 1.

Table 1: Different approaches to setting emission baselines

Approach	Description	Comment
Project-specific: - tailored - comparison-based - simulation-based	Baseline determined on a case-by-case basis, with project-specific measurements or assumptions for all key parameters. Baseline is the measured performance of a control group/system. Baseline scenario is simulated for project, e.g. via models.	Most (AIJ) experience to date is with these baseline types, particularly the tailored approach, despite the lack of existing guidelines on how to set up baselines in this manner. The approach is frequently criticised for its cost and complexity.
Standardised project	Baseline determined in a hybrid fashion, with some key parameters project-specific, and others standardised (the number and level of the standardised parameters will vary for each different project category).	No experience with this baseline type under the AIJ pilot phase*, but of interest to some potential stakeholders because of its simplicity (and lower potential cost)
Activity standards**: - technology level - (sub-)sectoral level	Baseline is equivalent to a "performance standard" that is aggregated at a certain level (e.g. technology group X in country Y, or sector P in country Q)	An extremely broad category of baseline types: cost, complexity and environmental credibility dependent on the level of aggregation and the homogeneity of the sector. More disaggregated activity standards may overlap with the "standardised project" approach. Used for at least one AIJ project.
Top down	Baseline aggregated – possibly at a higher level than for activity standards (e.g. sector or country) – and with key assumptions for the future based on country targets/policies.	Little experience has been gained with this baseline type under the AIJ pilot phase. Given the differing emission trends in different sectors and gases, a high level of aggregation may lead to significant errors.

* However, the first reports of some Swedish AIJ projects did use one standard value for the emissions timeline (which was changed in some subsequent reports).

** This approach is also referred to as "benchmarking", "project category" or "intensity indicators".

These different approaches to baseline-setting have their relative advantages and disadvantages. Any hypothetical baseline is subject to a large degree of uncertainty. Project-specific methods may be more accurate, and therefore more environmentally effective, than some more aggregated baseline-setting types as project-specific baselines assess the environmental additionality of the individual project. However, the requirement for project-specific data increases the time and cost in setting up such baselines. Moreover, analysis of experience with emission baselines used in AIJ projects has shown that project-specific methods used to date are often neither comparable nor transparent (Ellis 1999), and therefore leave room for "gaming".

More aggregated methods may be cheaper to implement than less aggregated baseline methods (at least for the investor - although in some cases aggregated baseline methods may just result in shifting up-front costs from private to public funds). However, if more aggregated methods result in investors obtaining credits for projects that would have gone ahead in the absence of CDM, they will be less environmentally effective than more detailed approaches. This is not to say that aggregated approaches are necessarily less environmentally effective than disaggregated approaches: environmental effectiveness depends entirely on how any standards are set. A stringent approach to setting activity standards could lead to fewer CERs for a particular CDM project than a project-specific baseline, while a less stringent approach would lead to more.

Not all baseline approaches will be suitable for all project types. For example, activity standards are most applicable for (sub-)sectors with a homogeneous output (Friedman 1999). Comparison-based approaches will be limited to those projects or activities where a comparable control group or system can be found. Simulation-based approaches may not be possible in countries with limited data availability, as the model may require historical time series for some components. Tailored project-specific approaches may be more difficult to use for "greenfield" projects, where there is no obvious "what if" alternative to (and data for) the proposed project.

Some potential stakeholders in CDM projects have strong views about which baseline approach(es) should be used (see UNFCCC 1999). However, separating the different approaches is often difficult, as the distinction is often one of degree (see box).

Distinguishing different baseline approaches

One of the reasons behind the difficulty in drawing distinct boundaries around different emission baseline approaches is that one emissions baseline is often made up of many underlying data components. The classification of these individual components may vary. For example, some information might be project-specific (e.g. the projected output from the project), others might be technology-specific (such as the technical lifetime of that equipment), others could be country- or region-specific (such as emissions per kWh) and still others could be general defaults (such as fuel emission factors). How should a baseline made up of these different types of data be labelled?

Moreover, these underlying data of varying status can be used in different ways to establish an emissions baseline. For example, a baseline could be tailored specifically to a project, except in the case of one parameter where a standardised methodology was used, such as the emissions timeline. If this was to occur, should the baseline be labelled as project-specific or standardised? If a project-specific baseline for one project is then extended to another similar project does the second project have a project-specific baseline, a standardised baseline, a technology-specific baseline, or a baseline founded in activity standards? Although this may seem to be purely semantics, the labels attached to project baselines are important since many countries' negotiating positions explicitly favour one approach over another.

Determining project eligibility

There are both political and technical aspects of project eligibility. The political aspects have generated most attention to date. Article 12 of the Kyoto Protocol states that CDM projects should assist developing countries to achieve sustainable development in non-Annex I countries, and should also assist Annex I countries to achieve compliance with their emission commitments under Article 3. The Protocol also requires that *reductions in emissions are additional to any that would occur in the absence of the certified project activity*. Beyond this, Article 12 does not explicitly state other eligibility criteria for CDM projects.

The open language has led different stakeholders to a number of interpretations on project or activity eligibility, such as whether or not sink projects are eligible as CDM projects and who decides whether or not a project assists in sustainable development. Article 12.5b of the Kyoto Protocol does, however, imply some technical project eligibility criteria. If emission reductions from each project activity need to be *measurable*, this may preclude some activities with non-

measurable results from the CDM². It might be argued that the CDM may be more applicable for projects involving the installation of less-polluting "hardware" than for "soft" projects (such as those focusing on capacity building)³.

In addition, the manner in which emission baselines are drawn up could also influence the eligibility of some projects or project types. For example, setting an emissions baseline based on a subset of low-emitting technologies would automatically disqualify more emitting technologies from participating in the CDM⁴. A hierarchy of eligibility (or non-eligibility) criteria may need to be defined to resolve possible conflicts. This could happen if a technology is judged ineligible for CDM credits from an agreed baseline-setting procedure, yet a potential host country judges that the same project meets its sustainable development criteria.

Monitoring, reporting and verification issues

There are a number of monitoring and reporting issues that are relevant to different stages of a CDM project. Once a project has been validated as a CDM project, monitoring may be needed for a certain period prior to the project implementation to determine the emissions baseline. Further monitoring and reporting will also be needed at regular intervals during the project's life in order to assess the project's performance. The emission reductions resulting from CDM projects will then need to be certified (perhaps from accredited certifiers). Finally, the CERs will need to be allocated to the developed and developing country parties involved in the project according to their credit sharing agreement (if any).

Baseline monitoring and reporting requirements

CDM projects can be in different sectors and aim to reduce (or possibly sequester) different gases. The type and amount of data that will need to be monitored and reported varies significantly between different project categories. Moreover, the monitoring and reporting requirements of one project category will vary substantially with different baseline approaches.

Once we have established project performance criteria, internationally-agreed guidance on *what* information needs to be monitored and reported would help project developers focus their resources most efficiently. This could help reduce costs of establishing emission baselines, even those at the project-specific level. Some analysis includes an initial assessment of monitoring and reporting needs for certain project types (e.g. Vine and Sathaye 1999; Ellis 1999). Some analysts have gone further and suggested that guidelines are also needed to lay out *how* such monitoring, reporting (and verification) procedures should be carried out (Tellnes et al. 1999).

Emission baselines with a large project-specific component have been criticised for needing much data, and hence sometimes elaborate monitoring requirements. However, some of these data may be readily available, particularly for energy supply projects where both inputs and outputs are

² An example of this would be information and education programmes: some Parties have argued (in the context of reporting the effects of domestic policies and measures) that the effect of these policies cannot be estimated accurately. However, the environmental benefits of at least one AIJ project is based on the increased deployment of renewable energy technologies brought about by increased public awareness of these technologies.

³ This has a precedent in the AIJ pilot phase as at least one host country for AIJ projects (Poland) stipulates that it will only accept as AIJ projects those that result in the installation of cleaner technologies (rather than e.g. educational programmes).

⁴ For example, if a baseline is based on the least-emitting quartile of a technology group, the more-emitting 75% of that group would automatically be disqualified.

routinely tracked, and data that is needed but not readily available for the first project is likely to be easier to collect for subsequent projects. There is only extremely limited experience with monitoring, reporting and verification procedures for greenhouse gas reduction projects, but some of this experience (e.g. Tellnes et. al.) comes out strongly in favour of project-specific monitoring and verification procedures for estimating a project's baseline and project emissions.

Perhaps the biggest disadvantage of project-specific baselines is their cost, estimated for some small to medium-sized AIJ projects in central and eastern Europe were estimated at 1-8% of total project costs (Puhl 1998)⁵. Using emission baselines based on activity standards is likely to be much cheaper. However, *setting up* these activity standards would be a costly procedure, although the cost might be borne by the public, rather than private, purse. But if this were to be done, which activity standards should be set up - should all sub-sectors in all countries have them, in case an investor is interested in setting up a CDM project in that area? Or should the first developer of a CDM project establish a baseline and then be reimbursed by future developers of similar projects? (If so, how would this work?).

Other issues

Other technical issues also need to be considered when setting up a CDM project. These include leakage and system boundary aspects, "free riders", and "gaming".

For AIJ projects, most boundaries were drawn at the project edges, even though the project would have greater or lesser effects on greenhouse gas emissions at a wider level. For example, fuel-switch AIJ projects did not quantify changes in emissions that would result from different fuel production and/or transportation patterns. (However, some AIJ projects gave a qualitative description of wider impacts on e.g. fuel use or prices that might arise due to the project).

The environmental credibility of drawing the project boundary at the project edges varies depending on the project type, and even with the project location. If the total mitigation effects of a project are lower than those at the project boundary there has been some "leakage", i.e. emission reductions (or removals) from the CDM project have been offset by emission increases (or reduced sequestration) elsewhere. For example, the environmental effect of switching from indigenous coal to indigenous gas is likely to be different than switching from indigenous coal to imported gas (because of fuel transportation issues). Whether or not the gas-producing country is subject to emission commitments could also change the global effects of a project. However, emissions from activities related to the project but outside its boundaries are likely to be relatively small compared to total project emissions, which may be one reason that differences were rarely highlighted or quantified in AIJ projects to date. The importance of indirect leakage effects may increase with the number of CDM projects if e.g. the CDM projects in one sector lead to reduced coal use and prices which then leads to increased coal consumption in other sectors.

Biotic projects may also lead to leakage. This can be illustrated by examples from the AIJ pilot phase. For example, some AIJ projects involve "forest preservation", i.e. protecting a certain area of forest from deforestation. In some of these projects, it was assumed that the project area was protected, and that the reduction in deforestation brought about by protecting these areas was not offset by displacing deforestation to neighbouring lands. This assumption may be more or less valid depending on the relative layout of the protected and other forested areas.

⁵ Further costs totalling 11% of the total project costs for successful projects were project preparation and feasibility study (3% of total costs) and administration costs (8% of total costs).

“Free rider” effects could also be important. A “free rider” would mean that CERs would be obtained for an emissions reduction that would have occurred even in the absence of the CDM project. Free rider effects can occur within projects, e.g. for projects aiming to increase the deployment of energy efficient technologies, (as some technology uptake may have happened in the absence of the CDM project). Entire projects could also be “free riders” if they result in CERs but would have gone ahead even in the absence of the CDM. Ensuring that these sort of projects do not occur would be difficult, particularly if certain projects automatically qualify for CERs. This danger is therefore more marked with projects if they are automatically considered eligible for the CDM, or that have a degree of automation or standardisation in allocating CERs (such as with activity standards).

“Gaming” could occur in CDM projects because both the developed and developing country parties involved in the project have an interest in inflating the credits that could be obtained from that project. Gaming is likely to be more prevalent in baseline-setting approaches that are not transparent or comparable (i.e. project-specific approaches): activity standards, especially those at the technology level, are less likely to suffer from this.

Conclusions

The CDM aims to promote sustainable development in developing countries and to assist Annex I countries to meet their greenhouse gas emissions targets. There are many technical aspects of CDM projects that need to be resolved to ensure that both of these objectives are satisfied. The aspects discussed in this paper, such as baselines, monitoring and reporting, eligibility, leakage, gaming and free riders have a significant impact on the environmental credibility of CDM projects. Some of these aspects also have significant cost implications. To a greater or lesser extent, all these issues are interlinked.

This paper raises many questions, and offers few answers. Nevertheless, raising these technical questions, and outlining the pros and cons of different options may facilitate a move to overcoming some of the challenges that currently hinder successful implementation of the CDM. However, it is becoming increasingly difficult to draw the line between technical issues and political issues as more countries issue detailed position papers on the CDM.

The centralised oversight and governance provisions of the CDM, and the project basis of transactions, will mean that investment in CDM projects may have higher transaction costs than mitigation reduction through other more conventional means (e.g. local options or even within other Annex I countries). This increases the complexity of the transaction and reduces the economic benefit that might otherwise be attained by participants. Great care is therefore needed in designing the rules governing the CDM to make sure that they ensure environmental performance while also favouring investment.

References

Ellis, Jane, 1999, *Experience with emission baselines under the AIJ pilot phase*, OECD Information Paper, <http://www.oecd.org/env/cc/freedocs.htm>

Friedman, Shari, 1999, *Benchmarking for Project-Level GHG Emission Reductions*, presentation at UNFCCC Technical workshop on Mechanisms, April 9-15 1999

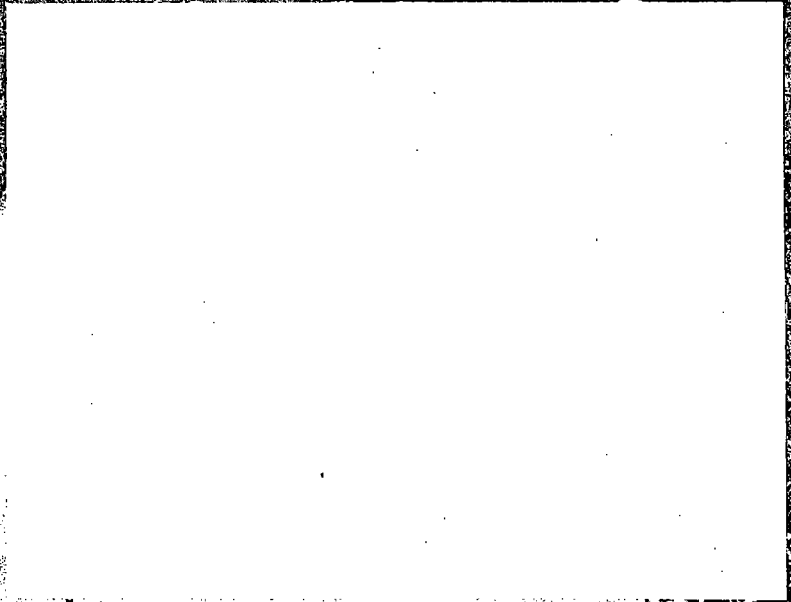
Puhl, Ingo, 1998, *Status of Research on Project Baselines Under the UNFCCC and the Kyoto Protocol*, OECD/IEA Information Paper, OECD, <http://www.oecd.org/env/cc/freedocs.htm>

Tellnes et. al., 1999, *Illumex: Lessons learned*, Technical report number 99-3287, Det Norske Veritas

UNFCCC, 1999, *Principles, Modalities, Rules and Guidelines for the Mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol: Submissions from Parties*, FCCC/SB/1999/MISC.3/Add.5

Vine, Edward and Jayant Sathaye, March 1999, *Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Energy-Efficiency Projects for Climate Change Mitigation*, Report number LBNL-41543, Lawrence Berkeley Laboratory, USA, <http://eetd.lbl.gov/ea/ccm/ccPubs.htm>

THE
AIRLIE CARBON TRADING PAPERS



**US CARBON EMISSIONS TRADING:
SOME OPTIONS THAT INCLUDE
DOWNSTREAM SOURCES**

Center For Clean Air Policy

April 1998

Acknowledgments

The primary author of this paper was David H. Festa, the Center's Deputy Director. However, this paper would not have been possible without the input of a number of people. In particular the Center would like to thank the members of the Greenhouse Gas Emissions Trading Braintrust; Ned Helme and Tim Hargrave of the Center for Clean Air Policy; and Jay Hakes and staff of the US Department of Energy's Energy Information Administration, who provided their ideas and made themselves available for consultation. Alice LeBlanc was a driving force behind the transportation chapter. She contributed significantly to the formulation of the trading approach and the drafting of the transportation chapter. In addition, she improved the overall paper with her thoughtful commentary. Finally, the Center wishes to acknowledge the research and editing support provided by Jeff Fiedler.

The Center for Clean Air Policy thanks the US Environmental Protection Agency's Office of Policy, Planning and Evaluation, and the "Friends of the Center" for their support of the Greenhouse Gas Emissions Trading Braintrust project.

Table of Contents

Executive Summary	1
1. Introduction.....	5
1.1 Advantages of a Downstream Approach	6
1.1.1 Familiar System	6
1.1.2 Stimulus for Innovation	6
1.1.3 Non-Fossil Fuel Options.....	7
1.2 Challenges of a Downstream Approach.....	8
1.3 Basic Elements of a Downstream System	9
2. Electricity Generators	12
2.1 Point of Regulation	13
2.2 Administrative Feasibility and Measurement Accuracy	13
2.3 Leakage	14
3. Industrial Sources.....	16
3.1 Point of Regulation	18
3.2 Measurement.....	21
3.3 Administrative Feasibility.....	23
3.3.1 Presence of Small Establishments	23
3.3.2 Using the MECS for Regulatory and Enforcement Purposes	24
3.3.3 Managing Changes Over Time	25
3.3.4 Coverage for the Non-Trading Establishments.....	25
3.3.5 Mechanism for Feedstocks and Offsets	27
3.4 Leakage	28
4. Commercial and Residential Sources	29
5. The Transportation Sector.....	30
5.1 Transportation Approaches.....	32
5.1.1 Market Mechanisms in the Transportation Sector	32
5.1.2 Fuel Prices.....	33
5.1.3 Vehicle Efficiency.....	34
5.2 Summary	35
6. Building a Downstream Program.....	36
Appendix 1	39
Appendix 2.....	42

Executive Summary

A US greenhouse gas (GHG) emissions cap-and-trade system could be implemented either “upstream,” at the level of primary fuel producers, or “downstream,” at or near the point of emissions. While experiences with cap-and-trade programs have been good, a GHG program would be larger than existing programs. For that reason, design questions need careful evaluation. This paper accomplishes this for a downstream trading program that covers US carbon dioxide emissions.

There are several reasons why a downstream system may be preferred over an upstream approach. Most trading programs (most notably SO₂ trading) are downstream. They directly target the emitters and are consistent with a “polluter pays” regulatory logic. Downstream carbon trading builds on existing programs and has strong precedence in environmental policy. Second, because a downstream program would have many stakeholders, there is the potential for greater participation in the allowance market. Assuming that sources receive allowances via an allocation mechanism (as in the SO₂ program)¹ some portion of the value of the allowances (or “rents”) would accrue to those sources. Because a greater number of sources would benefit from these rents, investing for example in clean technologies, a downstream program may engender more political support and stimulate more innovation than an upstream system or non-trading approaches.

The chief drawback of a downstream program is that it will be more complicated than an upstream system and will not be able to match its almost complete coverage of carbon emissions unless some fuels are treated in an upstream program.

This paper outlines a **“core” program** (Table ES-1) which would achieve adequate coverage with minimal administrative burdens. This option would require participation of only the electric utilities and large industrial companies yet would cover half of all emissions. The same exact program design can not be used in each sector. In particular, the optimal point of monitoring emissions differs across sectors and even subsectors, as does the monitoring approach. Despite the differences in the details of program design, however, the emissions measurement uncertainties are similar enough in each sector to allow for inter-sector trading.

¹ The alternative is to auction the allowances. The benefits of an auction approach are detailed in *Tradable Carbon Allowance Auctions: How and why to Auction* by Peter Crampton and Suzi Kerr, Center for Clean Air Policy, March 1998.

Table ES-1: Core Program

Source	Coverage		Total Sources	“Rents”
	Carbon (MMTC)	Share of US Total		
Electricity Generators	495	36%	2,200	large
Large Industry	161	12%	2,940	moderate
TOTAL	656	48%	5,140	

Electricity Generators

Electricity generation is the backbone of any downstream trading program. It is a large and concentrated source of carbon emissions and, by virtue of the SO₂ trading program, sets the standard for administrative feasibility and measurement. Covering electricity generators is important for a number of reasons. First, by including this sector the core program also covers the majority of emissions from the residential and commercial sectors without involving households and commercial establishments directly because electricity use is the primary source of energy in these two sectors. In addition, electricity generators have numerous opportunities to reduce CO₂ emissions, often while increasing output. Finally, this sector’s participation in the SO₂ trading program and high participation rate in early action programs to reduce CO₂ indicate that it has the institutional capacity to take advantage of trading programs.

Because end users can switch between electricity and fossil fuels for many applications, fossil fuel prices must reflect carbon costs or they will appear artificially lower than electricity prices, which would include the value of carbon allowances. If this distortion occurred, it could drive energy use towards direct combustion of fossil fuels even in those cases where this choice increased total emissions. The choices are to: (a) include the other sectors in a downstream program, (b) devise a tax or trading program to cover the carbon in the fuels, or (c) implement non-market-based approaches.

The core program outlined in Table ES-1 assumes, for simplicity’s sake, that a carbon tax or other measures are put into place to prevent distortion in uncapped sectors.

Industrial Emissions

Conventional wisdom assumes that, based on the Acid Rain Program (ARP) experience, there are far too many sources to have a comprehensive trading program for industrial

emissions. However, the ARP collects as many as 4 billion data points measuring 200 parameters every hour throughout the year at 2,200 sources. If a carbon trading scheme collects fewer data points per source, then it may be administratively feasible to include more sources. We think it likely that data requirements can be streamlined and we are investigating how this might be done. Until this issue is resolved, however, we will adopt the view that only a subset of industrial establishments can be included.

Fortunately, 70 percent of the manufacturing sector's emissions (or roughly 55 percent of the entire industrial sector) are associated with just under 3,000 energy-intensive establishments. An advantage of dealing with these establishments is that they participate in the mandatory Manufacturing Energy Consumption Survey (MECS). This survey collects detailed data on energy use and could serve as a model the basis for the administrative and monitoring framework for this sector.

A disadvantage of this approach is the fact that a legislative change would be required to use the MECS in a regulatory program. There would also have to be more complex accounting systems put into place to track and verify the flows of fossil fuel through the subsectors. Finally, an enforcement element would need to be crafted.

A downstream system built on just the electricity and industry sectors would have a high probability of success in that it:

- would have a robust monitoring system;
- could be implemented relatively quickly and in advance of trading programs in the transportation sector;
- could incorporate non-fossil fuel emissions;
- would target sectors that have the most capacity to engage in trading;
- would build on the existing SO₂ program; and
- would make maximum use of infrastructure already in place.

The core program is not likely to entail many new administrative costs for electricity. Similarly, for industry the basic data collection is already being done as a part of the MECS. This effort costs between \$2 and \$3 million to produce once every four years. If we assume that (a) adding any new elements triples those costs for the industrial component, (b) that the incremental costs for electricity are equal to those of the SO₂ program which has an operating budget of around \$2 million, and (c) that there are no

economies of scale for dealing with the two sectors at the same time, then the total operating costs for the core program might be in the \$8 to \$11 million range. This compares to the total value of allowances that might be in the \$13 to \$30 billion range.²

With additional research, other sectors or subsectors could be phased-in to the downstream trading program. Where downstream options do not appear feasible, certain sectors could be included in the trading system by adding upstream elements to a “core” program, creating a hybrid system. Finally, remaining non-covered sectors would need to be addressed using non-trading regulatory approaches in order to achieve environmental goals and prevent price distortions between regulated and non-regulated sectors.

Transportation

This paper examines in some detail the possibility of downstream trading in the transportation sector, as well as an upstream approach. Although any trading approaches to the transportation will require considerable additional research before concrete policy proposals can be recommended, two approaches appear promising. First, the carbon content of fuels can be regulated by requiring refineries to hold allowances for transportation fuels. This will send an indirect price signal to vehicle users, which may not be sufficient to reduce emissions enough, but minimizes the number of regulated entities and does not raise complex monitoring issues. Second, vehicle manufacturers (cars, trucks, aircraft, etc.) could be held responsible for the estimated emissions of the cars they produce. Targeting manufacturers also minimizes the number of entities, but introduces significant unresolved measurement issues.

Overall, emissions from the transportation sector will be difficult to include because no one policy approach is sufficiently effective, and multiple actors and the large number of end users make it difficult to select an effective point of regulation. There does not appear to be a direct way to calculate emissions in a reliable way from the bottom up (that is, by aggregating the reported emissions at the point of regulation).

² Assuming total allowances in circulation are roughly 1,300 million and cost between \$14 and \$23 a ton. Dr. Janet Yellen, Chair of the Council of Economic Advisors, Testimony before the House Commerce Committee. March 4, 1998.

1. Introduction

Recent negotiations among the Parties to the United Nations Framework Convention on Climate Change have resulted in a protocol to reduce global greenhouse gas emissions. The protocol calls for binding emission reduction commitments from developed countries. Although the protocol has not been ratified by the US, if the US does commit to a binding emissions limit then domestic regulations will be required to insure the target is reached.

This regulation will almost certainly involve some form of domestic greenhouse gas (GHG) emissions trading—a cap-and-trade system. In any GHG trading system, the government would issue a fixed number of “allowances”³ representing emissions in a given year or budget period.⁴ Regulated entities would have to obtain and surrender allowances to cover their carbon emissions. An entity able to reduce emissions below the level of the allowances it holds could sell the excess. Similarly, a regulated entity unable to cover its emissions with its allowances could purchase additional allowances on an open market. Thus, the allowances would function as commodities with entities buying, selling, or banking them for future use.

The structure and dynamics of a US domestic GHG emissions trading system will be determined, in large part, by who is required to have allowances. There are two choices:

- “upstream,” at the level of primary fuel producers; and
- “downstream,” where emissions actually occur.

These two approaches are not mutually exclusive and can be combined in a hybrid system.

³ We have adopted the word “allowance” to denote the emission units that would be traded in a carbon trading system. Although other terms such as “credit” can have equivalent meaning, the SO₂ trading program has popularized the term “allowance.” In addition, we believe there is less potential for confusion with other terms of art.

⁴ How allowances should be issued is not addressed directly in this paper. Whether they are allocated at no cost to regulated entities, or auctioned, has very important distribution ramifications which are discussed in another paper in this series: *Tradable Carbon Allowance Auctions: How and why to Auction* by Peter Crampton and Suzi Kerr, Center for Clean Air Policy, February 1998.

1.1 Advantages of a Downstream Approach

This paper lays out key design elements of one type of downstream approach, which focuses on carbon dioxide (CO₂) emissions.⁵ This approach has several advantages. First, it is familiar and has a logic to it that is easy to grasp. Second, by selecting a point of regulation closer to the emissions-producing activities, it may stimulate innovation more effectively than an upstream system. Third, it may be better able to incorporate “off-system” options, such as future technical options to capture and store carbon from combustion and various non-CO₂ emission reduction options.

1.1.1 Familiar System

A carbon trading market will be orders of magnitude bigger than any emissions trading program to date. It will be a distinct advantage to start with building blocks that are familiar. Virtually all the trading programs established to date have been downstream.⁶ They directly target the emitters and are consistent with a “polluter pays” regulatory logic. As such, it has strong precedence in environmental policy. In particular, the SO₂ program provides a clear model. The success of that program will help build confidence that a workable carbon trading system can be devised. Finally, since some of the sources that would be regulated for carbon are already in the acid rain or ozone precursor trading programs, the carbon trading component would be incremental for them.

1.1.2 Stimulus for Innovation

A carbon reduction program—regardless of whether it is upstream or downstream—will raise the costs associated with carbon-intensive products and processes. This cost increase will encourage consumers to shift to lower-carbon goods and send a signal to companies to find innovative ways to reduce their carbon emissions. However, analysts disagree over how effectively price signals foster changes in energy (and, hence, carbon) use. There is evidence to show that price signals are not always sufficient for consumers to implement profitable energy savings.

⁵ This paper does not address the regulation of greenhouse gases other than CO₂ from fossil fuel emissions. Other sources of CO₂ and non-CO₂ GHGs will be addressed in subsequent papers.

⁶ An exception is the lead trading program, in which refineries were allowed to trade lead allocations in their fuels as they phased out lead altogether. This upstream approach worked well and may be instructive in dealing with carbon emissions from the transportation sector.

By requiring downstream entities to hold allowances to cover their emissions, a downstream system may create a more immediate, tangible incentive for entities to find ways to reduce their need for allowances and generate new revenue streams from their sale.⁷

The analysts' debate over the ability of price signals alone to produce a "least cost" response in the economy cannot be resolved in this paper. Suffice to say that for those who believe that direct incentives are a necessary adjunct to indirect price signals to stimulate innovation, a downstream approach would have appeal.

A consideration in analyzing the effectiveness and political feasibility of trading is whether entities initially receive allowances for free or are required to purchase them at the emergent market price. Restricting the "supply" of carbon allowances will turn them into a valuable commodity. Modeling by the US Government's Interagency Task Force puts the value of the allowance market as high as \$30 billion⁸ and other estimates have been as high as \$130 billion. Clearly, how allowances are allocated has important cost implications.

The economic efficiency, equity, and political feasibility of different allocation methods are discussed in other papers in this series.⁹ For the purposes of this paper, we simply observe that the cost (auction) or benefit (grandfathering) of being required to hold allowances is distributed more widely in a downstream system than in an upstream system. If allowances are grandfathered, the economic value of the allowances can help compensate downstream businesses for the cost of changing the way they operate, thereby blunting opposition to the introduction of carbon regulation.

1.1.3 Non-Fossil Fuel Options

A downstream system sets the point of regulation where emissions occur. As such, it may more easily facilitate reporting emission reduction options that do not achieve their impact by reducing the combustion of fossil fuels. For example, there are options to

⁷ Other policies that address barriers include: tax breaks, government-financed R&D, and information campaigns. US policy-makers will want to evaluate the effectiveness of a trading program vis-à-vis these other options. This paper assumes that trading could be used in combination with other policies.

⁸ Dr. Janet Yellen, Chair of the Council of Economic Advisors, Testimony before the House Commerce Committee. March 4, 1998.

⁹ Peter Crampton and Suzi Kerr, *Tradable Carbon Allowance Auctions: How and why to auction*, Center for Clean Air Policy, February 1998.

reduce the CO₂ emissions associated with certain chemical and industrial processes, such as lime production.

Although an upstream system could incorporate provisions for offsets, a downstream system would already be set up to process these claims because they would be submitted by entities already in the regulatory system.

It is likely that non-CO₂ GHG emissions sources will also be regulated in some manner. Non-CO₂ emissions from entities already included in the downstream carbon program would be relatively easy to address within the trading system. In some cases, however, relevant entities may not already be included (e.g., those causing fugitive emissions from gas pipelines, agricultural methane emissions, etc.) and other mechanisms would need to be developed to address emissions from these sources.

1.2 Challenges of a Downstream Approach

Along with these advantages come a number of challenges. The biggest of these is attaining sufficient coverage of emissions. Challenges also include containing emissions-shifting and keeping administrative costs manageable.

As the remainder of this paper explains, it does not seem possible to include all sectors and subsectors in a downstream system. This does not mean that downstream trading should be discarded outright as a policy approach because it may still be the most effective approach for certain sectors.¹⁰ At some point, though, limiting the coverage of the trading system reduces the size of the market and loses the benefit of inter-sector trading.

Partial implementation of downstream trading raises a significant challenge: how to address the other sectors? There are two critical concerns here. First, incomplete coverage can cause emissions-producing activities to be shifted to subsectors that are not covered by the system. This type of shifting of emissions, often referred to as “leakage,” is largely bounded within sectors, and as such is addressed in more detail in the sector discussions that follow. Where entire sectors or significant subsectors are not covered by the downstream system, we assume that other more suitable policy approaches will be implemented.

¹⁰ In fact, trading is unlikely to be the only policy tool used to control domestic GHG emissions. The approach laid out by President Clinton in October 1997, for example, outlines a package of trading and incentives.

Second, where emissions sources are not covered in the trading system, it is important that they be regulated with comparable stringency by other means. If different sectors are regulated with different stringency, the overall policy response could cause price distortions across sectors and may make it more difficult to achieve environmental goals.

In any system, it is important that the number of entities and associated amount of data be limited so that the administrative burden and the accounting system are manageable but plentiful enough so that there is meaningful trading. The downstream approach does have two to three times more entities than the upstream system. But is this difference significant? Clearly, some government administrative costs would be higher with more entities. But this disadvantage could be offset by potential advantages in how the market functions with more entities, particularly by making it more difficult to hoard allowances and otherwise concentrate market power.

In terms of the data management requirements, there is no compelling evidence that costs escalate beyond reasonable levels with the 5,000 to 6,000 entities proposed in this paper. The conventional wisdom concerning the maximum number of entities is based on the experience of the Acid Rain Program. This program collects hourly data—24 hours a day throughout the year—on roughly 200 parameters. Because carbon monitoring could use fuel use and carbon content data, this intensity of data collection may not be necessary. As a result, administrative costs could remain reasonable with more than 5,000 to 6,000 entities. Additional research is required to better understand the limits imposed on a carbon trading system by data management concerns.

Incomplete coverage in a downstream system will impose an additional cost: Setting up and administering other regulatory programs to reduce emissions in the non-covered sectors. This cost will not be incurred in a pure upstream system, and this difference should be taken into account when comparing the two systems. In reality, however, even an upstream system is unlikely to be the only approach because of certain political realities in developing domestic policy. Therefore, an upstream system is still likely to incur some additional costs to set up other programs, reducing the difference in total costs between upstream and downstream trading systems.

1.3 Basic Elements of a Downstream System

In a downstream system, each regulated entity would be required to meet an emissions cap. Allowances might be auctioned or allocated according to the cap, but each regulated entity would be required to surrender allowances to cover its emissions. Entities with

extra allowances could sell them to another regulated company whose emissions are greater than the allowances it holds or bank them for future use.

Entities would report their emissions to the government but there would be little oversight on compliance planning or individual carbon transactions. Entities would have a true-up period at the end of the budget period in order to make sure their carbon accounts balanced. At the end of the true up period, entities found to be in non-compliance would face steep fines (in the SO₂ program the fine is over 20 times the current trading price of allowances) as well as a requirement to purchase enough allowances or offsets to make up the deficit between their emissions and the number of allowances they held.

Beyond this basic structure, there are many distinct elements that will need to be defined in order to have a functioning trading system. A number of these elements are common to both downstream and upstream systems. These elements include matters such as how imports and exports are handled, the definition of the trading instrument and the treatment of offsets and “sinks.” Because they are common to both systems and because they can be quite complex matters in and of themselves, they will be covered in other papers in this series.

This paper focuses on several elements of a downstream trading program starting with the “point of regulation.” The “point of regulation” is the entity made responsible for holding allowances. There are three possible points of regulation: individual **sources or units** within a facility, **facilities or establishments** which may have a large number of individual sources operating under one roof, or **business entities** which own sources distributed over one or more facilities. Key criteria for selecting a point of regulation within a sector include the following:

- *Coverage of Total Emissions.* To ensure that it is cost-effective, equitable, and meets environmental goals, the system should cover as high a percentage of total emissions as possible.
- *Administrative Feasibility.* The total number of regulated sources must be kept to a manageable level.
- *Measurement Accuracy.* Methods for monitoring or estimating emissions at the point of regulation must be available, accurate, low cost, and verifiable.
- *Leakage.* The system must be able to account for the potential flows of carbon-containing products through the economy. For example, there must be only minimal

ability to move an activity from a “covered” sector of the economy to one in which there is no penalty for emitting CO₂.

- *Effectiveness of Incentives.* Fossil fuels flow through a complex web from production, refining, and distribution, to primary users and final consumers of energy services. Emission reductions may be achieved at any of these points. Bearing in mind the arguments in Section II, the point of regulation should be placed as near as possible to the entity best able to implement emission reductions.

Given these criteria, let us look at how a downstream system might be constructed.

Table 1 shows the contribution to total fossil fuel-related CO₂ emissions for the main end use sectors and points to two conclusions; (i) electricity generation is a logical backbone of a downstream trading system, and (ii) a carbon reduction program can not afford to leave any of the sectors unaddressed.

Table 1. US Fossil Fuel-Related CO₂ Emissions by Sector, 1994¹¹
(Million metric tons of carbon)

Sector	Emissions (including emissions associated with electricity)	Emissions Net of Electricity	Sector share of US Total	Electricity share of sector
Residential	272	101	7%	63%
Commercial	217	61	4%	72%
Industrial	462	293	21%	36%
Transportation	446	446	32%	>1%
Electricity	n/a	495	36%	n/a
TOTAL	1,396	1,396	100%	n/a

While the electricity sector can be thought of as a central component of the CO₂ trading program, the US program to meet the Kyoto Protocol commitment of a 7 percent reduction from 1990 levels will not be cost effective if only the emissions from electricity generation are regulated.

¹¹ *Emissions of Greenhouse Gases in the United States, 1987-1994*, EIA/DOE, October 1995. DOE/EIA-0573(87-94). The data in this table do not include industrial process emissions of approximately 1 percent of US total CO₂ emissions.

If all other sectors were to grow in a “business as usual” manner, 2010 emissions from electric generation would need to be limited to 210 million tons of carbon equivalent (MTCE)—roughly equivalent to a generating system relying totally on natural gas.¹²

Even just leaving out the residential sector will significantly increase the burden on the other sectors. The projected growth in fossil fuel-related emissions from this sector (about 20 MTCE) will need to be made up by equivalent reductions in the other sectors, increasing their aggregate reduction requirement by around 5 percent. Moreover, if any one sector is left unaddressed by some program (trading, incentives, standards or direct regulation) there could be problems with emissions leakage to that sector.

Given that all sectors of the economy need to be covered by some carbon control program and that we would like to be able to benefit from the economic advantages and environmental certainty offered by cap and trade regimes, the remainder of this paper will look at each of the five sectors to determine whether there is a point of regulation that meets the criteria spelled out above.

2. Electricity Generators

Requiring allowances for electricity generation has several advantages. First, it could be modeled on the successful Acid Rain Program’s SO₂ trading. The experience gained and administrative infrastructure developed would streamline implementation of CO₂ trading.

Second, many of the options for reducing CO₂ emissions—fuel switching, plant dispatching decisions, generation and transmission efficiency improvements—can only be undertaken by the generation owners. Also, generation owners have been among the most pro-active when it comes to developing emission offsets. Remembering the premise that, all other things being equal, requiring allowances of entities capable of making reductions best stimulates innovation, the generation entities are a logical choice.

Third, implementing a downstream system at the generator level also has the advantage of covering a significant portion of residential and commercial emissions —63 and 72

¹² *Scenarios of U.S. Carbon Reductions: Potential impacts of Energy Technology by 2010 and beyond*, 1997, Interlaboratory Working Group of Energy-Efficient and Low Carbon Technologies, Office of Energy Efficiency and Renewables. Page 1.5, Table 1.2.

percent respectively—without directly involving households and commercial entities in the system.¹³

2.1 Point of Regulation

Mirroring the approach taken by the SO₂ trading program, allowances would be required at the level of individual units. Business entities would be responsible for the compliance actions at the units they owned at the end of the budget period. The compliance implications of the sale of a given unit in the middle of a budget period would need to be worked out as a part of the transaction. Otherwise, the entity owning the unit at the end of the budget period would bear the full burden (or receives the benefit) of CO₂ emissions over the whole budget period.

Because the SO₂ trading program covers only units whose potential fuel consumption is over a certain threshold, a carbon trading system based on this threshold would exclude about 1 percent of total sector CO₂ emissions.¹⁴ This is likely to have little effect on the operation of the trading program. For one thing, the total electricity generating capacity from excluded units is small compared to that of their bigger brothers. Also, the small units are more costly to operate. Therefore, it is unlikely that generation owners would be able to economically shift output to these smaller units even in the face of carbon restrictions on the larger units.

If, over time, shifting to smaller generation units did become economical, it would be a relatively simple adjustment to expand the trading regime to include these units. Alternatively, it would be possible to set carbon emission standards for new, small units such that any shift in generation to these units would not be at the expense of meeting the sector's overall emission goals.

2.2 Administrative Feasibility and Measurement Accuracy

Since this program would piggyback on the existing and well-functioning SO₂ program, it is reasonable to assume that administrative feasibility is high. As in the SO₂ program, there would be little need for oversight on actual trades and compliance actions.

¹³ There are some highly effective demand side management (DSM) reduction options which require the involvement of end users. However, customers can still benefit from DSM cost savings regardless of where allowances are held. In addition, generators could fund DSM programs that may help to reduce their own compliance costs by reducing their need to acquire new allowances to meet load growth.

¹⁴ *Inventory of Power Plants in the US as of January 1, 1996*. EIA/DOE 0095 (96), 1996.

As a point of reference, EPA estimates that it has spent \$1.09 billion implementing the 1990 Clean Air Act Amendments.¹⁵ Of this, \$44 million has been spent on the SO₂ program. EPA also awarded almost \$19 million to states for acid rain program implementation.

Ongoing costs are expected to fall for a variety of reasons. Estimated annual operating costs are predicted to be in the \$2 to \$3 million range.¹⁶ These costs can be compared to savings attributable to the trading program that are between \$1 billion and \$1.5 billion.

Accurate CO₂ monitoring using continuous emissions monitoring systems (CEMS) is already performed at the roughly 2,200 generating units covered by Title IV of the Clean Air Act Amendments of 1990. The Acid Rain program allows companies not utilizing CEMS to report emissions by alternative methodologies. One alternative is to monitor emissions, but not on a continuous basis. If emissions are calculated periodically, then the unit must demonstrate that this method achieves the same accuracy as CEMS. The other alternative measurement method under the Acid Rain program is to calculate emissions using fuel sampling, fuel analysis, and fuel consumption data. The predictive emissions monitoring system (PEMS) relies on the accuracy of the fuel use data and the analysis of carbon content of fuel. PEMS requires certification of flow meters and other monitoring performed for each unit.

Compliance could be determined at the end of the budget period by comparing the CEMS or fuel use data to the total of allowances acquired for that unit either through the allocation mechanism or through trading.

2.3 Leakage

Leakage from the electricity sector to other sectors could be troublesome, but only if no other measures are introduced that target fuel use in the other sectors. Leakage will occur if it is less expensive for an entity to purchase fossil fuels, and generate electricity or substitute direct combustion of fuels for electricity, than to purchase electricity from a regulated electricity generator.

For example, a homeowner buying a new water heater might decide on a gas-fired heater rather than an electric one if residential gas is not covered in the trading system or

¹⁵ *The Sulfur Dioxide Allowance Trading Program: The first five years*, Acid Rain Division, US EPA, January 1996.

¹⁶ The total budget for the Acid Rain Program larger than this but it includes funding for research and development initiatives.

otherwise regulated. Similarly, facilities in the industrial sector might choose to generate electricity on-site.

Self-generation is already practiced in the industrial sector. Approximately 16 percent of its electricity is self-generated and the growth in self-generation has been strong (up 12 percent between 1991 to 1994).¹⁷

Leakage will occur only if a price difference sufficient to induce change exists as a result of the system. This is unlikely to occur in most cases within the electricity generation sector. Section 2.1 above discussed how any price difference between capped and non-capped utility generating units is unlikely to cause significant leakage because of the limited capacity of smaller units and the underlying economics.

Leakage to non-capped establishments could occur because their fossil fuel purchases would not be reported in the system or bear the cost of carbon allowances, whereas their electricity purchases would include this cost. This discrepancy would make self-generation or direct combustion more favorable, and possibly reduce the effectiveness of the trading system. But the majority of industrial sector emissions will be capped: Section 3 of this paper outlines a downstream system that could cover 55 percent of industrial fossil fuel-related emissions. A tax or upstream system would then be required to cover the remaining 45 percent.¹⁸ Tax or upstream provisions are also envisioned for non-covered subsectors of the residential, commercial, and transportation sectors. This would greatly reduce any incentive to switch from electricity or to self-generation motivated by the ability to avoid carbon regulation.

Although international leakage is not covered in detail in this paper, it is worth noting that international electricity trade can be expected to have minimal impact on leakage. Total net imports have been in the 1 percent range and are not expected to increase from that level.¹⁹

A limiting factor in how many transactions could increase is the nature of the power line connections between the US and its neighbors. There are very limited power line connections between Mexico and the US. To the extent that Mexico is able to build new

¹⁷ *Manufacturing Consumption of Energy, (MECS) 1994*, EIA/DOE, December 1997. DOE/EIA-0512(94), page xxii.

¹⁸ An important implementation issue is how to set a tax (or other regulatory standards) at a level to minimize unwanted shifting of emissions between different parts of the system and that is equitable across economic sectors.

¹⁹ *Annual Energy Outlook*, EIA/DOE, 1998. DOE/EIA-0383(98).

power plants and new transmission lines to export carbon-intensive generation to the US, leakage could be a problem. However, building new transmission is politically difficult and it is likely that mechanisms in the North American Free Trade Agreement could be used to address the carbon issue.

There are more extensive, but still limited, power line connections between the US and Canada. However, Canadian generation tends to use less carbon than the US—a factor especially important in the major exporting regions, British Columbia and Quebec. Both are dominated by hydroelectric generation and have emission rates that are less than those immediately across the border. It is also safe to assume that Canada, as an Annex 1 country, will have some carbon control program of its own, further reducing any distortion.

3. Industrial Sources

Industrial on-site CO₂ emissions represent approximately 21 percent of total US carbon dioxide emissions from fossil energy combustion. The industrial sector is comprised of manufacturing—the largest subsector—as well as mining, construction, agriculture, fisheries, and forestry. Numerous studies indicate that there is room for low-cost improvements in energy and CO₂ emissions from this sector. For example, a recent DOE study estimated that about 100 million tons could be reduced in a cost-effective manner.²⁰ There has also been some success in emission trading programs that include industrial facilities, most notably the RECLAIM program in California.

At the same time, other characteristics create challenges to emissions trading. Consider the following:

- **The sector is large.** Just within the manufacturing sector, which accounts for over two-thirds of industrial emissions, there are 380,000 establishments.²¹ There are even more individual emission sources. It would be without parallel to set up a trading system for such a large number of facilities.
- **The sector is diverse.** This sector is extraordinarily heterogeneous. The Standard Industrial Classification System (SIC) has 1004 industries, 459 of which are in the

²⁰ *Scenarios of U.S. Carbon Reductions: Potential impacts of Energy Technology by 2010 and beyond*, 1997, Interlaboratory Working Group of Energy-Efficient and Low Carbon Technologies, Office of Energy Efficiency and Renewables. Pages 3-14.

²¹ *Manufacturing Consumption of Energy, (MECS) 1994*, EIA/DOE, 12/97. DOE/EIA-0512(94). page xx.

manufacturing subsector. Just one industry category (chemicals) has over 12,000 plants producing 70,000 different products.

- **The sector has complex emission patterns.** In addition to CO₂ emissions from fossil fuel use, there are “process” emissions in which CO₂ is emitted from chemical and other reactions during manufacturing. Moreover, there are CO₂ “sinks” within this sector where carbon in fossil fuels may not be emitted but is sequestered products. The carbon that goes into steel, the tar that goes on the road and petrochemical feedstocks that go into durable goods are examples. Similarly, there are “shipments of energy sources” in which the original purchaser of the fossil fuel may process the fuel and then sell it further downstream to the ultimate end user. Finally, there is the issue of biomass as a fuel (see Box 1). None of these issues is insurmountable, but they suggest that a robust trading program in this sector will need a detailed accounting system.
- **Data on emission sources are inconsistent.** The population of boilers, furnaces, turbines and other combustion devices has not been as reliably catalogued as it has in the electricity sector. As an example, one recent survey of fossil-fired boilers estimated a total of roughly 33,000 units above a threshold of 10 MMBtu/hr.²² An EPA inventory of emissions sources compiled to identify major sources of Clean Air Act criteria pollutants identified roughly 7,600 boilers above the same capacity threshold and emitting over 100 tons of total criteria (non-CO₂) pollutants. The total number of boilers emitting over 100 tons of pollutants was estimated to be about 8,000.²³ The discrepancy in unit numbers is probably explainable by the pollutant threshold in the EPA report, although this has not been verified.

Box 1: Biomass Fuel Use

Currently total biomass use is small. But within key subsectors (particularly paper and pulp) biomass use can be high. If biomass is a carbon-neutral fuel, then there could be an incentive to increase its use. It is crucial, therefore, to be able to determine with certainty whether or not biomass is carbon-neutral. The treatment of biomass fuels is dealt with in a companion paper.²⁴ It lays out the conditions under which biomass can be considered carbon-neutral. cursory evaluation suggests that some but not all of the current set of biomass plants would be considered zero-emission. For the remainder, there will need to be administrative and accounting procedures established to assign a carbon emission rates or set CEM requirements. This requirement will also occur in the electricity sector.

²² *Analysis of the Industrial Boiler Population. Final topical report*, Gas Research Institute, 1996.

These boilers were estimated to be responsible for only 45 percent of total emissions from industrial boilers. To get 90 percent coverage of industrial boiler emissions would require the inclusion of most of the GRI's estimated total boiler population of 133,000.

²³ *1990 Interim Emission Inventory*. Point Source File. EPA 1996. Based on 1985 data.

²⁴ David Kline, Tim Hargrave, and Christine Vanderlan, *The Treatment of Biomass Fuels in Carbon Emissions Trading Systems*, Center for Clean Air Policy, March 1998.

By focusing on the manufacturing sector, and energy-intensive subsectors in particular, some of these potential problems can be minimized. Without downplaying these challenges, several factors may make it possible to design a viable trading program for this sector:

- Energy use and hence carbon emissions are highly concentrated. In fact, the majority of GHG emissions occur within the manufacturing sector, and even these emissions are concentrated in just a few manufacturing subsectors;
- There are excellent data available on energy use within these manufacturing subsectors;
- The big users of energy are likely to have the institutional capacity to benefit from market-based approaches such as trading to reducing their CO₂ emissions.

Using these factors as a starting point, we outline a trading system focusing on the largest emitters within the manufacturing sector. This approach achieves significant, but not complete, coverage within this sector while satisfying the other system design criteria.

3.1 Point of Regulation

Table 2 summarizes the total first use of energy by the establishments included in the 1994 Manufacturing Energy Consumption Survey (MECS).

Table 2. 1994 MECS: Energy Use by Group
(98 percent of total energy use, 65 percent total establishments)

	Tbtu	% of Industry	Cumulative %	# of Establishments	Cumulative establishments
Petroleum and coal products	6,339	29.3%	29%	1,971	1,971
Chemicals and allied	5,328	24.6%	54%	9,565	11,536
Paper and allied	2,665	12.3%	66%	5,582	17,118
Primary metal	2,462	11.4%	78%	5,171	22,289
Food and kindred	1,193	5.5%	83%	14,698	36,987
Stone/glass	944	4.4%	87%	11,970	48,957
Lumber and wood	491	2.3%	90%	21,623	70,580
Fabricated metal	367	1.7%	91%	26,262	96,842
Transport equipment	363	1.7%	93%	7,240	104,082
Textile mill	310	1.4%	94%	4,428	108,510
Rubber & misc. plastic	287	1.3%	96%	11,952	120,462
Industrial machinery	246	1.1%	97%	33,837	154,299
Electronic	243	1.1%	98%	11,264	165,563
Printing	112	0.5%	99%	37,384	202,947
Instruments	107	0.5%	99%	7,071	210,018
Furniture	69	0.3%	99%	7,691	217,709
Other	137	0.6%	100%	29,490	247,199
Total	21,663			247,199	

Source: MECS 94 Table A1, part 1

The degree of concentration of energy use is apparent in the fact that 90 percent of it is concentrated in seven industry groups. Limiting a trading program to those sectors would eliminate almost three-quarters of the establishments surveyed. Yet, it would still leave a regulated universe of over 70,000 establishments, which for now we assume is too many.

If we subdivide the top seven sectors into subsectors with higher energy usage per establishment, it is possible to cover 70 percent of manufacturing emissions, or roughly 55 percent of total industrial emissions, with only 3,000 establishments (Table 3). The exact rule governing whether a subsector is covered or not will be the subject of negotiation and analysis.

Table 3. Energy Intensive Subset
(4 digit SIC codes where Tbtu is greater than 100 and total establishments less than 650)

<i>Sector/ Subsector</i>	Tbtu	Number of establishments	Subset as percent of Sector total
<i>Petroleum</i>			<i>99%</i>
Petroleum refining	6,263	247	
<i>Chemicals</i>			<i>74%</i>
Industrial organic	2,369	631	
Nitrogenous fert.	622	118	
Plastic & resins	642	456	
Alkalies & Chlorine	129	44	
Cyclic crudes & int.	155	187	
<i>Paper and allied</i>			<i>94%</i>
Paper mills	1,297	310	
Paperboard mills	954	219	
Pulp mills	251	55	
<i>Primary metal</i>			<i>77%</i>
Blast furnaces	1,649	284	
Primary aluminum	241	44	
<i>Food and kindred</i>			<i>23%</i>
Wet corn milling	173	58	
Cane sugar (not refining)	105	43	
<i>Stone/glass</i>			<i>35%</i>
Cement	327	190	
TOTAL	15,177	2886	
Percent of Industry	70%	1.2%	

MECS 1994, Tables A1 parts 4 and 5

In this example, a subsector was included if its energy use was greater than 100 Tbtu and total establishments were fewer than 650. An argument could be made that, in the Stone and Glass Sector, the “lime” subsector should be included since it is a significant source of process CO₂ and it misses the sample cut-off rule (96 Tbtu from 84 establishments).

This would also bring the total covered emissions up to 45 percent for that sector. On the other hand, it might be argued that because so few emissions in the “Food and Kindred” group would be covered (23 percent) it is best to exempt the subsectors to avoid distortion in that sector. Despite the inevitable adjustments to the grouping, the data suggests that a subsector approach can be used to define a workable trading group.

The point of regulation would need to be at the establishment level. An alternative option would be to regulate individual boilers in the same way that the Acid Rain Program regulates individual generating units. There are two problems with this approach. As mentioned earlier, individual emission sources within establishments are not well catalogued. Moreover, a strategy based on targeting large emissions sources such as boilers can not capture a significant share of emissions while keeping the number of regulated units low.²⁵

Equally as important, the MECS is the best means of developing emissions reports and data are reported at the establishment level.²⁶

Actual reporting would be done by the business entity owning the establishments and it is likely, therefore, that the number of actual players in the market would be smaller than the number of covered establishments.

Under this type of trading program, all the facilities, regardless of size, within key industry sub-sectors would need to hold allowances to cover their facility-wide emissions. Emissions would be calculated using data from the MECS. Compliance would be determined by comparing the calculated emissions with the facility’s allowance holdings at the end of the budget period. Ownership transfers and related issues regarding establishments would be dealt with in the same manner as in the electricity sector.

²⁵ Using a threshold of 250 MMBtu/hr would capture less than 20 percent of emissions from boilers, with 1,258 units. Lowering the threshold to 10 MMBtu/hr captures about 45 percent of emissions with over 23,000 boilers. (GRI 1996)

²⁶ As used in the MECS, an establishment is “...an economic unit, generally at a single physical location, where business is conducted or where services or industrial operations are performed.”

One advantage of the establishment-level approach is that it may eliminate leakage between sources within facilities. In addition, it may allow companies more flexibility in reducing emissions because they could take credit for CO₂ reductions anywhere within the facility, not just at a boiler.

3.2 Measurement

Measurement would use the Manufacturing Energy Consumption Survey as its base. The MECS is the only comprehensive source of national level data on US manufacturing energy use.²⁷ It consists of a nationally representative sample of manufacturing establishments by means of mailed questionnaires.

Because the surveys include only a small sample of the total number of companies for many of the 4-digit SIC codes, the data suffer from sampling inaccuracies. However, the MECS is sent to all companies in the 4-digit SIC codes with the highest levels of energy use (and, presumably, of CO₂ emissions). This means that there is complete survey coverage for those industries selected for inclusion in the trading program.

The MECS provides very detailed information on how energy is used at each individual facility. As a general approach, therefore, fuel use data could be combined with CO₂ emission factors to estimate emissions. The accuracy of this approach depends on both the fuel use data accuracy, and the applicability of emission factors to the actual fuels used. As has been pointed out, there are well-established methods for making these conversions which have been accepted by the US EPA and used by Parties to the Framework Convention on Climate Change in preparing national emissions inventories.

The MECS data are sufficiently detailed to be able to distinguish between several types of fuel inputs. Additional information, such as detailed sub-types of coal with distinct carbon contents, could be required in system reporting. It is also possible that future MECS could include reporting on emissions.²⁸

A key benefit of the MECS data are that they provide detail on the actual uses of fossil fuel, information not readily available to an upstream system. For instance, facilities

²⁷ MECS is the reporting mechanism used to gather data on energy use, and would be the vehicle for regulators to estimate emissions. Technically, the measurement occurs at the facility by compiling data from flow meters, purchase records, etc.

²⁸ The EIA is designing the 1998 survey. It is considering adding emissions information to the output of the survey and is seeking comments and suggestions for other changes that might improve it.

report on fuel products they purchased but then sold or transferred to other facilities where the combustion and emissions actually occurred. The MECS data also identify fuel use developed from on-site sources such as waste biomass. Another important feature is that the MECS identifies feedstocks: fossil fuels used to produce non-energy products such as plastics and asphalt. Many of these non-energy uses can sequester carbon for significant periods of time.

Difficulties with using MECS as a model for measuring emissions emerge from the fact that MECS is largely self-reported. The current MECS survey is mandatory for firms to fill out but “verification” is limited to basic reasonableness checks given previous data and other information provided or known about facilities.

Within the context of a survey to estimate national energy use, this is acceptable. For a regulatory system that imposes costs on companies based on the reported data, some degree of actual on-site verification and inspection would almost certainly be necessary. In addition, for a trading program to maintain a high level of credibility with the public as well as the government, it will be necessary to ensure that measurement for compliance is transparent and verifiable.

Rigorous verification of reported data may not be as difficult and costly to perform as it first appears. By necessity, verification will be a “bottom-up” process, requiring the collection, review, and aggregation of a large volume of purchase records, fuel supply data, and the like. Without minimizing the potential burden of such a process, there are two reasons why this could in fact be feasible. First, the reporting entities already have experience in collecting the relevant data under MECS, and will have aggregated them in order to report. Second, verification is an accounting task that does not involve technical evaluation of emission reduction claims. That is, no subjective evaluation of baseline emissions levels or motivation for actions is required as it is for projects in non-capped systems. Only the actual emissions that have occurred must be verified by reviewing the documentation maintained by the allowance holder.

As an indication of costs, the current MECS survey, which covers a total of about 16,000 facilities and is only done once every four years, costs around \$2 to \$3 million to implement, without site verification.²⁹

²⁹ Personal communication with Jay Hakes, Director of the Energy Information Agency on February 23, 1998.

If a large percentage of the facilities would need to be audited each year to protect the integrity of the system, verification costs would certainly increase this cost, although no estimates of this cost are available at this time.

3.3 Administrative Feasibility

Generally speaking, this type of trading system should be relatively feasible from an administrative point of view. There are about the same number of sources as currently exist in the Acid Rain trading program and this has proved to be a workable number.³⁰

Also, it builds on an existing reporting infrastructure. Finally, most of the trading entities are likely to have the administrative capacity to manage the new program, and have measurement methods in place.

These general observations notwithstanding, there are some specific issues that are of concern. We have already mentioned verification and the fact that selecting the subsectors will be the subject of negotiation. Several additional issues are discussed below.

3.3.1 Presence of Small Establishments

Transaction costs for the small establishments may be higher than the expected return on their investment in the efficient management of their allowance holdings. Smaller entities in this sector already are known to forego what would otherwise look like cost-effective investments in energy management for similar reasons. Consequently, if there are many small establishments in the covered subsectors, administrative feasibility may be affected. While small establishments could be exempted, this solution would create the possibility for gaming with production shifting to smaller firms or larger firms breaking up into smaller units to avoid having to hold allowances.

Fortunately, there are several reasons why this issue may not be a problem. First, the allowance management will be done at a company level, which may be an aggregation of several small establishments. Second, energy intensity tends to be concentrated in large

³⁰ The amount of data collected per establishment in this system may be significantly less than under the SO₂ program, because data collection would be less frequent and require fewer parameters to be recorded. Thus, from a data management perspective, more regulated entities may be feasible in a GHG trading system.

establishments. Looking at the manufacturing sector as a whole, 70 percent of the energy use is concentrated in these establishments (Table 4).

Table 4: Concentration of energy use in large establishments

Establishment Size	Percentage Share of Energy Use
Establishments shipping over \$100 million of goods	70
Establishments employing more than 250 employees	72

MECS, 1994

Finally, even if there are smaller firms in the trading program, the market may find ways of efficiently aggregating them. Energy service companies (ESCOs) and firms like them could emerge as players in the allowance market. They would relieve the small operators of the burden of decision-making on energy and allowance management. In addition to a fee, the ESCO might also, for example, retain the right to the client's allowances. If the ESCO can meet all of the client's energy needs without using all of the allowance, the ESCO can then sell the remainder and keep the revenue.

3.3.2 Using the MECS for Regulatory and Enforcement Purposes

The Energy Information Administration (EIA) conducts the MECS under the authority of the Federal Energy Administration Act of 1974. The purpose is to contribute information to energy, security and environmental policy discussions. Because the information collected at the establishment level can be commercially sensitive—entities with high energy use that are targeted under this proposal are particularly reluctant to reveal data—the confidentiality of respondents is guaranteed.

In fact, the EIA does not even conduct the actual survey. It contracts this job to the Bureau of the Census, which collects and compiles the data. Thus, in its current form, it is impossible to use the MECS to evaluate compliance at individual establishments. To do so would require a change in legislation.

Making the MECS the basis of a regulatory enforcement program would create opposition from those who believe that this would compromise the integrity and trust the statistical agency (the EIA) has with those it surveys. While this is a real issue that needs to be considered, it is important to remember that this balancing act is successfully performed elsewhere in the government (e.g., at the Federal Energy Regulatory Commission) and even at the EIA itself. The Department of Justice can review the filings made by oil companies to EIA if Justice suspects collusion. In practice, Justice rarely

exercises its authority since it can get much of the evidence it needs elsewhere. Nevertheless, it still demonstrates the principle.

3.3.3 Managing Changes over Time

There are two aspects to this issue. First, some subsectors may cease to be considered “high emitters” while others increase their relative contribution to total emissions.³¹ Many of the subsectors not included in this proposal have the highest projected growth in energy use (although absolute energy use is expected to remain relatively small over the next decade). To maintain the effectiveness of the trading regime in achieving emission reductions, there would need to be a periodic adjustment of which subgroups are included in the trading regime.

Making this adjustment could be disruptive to the trading program and could encounter resistance from establishments that find they are large net sellers of allowances as well as from establishments that find themselves newly included in a trading program.

Counterbalancing these administrative challenges is the fact that the evolution is likely to be slow – decadal in time-scale. As long as the system has a clear, predictable “sunset” or reevaluation procedure, the market should be able to make the necessary adjustments. Evidence for this can be found in the RECLAIM market’s relatively smooth transition between different methods for calculating emission credits.³²

Second, noticeable changes in stock and ownership can occur over the budget period (assumed to be five years). Keeping track of who has the compliance burdens and for what units at five year intervals will increase administrative costs. This issue could be addressed by having a shorter budget period, or also could simply be left to the marketplace to resolve. It is entirely possible that efficient systems will evolve for accounting for carbon implications of changes in unit stock and ownership.

3.3.4 Coverage for the Non-Trading Establishments

About 45 percent of the industrial sector’s carbon use would not be included in the downstream trading program. To achieve environmental goals in an effective and

³¹ The potential problem caused by establishments selecting an SIC code to avoid regulation is discussed below in Section 3.4 on Leakage.

³² Personal communication, Josh Margolis, Cantor Fitzgerald. January 14, 1998.

equitable fashion, and to avoid fuel price distortions, these emissions must be dealt with in some manner. There are several possible ways to accomplish this.

One approach is to use other market-based mechanisms to raise the price of fuel supplied to exempt establishments to a level comparable to that for capped establishments. This avoids the price distortions that would arise from having carbon in some energy sources covered (i.e., electricity, large manufacturers) and not in others. Two ways of accomplishing this would be: (i) to institute a carbon tax for fossil fuels used by non-trading (exempt) establishments, and (ii) to set up an upstream trading program for the suppliers of fossil fuels who serve exempt establishments.

Under an upstream approach, suppliers would need to hold allowances to cover the carbon in the fuel they sell to exempt establishments. As described in the companion paper on designing an upstream system, these would be refineries for oil, pipelines for natural gas, and, for coal, the coal processing plants or, in some instances, the mines themselves.³³ They could meet their carbon targets by selling less, lowering the carbon content of their fuels (e.g. with low-carbon biomass additives) or purchasing allowances from other sectors.

For an upstream/downstream hybrid like this to work, the following conditions must be met:

- There is a simple, robust way to segregate fuels destined for consumption in non-trading establishments from those being used by the establishments included in the trading program. This separation might be physical (especially for petroleum products) or it could be achieved via records of shipments to non-trading establishments over the budget period.
- Fuel destined for trading entities cannot easily be diverted to non-trading entities and thus avoid the need for allowances. With petroleum products, there is experience already with segregating and tagging, via colorants, for tax purposes.
- The upstream trading program is a better driver for carbon reductions than a simple carbon tax on their fuels. Alternatively, upstream trading might be preferred over taxes if it is more politically expedient, regardless of whether it is any more effective at stimulating reductions from the non-participants in the downstream program.

³³ Center for Clean Air Policy, *US Carbon Emissions Trading: Description of an Upstream Approach*, March 1998.

Non-market approaches are also possible. These could include energy efficiency standards or emissions standards for equipment. Critical issues to resolve here are how to set the stringency of such standards as to reliably meet emission reduction goals and to avoid the distortions between subsectors in different regulatory programs.

Another method for increasing coverage in the downstream trading system is to allow some degree of “opt-in” by establishments not initially covered by the trading requirement. Industrial sources that are not required to be a part of the trading program but believe that they can do better under a trading program than they can under alternative programs can opt-in to the trading system on the same terms as selected entities.

One of the administrative issues that would need to be resolved is how to prevent double counting. If, for example, the carbon in the fuels used by the opt-in establishment was already subject to carbon tax, then there would need to be a tax credit reflecting the fact that the carbon is now included in the industrial trading program. The situation would be more complex if the fossil fuel delivered to the opt-in establishment had been through an upstream trading program. In that instance, it would be necessary to reconcile the allowance accounts between the upstream and downstream systems. Although a necessary adjustment, the process could increase the administrative complexity.

Another issue is the number of sources that would be allowed to opt in. Taken to an extreme, if every source chose to opt-in, the system administration could be overwhelmed with too many sources. The experience with the SO₂ program is that industrial sources have not found it advantageous enough to become a regulated source under the SO₂ program.³⁴ Still, given the size of the CO₂ market, there may be more interest in opting-in. Therefore, it may be desirable to limit the number of sources that can opt-in during any one budget period.

3.3.5 Mechanism for Feedstocks and Offsets

As in an upstream trading program, there will need to be a system for dealing with feedstocks and other non-fuel uses of fossil fuels. Since the MECS already identifies feedstocks, there will be little additional administrative burden added beyond that incurred in developing carbon accounting methodology.³⁵

³⁴ Only seven sources have chosen to “opt-in” to the SO₂ trading program.

³⁵ Center for Clean Air Policy, *Accounting for Non-fuel Uses of Fossil Fuels in an Upstream Carbon Trading System*, March 1998.

Since there is potential for generating offset credits by reducing process emissions,³⁶ it is likely that market participants will want a procedure for doing so.

The issue of offsets is complex and not the subject of this paper, however. Suffice it to say that offsets will increase administrative overhead but they can be incorporated at a later date, after the basic program has been “debugged.”

3.4 Leakage

There are several reasons to suspect that leakage may not be great. Within a given subsector, the easiest form of leakage would be to shift manufacture of a product to a facility too small to be regulated. But because all facilities are covered that are in a given subsector, this will be impossible. It is also difficult to see how there could be significant leakage of activities undertaken by a subsector to another subsector not included in this list. For example, printing is not included in the illustrative trading program but the paper it uses would be. It would be highly impractical for printers to “in source” micro-scale paper making in order to get around the carbon restrictions.

In addition, because the point of regulation is the establishment, if printers simply purchased paper mills, those establishments would still be classified by the MECS as paper mills regardless of their ownership.

Leakage of a sort might be an issue for manufacturers that have a choice between a raw material that is covered versus one that is not. Similarly, consumers may be able to substitute between one product in a capped subsector and one in an uncapped subsector. Manufacturers may also be able to outsource the productions of certain carbon-intensive products or process inputs. If the carbon implications of this type of substitution are not dealt with by some mechanism, then there could be some impact on the country’s progress towards the Kyoto targets. This issue bears additional investigation but may be moot as long as there are other policies and measures dealing with the remaining 45 percent of the industrial sectors’ emissions.

The use of SIC codes to define which entities are in covered subsectors can lead to another form of leakage. Because SIC codes are self-selected and are somewhat subjective for some facilities, it is possible that establishments would select a SIC classification to avoid being included in the trading system.

³⁶ Process emissions are those emissions not associated with the combustion of fossil fuels that occur as a result of industrial processes.

However, it is unclear to what extent establishments could actually benefit from their SIC code choice. First, similar SIC codes may all be included in the trading system, thereby eliminating the possibility of avoiding coverage. For example, both petroleum refining and many of the chemicals subsectors will be covered.³⁷ Second, as discussed in Section 3.3.4 above, establishments in non-covered sectors will still be regulated by other means. Thus it is not clear that choosing a SIC code to exit the trading system will be beneficial because the company will not avoid regulation altogether. Nevertheless, the issue of using SIC codes to select regulated entities requires additional analysis, and a final system design may need to include some mechanism for verifying SIC code designation. Alternatively, if additional research shows that including as many as 70,000 entities is feasible from a data collection and management point of view, then leakage from improper SIC code selection could be further reduced by regulating the top seven industry groups in their entirety.

4. Commercial and Residential Sources

The commercial and residential sectors account for 11 percent of US CO₂ emissions from fossil fuel use (not including the emissions associated with these sectors' electricity use). Of this, natural gas accounts for 71 percent of sector emissions, refined petroleum products for 27 percent and coal for the remaining 2 percent.

There are millions of household and commercial sources. Policy debates continue about the wisdom of including these sources directly in an allowance trading program. A number of people have argued that including them directly in trading is important for accessing the total energy savings in these sectors.³⁸

Our assessment is that it is simply too costly to do so. This is not to preclude the possibility that in the future, technology and user sophistication will improve. In the meantime, the trading approach could be preserved by including residential and commercial fuels in an upstream program just as it could be for the non-participating establishments in the industrial sector. This program would have to meet the same criteria of that program.

³⁷ New Jersey found 70 percent matching between self-selected and agency-selected SIC codes at the 2-digit level, but only 50 percent matching at the 4-digit level. (Mike Aucott, New Jersey DEP, March 19, 1998; GHG Emissions Trading Braintrust Meeting.) This indicates that self-selection is less of a problem if entire industry groups are covered, but also that agency selection and verification is a possibility.

³⁸ Ralph Torrie, Ralph Torrie Associates, Presentation to the GHG Emissions Trading Braintrust. June 12, 1997.

5. The Transportation Sector

Approximately one-third of US CO₂ emissions come from energy use in the transportation sector. As shown in Table 5, most of these emissions were from on-road vehicles: cars, buses and trucks. The sector as a whole is expected to grow steadily with some modes, aviation in particular, anticipating dramatic increases.

Table 5. Estimated CO₂ Emissions from the Transportation Sector³⁹

Mode	% Total US CO ₂ Emissions	% of Transportation Emissions
On-road vehicles	24	75
Aviation	4	13
Water	2	6
Other	2	6
Total	32	100

The transportation sector is clearly important but including it in a carbon reduction strategy is complex, even if we put aside the historic political difficulties in addressing environmental issues in the transportation sector. Two general problems emerged from our analysis of incorporating transportation in a trading system.

- **Fuel Price vs. Vehicle Efficiency Standards.** There is an unresolved debate about the relative effectiveness of increasing fuel prices and providing direct economic incentives for improved vehicle efficiency. Raising fuel prices clearly sends a signal to vehicle users, through increased operating costs, to reduce the amount of fuel used and thereby reduce emissions. However, it is unclear to what extent end users can effectively influence the availability of fuel efficient vehicles and other transportation planning decisions that affect their transportation needs. It may also be politically difficult to raise fuel prices high enough to cause a major change in vehicle use.

³⁹ *Emissions of Greenhouse Gases in the United States, 1987-1994; Climate Action Report*, submission of the USA under the UN Framework Convention on Climate Change, 1995.

On the other hand efficiency standards alone may not be a sufficient tool. This is in part because efficiency standards also do not directly influence many other important planning decisions.

In addition, there is empirical evidence to suggest that end users take advantage of some of the savings associated with increased efficiency to increase their use of transportation rather than reduce fuel use.

These issues are discussed in more depth in *Appendix 1*. The conclusion we draw is that a system that relies on either price increases or efficiency standards alone is unlikely to be an effective approach to reducing GHG emissions in this sector. This raises the tricky task of integrating two different approaches into a single trading system.

- **Multiple Actors.** Emissions from this sector are influenced by a wide range of variables including vehicle efficiency and usage, land use planning decisions, income levels, and attitudes about different transportation modes. For example, vehicle manufacturers respond to consumer demand to a large degree, but at the same time make important decisions about where to focus R&D and which technical options to introduce to the market.

Consumer choice and behavior is clearly critical to what types of cars are on the road, how much they are used, and how well they are maintained. However, consumers' preferences are diffuse, and are shaped by the options presented to them. Local and state governments have a crucial impact on long term transportation patterns through zoning, development, and other policies. A trading system (or any policy response) that provides incentives to only one of these actors is unlikely to be the most effective approach.

Added to these issues is the fact that most research has focused on on-road vehicles. The fast-growing aviation contribution as well as the other transportation modes have only recently been evaluated for cost-effective emission reductions.

Taken together these issues make it difficult to envision a simple approach to GHG emissions trading in the transportation sector. The preliminary analysis offered here does not propose an approach based on a single point of regulation. To do so would make it impossible to affect every significant actor. Moreover, a single approach could not simultaneously affect both fuel prices and efficiency standards. On the other hand, dual approaches can introduce additional administrative and measurement complications to avoid double counting or gaps in coverage.

Matters are further complicated by several factors dealing with administrative and measurement considerations. First, cap-and-trade approaches have not been tested within this sector as they have in both the electricity and industrial sectors. While there is some experience with trading at the refinery level, there is limited experience any further downstream.

Second, the sector shares the industrial sector problem of defining the point of regulation in such a way as to deal effectively with an enormous number of individual sources. A leading candidate for point of regulation is the vehicle manufacturers because of their relatively small number. However, vehicle manufacturers (or equipment manufacturers in the case of aircraft and other modes) do not have control over all the important variables in the emissions equation, reducing the directness of the incentive.

Third, there are gaps in the basic data and measurement techniques. Although national-level emissions are well known based on aggregate fuel use data, estimating and verifying emissions from individual sources is very difficult, largely because of the number and heterogeneity of individual sources. These data gaps may turn out to be easily filled but they add a level of uncertainty that we did not experience in the other sectors.

Finally, we have not been able to assess the relative value of being able to have a trading program in the transportation sector that was structured so as to allow inter-sector trading. It may be that there are adequate incentives provided by having a separate trading program for the transportation sector. A separate program for this sector would reduce the need to achieve comparable levels of certainty in estimating emissions, a requirement for inter-sector trading.

In short, this section is no substitute for a rigorous assessment of strategies to control the growth of carbon dioxide emissions from the transportation sector and the role that trading might play in those strategies. With these caveats in mind, the remainder of the transportation section briefly discusses the two general options which could be applied to on-road vehicles—increasing fuel prices and improving vehicle efficiency.

5.1 Transportation Approaches

5.1.1 Market Mechanisms in the Transportation Sector

There are several possible market mechanisms that could be used in the transportation sector:

- **Emissions Trading.** An emissions cap is determined for the sector or subsectors, and allowances allocated to regulated entities. These entities must hold allowances for their emissions, but have flexibility in achieving compliance through a mix of emission reductions and purchasing additional allowances.
- **Standards Trading.** Performance standards are determined for regulated entities. Entities that achieve better performance can trade to entities that fail to meet the standards. For example, vehicle manufacturers could be required to meet a standard similar to current CAFE requirements. If a manufacturer achieves better efficiency than the standard improvements beyond their CAFE requirement could be purchased by other manufacturers to offset their shortfall.
- **Fleet-Based Trading.** Fleet operations are a moderate but important contributor to overall transportation emissions. Because purchasing and operation decisions are centralized, fleets may be logical place to establish a trading program. Either an emissions or standards trading approach could be used.
- **Fees, Rebates, and Tax Credits.** These and other similar market mechanisms could be used in addition to or instead of emissions trading. There is some experience using these approaches for air quality programs.

One of the goals of this paper is to outline emission trading options that are sufficiently similar and consistent so as to allow inter-sector trading. Therefore, the following sections examine two emissions trading approaches. The first focuses on upstream allocation of allowances, thereby relying on associated fuel price increases to spur emission reductions. The second targets vehicle manufacturers and fleet-wide emissions.

5.1.2 Fuel Prices

Increasing fuel prices can be achieved by requiring allowances to be held representing the carbon contained in fuels. A trading program targeted at transportation fuels would most likely need to be implemented at the refinery level. A cursory count of the number of vehicles leads to the conclusion that a fuels-based downstream trading program would be unworkable. Moreover, the only place we can look to for insights on how such a program might be implemented is the gasoline rationing programs. Not only were such rationing programs unpopular, but they were never designed with cost-effectiveness in mind. On the other hand, the effectiveness of the lead trading program, which allowed refineries to trade permits based on lead concentrations in fuels as lead was being phased out

altogether, suggests that refinery level trading holds promise.⁴⁰ A serious drawback to this approach, from the context of this paper, is that it is not a downstream trading program.

The upstream paper in this series highlights the benefits of treating fuels upstream and lays-out how such a program could work. The only adjustment needed to include an upstream approach to fuels in a predominantly downstream trading regime is a way to segregate transportation fuels from other fuels. Fortunately, there is already segregation occurring for tax purposes. For example, home heating oil is essentially the same as diesel used in trucks yet it is taxed at a different rate and there are systems to make sure the appropriate tax rate is applied to each use.

Measurement is relatively easy and results in emissions estimates with a high degree of certainty. The carbon content of fuels is assumed to result in emissions based on approved emissions factors. The critical element of this approach is to correctly identify fuels that will be used in the transportation sector.

5.1.3 Vehicle Efficiency

There are two particularly difficult questions in targeting vehicle efficiency through a downstream trading program: Who should hold permits; and can emissions be accurately measured? Although consumers are the end users of transportation fuels, it is not clear that they would have the necessary influence on vehicle efficiency. Moreover, the sheer number of end users in this sector strongly suggests that we look elsewhere for an effective point of regulation. Nevertheless, it is possible to envision an approach that requires car buyers to hold allowances based on the efficiency of their vehicle. Purchasing a highly efficient car, for example, would free up some allowances, which could then be sold by the consumer. Additional research is necessary to examine questions such as whether the administrative burden can be overcome, and whether individual consumers can participate effectively in a trading system.

Another approach might be to require that vehicle manufacturers hold allowances for the cars they sell. This has the main advantage that there are far fewer manufacturers -- perhaps less than 50 -- reducing the administrative burden and increasing the confidence

⁴⁰ Note, however, that the lead program encountered some unforeseen abuse of loopholes in the standards. In some cases, small and hard to regulate companies emerged that diluted gasoline with fuel alcohol so as to meet the standard. In others, refiners added lead to unleaded gasoline to create a false baseline against which to assess credits.

that trades can be accomplished with minimal transaction costs. Manufacturers will have a strong incentive to increase the overall efficiency of their fleet. The cost of holding allowances for selling inefficient vehicles could be passed on to consumers.

Wherever the point of regulation is placed, the second critical issue is how to measure emissions. We assume that directly measuring emissions from vehicles is not feasible. Estimating total emissions from the transportation sector based on fuel use is, however, quite accurate.

The most promising approach, therefore, appears to be developing a method to assign to each manufacturer the responsibility for a share of total emissions. This assignment could be based on a relationship between the assumed use of its vehicles and their relative contribution to the overall emissions levels. The confidence we would have in these equations to yield the absolute levels is modest. However, the confidence in their ability to yield the relative contribution that each manufacturer made to the absolute level of emissions could be high. *Appendix 2* provides a detailed description of how such a program might work and highlights some of the measurement, administrative and leakage characteristics of the program. *Appendix 2* also briefly outlines how an upstream fuels system might be integrated with a downstream vehicles system in order to maximize consumer and manufacture response.

Note that car manufacturers have a very limited ability to affect the imputed emissions of existing vehicles. Thus, total imputed emissions can only be significantly reduced by altering the characteristics of new vehicles, which places a limit on the speed of emission reductions. Roughly 50 percent of the vehicle fleet turns over every 5 years, so significant reductions can occur over one or more full budget periods.⁴¹

5.2 Summary

Overall, downstream trading approaches in the transportation require considerable additional research before any concrete recommendations can be made. This sector poses uniquely difficult problems as well as tremendous opportunities. First, different policy approaches must be brought to bear. Second, multiple actors and the large number of end users make it difficult to select an effective point of regulation. In addition, there does not appear to be a direct way to calculate emissions in a reliable way from the bottom up (that is, by aggregating the reported emissions at the point of regulation). Nevertheless,

⁴¹ John Holmes , *Alternative Design for a Domestic System to Control Greenhouse Gas Emissions*, Heinz Center, 1998. Draft Paper.

Carefully designed training programs may harness market forces to yield cost effective improvements. The results of additional analysis will be presented in a companion paper in this series.

6. Building a Downstream Program

Based on this analysis, we believe that a “core” downstream trading program (Table 6) could be successfully implemented which would achieve adequate coverage with minimal administrative burdens.

Table 6: Core Program

Source	Coverage		Total Sources	“Rents”	Point of Regulation	How Monitored
	Carbon (MMTC)	Share of US Total				
Electricity Generators	495	36%	2,200	large	units	CEMS or fuel inputs
Large Industry	161	12%	2,940	moderate	facilities	fuel inputs
TOTAL	656	48%	5,140			

The “core” program would include only electricity generators and large industry. This approach would cover about half the emissions and would have a high probability of success in that it:

- would have a robust monitoring system;
- could be implemented relatively quickly and in advance of trading programs in the transportation sector;
- could incorporate non-fossil fuel emissions;
- would target sectors that have the most capacity to engage in trading;
- would build on the existing SO₂ program; and
- would make maximum use of infrastructure already in place.

The last three points are important because they will help keep governmental administrative costs down. The “core” program is not likely to entail many new

administrative costs for electricity generators. Similarly, for industry the basic data collection and reporting is already being done as a part of the Manufacturing Energy Consumption Survey. This effort costs between \$2 and \$3 million to produce.

Even assuming that adding the necessary verification, enforcement and related activities triples those costs and that the incremental costs of adding CO₂ to the electricity sector costs roughly the same as cost of the SO₂ program (operating budget of somewhat over \$2 million), the total operating costs could be in the \$8 to \$11 million range.

Coverage could be expanded in several ways. With additional research, other sectors or subsectors could be phased-in to the downstream trading program. Where downstream options do not appear feasible, certain sectors could be included in the trading system by adding upstream elements to “core” program, creating a hybrid system. Finally, remaining non-covered sectors would need to be addressed using non-trading regulatory approaches in order to achieve environmental goals and prevent price distortions between regulated and non-regulated sectors.

This paper examined in some detail the possibility of downstream trading in the transportation sector, as well as an upstream approach. Although any trading approaches in the transportation will require considerable additional research before concrete policy proposals can be recommended, two approaches appear promising. First, the carbon content of fuels can be regulated by requiring refineries to hold allowances for transportation fuels. This will send an indirect price signal to vehicle users, which may not be sufficient to reduce emissions, but minimizes the number of regulated entities and does not raise complex monitoring issues. Second, vehicle manufacturers could be held responsible for the estimated emissions of the cars they produce. Targeting manufacturers also minimizes the number of entities, but introduces significant unresolved measurement issues. Assuming these problems can be overcome, a “three sector” program could be designed that covers 70 percent of US emissions (Table 7). A benefit of this approach is that motor fuels like gasoline would be covered in the “Large Industry” sector. This approach would require a mechanism to ensure that emissions were not “double counted” (once at the refinery level and again at the vehicle level -- see *Appendix 2*). It would, however, provide price signals to both consumers and manufacturers. Recent research tends to suggest that this kind of synergy is necessary in order to achieve maximum potential reductions in this sector.

Table 7: Three Sector Program

Source	Coverage		Total Sources	“Rents”	Point of Regulation	How Monitored
	Carbon (MMTC)	Share of US Total				
Electricity Generators	495	36%	2,200	large	units	CEMS or fuel inputs
Large Industry	161	12%	2,940	moderate	facilities	fuel inputs
Vehicle Manufacturers	335	23%	50	large	business entities	imputed emits
TOTAL	991	71%	5,190			

This three sector program leaves approximately 30% of emissions left “unregulated” (about half of which are in the other industrial sectors). In order to prevent possible economic distortions and emissions leakage to unregulated sectors, other market-based or traditional regulatory and fiscal approaches would be required.

Appendix 1

Research on the Impact of Changes in Gasoline Price and Increased Fuel Efficiency on Gasoline Consumption

There is an ample body of literature and economic research that addresses the impacts of an increase in gasoline price and of increased fuel efficiency on fuel consumption and driving behavior. The issue is complicated because of the interrelationships between several key variables that affect the amount of fuel consumed. The following discussion focuses on on-road vehicle use (trucks and passenger vehicles) but some of the implications for policy can be instructive for the other transportation modes as well.

Key Parameters and Relationships

The variables that determine the amount of gasoline consumed are gasoline prices, fuel economy or vehicle efficiency (miles per gallon or mpg), vehicle miles traveled (vmt), price of vehicles and income level. In economic terms, the relationship between the changes in these variables is described in terms of elasticity; for example, the relationship between a change in fuel price and the resulting change in the quantity of gasoline demanded is called the price elasticity of demand for gasoline.⁴²

The price elasticity of demand for gasoline is negative -- that is, an increase in the price of gasoline will result in a decrease in its use. There is both a short and long term elasticity. The short term elasticity is of smaller absolute magnitude and represents the short term adjustment to higher gas prices, mainly through decreased use of the vehicle (decreased vmt). The long term elasticity is of greater absolute magnitude and represents the longer term (10-15 year) adjustment that includes the change in demand due to the purchase of more fuel efficient vehicles. An increase in average vehicle fuel efficiency will result in reduced use of gasoline.

However, if gasoline prices are held constant, the increased efficiency results in a lower fuel cost per vehicle mile traveled. This in turn causes a “rebound” effect, an increase in

⁴² An elasticity measures the percentage change in one factor of interest that will be caused by a one percent change in another factor of interest. A price elasticity of gasoline demand of -0.15 means that a one percent increase in gasoline price will cause a 0.15 percent decrease in gasoline use.

vehicle miles traveled, that partially offsets the reduction in gasoline use resulting from the more fuel efficient vehicle.

The rate of turnover in automobile stock is also important in raising the average fleet fuel efficiency, assuming that newer cars are more fuel efficient. This is influenced by real income levels and the relative prices of more efficient and less efficient vehicles as well as by changes in gasoline prices.

Several factors can cause a dampening of the decrease in gasoline use resulting from the price increases. One is income; if real income increases, vehicle miles traveled also tend to increase. Another is the rebound effect that will result, in the longer term response, if the consumer buys a more fuel efficient vehicle.

Estimates of Price Elasticity for Gasoline

While much research has been done on the subject of the price elasticity of gasoline, estimates of the various elasticities differ. As Carol Dahl, a leading researcher in the field, states, "Since the 1973 oil embargo, there have been a plethora of energy studies designed to capture demand elasticities. These studies have used a variety of models that have increased in sophistication. And yet, despite our attempts, it appears that demand elasticities are like snowflakes. No two are alike. Some are close, many are not. The long run seems to elude us. In time series long enough to allow complete adjustment, there may be too much structural change to capture long run adjustments."⁴³

In a recent technical document from the Department of Energy⁴⁴, it is noted that using older or "historical" studies of these elasticities, as compared to recent ones, changes the CO₂ impacts by a factor of 2 and reverses the ranking of policies by CO₂ effectiveness. For example, an earlier set of estimates (pre-1986) found that short and long run price elasticities of vehicle miles averaged -0.32 and -0.55 respectively.⁴⁵

More recent estimates suggest short-run elasticities of vehicle miles with respect to fuel cost per mile of -0.05 to -0.2 and long-run of -0.09 to -0.26. The recent estimates suggest a long-run gasoline price elasticity less than half as great as the older estimates. The

⁴³ "A Survey of Energy Demand Elasticities in Support of the NEMS," October 19, 1993.

⁴⁴ "Policies and Measures for Reducing Energy Related Greenhouse Gas Emissions: Lessons from Recent Literature," US Department of Energy, Office of Policy and International Affairs, July 1996.

⁴⁵ Carol Dahl in a survey of existing studies, 1986.

recent estimates indicate an average long run (10 year) price elasticity of gasoline of -0.38 as contrasted with earlier average estimates of -0.81.⁴⁶

The report concludes, “Those who believe that gasoline demand and fuel economy are quite sensitive to fuel prices will conclude that fuel taxes are relatively more effective than fuel economy standards, feebates or energy efficiency R&D, for example. Those who believe that travel is relatively insensitive to fuel costs, on the other hand, will conclude that fuel economy standards may be just as effective as reducing vehicle travel. If one accepts the lower elasticity estimates of many of the more recent studies, then one would conclude that improving energy efficiency is the most direct means to reducing CO2 emissions”⁴⁷

Policy Implications of the Research

The research indicates that it takes a long time (10 to 15 years) for most of the decrease in consumption resulting from a gasoline price increase to occur. Further, the low gasoline price elasticity estimates of the most recent research indicates that changes in gasoline prices may need to be higher than is currently considered politically feasible. Yet, the effectiveness of a policy that only targets vehicle efficiency would be hurt by the “rebound” effect and would not fully engage consumers or producers. As with the industrial sector, it appears likely that no one policy will be adequate. A policy that both provides incentives for increased fuel efficiency and leads to increased gasoline prices may be required to obtain the desired reduction in gasoline consumption.

⁴⁶ “Policies and Measures for Reducing Energy Related Greenhouse Gas Emissions: Lessons from Recent Literature,” US Department of Energy, Office of Policy and International Affairs, July 1996.

⁴⁷ “Policies and Measures for Reducing Energy Related Greenhouse Gas Emissions: Lessons from Recent Literature,” US Department of Energy, Office of Policy and International Affairs, July 1996.

Appendix 2

A Downstream Trading Concept for Vehicle Manufacturers

Introduction

This Appendix presents a “thought experiment” as to how a carbon trading program for vehicle manufactures might work. We presented this material at the March 1998 meeting of the Center’s “Carbon Trading Braintrust.” Numerous comments were made at the meeting that suggest this mechanism would need to be modified before it could be considered a robust policy proposal. The Center will be working on different formulations and on ways to extend trading ideas to other manufacturers of transportation equipment (e.g. aircraft, locomotive, and ships). Nevertheless, in the interest of generating further discussion on this topic and in highlighting implementation challenges any proposal must address, we will present this way of using “imputed” emissions as a basis for trading.

“Imputed Emissions” of Vehicles

The manufacturers of transportation equipment are not the end users of transportation fuels. They are, however, selling products with “imputed emissions” -- emissions that have occurred because of the use of the manufacturer’s products. It may be possible to use these imputed emissions as the foundation of a trading program.

Technically, the point of regulation would be at the level of business entity (Ford, GM, Mack, Peterbilt, etc.)⁴⁸. Imputed emissions would be derived from data on fuel efficiency, carbon in the fuel, and the vehicle miles traveled (VMT). A manufacturer (or importer) would need to hold allowances for the calculated emissions from all the vehicles of its manufacture (its “fleet”) that were in use during the budget period. In theory, this system could apply to manufacturers of all types of transportation equipment. However, because on-road vehicles are the source of 75% of transportation emissions and because manufacturers of on-road vehicles tend to be more vertically integrated than

⁴⁸ An informal count suggests that there is somewhere between 25 and 50 such entities.

those of other transportation equipment, it would be logical to start with on-road vehicle manufacturers.

The advantages of engaging the vehicle manufacturers through a system of allowances would be to motivate them to become actively involved in more efficient and less carbon-intensive vehicle design and marketing in addition to reacting to a long term consumer response to a fuel price increase. This could result in more timely innovation and marketing strategies to sell more fuel efficient cars.

Requiring allowances to cover emissions from a “gas-guzzler” will raise its price (or lower its profits) relative to those of a more efficient car or truck. Further, in the event that allowances were allocated (as opposed to auctioned), they would give vehicle manufacturers a chance to receive some of the “rents” associated with the allowances.

Measurement Accuracy

Measurement would occur in a two step process. **Step One** would establish the actual emissions from all vehicles in a given budget period. **Step Two** would allocate those emissions to individual manufacturers in order to determine compliance at the point of regulation (see the sample worksheet at the end of this appendix).

Step One: Determining Sector Emissions

Measuring the total on-road emissions is relatively simple and robust. Data on motor fuel sales are currently collected and considered reliable.⁴⁹ Emissions factors are well developed to translate total gallons of fuel into tons of carbon. Thus, it would be possible to know with a high level of confidence whether the overall cap for the trading entities had been met. Since both the measurement technique for the aggregate data and the data’s accuracy are identical to those of the industrial and electricity sectors, there would be no problem trading allowances among any of the regulated entities.

⁴⁹ The EIA publishes monthly estimates of petroleum products supplied, including gasoline, in the “Petroleum Supply Monthly.” The estimate consists of production and imports minus stock change and exports. Data on diesel motor fuel consumed by on-road vehicles can be obtained from two EIA publications: “Fuel Oil and Kerosene Sales Report” and “State Energy Data Reports.” The amount and type of alternate fuels consumed annually by vehicles are reported in another EIA report “Alternatives to Traditional Transportation Fuels.” Data is also published in the “Transportation Energy Data Book” published by Oak Ridge National Laboratory.

Step Two: Determining Compliance of Manufacturers

Each manufacturer would need to be assigned responsibility for a share of total emissions. This assignment could be based on a relationship between the assumed use of their vehicles and their relative contribution to the overall emissions levels.

The confidence we would have in these equations to yield the absolute levels is modest. However, the confidence in their ability to yield the relative contribution that each manufacturer made to the absolute level of emissions could be high.

Referring to the sample worksheet, assume that the measured emissions from the three fleets are 14,000 tons. Also assume that the sector was allocated 15,000 tons. Since the sector as a whole is under its cap, it can offer up to 1,000 allowances for sale to other sectors. Within that sector, though, the three manufacturers have greatly differing compliance pictures. Each manufacturer is assigned a share of the total emissions based on its share of imputed emissions (Steps 2a and 2b). When their shares are compared to the allowances (Step 2c), we can see that the manufactures of “Car 1” and “Car 2” would need to buy allowances from the other manufacturers (or from other sectors).

In subsequent years, the “Car 1” and “Car 2” manufacturers could reduce the need to buy allowances by improving MPG, increasing the ability to burn fuels with lower carbon values, or, perhaps, initiating programs targeted at owners of their cars to reduce VMT. The manufacturer of “Car 3,” however, could bank allowances to use in future years, sell to other manufacturers, or sell to other sectors.

Note that car manufacturers have a very limited ability to affect the imputed emissions of existing vehicles. Thus total imputed emissions only can be significantly reduced by altering the characteristics of new vehicles or changing the relative number of high and low efficiency vehicles sold in any given year. These factors place a limit on the speed of emission reductions. Roughly 50% of the vehicle fleet turns over every 5 years, so significant reductions can occur over one or more full budget periods.⁵⁰

In practice, determining a manufacturer’s compliance status requires:

- an inventory of all the vehicles by manufacturer classified by age and model;
- the fuel efficiency of those vehicles;
- the miles traveled of those vehicles; and,
- the type of fuel most likely to be used by the vehicles.

⁵⁰ John Holmes, Heinz Center, 1998. Draft Paper: *Alternative Design for a Domestic System to Control Greenhouse Gas Emissions*.

Assuming that a number of models can be aggregated in to a single model-type reflecting efficiency, usage and fuel type, the manufacturer would perform much the same calculation that appears in the example above or each model-type. The viability of such a system depends on the availability and reliability of the data.

The EPA has collected information on all new vehicles sold in the U.S. since 1975. For this report, EPA collects information on year, model and fuel efficiency. The EPA information is fairly detailed (e.g., model name, type and mpg when new). The EPA does not verify this data, but discrepancies are probably not biased in favor of a particular manufacturer. This may change as manufacturers have incentives to exaggerate efficiency claims and some verification would need to be undertaken.

The data set could be thought of as the “birth certificates” for all vehicles. The next step is to determine how many of those vehicles, by vehicle type, are still being used. The simplest way to do this is to use a generic vehicle retirement curve (or “scrapage rate”). Oak Ridge National Laboratory has computed scrapage curves that could be used for this purpose. The new distribution of model types by age would need to have an addition adjustment made to reflect the degradation in fuel efficiency that normally takes place over a vehicle’s life.

A problem with this approach is that there may be differences among the scrapage rates of manufacturers’ vehicles. An existing data source that could be used to control for this variation is the survey done by the Polk Company, a private, proprietary source of information. Polk estimates vehicles on the road and scrapage, by make and model, based on state registration information. Because estimates are based on registrations, this data is considered reliable but it is more aggregate than that reported to USEPA (e.g., estimates for Honda Civics would be aggregated over all Civic types for a given year). It might be adequate to develop a general retirement curve for each model and assume it holds to the model’s subtypes in the EPA data set.

The weakest link is the data on vehicle miles traveled. Three government surveys have, in the past, collected data on VMT. These surveys have estimated VMT by age of the vehicle, but not by make or model. They are the Department of Transportation National Personal Transportation Survey (NPTS), which collects data on passenger car VMT by household, driver and vehicle; the Department of Energy Residential Transportation Energy Consumption Survey (RTECS), which also collected data on passenger car VMT; and the Department of Commerce Truck Inventory and Use Survey.

The RTECS has been preferred to the NPTS because it represented actual odometer readings in lieu of estimates by respondents. Data were collected on VMT by age and make, and survey results include estimates of VMT by fuel efficiency, vehicle type, family income, and model year.

However, because the total sample size was only 5,000, there was not enough data to get meaningful estimates of VMT by make/model/age. The RTECS was discontinued in 1994 and the NPTS has been expanded to include odometer readings and estimates of VMT by make/model in its next version.

The Truck Inventory and Use Survey has been renamed the Vehicle Inventory and Use Survey. It will collect information on make and model as well as VMT and MPG for everything but passenger cars, including mini-vans, pick-up trucks, sports utility vehicles and heavy duty trucks.

Oak Ridge National Laboratory has extrapolated data from all three of the surveys to estimate average VMT by all vehicles in a given vehicle type (e.g. light duty trucks, automobiles, household vehicles and passenger vehicles) by age. In addition, the Department of Transportation and State Highway Departments conduct direct observations and indirect measurements as part of the Highway Performance Monitoring System that are used to estimate VMT. However, these would need to be combined with other information to get estimates by manufacturer.

While it is difficult to have high confidence in the VMT data at this stage, it may not be as important as efficiency and total number of vehicles on the road in determining the relative share of a particular manufacturer. This is because there may not be a significant difference in the VMT driven by owners of a particular type of vehicle. Put another way, a Ford minivan might turn out to be driven roughly the same number of miles in a year as an equivalent Chrysler minivan. Nevertheless, hypotheses such as these need to be tested to ensure a fair allocation formula is being used.

Overall, there are noticeable differences between the measurement of carbon in this sector and in the other sectors. There is no one source for all the information such as the MECS for the industrial sector or the CEMS for electricity generation. Also, there does not appear to be a direct way to calculate emissions in a reliable way from the bottom up (that is, by aggregating the reported emissions at the point of regulation). Despite those points, it does seem possible to have a robust "top-down" estimate for the sector as a whole. At the same time, the formulae, which would be used to determine compliance, is likely to be the subject of negotiation.

Administrative Feasibility

The number of entities in the trading program would be quite small, which would simplify the administrative process. A preliminary conclusion is that while the costs and administrative challenges are the least well characterized for this sector, it seems that the basic administrative functions would be workable.⁵¹ However, the amount of data processing and development of new data collection requirements could be large. Moreover, the extent to which such a system could build on existing regulatory infrastructure (such as that in place to monitor the Corporate Average Fuel Economy program) has not been assessed at this point.

Two additional areas that may be more problematic are the integration with an upstream program for transportation fuels and “orphan vehicles.”

Integrating Upstream Fuels

It is assumed that the fuels used by the rest of the sector (e.g., jet fuel) would be covered by an upstream trading program or taxes.⁵² There would need to be an administrative procedure established to keep these fuels segregated. An important administrative disadvantage arises if fuels are treated in an upstream trading program but vehicles are also regulated in a downstream system.⁵³ The difficulty arises because the carbon in the fuel already is assumed to be fully covered by the upstream system. Therefore, counting the emissions downstream as the fuel is used in vehicles would be double counting.

To prevent double counting, some system of sharing the allowance responsibility between the fuel supplier and vehicles would need to be developed. For instance, each ton of CO₂ allocated to the transportation sector as a whole might be split 50/50 between

⁵¹ General Motors has, in fact, been using this methodology to compute its greenhouse gases emissions in its 1605(b) filings for the last three years. GM estimates that emissions from cars and light trucks of its manufacture have decreased by 15% from 1987 to 1996 (433 million metric tons CO₂ to 364 mmtCO₂). The decrease comes from increased fuel economy of the on-road fleet but it was partially offset by increased VMT. If VMT had remained constant, emissions would have been 23 mmtCO₂ lower.

⁵² If the other modes are not covered in some fashion there will be distortion in transportation choices. For example, shipping by rail would gain a new price advantage over trucks because those modes would not need allowances to cover the carbon in their fuel where as the trucks would.

⁵³ Transportation fuels might be addressed by both fuel price increases (i.e., upstream coverage) and direct incentives for more efficient vehicles (i.e., coverage of vehicle fleets) in order to prevent a “rebound” in VMT that would reduce emission reductions. Rebound can occur if fuel price increases do not reinforce vehicle efficiency improvements. In addition, upstream regulation can provide an incentive for owners of existing cars to reduce emissions, whereas regulation of fleet efficiencies cannot.

vehicle manufacturers and refineries. Thus, refineries would be responsible for half of the carbon in the transportation fuels they sell and the manufacturers would be responsible for half of the actual emissions from their vehicles.

The recent moves by vehicle manufacturers and oil companies in working together to design clean fuels for clean cars may suggest that a collaboration on CO₂ allocation could be worked out. Still, having such a system would increase administrative complexity.

Orphan Vehicles

Another concern is that of “orphan vehicles.” Orphan vehicles are vehicles on the road whose manufacturer no longer sells on-road vehicles. At the moment, there are very few of these vehicles. These could probably be dealt with by simply allocating their imputed emissions evenly across all remaining players. In the future this might become a more pressing question. This would be particularly so if manufacturers could “game” the system by declaring themselves out of business, thus absolving themselves of the current vehicle fleet, and starting up shortly thereafter with only new vehicles which are usually lower emitting than the rest of the fleet.

There are several ways that this situation could be presented. The simplest way is if the company could be made to surrender future allowances “grandfathered” to it. Alternatively, the carbon obligation could remain on a company’s books as a liability when it goes out of business. The company would then have to pay off this liability like it would any other debt. The issue could also be treated like pension funds in that the companies could be required to pay into a fund such that if the company were to go out of business, there would be a stream of allowances guaranteed to cover the emissions of the old company’s fleet.

Leakage

Assuming that all on road vehicles are included in the program, there would be no leakage. There may some distortion, however, if the carbon emissions of other modes of transportation are not addressed. Without such a mechanism, there could be incentives to shift transportation activities from one regulated mode to another more lightly regulated mode.

SAMPLE CALCULATION OF EMISSIONS AND COMPLIANCE DETERMINATION

Step 1: Determine total measured emissions from on-road vehicles

For this sample, assume: a) measured emissions are 14,000 tons CO₂, b) sector allowance allocation is 15,000 tons CO₂ equally distributed among three manufacturers.

Step 2a: Assess relative contribution by manufacturer's imputed emissions

Make and Model	MPG	VMT	Fuel Burn (vmt/mpg)	Number of vehicles	Imputed emissions (19.5lbs/gal)
<i>Car 1</i>	15	10,000	670	1,000	6,530 tons
<i>Car 2</i>	25	14,000	560	1,000	5,460 tons
<i>Car 3</i>	35	12,000	340	1,000	3,320 tons

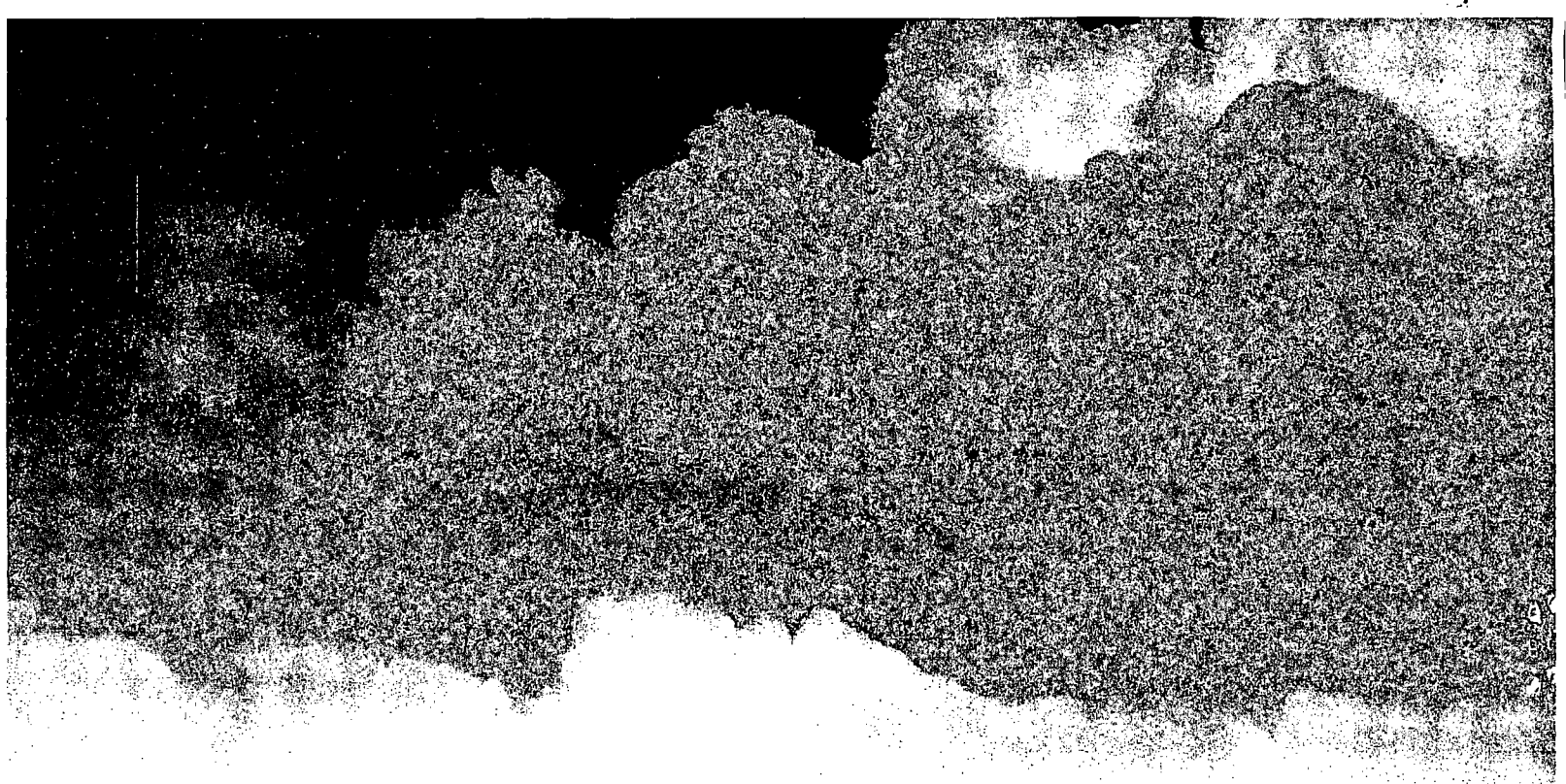
	Imputed Emissions (tons) (vmt/mpg) x (CO ₂ /gal) x (vehicles)	Calculated Relative Contribution
Manufacturer of Car 1	6,530	42%
Manufacturer of Car 2	5,460	36%
Manufacturer of Car 3	3,320	22%
<i>Total Imputed Emissions</i>	<i>15,310</i>	

Step 2b: Use relative contribution to assign share of measured emissions

	Calculated Relative Contribution	Tons (measured) x (rel. contribution)
Manufacturer of Car 1	42%	5,880
Manufacturer of Car 2	36%	5,040
Manufacturer of Car 3	22%	3,080

Step 2c: Compare tons to allocated allowances

	Tons (measured) x (rel. contribution)	Allowances Allocated for Budget Period	Surplus (Deficit)
Manufacture of Car 1	5,880	5,000	(880)
Manufacturer of Car 2	5,040	5,000	(40)
Manufacturer of Car 3	3,080	5,000	1,920
Sector Total	14,000	15,000	1,000



Center for Clean Air Policy

750 First Street, NE • Suite 1140
Washington, DC 20002