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# The Effects on Developing Countries of the Kyoto Protocol and Carbon Dioxide Emissions Trading

A. Denny Ellerman Henry D. Jacoby Annelene Decaux Developing countries — both importers and exporters — could in fact benefit from carbon dioxide emissions trading to achieve tagets mandated by the Kyoto Protocol.

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# **Summary findings**

The trading of rights to emit carbon dioxide has not officially been sanctioned by the United Nations Framework Convention on Climate Change, but it is of interest to investigate the consequences, both for industrial (Annex B) and developing countries, of allowing such trades. Ellerman, Jacoby, and Decaux examine the trading of caps assigned to Annex B countries under the Kyoto Protocol and compare the outcome with a world in which Annex B countries meet their Kyoto targets without trading. Under the trading scenario the former Soviet Union is the main seller of carbon dioxide permits and Japan, the European Union, and the United States are the main buyers. Permit trading is estimated to reduce the aggregate cost of meeting the Kyoto targets by about 50 percent, compared with no trading. Developing countries, though they do not trade, are nonetheless affected by trading. For example, the price of oil and the demand for other developing country exports are higher with trading than without.

The authors also consider what might happen if developing countries were to voluntarily accept caps equal to Business as Usual Emissions and were allowed to sell emission reductions below these caps to Annex B countries. The gains from emissions trading could be big enough to give buyers and sellers incentive to support the system. Indeed, a global market for rights to emit carbon dioxide could reduce the cost of meeting the Kyoto targets by almost 90 percent, if the market were to operate competitively. The division of trading gains, however, may make a competitive outcome unlikely: Under perfect competition, the vast majority of trading gains go to buyers of permits rather than to sellers. Even markets in which the supply of permits is restricted can, however, substantially reduce the cost to Annex B countries of meeting their Kyoto targets, while yielding profits to developing countries that elect to sell permits.

This paper — a product of Infrastructure and Environment, Development Research Group — is part of a larger effort in the group to examine the impact on developing countries of programs to correct global environmental problems. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Tourya Tourougui, room MC2-521, telephone 202-458-7431, fax 202-522-3230, Internet address ttourougui@worldbank.org. Denny Ellerman may be contacted at dellerman@mit.edu. December 1998. (43 pages)

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# THE EFFECTS ON DEVELOPING COUNTRIES OF THE KYOTO PROTOCOL AND CO<sub>2</sub> EMISSIONS TRADING

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#### 1. INTRODUCTION

The Kyoto Protocol recognizes a strong linkage between CO<sub>2</sub> emission reduction goals, emissions trading, and the role of developing economies. Annex B parties, generally the industrialized nations, have set targets that, for most, imply a significant reduction of CO<sub>2</sub>-equivalent emissions by 2010. The ability and even willingness of Annex B parties to achieve these targets will depend on the cost of abatement. The cheapest sources of CO<sub>2</sub> emission reductions are found, not in the Annex B countries, but in the developing economies (or non-Annex B parties), which for historic and equity reasons are not expected to contribute to the global emissions reduction in the near term. Since the location of CO<sub>2</sub> emissions does not matter from a global warming perspective, the achievement of the Kyoto targets will depend in large part upon the ability of Annex B countries to substitute cheaper emission reductions in non-Annex B regions for equivalent abatement at home. In providing a mechanism for this exchange, emissions trading not only reduces the cost of meeting the Kyoto goals for Annex B parties, but also provides a new source of export earnings for non-Annex B parties.

Developing country interest in emissions trading is not limited to the potential for new export earnings. Achieving the goals set at Kyoto will change patterns of consumption and production within Annex B nations; and these changes will have inevitable effects on the flows of internationally traded goods. As a result, developing countries will be affected through conventional trade linkages with the Annex B countries; however, these effects, both favorable and unfavorable, will be diminished to the extent that emissions trading reduces the cost of achieving the Kyoto targets.

In examining the effects of the Kyoto Protocol upon non-Annex B parties, we assume that the Annex B goals are met, and we focus in particular on how emissions trading would affect the developing countries. We refer to emissions trading generically, to include bubbles, joint implementation, allowance or credit systems, and perhaps other forms yet to be devised. The chief practical distinction among these forms concerns the transaction cost involved in effecting an individual trade.

The paper relies heavily upon the use of marginal abatement curves (MACs). These curves represent the marginal cost of reducing carbon emissions by different amounts within an economy. The details of their construction, and the elaboration of the aggregate demand and supply curves for carbon permits which are drawn from them, are explained in Appendix A. The MACs used here are generated using MIT's Emissions Prediction and Policy Assessment (EPPA) model (Yang et al. 1996). This is a multi-sectoral, multi-regional, computable general equilibrium (CGE) model of global economic activity, energy use and carbon emissions. The underlying model simulates real emission reductions, so that our analysis implicitly assumes that the "additionality" criterion established in the Kyoto Protocol [Arts. 6.1(b) and 12.5(c)] is satisfied. We do not attempt to address the considerable political and practical problems of measurement and verification that are associated with this criterion, but we will account for the effect of these problems in a subsequent section.<sup>2</sup>

The main body of the paper consists of five sections. Section 2 uses the MACs to analyze three basic cases: no emissions trading, emissions trading limited to Annex B parties (including the Former Soviet Union), and full global trading. Results are presented in graphical form in the text,

<sup>&</sup>lt;sup>2</sup> UNCTAD (1998) contains an excellent discussion of these issues.

and the regional detail--in terms of abatement, costs, emission permit trade and prices for all the cases discussed--is presented in tabular form in Appendix B.

The next three sections address the effects of various departures from the three basic cases. The first departure, in Section 3, is the effect of limitations on imports of emission permits, as might correspond to the "supplementarity" criterion included in the Kyoto Protocol [Arts. 6.1(d) and 17] or to the recent call by the EU environmental ministers for a "concrete ceiling" on emissions trading. Section 4 evaluates the effect of surcharges on emission permits generated under the Clean Development Mechanism (CDM), as also provided in the Kyoto Protocol [Art. 12.8], and of non-competitive pricing. The third departure, discussed in Section 5, is the effect of a smaller supply of permits from the non-Annex B regions than is indicated by EPPA's assumptions of complete economic rationality and zero transaction costs, which we term "inefficient supply."

In Sections 2 through 5, the measure of welfare used is the total direct resource cost required to meet the emissions constraint. As explained in Appendix A, for any country this cost is the area under its marginal abatement curve up to any point of constraint, corrected for any purchase or sale of emissions permits. This is the conventional measure which is generated using the MAC approach. However, because the MACs are generated at the country level, they are not able to take account of effects that are mediated through international trade in energy or other goods. As shown in Appendix A, the MAC results themselves are not sensitive to trade effects. Nevertheless, these effects will influence sub-national details, such as patterns of trade in particular goods and activity at the sectoral level. To explore these effects, we depart from the MAC analysis in Section 6, and present results taken directly from the EPPA model.

In Section 7 we offer some concluding observations.

In conducting our analysis, we will make frequent reference to the twelve regions represented in EPPA, which are listed below with the model's acronyms.

ANNEX	B REGIONS:	Non-Annex B Regions:				
USA:	USA	EEX: Energy Exporting Countries				
JPN:	Japan	CHN: China				
EEC:	European Union (12 countries)	IND: India				
OOE:	Other OECD Countries	DAE: Dynamic Asian Economies				
EET:	Eastern Economies in Transition	BRA: Brazil				
FSU:	Former Soviet Union	ROW: Rest Of World				

#### Definition of Regions in the EPPA Model

The CO<sub>2</sub> emission reductions required of Annex B regions are calculated as the differences between EPPA's predicted emissions for these regions in 2010 and the goals established at Kyoto

for the constituent parties, which are generally stated as a percentage of 1990 emissions, as indicated in Table 1 below.<sup>3 4</sup>

		<u>USA</u>	<u>JPN</u>	<u>EEC</u>	00E	EET	<u>FSU</u>	Non An. B
Ref emissions 1990	(Mton)	1362	298	822	318	266	891	2022
Ref emissions 2010 (Mton)		1838	424	1064	472	395	763	4142
Kyoto commitments	Kyoto commitments / 1990		94%	92%	94.5%	104%	98%	NA
Hence Emissions Ta 2010 (Mto		1267	280	756	301	273	873	4142
i.e. Reduction / ref	<u>Mton</u>	571	144	308	171	118	0	NA
	<u>%</u>	31%	34%	29%	36%	30%	0	NA
"Hot Air" (Mton)		0	0	0	0	0	111	NA

Table 1: Emissions Levels Corresponding to Kyoto Commitments

Only five of the six EPPA regions encompassing Annex B countries are constrained by the commitment made at Kyoto<sup>5</sup> and these five will subsequently be termed the Kyoto-constrained regions. For the sixth Annex B region, the FSU, emissions are predicted to be below the aggregate level to which the principal nations constituting the FSU—Russia, the Ukraine, and the Baltics—committed at Kyoto. The difference between the FSU commitment and predicted emissions is controversially called "hot air," but in our analysis we assume that it constitutes a "right to emit" that can be exported. For the non-Annex B regions, as well as for the FSU, any reduction from 2010 reference emissions also generates a permit for export to the Kyoto-constrained regions.

<sup>&</sup>lt;sup>3</sup> Under Kyoto Protocol accounting, as best it is understood, this procedure involves the implicit assumption that all other GHGs are also reduced by the same percentage below the appropriate baseline value for each. No costs are included for these controls in our study, nor is any account taken of possible carbon sinks.

<sup>&</sup>lt;sup>4</sup> The correspondence between regional aggregates in EPPA and Annex B parties is not exact. For instance, Turkey is included in OOE (Other OECD), but it is not an Annex B party. Similarly EET includes all of the former Yugoslavia, but only Slovenia and Croatia are Annex B parties. Likewise, the Central Asian Republics are included in the FSU, but they also are not Annex B parties. Furthermore, the Kyoto commitments indicated for these EPPA regions depend upon our weighting of various constituent Annex B countries. Finally, the Annex B countries constituting the EET committed to targets at Kyoto that were from 5% to 8% below baseline emissions; however, these countries were allowed to choose an alternative to 1990 as the baseline year. Based on the national communications to date, the change of baseline year appears to translate into a limitation that is 4% above 1990 emissions for this region as a whole. The term 'hot air' refers to the amount by which any country's emissions are expected to be below the Kyoto Commitment, which is widely expected to be the case for the FSU.

<sup>&</sup>lt;sup>5</sup> The Kyoto Protocol refers to the targets established for Annex B parties as "legally binding commitments," although neither the legal structure nor the sanctioning mechanism are evident. In this paper, we use the terms "goals," "targets," and "commitments" more or less interchangeably.

# 2. THREE BASIC CASES: NO TRADING, ANNEX B TRADING AND FULL GLOBAL TRADING

Three basic cases are used to illustrate the effects of the Kyoto Protocol and the role of emissions trading. The first case is an autarkic one in which Annex B parties meet their Kyoto commitments without any emissions trading. As a result, the FSU and non-Annex B regions are affected only through the prices and quantities of goods traded with the Kyoto-constrained regions. In the second case, Annex B parties (including the FSU) trade emission permits among themselves. Emissions trading within Annex B reduces the costs of the Kyoto commitment for the constrained regions, and the FSU finds a new source of export revenue; but non-Annex B countries will continue to be affected only through conventional trade linkages. The third basic case examines emissions trading on a global scale in which non-Annex B countries join the FSU in earning export revenue from supplying permits to Annex B countries. Further variations of these basic cases will be developed in subsequent sections, but these three frame the salient alternatives.

#### a) The Autarkic, No-Trading Case (Fig. 1, Table A)

<u>Fig. 1</u> presents the MACs and the costs associated with the carbon emission reductions required of each of the Kyoto-constrained regions (excluding the FSU) when there is no emissions trading. The black diamonds on the MACs indicate, on the horizontal axis, the quantity of abatement required of each region (cf. Table 1), and, on the vertical axis, the shadow price of carbon for the region. The shadow price is the marginal cost for the last ton abated. The autarkic marginal cost of abatement for Japan (\$584/ton) is much higher than the marginal costs for the EEC (\$273), the OOE (\$233), the USA (\$186), or the EET (\$116). The areas under the curves represent the total costs of abatement for each region, which sum to \$120 billion. The details are shown in Appendix B, Table A.

With no emissions trading, there are no export earnings for the FSU or the non-Annex B regions. None of these regions would have any incentive to abate in order to generate "rights to emit" for export; and, of course, the FSU would not be able to export its "hot air."

#### b) Annex B Trading (Figs. 2 and 3, Table B)

<u>Fig. 2</u> shows the effect of Annex B trading on the Kyoto-constrained regions. At the market clearing price of \$127/ton, the OECD regions (USA, EEC, JPN, OOE) are importers of permits and the EET and FSU are exporters. As an unconstrained Annex B party, the FSU accounts for virtually all of the exports (98%). As shown in <u>Fig. 3</u>, about a third of these consist of "hot air," with a cost of zero; but the remaining exports are generated by abatement undertaken to earn additional export profits up to the point where marginal abatement cost equals the market price. It costs the FSU \$10 billion to abate 234 megatons (Mton), but the permits can be sold for \$30 billion for a net gain of \$20 billion. When added to the \$14 billion earned for exporting 111 Mton of the unused Kyoto entitlement, the FSU's total gain from emissions trading is \$34 billion.

<sup>&</sup>lt;sup>6</sup> The MACs for the OOE and EET are virtually identical and are therefore superimposed in Fig. 1.

<sup>&</sup>lt;sup>7</sup> All prices and costs are in 1985 US\$. Multiplication by 1.5 converts these figures into current (1998) US dollars.

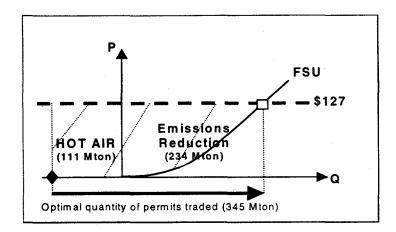


Fig. 3: Trade with FSU: the 'hot air' effect

For the five Kyoto-constrained regions depicted on Fig 2, the cost of meeting the Kyoto commitment is reduced by \$32 billion. This is the area of the hatched triangles, which represent costly domestic abatement avoided by importing permits for the four OECD regions and the export earnings for the EET. From the standpoint of world resource use, the aggregate cost of meeting the Kyoto commitments is much lower with Annex B trade (\$54 billion) than without (\$120 billion). The total gains from emissions trading are \$66 billion, split about evenly between the FSU (\$34 billion) and the OECD + EET (\$32 billion).

The distribution of the reduction in costs (that is, the gains from emissions trading for the Kyoto-constrained regions) is distributed roughly in proportion to autarkic marginal cost. The two regions with the highest autarkic marginal costs, Japan and the EEC, benefit the most from traded permits. Japan imports 66% of its reduction requirement and reduces its cost by \$19 billion. The EEC imports 35% of its reduction requirement and reduces its cost by \$7 billion. These two regions account for about one-third of the total emission reduction requirement for the five Kyoto-constrained regions, and about five-sixths of the gains from emissions trading for these regions accrue to them. The other three regions are characterized by autarkic marginal costs much closer to the Annex B market price; consequently, they trade much less. The USA and OOE are importers for 19% and 25% of their respective requirements, and the EET reduces emissions by 5% more than required in order to export permits. The gains for these regions, which account for two-thirds of the total reduction requirement, total \$5 billion, about a sixth of the gains from trading for the Kyoto-constrained regions.

This distribution of the gains from trade reflects an important feature of emissions trading. Regions with autarkic marginal cost farther from the trading equilibrium will import or export more (and benefit more) than those regions with autarkic marginal cost closer to the trading equilibrium. Thus, Japan and the EEC benefit most from emissions trading among the importers, as does the FSU, not just because of the "hot air," but also because its autarkic marginal cost (\$0/ton) is far from the market price.

#### c) Full Global Trading (Fig. 4, Table C)

To illustrate full global trading, we rely on aggregate supply and demand curves for emissions permits (not abatement), as explained in the Appendix A and illustrated in <u>Fig. 4</u>. These curves indicate the total quantities of permits that would be supplied or demanded at various price levels in a given market. In Figure 4, there is only one demand curve because the Kyoto-constrained

regions are the same in both the Annex B and the global markets. Only the supply changes, reflecting the large amount of low-cost carbon abatement that becomes potentially available with the shift to global trading. The ample supply of permits from non-Annex B regions results in a market price that is much lower (\$24/ton) than in the Annex B trading case. The total cost of reducing global CO<sub>2</sub> emissions to achieve the Kyoto goals is reduced dramatically: \$11 billion vs. \$54 billion or \$120 billion in the other two cases!

At this price, the Kyoto-constrained regions depend far more on imports than when trading was restricted to Annex B regions only. In the aggregate, 71% of OECD + EET commitments are met by importing emission permits from non-constrained regions; and the percentage reliance upon imports reflects autarkic marginal cost: Japan, 92%; EEC, 76%; USA, 68%; OOE, 66% and EET, 56%. On the suppliers' side, three countries account for the bulk of exports: China (47%), the FSU (23%) and India (11%), hence 81% altogether. Whether because of relatively small size or high relative abatement costs, the remaining four non-Annex B regions are small suppliers of emission permits to the Annex B regions.

With full global trading, the gains from emissions trading are much greater for the Kyoto-constrained regions (\$94 billion vs. \$32 billion with Annex B trading). The non-Annex B regions gain \$10 billion by exporting permits, but their gains are markedly less than those of the Kyoto-constrained regions. The FSU is the only party that is made worse off by this widening of the market. At \$24/ton, the FSU abates about half as much as before, (101 Mton), and the "hot air" is worth much less. As a result, the FSU's net gain (\$4 billion) in the global market is much less than its \$34 billion gain when it does not compete with the non-Annex B regions.

The distribution of the gains from emissions trading in the global market illustrates again the feature of emissions trading we just noted: regions whose autarkic marginal cost is further from the equilibrium price benefit more than regions whose marginal cost is closer to that price. In this global trading case, the clearing price is much closer to the suppliers' autarkic marginal cost (\$0/ton) than it is to the autarkic marginal cost of any of the importers.

#### d) Effect of Higher and Lower Economic Growth (Figs. 5 and 6, Tables A' to C', A" to C")

The three basic cases, and those to be presented hereafter, provide point estimates of prices, quantities and costs. In this section, we briefly note the effect of different assumptions about economic growth, namely, that it is 10% higher and 10% lower than in the reference EPPA projection for all regions. Fig. 5 shows the effect of higher and lower growth rates for illustrative Kyoto-constrained regions (JPN, EEC and USA), and Fig. 6 shows the effects on aggregate supply and demand for permits in the Annex B and full global markets.

The effects of higher or lower growth on emissions is typically fairly small, always less than  $\pm$  5%, but the Kyoto commitment is fixed so that the effect on the required reduction is amplified. For instance, for the Kyoto-constrained regions, the variation in total required emission is  $\pm$  13-14%. Finally, the change in total costs, without trading, is even greater ( $\pm$  31-36%), because the most expensive abatement, that on the margin, represented by the hatched area in Fig. 5, is what is being increased or decreased by the variation in economic growth.

When aggregated into demand and supply curves for permits, the variation in economic growth has a large effect on demand, but not much on supply since most of the supply comes from unconstrained regions, the FSU or the non-Annex B countries. The chief effect upon supply within

the relevant price range is through the influence on hot air. Higher growth reduces hot air and shifts the supply curve inward; and conversely, for lower economic growth.

The effect of higher or lower economic growth on the price and quantities of traded permits is very different in the Annex B and full global trading markets. In the former, the volumes traded change very slightly ( $\pm$  12 Mton), but the price varies greatly ( $\pm$  \$40). In a market limited to Annex B regions, most of the incremental effort required by higher or lower growth translates into more or less domestic abatement. In contrast, for full global trading, the aggregate supply curve is flatter, so that the variation in the volume of traded permits is greater ( $\pm$  120 Mton) but the variation in price much less ( $\pm$  \$6).

The variation in total cost for the Kyoto-constrained regions is slightly greater in the trading cases than in the non-trading case ( $\pm$  36-42% vs.  $\pm$  31-36%) because with lower or higher growth, greater or smaller amounts of hot air from the FSU enter the trading system.

#### e) Per Capita Emissions (Fig. 7)

As a further summary statistic, the effect of the Kyoto commitment and of the scope of trading can be shown in per capita terms. <u>Table 2</u> below provides full regional detail, but the essential features can be grasped by reference to <u>Fig. 7</u>, where per capita emissions in 2010 are shown for the USA, the five Kyoto-constrained regions as a group, the FSU, the Non-Annex B regions, and the world.

TABLE 2a. PER CAPITA EMISSIONS IN THE REFERENCE CASE AND IN THE THREE BASIC TRADING CASES											
	USA	JPN	EEC	OOE	EET	OECD + EET	FSU	Non- An. B	World		
Pop. in 2010 (million)	277.2	125.0	341.9	135.8	128.5	1008.3	324.5	5585.7	6918.5		
Reference (tonC/cap)	6.63	3.39	3.11	3.48	3.07	4.16	2.35	0.74	1.32		
No Trading (tonC/cap)	4.57	2.24	2.21	2.21	2.15	2.86	2.35	0.74	1.13		
Annex B Trading (tonC/cap)	4.95	3.00	2.52	2.53	2.11	3.20	1.63	0.74	1.14		
World Trading (tonC/cap)	5.98	3.30	2.90	3.04	2.67	2.78	2.04	0.61	1.14		
TABLE	2b. D	ETAIL	S FOR	NON-A	ANNEX	( B REG	IONS				
	EEX	<b>(</b>	CHN	IN	ID D	DAE	В	RA	ROW		
Pop. in 2010 (million)	1103	.8	1376.9	113	32.4	236.8	19	9.9	1535.8		
Reference (tonC/cap)	0.84	1	1.30	0.	43	1.30	0.	49	0.35		
World Trading (tonC/cap)	0.79	•	0.98	0.	34	1.13	0.	47	0.29		

The Kyoto commitment reduces per capita emissions in all the Kyoto-constrained regions; however, the reduction is less severe, the greater the scope of trading. In full global trading, as an example, per capita emissions are reduced by 14% on a global scale, but by a greater percentage in the non-Annex B regions since the share of the global emission reduction in the non-Annex B regions is greater than their share of emissions: the aggregate OECD+EET reduction is 9%, while the FSU reduction is 13% and the non-Annex B reduction is 18%.

Within the Kyoto-constrained regions, the reduction in per capita emissions varies considerably depending on the extent to which the region imports permits. At one extreme is Japan, where per capita emissions would be less by only 2.7% because it imports 92% of its emission reduction obligation. The greater percentage reductions in the other constrained regions reflect their lesser dependence on permit imports: EEC, -6.7%; USA, -9.8%; OOE, -12.6%; and EET, -13.0%. Finally, as shown in the figure, neither the Kyoto commitments nor the scope of trading do much to change the ratio of emissions per capita between the industrialized and developing economies of the world.

# 3. IMPORT LIMITATIONS (Fig. 8, Tables D to F)

The three illustrative cases presented above are based on several assumptions:

- Potential participants in emissions trading are not impeded by restrictions on trading,
- All parties participate to the extent warranted by the economics,
- Trading is conducted efficiently with low or non-existent transactions costs, and
- There is no monopolistic behavior.

Such assumptions simplify exposition and the analysis of emissions trading, but they are not necessarily realistic. One of the possible departures from this theoretical ideal is a limit on the extent to which an Annex B party can rely on emission permits to reduce what otherwise would be its domestic abatement requirement. The "supplementarity" provisions of the Kyoto Protocol suggest such a limit, although no specific number has been agreed upon. More recently, the EU environmental ministers have called for a "concrete ceiling" on permit imports.

To illustrate the implications of such a restriction, we consider limits of 75%, 50% and 25% on any Annex B party's ability to meet its emission reduction requirement through imported permits. From the full global trading case without restrictions, we know that Japan would optimally realize 92% of its Kyoto commitment through imports, so that with a 75% limit, it would have to abate more domestically. The EEC would also be affected, but to a very slight extent since it would otherwise import 76% of its emission reduction requirement; but none of the other importing regions would be affected. With a 50% limit, all regions would be limited and forced to abate more domestically at higher cost; and at a 25% limit, the reliance on higher cost domestic abatement would be even greater.

<u>Fig. 8</u> shows how the demand curve is shifted inward by such limitations, and <u>Table 3</u> summarizes the effects on prices, quantities and costs. The "No Limit" case is the same as full global trading, and it is provided for comparison.

<sup>&</sup>lt;sup>8</sup> The Kyoto Protocol specifies only that "trading shall be supplemental to domestic actions." We define this potential limitation as a percentage relative to the emission reduction implied by the Kyoto commitment without trading, given EPPA's prediction of reference emissions.

TABLE 3: Effects of Import Limits on Global Emissions Trading										
·	No Limit	75% Limit	50% Limit	25% Limit						
Market Price (85US\$/tonC)	\$24	\$23	\$13	\$3						
Quantity Traded (Mton C)	935	913	656	328						
FSU (Mton)	211	209	183	148						
Non Annex B (Mton)	723	704	473	180						
World Cost (Billion US85\$)	\$11.2	\$11.9	\$21.7	\$55.3						
OECD+EET Cost	\$25.6	\$25.4	\$27.1	\$56.1						
FSU Gain	\$4.2	\$4.0	\$2.0	\$0.5						
Non Annex B Gain	\$10.2	\$9.5	\$3.4	\$0.3						

The effect of import limits upon the exporting regions is predictable. With less demand, the market price falls, fewer "rights to emit" are produced and exported, and there is a drop in the gains to exporters. The effects on importers are twofold. Importers that are not affected by the limitation import more, and at a cheaper price; thus they realize more savings. They are better off because the limitation removes some of the demand by higher cost abaters from the market. Importers who are affected by the limitation also benefit from this lower market price on their imports, but they also incur higher domestic abatement cost. For instance, with the 75% limit, the net balance between these two opposing effects is positive for the EEC (+1.14% gains) but negative for Japan (-1.94%).

The overall effect of the 75% limit is relatively slight: the world cost increases slightly (6.5%), the quantity traded is 2% less, the price falls by 4.1%, and the cost to the Kyoto-constrained regions is reduced slightly. With a 50% or 25% limit on imported permits, all the importing regions are restricted, and the price of imports is much lower, \$13 and \$3, respectively. Among the importing regions, the effects of this tighter limit depend upon the balance between higher domestic abatement costs and cheaper import costs. At 50%, this balance is now negative for both EEC and Japan, but the benefit of the much cheaper imports continues to outweigh the higher domestic abatement costs for the other three importing regions. With a 25% limit, all the importing regions are worse off than they would be without any limit on imports, and the percentage increases in cost are greatest for the higher cost producers of abatement among the importing regions (JPN, +425%; EEC, +123%; OOE, +73%; USA, +58%; EET, +5%).

From the standpoint of the suppliers, the effect of a limitation on imports is to skew the distribution of gains from trading even more heavily in favor of the importing regions. It can be seen in Table 2 that, as the limit becomes more stringent, greater domestic abatement by the importing regions causes world cost. to rise, but at least up to the 50% limit, the total cost for the importing regions remains relatively constant, at \$25-27 billion. In contrast, for the exporting regions, the gains from emissions trading diminish markedly. The global efficiency losses due to the import limit are

<sup>&</sup>lt;sup>9</sup> Consumers will not receive the benefit of cheaper imports since the discrepancy between the internal marginal abatement cost and the world market price creates a rent for the allowed imports that will be collected somehow, perhaps through a government auction of the rights to import permits. Since this sum is a internal transfer, we do not count it as a resource cost. We are indebted to Ken Chomitz of the World Bank for pointing out this feature of our analysis.

effectively shifted to the exporting regions through the lower price of imported permits. Only when the limit becomes very tight and the price of permits is very low, for instance within 25% limit, do the increases in domestic abatement costs outweigh the benefits of cheaper imports, and the importing regions start to absorb the efficiency losses.

The effect of a quantitative limit on imports can be summarized quickly. To the extent that it is binding, it redistributes the gains from trading among the importing regions from those facing the highest abatement costs to those facing the lowest costs. Furthermore, and at least initially, it shifts the increase in global cost caused by a binding import limit onto the suppliers.

#### 4. CDM "SURCHARGES" AND CARTELIZATION OF SUPPLY

Departures from the theoretical ideal can also arise on the supply side. The Kyoto Protocol provides for a Clean Development Mechanism (CDM) by which non-Annex B emissions reductions would be certified and made available as emission permits for Annex B countries. The exact role of the CDM has yet to be defined, but the Protocol does provide that the CDM would apply a surcharge to cover its administrative expense and to collect funds to assist countries "to meet the cost of adaptation" (Article 12.8). Also, because of the inelasticity of demand at low market prices, there is a possibility that suppliers could increase their gains significantly by colluding to limit supply, instead of competing among themselves.

## a) CDM Surcharges (Fig. 9, Tables G to I)

CDM surcharges would create a wedge between the price paid by consumers and that received by producers, as illustrated in <u>Fig. 9</u> for surcharges of 25%, 50% and 100% of the marginal cost of supply. <u>Table 4</u> provides details concerning prices, quantities and gains. Surcharges of 50% or 100% are beyond any level being discussed currently, but they do illustrate the effects of inelastic demand. Since FSU exports would not be surcharged, we treat the FSU as a competitive supplier in all these cases.

TABLE 4. PRICES, FLOWS AND GAINS WITH A CDM SURCHARGE										
LEVEL OF CDM SURCHARGE None 25% 50% 10										
Market Price (85\$)	\$23.8	\$27.4	\$30.6	\$35.9						
Producers Marginal Cost (85\$)	\$23.8	\$22.0	\$20.4	\$17.9						
CDM Net profit (billion \$)	\$10.2	\$12.6	\$14.4	\$17.0						
Profit to producers	\$10.2	\$8.9	\$7.9	\$6.3						
Surcharge Proceeds	\$0	\$3.7	\$6.6	\$10.7						
CDM Exports (MtonC)	723	687	654	602						
FSU Exports (MtonC)	211	219	225	235						
FSU Gains (billion \$)	\$4.2	\$5.0	\$5.7	\$6.9						
OECD+EET Cost (billion \$)	\$25.6	\$28.9	\$31.7	\$36.3						
World Cost (billion \$)	\$11.2	\$15.0	\$18.2	\$23.0						

The most notable feature of Table 4 is that CDM net profit, defined as revenue minus abatement cost, increases as the surcharge is raised even though importers reduce demand in response to the higher prices. This phenomenon reflects the price inelasticity of demand over this portion of the aggregate demand curve. As would be true of any tax, there is a welfare loss, equal to the increase in world cost as a result of the more expensive abatement undertaken by importers.

The second notable feature of Table 4 is that producer profit decreases on the assumption that surcharge revenue goes to the CDM. Of course, the distribution of the proceeds raised by the surcharge would be a matter for the producers to decide. With inelastic demand, it would be theoretically possible to devise distributions that would keep producers whole and still make funds available for other purposes such as adaptation. Nevertheless, any redistribution of funds for such purposes will reduce what the non-Annex B producers might otherwise receive.

The implicit conflict between producer interests and re-distributive goals has larger implications for the evolution of the global climate regime. It will be readily evident to all non-Annex B producers that the greatest beneficiary from CDM surcharges is the FSU. As a competitive supplier, the FSU benefits directly from the increase of the market price and the increase of its exports. It is able to benefit doubly because, having accepted an Annex B limit on emissions, its exports are not surcharged. The example will be compelling for many non-Annex B producers, who will come to see Annex B accession as a way to by-pass the CDM. Proponents of the CDM will not be pleased, but such action is essential both to the creation of a more efficient global trading system and to achieving the stabilization of atmospheric concentrations of GHGs.<sup>10</sup>

Accession logically implies a transitional role for the CDM. So long as the CDM provides an essential service—recordation, certification and verification—for converting non-Annex B emission reductions into tradable emission permits, a reasonable fee can be charged. But that service, and the attendant role for the CDM, would no longer be needed as non-Annex B parties accept limits and arrange for their own certification and verification as part of the global emissions trading regime.

#### b) Cartelization of Supply (Tables J to L)

The ability to raise surcharges without diminishing net profit to non-Annex B producers may inspire thoughts of a cartel, not so much because of the CDM, which might serve as a coordinating mechanism, but because of the inelasticity of demand that characterizes the global emissions market. This potential is explored in <u>Table 5</u>, which compares the effects, under full global trading, for a fully competitive market and two alternative assumptions about non-competitive behavior:

- 1) A CDM cartel in which the FSU is a competitive supplier, and
- 2) A full supplier monopoly in which the FSU and the non-Annex B countries cooperate through the CDM or an alternative mechanism.

In calculating the gains for the FSU and the non-Annex B regions, we assume that the monopoly rent, the difference between market price and marginal cost, is shared in proportion to the quantity

<sup>&</sup>lt;sup>10</sup> See Yang and Jacoby (1997) and Jacoby, Prinn and Schmalensee (1998).

<sup>&</sup>lt;sup>11</sup> In contrast, there is little potential for non-competitive behavior in the Annex B case because of the higher price and more price elastic demand, as discussed in Ellerman and Decaux (1998).

of abatement provided at marginal cost. In doing so, we also assume a highly efficient cartel in which only the lowest cost sources of permits are produced (including the FSU's hot air).

TABLE 5. EFFECT OF NON-COMPETITIVE BEHAVIOR ON GAINS FROM TRADE, COSTS AND PRICES								
Competitive Non-Annex B Non-Arcase cartel + F								
Market Price (\$/metric ton C)	\$23.8	\$62.7	\$108.2					
World Cost (billion 85US\$)	\$11.2	\$20.0	\$32.2					
Non-Annex B Gains (billion \$)	\$10.2	\$22.4	\$30.1					
FSU Gains (billion \$)	\$4.2	\$13.8	\$17.4					
OECD+EET Gains (billion \$)	\$94.2	\$63.6	\$39.2					

Successful monopolization has the expected effects: the market price is higher, as is world resource cost, and the gains from trade are shifted substantially to the suppliers. In the case of the CDM cartel for example, the importing regions lose \$32 billion: the \$9 billion increase in global costs plus a \$23 billion transfer of income to the suppliers. With the full supply monopoly, the importing regions lose another \$25 billion, \$12 billion in increased resource cost and another \$13 billion transfer to the suppliers. Even though this is a dramatic change in the distribution of the gains from permit trade, the Kyoto-constrained regions are still better off (by \$7 billion) than if there were no supply at all from the non-Annex B regions. The FSU is, however, always worse off, even when the suppliers successfully create an efficient monopoly.

The incentive to collude would be even greater if limits were placed simultaneously on import demands, since the effect of such limits is to make demand more inelastic. <u>Table 6</u> makes the point. It shows the effect of the full monopoly on price, world cost and gains when there is no limit on permit imports and when a 50% limit is set.

TABLE 6. EFFECT OF MONOPOLY ON GAINS FOR SUPPLIERS WHEN LIMIT ON PERMIT IMPORTS									
	Limit on imports	Competitive case	Non-Annex B + FSU monopoly						
Market Price (\$/metric ton C)	No limit	\$23.8	\$108.2						
	50% limit	\$12.5	\$103.4						
World Cost (Billion 85US\$)	No limit	\$11.2	\$32.2						
	50% limit	\$21.7	\$37.6						
Non-Annex B Gains (billion \$)	No limit	\$10.2	\$30.1						
	50% limit	\$3.4	\$26.2						
FSU Gains (billion \$)	No limit	\$4.2	\$17.4						
	50% limit	\$2.0	\$16.3						
OECD + EET Savings (billion \$)	No limit	\$94.2	\$39.2						
	50% limit	\$92.6	\$39.8						

The effect of successful monopoly is much the same whether or not there are import limits. The market price rises to about the same level, \$103 vs. \$108, world cost increases, and the exporting regions gain significantly at the expense of the importing regions. The effect of a 50% import limit is also much the same whether a competitive market or a monopoly is assumed. The market price is reduced, world cost increases, and producer gains are diminished, but by less when there is a monopoly.

# 5. INEFFICIENT SUPPLY (Figs. 10 and 11, Tables M to Y)

Full global trading is an appealing prospect, to importers for the great reductions in cost and to exporters for the possibilities of non-competitive pricing, but both importers and exporters should remember that the potential trading gains shown by CGE models assume complete economic rationality and negligible transactions cost. The more likely contour of global emissions trading is that this potential will not spring forth full blown once trading is allowed, but that it will develop only slowly as experience is gained. Fig 10 depicts several possibilities for less than fully efficient supply in which it is assumed that 5%, 10%, 15%, 25%, and 50% of the supplies from the FSU and non-Annex B regions are available at every price. The lowest line, corresponding to 100%, is fully efficient global trading.

Inefficient supply could result from several causes. The most serious and most likely is the influence of transaction cost, particularly that involved in meeting the "additionality" criterion. Past experience with credit-based emissions trading systems applied to other environmental problems and with Joint Implementation pilot projects has shown these costs to be large and the quantities traded to be small. Alternatively, a general failure to take full advantage of economic opportunities presented by emissions trading would also limit the amount of credits available from the non-Annex B regions and the FSU. Finally, some non-Annex B countries have expressed considerable antipathy to emissions trading as a concept; and they may decide not to participate in an emissions trading regime, whether through the CDM or otherwise, for political reasons. It is not possible to assess beforehand to what extent these causes might operate in a global market, but they will certainly be present.

If the supplies from the global market are very small initially, say 5% of the full global potential, then the market price for permits would be relatively high (\$181) and the quantities traded small (170 Mton). As experience is gained and supplies become more ample, the quantities traded would increase and prices fall. The gains from emissions trading increase with improved efficiency of supply and they become quite large well before attaining 100% efficiency. As shown in Fig 11,

EPPA 2.6 is not alone in making such forecasts. The recent malysis provided by the U.S. Council of Economic Advisors to support Chairman Janet Yellen's earlier testimony, USG/EOB (1998), obtains a similarly low permit price for a comparable market.

Expansion in the scope of trading would occur in periods after 2010, when permit demands and supplies might vary depending on growth and subsequent climate agreements. This illustration, using a static 2010 picture, shows the nature and approximate magnitude of the changes over time.

<sup>&</sup>lt;sup>14</sup> See UNCTAD (1998) for a discussion of the relative efficiency of allowance and credit based trading systems. These costs will be greatly reduced to the extent that non-Annex B regions accept emission caps that remove the concern about additionality and the necessity to establish a counterfactual baseline. Curiously, the Kyoto Protocol also asserts "additionality" as a criterion for joint implementation projects within Annex B countries (cf. Art. 6).

total gains increase steadily, but those for exporters increase only up to a point a little above 15%. Thereafter, the relatively inelastic demand causes the gains to exporters to decline, while those to the importers increase dramatically.

When supply is very inefficient, the market distortions considered earlier have little effect. For example, as severe a limitation on demand as a 25% ceiling would affect only Japan if supplies from the FSU and non-Annex B regions were only 5% of the full potential. And at the prices reflecting very inefficient supply, there would be no gain to monopoly. Nevertheless, as supply becomes more efficient and prices decrease, a limitation on imports would become more binding; and as the market clearing price moved into the inelastic range (below about \$110), non-competitive pricing could become more of a concern.

With inefficient supply, the effect of CDM surcharges will also depend on the elasticity of demand. In the inelastic range (low price, large quantity), corresponding to greater supply from the non-Annex B regions, the surcharge can result in greater gains for exporters, so that it is at least possible to keep producers whole (compared to no surcharge) and generate funds for other purposes. However, in the inelastic range (high price, small quantity), any surcharge will reduce the total gain to be shared between producers and other claimants.

As would be expected, inefficient supply implies a higher market price, greater world cost and fewer gains from trade, but the gains will still be substantial and decidedly worth pursuing. The effects of distortions, such as import limitations and non-competitive pricing, are the same as with fully efficient supply, but the magnitude of the effect is less because there is less to lose. Perhaps the most notable feature of inefficient supply is that the gains to early entrants in the global emissions market will be very large. Thereafter, as is true for any innovator, the large initial reward will dissipate as imitators follow.

#### 6. INTERNATIONAL TRADE IN ENERGY AND NON-ENERGY GOODS

MACs provide a simple and direct way to study emissions trading, but they do not indicate the effect of abatement actions on the prices and quantities of goods in international trade. The effects of emissions reductions may not be restricted to the countries undertaking the abatement actions. Through trade they may be transmitted to countries that made no commitment. In this section, we depart from the use of MACs and examine these other effects using the EPPA results directly.

The central feature driving these trade-in-goods effects is the shadow price for carbon that is faced by the Kyoto-constrained regions, and the effect of that shadow price on the world price for oil and natural gas. <u>Table 7</u> provides a quick summary of those prices for the 2010 reference case and our three basic emissions trading scenarios. Carbon prices are shown in 1985 dollars; oil and gas prices are shown as an index with the 2010 price in the reference case set to 1.0.

TABLE 7. CARBON AND ENERGY PRICES IN 2010 for Kyoto-constrained regions										
	Annex B	Global								
Carbon Price	\$0	\$116-584	\$127	\$24						
Oil Price	1.0	0.90	0.95	0.99						
Natural Gas Price	1.0	0.83	0.86	0.96						

Oil and natural gas are treated as Hecksher-Ohlin goods in EPPA, which means that there is complete freedom of trade among regions and a single world price. As a result, restrictions on carbon emissions in Annex B countries lead to lower oil and natural gas prices for producers and consumers throughout the world. In contrast, coal is an Armington good, which means that there is no single world price but a series of regional prices that can be affected by changes in trade flows. Consequently, actions by the Annex B regions will affect coal prices in these regions, but generally not elsewhere, or only through the quantities traded (which are not great.)

As the scope of emissions trading expands and the price of carbon declines, the effect of Kyoto commitments on energy prices diminishes. This effect occurs because one of the cheapest forms of carbon abatement is the reduction of and substitution away from the use of coal. Emissions trading makes it possible to substitute reduced coal use in non-Annex B regions for more expensive abatement that reduces oil and natural gas use in Annex B regions.

The effects on trade patterns of the Kyoto commitments and emissions trading are most usefully observed by comparing the no trading case with full global trading. The former can be viewed as a relatively inefficient way of achieving the goals set at Kyoto, while the latter represents the most efficient way. Emissions trade limited to Annex B is an intermediate case, which we omit because its effects lie between what occurs with no emission trading and with full global trading.<sup>15</sup>

## a) Trade in Goods with No Emissions Trading

The starting point for the no emissions trading case is the effect of the carbon price on domestic demand in the Kyoto-constrained regions. <u>Table 8</u> provides the percentage change from the reference prediction for domestic use of sectoral output (production less exports plus imports) by each Kyoto-constrained region. The sectoral breakdown in EPPA includes five energy sectors (oil, gas, coal, electricity and refined oil) and three non-energy sectors (agriculture, energy intensive industries, and other industries).

7	TABLE 8. % CHANGE IN DOMESTIC USE BY SECTOR AND REGION DUE TO KYOTO COMMITMENT WITHOUT EMISSIONS TRADING												
USA JPN EEC OOE EET													
OIL	-3.5%	-19.6%	-4.0%	-7.6%	-3.4%								
GAS	-11.1%	-24.8%	-10.3%	-14.1%	-12.1%								
COAL	-54.5%	-48.8%	-52.1%	-63.2%	-49.4%								
ELEC	-11.1%	- <b>1</b> 1.3%	-12.2%	-13.1%	-19.7%								
REFOIL	-6.5%	<i>-</i> 20.3%	-7.7%	-10.6%	-7 <u>.</u> 7%								
AGR	-0.7%	-2.2%	-0.2%	-0.9%	-0.4%								
ENINTSV	-0.5%	-5.1%	-2.6%	-1.7%	-2.2%								
OTHIND	+0.1%	-1.1%	-0.2%	-0.4%	-0.6%								

With one insignificant exception, all the signs are negative, and they are greatest in magnitude for the energy sectors. Coal is hit hardest with domestic use declining by about half in all regions.

The FSU is the one exception. With Annex B trading, its demand for energy declines in the same manner as the Kyoto-constrained Annex B regions, as does its production and export of energy-intensive goods.

However, coal, like electricity and refined oil, is mostly a domestic good so that the international trade effect of this reduction in demand is not particularly great. Oil and gas are more heavily traded internationally, and the effect of the reduction in Annex B demand is a world-wide fall in the price of oil and gas: by 10% and 17%, respectively, as was shown above in Table 6. This reduction in price reduces the income of oil and gas producers throughout the world; and the effect will be particularly large on the two oil and gas exporting regions, the EEX and the FSU. Interestingly, the quantities of oil and gas traded internationally do not change much, but there is a shift in the destination of energy exports away from the Kyoto-constrained regions towards the non-constrained regions, as illustrated next, through trade in energy-intensive goods.

The domestic use of energy-intensive goods declines in all Kyoto-constrained regions; however, the most significant effects show up in the trade balances and domestic output for these goods, as shown in Table 9.

TABLE 9. CHANGES IN EXPORT, IMPORT AND OUTPUT OF ENERGY INTENSIVE GOODS: NO EMISSIONS TRADING												
Absolute Change in:	USA	JPN	EEC	OOE	EET	FSU	EEX	CHN	IND	DAE	BRA	ROW
Net trade	-2.57	-30.96	-26.20	-6.29	-1.61	+7.93	+22.8	+6.78	+1.13	+6.07	+1.86	+21.1
Output	-6.90	-61.68	-42.25	-9.31	-4.99	+9.81	+21.1	+15.3	+2.74	+15.8	+3.46	+22.9

The patterns are very clear. The Kyoto-constrained regions reduce production and net exports of energy-intensive goods, while the non-constrained regions increase output and net exports of them. The Kyoto-constrained regions increase imports of these goods, and of the non-taxed carbon that is embodied in them.

#### b) Comparing the No-Trading Case with Full Global Trading

Meeting the Kyoto commitments with full global trading has much less effect on Ani.ex B demand for oil and gas and on the trade in energy-intensive goods than was the case with no emissions trading, as shown in Table 10 and Table 11.

The greater effect upon natural gas results from the greater responsiveness to price changes in the industrial and residential sectors, where natural gas is mostly used, than in the transportation sector, where petroleum products dominate. Both oil and natural gas gain share in electricity generation at the expense of coal, but electricity demand also shrinks. In the end, the balance between the losses in non-electricity sectors and the gains in electricity generation are less favorable for natural gas than for oil.

TABLE 10: % CHANGE IN DOMESTIC USE BY SECTOR AND REGION DUE TO KYOTO COMMITMENT WITH FULL GLOBAL TRADING											
	USA	JPN	EEC	OOE	EET						
OIL	-0.2%	-0.2%	-0.2%	-0.3%	-0.5%						
GAS	-0.5%	-0.5%	-0.7%	-0.04%	-0.9%						
COAL	-21.5%	-5.0%	-13.2%	-25.0%	-15.4%						
ELEC	-2.5%	-0.3%	-1.6%	-2.3%	-5.0%						
REFOIL	-1.0%	-0.8%	-0.6%	-1.2%	-1.5%						
AGR	-0.1%	-0.1%	-0.03%	-0.1%	+0.2%						
ENINTSV	-0.1%	-0.1%	-0.1%	-0.1%	+0.02%						
OTHIND	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%						

The effects of the Kyoto Protocol remain negative, but the magnitudes are much attenuated. Coal use is reduced by at most a quarter; and the effect on other goods is generally less than 1%. The world prices for oil and natural gas are reduced by only 1.3% and 3.5%, respectively, instead of 10% and 17% in the no trading case.

TABLE 11. CHANGES IN EXPORT, IMPORT AND OUTPUT OF ENERGY INTENSIVE GOODS: FULL GLOBAL TRADING												
Absolute Change in:	USA	JPN	EEC	OOE	EET	FSU	EEX	CHN	IND	DAE	BRA	ROW
Net trade	+0.37	+0.30	-0.09	+0.16	+0.19	-0.71	+1.61	-2.60	-0.94	+0.53	-0.02	+1.22
Output	-0.59	-0.18	-0.93	-0.02	+0.21	-1.81	+0.45	-8.90	-2.25	+0.10	-0.01	+1.24

The changes in trade and output of energy-intensive goods are all relatively small; and there is no consistent pattern as in Table 9, because the price of carbon is the same in all countries. Output and the net trade position is most adversely affected in China, India and FSU because their production of energy intensive goods is more dependent on coal, which is the fuel most strongly affected by any positive price on carbon emissions.

#### c) Summary

The effects of the Kyoto Protocol and of emissions trading on non-Annex B regions consist of three analytically separate elements, which can be summarized by the following simple matrix.

TABLE 12: EFFECT OF KYOTO AND EMISSIONS TRADING					
KYOTO EFFECT	No Emissions Trading	Global Emissions Trading			
Permit Revenues	0	+			
Oil & Gas Export Revenue		•			
Energy Intensive Goods Trade	+	0			

Whether there is emissions trading or not, the effect of the Kyoto commitments on non-Annex B countries is mixed. Without emissions trading, there will be no permit exports, but an increase in the production and export of energy intensive goods can be expected, assuming no protective trade measures are enacted by the Kyoto-constrained regions. With global emissions trading, there will be permit export revenues, but no significant increase in production and exports of energy intensive goods. The revenues of Non-Annex B regions that export oil and gas will be adversely affected in either case, but much less so with the lower carbon price associated with a broadened market for emissions permits. In effect, oil and gas exporters benefit as emissions trading makes it possible for Kyoto-constrained regions to substitute reduced coal use in non-Annex B regions for reduced oil and natural gas use at home.

#### 7. CONCLUDING OBSERVATIONS

The effect on developing countries of Annex B actions to comply with the Kyoto Protocol will depend on the particular country and on the success of emissions trading. All developing economies will have an interest in emissions trading as a source of new export earnings, but their interest will extend beyond this new commercial possibility. In particular, oil and gas exporters will have a strong interest in emissions trading as a means to reduce the cost for Annex B parties generally, and specifically to allow Annex B parties to substitute reduced coal emissions abroad for reduced oil and gas emissions at home. It is possible that some countries and sectors would be adversely affected by emissions trading. For instance, the advantage enjoyed by producers of energy-intensive goods will be greater with no emissions trading, assuming that importing embodied carbon is permitted by the Annex B regions. The net balance will be different for various countries, but in general it seems likely that developing countries will benefit from emissions trading.

The gains from emissions trading are potentially very large, fully sufficient to give potential buyers and sellers an economic incentive to support such a system. Most studies of permit trade suggest ample supplies would be offered by non-Annex B regions, at commensurately low prices, yielding large cost reductions for the Kyoto-constrained regions and substantial benefits to non-Annex B regions. The actual supply is likely to be somewhat less, at least initially, due to transactions cost and less than complete participation in the market by non-Annex B regions. Nevertheless, whatever the initial extent of the market and its subsequent development, both importing and exporting parties will gain.

As in any market, the potential for welfare-damaging distortions is always present. Given the undefined meaning of "supplemental" in the Kyoto Protocol, a particularly alarming distortion from the developing country standpoint is a limitation on Annex B imports of emission permits. Not only will such limits depress permit prices and the export earnings of non-Annex B parties, but they will have perverse effects on importing countries. Annex B parties with relatively high domestic abatement costs, and thus higher imports, would be penalized, while those with relatively low domestic abatement costs, and fewer imports, would find the cost of meeting their Kyoto commitments reduced.

The ability of the CDM to impose surcharges to help countries meet the costs of adaptation will depend upon the elasticity of demand, which depends in turn on the supply available from non-Annex B regions. The greater the supply and the lower the price, the greater the ability to impose surcharges without fear of losing revenue. Still, there is an unavoidable conflict between the

interests of the producers of the permits and redistributive goals, since whatever is redistributed could as well be kept by the producers.

The FSU and the non-Annex B countries appear as clear rivals to each other in the stylized cases we have presented, but casting this rivalry in geopolitical terms obscures a more practical aspect. Neither the Annex B nor the global market will spring into life full blown as soon as the appropriate institutional arrangements are made; instead these markets will develop slowly over time. The stylized Annex B market should be thought of as illustrating the potential gains for first entrants of whatever provenance into a new and expanding market. Those gains will inevitably be dissipated as others follow, so that the conflict, which appears here as one between the FSU and non-Annex B regions, is really one between the early entrants and later followers.

The FSU does however have one large advantage. Assuming effective accounting and enforcement, its acceptance of an Annex B emission limitation removes the high costs of establishing additionality, which will be required of projects in non-Annex B countries. This example will encourage the most enterprising non-Annex B countries to accede to Annex B to capture more of the large gains of early emissions trading. In doing so, these parties will foster more efficient emissions trading and promote the ultimate goals of the Kyoto Protocol, but they will also necessarily reduce the ability of the CDM to act as a re-distributive mechanism.

#### **FIGURES**

Fig. 1: Annex B Meeting their Kyoto Commitment, No Trading

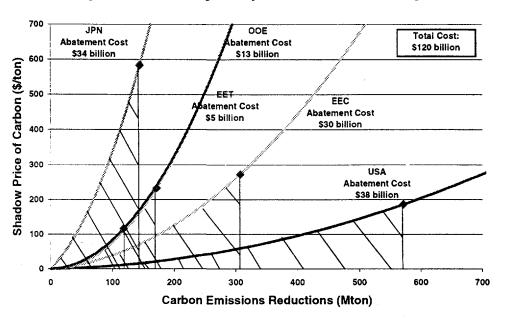
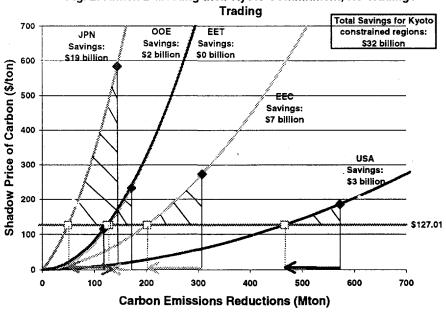
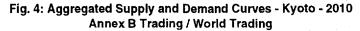


Fig. 2: Annex B Meeting their Kyoto Commitment, No Trading /





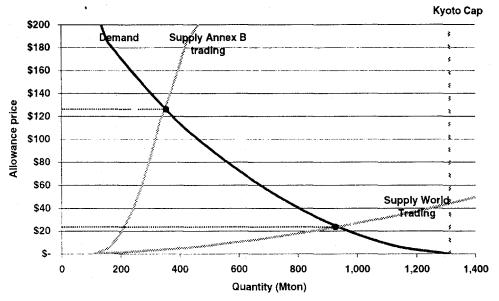


Fig. 5: Effect of Lower and Higher Growth Rates (+/- 10%) on the Kyoto Commitment for JPN, EEC, USA

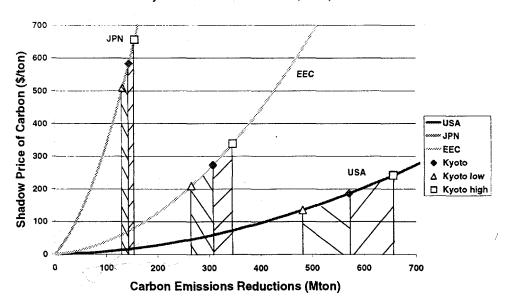


Fig. 6: World Supply and Demand - Kyoto - 2010 Annex BTrading / World Trading - Low and High Scenarios

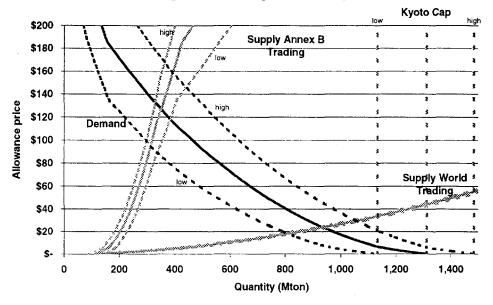


Fig. 7: Per Capita Carbon Emissions

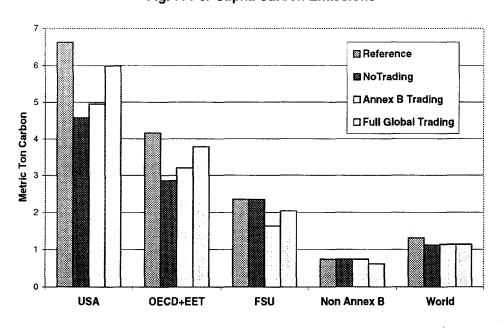


Figure 8: World Supply and Demand - Kyoto - 2010 Limitations on Demand: 75%, 50%, 25%

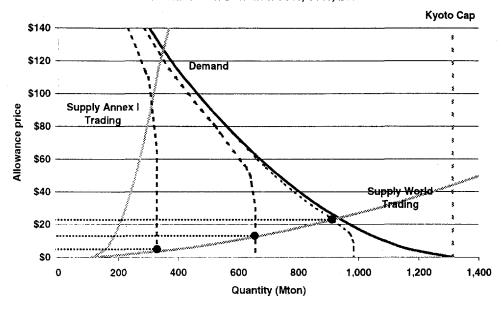


Figure 9: CDM Surcharges: 25%, 50%, 100%

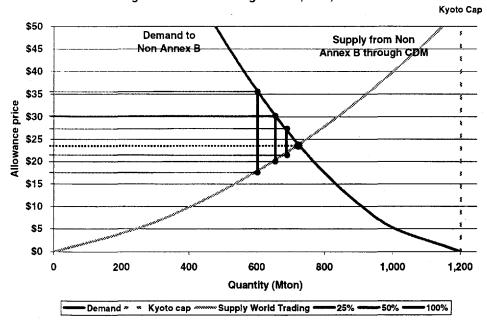


Fig. 10: World Permit Supply and Demand - Kyoto - 2010 Limitation on Supply: Supply = 50% - 25% - 15% - 10% - 5% Total

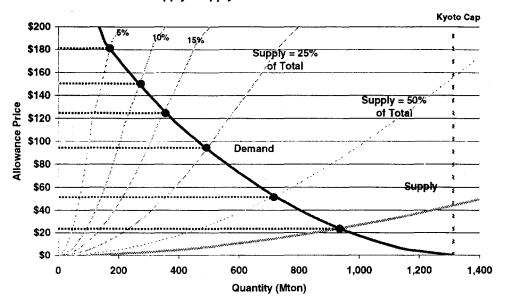
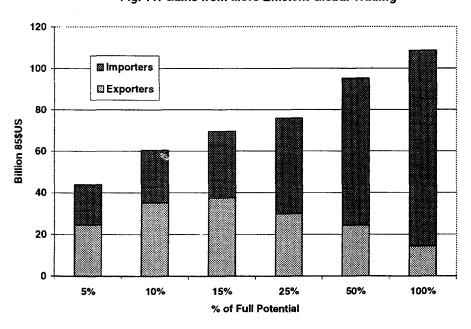


Fig. 11: Gains from More Efficient Global Trading



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# **APPENDIX A: MARGINAL ABATEMENT CURVES<sup>17</sup>**

#### a) What are Marginal Abatement Curves and What Do They Represent? (Fig. A1)

A CGE model will produce a shadow price for any constraint on carbon emissions for a given region R at time T. An example would be a 10% reduction below the reference case for USA in 2010. This price indicates the marginal cost of reducing the last ton of carbon required to meet the constraint. As might be expected in a proper CGE model, the shadow prices corresponding to constraints of increasing severity rise as an increasing function of emissions reduction.

A Marginal Abatement Curve is described by generating the plots of the shadow prices corresponding to constraints of increasing severity at time T, then drawing a line joining the plots, as in Fig. A1. Each plot on the curve for region R at time T represents the marginal cost (p) of abating an

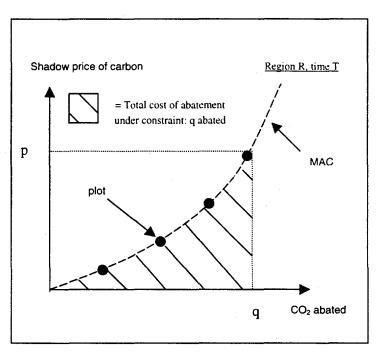


Fig. A1: Marginal Abatement Curves

additional unit of carbon emissions at quantity q. The integral under the curve (hatched area) represents the total abatement cost associated with each level of abatement, that is, the resources re-allocated to abatement because of the constraint.

#### b) How can MACs be Used for Trade Studies? (Fig. A2)

If several regions commit to achieve emission reductions at the same time and there is some prediction of what emissions would be without the commitment, the abatement required can be represented as a point on each region's marginal abatement curve. Moreover, if the marginal costs associated with those reductions are different across regions, the aggregate cost of meeting the commitments will be less to the extent that a region with higher marginal costs can induce a region with lower marginal costs to abate more on its behalf.<sup>18</sup> By abating more, the lower cost region produces "rights to emit," or emission permits, which it can sell to the higher cost region which would thereby avoid a like amount of higher cost domestic abatement. Thus, the difference in the

<sup>&</sup>lt;sup>17</sup> This appendix draws heavily on Ellerman and Decaux, 1998.

<sup>&</sup>lt;sup>18</sup> As is typically assumed in such analyses, and as is the case here, the environmental goal pursued – reducing atmospheric concentration of a long-lived, well-mixed greenhouse gas like CO<sub>2</sub> is not affected by the location of the emission reduction.

marginal costs associated with each region's commitment in the absence of trade creates a potential gain to be shared in some manner between them. The aggregate emission reduction will be achieved at least cost when the two regions trade until their marginal abatement costs are equal at what will then be the market clearing price for the "right to emit" carbon.

Fig. A2 illustrates the gains from trading for 2 regions  $R_1$  and  $R_2$ , subject to the constraints:  $CO_2$  abated =  $q_1$  for  $R_1$  and  $q_2$  for  $R_2$ , and Table A1 below displays the cost calculations in the no trading and trading cases.

These cost calculations can easily be generalized to N regions, and they constitute the basis for emissions trading studies using MACs.

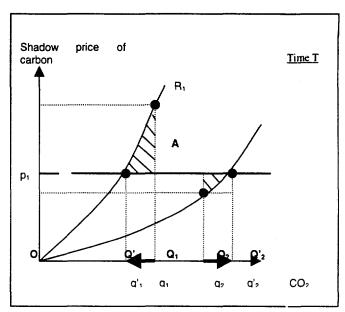


Fig. A2: MACs Used for Trade Studies

	No Trade	Trade between R₁ and R₂				
Constraints	R <sub>1</sub> : q <sub>1</sub> abated R <sub>2</sub> : q <sub>2</sub> abated	R <sub>1</sub> and R <sub>2</sub> : q <sub>1</sub> + q <sub>2</sub> abated				
Marginal Cost / Market Price	R <sub>1</sub> : p <sub>1</sub> R <sub>2</sub> : p <sub>2</sub>	$^{-}R_1$ and $R_2$ : p' such that $p'_1(q'_1) = p'_2(q'_2) = p'$ and $q'_1 + q'_2 = q_1 + q_2$				
Abatement Cost	R <sub>1</sub> : area AOQ <sub>1</sub> R <sub>2</sub> : area BOQ <sub>2</sub>	R <sub>1</sub> : area (A'OQ' <sub>1</sub> ) R <sub>2</sub> : area (B'OQ' <sub>2</sub> )				
Emission Permits Trading	NA	$R_1$ : buys right to emit $q_1$ - $q'_1$ $R_2$ : sells right to emit $q'_2$ - $q_2$ = $q_1$ - $q'_1$				
Imports (+) / Exports (-) Flows	NA	$R_1$ : pays p' * $(q_1-q'_1)$ = area $(A'l_1Q_1Q'_1)$ to $R_2$ $R_2$ : receives p' * $(q'_2-q_2)$ = area $(B'l_2Q_2Q'_2)$ from $R_1$				
Total Cost	R <sub>1</sub> : area AOQ <sub>1</sub> R <sub>2</sub> : area BOQ <sub>2</sub>	R <sub>1</sub> : area (A'OQ' <sub>1</sub> ) + area (A'I <sub>1</sub> Q <sub>1</sub> Q' <sub>1</sub> ) < area (AOQ <sub>1</sub> ) R <sub>2</sub> : area (B'OQ' <sub>2</sub> ) – area (B'I <sub>2</sub> Q <sub>2</sub> Q' <sub>2</sub> ) < area (BOQ <sub>2</sub> )				
Savings from Trading	NA	R <sub>1</sub> : area (Al <sub>1</sub> A') (hatched) R <sub>2</sub> : area (Bl <sub>2</sub> B') (hatched)				

Table A1: Basics of Trade Studies

### c) How are MACs Generated from CGE Models? (Fig. A3, A4 and A5)

The CGE model we use to generate MACs is the MIT Emissions Prediction and Policy Assessment (EEPA) model. It is a multi-sectoral, multi-regional global model of economic activity, energy use and greenhouse gas (GHG) emissions that is part of MIT's larger Integrated Global

Systems Model (IGSM).<sup>19</sup> As such, EPPA is frequently used to predict emissions and to assess the costs associated with constraints on carbon emissions. Although EPPA predicts emissions and assesses costs through the year 2100, this study takes the year 2010 as representative of the first commitment period, which includes the years 2008 through 2012. The model keeps track of five vintages of capital. Version 2.6 of the model incorporates two backstop technologies; however, because these energy sources will not play a substantial role in 2010, they are omitted from the calculations presented here.

To build the MACs, we run the EPPA model under different constraints corresponding to different levels of carbon abatement, such as 10%, 20%, or 30% of reference emissions in the year 2010. For each set of constraints, the corresponding, regional shadow prices of carbon are an output of the model (in 1985 US\$).<sup>20</sup> The shadow prices for each region can then be plotted as a function of the level of abatement, and a line can be fitted to the plots to get the MAC for that region and time.

As an example, Fig. A3 shows the results obtained for the four OECD regions in 2010 when the policies applied are: proportional reductions by all OECD regions (1, 5, 10, 15, 20, 30 and 40% of reference 2010 emissions), and no reduction by other regions. Here, the shadow prices have been plotted as a function of the percentage of carbon emission reduction (and not the absolute quantities), in order to normalize for the size of the regions and to show the variation in relative cost across regions. For any equal percentage reduction among the OECD regions, the abatement of the corresponding quantities would cost most in Japan, then in EEC, and least in USA and OOE.

Similar curves can be obtained for all regions. For example, the same proportional reductions can be applied to all of EPPA's twelve regions at the same time.<sup>21</sup> Fig. A4 displays the marginal abatement curves thus obtained. It shows where it is the cheapest to abate carbon emissions (India and China) and where it is the most expensive (Japan).

Stating marginal cost in terms of the proportional reduction reveals the relative cost of carbon abatement among the twelve EPPA regions, but it does not indicate the importance of various regions in an emissions trading market. For example, as shown in Fig. A4, both China and India are relatively low cost suppliers of abatement. However, as shown in Fig. A5, China is a significantly greater potential supplier of abatement than India by the simple fact that its reference emissions are predicted to be 3.5 times as large (1,792 vs. 486 Mton). China is about 70% more carbon intensive than India; and its economy is predicted to be about twice the size of India's in 2010. As a result, for any given price, China supplies a much larger quantity of permits than India. China is by far the largest potential source of emissions permits from the non-Annex B regions. For instance, if the market price for emissions permits were \$50, China would provide about 700 Mton of emissions reduction, while the five other regions combined would provide only 400 Mton.

<sup>&</sup>lt;sup>19</sup> See Yang et. al, 1996, for a description of EPPA, and Prinn et. al., 1998, for a description of the IGSM.

<sup>&</sup>lt;sup>20</sup> Although we often refer to CO<sub>2</sub> emissions, all prices and quantities are in terms of carbon. Each ton of carbon corresponds to 3.67 tons of carbon dioxide.

<sup>&</sup>lt;sup>21</sup> In doing so, we do not imply that non-Annex B countries assume quantitative national constraints, but only that when faced with the corresponding price for carbon emission reductions, they choose to abate emissions in the proportions indicated. The result is similar, but the motivation is different.

<sup>&</sup>lt;sup>22</sup> We include the USA in Fig A5 for comparison.

#### d) Assessing the "Robustness" of MACs with Regard to the Policy Applied (Fig. A6)

One question that arises immediately from our use of equal proportional reduction across regions to generate the MACs is whether the location of these curves, or more generally, the cost associated with any given level of carbon abatement, is affected by differing levels of abatement in other regions. For instance, as can be seen in Table 1, the levels of implied abatement corresponding to the Kyoto commitment are not strictly proportional, and with emissions trading, we would not expect the percentage reductions among regions to remain the same. Will region  $R_1$ 's MAC look different depending on whether region  $R_2$  reduces by 10% or 40%? In a model with international trade in all goods, such as EPPA, there is the possibility that a 40% reduction by region  $R_2$  would alter trade flows such that abatement of, say, 100 Mton by  $R_1$  would cost more (or less) than if  $R_2$  reduced emissions by only 10%. This fundamental question is that of the robustness of the MACs. And indeed, a drawing like Fig. 2 and the simple method we have deduced from it assume this robustness (one curve for each region, whatever the reductions in other regions). The answer: they are robust.

For example, Fig. A6 shows simultaneously the two sets of MACs corresponding to varying levels of OECD abatement assuming no emissions trading and fully efficient emissions trading.<sup>23</sup> The curves in both sets are similar (less than 10% variation in price for any given level of abatement), thus showing that the MACs are robust with regard to this change of policy. We have made similar comparisons for Annex B trading and global trading, and we have examined one region's MAC (the USA) when all other regions vary from reference to as much as a 60% reduction. In all cases, we have found the same fundamental result: whatever the trading scheme, whatever the extent of the market, the marginal abatement curves are almost identical. These model results indicate that abatement cost in a region is largely independent of abatement efforts in other regions.

Our conclusion is that MACs, and more generally, the costs associated with a given level of domestic abatement, are sufficiently insensitive to different levels of abatement among regions and the scope of emissions trading to justify the analytic method applied here.

#### e) Analytical Approximations: a Simple Tool for Trade Studies (Fig. A7)

Robustness implies that at time T each region has a unique marginal abatement curve. This result allows independent use of marginal abatement curves, once generated from CGE model, and makes trade analysis straightforward. Such an analysis can be even further simplified if each curve is described by a single mathematical expression because, once we have the equations of the MACs, the cost calculations (i.e. integration under the curves) are simple and rapid.

<u>Fig. A7</u> shows, for the OECD regions, that we can fit very simple analytical curves to the sets of plots resulting from the EPPA runs, and that those fits are very good (for each curve,  $R^2$  very close to 1.0). This result holds for all the other regions as well. The curves that best fit the EPPA-generated plots are of the form:  $P = aQ^2 + bQ$ , where Q is the amount of carbon abatement in Mton and P is the marginal cost, or shadow price, of carbon in 1985 US\$. By integration, the total cost of abatement is  $C = 1/3*aQ^3 + 1/2*bQ^2$ . The table below displays the coefficients a and b for each region in 2010, as well as the coefficient of determination  $R^2$ .

<sup>&</sup>lt;sup>23</sup> Note that, compared to figs. 3 and 4, the x-axis has been re-scaled to quantities.

Region	a	ь	$R^2$	Region	A	b	$R^2$
USA	0.0005	0.0398	0.9923	EEX	0.0032	0.3029	0.9983
JPN	0.0155	1.816	0.9938	CHN	0.00007	0.0239	0.9992
EEC	0.0024	0.1503	0.9951	IND	0.0015	0.0787	0.9970
OOE	0.0085	- 0.0986	0.9981	DAE	0.0047	0.3774	0.9996
EET	0.0u/9	0.0486	0.9973	BRA	0.5612	8.4974	0.9997
FSU	0.0023	0.0042	0.9938	ROW	0.0021	0.0805	0.9967

Table A2: Coefficients of the Approximations of the MACs of the Form:  $P = aQ^2 + bQ$ 

In using these approximations, analysts should keep in mind that the price of this simplicity is some loss of the details of the general equilibrium features of the underlying model. The robustness of the curves assures us that the relation between price and quantity of abatement is relatively fixed, but the curves do not capture all the effects of emissions trading. Since the EPPA model remains our primary analysis tool, we have run the model in every policy case we studied in order both to ensure that the approximations are not misleading and to capture any possible side effects. The prices and quantities for abatement were all very close to the approximations, but there is a side effect that the MACs do not show: "leakage." When carbon emissions are constrained for only a sub-set of regions, carbon emissions tend to "leak" to non-constrained regions. Nevertheless, these effects are not essential to the analysis conducted here;<sup>24</sup> and the analytical approximations are a powerful computational shortcut to particular results. They also provide a convenient way to represent graphically the results of the trading analysis.

<sup>&</sup>lt;sup>24</sup> A more extensive discussion of leakage, and its relation to hot air and emissions trading, is contained in Ellerman and Decaux (1998).

# f) Construction of Aggregate Supply and Demand Curves (Figs. A8, A9)

Marginal abatement curves are the basis for determining the demand and supply for emission permits in any given market. Emission permits represent "rights to emit" and these rights can be produced by some party abating more than it is required to do, or undertaking some abatement when not required to do so. The willingness of any party to produce these permits is illustrated by Fig. A8. The vertical dotted line represents the amount of abatement required for a region to meet its Kyoto commitment. In the absence of any emissions trading it would abate the amount indicated by the intersection of this line with the MAC, and the

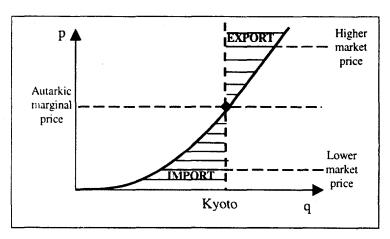


Fig. A8: Willingness to Import / Export with Regard to Market Price of Permits

corresponding price would be its autarkic marginal cost. If emissions trading were a possibility, the region would purchase or sell permits according to the relation of the market price to its autarkic marginal cost.

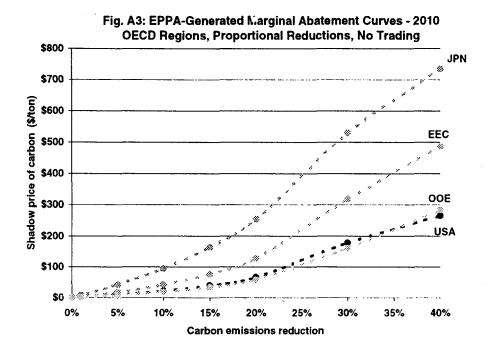
- If the market price is lower than its autarkic marginal abatement cost, this region would be willing to buy emission permits corresponding to the quantity difference between the autarkic emission reduction and the domestic abatement it would undertake at the market price.
- Conversely, if the market price is higher than its autarkic marginal abatement cost, it would be willing to undertake more abatement and supply the market with the 'right to emit' the corresponding quantity.
- Unconstrained regions, such as the non-Annex B regions or the FSU, are a special case. Their
  autarkic marginal cost is zero, and they would be only suppliers to the market at any positive
  price.

For whatever market one is considering, we simply add up the quantities (x-axis) potentially supplied and those potentially demanded at each price (y-axis) across the constituent regions. As we vary the price, we describe the demand and the supply curves for this market, and their intersection indicates the market clearing price on the y-axis and the total quantity traded in that market on the x-axis.

Fig. A9 shows the aggregate demand and supply curves obtained in the Annex B and world trading cases. The aggregate demand curve is the same in both the Annex B and the global market because both include all Kyoto-constrained, i.e. potentially importing, regions. This single demand curve intersects the horizontal axis at the quantity equal to the sum of the emission reductions required to meet the Kyoto commitments, which is 1.31 Gton. This is the "Kyoto cap" represented by a vertical dotted line on the figure; it is also the quantity of emission permits that would be demanded if the price were \$0/ton. At this price, the aggregate supply is the quantity of permits available at no cost. This is the FSU's 111 Mton of hot air.

As the price increases, the demand for permits diminishes, as more and more domestic abatement is undertaken, and the supply of permits increases as more abatement is justified in the unconstrained, exporting regions. As long as the market price is less than the lowest autarkic marginal cost for the Kyoto-constrained regions, these regions are always on the demand side; and the unconstrained regions are on the supply side. When the price reaches \$116, the marginal cost for EET, this region switches from the demand side to the supply side, resulting in a "kink" on the demand and supply curves (which happens to be almost indiscernible because of the small economic size of this region). Such a kink can readily be seen on both supply and demand curves when the price reaches \$186, the autarkic marginal cost for USA. There would be similar kinks at \$233 when OOE becomes a supplier and at \$273 when the EEC does. At \$584, the autarkic marginal cost for Japan meeting the commitment, the demand for permits would be zero.

#### g) Figures



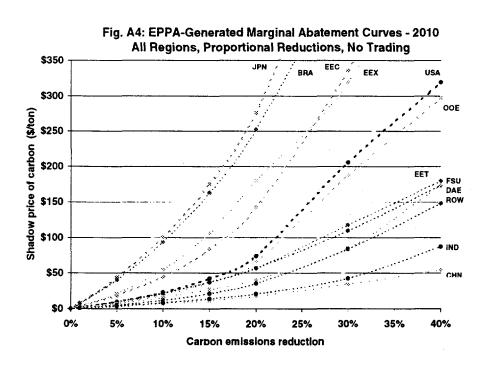


Fig. A5: EPPA-Generated Marginal Abatement Curves - 2010 Non-Annex B regions, Proportional Reductions, No Trading

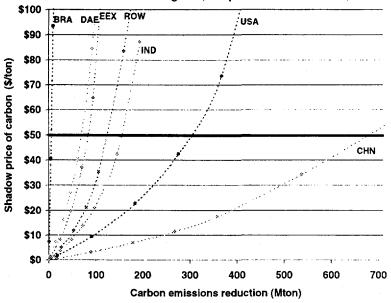


Fig. A6: EPPA-Generated Marginal Abatement Curves - 2010 OECD Proportional Reductions - No Trading / OECD Trading

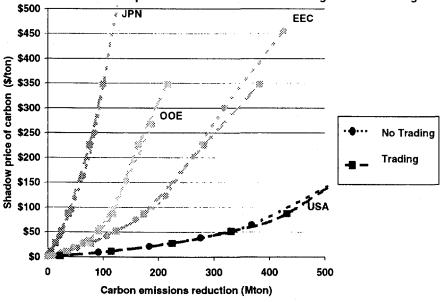


Fig. A7: Marginal Abatement Curves - 2010 OECD Regions - Polynomial Approximations

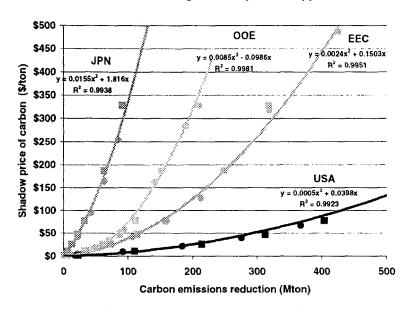
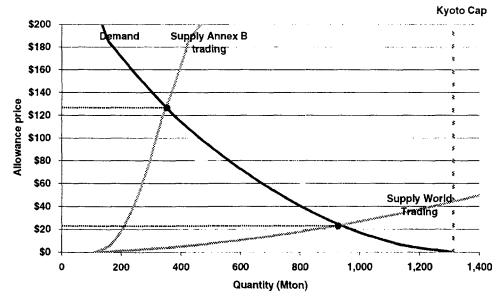


Fig. A8: Aggregated Supply and Demand Curves - Kyoto - 2010
Annex B Trading / World Trading



## **APPENDIX B: DATA TABLES**

The following tables show the detailed results for cases studied in the text. They are the following:

Repeat of Tables Shown in the Text	
Table 1: Reference Emissions and Kyoto Commitments	В 3
Table 2: MACs Approximations Coefficients	В 3
Basic Cases - Reference Scenario	
Table A: Kyoto No Trading	В 3
Table B: Annex B Trading	
Table C: World Trading	ВЗ
Basic Cases - Low Growth Scenario	
Table A': Kyoto No Trading	ВЗ
Table B': Annex B Trading	
Table C': World Trading	В 3
Basic Cases - High Growth Scenario	
Table A": Kyoto No Trading	В 4
Table B": Annex B Trading	В 4
Table C": World Trading	В 4
Import Limitations	
Table D: Imports Limited to 75% of Total Reduction	В 4
Table E: Imports Limited to 50% of Total Reduction	В 4
Table F: Imports Limited to 25% of Total Reduction	В 4
CDM Surcharges	
Table G: 25% Surcharge	В 5
Table H: 50% Surcharge	В 5
Table I: 100% Surcharge	
Non-Competitive Behavior	
Table J: World Trading, CDM Monopoly	В 5
Table K: World Trading, CDM + FSU Monopoly	

Table L: World Trading, CDM + FSU Monopoly, with Imports Limited to 50% of Total Reduction	<i>B</i> 5
Inefficient Supply: Limited to 50% of Full Potential Supply	
Table M: World Trading, Competitive Case	В 6
Table N: World Trading, CDM Monopoly	В 6
Table O: World Trading, CDM + FSU Monopoly	В 6
Table P: World Trading, Competitive Case, with Imports Limited to 50% of Total Reduction	В 6
Table Q: World Trading, CDM Monopoly, with Imports Limited to 50% of Total Reduction	В 6
Table R: World Trading, CDM + FSU Monopoly, with Imports Limited to 50% of Total Reduction	В 6
Table S: World Trading, Competitive Case, with Imports Limited to 25% of Total Reduction	В 6
Table T: World Trading, CDM Monopoly, with Imports Limited to 25% of Total Reduction	В 7
Table U: World Trading, CDM + FSU Monopoly, with Imports Limited to 25% of Total Reduction	В 7
Other Inefficient Suppy Cases: Limited to 25%, 15%, 10%, 5% of Full Potential Suppl	<u>'Y</u>
Table V: World Trading, Competitive Case, Supply Limited to 25% of Full Potential	B 7
Table W: World Trading, Competitive Case, Supply Limited to 15% of Full Potential	В 7
Table X: World Trading, Competitive Case, Supply Limited to 10% of Full Potential	<i>B</i> 7
Table Y: World Trading, Competitive Case, Supply Limited to 5% of Full Potential	В 7

LE 1 - bis: Reference emis	isions an	d Kyoto	commit	ments											
erence emissions	USA	JPN	EEC	OOE I	EET	oecd+eet	FSU [	NAB	World	EEX (	CHN	ND	DAE	BRA	ROW
1990 (Mton)	1362	298	822	318	266	3066	891	2022	5979	508	833	183	115	63	3
2010 (Mton)	1838	424	1064	472	395	4193	763	4142	9098	927	1792	486	308	97	5
low scenario	1748	412	1022	455	375	4012	737	3943	8695	903	1687	457	293	96	5
high scenario	1923	435	1102	488	416	4364	783	4327	9475	950	1891	514	323	98	5
to	0.93	0.94	0.92	0.95	1.04	)	0.98	1110	7000	, ,	4700	<u> </u>	1 ,	<u> </u>	<u>'</u>
sions in 2010 (Mton)	1267	280	757	301	277	2881	873	4142	7896	927	1792	486	308	97	5
low scenario	1267	280	757	301	277	2881	873	3946	7700	903	1687	457	293	96	5
high scenario uctions / ref 2010 (Mton)	1267	280 144	757 307	301 171	277 118	2881	873 -111	4327	8081 1202	950 0	1891 0	514 0	323 0	·98 0	5
low scenario	572 481	132	266	154	98	1312 1132	-136	0	995	0	0	.0	0	0	
high scenario	657	155	346	187	139	1484	-90	0	1393	0	0	0	0	0	
LE 2 - bis: MACs approxi						1404	- 301		1030						-
LE 2 - bis. IIIAOS appioxii					EET	ſ	FSU			EEX	CHN	IND	DAE	BRA	ROV
	5.00E-04	1.55E-02	2.40E-03	8.50E-03	7.90E-03	<b> </b>	2.30E-03			3.20E-03	7.00E-05	1.50E-03	4.70E-03	5.61E-01	2.10
	0.0398		0.1503	-0.099			0.0042			0.3029			0.3774		0.08
	10.000				<u> </u>		5.55			0.00		******			
IC CASES															
LE A: Kyoto no trading															
	USA	JPN	EEC	OOE	EET Î	oecd+eet	FSU		World ·	1					
actions / ref 2010 (Mton)	572	144	307	171	118	1312	0		1312						
inal Costs (\$/ton)	\$186	\$584	\$273	\$233	\$116	\ <b>[</b>	、 ~		۰۰۰۰						
of Abatement (\$billion)	37.62	34.37	30.29	12.81	4.67	119.76	0.00		119.76						
LE B: Annex B trading				···				'		•					
	USA	JPN	EEC	OOE	EET 1	cecd+eet	FSU ]		World	1					
ctions / ref 2010 (Mton)	466	49	201	128	124	968	234		1202						
air' (Mton)				۱ ، ۱		- 0	111		111						
its Market Pice (S/ton)	\$127	\$127	\$127	\$127	\$127	\$127	\$127		\$127						
of Abatement (\$billion)	21.16	2.82	9.51	5.16	5.36	44.01	9.95		53.96						
its exp(-)/imp(+) (Mton)	106	95	106	43	-6	345	-345		0						
of commitment (import)	19%	66%	35%	25%	١	26%	1		i l	l					
s exp(-)/imp(+) (\$billion)	13.44	12.06	13.51	5.49	-0.73	43.77	-43.77		0.00	1					
Cost (\$billion)	34.60	14.88	23.02	10.64	4.64	87.78	-33.82		53.96	1					
s from trade (\$billion)	3.03	19.49	7.27	2.17	0.03	31.99	33.82		65.81	]					
LE C: World trading										•					
	USA	JPN	EEC		EET	oecd+eet	FSU	NAB	World	EEX	CHN	IND	DAE	BRA	RO
uctions / ref 2010 (Mton)	182	12	73	59	52	378	101	723	1202	51	437	102	42	2	
air' (Mton)	1		•		١	0	111	0		١	\	1		•	1
nits Market Pice (\$/ton)	\$24	\$24	\$24	\$24	\$24	\$24	\$24	\$24	\$24	\$24	\$24	\$24	\$24	\$24	\$
of Abatement (\$billion)	1.66	0.14	0.71	0.41	0.43	3.36	0.81	6.99	11.15		4.22	0.95	0.44	0.03	(
nits exp(-)/imp(+) (Mton)	390		234	112	66	935	-211	-723	]. 0		-437	-102	-42	2	
of commitment (import)	68%	92%	76%	66%	56%	71%	1	1 04	1 000	1.	1	1	1	1	١ ,
s exp(-)/imp(+) (\$billion)	9.27	3.15	5.57	2.67	1.57	22.24	-5.03	-17.21	0.00		-10.40	-2.44	-0.99	-0.06	-2
Cost (\$billion)	10.94	3.29	6.29	3.09	2.01	25.60	-4.22	-10.22		1	-6.17	-1.49	-0.55	-0.03	-1
s from trade (\$billion)	26.69	31.08	24.00	9.73	2.66	94.16	4.22	10.22	108.61	0.68	6.17	1.49	0.55	0.03	1
IC CACEC James and in									-						
IC CASES, low scenario															
LE A': Kyoto no trading	TUCA	IDM	FFO	005	<b></b>		FOLL	1	1141-11	,					
	USA	JPN	EEC		ÉET	oecd+eet			World	Į					
1 10010 (14)	481	132	266	154	98	1132	0		1132	1					
		\$510	\$210	\$187	\$81	00.04	1		83.24	ł					
jinal Costs (\$/ton)	\$135	0774					~ ~~			1					
ginal Costs (\$/ton) of Abatement (\$billion)	\$135 23.19	27.74	20.36	9.24	2.71	83.24	0.00	ļ	03.24						
ginal Costs (\$/ton) of Abatement (\$billion)	23.19							ļ i		1					
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading	23.19 USA	JPN	EEC	OOE	EET	oecd+eet	FSU	, 	World	1					
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton)	23.19	JPN 37	EEC 164	OOE 109	EET 103	oecd+eet 799	FSU 196	, 	World 995						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air' (Mton)	23.19 USA 385	JPN 37 \	EEC 164	OOE 109	EET 103 \	oecd+eet 799 0	FSU 196 136	, 	World 995 136						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air' (Mton) nits Market Pice (\$/ton)	23.19 USA 385 \$90	JPN 37 \ \$90	EEC 164 \ \$90	OOE 109 \ \$90	EET 103 \ \$90	oecd+eet 799 0 <b>\$90</b>	FSU 196 136 <b>\$90</b>		World 995 136 <b>\$90</b>						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading actions / ref 2010 (Mton) air' (Mton) of Abatement (\$billion)	23.19 USA 385 \$90 12.47	JPN 37 \ \$90 1.54	EEC 164 \ \$90 5.58	OOE 109 \ \$90 3.05	EET 103 \ \$90 3.17	oecd+eet 799 0 <b>\$90</b> 25.81	FSU 196 136 <b>\$90</b> 5.88		World 995 136 <b>\$90</b> 31.69						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air' (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) nits exp(-)/imp(+) (Mton)	23.19 USA 385 \$90 12.47 96	JPN 37 \     \$90   1.54   95	164 \ \$90 5.58 102	OOE 109 \ \$90 3.05 46	EET 103 \ \$90 3.17 -5	oecd+eet 799 0 <b>\$90</b> 25.81 333	FSU 196 136 <b>\$90</b>		World 995 136 <b>\$90</b>						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading actions / ref 2010 (Mton) air' (Mton) of Abatement (\$billion) of Abatement (\$billion) of of commitment (import)	23.19 USA 385 S90 12.47 96 20%	JPN 37 \$90 1.54 95 72%	\$90 5.58 102 38%	OOE 109 \ \$90 3.05 46 30%	EET 103 \ \$90 3.17 -5	0ecd+eet 799 0 <b>\$90</b> 25.81 333 29%	FSU 196 136 <b>\$90</b> 5.88 -333		World 995 136 <b>\$90</b> 31.69						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air' (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) nits exp(-)/imp(+) (Mton) is of commitment (import) is exp(-)/imp(+) (\$billion)	23.19 USA 385 S90 12.47 96 20% 8.60	JPN 37 \$90 1.54 95 72% 8.48	EEC 164 \$90 5.58 102 38% 9.10	OOE 109 \ \$90 3.05 46 30% 4.10	EET 103 \     \$90 3.17 -5 \     -5 1 -0.48	0ecd+eet 799 0 \$90 25.81 333 29% 29.79	FSU 196 136 <b>\$90</b> 5.88 -333		World 995 136 <b>\$90</b> 31.69						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) nits of commitment (import) is exp(-)/imp(+) (\$billion) If Cost (\$billion)	23.19 USA 385 S90 12.47 96 20% 8.60 21.08	JPN 37 \$90 1.54 95 72% 8.48 10.01	\$90 5.58 102 38% 9.10 14.67	OOE 109 \$90 3.05 46 30% 4.10 7.14	S90 3.17 -5 1 -0.48 2.69	0ecd+eet 799 0 <b>\$90</b> 25.81 333 <i>29%</i> 29.79 55.59	FSU 196 136 <b>\$90</b> 5.88 -333 1 -29.79 -23.90		World 995 136 <b>\$90</b> 31.69						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air' (Mton) of Abatement (\$billion) of Abatement (\$billion) nits exp(-)/imp(+) (Mton) of commitment (import) is exp(-)/imp(+) (\$billion) I Cost (\$billion) is from trade (\$billion)	23.19 USA 385 S90 12.47 96 20% 8.60	JPN 37 \$90 1.54 95 72% 8.48 10.01	EEC 164 \$90 5.58 102 38% 9.10	OOE 109 \ \$90 3.05 46 30% 4.10	EET 103 \     \$90 3.17 -5 \     -5 1 -0.48	0ecd+eet 799 0 <b>\$90</b> 25.81 333 <i>29%</i> 29.79 55.59	FSU 196 136 <b>\$90</b> 5.88 -333		World 995 136 <b>\$90</b> 31.69						
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) of air' (Mton) of Abatement (\$/ton) of Abatement (\$/ton) of Abatement (\$/ton) of commitment (import) of exp(-)/imp(+) (\$/ton) of cost (\$/ton) of Cost (\$/ton) of from trade (\$/ton) of from trade (\$/ton) of from trade (\$/ton)	23.19 USA 385 S90 12.47 96 20% 8.60 21.08 2.11	JPN 37 \$90 1.54 95 72% 8.48 10.01 17.73	\$90 5.58 102 38% 9.10 14.67 5.69	OOE 109 \ \$90 3.05 46 30% 4.10 7.14 2.10	EET 103 \ \$90 3.17 -5 \ -0.48 2.69 0.02	0ecd+eet 799 0 \$90 25.81 333 29% 29.79 55.59 27.65	FSU 196 136 <b>\$90</b> 5.88 -333 \ -29.79 -23.90 23.90		World 995 136 <b>\$90</b> 31.69 0.00 31.69 51.55		CHN	IND	DAF	RR∆	BO
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) of air' (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) nits exp(-)/imp(+) (Mton) of of commitment (import) of se exp(-)/imp(+) (\$billion) of Cost (\$billion) of from trade (\$billion) of the cost (\$billion)	23.19  USA  385  \$90 12.47 96 20% 8.60 21.08 2.11	JPN 37 \	EEC 164 \ \$90 5.58 102 38% 9.10 14.67 5.69	OOE 109 \ \$90 3.05 46 30% 4.10 7.14 2.10	EET 103 \     \$90    3.17    -5 \     -0.48    2.69    0.02	oecd+eet 799 0 \$90 25.81 333 29% 29.79 55.59 27.65	FSU 196 136 \$90 5.88 -333 1 -29.79 -23.90 23.90	NAB	World 995 136 <b>\$90</b> 31.69 0.00 31.69 51.55	EEX	CHN 358	IND 85	DAE	BRA 2	
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air' (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) nits exp(-)/imp(+) (Mton) of commitment (import) or exp(-)/imp(+) (\$billion) of Cost (\$billion) as from trade (\$billion) set C': World trading uctions / ref 2010 (Mton)	23.19 USA 385 S90 12.47 96 20% 8.60 21.08 2.11	JPN 37 \ \$90 1.54 95 72% 8.48 10.01 17.73 JPN 9	\$90 5.58 102 38% 9.10 14.67 5.69 EEC	OOE 109 \ \$90 3.05 46 30% 4.10 7.14 2.10  OOE 52	EET 103 \ \$90 3.17 -5 \ -0.48 2.69 0.02  EET 44	oecd+eet 799 0 \$90 25.81 333 29% 29.79 55.59 27.65	FSU 196 136 \$90 5.88 -333 \( \) -29.79 -23.90 23.90 FSU 86	NAB 593	World 995 136 \$90 31.69 0.00 31.69 51.55	EEX 41	358	85	33	2	
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air' (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) its exp(-)/imp(+) (Mton) of commitment (import) or exp(-)/imp(+) (\$billion) it Cost (\$billion) is from trade (\$billion) et E C': World trading uctions / ref 2010 (Mton) it air' (Mton)	23.19  USA  385  \$90 12.47 96 20% 8.60 21.08 2.11  USA  152	JPN 37 \$90 1.54 95 72% 8.48 10.01 17.73  JPN 9	\$90 5.58 102 38% 9.10 14.67 5.69 EEC 60	OOE 109 \	EET 103 \ \$90 3.17 -5 \ -0.48 2.69 0.02  EET 44	0ecd+eet 799 0 \$90 25.81 333 29% 29.79 55.59 27.65 0ecd+eet 316 0	FSU 196 136 \$90 5.88 -333 1 -29.79 -23.90 23.90 FSU 86 136	NAB 593	World 995 136 \$90 31.69 0.00 31.69 51.55	EEX 41	358 \	85 \	33	\ 2	١
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) of air' (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) of of commitment (import) of sexp(-)/imp(+) (Mton) of cost (\$billion) of Cost (\$bill	23.19  USA  385  \$90 12.47 96 20% 8.60 21.08 2.11  USA  152 \$18	JPN 37 \$90 1.54 95 72% 8.48 10.01 17.73 JPN 9	\$90 5.58 102 38% 9.10 14.67 5.69 \$18	OOE 109 \ \$90 3.05 46 30% 4.10 7.14 2.10  OOE 52 \ \$18	EET 103 \     \$90 3.17 -5 \     -0.48 2.69 0.02 \ EET 44 \     \$18	Decd+eet   799	FSU 196 136 \$90 5.88 -333 1 -29.79 -23.90 23.90 FSU 86 136 \$18	NAB 593 C \$18	World 995 136 \$90 31.69 0.00 31.69 51.55 World 995 136 \$18	EEX 41 \	358 \ \$18	85 \ <b>\$18</b>	33 \ \$18	\$18	١ .
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) of Abatement (\$\text{station}\) air (Mton) of Abatement (\$\text{station}\) of Abatement (\$\text{stillion}\) nits exp(-\frac{\frac{1}{2}}{\text{imp}}(+) (Mton) of commitment (import) of exp(-\frac{1}{2}\text{imp}(+) (\$\text{billion}\) of cost (\$\text{stillion}\) os from trade (\$\text{stillion}\) os from trade (\$\text{stillion}\) os to (\$\text{Mton}\) air (Mton) on the Market Pice (\$\text{fon}\) of Abatement (\$\text{billion}\)	USA 385 \$90 12.47 96 20% 8.600 21.08 2.11 USA 152 \$18 1.04	JPN 37 \ \$90 1.54 95 72% 8.48 10.01 17.73  JPN 9 \$18 0.08	S90 5.58 102 38% 9.10 14.67 5.69 EEC 60 \$18 0.44	OOE 109 \ \$90 3.05 46 30% 4.10 7.14 2.10  OOE 52 \ \$18 0.26	EET 103 \ \$90 3.17 -5 \ -0.48 2.69 0.02 \ EET 44 \ \$18 0.27	Oecd+eet   799	FSU 196 136 \$90 5.88 -333 \\ -29.79 -23.90 23.90 \\ FSU 866 \$136 \$18 0.51	NAB 593 0 \$18 4.30	World 995 136 \$90 31.69 0.00 31.69 51.55  World 995 136 \$18	EEX 41 \$18 0.32	358 \ \$18 2.60	85 \ \$18 0.59	33 \ \$18 0.26	\$18 0.02	\
ginal Costs (\$/ton) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) air (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) nits exp(-)/imp(+) (Mton) /s of commitment (import) /s exp(-)/imp(+) (\$billion) I Cost (\$billion) Is from trade (\$billion) LE C': World trading  uctions / ref 2010 (Mton) nits Market Pice (\$/ton) of Abatement (\$billion) nits Market Pice (\$/ton) of Abatement (\$billion)	USA 385 \$90 12.47 96 20% 8.60 21.08 2.11 USA 152 \$18 1.04 330	JPN 37 \$90 1.54 95 72% 8.48 10.01 17.73 JPN 9 \$18 0.08 123	\$90 5.58 102 38% 9.10 14.67 5.69 EEC 60 \$18 0.44 206	OOE 109 \ \ \\$90 3.05 46 30% 4.10 7.14 2.10 \ OOE 52 \ \\$18 0.26 103	S90 3.17 -5 1 -0.48 2.69 0.02  EET 44 \$18 0.27 54	Oecd+eet   799	FSU 196 136 \$90 5.88 -333 \ -29.79 -23.90 23.90 FSU 866 \$186 0.51 -223	NAB 593 0 \$18 4.30	World 995 136 \$90 31.69 0.00 31.69 51.55  World 995 136 \$18	EEX 41 \$18 0.32	358 \ \$18	85 \ \$18 0.59	33 \ \$18 0.26	\$18 0.02 -2	\
ginal Costs (\$/ton) of Abatement (\$billion) of Abatement (\$billion) LE B': Annex B trading uctions / ref 2010 (Mton) of Abatement (\$billion) nits Market Pice (\$/ton) of Abatement (\$billion) of commitment (import) of cost (\$billion) of the C': World trading uctions / ref 2010 (Mton) of air' (Mton) of specific (\$/ton) of of commitment (\$billion) of of commitment (import)	USA 385 \$90 12.47 96 20% 8.60 21.08 2.11 USA 152 \$18 1.04 330 68%	JPN 37 \$90 1.54 95 72% 8.48 10.01 17.73 JPN 9 \$18 0.08 123 93%	\$90 5.58 102 38% 9.10 14.67 5.69 \$EEC 60 \$18 0.44 206 78%	OOE 109 \ \ \\$90 3.05 46 30% 4.10 7.14 2.10  OOE 52 \ \\$18 0.26 103 67%	EET 103 \$90 3.17 -5 1 -0.48 2.69 0.02 EET 44 \$18 0.27 54 55%	0ecd+eet 799 0 \$90 25.81 333 29% 29.79 55.59 27.65  0ecd+eet 316 0 \$18 2.09 816 72%	FSU 196 136 \$90 5.88 -333 1 -29.79 -23.90 23.90 FSU 86 136 \$18 0.51 -223	593 C \$18 4.30 -593	World 995 136 \$90 31.69 51.55  World 995 136 \$18 6.90	S18 0.32 -41	358 \ \$18 2.60 -358	\$18 0.59 -85	\$18 0.26 -33	\$18 0.02 -2	\
uctions / ref 2010 (Mton) ginal Costs (\$/ton) t of Abatement (\$billion) tof Abatement (\$billion) tof Abatement (\$billion) tof Abatement (\$billion) that if (Mton) that if (Stillion) that if (Stillion) that if (Mton) t	USA 385 \$90 12.47 96 20% 8.60 21.08 2.11 USA 152 \$18 1.04 330	JPN 37 \$90 1.54 95 72% 8.48 10.01 17.73  JPN 9 \$18 0.08 123 93% 2.16	\$90 5.58 102 38% 9.10 14.67 5.69 \$18 0.44 206 78% 3.62	OOE 109 \ \ \\$90 3.05 46 30% 4.10 7.14 2.10 \ OOE 52 \ \\$18 0.26 103	S90 3.17 -5 1 -0.48 2.69 0.02  EET 44 \$18 0.27 54	0ecd+eet 799 0 90 25.81 333 29% 29.79 55.59 27.65  0ecd+eet 316 0 \$18 2.09 816 72% 14.30	FSU 196 136 \$90 5.88 -333 \ -29.79 -23.90 23.90 FSU 866 \$186 0.51 -223	NAB 593 0 \$18 4.30 -593 1	World 995 136 \$90 31.69 0.00 31.65 51.55  World 995 136 \$18 6.90	S18 0.32 -41 -0.71	358 \ \$18 2.60	85 \$18 0.59 -85 i	\$18 0.26 -33	\$18 0.02 -2 i -0.03	\

BASIC CASES, high scenario															
TABLE A": Kyoto no trading			***********				*****								
	USA	JPN	EEC	OOE	EET	oecd+eet	FSU	1	World	ì					
Reductions / ref 2010 (Mton)	657	155	346	187	139	1484	0		1484						
Marginal Costs (\$/ton)	\$242	\$656	\$339	\$279	\$159	١	\		\						
Cost of Abatement (\$billion)	55.77	41.28	42.00	16.83	7.53	163.41	0.00		163.41						
TABLE B": Annex B trading			72.00	10.00		100.77	0.00								
	USA .	JPN	FFC	OOF	EET		EC:1	1	World	1					
			EEC	OOE		oecd+eet	FSU								
Reductions / ref 2010 (Mton)	540	61	235	146	143	1124	269		1393						
'Hot air' (Mton)	·	•	١	١	\	0	90		90						
Permits Market Pice (\$/ton)	\$167	\$167	\$167	\$167	\$167	\$167	\$167		\$167						
Cost of Abatement (\$billion)	32.09	4.51	14.48	7.81	8.12	67.00	15.06		82.06						
Permits exp(-)/imp(+) (Mton)	116	95	111	41	-4	359	-359		0						
i.e % of commitment (import)	18%	61%	32%	22%	1	24%	1		١ .						
Flows exp(-)/imp(+) (\$billion)	19.49	15.84	18.57	6.84	-0.61	60.14	-60.14		0.00	i					
Total Cost (\$billion)	51.58	20.35	33.05	14.65	7.51	127.14	-45.08		82.06						
Gains from trade (\$billion)	4.19	20.93	8.95	2.18	0.01	36.27	45.08		81.36						
TABLE C": World trading										•					
	USA	JPN	EEC	OÕE	EET	oecd+eet	FSU	NAB	World	EEX	CHN	IND	DAE	BRA	ROW
Reductions / ref 2010 (Mton)	210	15	85	66	59	435	114	844	1393	61	510		50	3	10
'Hot air' (Mton)			1	\	١	0	90	0.0	90	١ .	١				١
Permits Market Pice (\$/ton)	S30	` <b>\$</b> 30	` <b>\$</b> 30	, \$30	<b>\$30</b>	\$30	\$30	S30	\$30	<b>S30</b>	` s30	` <b>\$30</b>	<b>\$30</b>	` <b>S</b> 30	` <b>\$</b> 30
Cost of Abatement (\$billion)	2.42	0.22	1.05	0.60	0.63	4.90	1.16	10.26	16.33	0.80	6.19	1.38	0.66	0.04	1.1
	447	141	260	121	80	1049	-204	-844	10.55	-61	-510	-118	-50	-3	-10
Permits exp(-)/imp(+) (Mton) i.e % of commitment (import)	68%	90%	75%	65%	58%	71%	, -204	-044	<b>l</b> . "l	01	-310	-110	-50 I	-3	1
Flows exp(-)/imp(+) (\$billion)	13.57	4.27	7.90	3.68	2.43	31.84	-6.20	-25.64	0.00	-1.85	-15.47	-3.60	-1.51	-0.09	· -3.1
	15.57	4.48	8.95	4.28	3.05	36.74	-5.04	-15.37	16.33	-1.05	-9.28	-2.21	-0.85	-0.05	-1.9
Total Cost (\$billion)	39.79	36.80	33.05	12.56	4.48	126.67	5.04	15.37	147.09	1.05	9.28	2.21	0.85	0.05	
Gains from trade (\$billion)	39.79	36.80	33.05	12.50	4.40	120.07	5.04	15.37	147.09	1.05	9.20	2.21	0.05	0.05	1.9
IMPORT LIMITATIONS															
TABLE D: 75%															
		JPN	EEC	OOE	EET	oecd+eet		NAB	World	EEX	CHN				ROW
Reductions / ref 2010 (Mton)	178	36	77	58	51	399	99	704	1202	49	425	100	40	2	87
'Hot air' (Mton)	\	1	1	1	1	0	111	0	111	١	1	1	١	1	1
Permits Market Pice (\$/ton)	\$23	\$23	\$23	\$23	\$23	\$23	\$23	\$23	\$23	\$23	\$23	\$23	\$23	\$23	\$23
Cost of Abatement (\$billion)	1.56	1.42	0.81	0.39	0.41	4.58	0.76	6.54	11.88	0.50	3.96	0.89	0.41	0.03	0.7
Permits exp(-)/imp(+) (Mton)	394	108	230	113	67	913	-209	-704	0	-49	-425	-100	-40	-2	-8
i.e % of commitment (import)	69%	75%		66%	57%	68%			1	١	1				
		15%	75%	00%			1	1	P' .			1	1	1	1
Flows exp(-)/imp(+) (\$billion)	8.99	75% 2.47	75% 5.26	2.59	1.54	20.84	\ -4.77	-16.07	0.00	-1.13	-9.70	-2.28	-0.92	-0.05	•
					1.54 1.94		-4.77 -4.02	-16.07 -9.52	0.00 <b>11.88</b>	-1.13 -0.63	•	•	•	•	-1.9
Flows exp(-)/imp(+) (\$billion)	8.99	2.47	5.26	2.59		20.84					-9.70	-2.28	-0.92	-0.05	-1.98 -1.23 1.23
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion)	8.99 10.55	2.47 3.89	5.26 6.06	2.59 2.97	1.94	20.84 25.42	-4.02	-9.52	11.88	-0.63	-9.70 -5.75	-2.28 -1.39	-0.92 -0.51	-0.05 -0.03	-1.9 -1.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion)	8.99 10.55 27.07	2.47 3.89 30.48	5.26 6.06 24.22	2.59 2.97 9.84	1.94 2.73	20.84 25.42 94.34	-4.02 4.02	-9.52 9.52	11.88 107.88	-0.63 0.63	-9.70 -5.75 5.75	-2.28 -1.39 1.39	-0.92 -0.51 0.51	-0.05 -0.03 0.03	-1.9 -1.2 1.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE E: 50%	8.99 10.55 27.07	2.47 3.89 30.48	5.26 6.06 24.22 1%	2.59 2.97 9.84	1.94 2.73 <b>2</b> %	20.84 25.42 94.34 <b>0%</b>	-4.02 4.02 -5%	-9.52 9.52 <b>-7%</b>	11.88 107.88 -1%	-0.63 0.63 -7%	-9.70 -5.75 5.75 <b>-7%</b>	-2.28 -1.39 1.39 -7%	-0.92 -0.51 0.51 <b>-7%</b>	-0.05 -0.03 0.03 -8%	-1.9 -1.2 1.2 -7%
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE E: 50%	8.99 10.55 27.07 1%	2.47 3.89 30.48 -2%	5.26 6.06 24.22 1% EEC	2.59 2.97 9.84 1%	1.94 2.73 <b>2%</b> EET	20.84 25.42 94.34 <b>0%</b> oecd+eet	-4.02 4.02 -5% FSU	-9.52 9.52 <b>-7%</b> NAB	11.88 107.88 -1% World	-0.63 0.63 -7% EEX	-9.70 -5.75 5.75 <b>-7%</b> CHN	-2.28 -1.39 1.39 -7%	-0.92 -0.51 0.51 -7%	-0.05 -0.03 0.03 -8% BRA	-1.9 -1.2 1.2 -79
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE E: 50%  Reductions / ref 2010 (Mton)	8.99 10.55 27.07 1% USA 286	2.47 3.89 30.48 -2% JPN 72	5.26 6.06 24.22 1% EEC	2.59 2.97 9.84 1% OOE 86	1.94 2.73 <b>2</b> %	20.84 25.42 94.34 <b>0%</b>	-4.02 4.02 -5% FSU 73	-9.52 9.52 <b>-7%</b>	11.88 107.88 -1% World	-0.63 0.63 -7% EEX	-9.70 -5.75 5.75 -7% CHN 286	-2.28 -1.39 1.39 -7% IND	-0.92 -0.51 0.51 -7% DAE	-0.05 -0.03 0.03 <b>-8%</b> BRA	-1.9 -1.2 1.2 -7%
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton)	8.99 10.55 27.07 1% USA 286	2.47 3.89 30.48 -2% JPN 72	5.26 6.06 24.22 1% EEC	2.59 2.97 9.84 1% OOE 86	1.94 2.73 <b>2%</b> EET 59	20.84 25.42 94.34 <b>0%</b> 0ecd+eet 656 0	-4.02 4.02 -5% FSU 73 111	-9.52 9.52 -7% NAB 473 0	11.88 107.88 -1% World 1202 111	-0.63 0.63 -7% EEX	-9.70 -5.75 5.75 -7% CHN 286	-2.28 -1.39 1.39 -7% IND 69	-0.92 -0.51 0.51 -7% DAE	-0.05 -0.03 0.03 -8% BRA	-1.9 -1.2 1.2 -79 ROW
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$fon)	8.99 10.55 27.07 1% USA 286 \$13	2.47 3.89 30.48 -2% JPN 72	5.26 6.06 24.22 1% EEC 154	2.59 2.97 9.84 1% OOE 86	1.94 2.73 <b>2%</b> EET 59	20.84 25.42 94.34 0% oecd+eet 656 0 \$13	-4.02 4.02 -5% FSU 73 111 \$13	-9.52 9.52 -7% NAB 473 0 \$13	11.88 107.88 -1% World 1202 111 \$13	-0.63 0.63 -7% EEX 31	-9.70 -5.75 5.75 -7% CHN 286	-2.28 -1.39 1.39 -7% IND 69	-0.92 -0.51 0.51 -7% DAE 25	-0.05 -0.03 0.03 -8% BRA 1	-1.9 -1.2 1.2 -79 ROW 6
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$\text{\$\text{\$\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\text{\$}\t	8.99 10.55 27.07 1% USA 286 \$13 5.52	2.47 3.89 30.48 -2% JPN 72 \$13 6.66	5.26 6.06 24.22 1% EEC 154 \$13 4.67	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42	1.94 2.73 2% EET 59 \ \$13 0.63	20.84 25.42 94.34 0% oecd+eet 656 0 \$13 18.89	-4.02 4.02 -5% FSU 73 111 \$13 0.31	-9.52 9.52 -7% NAB 473 0 \$13 2.50	11.88 107.88 -1% World 1202 111 \$13 21.70	-0.63 0.63 -7% EEX 31 \$13 0.18	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15	-0.05 -0.03 0.03 -8% BRA 1 \ \$13 0.01	-1.9 -1.2 1.2 -79 ROW 6
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Aton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton)	8.99 10.55 27.07 1% USA 286 \$13 5.52 286	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 154	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86	1.94 2.73 2% EET 59 \$13 0.63 59	20.84 25.42 94.34 0% oecd+eel 656 0 \$13 18.89 656	-4.02 4.02 -5% FSU 73 111 \$13	-9.52 9.52 -7% NAB 473 0 \$13	11.88 107.88 -1% World 1202 111 \$13	-0.63 0.63 -7% EEX 31	-9.70 -5.75 5.75 -7% CHN 286	-2.28 -1.39 1.39 -7% IND 69	-0.92 -0.51 0.51 -7% DAE 25	-0.05 -0.03 0.03 -8% BRA 1	-1.9 -1.2 1.2 -79 ROW 6
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Aton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import)	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 50%	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50%	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 154 50%	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50%	1.94 2.73 <b>2%</b> EET 59 \ \$13 0.63 59 50%	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49%	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -183	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473	11.88 107.88 -1% World 1202 111 \$13 21.70 0	-0.63 0.63 -7% EEX 31 \$13 0.18 -31	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69	-0.92 -0.51 -7% DAE 25 \$13 0.15 -25	-0.05 -0.03 0.03 -8% BRA 1 \ \$13 0.01 -1	-1.9 -1.2 1.2 -79 ROW 6 \ \$13 0.3 -6
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion)	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 50% 3.58	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90	5.26 6.06 24.22 1% EEC 154 \$13 4.67 154 50% 1.93	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -183 1	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \	11.88 107.88 -1% World 1202 111 \$13 21.70 0	-0.63 -7% EEX 31 \$13 0.18 -31 1	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 \ \	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69	-0.92 -0.51 -7% DAE 25 \$13 0.15 -25	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1	-1.9 -1.2 1.2 -79 6 \ \$13 0.3 -6
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) defta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$\frac{1}{2}\text{Con}) Cost of Abatement (\$\frac{1}{2}\text{Colin}) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$\frac{1}{2}\text{Colin}) Total Cost (\$\frac{1}{2}\text{Colin})	8.99 10.55 27.07 1% USA 286 \ \$13 5.52 286 50% 3.58 9.10	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07 2.50	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -183 1 -2.30 -1.99	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \ -5.93 -3.42	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70	-0.63 0.63 -7% EEX 31 \ \$13 0.18 -31 \ -0.39 -0.21	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 \ \ -3.58 -2.06	-2.28 -1.39 1.39 -7% IND 69 \ \$13 0.35 -69 1 -0.86 -0.51	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1 1 -0.02 -0.01	-1.9 -1.2 1.2 -79 ROW 6 \ \$13 0.3 -6 1
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) defta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Aon) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion)	8.99 10.55 27.07 1% USA 286 \ \$13 5.52 286 50% 3.58 9.10 28.53	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60 23.69	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07 2.50 10.32	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37 3.30	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 27.12 92.64	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -183 1 -2.30 -1.99 1.99	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \tag{-5.93} -3.42 3.42	11.88 107.88 -1% World 1202 111 \$13 21.70 0 0.00 21.70 98.06	-0.63 -7% EEX 31 \$13 0.18 -31 1 -0.39 -0.21 0.21	-9.70 -5.75 5.75 -7% CHN 286 \$13 1.52 -286 1 -3.58 -2.06 2.06	-2.28 -1.39 1.39 -7% IND 69 \ \$13 0.35 -69 1 -0.86 -0.51 0.51	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 0.17	-0.05 -0.03 0.03 -8% BRA 1 \\$13 0.01 -1 1 -0.02 -0.01 0.01	-1.9 -1.2 1.2 -79 6 \ \$13 0.3 -6 1 -0.7 -0.4 0.4
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Cost of Abatement (\$billion) Permits Market Pice (\$Aton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table)	8.99 10.55 27.07 1% USA 286 \ \$13 5.52 286 50% 3.58 9.10	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07 2.50	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -183 1 -2.30 -1.99	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \ -5.93 -3.42	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70	-0.63 0.63 -7% EEX 31 \ \$13 0.18 -31 \ -0.39 -0.21	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 \ \ -3.58 -2.06	-2.28 -1.39 1.39 -7% IND 69 \ \$13 0.35 -69 1 -0.86 -0.51	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1 1 -0.02 -0.01	-1.9 -1.2 1.2 -79 80W 6 \ \$13 -6 1 -0.7
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) Hot air' (Mton) Permits Market Pice (\$Aton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) detts gain in % / no limit (table) TABLE F: 25%	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 50% 3.58 9.10 28.53 7%	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14%	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60 23.69 -1%	2.59 2.97 9.84 1% OOE 86 \\$13 1.42 86 50% 1.07 2.50 10.32 6%	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37 3.30 24%	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12 92.64	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -183 1 -2.30 -1.99 1.99	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \( \) -5.93 -3.42 3.42 -67%	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10%	-0.63 -7% EEX 31 \$13 0.18 -31 -0.39 -0.21 0.21 -69%	-9.70 -5.75 5.75 -7% CHN 286 \$13 1.52 -286 1 -3.58 -2.06 2.06 -67%	-2.28 -1.39 1.39 -7% IND 69 \\$13 0.35 -69 \ -0.86 -0.51 0.51 -65%	-0.92 -0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 -69%	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1 1 -0.02 -0.01 -71%	-1.9 -1.2 1.2 -79 ROW 6 \ \$13 -6 1 -0.7 -0.4 0.4 -659
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Aton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE F: 25%	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 50% 3.58 9.10 28.53 7%	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14%	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60 23.69 -1% EEC	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37 3.30 24%	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eel	-4.02 4.02 -5% FSU 73 111 513 0.31 -183 1 -2.30 -1.99 -53%	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \ \ -5.93 -3.42 3.42 -67%	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10%	-0.63 -7% EEX 31 \$13 0.18 -31 -0.39 -0.21 -69% EEX	-9.70 -5.75 5.75 -7% CHN 286 \$13 1.52 -286 1 -3.58 -2.06 2.06 -67% CHN	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69 1 -0.86 -0.51 0.51 -65%	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 -69%	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1 1 -0.02 -0.01 -71%	-1.9 -1.2 1.2 -7° ROW 6 \ \$1: 0.3 -6 \ \ -0.7 -0.4 0.4 -65°
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$xton) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE F: 25%  Reductions / ref 2010 (Mton)	8.99 10.55 27.07 1% USA 286 \ \$13 5.52 286 50% 3.58 9.10 28.53 7% USA	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14%	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60 23.69 -1% EEC 230	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37 3.30 24% EET 89	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eel 984	-4.02 4.02 -5% FSU 73 111 513 0.31 -183 1 -2.30 -1.99 -53% FSU 38	-9.52 9.52 -7% NAB 473 0.513 2.50 -473 \ \ -5.93 -3.42 -67% NAB 180	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10% World 1202	-0.63 -7% EEX 31 \$13 0.18 -31 -0.39 -0.21 -69% EEX	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 \ \ -3.58 -2.06 2.06 -67% CHN 108	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69 1 -0.86 -0.51 0.51 -65% IND	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 0.17 -69% DAE 8	-0.05 -0.03 0.03 -8% BRA 1 \ \$13 0.01 -1 \ -0.02 -0.01 0.01 -71% BRA 0	-1.9 -1.2 -7 -1.2 -7 -7 -1.2 -7 -1.2 -7 -1.2 -7 -1.2 -7 -1.2 -1.2 -1.2 -1.2 -1.2 -1.2 -1.2 -1.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) defta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Xon) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) defta gain in % / no limit (table) TABLE F: 25%  Reductions / ref 2010 (Mton) 'Hot air' (Mton)	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 5.0% 3.58 9.10 28.53 7% USA 429	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14% JPN 108	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.93 6.60 23.69 -1% EEC 230	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE 129	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37 3.30 24% EET 89	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eel 984	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -183 1 -2.30 -1.99 -53% FSU 38 111	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \( \) -5.93 -3.42 -67% NAB 180 0	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10% World 1202 111	-0.63 0.63 -7% EEX 31 \$13 0.18 -3.1 -0.39 -0.21 0.21 -69% EEX	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 1 -3.58 -2.06 2.06 -67% CHN 108	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69 1 -0.86 -0.51 0.51 -65% IND	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 -69% DAE 8	-0.05 -0.03 0.03 -8% BRA 1 \ \$13 0.01 -1 \ -0.02 -0.01 0.01 -71% BRA 0	-1.9.1.2.1.2.1.2.2.7.4.1.2.1.2.2.7.4.1.2.1.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delts gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Aton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE F: 25%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Aton)	8.99 10.55 27.07 1% USA 286 5.52 286 50% 3.58 9.10 28.53 7% USA 429 \$3	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14% JPN 108	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60 23.69 -1% EEC 230 \ \$3	2.59 2.97 9.84 1% OOE 86 \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE 129	1.94 2.73 2% EET 59 \ \$13 0.63 59% 0.74 1.37 3.30 24% EET 89 \ \$3	20.84 25.42 94.34 0% 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eet	-4.02 4.02 -5% 73 111 \$13 0.31 -183 1 -2.30 -1.99 -53% FSU 38 111 \$3	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \( \) -5.93 -3.42 -67% NAB 180 0 \$3	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10% World 1202 111 \$3	-0.63 0.63 -7% S13 0.18 -31 -0.39 -0.21 0.21 -69% EEX	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 \ -3.58 -2.06 2.06 -67% CHN 108 \ \$3	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69 1 -0.86 -0.51 0.51 -65% IND	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 0.17 -69% DAE 8	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1 1 -0.02 -0.01 0.01 -71% BRA 0	-1.9.1.2.1.2.2.7.7.1.2.2.1.2.2.7.7.1.2.2.1.2.2.1.2.2.1.2.2.1.2.2.2.1.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) detts gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) detta gain in % / no limit (table) TABLE F: 25%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$7on) Cost of Abatement (\$billion)	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 5.0% 3.58 9.10 28.53 7% USA 429	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14% JPN 108	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.93 6.60 23.69 -1% EEC 230	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE 129	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37 3.30 24% EET 89	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eel 984	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -1.83 1 -2.30 -1.99 -53% FSU 38 111 115 30 30 30 30 30 30 30 30 30 30 30 30 30	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \( -5.93 -3.42 -67% NAB 180 0 \$3 0.28	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10% World 1202 111	-0.63 0.63 -7% EEX 31 \$13 0.18 -3.1 -0.39 -0.21 0.21 -69% EEX	-9.70 -5.75 5.75 -7% CHN 286 \\$13 1.52 -286 \\\ -3.58 -2.06 -67% CHN 108 \\ \$3 0.17	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69 1 -0.86 -0.51 -65% IND 28 \$3 0.04	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 -69% DAE 8	-0.05 -0.03 0.03 -8% BRA 1 \ \$13 0.01 -1 \ -0.02 -0.01 0.01 -71% BRA 0	-1.9.1.2.1.2.2.7.7.1.2.2.7.7.2.1.2.2.7.7.2.1.2.2.7.7.2.1.2.2.7.2.2.1.2.2.2.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) detts gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) detta gain in % / no limit (table) TABLE F: 25%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$7on) Cost of Abatement (\$billion)	8.99 10.55 27.07 1% USA 286 5.52 286 50% 3.58 9.10 28.53 7% USA 429 \$3	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14% JPN 108	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60 23.69 -1% EEC 230 \ \$3	2.59 2.97 9.84 1% OOE 86 \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE 129	1.94 2.73 2% EET 59 \ \$13 0.63 59% 0.74 1.37 3.30 24% EET 89 \ \$3	20.84 25.42 94.34 0% 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eet	-4.02 4.02 -5% 73 111 \$13 0.31 -183 1 -2.30 -1.99 -53% FSU 38 111 \$3	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \( \) -5.93 -3.42 -67% NAB 180 0 \$3	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10% World 1202 111 \$3	-0.63 0.63 -7% S13 0.18 -31 -0.39 -0.21 0.21 -69% EEX	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 \ -3.58 -2.06 2.06 -67% CHN 108 \ \$3	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69 1 -0.86 -0.51 0.51 -65% IND	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 0.17 -69% DAE 8	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1 1 -0.02 -0.01 0.01 -71% BRA 0	-1.9.1.2.1.2.1.2.2.7.7.2.1.2.2.7.7.2.1.2.2.7.7.2.1.2.2.2.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) Gains from trade (\$billion) Gains from trade (\$billion) Gelta gain in % / no limit (table TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) 'Hot air' (Mton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) detta gain in % / no limit (table) TABLE F: 25%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$7on) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton)	8.99 10.55 27.07 1% USA 286 5.52 286 50% 3.58 9.10 28.53 7% USA 429 \$3 16.79	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.90 26.81 -14% JPN 108	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.93 6.60 23.69 -1% EEC 230 \ \$3 13.77	2.59 2.97 9.84 1% OOE 86 \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE 129 \	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37 3.30 24% EET 89 \ \$3 2.02	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eel 984 0 0 \$3 54.94	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -1.83 1 -2.30 -1.99 -53% FSU 38 111 115 30 30 30 30 30 30 30 30 30 30 30 30 30	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \( -5.93 -3.42 -67% NAB 180 0 \$3 0.28	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10% World 1202 111 \$3 55.26	-0.63 0.63 -7% EEX 31 \$13 0.18 -31 -0.39 -0.21 -0.21 -69% EEX 10 \ \$3 0.02 -10	-9.70 -5.75 5.75 -7% CHN 286 \\$13 1.52 -286 \\\ -3.58 -2.06 -67% CHN 108 \\ \$3 0.17	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69 -0.86 -0.51 -65% IND 28 \$3 0.04 -28	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 -69% DAE 8	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1 -0.02 -0.01 -71% BRA 0	-1.9.1.2.1.2.2.7.7.1.2.2.7.7.2.1.2.2.7.7.2.1.2.2.7.7.2.1.2.2.7.2.2.1.2.2.2.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) Fable E: 50%  Reductions / ref 2010 (Mton) Hot air' (Mton) Permits Market Pice (\$Aton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no timit (table) TABLE F: 25%  Reductions / ref 2010 (Mton) Hot air' (Mton) Permits Market Pice (\$Aton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import)	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 50% 3.58 9.10 28.53 7% USA 429 \$16.79	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14% JPN 108 \$3 17.15	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.93 6.60 23.69 -1% EEC 230 \ \$3 13.77 77	2.59 2.97 9.84 1% OOE 86 \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE 129 \ \$3 5.20 43	1.94 2.73 2% EET 59 \ \$13 0.63 59 50% 0.74 1.37 3.30 24% EET 89 \ \$3 2.02 30	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 277.12 92.64 -2% 0ecd+eel 984 0 \$3 54.94	-4.02 4.02 -5% FSU 73 111 \$13 0.31 -1.83 1 -2.30 -1.99 -53% FSU 38 111 115 30 30 30 30 30 30 30 30 30 30 30 30 30	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 \( -5.93 -3.42 -67% NAB 180 0 \$3 0.28	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10% World 1202 111 \$3 55.26	-0.63 0.63 -7% EEX 31 \$13 0.18 -31 -0.39 -0.21 -0.21 -69% EEX 10 \ \$3 0.02 -10	-9.70 -5.75 5.75 -7% CHN 286 \\$13 1.52 -286 \\\ -3.58 -2.06 2.06 -67% CHN 108 \\ \$3 0.17 -108	-2.28 -1.39 1.39 -7% IND 69 \$13 0.35 -69 -0.86 -0.51 -65% IND 28 \$3 0.04 -28	-0.92 -0.51 0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 -69% DAE 8	-0.05 -0.03 0.03 -8% BRA 1 \$13 0.01 -1 -0.02 -0.01 -71% BRA 0	-1.5.1.2.1.2.1.2.2.7.7.1.2.1.2.2.7.7.1.2.2.1.2.2.7.7.1.2.2.2.2
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$xton) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE F: 25%  Reductions / ref 2010 (Mton)	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 50% 3.58 9.10 28.53 7% USA 429 \$16.79 143 25%	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14% JPN 108 \$3 17.15 36 25%	5.26 6.06 24.22 1% EEC 154 \$13 4.67 1.54 50% 1.93 6.60 23.69 -1% EEC 230 \$\frac{1}{3}\$ \$13.77 77 25%	2.59 2.97 9.84 1% OOE 86 \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE 129 \ \$3 5.20 43 25%	1.94 2.73 2% EET 59 \ \$13 0.63 59 0.74 1.37 3.30 24% EET 89 \ \$3 2.02 30 25%	20.84 25.42 94.34 0% 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eet 984 0 \$3 54.94	-4.02 4.02 -5% 73 111 \$13 0.31 -183 1 -2.30 -1.99 -53% FSU 38 111 \$3 0.04 -148	-9.52 9.52 -7% 473 0 \$13 2.50 -473 \\ -5.93 -3.42 -67% NAB 180 0 \$3 0.28 -180	11.88 107.88 -1% World 1202 111 \$13 21.70 0 1 0.00 21.70 98.06 -10% World 1202 111 \$3 55.26 0	-0.63 -7% EEX 31 \ \$13 0.18 -31 \ -0.39 -0.21 -69% EEX 10 \ \$3 0.02 -10	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 1 -3.58 -2.06 -67% CHN 108 \ \$3 0.17 -108	-2.28 -1.39 -7% IND 69 \$13 0.35 -69 1 -0.86 -0.51 0.51 -65% IND 28 \$3 0.04 -28	-0.92 -0.51 -7% DAE 25 \$13 -0.15 -0.32 -0.17 -0.9% DAE 8	-0.05 -0.03 0.03 -8%  BRA  1 \$13 0.01 -1 1 -0.02 -0.01 0.01 -71%  BRA  0 \$3 0.00 0	-1.9.3 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1.2.1 -1
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) Gains from trade (\$billion) Gains from trade (\$billion) Gains from trade (\$billion) TABLE E: 50%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Xon) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Gains from trade (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table) TABLE F: 25%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$Xon) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion)	8.99 10.55 27.07 1% USA 286 \$13 5.52 286 5.0% 3.58 9.10 28.53 7% USA 429 \$3 16.79 14.43 25% 0.48	2.47 3.89 30.48 -2% JPN 72 \$13 6.66 72 50% 0.90 7.56 26.81 -14% JPN 108 \$3 17.15 36 25% 0.12	5.26 6.06 24.22 1% EEC 154 \ \$13 4.67 1.54 50% 1.93 6.60 23.69 -1% EEC 230 \ \$3 13.77 77 25% 0.26	2.59 2.97 9.84 1% OOE 86 \ \$13 1.42 86 50% 1.07 2.50 10.32 6% OOE 129 \ \$3 5.20 43 25% 0.15	1.94 2.73 2% 59 \$13 0.63 59 0.74 1.37 3.30 24% EET 89 \$3 2.02 30 25% 0.10	20.84 25.42 94.34 0% 0ecd+eel 656 0 \$13 18.89 656 49% 8.23 27.12 92.64 -2% 0ecd+eel 984 0 \$3 54.94 328 24% 1.11	FSU 73 111 513 0.31 -183 1 -2.30 -1.99 -53% FSU 38 111 53 0.04 -148 1 -0.50	-9.52 9.52 -7% NAB 473 0 \$13 2.50 -473 1 -5.93 -3.42 -67% NAB 180 0 \$3 0.28 -180 1	11.88 107.88 -1% World 1202 1111 \$13 21.70 0 0 0 0.00 21.70 98.06 -10% World 1202 1111 \$3 55.26 0	-0.63 -7% EEX 31 \$13 0.18 -31 -0.39 -0.21 -69% EEX 10 \$3 0.02 -10 \bigs_{-10}	-9.70 -5.75 5.75 -7% CHN 286 \ \$13 1.52 -286 2.06 2.06 -67% CHN 108 \ \$3 0.17 -108	-2.28 -1.39 -7% IND 69 \$13 0.35 -69 -0.86 -0.51 -65% IND 28 \$3 0.04 -28 -0.10	-0.92 -0.51 -7% DAE 25 \$13 0.15 -25 -0.32 -0.17 -69% DAE 8 33 0.01 -8	-0.05 -0.03 0.03 -8%  BRA  1 \$13 0.01 -1 1 -0.02 -0.01 -71%  BRA  0 \$3 0.00 0 1 0.00	-1.9.1.2.1.2.2.7.7.2.1.2.2.7.7.2.1.2.2.7.7.2.1.2.2.7.2.2.2.2

BLE G: 25%															
	USA	JPN	EEC	OOE	EET	oecd+eet	FSU	NAB	World	EEX	CHN	IND	DAE	BRA	ROW
ductions / ref 2010 (Mton)	198	14	80	63	56	410	108	687	1205	48	415	98	39	2	8
ot air' (Mton)	١	١	1	١ '		0	111	0	111	)	<b>\</b>	1	\	1	1
mits Market Pice (\$/ton)	\$27	\$27	\$27	\$27	\$27	\$27	\$27	\$22	`	\$22	\$22	\$22	\$22	\$22	\$22
st of Abatement (\$billion)	2.07	0.18	0.89	0.51	0.54	4.19	1.00	6.15	11.34	0.47	3.72	0.84	0.38	0.02	0.7
rmits exp(-)/imp(+) (Mton)	374	131	227	108	62	902	-219	-687	-3	-48	-415	-98	-39	-2	-8
% of commitment (import)	65%	91%	74%	63%	53%	67%	١	1	1	,	ı	1	1	1	ı
ws exp(-)/imp(+) (\$billion)	10.26	3.58	6.23	2.98	1.70	24.75	-6.01	-15.07	3.68	1.05	-9.10	-2.14	-0.86	-0.05	-1.8
tal Cost (\$billion)	12.32	3.76	7.13	3.49	2.24	28.94	-5.01	-8.92	15.02	-0.59	-5.38	-1.30	-0.48	-0.03	-1.1
ins from trade (\$billion)	25.30	30.60	23.16	9.33	2.43	90.82	5.01	8.92	104.75	0.59	5.38	1.30	0.48	0.03	1.1
ta gain in % / no limit (table	-5%	-2%	-3%	-4%	-9%	-4%	19%	-13%	-4%	-14%	-13%	-12%	-14%	-14%	-12
BLE H: 50%															
	USA	JPN	EEC	OOE	EET	0000+001	FSU	NAB	World	EEX	CHN	IND	DAE	BRA	ROW
ductions / ref 2010 (Mton)	211	15	86	66	59	436	114	654	1205	45	395	93	37	2	
ot air' (Mton)	<b>N</b>	V	١	١ '	١	0	111	. 0	111	١	١	١	<b>\</b>	١	١
rmits Market Pice (\$/ton)	\$31	\$31	\$31	\$31	\$31	\$31	\$31	\$20	١ ١	\$20	\$20	\$20	\$20	\$20	\$2
st of Abatement (\$billion)	2.44	0.22	1.06	0.60	0.63	4.95	1.17	5.46	11.58	0.41	3.30	0.75	0.34	0.02	0.0
mits exp(-)/imp(+) (Mton)	361	129	221	105	59	876	-225	-654	-3	-45	-395	-93	-37	-2	-
% of commitment (import)	63%	90%	72%	61%	50%	65%	1	1	1	1	1	1	1	1	1
ws exp(-)/imp(+) (\$billion)	11.03	3.95	6.76	3.22	1.80	26.76	-6.87	-13.32	6.57	-0.93	-8.05	-1.90	-0.75	-0.04	-1.6
tal Cost (\$billion)	13.47	4.17	7.82	3.82	2.43	31.71	-5.70	-7.86	18.15	-0.51	-4.74	-1.15	-0.42	-0.02	
ins from trade (Sbillion)	24.16	30.20	22.46	9.00	2.24	88.06	5.70	7.86	101.61	0.51	4.74	1.15	0.42	0.02	
ta gain in % / no limit (table	-9%	-3%	-6%	-8%	-16%	-6%	35%	-23%	-6%	-24%	-23%	-23%	-24%	-26%	
BLE I: 100%	1 -3/6	-3%	-0%	-0.76	-10%	-0%	35 /0	-23%	-0-76	-24 %	-23%	-23%	-24 /6	-20%	-22
BLE 1. 100%	fi io a	100	FFA	005			leou i	A.A.D.	044-33	CEV	OL 18.1	INID	D16	004	004
1 5 - 1 - 10040 (11)	USA	JPN			EET	oecd+eet		NAB		EEX	CHN	IND	DAE	BRA	ROW
ductions / ref 2010 (Mton)	231	. 17	95	71	64	479	124	602	1204	41	364	. 86	. 34	2	
ot air' (Mton)	\	1	١	•	١	0	111	0	111		١	١	١	١	١
mits Market Pice (\$/ton)	\$36	\$36	\$36	\$36	\$36	\$36	\$36	\$18	١ ا	\$18	S18	\$18	\$18	\$18	\$1
st of Abatement (\$billion)	3.12	0.30	1.36	0.77	0.80	6.34	1.49	4.46	12.30	0.33	2.70	0.61	0.27	0.02	
mits exp(-)/imp(+) (Mton)	341	127	212	100	54	834	-235	-602	-2	-41	-364	-86	-34	-2	-
% of commitment (import)	60%	88%	69%	59%	45%	62%	1	1	ı	1	1	l	1	I	1
ws exp(-)/imp(+) (\$billion)	12.22	4.56	7.62	3.60	1.93	29.92	-8.41	-10.79	10.71	-0.74	-6.52	-1.55	-0.60	-0.03	-1.
tal Cost (\$billion)	1														
···· + · · ( + - · · · · · )	15.34	4.85	8.98	4.37	2.73	36.26	-6.92	-6.33	23.01	-0.41	-3.82	-0.93	-0.33	-0.02	-0.
	22.29	4.85 29.52	8.98 21.31	4.37 8.45	2.73 1.94	36.26 83.50	-6.92 6.92	-6.33 6.33	23.01 96.76	-0.41 0.41	-3.82 3.82	-0.93 0.93	-0.33 0.33	-0.02 0.02	
ins from trade (\$billion) Ita gain in % / no limit (table ON-COMPETITIVE BEHAVIO	22.29 -16%	29.52 - <b>5%</b>		-		83.50									0.
ins from trade (\$billion) Ita gain in % / no limit (table ON-COMPETITIVE BEHAVIO	22.29 -16%	29.52 - <b>5%</b>	21.31	8.45 -13%	1.94	83.50	6.92 <b>64%</b>	6.33	96.76	0.41	3.82	0.93	0.33	0.02	0. -37
ins from trade (\$billion) Ita gain in % / no limit (table ON-COMPETITIVE BEHAVIO BLE J: World trading, CDM	22.29 -16% -16% monopo	29.52 -5%	21.31	8.45 -13%	1.94 -27%	83.50 -11%	6.92 <b>64%</b>	6.33 -38%	96.76 -11%	0.41 -40%	3.82	0.93 -37%	0.33 -40%	0.02 -42%	0. -37
ins from trade (\$billion) Ita gain in % / no limit (table ON-COMPETITIVE BEHAVIO) IBLE J: World trading, CDM Iductions / ref 2010 (Mton)	22.29 -16% -16% monopo USA	29.52 -5% ly JPN	21.31 -11% EEC 133	8.45 -13% OOE 92	1.94 -27% EET	83.50 -11%	6.92 <b>64%</b> FSU	6.33 -38% NAB	96.76 -11% World	0.41 -40% EEX	3.82 -38% CHN 230	0.93 -37% IND	0.33 -40% DAE	0.02 -42% BRA	0. -37
hins from trade (\$billion) Ita gain in % / no limit (table ON-COMPETITIVE BEHAVIO IBLE J: World trading, CDM Iductions / ref 2010 (Mton) Iot air' (Mton) Iotmits Market Pice (\$fton)	22.29 -16% -16% monopo USA	29.52 -5% by JPN 28	21.31 -11% EEC 133	8.45 -13% OOE 92	1.94 -27% EET 86	83.50 -11% oecd+eel 656	6.92 <b>64%</b> FSU 164	6.33 -38% NAB 382	96.76 -11% World 1202	0.41 -40% EEX	3.82 -38% CHN 230	0.93 -37% IND 56	0.33 -40% DAE	0.02 -42% BRA	0.
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ins from trade (\$billion) Ita gain in % / no limit (table  DN-COMPETITIVE BEHAVIOR BLE J: World trading, CDM  ductions / ref 2010 (Mton) ot air' (Mton) rmits Market Pice (\$fton) sits exp(-)/imp(+) (Mton) % of commitment (import) was exp(-)/imp(+) (\$billion) tal Cost (\$billion) ins from trade (\$billion) BLE K: World trading, CDM  ductions / ref 2010 (Mton) ot air' (Mton) rmits Market Pice (\$fton) st of Abatement (\$billion) mits exp(-)/imp(+) (Mton) % of commitment (import) was exp(-)/imp(+) (\$billion) tal Cost (\$billion) ins from trade (\$billion) BLE L: 50% - CDM+FSU mo  ductions / ref 2010 (Mton) ot air' (Mton) rmits Market Pice (\$fton) st of Abatement (\$billion) mits from trade (\$billion) mits of Abatement (\$billion) st of Abatement (\$billion) was exp(-)/imp(+) (Mton) % of commitment (import) was exp(-)/imp(+) (Mton) % of commitment (import) was exp(-)/imp(+) (\$billion)	22.29 -16% 317 \$63 7.29 23.28 15.99 23.28 15.99 23.28 15.99 23.28 15.52 155 154 27% 16.69 32.28 32.28 15.52 15.52 15.52 15.52 15.52	29.52 -5% by JPN 28 \$63 0.82 116 81% 7.30 81.2 26.25 conopoly JPN 42 \ \$1.99 102 71% 11.06 13.05 21.32 JPN 72 \$103 6.66 72 50% 7.46 14.11	21.31 -11% EEC 133 \ \$63 3.24 174 57% 10.91 14.14 16.15 EEC 179 \ \$108 6.99 20.87 9.41 EEC 179 \ \$103 6.96 129 42% 13.89 20.87 9.41	8.45 -13%  OOE 92 \$63 1.78 79 46% 4.99 6.77 6.05  OOE 116 \$108 3.80 5.55 32% 5.95 9.75 3.06  OOE 116 \$103 3.78 55 32% 5.70	1.94 -27%  EET 86 \$63 1.86 3.26 2.7% 2.00 3.86 0.80  EET 112 \$108 3.96 0.70 4.66 0.01  EET 111 \$103 3.94 7 6% 0.69	83.50   -11%   656   656   0   653   14.99   656   50%   41.19   56.17   63.59   63.59   63.31   446   34.31   43.31   43.31   43.31   63.31   63.31	FSU 164 111 \$63 3.45 -275 1 -17.24 -13.79 13.79 FSU 51 111 \$108 0.11 -161 1 -17.47 -17.36 17.36 17.36 FSU 48 111 \$103 0.09 -158 1 -16.36	NAB 382 0 \$63 1.52 -382 1 -23.94 -22.43 22.43  NAB 285 0 \$108 0.77 -285 1 -30.82 -30.05 30.05  NAB 259 0 \$103 0.63 -259 1 -26.80	World 1202 111 \$63 19.96 99.81  World 1202 111 \$103 33.20 33.20 86.57  World 1202 111 \$103 37.56 0 1 0.00 37.56 82.20	EEX 24 \$63 0.10 -24 1 .1.52 1.42 EEX 17 \$108 0.05 -17 \$1.86 -1.81 1.81 EEX 15 \$103 0.04 -15 1 .1.56	3.82 -38% CHN 230 \$63 0.92 -230 \  -14.46 -13.54 13.54 CHN 172 \  \$108 0.47 -172 \  -18.58 -18.11 18.11 CHN 156 \  \$103 0.38 -156 \  \  -16.14	0.93 -37%  IND 56 \$63 0.22 -56 1 -3.54 -3.33 3.33  IND 43 \$108 0.11 -43 1 -4.66 -4.54  IND 39 \$103 0.09 -39 1 -4.08 3.98	0.33 -40%  DAE 20 \ \$63 -20 -1.23 -1.15 1.15  DAE 14 \ \$108 0.04 -14 \ -1.51 -1.47  DAE 12 \ \$103 0.03 -12 \ -1.29 -1.26 1.26	0.02 -42%  BRA 1 \$63 0.000 -1 -0.06 -0.06 0.06  BRA 1 \$108 -0.07 -0.08 -0.07 -1 \$103 0.00 -1 \$103 0.00 -1	ROW  \$6  -3.7  ROW  \$10  -4.4  -4.4  -4.3  -3.3  -3.3  -3.3  -3.3  -3.3

INEFFICIENT SUPPLY - 50%															
TABLE M: competitive case															
Coductions ( rof 2010 (1 Heat)	USA	JPN 04	EEC	OOE	EET	oecd+eet		NAB	World	EEX	CHN	IND	DAE	BRA	ROW
Reductions / ref 2010 (Mton) 'Hot air' (Mton)	286	24	120	84 \	78 \	593 0	75 55		1257 55	\ 45		81 \	36	2	70 \
Permits Market Pice (\$/ton)	\$52	\$52	\$52	\$52	\$52	\$52	\$52	\$52	\$52	\$52	\$52	\$52	\$52	\$52	\$52
Cost of Abatement (\$billion)	5.53	0.59	2.45	1.36	1.42	11.34	1.32					1.59	0.80	0.06	1.35
Permits exp(-)/imp(+) (Mton) i.e % of commitment (import)	285 50%	120 83%	188 <i>61%</i>	87 51%	40 <i>34%</i>	720 55%	-130	-590	, 0	-45	-355	-81	-36	-2	-70
Flows exp(-)/imp(+) (\$billion)	14.94	6.29	9.82	4.55	2.08	37.67	-6.82	-30.86	0.00	-2.33	•	4.25	-1.90	-0.12	-3.66
Total Cost (\$billion)	20.47	6.88	12.26	5.90	3.49	49.01	-5.50			:		-2.66	-1.10	-0.07	-2.31
Gains from trade (\$billion) delta gain in % / no limit (table	17.15 -36%	27.48 -12%	18.03 -25%	6.91 -29%	1.18 -56%	70.75	5.50 <b>30%</b>	_		1.35 99%	11.39 <b>85%</b>	2.66 <b>79%</b>	1.10	0.07 121%	2.31 77%
TABLE N: CDM monopoly	-30%	-1276	-25%	-29%	-50%	-25%	30%	85%	-12%	99%	85%	/9%	100%	121%	11%
	USA	JPN	EEC	OOE	EET	oecd+eet	FSU	NAB	World	EEX	CHN	IND	DAE	BRA	ROW
Reductions / ref 2010 (Mton)	385	37	164	109	103	799	98		1257	25		-51	21	1	44
'Hot air' (Mton)	\$90	\ \$90	\ \$90	\ \$90	\ \$90	90 <b>590</b>	55 <b>\$90</b>	0 <b>590</b>	55 <b>\$90</b>	\ S90	\ \$90	\$90	\ \$90	\ \$90	\ enn
Permits Market Pice (\$/ton) Cost of Abatement (\$billion)	12.48	1.54	5.58	3.05	3.17	25.83	2.94	3.45	32.22	0.26		0.47	0.22	0.01	<b>\$90</b> 0.40
Permits exp(-)/imp(+) (Mton)	186	107	143	63	15	513	-153	1				-51	-21	-1	-44
i.e % of commitment (import)	33%	74%	46%	37%	12%	39%	١	1	1	1	1	1	1	1	1
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion)	16.68 29.17	9.56 11.10	12.79 18.37	5.62 8.67	1.31 4.48	45.97 71.79	-13.74 -10.80	-32.23 -28.77	0.00 <b>32.22</b>	-2.27 -2.01	-19.46 -17.38	-4.57 -4.10	-1.85 -1.63	-0.11 -0.09	-3.97 -3.57
Gains from trade (\$billion)	8.46	23.27	11.91	4.15	0.19	47.97	10.80	28.77	87.54	2.01	17.38	4.10	1.63	0.09	3.57
delta gain in % / no limit (table	-68%	-25%	-50%	-57%	-93%	-49%	156%	181%	-19%	196%	182%	175%	197%	212%	173%
TABLE O: CDM+FSU monopol		104:	ere.	005			leo:	Dive-		iee.	A				500
Reductions / ref 2010 (Mton)	USA 434	JPN 45	EEC 187	00E 121	EET 116	oecd+eet 902	FSU 45	NAB 310	World 1257	EEX 21	CHN 187	IND 44	DAE 17	BRA 1	ROW 39
'Hot air' (Mton)	1 434				\	902	55 55			( 2'					\
Permits Market Pice (\$/ton)	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112	\$112
Cost of Abatement (\$billion)	17.43	2.26	7.82	4.25	4.42	36.18	0.28	2.40	38.87	0.18		0.33	0.15	0.01	0.28
Permits exp(-)/imp(+) (Mton) i.e % of commitment (import)	137 24%	100 <i>69%</i>	121 <i>39</i> %	51 <i>30</i> %	2 2%	410 31%	-100	-310	1 0	21	-187 \	-44	-17	-1	-39
Flows exp(-)/imp(+) (\$billion)	15.31	11.13	13.46	5.67	0.24	45.82	-11.17	-34.65	0.00	-2.39	•	-4.96	-1.94	-0.11	-4.32
Total Cost (\$billion)	32.74	13.39	21.29	9.92	4.67	82.00	-10.89	-32.25	38.87	-2.21	-19.48	-4.63	-1.79	-0.10	-4.04
Gains from trade (\$billion)	4.89	20.98 -33%	9.00	2.89	0.00	37.76	10.89	32.25	80.90	2.21	19.48	4.63	1.79	0.10	4.04
delta gain in % / no limit (table TABLE P: competitive case - w	-82%		-62%	-70%	-100%	-60%	158%	215%	-26%	225%	216%	211%	226%	234%	209%
TABLE 1 : Competitive case - to	USA	JPN	EEC		EET	oecd+eet	FSU	NAB	World	EEX	CHN	IND	DAE	BRA	NOR
Reductions / ref 2010 (Mton)	286	72	154	86	71	668	68	522	1257	39	315	72	32	2	62
'Hot air' (Mton)	S43	\ \$43	\ \$43	\ \$43	\ <b>543</b>	9 <b>S43</b>	55 <b>\$43</b>	0 <b>S43</b>	55 <b>\$43</b>	\$43	\ \$43	\ \$43	\ \$43	\ \$43	\ \$43
Permits Market Pice (\$/ton) Cost of Abatement (\$billion)	5.52	6.66	4.67	1.42	1.05	19.31	0.97	8.75	29.03	0.70	5.27	1.17	0.58	0.04	0.99
Permits exp(-)/imp(+) (Mton)	286	72	154	86	47	645	-123	-522	0	-39	-315	-72	-32	-2	-62
i.e % of commitment (import)	50%	50%	50%	50%	40%	49%	1	1	۱ ا	١		1	•		1
Flows exp(-)/imp(+) (\$billion) [Total Cost (\$billion)	12.22	3.08 9.74	6.57 11.24	3.66 5.08	2.03 3.08	27.56 46.87	-5.26 -4.29	-22.30 -13.55	0.00 <b>29.03</b>	-1.66 -0.95	-13.45 -8.18	-3.09 -1.92	-1.35 -0.78	-0.09 -0.05	-2.67 -1.67
Gains from trade (\$billion)	19.89	24.63	19.05	7.73	1.59	72.89	4.29	13.55	90.73	0.95	8.18	1.92	0.78	0.05	1.67
delta gain in % / no limit (table	-25%	-21%	-21%	-21%	-40%	-23%	1%	33%	-16%	41%	33%	29%	41%	51%	28%
TABLE Q: CDM monopoly - wit							leou :			Të est				22.	2000
Reductions / ref 2010 (Mton)	USA 379	JPN 72	EEC 161	00E 107	EET 102	oecd+eet 821	FSU 97	NAB 339	World 1257	EEX 24	CHN 205	IND 48	DAE 19	BRA 1	ROW 42
'Hot air' (Mton)					١٠٠٤	0	55	0		h 24				•	۱ 42
Permits Market Pice (\$/ton)	\$87	\$87	\$87	\$87	\$87	\$87	\$87	\$87	\$87	\$87	\$87	S87	\$87	\$87	\$87
Cost of Abatement (\$billion)	11.91	6.66	5.32	2.91	3.03	29.82	2.81	2.99		0.23	1.81	0.41	0.19	0.01	0.35
Permits exp(-)/imp(+) (Mton) i.e % of commitment (import)	193 34%	72 50%	146 <i>47%</i>	64 38%	16 14%	491 37%	-152 I	-339	0	-24	-205 l	-48 \	-19 I	-1 1	-42
Flows exp(-)/imp(+) (\$billion)	16.74	6.26	12.65	5.59	1.41	42.65	-13.19	-29.46	0.00	-2.06		-4.19	-1.68	-0.10	-3.64
Total Cost (\$billion)	28.65	12.91	17.98	8.49	4.44	72.47	-10.38	-26.47	35.63	-1.83		-3.78	-1.49	-0.08	-3.30
Gains from trade (\$billion)	8.98 -66%	21.45 -31%	12.31 -49%	4.32 -56%	0.23 -91%	47.29 - <b>50%</b>	10.38	26.47	84.14	1.83 170%	15.99 <b>159%</b>	3.78 154%	1.49	0.08	3.30
delta gain in % / no limit (table TABLE R: CDM+FSU monopoly		-31% 0% limit				•50%	146%	159%	-23%	1/0%	105%	134%	1/0%	102%	152%
					EET	oecd+eet	FSU	NAB	World	EEX	CHN	IND	DAE	BRA	ROW
Reductions / ref 2010 (Mton)	432	72	186	120	115	926	42	289	1257	20	175	42	16	1	36
'Hot air' (Mton) Permits Market Pice (\$/ton)	\ \$111	\ \$111	\$111	\	\ \$111	S111	55 \$111	0 \$111	55 \$111	\ S111	\ \$111	\ \$111	\ \$111	\ \$111	\ \$111
Cost of Abatement (\$billion)	17.20	6.66	7.72	4.19	4.36	40.14	0.24	2.02	42.40	0.15	1.23	0.28	0.12	0.01	0.24
Permits exp(-)/imp(+) (Mton)	139	72	121	51	3	387	-98	-289	0	-20	-175	-42	-16	-1	-36
i.e % of commitment (import)	24%	50%	40%	30%	2%	29%	ا م م	1 00 00	1 000	١	•	1 4.00		1 0.40	1
Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion)	15.40 32.61	7.98 14.64	13.45 21.17	5.68 9.88	0.30 4.66	42.81 82.95	-10.81 -10.57	-32.00 -29.98	0.00 <b>42.40</b>	-2.18 -2.03	-19.34 -18.11	-4.60 -4.32	-1.77 -1.65	-0.10 -0.09	-4.02 -3.78
Gains from trade (\$billion)	5.02	19.73	9.12	2.94	0.01	36.81	10.57	29.98	77.36	2.03	18.11	4.32	1.65	0.09	3.78
delta gain in % / no limit (table	-81%	-37%	-62%	-70%	-100%	-61%	150%	193%	-29%	199%	193%	190%	199%	203%	189%
TABLE S: competitive case - w								NAG		leev.	01.10	10.15	DAG	004	5000
Reductions / ref 2010 (Mton)		JPN 108	230	00E 129	EET 89	oecd+eet 984	FSU 36	NAB	World	EEX 16	CHN 143	IND 34	DAE 13	BRA 1	ROW 30
'Hot air' (Mton)	429				\ 09	904	55	236 0	1257 55						\ 30
Permits Market Pice (\$/ton)	\$13	\$13	\$13	\$13	\$13	\$13	\$13	\$13	\$13	\$13	\$13	\$13	\$13	\$13	\$13
Cost of Abatement (\$billion)	16.79	17.15	13.77	5.20	2.02	54.94	0.15	1.25	56.34	0.09	0.76	0.18	0.07	0.00	0.15
Permits exp(-)/imp(+) (Mton) i.e % of commitment (import)	143 25%	36 <i>25%</i>	77 25%	43 <i>25%</i>	30 <i>25</i> %	328 <i>25%</i>	-92	-236	0	-16 i	-143	-34 i	-13 1	-1 ì	-30
Flows exp(-)/imp(+) (\$billion)	1.79	0.45	0.96	0.54	0.37	4.11	-1.15	-2.96	0.00	-0.20	-1.79	-0.43	-0.16	-0.01	-0.38
Total Cost (\$billion)	18.58	17.61	14.74	5.74	2.39	59.05	-1.00	-1.71	56.34	-0.11	-1.03	-0.26	-0.09	0.00	-0.23
Gains from trade (\$billion)	19.05	16.76	15.55	7.07	2.28	60.71	1.00	1.71	63.42	0.11	1.03	0.26	0.09	0.00	0.23
delta gain in % / no limit (table	-29%	-46%	-35%	-27%	-14%	-36%	-76%	-83%	-42%	-84%	-83%	-83%	-84%	-85%	-83%

TABLE T:	CDM monopoly	- with 25%	imitätion on	imports

TABLE T: CDM monopoly - with	1 25% lim	nitation	on impo	rts											
	USA .	JPN	EEC (	00E	EET	oecd+eet	FSU	NAB	World	EEX (	CHN	ND [	DAE I	BRA I	ROW
Reductions / ref 2010 (Mton)	429	108	230	129	114	1010	108	139	1257	8	84	21	7	0	19
'Hot air' (Mton)	١ ١		۱ ۱		١	0	55	0	55	' '	•	•			
Permits Market Pice (\$/ton)	\$109	\$109	\$109	\$109	\$109	\$109	\$109	\$109	\$109	\$109	\$109	\$109	\$109	\$109	\$109
Cost of Abatement (\$billion)	16.79	17.15	13.77	5.20	4.26	57.18	3.95	0.36	61.49	0.02	0.22	0.05	0.02	0.00	0.05
Permits exp(-)/imp(+) (Mton)	143	36	77	43	4	302	-164	-139	0	-8	-84	-21	-7	0	-19
i.e % of commitment (import)	25%	25%	25%	25%	3%	23%	1	١	l l	1	١	1	l	) !	۱
Flows exp(-)/imp(+) (\$billion)	15.57	3.93	8.37	4.67	0.40	32.93	-17.83	-15.10	0.00	-0.91	-9.10	-2.29	-0.73	-0.04	-2.04
Total Cost (\$billion)	32.36	21.08	22.14	9.87	4.66	90.11	-13.88	-14.74	61.49	-0.89	-8.88	-2.23	-0.72	-0.04	-1.99
Gains from trade (\$billion)	5.27	13.29	8.14	2.94	0.01	29.66	13.88	14.74	58.27	0.89	8.88	2.23	0.72	0.04	1.99
delta gain in % / no limit (table	-80%	-57%	-66%	-70%	-100%	-69%	229%	44%	-46%	31%	44%	50%	30%	18%	52%
TABLE U: CDM+FSU monopoly	- with 2	5% limit	ation on	import											· ·
					EET	oecd+eet	FSU	NAB	World	EEX (	CHN	IND	DAE	BRA I	ROW
Reductions / ref 2010 (Mton)	447	108	230	129	119	1034	31	192	1257	12	116	28	10	1	25
'Hot air' (Mton)			\		\	0	55	. 0	55			۱ - ۱			\ -
Permits Market Pice (\$/ton)	\$118	\$118	\$118	\$118	S118	\$118	\$118	S118	\$118	S118	\$118	S118	S118	S118	\$118
Cost of Abatement (\$billion)	18.92	17.15	13.77	5.20	4.80	59.85	0.10	0.77	60.72	0.05	0.47	0.11	0.04	0.00	0.09
Permits exp(-)/imp(+) (Mton)	124	36	77	43	-1	279	-87	-192	00.72	-12	-116	-28	-10	-1	-25
i.e % of commitment (import)	22%	25%	25%	25%	- ۱	21%	ι -0,	, 132	, ď	1	-	1	1	,	, 23
Flows exp(-)/imp(+) (\$billion)	14.64	4.25	9.06	5.05	-0.13	32.87	-10.22	-22.65	0.00	-1.44	-13.68	-3.35	-1,17	-0.06	-2.96
	33.55	21.41	22.83	10.26	4.67	92.71	-10.12	-21.88	60.71	-1.39	-13.21	-3.24	-1.12	-0.06	-2.86
Total Cost (\$billion)	I .		7.46		0.00		10.12		59.05	1.39	13.21	3.24	1,12	0.06	2.86
Gains from trade (\$billion)	4.07	12.96		2.56		27.05		21.88					104%	94%	119%
delta gain in % / no limit (table	-85%	-58%	-69%	-74%	-100%	-71%	140%	114%	-46%	105%	114%	118%	104%	94%	119%
ATTIEN INTERPOLITATION OF THE	0. 054	150/ AC	V 65'												
OTHER INEFFICIENT SUPPLIE	<b>5: 25%,</b> 1	15%, 10	76, 3%, C	ompetit	Ve case	3									
TABLE V: 25%		1011					EQ. 1	****		FEV	O. IN.	11.15	515	204	DOM 7
					EET	oecd+eet	FSU	NAB	World						ROW
Reductions / ref 2010 (Mton)	395	39	169	111	106	819	50	415	1285	33	250	56	27	2	48
'Hot air' (Mton)	1'	•	١ .		1	0	28	0	28	•		•			١
Permits Market Pice (\$/ton)	\$94	\$94	\$94	\$94	\$94	\$94	\$94	\$94	\$94	\$94	\$94	<b>\$94</b>	\$94	\$94	\$94
Cost of Abatement (\$billion)	13.37	1.67	5.98	3.26	3.40	27.68	1.58	14.67	43.92	1.23	8.79	1.92	1.01	0.08	1.63
Permits exp(-)/imp(+) (Mton)	177	105	138	60	12	493	-78	-415	0	-33	-250	-56	-27	-2	-48
i.e % of commitment (import)	31%	73%	45%	35%	10%	38%	١	1	1	1	1	1	1	1	1
Flows exp(-)/imp(+) (\$billion)	16.55	9.88	12.97	5.66	1.14	46.21	-7.30	-38.91	0.00	-3.05	-23.40	-5.27	-2.50	-0.17	4.52
Total Cost (\$billion)	29.92	11.54	18.96	8.93	4.54	73.89	-5.72	-24.24	43.92	-1.82	-14.60	-3.35	-1.49	-0.10	2.89
Gains from trade (\$billion)	7.70	22.82	44.00	0.00	0.40	40.00				4 00	4400	~ ~ -			2.89
	, ,,,,	22.02	11.33	3.89	0.13	45.88	5.72	24.24	75.84	1.82	14.60	3.35	1.49	0.10	2.09
delta gain in % / no limit (table	-71%	-27%	-53%	-60%	-95%	45.88 -51%	5.72 35%	137%	75.84 -30%	168%	137%	125%	1.49	220%	121%
delta gain in % / no limit (table	-71%	-27%	-53%	-60%						168%	137%	125%	170%	220%	
delta gain in % / no limit (table	-71%	-27%	-53%	-60%	-95%	-51%	35%	137%	-30%	168%	137%	125%	170%	220%	121%
delta gain in % / no limit (table TABLE W: 15%	-71% USA	-27% JPN 49	-53% EEC	-60% OOE 128	-95% EET	-51% oecd+eet	35% FSU	137% NAB	-30% World	168% EEX	137% CHN	125% IND 40	170% DAE 19	220% BRA 1	121% ROW
delta gain in % / no limit (table TABLE W: 15% Reductions / ref 2010 (Mton)	-71% USA	-27% JPN 49	-53% EEC 200	-60% OOE 128	-95% EET 123	-51% oecd+eet 965	35% FSU 35	137% NAB 296	-30% World 1296	168% EEX	137% CHN	125% IND 40	170% DAE 19	220% BRA 1	121% ROW 34
delta gain in % / no limit (table TABLE W: 15% Reductions / ref 2010 (Mton) 'Hot air' (Mton)	-71% USA 465	-27% JPN 49	-53% EEC 200	-60% OOE 128	-95% EET 123	-51% oecd+eet 965 0	35% FSU 35 17	137% NAB 296 0	-30% World 1296 17	168% EEX 24	137% CHN 178	125% IND 40	170% DAE 19	220% BRA 1	121% ROW 34
delta gain in % / no limit (table TABLE W: 15% Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton)	-71% USA 465 \$126	-27% JPN 49 \ \$126	-53% EEC 200 \$126	-60% OOE 128 \	-95% EET 123 \ \$126	-51% oecd+eet 965 0 \$126	35% FSU 35 17 \$126	137% NAB 296 0 \$126	-30% World 1296 17 \$126	168% EEX 24 \$126	137% CHN 178	125% IND 40 \$126	170% DAE 19 \ \$126	220% BRA 1 \ \$126	121% ROW 34 \ \$126
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton)	-71% USA 465 \$126 21.00	-27% JPN 49 \$126 2.79	-53% EEC 200 \$126 9.44	-60% OOE 128 \$126 5.12	-95% EET 123 \$126 5.32	-51% oecd+eet 965 0 \$126 43.68	35% FSU 35 17 \$126 0.54	137% NAB 296 0 \$126 6.04	-30% World 1296 17 \$126 50.26	168% EEX 24 \$126 0.56	137% CHN 178 \$126 3.60	125% IND 40 \$126 0.75	170% DAE 19 \$126 0.46	220% BRA 1 \ \$126 0.04	ROW 34 \$126 0.63
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) 'Permits Market Pice (\$/ton) Cost of Abatement (\$billion)	-71% USA 465 \$126 21.00 107	-27%  JPN 49  \$126 2.79 95	-53% EEC 200 \$126 9.44 107	-60% OOE 128 \ \$126 5.12 44	-95% EET 123 \ \$126 5.32 -5	-51% 0ecd+eet 965 0 \$126 43.68 347 26%	35% FSU 35 17 \$126 0.54	137% NAB 296 0 \$126 6.04	-30% World 1296 17 \$126 50.26	168% EEX 24 \$126 0.56	137% CHN 178 \$126 3.60	125% IND 40 \$126 0.75	170% DAE 19 \$126 0.46	220% BRA 1 \ \$126 0.04	ROW 34 \ \$126 0.63
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion)	-71% USA 465 \$126 21.00 107 19%	-27%  JPN 49 \$126 2.79 95 66%	-53% EEC 200 \$126 9.44 107 35%	-60%  OOE 128  \$126 5.12 44 25%	-95% EET 123 \$126 5.32 -5 -5%	-51% 0ecd+eet 965 0 \$126 43.68 347 26%	35% FSU 35 17 \$126 0.54 -52	137% NAB 296 0 \$126 6.04 -296	-30% World 1296 17 \$126 50.26 0	168% EEX 24 \$126 0.56 -24	137% CHN 178 \$126 3.60 -178	125% IND 40 \$126 0.75 -40	170%  DAE  19  \$126  0.46  -19	220% BRA 1 S126 0.04 -1	121% ROW 34 \$126 0.63 -34
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-Vimp(+) (Mton) i.e % of commitment (import)	-71% USA 465 \$126 21.00 107 19% 13.53	-27%  JPN 49 \$126 2.79 95 66% 12.02	-53% EEC 200 \$126 9.44 107 35% 13.51	-60%  128  \$126  5.12  44  25%  5.50	-95% EET 123 \$126 5.32 -5 -5% -0.68	-51%  cecd+eet 965 0 \$126 43.68 347 26% 43.88	35% FSU 35 17 \$126 0.54 -52	NAB 296 0 \$126 6.04 -296 \ \ -37.36	-30% World 1296 17 \$126 50.26 0	168% EEX 24 \$126 0.56 -24	137% CHN 178 \$126 3.60 -178	125% IND 40 \$126 0.75 -40	170%  DAE  19  \$126  0.46  -19  -2.44	220% BRA 1 \$126 0.04 -1	121% ROW 34 \$126 0.63 -34 1 -4.30
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-//imp(+) (Mton) i.e % of commitment (import) Flows exp(-//imp(+) (\$billion) Total Cost (\$billion)	-71% USA 465 \$126 21.00 107 19% 13.53 34.53	-27%  JPN 49 \$126 2.79 95 66% 12.02 14.82	-53% EEC 200 \$126 9.44 107 35% 13.51 22.96	-60%  OOE 128 \$126 5.12 44 25% 5.50 10.62	-95% EET 123 \$126 5.32 -5 -5% -0.68 4.64	-51%  oecd+eet  965  0 \$126  43.68  347  26%  43.88  87.56	35% FSU 35 17 \$126 0.54 -52 -6.52 -5.98	NAB 296 0 \$126 6.04 -296 1 -37.36 -31.32	-30% World 1296 17 \$126 50.26 0	168% EEX 24 \$126 0.56 -24 -2.98 -2.42	137% CHN 178 \$126 3.60 -178 -22.44 -18.84	125% IND 40 \$126 0.75 -40 -5.03 -4.27	170%  DAE  19  \$126  0.46  -19  -2.44  -1.98	220% BRA 1 S126 0.04 -1 -0.18 -0.13	121% ROW 34 \$126 0.63 -34 1 -4.30 -3.67
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion)	-71% USA 465 \$126 21.00 107 19% 13.53 34.53 3.09	-27%  JPN 49  \$126 2.79 95 66% 12.02 14.82 19.55	-53% EEC 200 \$126 9.44 107 35% 13.51 22.96 7.33	-60%  OOE  128  \$126  5.12  44  25%  5.50  10.62  2.20	-95%  EET 123  \$126 5.32 -5 -5% -0.68 4.64 0.03	-51%  oecd+eet 965 0 \$126 43.68 347 26% 43.88 87.56 32.20	35% FSU 35 17 \$126 0.54 -52 1 -6.52 -5.98 5.98	NAB 296 0 \$126 6.04 -296 \ \ -37.36 -31.32 31.32	-30% World 1296 17 \$126 50.26 0 0.00 50.26 69.51	168% EEX 24 \$126 0.56 -24 1 -2.98 -2.42 2.42	137% CHN 178 \$126 3.60 -178 1 -22.44 -18.84 18.84	125% IND 40 \$126 0.75 -40 \ -5.03 -4.27 4.27	170%  DAE  19  \$126 0.46 -19  -2.44 -1.98 1.98	220%  BRA  1  \$126  0.04  -1  -0.18  -0.13  0.13	ROW 34 \ \$126 0.63 -34 \ -4.30 -3.67 3.67
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delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) 'Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE X: 10%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE Y: 5%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton)	USA 465 21.00 107 19% 13.53 3.09 -88% USA 509 27.16 62 11% 9.36 36.51 1.11 -96% USA 563	JPN 49 566% 12.02 19.55 -37% S150 3.74 88 61% 13.24 16.97 17.40 -44% JPN 64	-53%  EEC 200  \$126 9.44 107 35% 13.51 22.96 7.33 -69%  EEC 221 \$150 12.24 87 28% 12.99 25.23 5.06 -79%  EEC 245 \$181	OOE 128 \$126 5.12 44 25% 5.50 10.62 2.20 -77%  OOE 139 \ \$150 6.61 33 19% 4.90 11.51 1.30 -87%  OOE 152 \ \$181	-95%  EET 123 \ \$126 5.32 -5 -5% -0.68 4.64 0.03 -99%  EET 135 \ \$150 6.88 -17 -14% -2.50 4.38 0.29 -89%  EET 148 \ \$181	-51%  0ecd+eet 965 43.68 347 26% 43.88 87.56 32.20 -66%  0ecd+eet 1059 56.62 253 19% 37.98 94.60 25.16 -73%	35% FSU 35 17 \$126 0.54 -52 -6.52 -5.98 42% FSU 25 11 \$150 0.21 -36 1 -5.47 -5.26 5.26 25% FSU 14 6 \$181	NAB 296 6.04 -296 \ -37.36 -31.32 206%  NAB 217 0 \$150 2.76 -217 \ -32.52 -29.75 29.75 191%  NAB 120 0 \$181	-30% World 1296 177 \$126 50.26 0 0.00 50.26 69.51 -36% World 1301 \$150 59.59 0 0.00 59.59 60.18 -45% World 1307 6 \$181	EEX 24 17 256% EEX 17 2.61 -2.34 2.34 244% EEX 10 \$181	137% CHN 178 \$126 3.60 -178 18.84 205% CHN 130 \$150 1.64 -130 1-19.52 -17.88 17.88 190% CHN 72	125% IND 40 \$126 0.75 -40 -5.03 -4.27 187% IND 29 \$150 0.33 -29 1 -4.36 -4.03 4.03 171% IND 16 \$181	DAE 19 \$126 0.46 -19 -2.44 -1.98 1.98 259%  DAE 14 \$150 0.23 -14 -2.14 -1.91 1.91 248%  DAE 8	BRA 1 1 S126 0.04 -1 1 -0.18 -0.13 0.13 347% BRA 1 S150 0.02 -1 1 -0.16 -0.13 0.13 348% BRA 1 S181	ROW 34 1 4.30 -3.67 181% ROW 25 150 0.27 -25 1 -3.73 -3.46 3.46 165% ROW 14 \$181
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-\text{/imp(+)} (Mton) i.e % of commitment (import) Flows exp(-\text{/imp(+)} (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE X: 10%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-\text{/imp(+)} (Mton) i.e % of commitment (import) Flows exp(-\text{/imp(+)} (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE Y: 5%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion)	-71%  USA  465  \$126  21.00  107  19%  13.53  34.53  3.09  -88%  USA  509  \$150  27.16  62  11%  9.36  36.51  1.11  -96%  USA  USA  USA  USA	-27%  JPN 49 \$126 2.79 95 66% 12.02 14.82 19.55 -37%  JPN 56 \$150 3.74 88 61% 13.24 16.97 17.40 -44%  JPN 64 \$181 5.13	-53%  EEC 200  \$126 9.44 107 35% 13.51 22.96 7.33 -69%  EEC 221  \$150 12.24 87 28% 12.99 25.23 5.06 -79%  EEC 245  \$181 16.28	OOE 128 \$126 5.12 44 25% 5.50 10.62 2.20 -77%  OOE 139 \$150 6.61 33 19% 4.90 11.51 1.30 -87%  OOE 152 \$181 8.77	-95%  EET  123  \$126 5.32 -5 -5% -0.68 4.64 0.03 -99%  EET  135 \$150 6.88 -17 -14% -2.50 4.38 0.29 -89%  EET  148  \$181 9.12	-51%  oecd+eet  965 0 \$126 43.68 347 26% 43.88 87.56 32.20 -66%  0ecd+eet 1059 56.62 253 19% 37.98 94.60 25.16 -73%  oecd+eet 1172 0 \$181 75.35	35% FSU 35 17 \$126 0.54 -52 -6.52 -5.98 5.98 42% FSU 25 11 \$150 0.21 -36 1 -5.47 -5.26 5.26 25% FSU 14 6 \$181 0.04	NAB 296 6.04 -296 1-37.36 -31.32 31.32 206% NAB 217 -32.52 -29.75 29.75 191% NAB 120 \$181 0.67	-30% World 1296 17 \$126 50.26 0 0.00 50.26 69.51 -36% World 1301 11 \$150 59.59 0 0.00 59.59 60.18 -45% World 1307 6.5181 76.05	168%  EEX 24 \$126 0.56 -24 -2.98 -2.42 2.56%  EEX 17 \$150 0.27 -17 -2.61 -2.34 2.34 244%  EEX 10 \$181 0.07	CHN 178 3.60 -178 18.84 205% S150 1.64 -130 1.71 -19.52 -17.88 190% CHN 72 S181 0.39	125% IND 40 \$126 0.75 -40 -5.03 -4.27 187% IND 29 \$150 0.33 -29 -4.36 -4.03 4.03 171% IND 16 \$181 0.07	DAE  19  \$126 0.46 -19 -2.44 -1.98 1.98 259%  DAE  4 -1.91 -2.14 -1.91 1.91 248%  DAE  8  \$181 0.06	BRA 1 1 S150 0.02 -1 1 -0.16 -0.13 348% BRA 1 S181 0.01	ROW 34 1 -4.30 -3.67 181% ROW 25 150 0.27 -25 1 -3.73 -3.46 165% ROW 14 \$181 0.06
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-//imp(+) (Mton) i.e % of commitment (import) Flows exp(-//imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE X: 10%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Total Cost (\$billion) Gains from trade (\$billion) Flows exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE Y: 5%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton)	USA 465 \$126 21.00 107 19% 13.53 34.53 3.09 -88%  USA 509 \$150 27.16 62 11% 9.36 36.51 1.11 -96%  USA 563 \$181 36.05	-27%  JPN 49 \$126 2.79 95 66% 12.02 14.82 19.55 -37%  JPN 56 \$150 3.74 88 61% 13.24 16.97 17.40 -44%  JPN 64 \$181 5.13 80	-53%  EEC 200  \$126 9.44 107 35% 13.51 22.96 7.33 -69%  EEC 221  \$150 12.24 87 28% 12.99 25.23 5.06 -79%  EEC 245  \$181 16.28 62	OOE 128 \$126 5.12 44 25% 5.50 10.62 2.20 -77% OOE 139 \ \$150 6.61 33 19% 4.90 11.51 1.30 -87% OOE 152 \ \$181 8.77 20	-95%  EET 123 \$126 5.32 -5.5% -0.68 4.64 0.03 -99%  EET 135 \ \$150 6.88 -17 -14% -2.50 4.38 0.29 -89%  EET 148 \ \$181 9.12 -30	-51%  □ 0ecd+eet  965 0 \$126 43.68 347 26% 43.88 87.56 32.20 -66% □ 1059 0 \$150 56.62 253 19% 37.98 94.60 25.16 -73%  □ 0ecd+eet  1172 0 \$181 75.35 140	35% FSU 35 17 \$126 0.54 -522 -5.98 5.98 42% FSU 25 11 \$150 0.21 -5.47 -5.26 5.26 25% FSU  FSU 14 6 \$181 0.04 -20	NAB 296 6.04 -296 1-37.36 -31.32 31.32 206% NAB 217 -32.52 -29.75 29.75 191% NAB 120 \$181 0.67	-30% World 1296 17 \$126 50.26 0 0.00 50.26 69.51 -36% World 1301 11 \$150 59.59 0 0.00 59.59 60.18 -45% World 1307 6.5181 76.05	EEX 24 17 256% EEX 17 -2.61 -2.34 2.34 244% EEX 10 0.07	137% CHN 178 \$126 3.60 -178 18.84 205% CHN 130 \$150 1.64 -130 1-19.52 -17.88 17.88 190% CHN 72	IND 40  \$126 0.75 -40  -5.03 -4.27 4.27 187%  IND 29  \$150 0.33 -29  -4.36 -4.03 4.03 171%  IND 16  \$181 0.07 -16	DAE 19 \$126 0.46 -19 -2.44 -1.98 1.98 259%  DAE 14 \$150 0.23 -14 -2.14 -1.91 1.91 248%  DAE 8	BRA 1 1 S126 0.04 -1 1 -0.18 -0.13 0.13 347% BRA 1 S150 0.02 -1 1 -0.16 -0.13 0.13 348% BRA 1 S181	ROW 34 1 4.30 -3.67 181% ROW 25 150 0.27 -25 1 -3.73 -3.46 3.46 165% ROW 14 \$181
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-//imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Total Cost (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE X: 10%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (\$/tillion) Total Cost (\$/tillion) Gains from trade (\$/tillion) Gains from trade (\$/tillion) Gains from trade (\$/tillion) Total Cost (\$/tillion) Gains from trade (\$/tillion) Cost of Abatement (\$/tillion) Cost of Abatement (\$/tillion) Cost of Abatement (\$/tillion) Permits Market Pice (\$/ton) Cost of Abatement (\$/tillion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import)	USA 465 \$126 21.00 107 19% 13.53 3.09 -88%  USA 509 \$150 27.16 62 11% 9.36 36.51 1.11 -96%  USA 563 \$181 36.05 9 2%	JPN 49 \$126 2.79 95 66% 12.02 14.82 19.55 -37% \$150 3.74 88 61% 13.24 16.97 17.40 -44% \$181 5.13 80 555%	-53%  EEC 200  \$126 9.44 107 35% 13.51 22.96 7.33 -69%  EEC 221  \$150 12.24 87 12.99 25.23 5.06 -79%  EEC 245  \$181 16.28 62 20%	OOE 128 \$126 5.12 44 25% 5.50 10.62 2.20 -77%  OOE 139 \ \$150 6.61 33 19% 4.90 11.51 1.30 -87%  OOE 152 \ \$181 8.77 20 11%	-95%  EET 123  \$126 5.32 -5.6% -0.68 4.64 0.03 -99%  EET 135  \$150 6.88 -17 -14% -2.50 4.38 0.29 -89%  EET 148  \$181 9.12 -30 -26%	-51%  oecd+eet  965 43.68 347 26% 43.88 87.56 32.20 -66%  oecd+eet  1059 9 \$150 56.62 253.19% 37.98 94.60 25.16 -73%  oecd+eet  1172 0 \$181 75.35 140 11%	35% FSU 35, 17 \$126 0.54 -5.28 5.98 5.98 42% FSU 25 11 \$150 0.21 -3.66 5.26 25% FSU 14 6 \$181 0.04 -20	NAB 296 0 \$126 6.04 -296 -37.36 -31.32 206%  NAB 217 0 \$150 2.76 -217 -32.52 -29.75 29.75 191%  NAB 120 0 \$181 0.67 -120	-30% World 1296 177 \$126 50.26 0 1.000 50.26 69.51 -36% World 1301: \$150 59.59 0.00 59.59 60.18 -45% World 1307 6 \$181 76.05	EEX 24 \$126 0.56 -24 \ -2.98 -2.42 2.56% EEX 17 \$150 0.27 -17 \ -2.61 -2.34 2.44% EEX 10 \ \$181 0.07 -10	137% CHN 178 \$126 3.60 -178 18.84 -18.84 205% CHN 130 \$150 1.64 -130 -19.52 -17.88 17.88 17.88 190% CHN 72 \$181 0.39 -72	125% IND 40 \$126 0.75 -40 -5.03 -4.27 4.27 187% IND 29 \$150 0.33 -29 -4.36 -4.03 4.03 171% IND 16 \$181 0.07 -16	DAE 19 \$126 0.46 -19 1-2.44 -1.98 1.98 259% DAE 14 \$150 0.23 -14 1.91 248% DAE 8 \$181 0.06 -8	BRA 1 1 S126 0.04 -1 1 1 S150 0.02 -1 1 1 S181 0.01 1 S181 0.0	ROW 34 1 25 121% ROW 25 181% ROW 25 150 0.27 -25 1-3.73 -3.46 3.46 165% ROW 14 1 \$181 0.066 -14
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE X: 10%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) delta gain in % / no limit (table TABLE Y: 5%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Cost of Abatement (\$billion) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion)	USA 465 21.00 107 19% 13.53 3.09 -88% USA 509 27.16 62 11% 9.36 36.51 1.11 -96% USA 563 \$181 36.05 9 2% 1.55	JPN 49 5126 2.79 95 66% 12.02 14.82 19.55 -37% S150 3.74 88 61% 13.24 16.97 17.40 -44% JPN 64 \  S181 5.13 80 55% 14.45	-53%  EEC 200  \$126 9.44 107 35% 13.51 122.96 7.33 -69%  EEC 221  \$150 12.24 87 28% 12.99 25.23 5.06 -79%  EEC 245  \\$181 16.28 62 20% 11.25	-60%  128  \$126 5.12 44 25% 5.50 10.62 2.20 -77%  OOE 139  \$150 6.61 33 19% 4.90 11.51 1.30 -87%  OOE 152 \ \$181 8.77 20 11% 3.54	-95%  EET 123  \$126 5.32 -5.8% -0.68 4.64 0.03 -99%  EET 135  \$150 6.88 -17 -14% -2.50 4.38 0.29 -89%  EET 148 \ \$181 9.12 -30 -26% -5.47	-51%  oecd+eet  965 43.68 347 26% 43.88 87.56 32.20 -66%  oecd+eet  1059 9.56.62 253 19% 37.98 94.60 25.16 -73%  oecd+eet  1172 0 \$181 75.35 1400 117% 25.33	35% FSU 35 17 \$126 0.54 -52 -6.52 -5.98 5.98 42% FSU 25 11: \$150 0.21 -36 25% FSU 66 25% FSU 14 66 \$181 0.04 -20 1 -3.53	NAB 296 6.04 -296 \ \ -37.36 -31.32 206%  NAB 217 0 \$150 2.76 -217  -32.52 -29.75 29.75 191%  NAB 120 0 \$181 0.67 -120 \ \ -21.80	-30% World 1296 177 \$126 50.26 0 0 10.00 50.26 69.51 -36% World 1301 \$150 59.59 0 0.00 59.59 60.18 -45% World 1307 6 \$181 76.05 0	EEX 24 17 256% EEX 17 \$150 0.27 -17 -2.61 -2.34 244% EEX 10 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	CHN 178 3.60 -178 18.84 205% CHN 130 1.64 -130 17.88 17.88 190% CHN 72 13.08 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 1	125% IND 40 \$126 0.75 -40 -5.03 -4.27 4.27 187% IND 29 \$150 0.33 -29 -4.36 -4.03 4.03 171% IND 16 \$181 0.07 -16 -2.91	DAE 19 \$126 0.46 -19 -2.44 -1.98 1.98 259%  DAE 14 \$150 0.23 -14 -2.14 -1.91 1.91 248%  DAE 8 \ \$181 0.06 -8 \ -1.45	BRA 1 1 S126 0.04 -1 1 -0.16 -0.13 0.13 348% BRA 1 S181 0.01 -1 1 -0.11	ROW 34 1 -4.30 -3.67 3.67 181% FOW 25 150 0.27 -25 1.3.46 3.46 165% FOW 14 1 \$181 0.06 -14 1 -2.49
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE X: 10%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE Y: 5%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits Market Pice (\$/ton) Cost of Abatement (\$/ton) Permits Market Pice (\$/ton) Cost of Abatement (\$/ton) Permits exp(-)/imp(+) (\$/ton) I flows exp(-)/imp(+) (\$/ton) I flows exp(-)/imp(+) (\$/ton) I fotal Cost (\$/ton) Total Cost (\$/ton)	USA 465 21.00 107 19% 13.53 3.09 -88%  USA 509 \$150 27.16 62 11% 9.36 36.51 1.11 -96%  USA USA  USA 563 \$181 36.05 9 2% 1.55 37.60	JPN 49 566% 12.02 14.82 19.55 -37% S150 3.74 88 61% 13.24 16.97 17.40 -44% JPN 64 555% 14.45 19.58	-53%  EEC 200  \$126 9.44 107 35% 13.51 22.96 7.33 -69%  EEC 221 \$150 12.24 87 28% 12.99 25.23 5.06 -79%  EEC 245  \$16.28 62 20% 511.25 27.53	OOE 128 \$126 5.12 44 25% 5.50 10.62 2.20 -77%  OOE 139 \ \$150 6.61 33 19% 4.90 11.51 1.30 -87%  OOE 152 \ \$181 8.77 20 11% 3.54 12.32	-95%  EET 123  \$126 5.32 -5.5% -0.68 4.64 0.03 -99%  EET 135  \$150 6.88 -17 -14% -2.50 4.38 0.29 -89%  EET 148  \$181 9.12 -30 -26% -5.47 3.65	-51%  0ecd+eet 965 43.68 347 26% 43.88 87.56 32.20 -66%  0ecd+eet 1059 56.62 253 19% 37.98 94.60 25.16 -73%  0ecd+eet 1172 0 \$181 75.35 140 11% 25.33 100.68	35% FSU 35, 17 \$126 0.54 -52 -6.52 -5.98 5.98 42% FSU 25 11: \$150 0.21 -36 5.26 5.26 25% FSU 14 6 \$181 0.04 -20 -3.53 -3.49	NAB 296 6.04 -296 137.36 -37.36 -31.32 206%  NAB 217 0 \$150 2.76 -217 -32.52 -29.75 29.75 191%  NAB 120 \$181 0.67 -120 -21.80 -21.13	-30% World 1296 177 \$126 50.26 0 0 0.00 50.26 69.51 -36% World 1301 \$11 \$150 59.59 0 0.00 59.59 60.18 -45% World 1307 6 \$181 76.05 0 0.00 76.05	EEX 24 \$126 0.56 -24 -2.98 -2.42 2.56%  EEX 17 \$150 0.27 -17 -2.61 -2.34 2.34 244%  EEX 10 \$181 0.07 -10 -1.76 -1.69	137%  CHN 178 3.60 -178 18.84 205%  CHN 130 \$150 1.64 -130 1-19.52 -17.88 17.88 190%  CHN 72 \$181 0.39 -72 -13.08 -12.69	IND 40  \$126 0.75 -40 -5.03 -4.27 187%  IND 29 \$150 0.33 -29 1 -4.36 -4.03 4.03 171%  IND 16  \$181 0.07 -16 1 -2.91 -2.84	DAE 19 \$126 0.46 -19 -2.44 -1.98 1.98 259%  DAE 14 \$150 0.23 -14 -2.14 -1.91 1.91 248%  DAE  \$181 0.06 -8 -1.45 -1.45 -1.39	BRA 1 1 S126 0.04 -1 1 -0.16 -0.13 0.13 347% BRA 1 S150 0.02 -1 1 1 -0.16 -0.13 0.13 348% BRA 1 1 S181 0.01 -1 1 -0.10	ROW 34 1 -4.30 -3.67 181% ROW 25 150 0.27 -25 1 -3.73 -3.46 3.46 165% ROW 14 \$181 0.06 -14 1 -2.49 -2.43
delta gain in % / no limit (table TABLE W: 15%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) Gains from trade (\$billion) delta gain in % / no limit (table TABLE X: 10%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion) delta gain in % / no limit (table TABLE Y: 5%  Reductions / ref 2010 (Mton) 'Hot air' (Mton) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Cost of Abatement (\$billion) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits Market Pice (\$/ton) Cost of Abatement (\$billion) Permits exp(-)/imp(+) (Mton) i.e % of commitment (import) Flows exp(-)/imp(+) (\$billion)	USA 465 \$126 21.00 107 19% 13.53 34.53 3.09 -88% USA 509 \$150 27.16 62 11% 9.36 36.51 1.11 -96% USA 563 \$181 36.05 9 2.55 37.60 0.02	JPN 49 5126 2.79 95 66% 12.02 14.82 19.55 -37% S150 3.74 88 61% 13.24 16.97 17.40 -44% JPN 64 \  S181 5.13 80 55% 14.45	-53%  EEC 200  \$126 9.44 107 35% 13.51 122.96 7.33 -69%  EEC 221  \$150 12.24 87 28% 12.99 25.23 5.06 -79%  EEC 245  \\$181 16.28 62 20% 11.25	-60%  128  \$126 5.12 44 25% 5.50 10.62 2.20 -77%  OOE 139  \$150 6.61 33 19% 4.90 11.51 1.30 -87%  OOE 152 \ \$181 8.77 20 11% 3.54	-95%  EET 123  \$126 5.32 -5.8% -0.68 4.64 0.03 -99%  EET 135  \$150 6.88 -17 -14% -2.50 4.38 0.29 -89%  EET 148 \ \$181 9.12 -30 -26% -5.47	-51%  oecd+eet  965 0 \$126 43.68 347 26% 43.88 87.56 32.20 -66%  oecd+eet  1059 0 \$150 56.62 253 19% 37.98 94.60 25.16 -73%  oecd+eet  1172 0 \$181 75.35 140 117% 25.33 100.68 19.09	35% FSU 35 17 \$126 0.54 -522 -5.98 5.98 42% FSU 25 11 \$150 0.21 -3.66 25% FSU 14 6.526 5.26 \$5.28 \$14 0.04 -20 \ -3.53 -3.49 3.49	NAB 296 6.04 -296 -37.36 -31.32 31.32 206%  NAB 217 0 \$150 2.76 -217 -32.52 -29.75 191%  NAB 120 0 \$181 0.67 -120 \[ -21.80 -21.13 21.13	-30% World 1296 177 \$126 50.26 0 0.00 50.26 69.51 -36% World 1301 11 \$150 59.59 0.00 59.59 60.18 -45% World 1307 6 \$181 76.05 0 1 0.00 76.05 43.71	EEX 24 17 256% EEX 17 \$150 0.27 -17 -2.61 -2.34 244% EEX 10 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	CHN 178 3.60 -178 18.84 205% CHN 130 1.64 -130 17.88 17.88 190% CHN 72 13.08 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 17.89 1	125% IND 40 \$126 0.75 -40 -5.03 -4.27 4.27 187% IND 29 \$150 0.33 -29 -4.36 -4.03 4.03 171% IND 16 \$181 0.07 -16 -2.91	DAE 19 \$126 0.46 -19 -2.44 -1.98 1.98 259%  DAE 14 \$150 0.23 -14 -2.14 -1.91 1.91 248%  DAE 8 \ \$181 0.06 -8 \ -1.45	BRA 1  S126 0.04 -1  -0.18 -0.13 0.13 347%  BRA 1  S150 0.02 -1 -0.16 -0.13 348%  BRA 1  S181 0.01 -1  -0.11 -0.10 0.10	ROW 34 1 -4.30 -3.67 3.67 181% S150 0.27 -25 1 -3.73 -3.46 165% ROW 14 1 0.06 -14 1 -2.49 -2.43 2.43

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