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INTERNATIONAL ENERGY AGENCY

CLIMATE CHANGE POLICY INITIATIVES: UPDATES

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AGENCE INTERNATIONALE DE L'ÉNERGIE

INITIATIVES DE LA POLITIQUE SUR LE CHANGEMENT CLIMATIQUE: MISE À JOUR

NOVEMBRE 1991

External Affairs and International Trade Canada
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INTERNATIONAL ENERGY AGENCY

CLIMATE CHANGE POLICY INITIATIVES UPDATE - INTRODUCTION

This International Energy Agency (IEA) publication updates the information in the first publication of July, 1991. It has been reproduced by the Department of External Affairs and International Trade as an aid to those interested in climate change issues, in particular those following the negotiations on a framework convention on climate change. It gives an up-to-date, detailed description of energy-related climate change policy initiatives in the 24 OECD countries, in the European Community, and in 11 key countries outside the OECD regions. There are new country profiles for Australia, Belgium, Canada, Denmark, Finland, France, Japan, the Netherlands, New Zealand, Switzerland, Turkey, the United Kingdom, the United States, and the European Community. A country profile for Iceland has been provided. For the OECD countries of Germany, Ireland, Italy, Portugal, Spain, and Sweden, there are new key energy and environment data sheets due to entirely 1989 data for world energy supply and world CO2.

A new introductory note is located under Tab 1. A description of methodology for calculating historical energy consumption and associated carbon dioxide emissions, each OECD country's share of CO2 emissions from other solid fuels combustion in 1989, and the new country profiles for the 11 key countries outside the OECD regions are found under Tab 27.

Min. des Affaires
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AGENCE INTERNATIONALE DE L'ÉNERGIE

INTRODUCTION

INITIATIVES DE LA POLITIQUE SUR LE CHANGEMENT CLIMATIQUE - MISE À JOUR

La présente publication de l'Agence internationale de l'énergie se veut une mise à jour des renseignements contenus dans la publication de juillet dernier. Elle a été reproduite par Affaires extérieures et Commerce extérieur Canada à l'intention des personnes qui s'intéressent au changement climatique, et plus particulièrement aux négociations entourant la convention cadre sur le changement climatique. La publication

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fait le point sur les mesures gouvernementales prises dans le domaine du changement climatique et liées à l'énergie au sein des 24 pays de l'OCDE, de la Communauté européenne et dans 11 grands pays ne faisant pas partie de l'OCDE. De plus, de nouveaux profils ont été établis pour l'Australie, la Belgique, le Canada, la Communauté européenne, le Danemark, les États-Unis, la Finlande, la France, le Japon, la Nouvelle-Zélande, les Pays-Bas, le Royaume-Uni, la Suisse et la Turquie. On y trouve également un profil pour l'Islande. Pour ce qui est de l'Allemagne, de l'Irlande, de l'Italie, du Portugal, de l'Espagne et de la Suède, tous membres de l'OCDE, on trouve de nouvelles fiches techniques sur l'énergie et l'environnement étant donné les nouvelles statistiques sur les ressources énergétiques et les émissions de dioxyde de carbone dans le monde publiées en 1989.

Une nouvelle note préliminaire figure à la section 1. De plus, la section 27 comprend maintenant une description de la méthode utilisée pour calculer, au cours des ans, la consommation d'énergie ainsi que les émissions de dioxyde de carbone qui y sont associées; on y donne également la quantité d'émissions de dioxyde de carbone provenant de la consommation de combustibles solides en 1989 pour chaque pays de l'OCDE, ainsi que les nouveaux profils des 11 grands pays qui ne font pas partie de l'OCDE.

INTERNATIONAL ENERGY AGENCY

CLIMATE CHANGE POLICY INITIATIVES: UPDATES

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CLIMATE CHANGE POLICY INITIATIVES:

UPDATE

20 November 1991

1. Introduction and Major Changes in Content and Policies to be Found in Country Profiles

This is the first update since the 20 June 1991 publication in binder form. The replacement pages provided should be substituted for those of the same title in the binder. This update is timed to coincide with the fourth session of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC). The next update will most likely precede its fifth session.

Together with these replacement pages, then, the publication gives an up-to-date, detailed description of energy-related climate change policy initiatives in the 24 OECD Member countries[1] and within the European Community. Country profiles include information on measures, either taken or contemplated, such as carbon taxes,

1. Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States.

regulations, and greenhouse gas emissions targets as well as factors influencing these policies. These profiles have again been reviewed for accuracy by individual country governments.

Since the 20 June 1991 edition of this binder, a country profile for Iceland has been added. Otherwise, no major modifications have been made in climate change policies of OECD members. Rather, some have refined their positions and further defined the actions, mostly of the "make-sense" variety, to be taken or being studied. The minor modifications in the updated country description provided for individual OECD Member countries include:

- for Australia, specific actions relating to energy efficiency in a variety of end-use sectors are described;
- for Belgium, a recently completed relevant study is added;
- for Canada, the National Action Strategy on Global Warming is described;
- for Denmark, the description of its CO_2 tax proposal is updated;
- for France, an action principle on differentiated responsibilities is added;
- for Japan, references to and description of its "New Earth 21 Initiative" are added;
- for the Netherlands, the new "White Paper on Climate Change" is described;
- for Turkey, air pollution emission limitation laws and policies are described;
- for the United Kingdom, measures taken in the transport sector are described; and
- for the European Community, details of the proposed carbon/energy tax are provided.

In addition there are very minor corrections or clarifications made in the country descriptions for Finland, New Zealand, Switzerland and the United States.

Completely new with this update is Annex III containing country profiles for the top eleven energy-related CO_2 emitters[1] outside OECD: Brazil, China, Czechoslovakia,

1. CO_2 accounts for the largest share of radiative forcing due to increased greenhouse gas emissions, but other important contributors are methane, chlorofluorocarbons and nitrous oxide. All GHGs and both their sources and sinks, must be accounted for in measuring contributions to net GHGs. However, limitations of IEA data restrict further discussion to CO_2 emissions only for the present.

India, Mexico, Poland, Romania, Republic of South Korea, Saudi Arabia, South Africa and the USSR. These profiles contain country positions, factors and key data.

This is an important addition to the binder as already these eleven countries represent 37 per cent of present global (and 70 per cent of non-OECD) emissions of energy-related CO_2. Table 1, which has been modified only slightly to update all data to 1989 data, provides Key Energy and Environmental Data for OECD countries relevant to climate change policies[1]. Table 2 is new and adds key data for these non-OECD countries, paralleling the information provided in Table 1 for OECD countries. For context, Table 3 provides the relevant percentages of the energy-related CO_2 emissions for the top 21 emitting countries globally.

For countries outside of the OECD region, the expectations for rapid industrialisation, population growth, urbanisation and increasing standard of living imply an increasing share of energy and hence emissions over the years as shown in Figure 1. For three of these countries coal represents over 70 per cent of TPES and for two others over 50 per cent. Within the TPES represented by commercial fuel use, fossil fuel dependency is over 90 per cent for all but two of the eleven (see Table 4, 1989 TPES, Fuel Shares of TPES and Fossil Fuel Dependency) and most of them have few affordable fuel-switching opportunities. Most are using sub-optimum combustion equipment. Furthermore, Table 4 also shows that a number of them use significant amounts of non-commercial fuels[2]. Hence, the trend to move away from non-commercial fuels has meant increasing use of fossil fuels. Finally, several of them are also major exporters of fossil fuels. For example, for world hard coal exports:

- South Africa is third largest;
- the USSR is fourth largest;
- Poland is sixth largest; and
- China is seventh largest.

Similarly for oil exports, the USSR, Saudi Arabia and Mexico are all major world oil exporters.

Most of these eleven key non-OECD countries have been very active in the ongoing IPCC and INC processes. Furthermore, China hosted and a number of them attended

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1. It should be noted that the data in Table 1 differ from those data published in the IEA publication, *Energy Policies and Programmes*, because here the energy data have been modified to exclude non-carbon dioxide emitting uses of fossil energy (i.e. non-energy use and petrochemical feedstocks). These modified data have then been converted to give country specific CO_2 emissions in million tonnes of carbon. Annex 1 describes the methodology for calculating historical energy consumption and associated carbon dioxide emission.

2. A wide variety of fuels burnt at very low efficiencies are included in this category. Their consumption, expressed in heat value (Mtoe), does not take account of the efficiency of their final use.

the Beijing Ministerial Declaration on Environment and Development (see excerpts at the end of Annex III.)

2. More on Treatment of CO_2 from Biomass

Certain countries would like to see their CO_2 emissions data, such as that presented in Table 1, reported minus the CO_2 resulting from the burning of biomass in a sustainable way (i.e. where carbon is in fact recycled in reforestation actions, etc.). This is still not yet possible to do with accuracy, even for OECD countries. Annex 2 provides the percentage of emissions that "other solid fuels" contribute to total energy-related CO_2 emissions in each OECD country. This gives some indication of the relative importance of "other solid fuels" but cannot exactly be treated as being equivalent to CO_2 from biomass burning, depending on the country in question. This is because "other solid fuels" includes wood, wood waste, vegetal waste and black liquor which are possibly sustainably produced as well as industrial waste, municipal waste, peat and other non-specified solid fuels which are either not considered to be sustainably produced (peat) or are a mixture of possibly sustainable and not sustainable components.

But the importance of obtaining this further precision can be illustrated by four examples for which the data are laid out in Table 5. For the case of Sweden, about 92 per cent of the CO_2 from combustion of "other solid fuels" could possibly be sustainably produced and therefore considered as recyclable CO_2 and subtracted from Sweden's total CO_2. This amount is significant as it represents just over 10 per cent of Sweden's total energy-related CO_2 emissions. For Greece, "other solid fuels" is reported to the IEA as virtually all wood combustion and, if sustainably produced, would represent 100 per cent recyclable carbon from "other solid fuels" combustion or slightly over 2 per cent of its total CO_2 emissions. This is perhaps not so significant. Ireland's "other solid fuels" are reported to be virtually all peat, representing 100 per cent non-recyclable CO2. Hence, reporting emissions for Ireland including "other solid fuels" probably accurately represents its net energy-related CO_2 emissions. Alternatively, Switzerland's "other solid fuels" are a mixture of wood, woodwaste, municipal and industrial waste of which approximately 35 per cent is possibly sustainable but again which is less than 2 per cent of its total energy-related CO_2 emissions and not so significant.

Unfortunately the IEA energy balances are not complete for all countries at this level of disaggregation for "other solid fuels". Furthermore, emission factors for some of these fuels are highly uncertain or unavailable. Even for the examples provided above, some assumptions on emission factors were necessary. The subject of "other solid fuels" and their treatment in greenhouse gas emissions inventories will be further discussed at the 5-6 December 1991 IPCC workshop on national emissions inventories to be held in Geneva.

3. Overview of Status of Country Commitments

National commitments to responses to stabilize or reduce greenhouse gas emissions are a primary focus of the INC and are engendering intense discussions in many OECD Member countries. As noted above, some OECD Member countries have developed their response strategies further. But Table 6, which provides an overview of the status of OECD countries' formal commitments to actions to deal with climate change, is largely unchanged from the 21 June 1991 version of this update[1]. Outside the OECD, few countries have either adopted targets or committed themselves to specific strategies for dealing with global climate change. Therefore, the message of Figure 1 remains the same, that is, the OECD Member country undertakings, if achieved, would account for only about a 4 per cent reduction of estimated global emissions of CO_2, which comprises the largest proportion of greenhouse gases, by 2000. Emissions of CO_2 would otherwise be expected to grow by 29 per cent by the year 2000. Nor has there been any significant change in the national approaches taken to commitments to deal with climate change. These approaches are set out in Box 1.

Box 1

Characterisation of Approach to Commitments by OECD Member Countries

- unilateral commitments to targets, backed by funded plans of action (e.g. Netherlands, Denmark);
- unilateral, but preliminary and/or conditional commitments to targets (e.g. Australia, Germany, New Zealand, Norway, United Kingdom);
- targets adjusted for need for economic growth (e.g. Spain, Portugal, Greece);
- targets based on per capita emissions (France, Japan);
- commitment to a set of policies which will stabilize emissions (United States).
- regional targets balanced out by allowing economic-growth-adjusted targets of some countries to be offset by the more aggressive targets of other countries (e.g. the European Community).

1. There have been minor modifications, notably bringing Sweden under the EFTA agreement on targets rather than having its own formal target, changes in the comments and base year for Canada and in the comments for New Zealand and Finland.

4. More on CO_2, Carbon or Related Taxes

There has been no addition to the countries which have actually enacted CO_2, carbon or related taxes either for revenue or for influencing consumer actions; they remain Norway, Finland, the Netherlands and Sweden. It should be noted that a number of countries and the EC itself are considering environment or climate-change related taxes and others have already adopted some environmentally based taxes. Carbon tax proposals are not discussed here because of the uncertainty about the final form and possibilities for adoption of such proposals. The IEA Secretariat has gathered more information to supplement the general information provided in the country profiles on the specific levels and impacts of these taxes, as presented below and in Table 7. This table shows that, except possibly for Sweden and Norway, the net effect of the taxes imposed could not be expected to influence behaviour significantly. Sweden reports that gasoline consumption has stopped its growth trend as a result of its tax reform package which includes the carbon tax.

These taxes have to be seen in the context of the sizeable taxes already imposed on these fuels for fiscal or other policy reasons, such as excise and VAT taxes, which are not necessarily related to the environmental impacts of the fuels. Thus, the relative importance of these carbon taxes tends to be rather negligible. Significant exceptions to the taxes are extended in each case except the Netherlands, e.g. to coal, to energy-intensive industries, the industrial or electricity sectors and air or vessel travel. In Sweden the nominal rate on coal is significant but with the exceptions and the virtually non-existent consumption of coal in the non-industrial sectors, there are in actuality very low amounts of tax collected. The carbon-related taxes in Norway and the Netherlands are not strictly based on the carbon content of the fuels taxed.

Figure 1

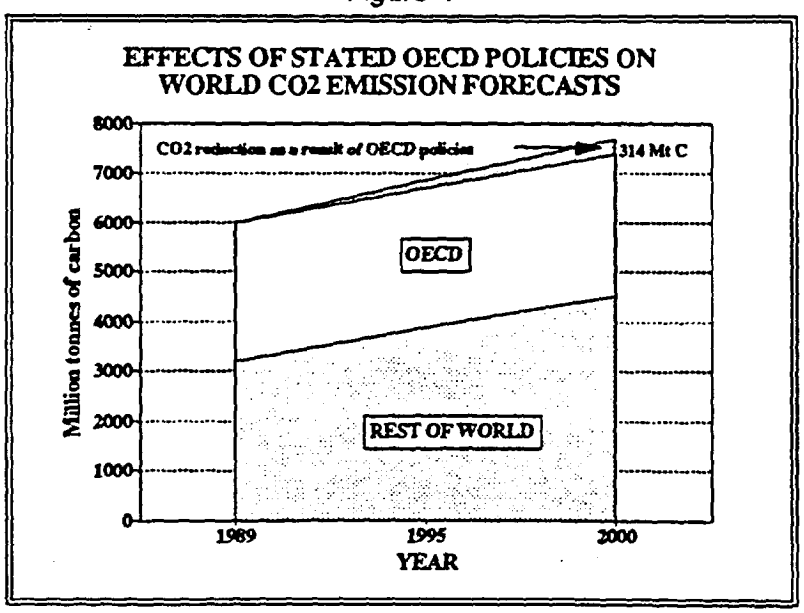

Table 1

Climate Change: Key Energy and Environmental Data for OECD Countries[1] (1989)

	TPES[1] Mtoe	% of Total OECD TPES[2]	% of Total World TPES[3]	Per Capita TPES[4]	TPES/ GDP ratio[5]	Per Capita TFC[1]	TFC/GDP ratio[5]	Energy related CO_2 emissions (Mt Carbon)[6]	Energy related CO_2 emissions per capita[7]	Energy related CO_2 emissions per unit GDP[8]	% of energy related OECD emissions of CO_2[9]	% of energy related World CO_2 emissions[10]
Australia	81.78	2.18	1.10	4.86	0.44	3.20	0.29	74.32	4.42	0.40	2.66	1.26
Austria	22.28	0.59	0.30	2.92	0.31	2.46	0.26	16.68	2.19	0.23	0.60	0.28
Belgium	44.19	1.18	0.60	4.45	0.49	3.09	0.34	29.32	2.95	0.33	1.05	0.50
Canada	204.39	5.44	2.76	7.79	0.51	5.67	0.37	130.05	4.95	0.32	4.66	2.21
Denmark	17.48	0.46	0.24	3.41	0.28	2.53	0.21	15.22	2.97	0.25	0.55	0.26
Finland	26.91	0.72	0.36	5.42	0.42	4.16	0.32	17.73	3.57	0.28	0.63	0.30
France	204.80	5.45	2.77	3.65	0.35	2.29	0.22	106.39	1.89	0.18	3.81	1.81
Germany	253.07	6.73	3.42	4.08	0.37	2.78	0.25	189.56	3.06	0.27	6.79	3.23
Greece	21.25	0.57	0.29	2.12	0.59	1.40	0.39	19.81	1.97	0.55	0.71	0.34
Iceland	1.29	0.03	0.02	5.10	0.40	4.11	0.32	0.59	2.33	0.18	0.02	0.01
Ireland	9.21	0.24	0.12	2.62	0.43	1.96	0.32	8.13	2.31	0.38	0.29	0.14
Italy	143.42	3.81	1.94	2.49	0.30	1.88	0.22	110.09	1.91	0.23	3.94	1.87
Japan	371.76	9.89	5.02	3.02	0.24	2.08	0.16	275.75	2.24	0.18	9.87	4.69
Luxembourg	3.40	0.09	0.05	8.99	0.82	8.52	0.77	2.80	7.41	0.67	0.10	0.05
Netherlands	56.09	1.49	0.76	3.78	0.41	2.82	0.30	42.25	2.85	0.31	1.51	0.72
New Zealand	11.95	0.32	0.16	3.57	0.53	2.49	0.37	6.96	2.08	0.31	0.25	0.12
Norway	20.87	0.56	0.28	4.94	0.33	3.79	0.26	9.94	2.35	0.16	0.36	0.17
Portugal	14.00	0.37	0.19	1.35	0.56	0.98	0.41	12.00	1.16	0.48	0.43	0.20
Spain	79.88	2.12	1.08	2.05	0.40	1.34	0.26	58.17	1.50	0.29	2.08	0.99
Sweden	46.36	1.23	0.63	5.46	0.42	3.70	0.28	20.22	2.38	0.18	0.72	0.34
Switzerland	22.97	0.61	0.31	3.42	0.22	2.85	0.19	12.12	1.80	0.12	0.43	0.21
Turkey	47.19	1.26	0.64	0.85	0.73	0.66	0.57	42.28	0.77	0.66	1.51	0.72
UK	201.03	5.35	2.72	3.51	0.38	2.41	0.26	160.05	2.80	0.30	5.73	2.72
US	1 853.99	49.31	25.04	7.45	0.41	5.24	0.29	1 432.21	5.76	0.31	51.29	24.37
EC	1 032.29	27.34	14.08	3.18	0.37	2.21	0.26	753.79	2.28	0.27	27.06	12.83

1. From the TPES and TFC data non-energy use and use as petrochemical feedstocks have been deducted. For a detailed description of the methodology used to calculate CO_2 emissions see attached Annex 1.
2. OECD total TPES = 3 759.56 Mtoe (being 50.8% of world total).
3. World TPES = 7 403 Mtoe.
4. Tons of oil equivalent per person.
5. Tons of oil equivalent per thousand $ at 1985 prices.
6. CO_2 accounts for the largest share of radiative forcing due to increased greenhouse gas emissions, but other important contributors are methane, chlorofluorocarbons and nitrous oxide. All GHGs and both their sources and sinks, must be accounted for in measuring contributions to net GHGs.
7. Tons of carbon per person.
8. Tons of carbon per thousand $ at 1985 prices.
9. OECD Total CO_2 emissions = 2 792.64 Mt.
10. World CO_2 emissions = 5 877.27 Mt Carbon.

Table 2

Climate Change: Key Energy and Environmental Data[1]
Top Eleven Energy-Related CO_2 Emitters Outside OECD
(1989)

	TPES[1] Mtoe	% of Total Non-OECD[2] TPES	% of Total World TPES[3]	Per Capita TPES[4]	TPES/ GDP ratio[5]	Per Capita TFC[4]	TFC/GDP ratio[5]	Energy related CO_2 emissions per capita[6]	Energy related CO_2 emissions per unit GDP[7]	% of energy related non-OECD emissions[8] of CO_2	% of energy related World CO_2 emissions[9]
Brazil	87.3	2.40	1.18	0.59	0.36	0.58	0.36	0.39	0.24	1.88	0.99
China	644.6	17.69	8.71	0.57	N.A.	0.58	N.A.	0.59	N.A.	20.33	10.67
Czech & Slovak Federal Republic	72.15	1.98	0.97	4.61	N.A.	3.10	N.A.	4.09	N.A.	2.08	1.09
India	167.3	4.59	2.26	0.21	0.70	0.14	0.45	0.20	0.66	5.14	2.70
Republic of Korea	73.9	2.03	1.00	1.74	0.61	1.43	0.50	1.36	0.47	1.86	0.98
Mexico	103.5	2.84	1.40	1.22	0.61	1.00	0.50	0.93	0.46	2.56	1.34
Poland	113.0	3.10	1.53	2.99	N.A.	2.09	N.A.	3.14	N.A.	3.85	2.02
Romania	63.4	1.74	0.86	2.74	N.A.	1.92	N.A.	2.36	N.A.	1.77	0.93
Saudi Arabia	62.7	1.72	0.85	4.35	0.62	3.02	0.43	3.31	0.47	1.55	0.81
South Africa	95.0	2.61	1.28	2.75	1.71	1.25	0.78	2.86	1.78	3.20	1.68
USSR	1 266.2	34.75	17.10	4.40	N.A.	3.34	N.A.	3.45	N.A.	32.13	16.86

1. From the TPES and TFC data *non-energy use and use as petrochemical feedstocks* have been deducted. For a detailed description of the methodology used to calculate CO_2 emissions see attached Annex 1.
2. Non-OECD total TPES = 3 643.83 Mtoe (being 50.8% of world total).
3. World TPES = 7 403 Mtoe.
4. Tons of oil equivalent per person.
5. Tons of oil equivalent per thousand $ at 1985 prices.
6. Tons of carbon per person.
7. Tons of carbon per thousand $ at 1965 prices.
8. OECD Total CO_2 emissions = 2 792.64 Mt.
9. World CO_2 emissions = 5 877.27 Mt Carbon.

Table 3

The Top 21 Energy-Related CO_2 Emitters in the World, 1989

(million tonnes carbon)

United States	1 480.0
USSR	991.0
China	627.0
Japan	288.0
Germany	281.9
United Kingdom	164.0
India	158.7
Canada	135.5
Poland	118.8
Italy	117.3
France	110.8
South Africa	98.7
Mexico	78.9
Australia	76.3
CSFR	64.0
Spain	63.2
Brazil	58.1
South Korea	57.5
Romania	54.7
Netherlands	53.5
Saudi Arabia	47.7

Source: IEA (1991), Energy Statistics and Balances of Non-OECD Countries, 1988-1989.

8. OECD Total CO_2 emissions = 2 792.64 Mt.
9. World CO_2 emissions = 5 877.27 Mt Carbon.

Table 4

1989 TPES[1], Fuel Shares of TPES and Fossil Fuel and Non-Commercial Fuel Dependency

	Coal (% of TPES)	Oil[2] (% of TPES)	Gas (% of TPES)	Nuclear[3] (% of TPES)	Hydro[4] (% of TPES)	Other (% of TPES)	TPES Fossil Fuel Dependency	TPES (Mtoe)	Non-Commercial Fuels (Mtoe)[5]
Brazil	11.2	64.3	2.7	0.5	19.3	2.0	78.29	97.0	45.7
China	79.0	17.5	1.9	-	1.6	-	98.4	649.6	43.4
CSFR	56.8	21.0	12.6	8.8	0.5	0.3	90.4	72.6	1.1
India	56.7	33.7	5.2	1.1	3.2	-	95.6	170.7	63.2
Korea	30.7	50.1	3.3	15.4	0.5	-	84.1	79.9	1.0
Mexico	3.3	69.2	22.0	0.1	5.3	0.2	94.5	114.9	10.0
Poland	78.4	13.6	7.7	-	0.3	0.1	99.7	118.9	1.6
Romania	29.7	23.3	44.5	-	1.5	0.9	97.5	72.6	1.1
Saudi Arabia	-	63.1	36.9	-	-	-	100.0	67.6	0
South Africa	82.2	14.5	-	3.0	0.3	-0.1	96.7	96.8	3.0
USSR	22.1	31.8	40.7	4.1	1.5	-	94.6	1 362.2	24.8

Source: IEA (1991). Energy Statistics and Balances of Non-OECD Countries. 1988-1989.

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1. This TPES includes non-energy use and feedstocks.
2. This includes alcohol fuels for Brazil.
3. Electricity generated by nuclear power is converted to oil equivalent based on the average thermal efficiency of a modern nuclear power plant, i.e. 33% efficiency.
4. Electricity generated by hydropower or other non-thermal sources (e.g. wind, tide, wave, photovoltaics) are converted to oil equivalent based on the energy content of the electricity generated (the equivalent of assuming a 100% efficiency.
5. A wide variety of fuels burnt at very low efficiencies are included in this category. Their consumption, expressed in heat value (Mtoe), does not take account of the efficiency of their final use.

Table 5

Example of Breakdown of Biomass (Other Solid Fuels) for Four OECD Countries

Other Solid Fuels 1988: Energy Use
(TJ)

	Greece	Ireland	Sweden	Switzerland
Wood	20 934	0	0	8 400
Wood Waste	0	0	103 582	3 350
Black Liquor	0	0	108 815	0
Total Possibly Sustainable	20 934	0	212 397	11 750
Peat	0	47 889	5 610	0
Municipal Waste	0	0	14 486	16 210
Industrial Waste	0	0	0	6 250
Total Non-Sustainable	0	47 889	20 096	22 460
Total Other Solid Fuels	20 934	47 889	232 493	34 210

Source for Energy Use: IEA Annual Coal Statistics.

Other Solid Fuels 1988: Carbon Content
(thousand tonnes carbon)

	Greece	Ireland	Sweden	Switzerland
Wood	559	0	0	224
Wood Waste	0	0	2 766	89
Black Liquor	0	0	3 188	0
Total Possibly Sustainable	559	0	5 954	313
Peat	0	1 384	162	0
Municipal Waste	0	0	361	404
Industrial Waste	0	0	0	156
Total Non-Sustainable	0	1 384	523	560
Total Carbon Content	559	1 384	6 477	873

Source of Carbon Factors Used:

Fuel	Carbon (wt %)	Heating Value (GJ/ton)	Carbon Coefficient (ton/TJ)
Municipal Waste[1]	26.7	10.7	24.9
Wood/Wood Waste[1]	27	10.1	26.7
Peat[2]	-	-	28.9
Black Liquor[3]	-	-	29.3

1. % Weight and Heating Value from "Estimation of Greenhouse Gas Emissions and Sinks, Background Report", OECD Experts' Meeting, 18-21 February 1991 and Carbon Coefficient calculated from these factors.
2. Taken directly from Ibid.
3. Taken directly from *Emissions Factors for Greenhouse and Other Gases by Fuel Type: An Inventory*, Energy, Mines and Resources Canada (December 1990).

Table 6

Status of Commitments of OECD Countries on Global Climate Change

Country	Type of Commitment	Gases Included	Action	Base Year	Commitment Year	Conditions/Comments
Australia	Target	NMP GHG	Stabilization 20% Reduction	1988 1988	2000 2005	Interim planning target; to be implemented if others take like action.
Austria*	Target	CO_2	20% Reduction	1988	2005	Still needs parliamentary approval.
Belgium**	EC Agreement	CO_2	(see footnote)			—
Canada	Target	CO_2 and other GHG	Stabilization	1990	2000	CFCs will be phased out by 1997, methyl chloroform by 2000, and other major ozone-depleting substances by 2005.
Denmark**	Target	CO_2	20% Reduction	1988	2005	Implementation plan adopted.
Finland*	Target	CO_2	Stabilization	1990	2000	Policy goal, not a formal target.
France**	Target	CO_2	Stabilization	1990	2000	This is a per capita per year target of less than 2 metric tons of carbon
Germany**	Target	CO_2	25% Reduction	1987	2005	Larger % reductions in eastern Länder
Greece**	EC Agreement	CO_2	(see footnote)			—
Iceland*	EFTA Agreement	CO_2	(see footnote)			—
Ireland**	EC Agreement	CO_2	(see footnote)			—
Italy**	Target	CO_2	Stabilization 20% Reduction	1988 1988	2000 2005	Non-binding resolution.
Japan	Target	CO_2	Stabilization	1990	2000	. on per capita basis; . implemented if others act likewise.
Luxembourg**	EC Agreement	CO_2	(see footnote)			—

Table 6 (Continued)

Status of Commitments of OECD Countries on Global Climate Change

Country	Type of Commitment	Gases Included	Action	Base Year	Commitment Year	Conditions/Comments
Netherlands**	Target	CO_2	Stabilization 3-5% Reduction	89/90 89/90	1995 2000	Unilateral action committed.
	Target	All GHG	20-25% Reduction	89/90	2000	Unilateral action committed.
New Zealand	Target	CO_2	20% Reduction	1990	2000	Conditional on measures to achieve the target not affecting New Zealand's competitive advantage, being cost-effective, providing the greatest range of benefits whether or not climate change occurs, and providing a net benefit for New Zealand society.
Norway*	Target	CO_2	Stabilization	1989	2000	Preliminary.
Portugal**	EC Agreement	CO_2	(see footnote)			—
Spain**	EC Agreement	CO_2	(see footnote)			—
Sweden*	EFTA Agreement	CO_2	(see footnote)			
Switzerland*	Target	CO_2	At least stabilization	1990	2000	Interim target.
Turkey	—	—	—	—	—	—
United Kingdom**	Target	CO_2	Stabilization	1990	2005	Conditional on like action. A 20% reduction in GWP of UK emissions of all GHG in 2005 compared with 1990 levels.
United States	Commitment to set of policies	All GHG	Stabilization	1990	2000	Stabilization achieved in part by CFC phase out
EC	Target	CO_2	Stabilization	1990	2000	Target is for Community as a whole

KEY
- * = EFTA Member
- ** = EC Member
- NMP = Non-Montreal Protocol (refers to greenhouse gases other than those covered under the 1987 "Montreal Protocol on Substances that Deplete the Ozone Layer" and its subsequent Amendments i.e. greenhouse gases other than CFCs, HCFC, halons, carbon tetrachloride, and methyl chloroform).
- GHG = greenhouse gases
- GWP = global warming potential

Note: EC Agreement means that country falls under EC-wide Target but has not yet developed its own target; EFTA agreement means that country falls under agreement between EFTA and the EC that EFTA members would together meet the EC target.

Source: IEA Secretariat and country submissions.

Table 7

Carbon, CO_2, or Related Taxes in OECD Member Countries

Country	Tax in Original Units for Main Products	Tax in $/TC[1]	Fuels Covered	Effective Date	Exceptions	Effects on Fuel Prices	Comments
Finland	Mk 24.50 per TC	6.8	Fossil Fuels	1/1/90	• Motor fuels • Products used as raw materials in industrial production • Fuels in overseas planes and vessels	+1-2% for electricity, light fuel oil and natural gas +5-8% for coal, petrol and heavy fuel oil +10% diesel	1991 all fuels taxes increased by 5% except motor fuel which increased 20%.
Sweden	SKr 250 per t of CO_2	166	Fossil fuels	1/1/91	• Industrial sector • Electricity sector • International sea and air traffic	With accompanying tax changes and drop in crude oil prices, gasoline and diesel remained roughly the same	Simultaneous major tax reform. Sulphur and nitrogen taxes are also in effect.
Norway	NKr 0.6/l petrol. NKr 0.3/l diesel and fuel oils. NKr 0.6/m^3 natural gas.	166 (petrol) 70 (diesel) 167 (natural gas)	Oil products and natural gas burned on Norwegian Continental Shelf	1/1/91	• Fuels in international or domestic air travel • Coal used in energy-intensive industries	+11-13% for petrol, diesel and light fuel oil +23% for heavy fuel oil	To be increased in 1992
Netherlands	Gld 0.31/hectolitre gasoline and kerosene Gld 0.34/hectolitre diesel/gas oil Gld 3.86/tonne heavy fuel oil Gld 3.06/tonne coal Gld 3.96/tonne LPG Gld 2.10/1 000 m^3 natural gas	Up to 3	Fossil fuels	1/2/90	None except non-energy uses	Minimal	In addition to a general environmental tax

TC = Tons of carbon.
t = tonne.

Sources: Country submissions and the Global Environmental Change Report.

1. Based on first quarter 1991 exchange rates.

AUSTRALIA

1. Official Position

On 11 October 1990 the Commonwealth Government of Australia adopted an interim planning target to stabilize emissions of greenhouse gases by the year 2000 (based on 1988 levels) and to reduce those emissions by 20 per cent by the year 2005. The interim target covers all greenhouse gases — namely, carbon dioxide, methane, nitrous oxide — not controlled by the Montreal Protocol on substances that deplete the ozone layer. Australia has an existing policy of phasing out CFCs and halons by 1997.

In implementing the interim planning target, Australia will not proceed with the adoption of response measures which have net adverse economic impacts nationally or on Australia's trade competitiveness in the absence of similar action by major greenhouse gas producing countries. The appropriateness of the level of the interim planning target will be kept under review by the Commonwealth Cabinet, with the first review by October 1991, pursuant to additional scientific information and in the context of any international agreements.

In the context of finalising the Government's Ecologically Sustainable Development Strategy, a working group will report on options to stabilize and reduce greenhouse gas emissions, consistent with the terms outlined above, and on the most cost-effective combination of measures available to reduce emissions. A National Greenhouse Response Strategy was also initiated as part of the 11 October decision. The Strategy will include as its first stage:

- placement of the greenhouse issue on the agenda of the Special Premier's Conference for urgent consideration by the States and Territories of Australia; this

Conference has subsequently been held, and all the States and Territories have adopted the Commonwealth's targets.

It was also agreed that the Industry Commission of Australia should prepare a report concerning the costs and benefits for Australian industry of an international consensus in favour of a 20 per cent reduction in greenhouse gas emissions by 2005, including new opportunities that could arise, and how Australia would best prepare itself to respond to those costs and benefits.

On 23rd October 1990, the Minister for Primary Industries and Energy and the Minister for Resources jointly announced a new package to improve energy efficiency and reduce greenhouse gas emissions. These initiatives aim to achieve more than A$ one billion in annual energy savings by the year 2005 and to reduce CO_2 emissions by around 14 million tonnes each year. The package emphasizes using known and available energy efficient technologies and energy management techniques that can be implemented immediately. The main initiatives incorporated in the package include:

- an information kit on energy efficiency to be delivered to every household in Australia;

- a new programme of energy audits of industrial and commercial enterprises, combined with technology demonstrations;

- demonstrations of energy-efficient technologies in commercial buildings, using Government buildings as models;

- development of codes of practice for energy-efficient construction of residential and commercial buildings;

- extending motor-vehicle fuel-efficiency advisory services to the commercial fleet market;

- new initiatives to upgrade energy management in the Government's own operations.

The Australian and New Zealand Minerals and Energy Council (ANZMEC), consisting of Australian Commonwealth, State and Territory and New Zealand Ministers with responsibility for energy policy, announced a suite of specific actions in the areas of energy labelling of domestic appliances, vehicle fuel efficiency, commercial building efficiency and increased industry involvement in energy efficiency in September 1991.

2. Factors Influencing Decisions

Australia is the world's leading exporter of coal, a major exporter of uranium and, since 1989, an exporter of natural gas. Indigenous production of oil currently provides the bulk of domestic requirements. Energy accounts for about 20 per cent of Australia's export income. It is an important source of revenue for both the Commonwealth and state and territorial governments and, consequently, is a significant element of national economic policy. Other sectors of the Australian economy and aspects of Australian life are also very sensitive to the climate change issue. For example, Australia is a significant exporter of alumina and aluminium; the Australian agricultural sector is very vulnerable to changes in rainfall and temperature; a significant part of the Australian population lives in coastal areas which would be threatened by a rise in the sea level; and much of Australia's unique natural flora and fauna would be endangered by climate change.

A critical aspect of Australian energy policy is the respective roles of the Commonwealth and state and territorial governments, as well as the relationships among individual states and territories. The Australian Constitution gives the Commonwealth Government responsibility for taxation, trade, foreign investment, the development of offshore resources, the negotiation and implementation of international agreements and some other areas affecting energy policy; however, authority over many energy-related areas — such as the regulation of electric and gas utilities; development and transport of onshore energy resources and environmental protection — are assigned to the states and territories except in cases where a Commonwealth Government decision is required.

3. Relevant Studies

- Commonwealth Scientific and Industrial Research Organisation, *Greenhouse: Planning for Climate Change* (Canberra: CSIRO, April 1988).

- Prime Minister's Environmental Strategy (July 1989).

- Prime Minister's Science Council, *Global Climate Change: Issues for Australia* (Canberra: October 1989).

- Prime Minister's Working Group on the Greenhouse Effect Report (December 1989).

- Commonwealth Scientific and Industrial Research Organisation, *The Greenhouse Effect: Issues and Directions for Australia* (Canberra: CSIRO, December 1989).

- Australian Minerals and Energy Council, *Energy and the Greenhouse Effect* (June 1990)

- Treasury Department, *Economic and Regulatory Measures for Ecologically Sustainable Development Strategies* (Canberra: July 1990).

- Australian and New Zealand Environmental Council, *Towards a National Greenhouse Strategy* (August 1990).

- Draft reports of the Ecologically Sustainable Development Working Groups (Canberra, Australian Government Publishing Service, August 1991).

- Draft report of the Industry Commission, *Costs and Benefits of Reducing Greenhouse Gas Emissions* (August 1991).

AUSTRALIA

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	81.78 Mtoe
% Total OECD TPES:	2.18
% Total World TPES	1.10
Per capita TPES:	4.86 toe/person
TPES/GDP ratio:	0.44 toe/100 US$ 1985
Per capita TFC (adjusted):	3.20 toe/person
TFC/GDP ratio:	0.29 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	4.42 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.40 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	2.66
% Total energy related World CO_2 emissions:	1.26
% Population growth (yearly average growth 1980-1989):	1.59

AUSTRIA

1. Official Position

The Austrian Government supported the Action Plan of the Toronto Conference in 1988 which called for a reduction of CO_2 emissions by 20 per cent of 1988 levels by the year 2005. The energy report, adopted by the Government in June 1990, includes environmental compatibility as one of the major goals in Austria's energy policy and the Toronto targets for CO_2 reduction. It is intended to forward the report to the Parliament.

Austria has signed the Sofia-agreement and is thereby committed to stabilize the emissions of NO_x by 1994 and to reduce the emissions by 30 per cent by 1998, compared with the 1987 level.

In another international agreement Austria has agreed that by 1993 the national emissions of SO_x should be reduced to the 1980 level.

Austria signed the CFCs Protocol to the Vienna Convention. CFCs will be totally phased out by 1995.

The target for CO_2 will be achieved through energy conservation and a shift from fossil fuels to renewable energy (hydropower, solar energy and biomass). A 15-20 per cent energy saving potential has been identified and is currently being evaluated.

A conservation programme was launched in 1988. Financial support was cut back and more emphasis put on information and educational activities. The 1990 Energy Report states that the highest priority is given to energy conservation in Austria's energy policy. The conservation programme in the 1990 Energy Report puts more emphasis on market oriented approaches and information. The main instruments to achieve the efficiency goals are research, energy auditing, creation of incentives and legal standards.

Planned measures to reduce emissions include:

- An energy tax is discussed in order to further enforce energy conservation and increase the use of renewable energy.

- An optimisation of the electricity supply sector including new cost-oriented tariff structures.

- An exchange of research results among utilities in order to promote new technologies for energy conservation and renewable energy.

- A reorganisation of the Energy Conservation Agency. The Agency will act as a clearing house for research and information activities.

- A change in the tax system for motor vehicles.

- A reduction of hydrocarbon losses and greenhouse gases from motor vehicles.

The Ministry for Economic Affairs is heading an inter-ministerial committee on energy policy responses to the problem of climate change.

2. Factors Influencing Decisions

Hydropower is the main indigenous energy source, covering over 70 per cent of electricity output. Oil covers 45 per cent of the energy supply and gas 18 per cent, both mainly imported. In 1978 a majority voted against the commissioning of a nuclear plant in a national referendum, which effectively halted nuclear programme in Austria.

The federal nature of Austria's constitution means that both the federal (Bund) and regional governments (Lander) have responsibilities in energy and environmental policies. Examples of responsibilities of the regional governments are: building codes and air pollution from space heating.

3. Relevant Studies

- Bundesministerium fur wirtschaftliche Angelegenheiten (Ministry for Economic Affairs): Energiebericht 1990 der Osterreichischen Bundesregierung (1990 Energy Report from the Austrian Federal Government). Wien, 1990.

- An evaluation of the energy conservation potential.

AUSTRIA

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	22.28 Mtoe
% Total OECD TPES:	0.59
% Total World TPES:	0.30
Per capita TPES:	2.92 toe per person
TPES/GDP ratio:	0.31 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.46 toe per person
TFC/GDP ratio:	0.26 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	2.19 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.23 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.60
% Total energy related World CO_2 emissions:	0.29
% Population growth (yearly average growth 1980-1989):	0.10

BELGIUM

1. Official Position

The Government Declaration of May 1988 on the environment showed that Belgium is sensitive to protection of the environment. However, Belgium has no precise objectives or strategies to address the specific question of GHG emissions.

The general policy on environment would consist of pursuing energy efficiency improvements, an energy pricing policy taking into account the environmental aspects, continued R&D, continued nuclear energy and the development of CHP.

Belgium considers that to deal with such an important and global problem as climate change a comprehensive approach in the EC framework and more generally in the international context (e.g. Toronto) is best.

2. Factors influencing Decisions

The environment has become a priority in public opinion and in politics and each political party has developed an environmental plan.

The energy situation in Belgium is characterised by its important nuclear industry for electricity generation. Nuclear energy represented 60.2 per cent of the fuel inputs in

1990 in electricity generation. The development of nuclear energy for electricity production has greatly contributed to the reduction of CO_2 emissions.

In the absence of new nuclear power stations which were to have been built in the framework of the Equipment Plan 1988-1998 for electricity generation, the Union des Exploitations Electriques et Gazières (Association of electricity and gas producers, UEGB) points out that CO_2 emissions and the use of fossil fuels will increase and thus partly counteracts the limitation of CO_2 emissions which so far has been achieved. The building of combined cycle gas power stations can at best only slightly slow down this trend.

The Law of 8th August 1988 reorganises the responsibilities of the central government and the regions, effective 1st January 1989: its introduction has caused difficulties in establishing new environmental policies as the implementation of environmental regulations had been fully transferred to the regions. Procedures are made more cumbersome by the setting up of new structures in the regions. A co-ordination process in the field of environment is being considered to associate the Administration for Energy, the regions and the Secretariat of State for the Environment.

To meet the requirements for internal coherence and also to comply with international commitments, the various authorities responsible for environmental and energy policies are endeavouring to improve co-ordination with one another: the Ministry of Economic Affairs, Secretariat of State for Energy, External Relations, Public Health and the Secretariat of State for the Environment.

3. Relevant Studies

- "Pollution atmosphérique dans le domaine de l'énergie" — Programme Energie —Convention No. 87-15, Francis Altdorfer. This study which is already available will be updated and data on CO_2 will be included.

- A team of scientific researchers has been set up recently through a joint initiative from the Free University of Brussels, Liège University and the Belgian Space and Aeronautics Institute to identify the various atmospheric pollutants responsible for the climate changes and study their long-term developments, including a systematic survey of various monthly and seasonal variations in pollutant levels.

- "Optimalisation de stratégies de réduction pour les émissions de gaz à effet de serre". This study is carried out in the framework of the national programme "Global change" of the Services de la Programmation de la Politique Scientifique. For this purpose, co-operation has been established between the Centrum voor Ekonomische Studiën (KUL) and the Vlaamse Instelling voor Technologisch Onderzoek (CEN/VITO). From 1991, these two bodies represent Belgium in ETSAP.

BELGIUM

Key Energy and Environment Data
(1989 data)

TPES (adjusted):	44.19 Mtoe
% Total OECD TPES:	1.18
% Total World TPES:	0.60
Per capita TPES:	4.45 toe per person
TPES/GDP ratio:	0.49 toe/1000 US$ 1985
Per capita TFC (adjusted):	3.09 toe per person
TFC/GDP ratio:	0.34 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	2.95 t carbon/person
Energy related CO_2 emissions per unit GDP:	0.33 t carbon/1 000 US$ 1985
% Total energy related OECD CO_2 emissions:	1.05
% Total energy related World CO_2 emissions:	0.50
% Population growth (yearly average growth 1980-1989):	0.09

CANADA

1. Official Position

In Canada's Green Plan, the Canadian Government committed itself to stabilize emissions of CO_2 and other GHGs at 1990 levels by the year 2000; CFCs will be phased-out by 1997, methyl chloroform by 2000, and other major ozone-depleting substances by the year 2005. A total of C$ 575 million over six years has been allocated by the Green Plan for global environment security goals.

The Government of Canada has been working since 1990 with provincial governments to develop the National Action Strategy on Global Warming, a comprehensive framework for addressing the global warming issue within Canada. The federal and provincial governments are considering a three-part approach to climate change issues, namely to limit net emissions of greenhouse gases, to help Canadians anticipate and prepare for the potential effects of any warming that might occur, and to improve scientific understanding and increase predictive capability with respect to climate change.

Canada's strategy of limiting net emissions includes a comprehensive response to climate change, addressing all major sources and kinds of greenhouse gases in addition to all potential new sinks for greenhouse gases. Its response will take into consideration the wider international context, recognising that the most cost-effective approach is international co-operation and co-ordination. It will also emphasize flexibility in recognition of the fact that scientific and economic understanding is not yet complete, and give due recognition to the importance of regional differences.

The National Action Strategy on Global Warming will be undertaken jointly by federal and provincial/territorial governments. Specific action programmes to limit greenhouse gas emissions will be announced independently by these governments as they are developed. However, intergovernmental agreements will be negotiated to co-ordinate implementation of the complex and interdependent plans of action which the federal, provincial and territorial governments will develop under the Strategy. The Federal Government will put in place first those measures that make economic sense in their own right, such as energy efficiency and tree planting, or that serve multiple policy objectives, such as elimination of CFCs. Discussions on more far-reaching initiatives are to start as quickly as possible.

A planned National Energy Efficiency and Alternative Energy Act is to deal specifically with regulation of minimum energy efficiency levels in energy-using equipment, labelling of products and collection of statistics on energy use. In addition, minimum energy efficiency standards will be developed for appliances and equipment. Energuide labelling for home appliances will be enhanced to provide consumers with information on opportunities for financial and energy savings, and the programme is to be extended later to other appliances and products. The incorporation of revised building standards into more federal, provincial and municipal building codes will be encouraged, and the development and commercialisation of promising technologies for energy-efficient buildings will be enhanced. In the transportation sector, aside from the development of strategies for reducing CO_2 and other emissions from transportation and the development of educational packages for fleet managers and drivers, new fuel efficiency targets for new vehicles are to be initiated. The Government will co-operate with industry to help achieve energy efficiency gains and to share information on new technologies and practices; energy efficiency targets are to be established for each industrial sector, and energy efficiency managers are to be trained.

Aside from energy efficiency improvements in the short term, alternative energies will be promoted, in particular less carbon-intensive energy sources, in order to contribute to the longer-term goal to reduce greenhouse gas emissions. The Canadian Government supports nuclear power as an option for electricity generation. Other measures include accelerated development and market penetration of alternative transportation fuels and the study of passive, active and photovoltaic solar energy options. Federal efforts will focus upon systems design and engineering as well as standard-setting and certification programmes, including enhanced R&D of alternative energy sources, cost-shared market assessments, and increased RD&D of advanced energy systems, e.g. combined cycle generation, CHP and district energy systems. These measures are to be supplemented by a major public information campaign and an annual report to Parliament on progress in meeting energy efficiency objectives. Other planned measures include a community tree-planting programme, as well as measures to limit greenhouse gas emissions from the agricultural sector and to reduce CFCs and ground-level ozone.

The Government estimates that the outlined measures to limit carbon dioxide emissions are, of themselves, unlikely to realise the stabilization target. However, they will lay the foundation for achieving this objective, and will be supplemented by initiatives at provincial and territorial level. Possibilities include more aggressive demand-side management by electric utilities, changes in electricity pricing and regulatory structures, and systemic changes in urban centres, e.g. increased public transit and improved traffic flows. On the basis of continuing reassessment, additional measures will be considered. The use of economic instruments to achieve environmental objectives, including taxes and an emissions trading system, is under review. Finally, the Government will significantly increase its commitment to scientific research on climate change, including more sophisticated climate modelling and monitoring.

2. Factors Influencing Decisions

In the Canadian constitutional system, provinces have rights of resource ownership and legislative powers in wide areas of energy and environmental policy. The federal government has responsibility for overall economic policy and international and interprovincial trade. Federal, provincial and territorial governments cooperate closely in the matters of energy and environment, with regular meetings of the Federal-Provincial-Territorial Ministers of Energy, as well as the Canadian Council of Ministers of the Environment. The development of comprehensive regional and national action plans therefore involves a large degree of cooperative effort at all levels.

The energy sector plays an important role in the Canadian economy as a source of employment, national income, and export earnings. In 1990, the energy supply sector accounted for 6 per cent of GDP and 14 per cent of total investment. Energy related activities provided about 3 per cent of employment. Canada is rich in virtually all energy resources, including hydroelectricity, and is a net exporter of all the main energy commodities. It is the world's leading uranium producer and exporter. Currently, Canada sells about 42 per cent of its energy production abroad. Energy exports generated about C$ 14 billion in revenue. Among the major energy users in the world, Canada has a relatively high ratio of energy use per unit of GDP. This energy-intensiveness is due to climatic conditions, geography-induced transport needs, a high standard of living, an industrial structure that reflects plentiful and competitively priced energy, and export of energy-intensive commodities.

Both energy supply and demand differ greatly among regions and provinces, as do levels of urban development and industrial activity. Consequently, carbon dioxide emissions vary both in quantity and source across the country. Ontario, the most populous and industrialised province, accounts for the largest proportion of Canadian emissions of carbon dioxide. Alberta, which produces large amounts of oil and gas

and uses mainly coal to generate electricity, is the next largest contributor. Quebec is a relatively minor contributor of emissions in part because of its hydraulic electricity generation. Regional variations in emissions are largely influenced by the way in which electricity is generated, by the proportion of electricity demand, and by the nature of the industrial structure. Fossil fuels are used extensively in electricity generation in the Atlantic region, Ontario, Saskatchewan, and Alberta. Ontario also makes extensive use of nuclear power. Quebec, Manitoba, and British Columbia rely heavily on hydro electricity, and they tend to make more use of electricity, thus using less fossil fuel. One of the key end-use sectors is transportation which overall is a significant contributor to carbon dioxide emissions in all provinces.

3. Relevant Studies

- Report on Reducing Greenhouse Gas Emissions. Federal/Provincial/Territorial Task Force on Energy and the Environment, August 1989.

- Report of the Federal-Provincial-Territorial Task Force on Energy and the Environment, April 2, 1990, Kananaskis, Alberta.

- The Green Plan - A National Challenge. A Framework for Discussion on the Environment. Environment Canada, March 1990.

- A Report on the Green Plan Consultations. Environment Canada, August 1990.

- Energy Use and Atmospheric Change - A Discussion Paper. EMR Canada, August 1990.

- Climate Change Digest (Various publications by authority of the Minister of the Environment, Minister of Supply and Services Canada).

- Canada's Green Plan - Canada's Green Plan for a Healthy Environment, December 1990.

- National Strategy on Global Warming (Draft), released November 1990.

CANADA

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	204.39 Mtoe
% Total OECD TPES:	5.44
% Total World TPES:	2.76
Per capita TPES:	7.79 toe/person
TPES/GDP ratio:	0.51 toe/1000 US$ 1985
Per capita TFC (adjusted):	5.67 toe/person
TFC/GDP ratio:	0.37 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	4.95 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.32 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	4.66
% Total energy related World CO_2 emissions:	2.21
% Population growth (yearly average growth 1980-1989):	1.01

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DENMARK

1. Official Position

In response to the report of the World Commission on Environment and Development ("Brundtland Report"), the Danish government published in early 1990 two action plans, one on energy and the other on transport. The two action plans contain targets for the reduction of CO_2 emissions as well as other pollutants which were formally agreed to by the Danish Parliament in May 1990.

Corresponding to the Toronto targets, the agreed overall target for the energy sector, including the transport sector, is a reduction of CO_2 emissions by 20 per cent in 2005 compared with the 1988 level, as well as further reductions in emissions of SO_2 and NO_x.

The energy action plan, which covers energy supply and demand in all sectors of the economy except transport, comprises a programme with initiatives to be implemented in the short term to reduce environmental impacts and to create a basis for further adaptation towards sustainable development in the energy sector. The government estimates that the following reductions can be achieved by the measures to be taken according to the energy action plan until 2005, as compared with 1988 levels:

- almost 15 per cent in gross energy consumption;
- almost 30 per cent of CO_2 emissions;
- around 60 per cent in SO_2 emissions; and

- 50 per cent of NO_x emissions.

The target of the transport action plan is:

- stabilization of energy consumption and CO_2 emissions in the transport sector before 2005, and a reduction of 25 per cent until 2030; and

- reduction of NO_x and HC emissions of at least 40 per cent before 2000, and further reductions thereafter.

The government estimates, however, that energy consumption and CO_2 emissions from the transport sector will be reduced by rather more than 5 per cent by 2005 compared with the 1988 level. The government will follow up on the two action plans and monitor achievement of the targets, which are not mandatory. The energy action plan will be assessed in 1995 to decide whether the objectives or the means to achieve them need to be revised. The aim of both action plans is, first of all, to ensure substantial reductions in CO_2 as the most important greenhouse gas caused by energy activities in Denmark.

The energy action plan includes a comprehensive programme of action and is to be implemented by measures in four main areas: energy efficiency improvements and conservation in energy end-use, changes and improvements in efficiency in energy supply, increased utilisation of more environmentally benign energy sources, and R&D. Some important elements of the intended measures have already been approved by Parliament, e.g. a programme concerning the expansion of combined heat and power production, while other legislation is in preparation.

Energy taxes in Denmark are high, and in contrast to many other countries they cover both oil products, electricity, coal and (indirectly) natural gas. In November 1991 a proposal for CO_2 taxes was put forward in Parliament. According to the proposal, a CO_2 tax of DKr 100 per ton of CO_2, corresponding to about US$55 per ton of carbon, should be introduced by 1 January 1992 on private energy consumption. The CO_2 tax would function in combination with the existing energy taxes, which would be somewhat reduced. For the industrial and commercial sector a CO_2 tax of DKr 50 per ton of CO_2 would be introduced by 1 January 1993. These sectors would subsequently be exempted in general from ordinary energy taxes, and there would be certain possibilities for reductions in the CO_2 tax depending on the ratio of CO_2 tax relative to value-added in production. For industries in which the CO_2 tax would correspond to more than 3 per cent of value added, there would be possibilities for a total tax reduction, if reasonable energy efficiency investments have been undertaken. According to the proposal, the level of the CO_2 tax on industrial and commercial energy consumption will be increased gradually following the expected CO_2 tax decision in the EEC. Finally it has been proposed in Parliament that a large part of the tax revenue

should be used for certain specified energy efficiency subsidies, i.e. for promotion of DH and CHP and energy conservation in the commercial and industrial sector.

Efficiency gains are expected through revised and/or new standards for buildings, energy installations and appliances. Other planned measures in the area of energy efficiency include energy consultancy schemes, energy management in buildings, energy efficiency financing arrangements, energy labelling, programmes for public buildings, and co-operative arrangements with industry and utilities.

Initiatives planned to increase the efficiency of the energy supply sector include promotion of CHP in district heating, expansion of industrial cogeneration, connection of block heating centrals to the natural gas and district heat supply systems, use of natural gas in central power plants, and demonstration projects for coal gasification and fuel cells. Several measures are planned to increase use of renewable energies, in particular biomass, wind, and solar energy.

2. Factors Influencing Decisions

Denmark has pursued an active energy policy since the 1970's in order to reduce its high reliance on oil. This was basically achieved through effective energy conservation programmes, development of indigenous energy resources (in particular oil, natural gas and renewable energies), a switch to coal as the primary fuel in electricity generation, a major expansion of CHP facilities and district heating systems, and a policy of introducing natural gas. Energy taxation policies traditionally have played an important role in Danish energy policy. The Danish government also supports a substantial and comprehensive non-nuclear energy R&D programme.

Environmental consciousness in Denmark is high. Environmental aspects are an integral part of long-term energy policy, and the government has repeatedly given proof of its determination to make strong efforts to reduce the environmental impacts of the energy system. However, the energy action plan will necessitate quite substantial investments in all sectors, including industry. Not surprisingly, the industry association and some unions point out that risks are high for the competitiveness of the Danish industry as well as for employment.

3. Relevant Studies

- Danish Ministry of Energy: Energy 2000 - A Plan of Action for Sustainable Development, April 1990.

- Danish Ministry of Transport: Action Plan on Transport, May 1990.

DENMARK

Key Energy and Environment Data
(1989 data)

TPES (adjusted):	17.48 Mtoe
% Total OECD TPES:	0.46
% Total World TPES:	0.24
Per capita TPES:	3.41 toe/person
TPES/GDP ratio:	0.28 toe/100 US$ 1985
Per capita TFC (adjusted):	2.53 toe/person
TFC/GDP ratio:	0.21 toe/1 000 US$ 1985
Energy related CO_2 emissions per capita:	2.97 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.25 t carbon/1 00 US$ 1985
% Total energy related OECD CO_2 emissions:	0.55
% Total energy related World CO_2 emissions:	0.26
% Population growth (yearly average growth 1980-1989):	0.02

FINLAND

1. Official Position

In 1990 the government prepared a report of current and planned national activities concerning sustainable development. This report was submitted to the Parliament in autumn 1990. The Report discussed climate change as the most important environmental issue for the future. This was the first time that Parliament had discussed the climate change issue.

In the beginning of November 1990 the government established a commission for elaborating strategies to control greenhouse gas emissions in Finland. The Commission will report its proposals in the beginning of June 1991. The work of the Commission is the first step in preparing a detailed national greenhouse strategy in Finland.

The Parliamentary Energy Policy Council published its report on energy strategy in Finland in September 1991. The Government intends to give a White Paper on energy policy to the Parliament in early 1992 where remaining policy questions are to be discussed. The report on energy strategy lists as the main objectives of energy policy secure energy supply, efficient energy production and use as well as the limitation of the emissions (greenhouse gases included) of the energy sector. The report stresses the importance of stabilizing CO_2 emissions before the year 2000 and demand side management and energy conservation. The primary measures to achieve the objective of the strategy listed in the interim report include financial support to new investments, intensified research and development activities, regulations and norms as well as environmentally motivated taxes on energy.

A new approach to reduce the emissions in Finland is the use of environmental taxes. In 1990 the government proposed the imposition of a carbon dioxide tax which is

estimated to raise the price of gasoline by 6 per cent, the price of gas by 2 per cent and the price of coal by 8 per cent. In the budget for 1991 this tax is estimated to add (over 1990 levels) about 7 per cent to the price of gasoline and about 5 per cent to the price of other fossil fuels. On the other hand, taxes on environmental investments, such as sulphur and nitrogen oxide reduction investments of power stations, and clean vehicles have been reduced or eliminated.

After finalisation of reports of the Commission on a greenhouse gas strategy and the Finnish Energy Policy Council, the government and the Parliament are expected to make conclusions and decisions concerning a greenhouse strategy before the end of 1991.

In the view of the Finnish government, climate change is an international problem that must be handled by international negotiations and agreements. Finland has endorsed the Noordwijk and Bergen declarations and the Ministerial Declaration of the Second World Climate Conference, thereby agreeing that a stabilization of greenhouse gas emissions is necessary as an initial step. The government supports the signing of an international agreement in 1992 at the World Conference on Environment and Development.

Finland has signed the CFCs reduction Protocol to the Vienna Convention. The interim national goal for CFC reduction is 50 per cent by the year 1992 compared to 1986 levels. The use of CFCs will be banned by the end of 1994. Halons will be allowed only for essential uses after 1991.

Finland has also signed agreements to limit emissions of SO_2 and NO_x. Under the SO_2 agreement the national emissions of SO_2 are to be reduced by 30 per cent by 1993 compared with 1980 levels. In Finland in 1990 emissions of SO_2 have already been reduced by about 60 per cent. The national goal for SO_2 reduction (decided by the government January 1991) is 80 per cent from 1980 levels by the year 2000. Finland has also signed the NO_x Protocol (Sofia 1988) and agreed to the goal for a NO_x reduction of 30 per cent from 1980 levels by the year 1998.

2. Factors Influencing Decisions

Finland's domestic fossil energy resources are limited. Approximately 30 per cent of its energy needs are met by domestic supplies of hydropower, wood processing wastes, wood and peat. Almost 50 per cent of the total energy consumed is derived from coal and oil. Nuclear energy at present provides some 15 per cent of total final energy consumption.

Both per capita and per GDP energy consumption in Finland are considered to be relatively high. The climate and size of the country and the structure of business and

industry can be considered the main factors influencing energy consumption. One fourth of the energy consumption is spent on heating of buildings, while industry accounts for nearly 50 per cent of total final energy consumption. The products of forest based industry, the most energy intensive industry, account for 40 per cent of total exports.

More than 35 per cent of all Finnish homes are connected to district heating networks. This figure will go up to 50 per cent by the end of century. More than 60 per cent of all district heat is produced in combined heat and power plants. The combined heat and power (CHP) potential and co-generation in industry are intensively utilised; the share of CHP of total electricity being the highest in the world. Because of this, the energy efficiency in urban areas is exceptionally high. On the other hand, the opportunities to decrease the energy demand and to decrease the CO_2 emissions by intensifying CHP or district heating are limited. Finland has already very low CO_2 emissions from electricity production.

Finland is very rich in forest and peatlands, both of which are sinks of carbon. The sustainable use of forest has been the basis of all forestry in Finland. The total amount of carbon in forest in Finland has increased during last 30-40 years. The area of forest has also increased slightly during last years. There is some evidence that it would still be possible to increase absorption of carbon in forests by means of forest management. The studies concerning the carbon balances in Finnish forests and peatlands are preliminary. More information is expected in two to three years, when the national research project on climate change (called SILMU) will produce assessment results.

Finland expects that it will experience large effects from climate change. The country is situated in the area where the temperatures are expected to rise significantly, especially in winter. The effects will most strongly be felt in the forestry sector and in the winter tourism sector. The risk of forest damage is expected to rise due to climate change and air pollution.

3. Relevant Studies

Most of the reports are available only in Finnish or Swedish.

- Government Report of Sustainable Development Activities (1990).
- Working Group Interim Report of Environmental Economic Incentives (1990).
- Interim Report of the Energy Policy Council on the Energy Policy (1990).

- Report on Energy Conservation Potential in Finland. Report of research project (1991).

- Report of the Working Group for Greenhouse Gas Emissions (1990).

- Bostrom, S. et al., Greenhouse Gas Emissions from Energy Production and Consumption in Finland. MTI Series D:186, 1990.

- Ahlholm, U. et Silvola, J. The Role of Peat exploitation in Altering the Carbon Balance in Finland and Worldwide, MTI Series D:183, 1990.

FINLAND

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	26.91 Mtoe
% Total OECD TPES:	0.72
% Total World TPES:	0.36
Per capita TPES:	5.42 toe/person
TPES/GDP ratio:	0.42 toe/1000 US$ 1985
Per capita TFC (adjusted):	4.16 toe/person
TFC/GDP ratio:	0.32 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	3.57 tonnes carbon/person
Energy related CO_2 emissions per unit of GDP:	0.28 tonnes carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.63
% Total energy related World CO_2 emissions:	0.30
% Population growth (yearly average growth 1980-1989):	0.42

FRANCE

1. Official Position

Action Principles: France feels that in order to build up and maintain the general support essential for success, a certain number of principles must be observed:

- Responsibility and preponderant role of the industrialised countries;
- The necessary participation of all countries from the very beginning;
- Equitable differentiation of the commitments between countries or regions, taking into account levels of development, special circumstances or past efforts;
- The greatest possible harmonization of the measures adopted in order to avoid the distortions of competition; and
- Consideration of the specific needs of the developing countries.

Establishment of Limitation Objectives: France believes that all gas emissions which contribute to the greenhouse effect should be limited but that carbon dioxide deserves special attention because:

- It is mainly responsible for the additional anthropogenic greenhouse effect;
- It remains for a very long time in the atmosphere once it has been emitted and this period becomes still longer as a result of the weakening of the ocean's role as a sink and as the warming effect increases;

- The reduction of CO_2 emissions as distinct from other gases requires important structural modifications in our economies, harmonized at the international level;

- The quantities of CO_2 emissions from fossil fuels are the best known. Only the control of CO_2 emissions is practicable today, much in the same way as CFC emissions can be controlled.

Thus, even if the negotiations must take into account all the gases contributing to the greenhouse effect, it is inappropriate to seek to negotiate a global objective of limitation for all GHG, without running the risk of failing to adopt specific short-term commitments.

France, which has already reduced its CO_2 emissions by 25 per cent since 1980, has set itself a national stabilization target by the year 2000 at a level below 2 tons per inhabitant per year, provided that the major industrialised countries take a similar approach.

Adoption of Harmonized Instruments: It is commonly acknowledged that CO_2 emissions reduction requires "tough" policies at yet undetermined costs, particularly since the objectives established must be ambitious in order to meet the objective of stabilizing the warming effect. In this context, countries cannot undertake commitments unless they are assured that the actions decided will not create situations in which competition is distorted.

International harmonization of the economic and regulatory measures to be taken is essential.

As recommended in the final IPCC report, countries must initially consider the subsidies and tax incentives which favour the energy and greenhouse gas-producing sectors. France, for its part, believes that such an analysis would bring about the rapid abolition of fossil energy subsidies.

France further believes that the industrialised countries should institute within their national tax systems a graduated surtax on fossil energy at a uniform rate to cover the external costs of the greenhouse effect. This tax would be applied in the industrialised countries under conditions which would avoid both distortions in competition and the dislocation of industrial sites.

The implementation of actions designed to reduce CO_2 emissions would be the natural corollary of the signal sent by this pricing but it could not in itself build a genuine market for energy efficiency. Therefore, reaction to the price must be accompanied by the simultaneous implementation of the following actions:

- Introduction of harmonized incentives or regulatory measures in the areas of industry, transport and construction;

- Emergence of a co-ordinated international effort for technological developments in energy management.

2. Relevant Studies

- Rapport du Groupe interministériel sur l'effet de serre (novembre 1990);

- Rapport de l'Académie des sciences (automne 1990).

FRANCE

Key Energy and Environmental Data (1989 data)

TPES (adjusted):	204.80 Mtoe
% Total OECD TPES:	5.45
% Total World TPES:	2.77
Per capita TPES:	3.65 toe/person
TPES/GDP ratio:	0.35 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.29 toe/person
TFC/GDP ratio:	0.22 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	1.89 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.18 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	3.81
% Total energy related World CO_2 emissions:	1.81
% Population growth (yearly average growth 1980-1989):	0.47

GERMANY

1. Official Position

The Federal Government decided to work towards a heavy reduction of CO_2 emissions in Germany. Because of the need for international action it also decided to work towards international agreements for the protection of the climate, especially to reduce CO_2 emissions.

Being an important element of an overall strategy to deal with climate change, the federal government is developing a concept for using the national potentials to reduce CO_2 emissions. This will consider international agreements and the effects on economic and social goals. An interministerial working group has been established which prepared a report on possible measures to reduce CO_2 emissions. The Federal Government accepted the report and asked the group to continue work. It is going to prepare further suggestions to reduce energy related emissions of CO_2 - oriented at a 25 per cent reduction by 2005 in former West Germany and at a higher reduction in former East Germany from 1987 levels - and to reduce other greenhouse gas emissions.

The concept will consider CO_2 reduction in the energy sector in general, in transportation, in the housing and residential sector, by new technologies and also in agriculture and forestry including sinks.

The Government is preparing concrete measures

- to use economic instruments with priority;
- to improve the energy law;
- to tighten standards for insulation and efficiency in heating systems:

- to improve eduction of professionals in construction related to energy saving;

- to increase energy efficiency in former East Germany;

- to promote renewable energies.

CO_2 has the dominant attention, but CH_4, NO_x, N_2O and other greenhouse gases will be considered as well.

In addition to the above-mentioned concrete measures in preparation, Germany is considering the whole range of legal, economic and persuasive instruments. The main topics in further political discussion are, for example:

- measures to reduce energy consumption of motor vehicles;

- improvement and implementation of power plant technology towards better efficiency.

2. Factors Influencing Decisions

German energy consumption relies heavily on the use of fossil fuels, especially on coal and lignite which are the indigenous energy sources in Germany (former FRG 30 per cent; former GDR 70 per cent). Although economic and environmental needs call for a smaller contribution of these fuels, social and regional considerations as well as security of supply aspects limit speed and amount of the reduction potential. Improvement of energy efficiency in the former GDR has priority. At the same time countervailing effects, e.g. increasing transport needs, cannot be neglected.

Public awareness of environmental issues is, in general, very high in Germany. This is true for the greenhouse gas discussion, too. It is difficult to foresee to what extent this corresponds with the willingness to take or accept measures to protect climate.

The speed of international agreements for climate protection might have influence on speed and amount of national measures.

3. Relevant Studies

In 1987, the German Bundestag established a study commission on "Preventive Measures to Protect the Earth's Atmosphere" in order to deal with issues related to the growing threats to the earth's atmosphere. The Commission submitted 3 reports to the German Bundestag. The first offers not only a detailed account of current scientific

knowledge about stratospheric ozone depletion and the anthropogenic greenhouse effect, but also recommendations on far-reaching measures to protect the earth's atmosphere (especially FCKW's). In its second report the Commission studied the problems involved in protecting tropical forests.

The major area of the Commission's last report (published 5th October 1990, around 1 000 pages) is the avoidance and reduction of releases of radioactive trace gases due to energy use, and the possible content of an international convention for the protection of the earth's atmosphere. The Commission had embarked upon a comprehensive study programme which reveals the state of knowledge on these complex subjects.

The Commission asks for a reduction of CO_2 emissions in Germany by 30 per cent, worldwide by 5 per cent until 2005. This target for Germany should be reached:

- by a comprehensive adjustment of all energy related laws;

- by a concept of energy taxes, incentives and measures in special sectors;

- by priority to energy saving and increased market penetration of renewable energies.

GERMANY

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	253.07 Mtoe
% Total OECD TPES:	6.73
% Total World TPES:	3.42
Per capita TPES:	4.08 toe/person
TPES/GDP ratio:	0.37 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.78 toe/person
TFC/GDP ratio:	0.25 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	3.06 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.27 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	6.79
% Total energy related World CO_2 emissions:	3.23
% Population growth (yearly average growth 1980-1989):	0.05

GREECE

1. Official Position

Greece has no stated position on greenhouse gas targets, nor any greenhouse gas stabilization or reduction programme. However, since some months, the Greek authorities have been working on the greenhouse effect issue. In view of the government, the problem of reducing greenhouse gas emissions would have to be dealt within the general context of the European Community.

2. Factors influencing Decisions

Although Greece has no official position on greenhouse gas reduction, the protection of the environment has become a top priority in Greek politics. Indeed, in the main urban areas, Athens and Thessaloniki, where a large portion of the country's commercial and industrial activity is concentrated, the atmospheric pollution, particularly in summertime, reaches unbearable levels. The phenomenon (called Nephos in Greek) has recently taken a very large place in all the programmes of the political parties and in public opinion.

In February 1990, a comprehensive plan for the protection of the environment in the Athens area was finalised: with a budget of Dr 400 billion over a period of four years, it includes 50 actions to be implemented, including for example car parking and traffic policies, green belts and public transport systems, etc. As the present government is aware that the situation requires an urgent solution, the emphasis of its actions has shifted to the transport sector which is now seen as the main contributor to air pollution

because of: the increasing number of vehicles; the high average age of cars; poor maintenance of cars; inadequate transport networks, traffic control and parking spaces; and the inefficiency of public transportation.

It is estimated that 79 per cent of pollutants in the Athens area are due to traffic pollution, mainly from old private cars -- 2 million cars in this area have an average age of twelve years. In this context, in May 1989, a law introduced an incentive scheme to encourage the purchase of new cleaner cars with catalytic converters and consuming lead-free gasoline. It corresponds to an average reduction of 15 per cent of the purchase tax on new cars. In addition, in February 1991, the new law 1921/91 was adopted by Parliament to accelerate the rate of renewal of the car fleet. According to this law, the following incentives are granted:

- reduction of the Special Consumption Tax by 60 per cent for cars with a cylinder capacity up to 1 400 cm^3 and by 50 per cent for cars with a cylinder capacity from 1 401 to 2 000 cm^3, but not more than Drs. 2 000 000;

- abolition of the Additional Special Tax; and

- abolition of the road tax for five years for the new car.

The above incentives are granted in the case of purchase of a new clean passenger car or a light duty truck with a gross weight up to 2.5 tonnes and only on the condition that an old car is withdrawn from circulation. It is estimated that 400,000 polluting vehicles will be replaced by cleaner vehicles over a two-year period (1990-1992).

Various specific measures to reduce pollution have been adopted -- such as reduction of the sulphur content of heavy fuel oil and diesel oil, restriction of the lead content in gasoline -- but they are judged absolutely ineffective by public opinion as atmospheric pollution increases continuously.

The most important indigenous production in Greece is lignite, mainly used for electricity generation. In 1989, lignite inputs represented 73.6 per cent in electricity generation. Although there is no serious problem related to sulphur dioxide in northern Greece since the sulphur content of lignite is only 0.4-0.6 per cent and, moreover, its high calcium content helps emissions to be kept to a low level, environmental considerations have resulted in a decision to import natural gas from the Soviet Union and Algeria. In addition, the strong interest shown by the Public Power Corporation in the development of renewable energy mainly in the islands -- wind energy and geothermal -- is also partly motivated by environmental considerations.

GREECE

Key Energy and Environment Data
(1989 data)

TPES (adjusted):	21.25 Mtoe
% Total OECD TPES:	0.57
% Total World TPES:	0.29
Per capita TPES:	2.12 toe/person
TPES/GDP ratio:	0.59 toe/1000 US$ 1985
Per capita TFC (adjusted):	1.40 toe/person
TFC/GDP ratio:	0.39 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	1.97 t carbon/person
Energy related CO_2 emissions per unit GDP:	0.55 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.71
% Total energy related World CO_2 emissions:	0.34
% Population growth (yearly average growth 1980-1989):	0.45

ICELAND

1. Official Position

Iceland has for a long time followed the policy of increasing the exploitation of relatively pollution-free hydroelectric and geothermal energy and to minimise the consumption of fossil fuels. This policy is the basis of the Icelandic energy programme, both for the present and the foreseeable future.

At the Second World Climate Conference in Geneva in November 1990 the Government of Iceland agreed to restrict carbon dioxide emissions in the year 2000 to the emission levels of 1990. In relation to these aims, an Icelandic Carbon Dioxide Committee has been established, to examine how the aims can be fulfilled and to put forward proposals for emission controls.

Iceland is a party to the ECE Agreement on Long-range, Transboundary Air Pollution (Geneva, 1979), which took effect in 1983. Iceland confirmed its membership of the agreement in 1982. Because of the relatively low sulphur dioxide emissions in Iceland, the Icelandic Government has not considered it possible to sign annexes to the ECE agreement, regarding reduction of sulphur dioxide emissions below the present levels. However, Iceland has pledged to exercise every precaution concerning any new potential sources of sulphur dioxide pollution. Regarding emissions of VOC and NO_x, Iceland aims at confirming the ECE agreements within a year.

According to a recently passed change on the regulation on pollution control, three way catalysts must be installed in all new gasoline propelled cars sold after mid-year 1992. Thus, the NOx emissions are expected to decrease at least 30 per cent during the next ten years.

The Government is currently considering the implementation of pollution taxes. A committee will be established soon to estimate the impact of pollution taxes and to work on proposals for controls through economic measures.

2. Factors Influencing Decisions

Iceland is the smallest economy in the OECD and, by far, the smallest emitter of carbon dioxide; however, the per capita emission is relatively high. Hydropower provides 40 per cent of the gross energy consumption, geothermal 32 per cent, imported oil 25 per cent and imported coal 3 per cent. Thus, over two-thirds of the total primary energy is supplied by domestic, relatively pollution-free sources.

Traffic is responsible for two-thirds of the carbon dioxide emissions, primarily for fishing vessels, personal transportation and airplanes. Electricity is generated almost entirely from either hydropower (94 per cent) or geothermal (5.8 per cent). In order to reduce the strong economic dependence upon the fishing industry and to enhance stability of the Icelandic economy, Iceland is planning to increase the use of hydropower for electricity-intensive industry. Thus, non-energy related emissions in Iceland could increase.

Presently there are relatively few industries in Iceland, the population is small and pollution has not created any major problems. However, the environmental consciousness in Iceland is growing very rapidly, and environmental aspects are of major pubic interest. Due to the fact that less than 30 per cent of the primary energy comes from fossil fuel, and as persona and commercial transport consumes the bulk of the fuel, there are some technical limitations to reductions in carbon dioxide emissions in Iceland. The small size of the Icelandic market limits the options, e.g. regarding support for major R&D programmes to reduce emissions.

3. Relevant Studies

- The Ministry of the Environment in Iceland, Icelandic Carbon Dioxide Committee, Draft Report 1991 (to be published soon; Icelandic)

- Energy Prognosis Committee: Fuel-Prognosis 1988-2015 (Icelandic)

ICELAND

Key Energy and Environmental Data
(1989 data)

TPES	1.29 Mtoe
% OECD TPES	0.03
% Total World TPES	0.02
Per Capita TPES	5.10 toe per person
TPES/GDP	0.40 toe/$1000 US$ 1985
TFC	1.08 Mtoe
Per Capita TFC	4.11 toe per person
TFC/GDP	0.32 toe/1000 US$ 1985
Energy related CO_2 emissions per capita	2.33 t carbon/person
Energy related CO_2 emissions per unit GDP	0.18 t carbon/1000 US$
% Total energy related OECD CO_2 emissions	0.02
% Total energy related World CO_2 emissions	0.01
% Population growth (yearly average growth 1980-1989)	0

IRELAND

1. Official Position

In January 1990 the Government announced a new, comprehensive national environmental action programme. This programme, described in a White Paper, proposes the establishment of an Environmental Protection Agency, and the expansion of activities by other government bodies with responsibilities impinging on the environment.

While the Government's programme does not state any particular target for CO_2 — its main emphasis is on reducing conventional pollutants — many of its policies will have the effect of slowing the rise in emissions of this gas. In particular, the programme stresses the importance of energy conservation and provides additional funds for that purpose. Reductions from the industrial, commercial and residential sectors will come about through improvements in the efficiency of energy use, and greater recycling of municipal solid waste. Demonstration projects and information campaigns will play an important part in disseminating new energy-saving techniques and technologies.

The Government supports the concept of sustainable development and participates in international initiatives to avert global climate change, especially those coordinated within the European Community.

The Department of Environment is now working to develop, in association with other responsible Departments (e.g., Energy, Agriculture and Transport), specific measures for meeting this challenge. It is expected to have this work finalised around mid-1991.

2. Factors Influencing Decisions

Ireland is at the periphery of Europe and is poorly endowed with fossil energy resources. Its main indigenous energy sources are peat (turf) and natural gas. For oil it is dependent entirely on imports. The country's electrical and natural gas grids are isolated from the rest of Europe, though plans are underway to connect the gas grid via underwater pipeline with the United Kingdom's natural gas system. Once this interconnection is complete, and with the likely prospect that new offshore deposits of natural gas will be found and developed, there is the possibility of expanding natural gas's share in all the consuming sectors. Over the longer term, there is a possibility that renewable energy sources, such as wind and wave energy, may be exploited on a large scale.

Ireland is remote from the major industrial areas of Europe, and thus it enjoys a relatively unspoilt environment. Although the environment is a less political issue than in some other countries, recent opinion polls show an increasing awareness and public concern over environmental matters. The warmer and drier weather of the last two years, in particular, have drawn attention to the sensitivity of the country's lush pastures and teeming fresh-water fisheries (tourism is an important industry) to slight changes in climate.

3. Relevant Studies

The Government's position on global climate change is set out in a White Paper by the Department of the Environment, *An Environment Action Programme* (Dublin: An Roinn Comhshaoil, January 1990). A series of expert studies to establish the specific implications of possible climatic change for Ireland have been commissioned and were to have been completed by the end of 1990. These studies will deal, *inter alia*, with changes in sea levels, the effects on crops and forestry, and the implications for the energy sector.

IRELAND

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	9.21 Mtoe
% Total OECD TPES:	0.24
% Total World TPES:	0.12
Per capita TPES:	2.62 toe/person
TPES/GDP ratio:	0.43 toe/1000 US$ 1985
Per capita TFC (adjusted):	1.96 toe/person
TFC/GDP ratio:	0.32 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	2.31 t carbon/person
Energy related CO_2 emissions per unit GDP:	0.38 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.29
% Total energy related World CO_2 emissions:	0.14
% Population growth (yearly average 1980-1989):	0.36

ITALY

1. Official Position

The Italian Chamber of Deputies passed a non-binding resolution in April 1990 asking for a 20 per cent reduction of carbon dioxide emissions in Italy by 2005 which, if consistent with the Toronto targets, would be based on 1988 levels. The resolution also called on the Government to work with other governments to revise the Montreal protocol to ban CFCs by the year 2000.

The Italian Environment Minister announced at the Bergen conference (15 May 1990) that Italy intended to stabilize carbon dioxide emissions at current levels by the year 2000 and reduce them by 20 per cent by 2005. Italy also intends to eliminate CFC production by 1997 and achieve a net forest growth by 1995.

The Italian government has analysis under way regarding the possible effects of policy instruments such as incentives and taxation to reduce consumption and improve efficiency. Possible measures include taxes to reflect environmental impacts, use of more natural gas and other fuel substitution options and expanded exploitation of renewable sources of energy. The government believes that nuclear energy could play a role in the future with new and safer technologies, but its future use depends on specific conditions being met concerning containment, radiation releases and the solution of problems of radioactive waste and de-commissioning. (Italian voters approved three 1987 referenda questioning nuclear power as a significant contributor to the nation's energy mix.)

On 24th November 1990, the Council of Ministers endorsed a revised National Energy Plan (PEN), which sets out a programme of activities aimed at improving energy efficiency and promoting energy conversion technologies that do not contribute to the build up of greenhouse gases. On 20th December 1990 the Italian Senate approved legislation enabling the Government and the State energy bodies to carry out the Plan. The Plan provides for measures that are intended to affect consumer behaviour in the short term and those that will affect energy consumption in the medium term.

Short-term measures include a campaign to increase public awareness of the need to use energy rationally, and changes in pricing formulae in order to adjust cost increases as promptly as possible. It is also envisaged that part or all of any price decreases will be offset by higher taxes on energy. ENEL, the national electricity board, is expected to introduce time-of-use tariffs to the household sector. Rates and conditions for electricity purchased by ENEL from independent electricity generators operating CHP systems or using renewable energy sources have been made more favourable.

Measures intended to achieve energy savings and emission reductions in the medium term include financial incentives for energy-efficient investments, renewable energy sources, research on new nuclear-power technologies, and public transit. Part of the funds spent in this programme are proposed to be collected through a new tax on CO_2 emissions from thermal power plants (1.94 ecu per tonne of CO_2). Besides investments, new rules are being drawn up to increase energy efficiency. These include new building codes, energy auditing services and installation of new light sources and controls in public buildings; periodic inspection of car efficiency, and enforcement of speed limits; and mandatory labelling of electricity consumption rates on household appliances.

2. Factors Influencing Position

The rapid growth of the Italian economy, combined with roughly stable energy prices before August of this year, has led to continuing increases in energy requirements, especially in the electricity sector. The 5 per cent growth in electricity consumption during 1988 forced a 35 per cent rise in net electricity imports, despite a small increase in domestic production. The latest electricity demand figures show an additional 3.9 per cent increase. Consumption of natural gas expanded 4.7 per cent in 1988 and 8.4 per cent in 1989.

Italy meets less than 20 per cent of its total energy requirements, and less than 5 per cent of its total oil requirements, from indigenous energy sources. Oil accounted for about 59 per cent of the Italian energy supply mix in 1988, increasing to 62 per cent in 1989. Energy-related and environmental issues have a high public profile, elevated by the recent oil market developments and by greater public awareness of various environmental impacts of energy-related activities.

3. Relevant Studies

- Ministry of Industry and Trade, *National Energy Plan (PEN)* (Rome: August 1988).
- Ministry of Industry and Trade, *National Energy Plan (PEN)* (Rome: November 1990).

ITALY

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	143.42 Mtoe
% Total OECD TPES:	3.81
% Total World TPES:	1.94
Per capita TPES:	2.49 toe/person
TPES/GDP ratio:	0.30 toe/1000 US$ 1985
Per capita TFC (adjusted):	1.88 toe/person
TFC/GDP ratio:	0.22 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	1.91 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.23 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	3.94
% Total energy related World CO_2 emissions:	1.87
% Population growth (yearly average growth 1980-1989):	0.21

JAPAN

1. Official Position

On 23rd October 1990, the Council of Ministers decided on an "Action Programme to Arrest Global Warming" which covers the period from 1991 to 2010. Japan's basic policy position in dealing with global warming is based on three elements: the formation of an environmentally sound socieity, compatibility with a stable development of the economy, and international coordination.

In the Action Programme, the Japanese government established the following targets for the stabilization of Japan's CO_2 emissions, based on the common efforts of the major industrialized countries to limit carbon dioxide emissions:

- The emissions of CO_2 should be stabilized on a per capita basis in the year 2000 and beyond at about the same level as in 1990. To achieve this target, a wide range of measures under the Action Programme are to be steadily implemented, as they become feasible, through the utmost efforts by both government and private sectors.

- Efforts should also be made to stabilize the total amount of CO_2 emissions in the year 2000 and beyond at about the same level as in 1990. Among other measures, this is to be achieved through progress in the development of innovative technologies, including those related to solar, hydrogen and other new energies, as well as fixation of CO_2, at a pace and scale greater than that currently predicted.

Furthermore, the Action Programme stipulates that the emission of methane gas should not exceed the present level. To the extent possible, nitrous oxide and other greenhouse gases should not be increased.

With respect to carbon dioxide sinks, according to the Action Programme efforts should be made to work for the conservation and development of forests, greenery in urban areas, etc. in Japan, and also to take steps to conserve and expand forests on a global scale, among other measures.

The Action Programme outlines the necessary measures to achieve the above targets. To limit CO_2 emissions, measures are foreseen to achieve structures with reduced carbon dioxide emissions by reforming urban and regional structures, transport systems, the production structure, and the energy supply structure, as well as realising an appropriate life style. Measures to reduce methane emissions include the areas of waste management, agriculture, and energy production and use. Other measures are foreseen to reduce nitrous oxide emissions. Measures to enhance CO_2 sinks, e.g. forests and other greens, include adequate management of domestic forests and greens in urban areas, and the rational use of timber resources.

Additionally, scientific research and surveys as well as observation and monitoring are to be promoted. Further efforts concern the development and dissemination of technologies, e.g. for limiting emissions of greenhouse gases, for absorption, fixation, etc. of greenhouse gases, and for adaptation to global warming. Public awareness is to be promoted through, e.g., dissemination of information based on latest scientific knowledge on global warming, and the promotion of environmental education.

In the area of international cooperation on climate change, measures include comprehensive support and promotion of technology transfer, support to conservation and development of tropical forests and other carbon dioxide sinks, cooperation in R&D, promotion of international cooperation with private sectors, and international cooperative projects.

To implement these measures, the central government will provide support to local governments. The ministries and agencies responsible for the implementation of the Action Programme also are to support the efforts of the industrial and private sectors in the areas mentioned.

In addition, the Japanese Government is proposing to the international community "the New Earth 21", which is a dynamic and evolving strategy for international co-operation to restore the Earth over future decades through the reduction of greenhouse gases accumulated during the last two centuries since the Industrial Revolution.

"The New Earth 21" consists of: (1) global promotion of energy efficiency and conservation; (2) massive introduction of clean energy sources; (3) development of

innovative environment-oriented technologies; (4) enhancement of sinks; and (5) energy-related technologies that will carry us into the future. Its essence is (a) the promotion of world-wide diffusion of environment and energy technologies and (b) the development of innovative environment-oriented technologies.

2. Factors Influencing Decisions

Japan imports over 80 per cent of its primary energy requirements and in particular virtually all of its oil and natural gas. Although considerable progress has been made in reducing its oil dependence since 1973, mainly due to its successful energy efficiency and conservation as well as fuel switching programmes, it still has an oil share in TPES of 57 per cent. Despite significant economic growth rates since the 1970's, its energy intensity (TPES/GDP and TFC/GDP ratios) is among the lowest in the OECD. Japan has one of the most comprehensive energy R&D programmes. The government's R&D budget reflects its strong intention to promote technological development.

In June 1990 the Advisory Committee for Energy, MITI, published a new long-term energy supply-demand outlook to 2010 which reflects the government's determination to respond as effectively as possible to maintain energy security and deal with global environmental problems. On the demand side, a vigorous effort at further improving energy efficiency and increasing conservation will be made, e.g. through significant improvements of the heating and cooling systems and automobile fuel efficiency, the promotion of recycling of resources, and further improvement of power generation efficiency. Concerning energy supply, improvements are to be made in particular by utilising unused and new energy sources, by steadily increasing nuclear power generation, and by introducing co-generation systems. The use of natural gas (LNG-based) will be increased for power generation and in the residential/commercial sector.

Public awareness of environmental problems is traditionally important in Japan, as the population has locally suffered from them earlier than in many other countries. Correspondingly, environmental restrictions in Japan have been among the tightest, with resulting encouraging improvements in environmental conditions. The government is making special efforts to raise awareness of global environmental problems to facilitate implementing measures.

3. Relevant Studies

- MITI: Long-Term Energy Supply-Demand Outlook, June 1990.

- Environment Agency: Impacts and Response Strategies Concerning Climate Change; Interim Report of Sub-Groups on Impacts and Response Strategies, The Advisory Committee on Climate Change, June 1989.

JAPAN

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	371.76 Mtoe
% Total OECD TPES:	9.89
% Total World TPES:	5.02
Per capita TPES:	3.02 toe/person
TPES/GDP ratio:	0.24 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.08 toe/person
TFC/GDP ratio:	0.16 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	2.24 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.18 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	9.87
% Total energy related World CO_2 emissions:	4.69
% Population growth (yearly average growth 1980-1989):	0.60

LUXEMBOURG

1. Official Position

Up to now, Luxembourg has not adopted a global strategy in the context of climate change. However, due to the geographic position of the country near large industrial areas and the transfrontier pollution, the authorities are concerned about the problem of environment protection and carefully follow the development of such policies in the context of the European Community.

The Ministry of Energy announced on 20th September 1990 an information/publicity campaign directed at energy consumers to strengthen their energy efficiency awareness which has been rather relaxed in the past context of low oil prices. One of the main arguments was that production, transport and use of energy have important impacts on the environment.

2. Factors influencing Decisions

Energy conservation is considered by the Ministry of Energy not only as a way to reduce the country's dependence on imported energy but also to reduce efficiently emissions of a wide range of environmental pollutants. Although protection of the environment is not the only motivation for its recent action, the government decided this year to support investments in energy conservation and in the use of renewable sources of energy through financial measures. This concerns direct grants to homeowners for energy saving investments in existing buildings, direct grants for small- and medium-sized enterprises to help them finance energy audits and studies on possible energy efficiency measures, and direct grants for installations using renewable

sources of energy or new technologies for energy conservation (solar energy, biomass, small hydropower, wind energy, heat pumps and CHP).

Luxembourg has already adopted different measures to limit the emissions of atmospheric pollutants, for example:

- Fuel oil was completely phased out in the residential sector and replaced by gas oil with a maximum sulphur content of 0.2 per cent by 1st January 1989.

- The sulphur content of heavy fuel oil used in combustion units rated at over 3 MW was limited to 1 per cent from 1st July 1988 onwards and only gas oil with a sulphur content of 0.2 per cent may be burned in combustion units rated at under 3 MW. For combustion units rated at 50 MW and above, the EEC Directive of 24th November 1988 is applicable.

- The iron and steel industry, ARBED, uses coking coal with a maximum sulphur content of 1 per cent.

- Since 1st January 1990, new cars up to 2 000 cc fitted with a three-way catalytic converter qualify for a maximum subsidy of LF 20 000. The subsidy is limited to LF 10 000 for similar vehicles with oxidising converters. Older cars fitted with new catalytic converters qualify for the same grants.

LUXEMBOURG

Key Energy and Environment Data
(1989 data)

TPES (adjusted):	3.40 Mtoe
% Total OECD TPES:	0.09
% Total World TPES:	0.05
Per capita TPES:	8.99 toe per person
TPES/GDP ratio:	0.82 toe/1000 US$ 1985
Per capita TFC (adjusted):	8.52 toe per person
TFC/GDP ratio:	0.77 toe/1 000 US$ 1985
Energy related CO_2 emissions per capita:	7.41 t carbon/person
Energy related CO_2 emissions per unit GDP:	0.67 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.10
% Total energy related World CO_2 emissions:	0.05
% Population growth (yearly average growth 1980-1989):	0.62

NETHERLANDS

1. Official Position

In May 1989, the Ministries with responsibilities for agriculture and fisheries, energy, environment and public housing, and transport and public works issued a joint White Paper on the environment, known as the *National Environmental Policy Plan*, or NEPP. Following a Parliamentary discussion on the paper, the Government announced in November 1989 its decision to stabilize CO_2 emissions at the 1989/90 level by 1995 at the latest. In June 1990, a revised plan (the NEPP-Plus) was submitted to Parliament that calls for a 3 per cent to 5 per cent reduction on average 1989/90 levels by 2000.

The energy sector is expected to make the most important contribution (75 per cent) to achieving these targets. Recycling and improved waste management is expected to account for 10 per cent of the envisaged reduction, and the transport sector 15 per cent. More than half of the necessary CO_2 reductions expected from the energy sector will be achieved through additional improvements in energy efficiency. This will require a rate of energy efficiency improvements of more than 2 per cent per annum over the next decade — double the rate of improvement expected earlier for the 1990s. Details on how these goals are expected to be achieved were published in June 1990 in a White Paper on energy conservation.

The Government will be relying on a mix of instruments to achieve its objectives. Publicity campaigns are already being expanded in an effort to increase public awareness and understanding of the global climate-change issue. The R&D budget

for renewable energy has been raised from Gld 120 million to Gld 200 million a year. New building and appliance standards will be introduced, and existing ones will be tightened. Subsidies will be increased or reintroduced to promote solar energy, wind-generated power, combined heat and power, and other more efficient techniques, and to help defray the costs on retrofitting insulation and more efficient heating systems in existing buildings. Related subsidy budgets were raised from Gld 175 million to Gld 450 million. The Government is also working out covenants with particular industries. The energy distribution utilities have proposed a major programme of investments to reduce pollution and improve energy efficiency within their areas of influence; the total cost of this programme will be Gld 250 million, which will be financed in part by a 1 per cent to 2 per cent increase in electricity and gas tariffs. Finally, a small tax on fuels (related to their CO_2 emissions) has been levied. This tax, which went into effect in February 1990, is intended more to raise revenue than to affect fundamentally consumer preferences.

A "Steering Group on Regulatory Energy Taxes" has recently been set up to obtain an answer to the question: How far can regulatory energy taxes generate energy savings? Their study will also provide insight into the subsidiary effects of such an energy tax on such items as the distribution of incomes and purchasing power, the collective tax burden, employment, and so forth. The effects of a CO_2-related tax will also be studied. It is expected that the Steering Group will issue a report of their findings by the end of 1991 or early 1992.

While the Government has taken these actions unilaterally, its position is that the problem of global climate change requires innovative international cooperation, with the main reductions in greenhouse gas emissions coming from the rich industrialised countries. The Netherlands is thus actively involved in the IPCC process and in multilateral programmes aimed at improving conditions in developing countries.

On 4th September 1991 the Minister of Housing, Physical Planning and Environment has put forward to Parliament a White Paper on Climate Policy. The White Paper provides, in addition to an international vision, an integral picture of the global warming problem and the risks of climate change, as well as the Dutch effort at addressing the problem. A long-term environmental quality target has been set in addition to targets for the reductions of the emissions of greenhouse gases other than CO_2 and CFCs such as methane and N_2O. For N_2O the target is stabilisation of emissions in the year 2000 with respect to 1990 and for methane the target is a 10% reduction in 2000. Altogether the GHG reduction on 2000 will be -25% compared with 1990 levels. The White Paper also includes an analysis of the possibility of achieving a CO_2 reduction of 20% in the year 2005 with respect to 1988 (the Toronto target). The possibilities are studied in two ways: through an analysis of technological-oriented measures and through volume-oriented measures. The conclusions of this study are that international co-ordination on this target is necessary to reach this target for the Netherlands and that the bottlenecks are the social and practical aspects of implementation.

2. Factors Influencing Decisions

The Netherlands is home to many energy-intensive industries and its competitive position is strongly influenced by the price of energy and particularly of electricity. The country is endowed with large deposits of natural gas, both onshore and offshore, and is a net exporter of this hydrocarbon. Natural gas has achieved a penetration ratio of over 80 per cent of TFC in the household and commercial sectors, and almost 90 per cent of TFC in the agricultural sector, where it is the main fuel used for space heating. Natural gas is also the mainstay of the electric power sector, accounting for half of the electricity generated in 1988. Efficient, natural-gas-fired combined heat and power (CHP) units, mainly integrated with industrial facilities, are expanding as a generating resource, and now account for over 15 per cent of all the electricity generated in the country. Because of the high share of natural gas in the total energy mix, opportunities for reducing carbon emissions through fuel switching are limited.

Apart from fossil energy sources, the country's electric utilities generate each year around 0.8 Mtoe of electricity from nuclear power plants, and lesser, though growing, amounts from small hydro-electric plants and wind turbines. A *de facto* moratorium on the building of new nuclear power plants has been in effect for 15 years, and a resolution of the question is not likely until 1992 at the earliest. Earlier plans to raise the share of total electricity generated by coal-fired plants to 75 per cent have been dropped for environmental reasons; a share closer to 50 per cent is now envisaged. The Netherlands' position at the heart of northern, industrialised Europe, its high population density, and its intensive agriculture, put considerable pressure on the country's environment; at the same time, public opinion polls show consistently the great importance that the population attaches to environmental matters. Concerns over the possibility of global climate change are rooted in part in the country's centuries-old battle against the sea. Government policies to reduce emissions of greenhouse gases enjoy widespread support. Most popular are those that encourage greater energy efficiency and the expansion of renewable energy. Opposition to nuclear power is still strong. Meanwhile, the Government and the electric utilities are continuing to look into ways to make nuclear power plants even safer, and to improve techniques for safely storing radioactive waste.

3. Relevant Studies

Over ten reports have served as a basis for the Government's proposals and subsequent Parliamentary debates. Some of the most relevant reports are listed below.

- Minister for Public Housing, Spacial Planning and Environmental Protection; Minister for Economic Affairs; Minister for Agriculture, Natural Resources and Fisheries; and Minister for Transport and Waterworks, *Nationaal Milieubeleidsplan* [National

Environmental Policy Plan]. Report to the Second Chamber, Session 1988-1989, No. 21 137 (The Hague: SDU Uitgeverij, May 1989).

- McKinsey & Company, *Protecting the Global Environment: Funding Mechanisms*, report to the Ministerial Conference on Atmospheric Pollution & Climate Change, Noordwijk (Leidschendam: Ministry of Environment, November 1989).

- Stichting Energieonderzoek Centrum Nederland, "Baseline and CO_2-response scenarios for the Netherlands", Paper submitted to the IPCC (Petten: December, 1989).

- VEEN, VEGIN, and VESTIN, "Points of departure for the first environmental action plan of the energy distribution sector in the Netherlands: Integrated environmental policy plan for the Dutch energy distribution sector" (Arnhem, 26 April 1990).

- Minister for Public Housing, Spacial Planning and Environmental Protection; Minister for Economic Affairs; Minister for Agriculture, Natural Resources and Fisheries; and Minister for Transport and Waterworks, *National Milieubeleidsplan Plus* [National Environmental Policy Plan—Plus], Report to the Second Chamber, Session 1989-1990, No. 21 137 (The Hague: SDU Uitgeverij, June 1990).

- Minister of Economic Affairs, *Memorandum on Energy Conservation*, Report to the Second Chamber, Session 1989-1990, No. 21 570 (The Hague: SDU Uitgeverij, June 1990).

NETHERLANDS

Key Energy and Environment Data
(1989 data)

TPES (adjusted):	56.09 Mtoe
% Total OECD TPES:	1.49
% Total World TPES:	0.76
Per capita TPES:	3.78 toe/person
TPES/GDP ratio:	0.41 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.82 toe/person
TFC/GDP ratio:	0.30 toe/1 000 US$ 1985
Energy related CO_2 emissions per capita:	2.85 t carbon/person
Energy related CO_2 emissions per unit GDP:	0.31 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	1.51
% Total energy related World CO_2 emissions:	0.72
% Population growth (yearly average growth 1980-1989):	0.54[1]

1. UN source indicates these estimates are of questionable reliability.

Form 675 G (5)
PROCÉDÉ **Plasdex** ® PROCESS
MONTRÉAL TORONTO

NEW ZEALAND

1. Official Position

In July 1990, after receiving the recommendations of the New Zealand Climate Change Programme established in June 1988, the New Zealand Government agreed to aim for a 20 per cent reduction of 1990 carbon dioxide emissions by 2005. The new government elected in October 1990 announced that this goal should be aimed for by the year 2000. The New Zealand Climate Change Programme is comprehensive: it covers carbon dioxide, methane, nitrous oxide, both the sources and sinks of these gases, research, education, monitoring and international negotiations. It is also consultative: the development of policy is being, and will continue to be done in consultation with industry and other interested groups. In 1991, the Government gave priority to climate change research by identifying climate change for a National Science Strategy (Climate Change).

Policy development has not reached the stage where specific instruments or measures are being recommended. This is seen as ongoing work and initial steps are only just being taken. However, it has been agreed that, in responding to the threat of climate change, New Zealand should begin by implementing measures which are estimated to be cost effective, to provide the greatest range of benefits whether climate change occurs or not, to have a net benefit for New Zealand society and to not reduce New Zealand's competitive advantage with its trading partners.

The Ministry for the Environment is to report in March 1992 on policy measures that would both reduce the net build-up of greenhouse gases in the atmosphere and/or increase carbon sinks and have either a net economic benefit or a low economic cost.

Although not a direct outcome of the Climate Change Programme, the Government has directed the Building Industry Authority to develop residential and commercial building energy performance standards. The Ministry for the Environment is currently developing a comprehensive waste management strategy which will consider the reduction of greenhouse gases such as methane from landfill.

The Indigenous Forests Policy agreed to by the Government in December 1990 has the primary objective to "maintain and enhance in perpetuity the existing areas of New Zealand's indigenous forests". New Zealand is also committed to the earliest practical phase-out of chlorofluorocarbons and was the second country to ratify the amendment to the Montreal Protocol which will see use of those substances cease by 2000.

2. Factors Influencing Decisions

The decision to aim for a 20 per cent reduction target for carbon dioxide emissions is placed in the context of international co-operation to achieve that goal. While New Zealand cannot on its own control the build-up of greenhouse gases in the atmosphere, the decision demonstrated New Zealand's willingness to take action, and is a signal to the international community of the importance attached by New Zealand to finding solutions to the climate change problem. New Zealand will continue to support the need for the strongest possible Framework Convention on Climate Change. Considerable concern is expressed in New Zealand at the possible effects climate change (especially rising sea levels) might have on Pacific Islands with a largely coastal-based population.

3. Relevant Studies

New Zealand has contributed to the IPCC process and New Zealand co-chaired the IPCC sub-group on Coastal Zone Management. The New Zealand Climate Committee of the Royal Society of New Zealand became the Facts Working Group of the New Zealand Climate Change Programme and prepared the *New Zealand Climate Report*, 1990 and an earlier abridged version *Climate Change in New Zealand*, 1988. The Impacts Working Group of the New Zealand Climate Change Programme prepared two reports, *Climate Change: a Review of Impacts on New Zealand* in April 1990 and the detailed background in *Climatic Change: Impacts on New Zealand* in May 1990. The Policy Working Group prepared *Responding to Climate Change: a Discussion of Options for New Zealand* in May 1990. The climate change policy response decisions were issued by the Prime Minister in August 1990 as *Climate Change: a Response Strategy*. In April 1991, the Ministry for the Environment completed a scoping paper on Developing a Strategy to Reduce CO_2 emissions, which sets out key issues and the associated work programme.

NEW ZEALAND

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	11.95 Mtoe
% Total OECD TPES:	0.32
% Total World TPES:	0.16
Per capita TPES:	3.57 toe/person
TPES/GDP ratio:	0.53 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.49 toe/person
TFC/GDP ratio:	0.37 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	2.08 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.31 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.25
% Total energy related World CO_2 emissions:	0.12
% Population growth (yearly average growth 1980-1989):	0.71

NORWAY

1. Official Position

The environmental policies and targets related to the energy sector were outlined in the White Paper on the Norwegian Government's follow-up of the World Commission Report on Development and Environment (Parliamentary Report no. 46). The Parliament gave its approval in April 1989.

The Parliament has stated that emissions of CO_2 should be stabilized by 2000 at the 1989 level. This goal is preliminary and has to be continuously analysed in the light of technological development, the outcome of further research and the results of international negotiations and agreements.

The national goal for CFC reduction is 50 per cent by 1991 and 100 per cent by 1995 (from 1986 levels). Norway has signed the CFCs Protocol to the Vienna Convention. Emissions of halons should be reduced by 50 per cent (from the 1986 level) by 1995 and eliminated before 2000.

Emission of greenhouse gases is an international problem and must be handled by international negotiations and agreements. Norway's position includes two main principles: precaution and cost-effectiveness. To avoid serious environmental damage the climate change needs to be taken seriously without having full scientific knowledge of the problem and consequences. Global reductions in emissions of greenhouse gases should be implemented at minimum costs for the global society. An international tax on emissions of greenhouse gases, as well as trading of emission rights, would contribute to equalise the marginal costs of reducing greenhouse^R
gases.

Norway has also signed other international agreements to limit emissions of SO_2 and NO_x. By 1993 the national emissions of SO_2 should be reduced by 30 per cent compared with the 1980 level. The objective of the Government is, however, to reduce the emissions by 50 per cent by 1993. Norway has also signed the Sofia Agreement and is thereby committed to stabilize the emissions of NO_x by 1994 (from the 1987-level). In addition, Norway and twelve other Western European countries have signed a declaration aiming at 30 per cent reduction by 1998, compared with the 1986 level.

Since 1989 new gasoline-fuelled private cars have had to satisfy emission standards equivalent to the 1983 U.S. standards, which require the use of catalytic converters. On 1st October 1990, these standards were extended to vans and new diesel-fuelled cars.

In 1990 the price of gasoline was Nkr. 5.82 per litre. This includes a tax on gasoline of NKr 2.83 per litre and VAT (20 per cent). The 1991 budget introduced CO_2 taxes on gasoline and fuel oil. The CO_2 tax on gasoline is NKr. 0.60 per litre and NKr. 0.30 per litre fuel oil. In order to reduce emissions of sulphur and lead, the sulphur-tax on fuels oils was increased and the difference in taxes between leaded and unleaded gasoline was widened. As a result total taxes on the most common oil products increased by NKr. 0.33 per litre, while total taxes on heavy fuel oil increased by NKr. 0.39-0.49 per litre. The total tax on unleaded gasoline increased by NKr. 0.65 per litre, while the tax on leaded gasoline increased by NKr. 0.75 per litre.

Finally, the Government introduced a tax on CO_2 emissions from oil and gas activities on the Norwegian Continental Shelf by 1 January 1991. The tax is NKr. 0.60 per cubic metre gas burnt.

2. Factors Influencing Decisions

As a major oil and gas exporting country, the Norwegian economy is closely related to the development in the international oil and gas markets. Hydro power is the main indigenous energy source and covers 45 per cent of the primary energy requirements and 99 per cent of electricity generation. Oil covers 40 per cent of the primary energy requirements, mainly in the transport sector and in industry. A major part of exports, excluding oil and gas, is constituted of energy intensive goods. The competitive position of the energy intensive industries is strongly influenced by the price of energy, in particular electricity.

The production capacity of the operating hydro power stations and hydro power stations under construction is around 110 TWh in a normal year. A production of 125 TWh is regarded as a limit for hydro production, although a further 23 TWh could conceivably be developed. This excludes areas which are permanently protected for environmental

reasons. In 1989 Norway exported 15 TWh electricity, due to a record level of precipitation.

Public opinion in Norway is concerned with environmental degradation and protection. The non-governmental environmental organisations have a rather strong public support. As part of the follow-up of the Bergen conference, the Government has appointed representatives of different non-governmental organisations to take part in discussions on environmentally related issues, in a national environmental committee. The Prime Minister is the head of the committee. The aim of the committee is to contribute to increased co-operation between government, industries, research communities, municipalities, youth and environmental organisations to enhance a sustainable development nationally as well as internationally.

A White Paper (Report no. 61 see below) from 1989 identified an economic potential for reducing energy consumption in residential buildings by around 13 per cent and by about 23 per cent in commercial buildings. Energy conservation measures should contribute to an energy use which is optimal from an economic as well as an environmental perspective. The energy conservation policy is a central element in the overall energy policy.

In June 1990, the Parliament approved a new energy law. The law is expected to lead to a significant reform of the electricity market, as a result of deregulation and increased competition between utilities in production and sale of electricity. These measures will lead to reduced costs, more efficient production, more rational investment decisions and a more flexible system. In addition, the reforms will contribute to a more efficient use of resources and improve the basis for evaluating investment costs against conservation costs.

3. Relevant Studies

- Environment and Development. Programme for Norway's Follow-up of the Report of the World Commission on Environment and Development. Report to the Storting No. 46. (1988-89).

- Energy Conservation and Energy Research and Development. Report to the Storting No. 61 (1988-89).

- The Effect of different Measures to combat Emissions of Climate Gases on Energy Markets. Report by the Centre for Economic Analysis (ECON) (1990).

- International Agreements on Reduction in Emissions of Carbon Dioxide. Report by the Centre of Applied Social Scientific Research (1990).

- Climate Change; The Effect on the Potential of Hydro Power and new Renewable Energy Resources. Report by the Norwegian Electricity Board (1990).

- The Status of the IPCC Process.

- The North South Dimension of the Climate Change Issue.

- Land Studies of Brazil, Mexico, the EEC and the United States.

- Three reports by the Fridtjof Nansen Institute (1990).

Forthcoming studies

- A national report on the use of environmental taxes (will be published February 1991).

- A national report on climate change, effects and measures to combat and adapt to climate change (will be published February 1991).

NORWAY

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	20.87 Mtoe
% Total OECD TPES:	0.56
% Total World TPES:	0.28
Per capita TPES:	4.94 toe/person
PER/GDP ratio:	0.33 toe/1000 US$ 1985
Per capita TFC (adjusted):	3.79 toe/person
TFC/GDP ratio:	0.26 toe/1000 US$ 1985
Energy related CO2 emissions per capita:	2.35 t carbon/person
Energy related CO2 emissions per unit of GDP:	0.16 t carbon/1000 US$ 1985
% Total energy related OECD CO2 emissions:	0.36
% Total energy related World CO_2 emissions:	0.17
% Population growth (yearly average growth 1980-1989):	0.38

Form 675 G (5)
PROCÉDÉ Plasdex PROCESS
MONTRÉAL TORONTO

PORTUGAL

1. Official Position

There is no formal statement by the Government of Portugal on the consequences of energy use for the environment. More specifically, the government has not set any greenhouse gas emission targets.

2. Factors Influencing Decisions

Reflecting a growing awareness of environmental issues, a new Ministry for the Environment was created in 1990. Nevertheless, the Government's efforts continue to focus on enhancing the performance of the economy. Protection of the environment and improving energy efficiency are two of the six general objectives of Portuguese energy policy. but these were not established with particular regard to the questions of CO_2 emissions and climate change.

As Portugal continues its efforts to diversify energy supplies and integrate into the European energy markets. its consumption of natural gas and coal will increase (at the expense of oil in certain sectors). As its economy expands, overall consumption of energy will increase (electricity, natural gas, transport fuels, and coal), so it is expected that CO_2 emissions will continue to grow at least until the year 2000. In the area of energy efficiency, the Government will be launching a massive publicity campaign to increase the awareness of energy users of the need to improve energy efficiency. Improvements in energy efficiency will moderate the trend toward increasing CO_2 emissions.

3. Relevant Studies

- Lei de Bases do Ambiente. in Diário da República. I Série. 7.4.90. pages 1386-1397;

- Relatório do Estado do Ambiente e Ordenamento do Território. Ministry of Planning/Ministry of Environment and Natural Resources. 1990;

- Inventário das Emissôes de Poluentes Atmosféricos, Ministry of Environment and Natural Resources. 1990;

- Cenários de Evoluçao da Procura de Energia. Ministry of Industry and Energy. Report prepared for the National Energy Plan. (1989);

- Several studies on the formation and reduction of pollutants from combustion. including NO_x, NO_2, particulates. LNETI, Ministry of Industry and Energy.

PORTUGAL

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	14.00 Mtoe
% Total OECD TPES:	0.37
% Total World TPES:	0.19
Per capita TPES:	1.35 toe/person
TPES/GDP ratio:	0.56 toe/1000 US$ 1985
Per capita TFC (adjusted):	0.98 toe/person
TFC/GDP ratio:	0.41 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	1.16 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.48 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.43
% Total energy related World CO_2 emissions:	0.20
% Population growth (yearly average growth 1980-1989):	0.80

SPAIN

1. Official Position

The Spanish government has not yet set any targets on reducing CO_2 emissions. In its view it would be premature to decide on specific measures without having clear evidence on which gases are provoking possible climate change. It is of the opinion that the climate change issue cannot be addressed by means of measures on a national level but can only be dealt with in an international context. The EEC framework is considered as an appropriate context. So far it is foreseen that CO_2 emissions will increase parallel with the anticipated development in energy requirements to ensure adequate economic growth.

Considering its future action on CO_2 emissions, the Spanish Government also refers to item 17 of the Noordwijk Declaration on Climate Change (6 and 7 November 1989) which states that industrialised countries with, as yet, relatively low energy requirements, which can reasonably be expected to grow in step with their development, may have targets that accommodate that development.

2. Factors Influencing Decisions

When considering the level of CO_2 emissions it must be borne in mind that the industrialisation of the country is relatively recent and that the potential of further economic growth remains important. The increase in electricity consumption and oil products for final energy consumption is expected to be above the average of the other EEC member countries. Presently, the CO_2 emission level per capita is smaller than the average in Western Europe.

Following the oil crises in the seventies, the Spanish energy policy adopted, as a priority, to increase coal use for both industry and electricity generation. Energy conservation and development of nuclear energy were two other priorities. However, the National Energy Plan of 1983 (NEP83) established a nuclear moratorium, which resulted in shelving plans to build five more nuclear reactors. Another sign of the increasing concern about environment is the creation, by the government, of a General Secretariat for Environment in the Ministry of Public Works and Urbanisation (MOPU), which has as a main mission to define the objectives referring to environmental issues and to prepare relevant legislation and regulation in coordination with the other ministries.

Major RD&D efforts are being devoted to improving coal combustion technologies. These efforts were initiated to contribute to the reduction of SO_2 emissions, but they may also lead to lower CO_2 emissions per unit of energy produced. The main project is the current construction of the Escatron pressurised fluidised bed combustion project (PFBC).

The new National Energy Plan currently being drafted will encompass the environmental goals in order to reconcile them in an overall energy policy strategy. The energy choices adopted in the new NEP will influence likely climate change responses measures. This National Energy Plan (NEP) may be presented to Parliament either late 1990 or early 1991.

3. Relevant Studies

- Information for the Environment - Present Time and in the Future - Monography by the Directorate General of the Environment - Ministry of Public Works and Urbanisation (MOPU) - (1989) (in Spanish)

- Law on the Environment and its Guiding Principles - Dirctorate General of the Environment - MOPU (1986) (in Spanish)

- Guides for Methodologies for the Elaboration of Studies on the Environmental Impact - Directorate General of the Environment MOPU (1990) (in Spanish)

SPAIN

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	79.88 Mtoe
% Total OECD TPES:	2.12
% Total World TPES:	1.08
Per capita TPES:	2.05 toe/person
TPES/GDP ratio:	0.40 toe/1000 US$ 1985
Per capita TFC (adjusted):	1.34 toe/person
TFC/GDP ratio:	0.26 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	1.50 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.29 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	2.08
% Total energy related World CO_2 emissions:	0.99
% Population growth (yearly average growth 1980-1989):	0.38[1]

1. UN source indicates these estimates are of questionable reliability.

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SWEDEN

1. Official Position

Parliament has declared that the use of CFC's should be phased out completely by the year 1994. By the end of 1990, the use of CFC's in Sweden should be decreased by 50 per cent, compared with the 1986 level.

In January 1991, an agreement on energy policy was reached by the Social Democrats, the Liberal Party and the Centre Party. This agreement included a strategy for reducing climate change, which was presented to Parliament by the Government in the Energy Policy Bill in February.

According to the agreement, Swedish efforts to limit climate change should be coordinated with those of other Western European countries and should contribute to action taken at an international level. The Swedish strategy to limit climate change must have a practical orientation and include all greenhouse gases and all economic sectors. Sweden must work actively to bring about emission reductions, even in sectors which are open to international trade and competition. Such far reaching reductions require international cooperation.

The agreement emphasises the efficient use of energy as an important instrument for limiting climate change and calls for an intensification of energy conservation efforts. Furthermore, environmentally-adapted energy production, with a relatively small impact on climate change, must be encouraged. Energy conservation measures and investments in environmentally-adapted energy production, combined with carbon taxes on fossil fuels, are to reduce carbon dioxide emissions from homes, services and district heating systems so that emissions in 2000 do not exceed today's levels.

The carbon tax introduced on 1st January 1991 applies to fossil fuels used in the domestic sector, the non-energy intensive industry, for cars and for domestic air traffic.

Carbon dioxide emissions will be subject to a tax of 0.25 SKr per kg of carbon dioxide (4.1 U.S. cents/kg). This tax represent 620 SKr/tonne of coal. 535 SKr/m3 of natural gas. 0.4 SKr/litre of LPG for cars, 750 SKr/tonne of LPG for other uses and 0.58 SKr/litre of gasoline. Emissions of carbon dioxide from domestic air traffic will be taxed at 0.75 SKr/tonne of fuel.

2. Factors Influencing Decisions

In the absence of national fossil fuel resources, Sweden has developed an energy system which relies heavily on electricity produced from nuclear and hydro energy. The Swedish economy is dependent on exports from energy intensive industries and its competitive position is strongly influenced by the price of energy.

A ban on the further development of hydroelectricity in the four remaining large, unexploited rivers was adopted in 1987. Sweden has also set a target for a 80 per cent reduction of SO_2 emissions in 2000 and of a reduction of NO_x emissions of 30 per cent in 1995, compared with 1980 levels.

In February 1991, the Energy Policy Bill, based on the inter-party agreement described above, was presented to Parliament. According to the agreement, the time at which the nuclear phase-out can begin and the rate at which it will proceed will depend on the results of electricity conservation measures, on the supply of electricity from environmentally acceptable sources and on whether internationally competitive electricity prices can be maintained. The 1980 parliamentary decision to phase out nuclear power by 2010 has not been reconsidered.

The Energy Policy Bill sets forth an energy conservation programme as well as measures for promoting renewable energy production, including biomass and wind and solar energy. Taxation has been modified in order to make combined heat and power production more competitive.

3. Relevant Studies

Over twenty reports were completed in the course of the preparation of the Energy Policy Bill. Some of the most relevant reports are listed below.

- Environmental charges (Special Expert Committee)

- Can industry meet environmental requirements? (National Industrial Board and National Board for Technical Development)

- Proposals for planning the energy system to meet environmental requirements up to 2015 (National Environment Board and National Energy Board)

- Consequences for electricity intensive industries of increasing electricity prices (Special Expert Committee)

- More efficient use of electricity, electricity conservation and substitution (National Energy Board)

- Economic analysis of domestic electric heating (National Energy Board and National Housing Board)

- Need for improved information on electricity conservation and improved energy efficiency (National Energy Board)

- Programme for air pollution control, including pollutants involved in acid rain and climate change (National Environment Board)

- Reactor phase Out 1995/1996: Consequences and Social costs (National Energy Administration)

- Growth and the Environment - a Study of Conflicting Objectives (Special Expert Committee)

- Nuclear Phase-Out - Competence and Employment (Special Committee)

- Electricity Market 1990 (National Energy Adminstration)

In addition, a number of studies were announced in the Energy Policy Bill. One of the most important studies is to be carried out by a Special Committee on Bioenergy, which will be appointed in the Spring of 1991.

SWEDEN

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	46.36 Mtoe
% Total OECD TPES:	1.23
% Total World TPES:	0.63
Per capita TPES:	5.46 toe/person
TPES/GDP ratio:	0.42 toe/1000 US$ 1985
Per capita TFC (adjusted):	3.70 toe/person
TFC/GDP ratio:	0.28 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	2.38 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.18 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.72
% Total energy related World CO_2 emissions:	0.34
% Population growth (yearly average growth 1980-1989):	0.25

SWITZERLAND

1. Official Position

The Swiss government (Federal Council) has expressed its determination at the Second World Climate Conference in November 1990 in Geneva, to take measures for at least stabilizing the emissions of carbon dioxide until the year 2000 at the 1990 level. Formal national targets and programmes already exist for pollutants like NO_x, SO_2, HC and CFCs.

Presently implemented energy policy measures, which are also part of the "Clean-Air-Concept", are based on the "Energy Policy Programme of Cantons and Confederation" (1985), and on the Energy 2000 Action Programme launched in February 1991. They include, among others, cantonal building codes, federal standards for heating equipment and burner control, tax incentives, information activities, R&D and a programme for public buildings. An assessment of the progress achieved so far was published in September 1991.

In the field of transport, incentives for and investments in public transport, taxes on motor fuels and cars, speed limits and weight limits for trucks already contribute to reduce CO_2 emissions. In addition there are new projects for "piggy-back" transport of goods in international transit, "Rail and Bus 2000" and new railway tunnels through the Alps ("NEAT").

After the constitutional amendment on energy was endorsed by public vote in September 1990, a Decree on the Rational Use of Energy became effective in May

1991. These new legal bases enables the Federal Government to considerably strengthen its policy.

The Federal Council can now implement, in particular, regulations on energy consumption of installations, equipment and motor vehicles, regulations on individual metering and invoicing of space heat and hot water consumption, regulations on the financial compensation of supplies for autoproducers to the public grid, and financial incentives for renewable energy and waste heat utilisation.

The objective of the Energy 2000 Action Programme is to increase efforts substantially, over the next ten years, in order to stabilize the consumption of fossil fuels and energy-related emissions of CO_2 between 1990 and 2000 at 1990 levels (thereafter consumption and emissions should be reduced). With regard to electricity demand, the programme aims at gradually reducing the growth rates and stabilizing demand as from the year 2000. The contribution of renewable energies is expected to increase (in particular by about 5 per cent for hydropower). The performance of the existing nuclear capacities shall be expanded (by 10 per cent) as far as safety requirements allow. Measures would include, on a federal level, the fast enactment of the decree on the Rational Use of Energy and, at a later stage, of an energy law, possibly a tax on CO_2, stronger financial incentives and additional and co-ordinated efforts of Cantons, communities and the private sector. The action programme constitutes an integral part of the environmental policies and programmes.

Regarding the possibility of a CO_2 tax, an interim report was prepared by the federal administration in 1990. Based on this report, the Federal Council decided that the Administration should prepare, in 1991, a proposal on CO_2 taxes ranging from 15 per cent for gasoline to more than 100 per cent for coal (at 1990 price levels) which could be submitted to a consultation procedure. The timing of the implementation and the ultimate tax levels will depend on the outcome of the consultation procedure. This has been deferred after a referendum on a revision of the general taxation system was turned down in June 1991.

2. Factors Influencing Decisions

The new constitutional amendment on energy implies more competences of the federal state, in particular for regulations on energy efficiency and for financial support of renewable energies and waste heat utilisation. The new legislation will be essential for further increases in energy efficiency (and to a lesser extent for fossil fuel substitution) and thus for reduction of CO_2 emissions. The federal parliament terminated its deliberations in 1991 on the first phase of the planned legislation, the

"Decree on the Rational Use of Energy". This decree will be replaced and possibly supplemented and strengthened by the Energy Law at the latest in 1999.

Electricity supplies in Switzerland rely essentially on nuclear (41 per cent) and hydro (57 per cent). In the referendum in September 1990, a ten-year (and in fact even longer) moratorium regarding the licencing of new nuclear production facilities was approved. However, a gradual phase-out of nuclear energy was rejected. According to the federal government, the construction of fossil-fuelled power plants or additional long-term contracts for electricity imports should be avoided. Priority is therefore given to the efficient use of energy, including electricity. After the turn of the century, the question whether to renew, extend, or phase-out nuclear capacities will arise again.

Public opinion in Switzerland is very concerned about environmental protection, and the Swiss environmental legislation is one of the most advanced among IEA countries. Because of the country's complex political structure, energy and environment policies require close co-ordination among the federal, cantonal and community levels. The new constitutional amendment on energy should facilitate this co-ordination of energy policy. Switzerland has a system of direct democracy whereby citizens vote by referenda or initiatives on new laws or changes of the constitution. The implementation of climate change response strategies thus heavily depends on the public perception of the problem.

3. Relevant Studies

The federal government created in 1989 an interdepartmental working group within the federal administration, which has the task to co-ordinate ongoing activities and to advise the government regarding climate change issues. Studies on policies and perspectives of CO_2 emissions are being carried out within the Ministry of Transportation, Energy and Communication and are part of this work. For the time being, only CO_2 emissions are being investigated in detail.

SWITZERLAND

Key Energy and Environment Data
(1989 data)

TPES (adjusted):	22.97 Mtoe
% Total OECD TPES:	0.61
% Total World TPES	0.31
Per capita TPES:	3.42 toe per person
TPES/GDP ratio:	0.22 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.85 toe per person
TFC/GDP ratio:	0.19 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	1.80 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.12 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	0.43
% Total energy related World CO_2 emissions:	0.21
% Population growth (yearly average growth 1980-1989)	0.58

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TURKEY

1. Official Position

In Turkey, the 6th Five Year Plan takes into account environmental issues in every sector including energy. Among policies which have a positive impact on the environment are the following:

- economic assessment of environmental factors in energy fuel cycles, from production to consumption;
- more emphasis on R&D and transfer of technology to limit pollution from existing and new electric generating plants, e.g. R&D on fluidised bed combustion technologies;
- increased use of natural gas in electricity generation and in residential heating;
- support for R&D programmes on renewable energies to increase their use, e.g. increased exploitation of all hydro sources;
- improvement of the quality of oil products and measures to prevent pollution caused by their use;
- increased emphasis on energy efficiency.

There is no production of CFC's in Turkey, the demand is met through imports.

There are three sets of measures that have been taken in Turkey to limit conventional air pollutants some of which are greenhouse gas emissions:

- an Environment Law (1983);
- an Instruction for Preserving the Air Quality;
- an Instruction for Fuel Saving and Heating Insulation in existing buildings and for the Diminution of Air Pollution.

In this context, there are severe restrictions in the energy production area, especially for the coal-fired power stations. Such restrictions have been installed for conventional air pollutants some of which are greenhouse gas emissions.

2. Factors Influencing Decisions

Over the past few years, Turkey has experienced one of the highest rates of economic growth among IEA countries, averaging 6.6 per cent per year from 1983 to 1987 and 3.6 per cent in 1988. Nevertheless, Turkey has the lowest GDP per capita among IEA countries. Its population grew annually by 2.3 per cent (about 1 million) on average between 1973 to 1988. An ambitious programme is being implemented both to modernise and privatise industry and to build the necessary infrastructure to boost energy supplies. Between 1975 and 1988, power generation capacity has been increased by a factor of 3.5, and a gas pipeline from the Bulgarian border to Istanbul and Ankara was built.

The share of solid fuels in TPES in Turkey was over 42 per cent in 1988, the highest among IEA countries (average about 25 per cent). Domestic production accounted for over 80 per cent of coal demand. Overall, indigenous energy production covered 56 per cent of TPES in 1988. The government's energy policy goal is to ensure sufficient, reliable and economic energy supplies to support economic and social development. A major element is to increase domestic supplies, and, as far as possible, regional energy demand is to be met by regional production. With its large fossil fuel resources, Turkey plans to continue to construct new coal-fired power plants, and permission to construct and operate plants fueled with imported coal according to the Build-Operate-Transfer (BOT) model was granted in 1986. For each plant the Ministry of Energy and Natural Resources prepares a report evaluating the environmental effects. The share of hydro-electric capacity in electric generation is high (40 per cent), and significant new hydro capacity is under construction. Taking advantage of small hydro-power resources, the goal is to reach a 50 per cent share of electricity production by hydro.

Public awareness of environmental problems has recently become increasingly sensitive, e.g. in connection with new coal-fired power plants. A commission to examine the reasons and find solutions for the air pollution problem in Ankara has been organised in the parliament. According to the "Environment Law" of 1983, a fund has been created to support pollution prevention activities.

3. Relevant Studies

A study project on "Assessment of the Principles of Legal, Administrative and Technical Measures for the Protection of the Ozone Layer" is in the 1990 programme of work of the Undersecretariat of Environment.

TURKEY

Key Energy and Environment Data (1989 data)

TPES (adjusted):	47.19 Mtoe
% Total OECD TPES:	1.26
% Total World TPES:	0.64
Per capita TPES:	0.85 toe per person
TPES/GDP ratio:	0.73 toe/1000 US$ 1985
Per capita TFC (adjusted):	0.66 toe per person
TFC/GDP ratio:	0.57 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	0.77 t carbon/person
Energy related CO_2 emissions per unit of GDP:	O.66 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	1.51
% Total energy related World CO_2 emissions:	0.72
% Population growth (yearly average growth 1980-1989):	3.07[1]

1. UN source indicates these estimates are of questionable reliability.

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UNITED KINGDOM

1. Official Position

The UK Government's position on the issue of climate change is set out in the White Paper, "This Common Inheritance", published on 25th September 1990. This reaffirmed that the UK is prepared, if other countries take similar action, to set itself the target of returning emissions of CO_2 to 1990 levels by 2005. The UK is also pursuing measures to reduce emissions of methane from various sources (e.g. encouraging the use of energy from landfill waste), and is committed to phasing out the production and consumption of CFCs by the middle of 1997. Taking action on all greenhouse gases together, the global warming potential of the UK's emissions in 2005 should fall significantly, by approximately 20 per cent compared with levels in 1990. An anniversary report was published on 25 September 1991 which reported on progress to date.

Cutting CO_2 emissions will, in the Government's view, call for adjustments to the economy and way of life in the UK. The Government plans to take first those measures which save energy or are otherwise justified in their own right, such as:

- encouraging greater energy efficiency (for example, through a Ministerial Committee to maintain the momentum for improvement, by cutting the energy use of the Government estate, by stepping up the work of the Energy Efficiency Scheme for low-income households, by providing information to encourage better design and technology in energy efficiency, by promoting CHP schemes, by monitoring the toughened energy efficiency standards for new buildings to see how they might be further strengthened, by encouraging energy labelling of houses and appliances, by

promoting the use of energy efficient lighting, by pressing for new minimum efficiency standards across Europe);

- taking steps to improve the efficiency of transport (for example, by encouraging the most fuel-efficient transport choices, by increasing fuel and company car taxes, by introducing speed limiters on heavy goods vehicles and improving enforcement of speed limits, by encouraging less emphasis in car advertisements on speed and acceleration, by extending vehicle testing to cover emissions and so improve the tuning of engines, by pressing for European controls on fuel efficiency of vehicles, by increasing funding to encourage freight off the roads and onto rail and water, by supporting substantial investment in public transport and in efficient road systems and by encouraging transport choice by privatising British Rail and providing a right of access to British Rail tracks for new operators);

- reviewing its policy on renewable energy technologies relevant to the UK, with a view to working towards a ten-fold increase over present capacity (excluding Scottish hydro-electricity) by 2000; and

- reviewing the prospects for nuclear power in the next century, taking full account of environmental issues.

In addition, in view of the role of trees, woods and forests as sinks, the Government will continue to encourage tree planting in the UK and the sustained management and regeneration of existing forests.

Even after these measures are taken, the Government believes further action will be necessary; in the longer term this will inevitably have to include increases, achieved by taxation or other means, in the relative prices of energy and fuel. But these further measures can only be taken when competitor countries are prepared to take similar action. In view of the time it is likely to take to achieve international consensus, tax or other measures directly raising the relative price of energy outside the transport sector will not be introduced in the next few years.

Government action already in hand, in view of the UK Government, will help to keep emissions down. For example, the competition stemming from the privatisation of the electricity industry will give a strong incentive to generate electricity more efficiently, and encourage generation from non-fossil fuels. Indeed, the two major non-nuclear electricity generating companies in England and Wales believe that their intended installation of high efficiency gas-fired plant, and greater use of renewable energy, will hold their CO_2 emissions approximately constant for the foreseeable future, whereas the Government's earlier projections assumed some growth.

2. Factors Influencing Decisions

The starting point for the UK Government's policies and proposals, as set out in the White Paper, is responsibility to future generations to preserve and enhance the environment of the country and the planet.

The fulfilment of this responsibility is based on a number of supporting principles, such as:

- policies must be based on and use the best scientific evidence and economic analysis available;

- where there are significant risks to the environment, the Government be prepared to take precautionary action to limit the use or spread of potentially dangerous pollutants, even where scientific evidence is not conclusive, if the balance of likely costs and benefits justifies it;

- to help people to make better and more informed choices as consumers, investors and voters, there must be improved access to and understanding of information on environmental matters;

- since many of the world's environmental problems are global in scale, international action is necessary to deal with them; and

- since safeguarding the environment can be very costly in the short term, whatever the longer term benefits, it is important to adopt the most cost-effective instruments. In particular, the Government will take account of the argument that market-based instruments will often be more efficient and less expensive than regulation in reducing emissions because they allow producers and consumers, rather than regulators, to decide how energy can best and most economically be used.

The United Kingdom is a net exporter of energy, with abundant supplies of oil, gas and coal, as well as existing nuclear generating capacity in place. The UK is a major supplier of crude oil to OECD countries. It also exports and imports considerable amounts of petroleum products. Concerning natural gas exports, there are at present only limited opportunities to sell new gas into continental markets, but the Government will consider applications for waiving the landing requirement on a case-by-case basis without any presumption that exports should not take place and bearing in mind security of domestic supplies.

3. Relevant Studies

Reports which have contributed to the development of the UK Government's policies and proposals, include:

- Energy Paper 55: Renewable energy - the way forward
- Energy Paper 56: Prospects for the use of advanced coal-based power generation plant in the United Kingdom
- Energy Paper 58: An evaluation of energy-related greenhouse gas emissions and measures to ameliorate them
- House of Commons Energy Committee Report: Energy policy implications of the greenhouse effect; and Government response
- House of Lords Science & Technology Committee Report: Greenhouse effect; and Government response
- Pezzey, J. (1991): *Imports of Greenhouse Gas Control Strategies on the Competitiveness of the UK Economy*. Report for Department of Trade and Industry.

Work underway and planned for the future includes:

- continuing collaboration in international climate research projects, for example, to improve monitoring, understanding and prediction of the climate, to study the cycling of carbon and other elements in the ocean and related atmospheric changes, to investigate changes in water and energy balance of land following deforestation, and to estimate the CO_2 storage potential of trees and the effects of increased CO_2 on tree growth;
- continuing research on energy efficiency and alternative energy;
- continuing research by Government and major public transport operators on transport demand;
- proposed Government study on relationship between land use and transport.

UNITED KINGDOM

Key Energy and Environmental Data (1989)

TPES (adjusted):	201.03 Mtoe
% Total OECD TPES:	5.35
% Total World TPES:	2.72
Per capita TPES:	3.51 toe/person
TPES/GDP ratio:	0.38 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.41 toe/person
TFC/GDP ratio:	0.26 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	2.80 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.30 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	5.73
% Total energy related World CO_2 emissions:	2.72
% Population growth (yearly average growth 1980-1989):	0.17

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UNITED STATES

1. Official Position

The United States believes that a successful climate change policy must be:

- comprehensive, addressing all greenhouse gases, and both their sources and sinks;
- long-term, taking account of the social, economic and environmental consequences and effectiveness of policies over the long term;
- flexible, building on diverse actions which are readily adjustable as knowledge improves through a strong research and development programme;
- global, designed to involve all nations and incorporate the unique circumstances of each in the development of response strategies.

The United States is undertaking and planning substantial actions to implement this policy. Examples of actions to reduce emissions of greenhouses gases (GHGs) include: amendments to the Clean Air Act which will reduce CO_2 and methane as well as the GHG precursors such as nitrogen oxides, volatile organic compounds and carbon monoxide; phasing out production and consumption of CFCs and related gases by the year 2000 on a schedule which accelerates the requirements of the Montreal Protocol; new initiatives, including expanded appliance efficiency standards and measures to accelerate adoption of energy efficiency and renewable energy technologies; proposed regulations to capture emissions of VOCs and methane from landfills; and initiating a programme to plant 1 billion trees per year. Together, these

initiatives will result in the United States' net GHG emissions in the year 2000 being at or below their present level.

The National Energy Strategy (NES) provides for a series of additional actions. It includes actions to: encourage greater use of alternative fuels for transport and to improve vehicle fuel efficiency; improve building and industrial efficiency; encourage integrated resource planning in electricity markets; and increase the availability of energy supply technologies associated with low or minimal net GHG emissions. The NES actions, when added to the actions already under way, will hold United States' net greenhouse gas emissions, on a global warming potential basis, at or below their present level into the foreseeable future — to the year 2030 and beyond.

Underlying United States' actions is the largest climate change science and technology research programme among all OECD countries. The United States is now investing over $1.0 billion annually in its Global Change Research Program to address the critical scientific and economic uncertainties identified by the IPCC.

The United States is committed to seeking a global response to climate change, on a comprehensive and integrated basis, through active participation in the Intergovernmental Negotiating Committee (INC) and related scientific, economic and technical assessments conducted by the IPCC. It endorses the goal of completing an international framework convention in time for the UN Conference on Environment and Development in June 1992. The United States is committed to working aggressively to meet this goal. The U.S. hosted the first session of the INC in February 1991, and has actively participated in the second and third sessions of the INC.

United States' climate change policy is described in detail in several reports, for example those issued in February 1991 by the U.S. Administration: the "National Energy Strategy: First Edition; America's Climate Change Strategy - An Action Agenda"; and "A Comprehensive Approach to Addressing Potential Climate Change".

2. Factors Influencing Decisions

The United States supports the need for a response to climate change that is global and comprehensive vis-a-vis: continued research to help resolve the remaining scientific, technical and economic uncertainties and to develop and deploy appropriate technologies; aggressive pursuit of actions now which are already justified on other grounds; and consideration of additional measures as the scientific, economic and technical evidence justifies. The United States strongly endorses the findings of the IPCC report which called on governments to take actions which are:

- beneficial for reasons other than climate change and justifiable in their own right;

- economically efficient and cost-effective, in particular those that use market-based mechanisms;

- able to serve multiple social, economic and environmental purposes;

- flexible and phased, so that they can easily be modified to respond to increased understanding of scientific, technological and economic aspects of climate change;

- compatible with economic growth and the concept of sustainable development;

- administratively practical and effective in terms of application, monitoring and enforcement;

- reflecting obligations of both industrialised and developing countries, while aware of the special needs of the developing countries, especially in the areas of financing and technology.

The United States also endorses the IPCC's finding that "... there is no single technological quick-fix; a comprehensive strategy addressing all aspects of the problem and reflecting environmental, economic and social costs and benefits is necessary ..." In November 1990, the government ministers at the Second World Climate Conference (SWCC) declared: "We recommend that in the elaboration of response strategies, over time, all greenhouse gases, sources and sinks be considered in the most comprehensive manner possible ...".

3. Relevant Studies

A. Completed Studies

- DOE: National Energy Strategy: First Edition 1991/1992 (February 1991);

- The White House: America's Climate Change Strategy: An Action Agenda (February 1991);

- Interagency Task Force on the Comprehensive Approach to Climate Change (chaired by DOJ): A Comprehensive Approach to Addressing Potential Climate Change (February 1991);

- EPA: The Potential Effects of Climate Change on the United States, J. Smith and D. Tirpak eds. (1989);

- EPA: Costs and Benefits of Phasing Out Production of CFCs and Halons in the United States (1989);

- EPA: Estimating Regional Anthropogenic Emissions of Greenhouse Gases, Ahuja, D.R. (September 1990);

- DOE: Energy Efficiency: How Far Can We Go?, Carlsmith, R.G. et al (1989);

- DOE: The Potential of Renewable Energy: An Interlaboratory Analytic Paper, Solar Energy Research Institute (1989);

- DOE: National Energy Strategy, Interim Report (April 1990);

- DOE: A Fossil Energy Perspective on Global Climate Change (January 1990);

- DOE: Global Climate Trends and Greenhouse Gas Data: Federal Activities In Data Collection, Archiving and Dissemination (June 1990);

- DOE: The Economics of Long-Term Global Climate Change: Report of an Interagency Taskforce headed by the CEA (September 1990);

- DOE: Compendium of Options for Government Policy to Encourage Private Sector Responses to Potential Climate Change, A Report to the Congress of the United States (October 1989);

- DOE: The Prospect of Solving the CO_2 Problem Through Global Reforestation, Marland, G. (1988);

- EPA: Interim Report of Long-Term Energy Scenarios for Developing Countries, Lawrence Berkeley Laboratories (August 1990);

- EPA: Report of the IPCC Energy and Industry Subgroup (January 1991);

- AID: Greenhouse Gas Emissions and the Developing Countries: Strategic Options and the USAID Response. A Report to Congress (July 1990);

- CBO: Carbon Charges as a Response to Global Warming: The Effects of Taxing Fossil Fuels (August 1990);

- OTA: Changing by Degrees: Steps to Reduce Greenhouse Gases (February 1991);

- NOAA: Economics and Global Change: New Haven Workshop (May 1990).

B. Studies in Progress

- DOE: Congressionally-mandated analysis of energy policies to achieve a 20% reduction of GHG emissions by 2000 and a 50% reduction by 2010 (expected to be completed in 1991);

- DOC: Study by DRI on the Economic Effects of Multilateral Strategies to Reduce CO_2 Emissions (1991);

- EPA: Policy Options for Stabilizing Global Climate , draft report to Congress (August 1990);

- EPA: Heat Island Guidebook (forthcoming);

- EPA/DOS: The U.S. Strategy to Address Global Climate Change: A Report to Congress (March 1991).

C. Conference and IPCC Proceedings

- EPA: Proceedings of North American Conference on Forestry Responses to Climate Change (September 1990);

- EPA: Proceedings of IPCC Tropical Forestry and Climate Change Workshop (July 1990);

- EPA: Proceedings of IPCC Agriculture Workshop (September 1990, published by the EPA for the IPCC);

- EPA: Proceedings of 1st North American Forestry and Climate Change Conference (November 1990, published by the EPA for the IPCC);

- EPA: Sea Level Rise Report: Changing Climate and the Coast (1990), (Published by the EPA for the IPCC).

UNITED STATES

Key Energy and Environment Data
(1989 data)

TPES:	1853.99 Mtoe
% Total OECD TPES:	49.31
% Total World TPES:	25.04
Per capita TPES:	7.45
TPES/GDP ratio:	0.41
Per capita TFC (adjusted):	5.24
TFC/GDP ratio:	0.29
Energy related CO_2 emissions per capita:	5.76 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.31 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	51.29
% Total energy related World CO_2 emissions:	24.37
% Population growth (yearly average growth 1980-1989):	1.02

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THE EUROPEAN COMMUNITY

1. Official Position

The Community and its Member States agreed at the Joint Energy and Environmental Council on 29th October 1990 on a common climate change policy which supports the scientific view of the Intergovernmental Panel on Climate Change with regard to the natural greenhouse effect, increasing emissions and concentrations of greenhouse gases and global warming. The Member States of the EC fully support this view and believe that the problem of man-induced climate change, being a global challenge, can only be countered effectively through the broadest international collaboration.

The European Community and Member States, assuming that other leading countries undertake commitments along the same lines and acknowledging the targets identified by a number of Member States for stabilizing or reducing emissions by different dates, are willing to take actions to reach stabilization of total CO_2 emissions by 2000 at 1990 levels in the Community as a whole. Member States which start from relatively low levels of energy consumption, and therefore have low emissions measured on a per capita or other appropriate basis, are entitled to have CO_2 targets and/or strategies corresponding to their economic and social development, while improving the energy efficiency of their economic activities.

The above objective should be achieved in Member States principally by fully exploiting the potential of energy conservation and energy efficiency of economic activities as well as the diversification of energy supply towards energy sources with lower CO_2 emissions. Member States should make efforts to achieve the objective taking advantage of their individual possibilities to use "no regret" measures. In particular EC and national energy and transport policies should be reviewed, adopting measures, where appropriate, along the following lines:

- energy conservation and efficiency improvements in the use of energy, in particular through promoting diffusion of energy efficient end use devices and improving the efficiency of mass-produced goods, such as transport vehicles;

- efficiency improvements in energy supply and conversion;

- promoting the availability of, access to and utilization of low carbon fuels;

- promotion of safe CO_2 zero emission technologies, paying special attention to those exploiting new and renewable energy sources;

- promotion of cost-effective public transport systems for persons and goods.

Furthermore the rate of deforestation should be reduced and the potential of the world forests to act as a sink for GHGs should be increased through vigorous programmes of forest protection and development.

The Commission will present, in due time before the 1992 World Conference on Environment and Development, a proposal for establishing global Community emissions reduction targets separately for CO_2 and other GHGs, including possible strategy options aimed at progressive reductions to 2005 and 2010.

In September 1991 the Commission adopted a Communication to the Council on a "Community strategy to limit carbon dioxide emissions and to improve energy efficiency". The purpose of this strategy is to reach the agreed objective of global Community CO_2 stabilisation by the year 2000.

The proposed strategy is based on a need to adopt measures which are designed to meet the target at lowest cost and which are also justified in terms of objectives other than those connected with climate change. The Commission agreed on an approach combining the traditional regulatory aspects with the introduction of a new fiscal instrument to raise existing energy prices. The strategy contains:

- a set of non-fiscal measures to improve energy efficiency;

- the possibility of a fiscal volet involving an energy/CO_2 tax directed to the rational use of energy and fuel switching to lower or carbon-free energy sources; and

- complementary national actions.

The rules and regulations announced are already to a large extent covered by the SAVE programme. Some of the measures will entail harmonization at Community level (minimum efficiency standards for household appliances, minimum insulation standards,

transport performance requirements etc.) and others can be implemented at a purely national level (rationalization of urban traffic, afforestation, green city areas etc.). Furthermore RD&D programmes, like JOULE and THERMIE need to be reviewed, intensified or enlarged. It is expected that these non-fiscal measures, together with the results of technical progress and other market developments, will contribute about half of the stabilisation objective.

The proposed \$10 energy/CO_2 tax (the energy component not to exceed 50%) needs to be designed with great care and could be introduced from 1 January 1993 with a tax level of \$3 per barrel of oil and then increased by \$1 every year. One of the key aspects of the new tax will be its revenue neutrality. In other words, the introduction of the tax should not result in an increase of the overall tax burden.

If the tax is only applied by the Community initially, it is essential to avoid an increase in economic costs in certain industrial sectors, in particular the ones which use highly energy-intensive production processes and are very dependent on foreign trade (steel, chemicals, non-ferrous metals, cement, glass, pulp and paper). Special treatment must be provided for until the Community's main competitors take similar action.

These sectors should nevertheless contribute to the proposed effort through voluntary agreements.

Provision is made for a mechanism for the permanent evaluation of the strategy and of the operation of the tax so that it can be suspended or adjusted to take account of economic developments and progress towards stabilization.

Introducing the proposed strategy should only entail modest macroeconomic costs, mainly as a result of the revenue neutrality and its gradual and foreseeable introduction. The \$10 energy/CO_2 tax should be a harmonized national tax in Member States and the revenues would flow to the national budgets.

3. Relevant Studies

- Communication to the Council on "The Greenhouse Effect and the Community" (COM(88)656 final);

- Communication to the Council on "Energy and the Environment" (COM(89)369 final);

- Communication to the Council on Community Policy Targets on the Greenhouse Issue (SEC(90)496 final):

- Etude sur le CO_2 Crash Programme, Mars 1991, rapport pour la Commission des Communautés Européennes, DG XII;

- Report of the Working Group on the Use of Economic and Fiscal Instruments in EC Environmental Policy, DG XI/185/90, September 1990;

- The Economics of Policies to Stabilize or Reduce Greenhouse Gas Emissions: The Case of CO_2 (draft 11.10.90: II/335/90-EN);

- CO_2 Targets and Burden Sharing, Energy in Europe n.16;

- Resolution of the Council on "The Greenhouse effect and the Community" (89/C183/03);

- Energy for a new Century: The European Perspectives, July 1990.

THE EUROPEAN COMMUNITY

Key Energy and Environmental Data
(1989 data)

TPES (adjusted):	1032.29 Mtoe
% Total OECD TPES:	27.34
% Total World TPES:	14.08
Per capita TPES:	3.18 toe/person
TPES/GDP ratio:	0.37 toe/1000 US$ 1985
Per capita TFC (adjusted):	2.21 toe/person
TFC/GDP ratio:	0.26 toe/1000 US$ 1985
Energy related CO_2 emissions per capita:	2.28 t carbon/person
Energy related CO_2 emissions per unit of GDP:	0.27 t carbon/1000 US$ 1985
% Total energy related OECD CO_2 emissions:	27.06
% Total energy related World CO_2 emissions:	12.83

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Annex 1

DESCRIPTION OF METHODOLOGY FOR CALCULATING HISTORICAL ENERGY CONSUMPTION AND ASSOCIATED CARBON DIOXIDE EMISSIONS

Source of Energy Data

The Statistics Division of the IEA compile annual Energy Balances for OECD Member countries commencing from 1960 and which run currently to 1988. The data shown in the Energy Balances are based on information provided in four annual OECD questionnaires: Oil, Natural Gas, Solid Fuels and Manufactured Gases, and Electricity. The data represents standardized energy balance sheets expressed in a common unit of million tonnes of oil equivalent (Mtoes) for all 24 OECD Member countries. It is, as well, separated into specific regions, North America, Pacific and OECD Europe.

In converting the basic data to a common unit a partial substitution model has been applied. Coal and gas are expressed in terms of the amount of oil that produces the same amount of heat, whereas hydro and nuclear electricity are expressed in terms of the hypothetical amount of oil which would be needed to generate the same amount of electricity in conventional thermal power plants.

The most recent data is published in the IEA publication "*Energy Balances of OECD Countries 1987-1988*", OECD, Paris, 1990. Two other publications providing a further breakdown of statistics are "*Energy Statistics of OECD Countries 1987-1988*", OECD, Paris, 1990, and "*World Energy Statistics and Balances 1971-1987*", OECD, Paris, 1989. The former provides, amongst other things, the breakdown of crude oil into its various refined products. The latter has similar statistics to the IEA Energy Balances but for most of the rest of the World. Additional explanations of the terms and material described in this Paper can be found within these publications.

Selection of the Data

All 24 OECD Member countries can be examined, along with the sum total for all OECD and for the three OECD regions. These are: the Pacific (being Japan, Australia and New Zealand), North America (Canada and the USA) and OECD Europe (representing the remaining OECD Member countries). Data for all years since 1971 are currently available.

All fuels listed in the IEA Energy Balances have been detailed: coal, oil, gas, other solid fuels, nuclear, hydro, geothermal, solar, heat, electricity and their total. These fuels are then cross-correlated with selective elements of the Energy Balances to display the distribution of the fuels amongst the various end-use sectors. These are:

Total Primary Energy Requirements (TPES)
Electricity input (being the sum of the two entries Autoproducers of electricity and public electricity)
Total Final Consumption (TFC)
Total Industry
Total Transport
Total Other

Within the industry sector, the end-uses can be further broken down into:

iron and steel	chemical including feedstocks
non-ferrous metals	non-metallic minerals
transport equipment	machinery
mining and quarrying	food and tobacco
paper, pulp and printing	wood and wood products
construction	textile and leather
non-specified industry	

Within other, the end-uses can be further broken down into:

agriculture	commerce and public service
residential	non-specified other

Within the transport sector, the end-uses can be further broken down into:

air	road
rail	inland water
non-specified transport	

By using the IEA data on non-Member countries (see: *"World Energy Statistics and Balances 1971 - 1987"*, IEA/OECD, Paris, 1989) and applying the same methodology, carbon emissions for the rest of the World can be calculated.

Purifying the data

From the data that has been selected, particular modifications are made to enable the utilization of the statistics to calculate carbon dioxide emissions for the purposes of making *policy analysis*. Specifically:

- The Energy Balances include a listing of non-energy use of energy sources. This includes the use of petroleum products such as white spirit, paraffin waxes, lubricants and bitumen. As their use is *non-energy*, they are not *initially* combusted. Non-energy use does not, therefore, contribute immediately to carbon dioxide emissions. Therefore, from total primary energy requirements and total final consumption is deducted the figure for total non-energy use. It is acknowledged that further down the fuel cycle, non-energy use may well make a small contribution to CO_2 emissions. For the purposes of this analysis it is not possible to quantify this contribution accurately. Suffice to say it exists but that it does not distort the results significantly.

- Within the total industry sector of the Energy Balances is a sub-section listing *petrochemical feedstocks* as a part of chemical industry. This covers all oil, including naphtha, used within the petrochemical industry. To avoid double counting of any emissions that may come from these products, they are deducted from the total industry, chemical, total final consumption and total primary energy requirement columns. As with non-energy use, this method of calculation is not 100 per cent accurate as some additional emissions may be generated by the feedstock products themselves.

The quantity of oil and natural gas (in Mtoes) utilized in feedstocks throughout the OECD is listed in Table One.

Calculation of Carbon Dioxide Emissions

It is to these modified energy balance tables that the emission factors are applied to enable the conversion of million tonnes of oil equivalent into million tonnes of carbon as a unit of CO_2 emissions. This is done on both a country specific and regional basis. The initial emission factors utilised are those applied by the OECD Environment Directorate as recorded in "*Greenhouse Gas Emissions: The Energy Dimension*", page 71. (A Working Paper submitted to the White House Conference on Science and Economics Research Related to Global Change, 17 - 18 April 1990) and recently published by the OECD/IEA. A full discussion of the calculation of these factors can be found within this document.

Table One

Feedstocks Use in the Petrochemical Industry (Mtoe)

(1989 data)

Product/Time	Oil	Natural Gas	Total
OECD	110.49	13.92	124.42
OECD Europe	45.93	9.27	55.20
Pacific	23.79	1.04	24.83
Australia	0.70	0.46	1.15
Austria	0	0.37	0.38
Belgium	1.70	0.45	2.14
Canada	6.00	3.61	9.61
Denmark	0	0	0
Finland	0.68	0	0.68
France	7.81	1.70	9.52
Germany	11.56	1.57	13.14
Greece	0.07	0.09	0.17
Iceland	0	0	0
Ireland	0	0.42	0.42
Italy	4.54	1.94	6.48
Japan	23.10	0	23.10
Luxembourg	0	0.	0
Netherlands	4.88	2.19	7.06
New Zealand	0	0.58	0.58
Norway	0.97	0	0.97
Portugal	1.64	0	1.64
Spain	3.20	0.53	3.73
Sweden	0.91	0	0.91
Switzerland	0.11	0	0.11
Turkey	1.61	0	1.61
United Kingdom	6.26	0	6.26
United States	34.77	0	34.77

The initial emission factors are based upon primary fuel factors for lower heat values. They are listed in Table Two.

Table Two
Initial Emission Factors

	Grams Carbon per Mega-joule	Range (% +/-)
Natural Gas	15.3	0.1
Oil	20.0	3.0
Coal	25.8	3.0
Other Solid Fuels	21.2	>10

To calculate CO_2 emissions it is necessary to first convert million tonnes of oil equivalent to mega-joules by multiplying by 41.868×10^9. This figure is then multiplied by the relevant initial emission factor and by 10^{-12} to convert grams of carbon to million tonnes of carbon. The resulting values represent the primary emission factors that are applied to the total primary energy requirement figures to obtain the carbon emissions. The primary emission factors for natural gas, oil and other solid fuels are represented in Table Three.

Table Three
Primary Emission Factors

Fuel	Primary Emission Factor
Natural Gas	0.64
Oil	0.84
Other solid Fuels	0.89

Because of variations in emissions among different coal types, it is preferable to apply differentiated coal emission factors when examining national data or specific OECD regions. For these purposes the values contained in Table B-1 page 175 of the (IEA/OECD) aforementioned study have been applied to express differences in regional coal properties. They are, for the OECD Total 26.1, OECD Europe 26.6, OECD North America 25.8 and OECD Pacific 26.2. Within the regions, the regional emission factor for coal has been applied to the countries making up the regions.

It is possible to apply average emission factors to a fuel such as oil. For coal, however, there can be significant differences between the heat factors and the coal types within regions and within countries. This work is very much preliminary in this regard. The intention has been

to examine the emissions utilising existing emission factors. It is hoped that emission factors, especially for coal, will be developed which take into account these problems.

Performing the above calculations gives the primary emission factors for coal set out in Table Four.

Table Four
Coal Regional Primary Emission Factors

OECD Total	1.09
OECD Europe	1.11
OECD North America	1.08
OECD Pacific	1.10

The emissions for total primary energy requirement are calculated by multiplying the million tonnes of oil equivalent by the relevant primary emission factor to give CO_2 emissions in the units of million tonnes of carbon.

Although there are no direct emissions of CO_2 from nuclear and renewable energy, indirect CO_2 emissions form nuclear energy (uranium mining and enrichment) and during the building of power plants, is believed to be significant (P. Okken, D. Tiemersa "Greenhouse Gas Emission Coefficients from the Energy System -Two Methods to Calculate National CO_2 Emissions", Paper for IPCC Response Strategies Working Group, 28-29 September 1989, page 17). These emissions will be noted in the total industry figures and hence fossil fuels used in the construction of such energy plants are included in the emissions inventory.

Delivered Fuel Emissions

When considering emissions further down the fuel cycle, it is necessary to take into account both the input of fuels into the production of electricity as well as the transformation and other losses. As such, a weighted emission factor is prepared for each country and each OECD region. The weighted emission factor distributes emissions which occur in the transformation process, or those that are lost in statistical differences and other losses, proportionately amongst the various end-use sectors.

To calculate the weighted emission factor the primary emission factor is multiplied by the Total Primary Energy Requirement and divided by the Total Primary Energy Requirement less all losses and statistical differences. These are recorded in the IEA Energy Balances as:

statistical differences	distribution losses
petroleum refineries	gas works
liquefaction	coal transformation
own use in transformation industry	other transformation losses

Thus: EF weighted = EF primary x TPES /(TPES - all losses)

It is this weighted emission factor that is applied to the end-use sectors: industry, transport and other, and to the different modes within each. It is also applied to total final consumption. By multiplying the Mtoe figure by the emission factor the emissions of carbon dioxide in million tonnes of carbon are calculated.

The non-energy uses defined in the IEA Energy Balances have been excluded from the emissions calculation but their contribution to the losses in transformation and statistical differences are difficult to calculate. It is possible, therefore, that a portion of the losses are caused by non-energy use. This portion would still figure when the emission factors are weighted and may produce a slightly inaccurate result. This distortion is considered, however, to be insignificant.

Electricity

The input of fossil fuels into the production of electricity is represented as a separate entry. Emissions resulting from electrical production are calculated in the same manner as for the end-use sectors. That is, each fuel input into the generation of electricity is multiplied by its weighted emission factor. No carbon dioxide emissions are assumed to emanate directly from electricity generated by nuclear or hydro, solar or wind methods. Thus, although one could look down the column showing carbon emissions from coal for total final consumption for the OECD Total for 1988 as being 8.43 per cent of all carbon emissions, this figure *must* be considered by taking into account the fact that 77.79 per cent of electricity emissions for that year come from coal. All emissions on a fuel basis after Total Primary Energy Requirements must, therefore, take into account the additional electricity emissions.

Within each sector, electricity emissions are distributed proportionately to the ratio of use each sector makes of electrical production. Total electrical emissions are calculated by summing electrical emissions from the four fuel sources. The ratio of electricity delivered to each sector is divided by total electricity recorded for TFC. This ratio is multiplied by total emissions from electricity and distributed accordingly. For data reasons, no account has been taken of the use of fuels for base or peak load applications. It is for this reason that electricity is not distributed on a fuel basis amongst the end-use sectors.

International Marine Bunkers

The arrangement of the Energy Balances is such that the Total Primary Energy Requirement excludes international marine bunkers. These represent the quantities delivered to sea-going ships of all flags, including warships and fishing vessels. The consumption by ships engaged in transport in inland and coastal waters is not included as they fall under the transport sector element, inland water. The potential emissions that may be generated from this oil source is not, therefore, assigned to an individual country as such. It is, however, represented as a total figure indicating the amount of oil held in bunkers within each country and the emissions that these would represent. The quantity of oil held in international marine bunkers (in Mtoes) and the carbon dioxide emissions from this fuel (in million tonnes of carbon) for all OECD regions and Member countries is listed in Table Five.

It is apparent that statistical analysis, such as this, has inherent inadequacies and varying degrees of uncertainty. The problems involved in determining greenhouse gas emissions and the use of emission factors are discussed in Chapter 3 and annexes B and E of the IEA/OECD Joint Study and in other source material for this work, such as M.J. Grubb, "*On Coefficients for Determining Greenhouse Gas Emission Factors from Fossil Fuel Production and Consumption*", IEA/OECD, "*Energy Technologies for Reducing Emissions of Greenhouse Gases*", Paris, 1989, page 537.3. For the purposes of policy analysis, however, the methodology is proving to be extremely useful.

Table Five
International Marine Bunkers
(1989 data)

	Oil (Mtoe)	Carbon Emissions from Oil (Million tonnes of carbon)
OECD	56.47	47.43
OECD Europe	31.22	26.23
Pacific	5.73	4.82
Australia	0.63	0.53
Austria	0	0
Belgium	3.89	3.27
Canada	0.65	0.54
Denmark	0.91	0.77
Finland	0.52	0.44
France	1.44	1.21
Germany	1.91	1.60
Greece	2.11	1.77
Iceland	0	0
Ireland	0.02	0.02
Italy	2.82	2.37
Japan	4.87	4.09
Luxembourg	0	0
Netherlands	10.33	8.68
New Zealand	0.23	0.19
Norway	0.33	0.28
Portugal	0.57	0.48
Spain	3.19	2.68
Sweden	0.68	0.57
Switzerland	0.02	0.02
Turkey	0.17	0.14
United Kingdom	2.31	1.94
United Stages	18.87	15.85

Annex 2
Share of CO_2 Emissions from Other Solid Fuels Combustion
1989

Product	Other Solid Fuels[1]	Total	"Share"
TPES			
Australia	4.15	85.46	4.85
Austria	2.38	23.83	9.98
Belgium	0.21	47.33	0.44
Canada	8.97	219.57	4.08
Denmark	1.02	17.94	5.66
Finland	5.06	28.95	17.47
France	3.95	219.01	1.80
Germany	2.07	271.60	0.76
Greece	0.50	22.04	2.27
Iceland	0	1.33	0
Ireland	1.40	9.77	14.29
Italy	1.16	153.47	0.75
Japan	0.04	404.58	0.01
Luxembourg	0.03	3.41	0.82
Netherlands	0.20	65.11	0.30
New Zealand	0.49	12.86	3.81
Norway	0.91	22.75	3.98
Portugal	1.14	16.07	7.12
Spain	0.51	86.35	0.59
Sweden	5.54	48.08	11.51
Switzerland	0.84	23.51	3.56
Turkey	7.92	49.64	15.96
United Kingdom	0	211.26	0
United States	71.47	1 943.41	3.68
OECD	119.93	3 987.33	3.01

1. In IEA's data base, the category, *Other Solid Fuels*, includes peat, wood, wood waste, black liquor, industrial waste and garbage, some of which cannot be counted as recycling carbon. No further breakdown is available: nor are data on non-commercial fuels.

ANNEX 3

This Annex gives an up-to-date, detailed description[1] of energy-related climate change policy initiatives of major non-OECD emitters of greenhouse gases. These country descriptions should be inserted at the back of the *Climate Change Policy Initiatives: Update* binder under the heading "Annex".

Some of these country descriptions have been reviewed by some government ministry or institute which has been active in either the International Negotiating Committee for a Framework Convention on Climate Change (INC) or the Intergovernmental Panel on Climate Change. Those for which no input was received from the subject country are presented as the "Apparent Position". Those which were reviewed by some part of the country's government are presented as "Position".

1. These country descriptions were prepared with the assistance of Mr. Rodney Janssen, consultant.

BRAZIL

1. Position

Brazil has been active in both the INC and the IPCC. It has implemented policies which have already produced results in reducing the rate of deforestation by at least a factor of two in recent years, and in introducing alcohol produced from sugar cane as a fuel replacement to gasoline, to an extent such that their annual consumption is of the same order of magnitude. Brazil signed the June 1991 Beijing Declaration. Brazil stated most recently at the third session of the INC that "all obligations and commitments to be taken by developing countries are conditioned to and dependent upon the provision of new and additional financial resources and the transfer of technology on a non-commercial and preferential basis."

The government has stated that the issue of global warming cannot be separated from wider development issues and the relationship between developed and developing countries. Brazil is quite insistent that countries have the sovereign right to exploit their own resources.

Brazil and the United States have agreed on a joint project to carry out a comprehensive greenhouse gas emissions inventory.

2. Factors Influencing Decisions

The contribution of Brazil to net greenhouse gas emissions is apparently still dominated by deforestation, as a result of its very large forests and of the fact that two-thirds of the energy is produced by renewable sources, notably hydroelectrical.

Brazil is the world's seventh major contributor to net greenhouse gas emissions. The energy-related carbon dioxide emissions rank Brazil eighth in the non-OECD (and seventeenth globally), significant enough even without consideration of deforestation. Brazil is highly dependent on petroleum even with efforts to develop alcohol fuels and its hydro potential. Nevertheless, analyses indicate considerable scope for further energy efficiency improvements and fuel switching.

BRAZIL

Key Energy and Environmental Data (1989 data)

TPES	87.30 Mtoe
% Non-OECD TPES	2.40
% Total World TPES	1.18
Per Capita TPES	0.59 toe per person
TPES/GDP	0.36 toe/1000 US$ 1985
Per Capita TFC	0.58 toe per person
TFC/GDP	0.36 toe/1000 US$ 1985
Energy related CO_2 emissions per capita	0.39 t carbon/person
Energy related CO_2 emissions per unit GDP	0.24 t carbon/1000 US$
% Total energy related Non-OECD CO_2 emissions	1.88
% Total energy related World CO_2 emissions	0.99
% Population growth (yearly average growth 1980-1989)	2.19

CHINA

1. Position

China hosted the Ministerial Conference of Developing Countries on Environment and Development in Beijing, 14-19 June 1991 resulting in the Beijing Declaration which affirms participation in the international negotiating process on the basis of differentiated responsibilities between developing and developed countries and that developed countries must provide adequate technology transfer and financing.

China has been participating actively in the Global Climate Change negotiations and in the IPCC, co-chairing the Energy and Industry Subgroup of the Working Group III.
China believes that there are major scientific uncertainties and stresses the lack of agreement on which measures should be taken. China wants a convention to set general principles and general obligations,"thereby preparing the ground for the eventual establishment of a legal regime". Nevertheless, it finds that climate change is a common concern of mankind and that there is a need for effective international cooperation based on equity. Consideration must be given to the need for developing countries to continue developing their economies to meet basic needs of their populations and that their energy consumption per capita is low.

However, the developed world needs to recognize responsibility for "human-induced climate change and their obligation in addressing it". This means that different timeframes would need to be set given the differences economically and technologically.

Meanwhile, China has made no specific commitment although it accepts in principle that emissions targets should be set. It feels that a Chinese commitment could only be made if there was a transfer of technology on favourable terms, and if there was additional financial assistance for such transfer from developed countries.

China is developing a greenhouse gas emissions inventory with the assistance of UNDP and the Global Environment Fund.

2. Factors Influencing Decisions

China is highly dependent on coal for direct consumption and for the generation of electricity. The country has an ambitious industrialisation programme based in large part on the use of its indigenous fuels. According to ESCAP, coal consumption is expected to more than double between 1988 and 2010 (490 Mtoe in 1988, 707 Mtoe in 2000 and 1003 Mtoe in 2010).

All studies show that coal and other forms of energy are used very inefficiently. Programmes have been initiated to increase coal combustion efficiency; however, the pricing of coal discourages energy saving. It is estimated that the marginal cost of coal is about twice as much as the price received by state-owned mines. [Grubb, 1991]

CHINA

Key Energy and Environmental Data
(1989 data)

TPES	644.6 Mtoe
% Non-OECD TPES	17.69
% Total World TPES	8.71
Per Capita TPES	0.57 toe per person
TPES/GDP	NA
Per Capita TFC	0.58 toe per person
TFC/GDP	NA
Energy related CO_2 emissions per capita	0.59 t carbon/person
Energy related CO_2 emissions per unit GDP	NA
% Total energy related Non-OECD CO_2 emissions	20.33
% Total energy related World CO_2 emissions	10.67
% Population growth (yearly average growth 1980-1989)	1.5

CZECH AND SLOVAK FEDERAL REPUBLIC (CSFR)

1. Apparent Position

According to a recent environment report, the government plans to study issues such as greenhouse gas concerns. Within one year they plan to have a programme developed to reduce greenhouse gas emissions. This programme would include energy efficiency and fuel switching to less polluting fuels such as natural gas. They plan to implement the programme within three years.

According to its response to IEA's Questionnaire, the Government stated that "strict environmental standards and laws will be prepared but their implementation will be complicated by unfavourable economic situation . . .".

2. Factors Influencing Decisions

The entire economy is undergoing restructuring and modernising. The transition will take time and many policy areas must be dealt with simultaneously. Restructuring is expected to bring greater efficiency of energy use leading in turn to reduced environmental impacts, including emissions of greenhouse gases.

CSFR is highly dependent on both hard coal and lignite. Coal represents almost 57 per cent of TPES. Of that, three-quarters is lignite. Coal is used extensively in all sectors except transport. CSFR is also highly industrialised of which a very high percentage is energy-intensive. The iron and steel industry, alone, uses 47 per cent of total hard coal consumption. Combustion efficiencies are considered quite low in all sectors. There is a strong anti-coal feeling in the country because of the environmental damage, especially that caused by the emissions of sulphur dioxide associated with coal combustion.

Government projections show lignite production dropping 40 per cent between 1990 and 2005 and hard coal production dropping 50 per cent. In the residential sector, it is expected that lignite will be replaced by natural gas and light fuel oil.

CZECH AND SLOVAK FEDERAL REPUBLIC

Key Energy and Environmental Data
(1989 data)

TPES	72.15 Mtoe
% Non-OECD TPES	1.98
% Total World TPES	0.97
Per Capita TPES	4.61 toe per person
TPES/GDP	NA
Per Capita TFC	3.10 toe per person
TFC/GDP	NA
Energy related CO_2 emissions per capita	4.09 t carbon/person
Energy related CO_2 emissions per unit GDP	NA
% Total energy related Non-OECD CO_2 emissions	2.08
% Total energy related World CO_2 emissions	1.09
% Population growth (yearly average growth 1980-1989)	0.2

INDIA

1. Apparent Position

India has been active in the INC and the IPCC. India is a signatory to the June 1991 Beijing Declaration. India believes that feasible measures can be considered "in accordance with their national development plans, priorities and objectives. India has also stressed the need for a "Climate Fund" to help developing countries "adapt to and mitigate the adverse effects of climate change. . ."

India wants included in the convention that "the largest part of the current emission of pollutants into the environment originates in developed countries, and recognizing therefore that these countries have the main responsibility for combating such pollution." [formal statements at the second session of INC at Geneva, June 1991]

2. Factors Influencing Decisions

TPES has grown at a rate of 6.0 per cent per year between 1973 and 1989. Energy use per capita, at 0.21 toe per person, is very low. Energy intensity continues to be high and without improvement, largely due to the fast pace of industrialisation.

India is highly dependent on coal, which represents almost 57 per cent of TPES. This dependence will continue even though natural gas and other energy sources are slowly increasing their shares. According to ESCAP, coal consumption is expected to go from 91 mtoe in 1988 to 160 mtoe in 2000 and 280 mtoe in 2005. Oil, which represented a further 33.7 per cent of TPES in 1989, will rise from 48 Mtoe in 1988 to 82 Mtoe in 2000 to 118 Mtoe in 2005.

INDIA

Key Energy and Environmental Data
(1989 data)

TPES	167.3 Mtoe
% Non-OECD TPES	4.59
% Total World TPES	2.26
Per Capita TPES	0.21 toe per person
TPES/GDP	0.70 toe/1000 US$ 1985
Per Capita TFC	0.14 toe per person
TFC/GDP	0.45 toe/1000 US$ 1985
Energy related CO_2 emissions per capita	0.19 t carbon/person
Energy related CO_2 emissions per unit GDP	0.66 t carbon/1000 US$
% Total energy related Non-OECD CO_2 emissions	5.14
% Total energy related World CO_2 emissions	2.70
% Population growth (yearly average growth 1980-1989)	2.07

REPUBLIC OF KOREA

1. Position

At the first session of the INC, the Ambassador stated that "the goal of the convention should not be to establish specific guidelines for all countries, but rather, to encourage their voluntary efforts . . ." Quotas "should be done in separate protocols rather than in the Convention." The statement continued to stress that consideration needs to be given to the specific economic and technical capabilities of individual countries under the principle of equity "and the common, but differentiated, responsibilities of the countries". The Convention would also need to ensure special treatment to developing countries for financial assistance "and the preferential transfer of environmental technology."

At the third session of the INC, the Korean statement amplified that some countries "need to maintain rather fast economic growth, at least for some time to come." For countries in the process of industrialisation, these "are the ones that are subject to high sacrifices to climate change convention commitments, at least until they manage to restructure their energy sectors and economies." Korea also stresses that, although some countries may phase out energy-intensive industries, "some other countries might have to fill the gap, often less efficiently. From a global point of view. . . those countries burdened with heavy industries . . . should be credited in one way or the other, at least on a transitionary basis.".

2. Factors Influencing Decisions

Korea is highly dependent on imported coal and oil for its rapid economic development. Over 70 per cent of total energy is imported. It has nine nuclear plants and plans for nine more in the 1990s.

Between 1973 and 1989, TPES grew at an annual rate of 7.7 per cent while total GDP grew 8.5 per cent. In recent years, however, energy consumption has started to grow faster than GDP mainly due to the continued expansion of basic energy-intensive industries and growth in income. The increase in per capita income has brought a rapid increase in demand for vehicles and electronics, although still below the level of most industrialised countries.

During the 1970s economic growth was based on energy-intensive industries such as steel and petrochemicals. Overall energy intensity has declined from 0.76 in 1980 to 0.65 in 1989, with some fluctuations paralleling industrial restructuring.

REPUBLIC OF KOREA

Key Energy and Environmental Data (1989 data)

TPES	73.9 Mtoe
% Non-OECD TPES	2.03
% Total World TPES	1.00
Per Capita TPES	1.74 toe per person
TPES/GDP	0.61 toe/1000 US$ 1985
Per Capita TFC	1.43 toe per person
TFC/GDP	0.50 toe/1000 US$ 1985
Energy related CO_2 emissions per capita	1.36 t carbon/person
Energy related CO_2 emissions per unit GDP	0.47 t carbon/1000 US$
% Total energy related Non-OECD CO_2 emissions	1.86
% Total energy related World CO_2 emissions	0.98
% Population growth (yearly average growth 1980-1989)	1.18

MEXICO

1. Apparent Position

The Government was in the process of issuing its official position on climate change policies as this description went to press.

Mexico has been active in both the INC (providing a co-chairman to its Working Group I) and the IPCC. It signed the June 1991 Beijing Declaration.

Mexico has stated that the 1992 Convention should provide preferential access to environmental technologies. "The Mexicans say that environmental technologies such as those for natural gas conversion, energy technologies for sustainable agriculture, or pollution control should receive special treatment". [Environmental Policy and Law, 21/2 (1991)].

Mexico is giving more attention to environmental issues and in March 1991, Mexico City released a comprehensive plan to reduce air pollution in the city. Recently, Mexico agreed to a joint project with the United States to inventory greenhouse gas emissions and assess technical and policy options to limit or reduce greenhouse gases.

2. Factors Influencing Decisions

Mexico is the second most indebted nation in the world behind Brazil with a total foreign debt of $107 billion in 1989. Since the oil price decrease in 1986 and the earthquake in Mexico City in 1985, the economy has stagnated. Mexico is highly dependent on oil for export revenues; oil's share dropped from over 65 per cent of export revenues in 1985 to less than one-third in 1989. Nevertheless, Mexico remains the world's fifth largest oil exporter.

Mexico has a large energy-intensive industrial sector based on petrochemicals and iron and steel. Mexico is currently negotiating with the United States and Canada for a North American free trade pact.

Almost 70 per cent of TPES is oil with a further 22 per cent being natural gas. Coal represents a very small share. All end-use sectors are highly dependent on oil (45 per cent in industry, 100 per cent in transport and 77 per cent in the residential/commercial sector). Energy intensity is quite high and there is scope for efficiency improvements throughout the entire energy system.

MEXICO

Key Energy and Environmental Data
(1989 data)

TPES	103.5 Mtoe
% Non-OECD TPES	2.84
% Total World TPES	1.40
Per Capita TPES	1.22 toe per person
TPES/GDP	0.61 toe/1000 US$ 1985
Per Capita TFC	1.00 toe per person
TFC/GDP	0.50 toe/1000 US$ 1985
Energy related CO_2 emissions per capita	0.93 t carbon/person
Energy related CO_2 emissions per unit GDP	0.46 t carbon/1000 US$
% Total energy related Non-OECD CO_2 emissions	2.56
% Total energy related World CO_2 emissions	1.34
% Population growth (yearly average growth 1980-1989)	2.17

POLAND

1. Position

The Polish Government has officially defined its position on greenhouse gases policy commitments during the Nordwijk Ministerial Conference (1989) where the Minister of Environmental Protection, Natural Resources and Forestry stated that the entire activity being actually undertaken in Poland in the field of environmental protection should have the effect in the next ten to 15 years *inter alia* of reaching the emission levels of 1988 in the period 2005 to 2010. Also during the Second World Climate Conference in Geneva (1990), the Polish representative repeated the above position declaring that Poland would be aiming at achieving, by the year 2000, the stabilization of the CO_2 emissions at the level of the years 1988 to 1989 and that the efficiency of these efforts depended on the progress in the stabilization of the Polish economy and the ability to have access to advanced and environmentally-sound technologies.

2. Factors Influencing Decisions

Poland is highly dependent on coal both for energy consumption and for trade. In 1989, over 78 per cent of TPES was coal. In 1990 Poland was also the third largest non-OECD coal exporter and sixth in the world. Poland is extracting and consuming ever increasing shares of lignite, which can adversely affect air pollution emissions.

Poland is modernising its entire economy but the transition is slow and expensive. Industry has traditionally been highly energy-intensive, using domestic coal for its fuel supply. Intense coal use is recognised to have been a major cause of environmental degradation. In 1990, the Ministry of Environmental Protection estimated that it would take $20 billion to clean up existing environmental problems over the next 20 years. Restructuring, modernisation and switching to cleaner fuels will undoubtedly reduce carbon dioxide emissions but the investment costs are high. However, as the economy develops, total energy use and emissions could rise as the demand for consumer products rises.

POLAND

Key Energy and Environmental Data
(1989 data)

TPES	113.0 Mtoe
% Non-OECD TPES	3.10
% Total World TPES	1.53
Per Capita TPES	2.99 toe per capita
TPES/GDP	NA
Per Capita TFC	2.09 toe per capita
TFC/GDP	NA
Energy related CO_2 emissions per capita	3.14 t carbon/person
Energy related CO_2 emissions per unit GDP	NA
% Total energy related Non-OECD CO_2 emissions	3.85
% Total energy related World CO_2 emissions	2.02
% Population growth (yearly average growth 1980-1989)	0.7

ROMANIA

1. Apparent Position

The IEA has been unable to find any description or written statement on Romania's position on greenhouse gas policy commitments.

2. Factors Influencing Decisions

The country is in a state of transition with the economy in a steady decline since 1986. In the past year, since the change in government, the economy has virtually collapsed.

Romania is about 75 per cent self-sufficient in energy. Of non-OECD countries, it is one of the highest consumers of natural gas in terms of the share of TPES (44.5 per cent). Under the previous regime, its economic policy was to develop energy-intensive industries (machinery and transport equipment). In 1988, Romania ranked second in exporting oil industry equipment.

Canada has recently extended new credits to complete the CANDU-style nuclear reactor.

ROMANIA

Key Energy and Environmental Data (1989 data)

TPES	63.4 Mtoe
% Non-OECD TPES	1.74
% Total World TPES	0.86
Per Capita TPES	2.74 toe per capita
TPES/GDP	NA
Per Capita TFC	1.92 toe per capita
TFC/GDP	NA
Energy related CO_2 emissions per capita	2.36 t carbon/person
Energy related CO_2 emissions per unit GDP	NA
% Total energy related Non-OECD CO_2 emissions	1.77
% Total energy related World CO_2 emissions	0.93
% Population growth (yearly average growth 1980-1989)	0.5

SAUDI ARABIA

1. Apparent Position

Saudi Arabia is actively participating in the INC and the IPCC. It signed the June 1991 Beijing Declaration.

At the second session of the INC in Geneva in June 1991, Saudi Arabia, along with the Soviet Union and Kuwait, provided a paper which stated: "The specific difficulties of those countries, particularly developing countries, whose economies are highly dependent on fossil fuel production and exportation, as a consequence of action taken on limiting greenhouse gas emissions, should be taken into account."

2. Factors Influencing Decisions

Saudi Arabia is one of the major oil producers and exporters and has over one-quarter of the world's proven crude oil reserves. The economy is highly dependent on oil and in 1989, oil exports represented 87 per cent of total export revenue.

Between 1973 and 1989, GDP grew at an annual rate of 2.7 per cent while total primary energy supply grew at a rate of 15.4 per cent, in large part for its growing energy-intensive industrial sector.

Saudi Arabia is completely dependent on oil and natural gas for all its energy requirements. It has taken the lead in the IPCC's Working Group III's Subgroup on Energy and Industry in a study to assess the economic impact of climate change response measures on developing countries.

SAUDI ARABIA

Key Energy and Environmental Data
(1989 data)

TPES	62.7 Mtoe
% Non-OECD TPES	1.72
% Total World TPES	0.85
Per Capita TPES	4.35 toe per person
TPES/GDP	0.62 toe/1000 US$ 1985
Per Capita TFC	3.02 toe per person
TFC/GDP	0.43 toe/1000 US$ 1985
Energy related CO_2 emissions per capita	3.31 t carbon/person
Energy related CO_2 emissions per unit GDP	0.47 t carbon/1000 US$
% Total energy related Non-OECD CO_2 emissions	1.55
% Total energy related World CO_2 emissions	0.81
% Population growth (yearly average growth 1980-1989)	4.89

SOUTH AFRICA

1. Position

The government is in the process of formulating policies on the issue of global climate change. To this end the Interdepartmental Coordinating Committee for Global Environmental Change was established in 1991 to "co-ordinate the action required for formulating broad national policy and strategy on global environmental change." There are six groups working on local policy and strategy implications. They cover: terrestrial environment (including agriculture, forestry and conservation); water resources and catchments; air quality; energy use; economics, trade technology and tourism; and the marine and coastal environment. The Department of Environmental Affairs is acting as the lead agent with other government departments participating. The task groups will involve a broad spectrum of experts from the public, private and research sectors. The policy formulation initiative is supported by an active programme of scientific research and environmental monitoring.

2. Factors Influencing Decisions

There are two main reasons for the government's interest in global climate change: first is because of the potential vulnerability of South Africa to such change. Much of South Africa is arid and the environment is subject to substantial natural variation. The implications of possible climate change for local industry, agriculture, forestry and marine resources and thus the economy are enormous. The second reason is that there is concern about the environment in general and a desire to play a responsible role regionally and globally in respect of global environmental change.

South Africa is the largest non-OECD hard coal exporter and ranks third in the world. South Africa also has the fourth largest coal reserves in the world. The country is highly dependent on fossil fuels. In 1989, 82 per cent of TPES was coal and a further 14.5 per cent was petroleum. In order to reduce reliance on imports, coal is used as a feedstock to produce synthetic oil. In the mid-1980s, it was the world leader in using synthetic fuel technology.

SOUTH AFRICA

Key Energy and Environmental Data
(1989 data)

TPES	95.0 Mtoe
% Non-OECD TPES	2.61
% Total World TPES	1.28
Per Capita TPES	2.75 toe per person
TPES/GDP	1.71 toe/1000 US$ 1985
Per Capita TFC	1.25 toe per person
TFC/GDP	0.78 toe/1000 US$ 1985
Energy related CO_2 emissions per capita	2.86 t carbon/person
Energy related CO_2 emissions per unit GDP	1.78 t carbon/1000 US$
% Total energy related Non-OECD CO_2 emissions	3.20
% Total energy related World CO_2 emissions	1.68
% Population growth (yearly average growth 1980-1989)	2.23

USSR

1. Position

The USSR is active in both the INC and the IPCC and chairs the IPCC's Working Group II on socio-economic impacts. The Soviet Union is represented by the USSR Committee of Hydrometeorology and the Global Climate and Ecology Institute. The Soviet Union has consistently stated that more scientific study needs to be undertaken on the extent and timing of global climate changes before specific targets are set.

At the second session of the INC, the Soviet Union, along with Saudi Arabia and Kuwait, provided a paper which stated: "The specific difficulties of those countries, particularly developing countries, whose economies are highly dependent on fossil fuel production and exportation, as a consequence of action taken on limiting greenhouse gas emissions, should be taken into account."

2. Factors Influencing Decisions

The USSR ranks second in total energy-related carbon dioxide emissions. The Soviet Union is one of the world's largest producers and consumers of oil, coal and natural gas for both domestic consumption and export. Production levels are difficult to maintain because of the lack of capital. Western countries are currently negotiating over a European Energy Charter which should help long-term energy development. The share of natural gas in total primary fuel production will continue to rise.

The country is currently in the midst of political, administrative and economic restructuring and the final outcome of the new federal system is still to be determined.

A number of studies indicate that there would be a significant scope for improving energy efficiency and fuel switching once the political and economic situation has stabilised and energy prices will have risen closer to world market levels.

USSR

Key Energy and Environmental Data (1989 data)

TPES	1 266.2 Mtoe
% Non-OECD TPES	34.75
% Total World TPES	17.10
Per Capita TPES	4.40 toe per person
TPES/GDP	NA
Per Capita TFC	3.34 toe per person
TFC/GDP	NA
Energy related CO_2 emissions per capita	3.45 t carbon/person
Energy related CO_2 emissions per unit GDP	NA
% Total energy related Non-OECD CO_2 emissions	32.13
% Total energy related World CO_2 emissions	16.86
% Population growth (yearly average growth 1980-1989)	0.8

BEIJING MINISTERIAL DECLARATION ON ENVIRONMENT AND DEVELOPMENT

On 18-19 June 1991, 41 ministers from developing countries met in Beijing to discuss environment and development issues. Of the 41 Ministers, five came from the top eleven non-OECD carbon dioxide emitting countries: Brazil, China, India, Mexico and Saudi Arabia.

Some of the relevant passages related to climate change are:

- "environmental protection and sustainable development is a matter of common concern to humankind. . . we hereby reaffirm out solemn commitment to participating actively, on the basis of differentiated responsibility. . ."

- "the right to development of the developing countries must be fully recognized, and the adoption of measures for the protection of the global environment should support their economic growth and development."

- "Each country must be enabled to determine the pace of transition, based on the adaptive capacity of its economic, social and cultural ethos and capabilities."

- "The environmental problems of the developing countries arise from the conditions of poverty."

- "International co-operation . . . should be based on the principle of equality among sovereign states. The developing countries have the sovereign right to use their own natural resources in keeping with their developmental and environmental objectives and priorities."

- ". . . the developed countries bear the main responsibility for the degradation of the global environment. Ever since the Industrial Revolution, the developed countries have over-exploited the world's natural resources through unsustainable patterns of production and consumption, causing damage to the global environment, to the detriment of the developing countries."

- "The developed countries . . . must take the lead in eliminating the damage to the environment as well as in assisting the developing countries to deal with the problems facing them."

- "The developing countries need adequate, new and additional financial resources to be able to address effectively the environmental and developmental problems confronting them. There should be preferential and non-commercial transfer of environmentally sound technologies to the developing countries."

- "Responsibility for the emission of green-house gases should be viewed both in historical and cumulative terms, and in terms of current emissions. On the basis of the principle of equity, those developed countries which have contaminated more must contribute more. Developed countries should therefore commit themselves to adopting measures to half human-induced climate change and to setting up mechanisms to guarantee the environmental security and development of the developing countries. . . "

- "The framework convention must include, inter alia, firm commitments by developed countries towards the transfer of technology to developing countries, the establishment of a separate funding mechanism and the development of the economically viable new and renewable energy sources . . . In addition, the developing countries must be provided with the full scientific, technical and financial co-operation necessary to cope with the adverse impacts of climate change."

- "Issues of intellectual property rights must be satisfactorily resolved so that they do not become an obstacle to the transfer of technology. . ."

- "a special Green Fund should be established to provide adequate and additional financial assistance . . ."

- "The relevant agreements reached at the Conference [UNCED in Brazil, 1992] must provide guidance to international deliberations on trade, finance, technology and other similar issues. The interlinkages, where relevant, should be incorporated in each."

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