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# INFORMATION SUBMITTED BY PARTIES ON POSSIBLE CRITERIA FOR DIFFERENTIATION

## Note by the secretariat

1. In addition to the submissions already received (see FCCC/AGBM/1997/MISC.3 and Add.1), a further submission has been received from Australia.

2. In accordance with the procedure for miscellaneous documents, this submission is attached and is reproduced in the language in which it was received and without formal editing.

FCCC/AGBM/1997/MISC.3/Add.2
GE.97-

CONTENTS

PAPER NO. 1: AUSTRALIA

**Australia: Data and Supporting Information on Differentiation Indicators Listed in Annex B of the Revised Negotiating Text - (November 1997)**

The Berlin Mandate requires the setting of quantified emission objectives to take account of differences in "starting points and approaches, economic structures and resource bases, the need to maintain strong and sustainable growth, available technologies and other individual circumstances, as well as the need for equitable and appropriate contributions by each of these [Annex I] Parties to the global effort". Recognising that uniform emission objectives do not give effect to this fundamental requirement, some Parties have advocated the need for differentiated emission objectives. These Parties have suggested a range of factors - articulated in Annex B - which should guide Parties in negotiating differentiated emission objectives which take full account of the range of individual national circumstances and equity considerations as required by the Berlin Mandate and the Framework Convention.

Only by taking full account of these factors will Parties be able to negotiate differentiated emission objectives which ensure an equality of effort by all Annex I Parties in terms of requiring each Party to incur similar per capita economic costs. Indeed, this equity principle will not only provide a basis for negotiating 'equitable and appropriate' contributions by Annex I Parties, but also provide a benchmark against which the outcome of the differentiation negotiations could be assessed.

These 'differentiation' factors which guide Parties in negotiating equitable differentiated commitments should be universally applicable and capture the major differences in national circumstances which result in different economic costs of meeting emission objectives across countries. Only by a careful consideration of these factors would Parties be able to satisfy themselves that the emission objective proposed by each Annex I Party met the key requirement of a fair contribution to the global effort to address climate change. Given the central importance of these factors in the negotiation of 'equitable and appropriate' targets, it is essential that the factors be fully substantiated by readily available official data.

To this end, at AGBM8, Parties were asked to provide information on the indicators in Annex B for the Berlin Mandate timeframe and 1995 to assist in the deliberations on establishing differentiated emission objectives for each Annex I Party. These are provided below.

**(a) Carbon dioxide equivalent emissions per capita of the greenhouse gases listed in Annex A**

This information is readily available from the regularly updated National Greenhouse Gas Inventories provided by Parties under Article 12.1. The FCCC Secretariat regularly compiles this information for carbon dioxide and methane in a easily understood format as part of the Synthesis on National Communications documents. This table is reproduced below (see Table 1). However, as this data does not include all gases, sources and sinks included in Annex A, it would not be appropriate for use in the consideration of emission objectives.

A perusal of the National Greenhouse Gas Inventories should enable the appropriate per capita emissions data to be calculated for each country in accordance with IPCC guidelines and methodology and including all gases, sources and sinks included in Annex A.

This data has been provided for Australia for 1995 including all gases, sources and sinks (see Table 2).

**Table 1: Per Capita CH4 and CO2 emissions, 1990**

| | **Per capita CH4** (tonnes) | **Per capita CO2** (tonnes) | **Per capita $CO_2$ and $CH_4$** (CO2 eq. tonnes) |
|---|---|---|---|
| Australia* | 0.37 | 15.57 | 23.34 |
| Austria | 0.08 | 7.68 | 9.36 |
| Bulgaria | 0.15 | 9.21 | 12.36 |
| Canada | 0.12 | 17.44 | 19.96 |
| Czech Republic | 0.09 | 16.00 | 17.89 |
| Denmark | 0.08 | 10.12 | 11.8 |
| Estonia | 0.21 | 24.06 | 28.47 |
| Finland | 0.05 | 10.81 | 11.86 |
| France | 0.05 | 6.49 | 7.54 |
| Germany | 0.07 | 12.76 | 14.23 |
| Greece | 0.03 | 8.17 | 8.8 |
| Hungary | 0.05 | 6.79 | 7.84 |
| Iceland | 0.09 | 8.52 | 10.41 |
| Ireland | 0.23 | 8.77 | 13.6 |
| Italy | 0.07 | 7.52 | 8.99 |
| Japan | 0.01 | 9.35 | 9.56 |
| Latvia | 0.06 | 8.56 | 9.82 |
| Liechtenstein | 0.03 | 7.17 | 7.8 |
| Luxembourg | 0.06 | 30.41 | 31.67 |
| Monaco | .. | 2.45 | 2.45 |
| Netherlands | 0.07 | 11.22 | 12.69 |
| New Zealand | 0.59 | 7.61 | 20 |
| Norway | 0.07 | 8.37 | 9.84 |
| Poland | 0.16 | 10.87 | 14.23 |
| Portugal | 0.02 | 4.00 | 4.42 |
| Romania | 0.08 | 7.38 | 9.06 |
| Russian Federation | 0.18 | 16.11 | 19.89 |
| Slovak Republic | 0.07 | 11.00 | 12.47 |
| Spain | 0.06 | 5.83 | 7.09 |
| Sweden | 0.04 | 7.16 | 8 |
| Switzerland | 0.05 | 6.71 | 7.76 |
| United Kingdom | 0.08 | 10.08 | 11.76 |
| United States | 0.10 | 19.83 | 21.93 |

* Figures updated to include new inventory estimates for 1990 Note: GWP used CO2 = 1, CH4 = 21
Source: Table A.9, Secretariat Home Page

**Table 2: Australian per capita emissions by gas, 1995**

| | Emissions (tonnes CO2 eq.) | Per Capita Emissions (tonnes) |
|---|---|---|
| **CO2** | 352,325 | 19.37 |
| **CH4** | 111,531 | 6.13 |
| **N2O** | 26,567 | 1.46 |
| **HFCs** | na | na |
| **PFCs** | 1,419 | 0.08 |
| **SF6** | na | na |
| **Total CO2 equivalent** | 490,423 | 26.96 |

Note 1: GWPs used: CO2 = 1; CH4 = 21; N2O = 310; CF4 = 6500; C2F6 = 9,200 Note 2: Australian Population, 1995 = 18,187,700
Source: Australian National Greenhouse Gas Inventory, 1995

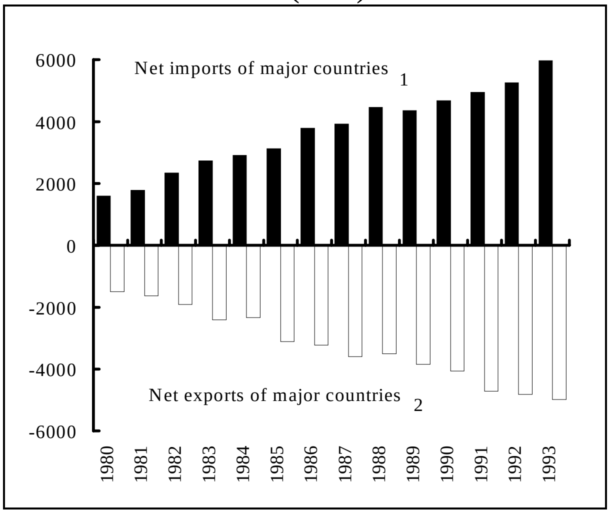
It is, however, worth emphasising that simple inter-country comparisons of per capita emission levels would not provide a sound basis for considering equitable and appropriate emission objectives for countries. They do not reflect the various national circumstances which have a crucial bearing on per capita emission levels. These factors include the availability of electricity generated from non fossil fuel sources, economic structure, transport requirements, climatic conditions and the like. For example, Australia does not use nuclear power and its opportunities for utilising hydro power are more limited than for many other OECD countries. It has also been estimated that around a quarter of the difference in Australia's and Japan's per capita emissions of carbon dioxide stem from differences in nuclear capacity

In addition, trade impacts are an important determinant of emission per unit of GDP levels. International trade allows industries which generate high emissions - such as petroleum refining and basic metals - to locate in countries where production costs are the most advantageous rather than in the country of final consumption. Countries which specialise in the export of such products may expect to have higher emission levels than if they produced only for domestic consumption. Similarly, countries which import such products will have lower emissions than if they produced such products for themselves.

The importance of changing trade patterns and specialisation of countries is best illustrated by the aluminium industry, which is also among the most energy intensive of industries. For some time aluminium producers have chosen to locate new production facilities in countries with low cost energy and placed less emphasis on being close to final markets. In some cases, such as Japan in the early 1980s, production facilities have been closed down and replaced offshore in countries such as Australia and Canada. The global specialisation of the industry has led to a number of exporters emerging, where the major proportion of production is destined for foreign markets. As shown in Chart 1, the growth in export from this small band of countries mirrors the growth in imports of the major markets.

This story is even more stark in considering methane emissions. In Australia, methane emissions make up 23% of total greenhouse emissions with the principal sources being livestock production and coal mining. This production is primarily destined for export markets with Australia being the world's largest exporter of coal and the second largest exporter of meat. As shown in Table 1, the importance of this economic and resource structure on per capita emissions of methane is profound. Per capita methane emissions are 37 times greater for Australia than for Japan; and around 5-7 times greater than most EU countries. New Zealand's per capita methane emissions of 0.59 tonnes per person further emphasises the importance of trade and international specialisation in determining per capita emission levels.

**Chart 1: Structural change in the aluminium industry: changing trade flows for major countries**
(US$)




1. Countries include EU-12, Sweden, Austria, Japan, United States.
2. Countries include Australia, Canada, Norway, Venezuela, Indonesia, UAE, Brazil.
Source: ABARE

The complex interaction of these various factors means that simple inter-country comparisons of per capita emission levels could prove misleading. This indicator must be considered in the light of the other indicators listed in Annex B. Parties must address the totality of the effects on economic welfare of countries to ensure equitable emission objectives for all Annex I countries.

**(b) Carbon dioxide equivalent emissions per unit of gross domestic product of greenhouse gases listed in Annex A**

Please see indicator (g) below: e*mission intensity of gross domestic product.*

**(c) Gross domestic product per capita**

Information on per capita incomes is best available from international sources such as the World Bank, IMF or the UN. The information in Table 3 on GNP per capita derives from the World Bank Atlas, 1997.

**(d) Gross domestic product per capita growth**

The growth of the economy is an important determinant of emission growth for all Parties. The importance of economic growth is recognised by the Convention and the Berlin Mandate, which require commitments to take into account the need to maintain strong and sustainable economic growth.

Other things being equal, faster economic growth would result in higher emissions growth and hence a higher economic welfare loss for any Party attempting to meet uniform emission objectives.

Given the broadly similar rates of economic growth for most OECD countries, this indicator is particularly relevant for the Economies in Transition and other relatively less developed countries. It can be expected that periods of "catch-up" for these countries would result in much higher growth rates than for the OECD average and, consequently, a higher economic welfare loss in achieving a uniform emission objective. Accordingly, inclusion of an indicator of GDP growth to guide differentiation of party commitments will be essential to meet the requirements of the Berlin Mandate and the Convention in ensuring equity.

**Table 3: Per capita GNP of Annex I countries**

| | **GNP per capita** ($US, 1995) | | **GNP per capita** ($US, 1995) |
|---|---|---|---|
| Australia | 18,720 | Japan | 39,640 |
| Austria | 26,890 | Latvia [a] | 2,270 |
| Belarus [a] | 2,070 | Lithuania [a] | 1,900 |
| Belgium | 24,710 | Luxembourg | 41,210 |
| Bulgaria [a] | 1,330 | Netherlands | 24,000 |
| Canada | 19,380 | New Zealand | 14,340 |
| Czech Republic [a] | 3,870 | Norway | 31,250 |
| Denmark | 29,890 | Poland [a] | 2,790 |
| EEC | - | Portugal | 9,740 |
| Estonia [a] | 2,860 | Romania [a] | 1,480 |
| Finland | 20,580 | Russian Federation [a] | 2,240 |
| France | 24,990 | Spain | 13,580 |
| Germany | 27,510 | Sweden | 23,750 |
| Greece | 8,210 | Switzerland | 40,630 |
| Hungary [a] | 4,120 | Turkey | 2,780 |
| Iceland | 24,950 | Ukraine [a] | 1,630 |
| Ireland | 14,710 | United Kingdom | 18,700 |
| Italy | 19,020 | United States of America | 26,980 |

[a] Countries that are undergoing the process of transition to a market economy

**(e) Effective emissions in a given time period, defined as the increase in global mean surface temperature at the end of the period, as determined by an agreed climate change model, resulting from both the net anthropogenic emissions of an agreed set of greenhouse gases at the beginning of the period**

No data available.

## (f) Projected population growth

Internationally comparable information on projected population growth is available from various international bodies such as the UN and the World Bank (see Chart 2 and Table 4).

Population growth is an important factor in determining the underlying emissions growth of an economy. Other things being equal, the higher the population growth, the higher will be the underlying rate of emissions growth.

Population growth varies widely across the OECD region causing sharp differences in pressures for energy demand (and consequent upward pressure on emissions). As shown in Chart 2 and Table 4, the World Bank has projected Australia, the United States, Canada and New Zealand to have the fastest growing populations to the year 2020. These variations stem mainly from differences in immigration rates and age structures of populations. Due to the faster population growth, emissions in these countries will grow more strongly and the cost of meeting uniform targets relative to 1990 levels will tend to be greater than countries with slower population growth.

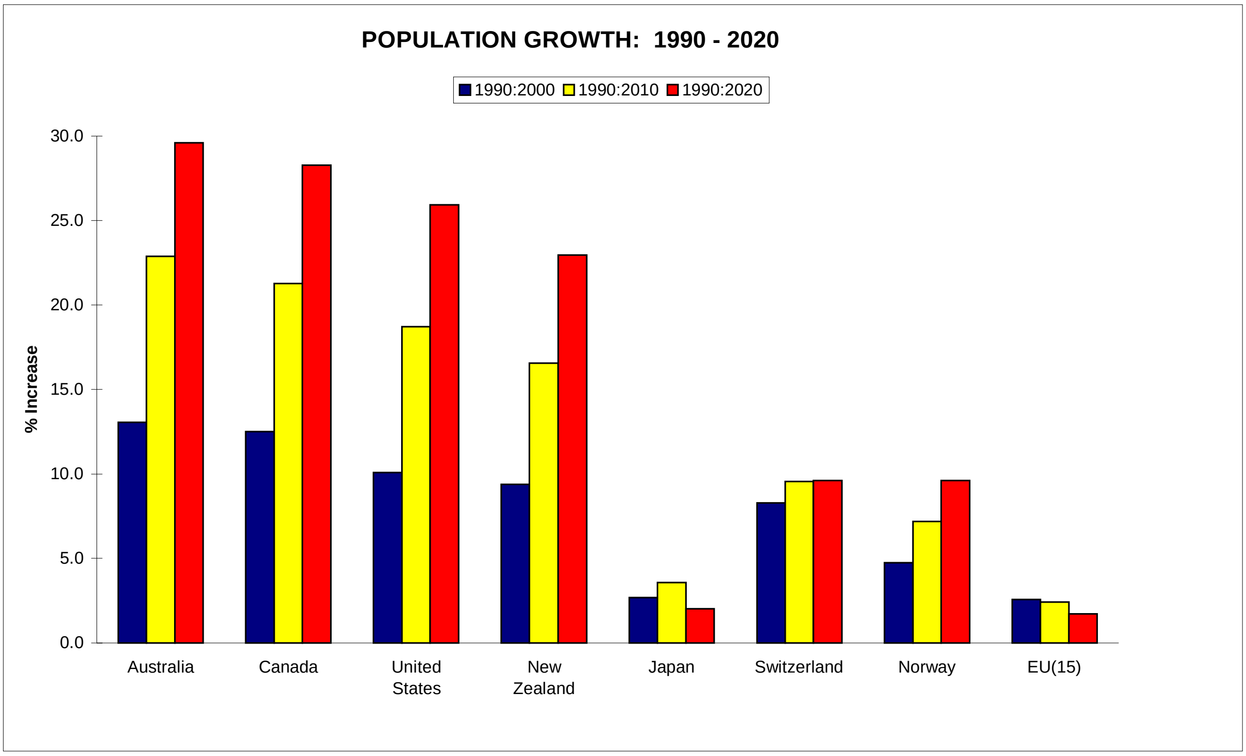


**Table 4: POPULATION GROWTH: OECD COUNTRIES**

| | Population | | | | Population Growth | | |
|---|---|---|---|---|---|---|---|
| | **1990** | **2000** | **2010** | **2020** | **1990:2000** | **1990:2010** | **1990:2020** |
| | (‘000s) | (‘000s) | (‘000s) | (‘000s) | (%) | (%) | (%) |
| Australia | 17,065 | 19,292 | 20,971 | 22,113 | 13.1 | 22.9 | 29.6 |
| Canada | 26,522 | 29,841 | 32,166 | 34,019 | 12.5 | 21.3 | 28.3 |
| Japan | 123,537 | 126,840 | 127,946 | 126,026 | 2.7 | 3.6 | 2.0 |
| New Zealand | 3,363 | 3,679 | 3,920 | 4,135 | 9.4 | 16.6 | 23.0 |
| Norway | 4,242 | 4,443 | 4,547 | 4,650 | 4.7 | 7.2 | 9.6 |
| Switzerland | 6,712 | 7,268 | 7,353 | 7,357 | 8.3 | 9.6 | 9.6 |
| United States | 250,372 | 275,636 | 297,205 | 315,268 | 10.1 | 18.7 | 25.9 |
| EU(15) | 365,376 | 374,736 | 374,260 | 371,697 | 2.6 | 2.4 | 1.7 |
| *Austria* | 7,712 | 8,138 | 8,180 | 8,169 | 5.5 | 6.07 | 5.93 |
| *Belgium* | 9,967 | 10,126 | 10,055 | 9,944 | 1.6 | 0.88 | -0.23 |
| *Denmark* | 5,140 | 5,267 | 5,277 | 5,261 | 2.5 | 2.67 | 2.35 |
| *Finland* | 4,986 | 5,183 | 5,272 | 5,322 | 4.0 | 5.74 | 6.74 |
| *France* | 56,735 | 59,425 | 60,993 | 62,121 | 4.7 | 7.51 | 9.49 |
| *Germany* | 79,452 | 81,097 | 78,867 | 76,393 | 2.1 | -0.74 | -3.85 |
| *Greece* | 10,089 | 10,692 | 10,748 | 10,616 | 6.0 | 6.53 | 5.22 |
| *Ireland* | 3,503 | 3,723 | 4,019 | 4,262 | 6.3 | 14.73 | 21.67 |
| *Italy* | 57,661 | 57,930 | 56,824 | 55,139 | 0.5 | -1.45 | -4.37 |
| *Luxembourg* | 382 | 420 | 422 | 422 | 9.9 | 10.47 | 10.47 |
| *Netherlands* | 14,952 | 15,794 | 15,999 | 16,064 | 5.6 | 7.00 | 7.44 |
| *Portugal* | 9,868 | 9,875 | 9,861 | 9,839 | 0.1 | -0.07 | -0.29 |
| *Spain* | 38,959 | 39,237 | 39,058 | 38,543 | 0.7 | 0.25 | -1.07 |
| *Sweden* | 8,559 | 8,947 | 9,117 | 9,287 | 4.5 | 6.52 | 9.38 |
| *UK* | 57,411 | 58,882 | 59,568 | 60,315 | 2.6 | 3.76 | 5.06 |

(Source: World Bank Population Projections 1994-95)

**(g) Emission intensity of gross domestic product**

This information can be obtained from national greenhouse gas inventories and information on gross domestic products obtained from international sources (such as the World Bank or IMF). The FCCC Secretariat regularly compiles inventory information as part of its Synthesis on National Communications documents. However, as this data does not include all gases, sources and sinks included in Annex A, it would not be appropriate for use in the consideration of emission objectives.

Table 5 provides figures on gross domestic product for Annex I economies drawn from the World Bank Atlas, 1997 and Table 6 provides figures for Australia on emissions per unit of GDP on a gas-by-gas basis.

**Table 5: Gross Domestic Product for Annex I Countries**

| | GDP ($US, 1995) | | GDP ($US, 1995) |
|---|---|---|---|
| Australia | 348 782 | Latvia [a] | 6 034 |
| Austria | 233 427 | Lithuania [a] | 7 089 |
| Belarus [a] | 20 561 | Luxembourg | |
| Belgium | 269 081 | Netherlands | 395 900 |
| Bulgaria [a] | 12 366 | New Zealand | 57 070 |
| Canada | 568 928 | Norway | 145 954 |
| Czech Republic [a] | 44 772 | Poland [a] | 117 663 |
| Denmark | 172 220 | Portugal | 102 337 |
| EEC | | Romania [a] | 35 533 |
| Estonia [a] | 4 007 | Russian Federation [a] | 344 711 |
| Finland | 125 432 | Slovak Republic | 17,414 |
| France | 1 536 089 | Spain | 558 617 |
| Germany | 2 415 764 | Sweden | 228 679 |
| Greece | 90 550 | Switzerland | 300 508 |
| Hungary [a] | 43 712 | Turkey | 164 789 |
| Iceland | | Ukraine [a] | 80 127 |
| Ireland | 60 780 | United Kingdom | 1 105 822 |
| Italy | 1 086 932 | United States of America | 6 952 020 |
| Japan | 5 108 540 | | |

[a] Countries that are undergoing the process of transition to a market economy

**Table 6: Australian Emissions per unit of GDP, 1995**

| | Emissions (tonnes CO2 eq.) | Emissions per unit of GDP (tonnes/$US) |
|---|---|---|
| **CO2** | 352,325 | 10.11 |
| **CH4** | 111,531 | 3.20 |
| **N2O** | 26,567 | 0.76 |
| **HFCs** | na | na |
| **PFCs** | 1,419 | 0.04 |
| **SF6** | na | na |
| **Total CO2 equivalent** | 490,423 | 14.06 |

Note 1: GWPs used: CO2 = 1; CH4 = 21; N2O = 310; CF4 = 6500; C2F6 = 9,200
Note 2: GDP, 1995 = $US348,782 (Source: World Development Report, 1997 (World Bank)

The interpretation of the emission intensity of GDP indicator is not straightforward. The emissions intensity of an economy is the product of the energy intensity of the economy (energy used per unit of GDP) and the carbon intensity of the mix of fuels used in the economy. In turn, the energy intensity of the economy reflects both the industrial structure of the economy and the energy intensities of those individual industries. Both of these factors needs to be considered before conclusions can be drawn about the difficulty of changing energy efficiency levels and changing the carbon intensity of the fuels used in the economy.

The emissions intensity of an economy influences the economic welfare changes associated with international abatement action that that economy will experience in a variety of ways. The nature of the impact and its relative importance will depend on the economic structure and circumstances of individual economies.

- a country with a relatively high emissions intensity of GDP will experience a higher magnitude of emissions growth for a given rate of economic growth than a similar economy with a lower emissions intensity of output. In the absence of subsidies and other market distortions, a relatively high emissions intensity of GDP is likely to reflect a country's comparative advantage in emission intensive goods and relatively high level of dependence on fossil fuels. Continued multilateral trade liberalisation will lead to further specialisation in areas of comparative advantage, driving economic growth in emission intensive activities in countries with a comparative advantage in these activities. In other words, other things being equal, the higher the emissions intensity of GDP, the higher the magnitude of the emissions reduction task and thus the higher the economic welfare cost of achieving a uniform emission objective.

- account should also be taken of circumstances where a country with a low emissions intensity of GDP would find it more costly to reduce unit emissions than an economy with higher emissions intensity of output. This stems from two factors. First, some countries with low emissions intensity of output have achieved high levels of energy efficiency in certain sectors. Secondly, some of these countries with low emissions intensity of output would find it necessary to reduce emissions across a more limited range of activities than countries with a higher emissions intensity of output. These elements are captured in the need to take account of differences in starting points in the Convention and the Berlin Mandate. Other things being equal, these countries are likely to incur higher economic welfare losses in reducing emissions to achieve a uniform emission objective.

The relative importance of these different influences will depend on the economic structure and circumstances of individual economies. This indicator demonstrates the importance of correctly identifying the impacts of factors affecting economic welfare loss in different economies and the need for them each to be carefully accounted for in ensuring commitments are determined equitably.

This is best understood by considering the factors driving the energy intensities of different economies. Energy intensities (or the energy use associated with the production of a unit of GDP) vary widely across the OECD. Australia’s energy intensity is high relative to most other OECD countries. In 1990 Australia’s energy intensity was around 15 per cent above the OECD average, although the differences with Japan was far greater (about 73 per cent higher, see table 7). The divergence across the OECD is larger for the manufacturing sector, whereas Australia, the United States, Canada and New Zealand have high energy intensities and the EU and Japan have low-energy intensities.

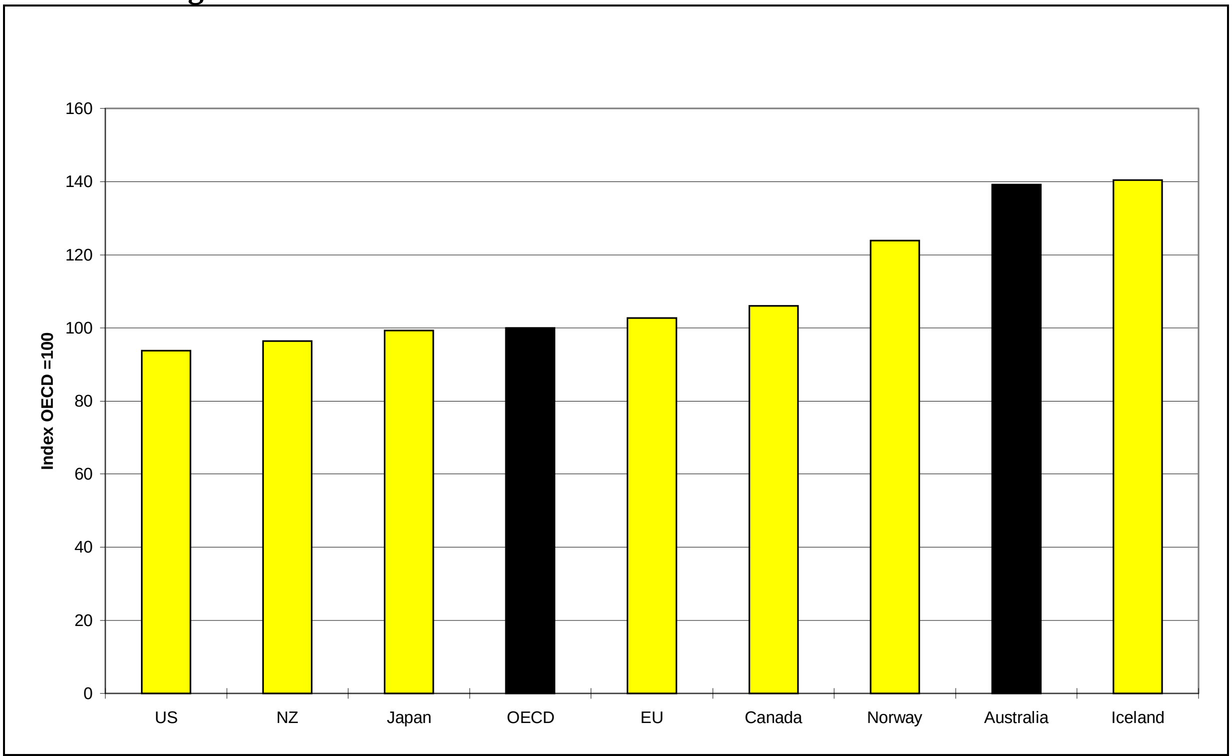
**Table 7: OECD energy intensities: 1990 (energy use per unit of GDP)**

| | Australia | Japan | United States | EU | OECD average |
|---|---|---|---|---|---|
| Energy intensity (economy) | 0.45 | 0.26 | 0.41 | 0.42 | 0.39 |
| Energy Intensity (manufacturing) | 1.50 | 0.58 | 1.45 | 0.77 | 0.97 |

Source: IEA (1994b); DFAT estimates derived from OECD STAN database and IEA 1997.

An important part of the explanation for the differences in the raw energy intensity data across the OECD is differences in industrial structure. There are several smaller, highly specialised economies with a predominance of energy-intensive industries (see Chart 3). These include Iceland, Australia and Norway. Each of these countries has substantial non-ferrous metals industries (accounting for around 7 per cent of manufacturing in each case, as against only two per cent for the OECD as a whole).

**Chart 3: OECD manufacturing: importance of energy-intensive industries relative to OECD average: 1990**




Source: DFAT estimates, derived from OECD STAN database and IEA 1997.
Note: An index greater than 100 implies that a country has a greater proportion of energy-intensive industries than the OECD as a whole. The definition of OECD only includes those countries which are also Annex I members.

Australia's manufacturing has a greater reliance on energy-intensive industries than any other OECD country, apart from Iceland. In particular, energy-intensive industries such as non-ferrous metals, iron and steel, and food and beverage industries are more important in Australian manufacturing than in OECD economies in general. On the other hand, industries such as machinery, electrical and non-electrical appliances, which are less energy-intensive, are less important in Australia. Overall, the particular industry composition of Australia's manufacturing sector results in around 40 per cent more energy use than if the composition of Australia’s manufacturing was the same as the OECD average. At the other extreme, US industries use about 5 per cent less energy than they would if the US had the same industrial structure as the OECD as a whole.

Energy-intensity levels can be interpreted as a rough proxy for the level of energy efficiency in an industry.[1] These results suggest that the opportunities for cost effective increases in energy efficiency in Australia’s manufacturing sector are around the average for the OECD in general. Cost effective opportunities are likely to be greater in North America and least in Europe and Japan. The situation of the latter two reflects past investments in energy efficiency because, as oil importers, these countries invested in energy efficiency in response to OPEC oil shocks of the 1970s and early 1980s.

Differences in the industrial structures of Australia and other OECD countries appear to be more important explanators of Australia’s high-energy intensity of the manufacturing sector overall, than are differences in the energy-intensity levels of individual Australian industries relative to the same industries overseas. According to the estimates presented in Chart 4, the energy-intensity levels of individual industries within Australia’s manufacturing sector are within 10 per cent of the OECD average. Australia’s individual energy intensity levels are less than that achieved in Japan and Europe, but better than that achieved in North America and New Zealand.

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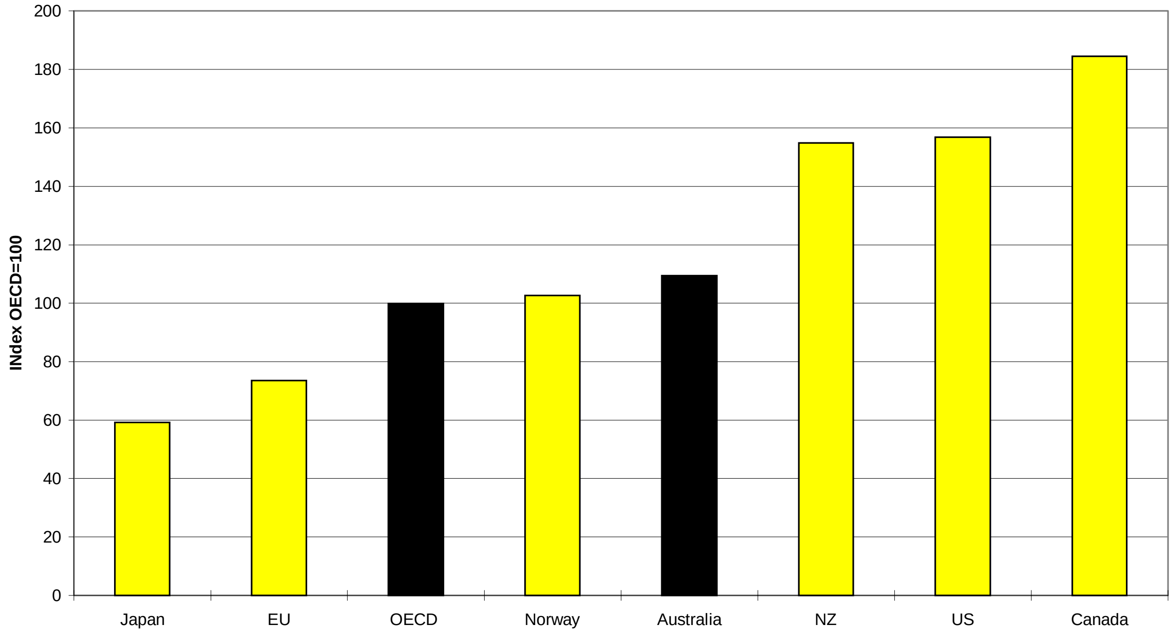
[1] The results presented here are based on a disaggregation of the manufacturing sector to 11 individual industries (in accordance with available IEA data). The results should be treated as indicative only and qualified by the limited disaggregation that was able to be undertaken. Further disaggregation would take into account differences (across Annex I) in energy-intensity levels that are due to differences in production structure within each of the 11 industry groups. For example, the proportion of aluminium production (by far the most energy-intensive metal) in the non-ferrous metals sector is high for Australia relative to the OECD which should be taken into account when making inferences about energy efficiency levels in the non-ferrous metals industry from data on energy intensity indicators.

**Chart 4: OECD manufacturing 1990: energy intensity of individual manufacturing industries relative to OECD average**

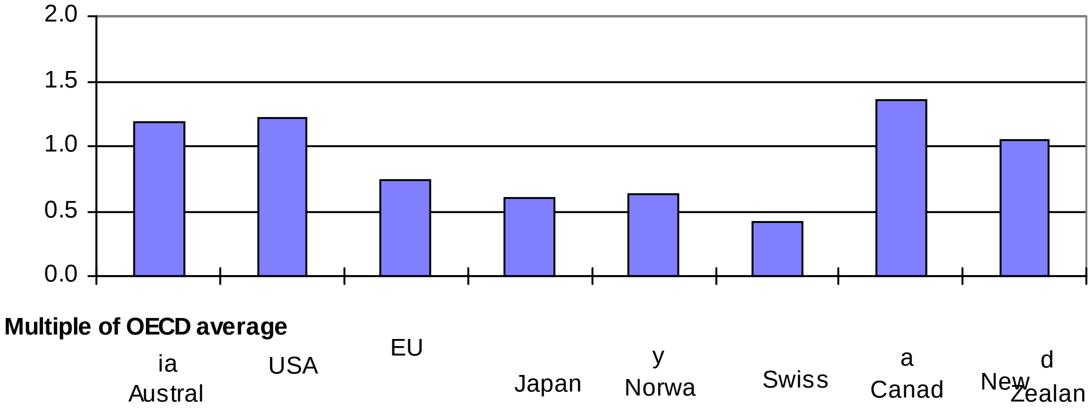



Source: DFAT estimates, derived from OECD STAN database and IEA 1997
Note: Greater than 100 implies a more energy intensive industry structure than the OECD average

In addition, assessments of the extent to which differing fuel mixes have implications for the costs of mitigation action depend on the extent to which there are constraints on fuel switching. Australia, for example, has not built a major hydro power station for almost two decades and has never built a nuclear power station. In contrast, Europe and Japan have relied heavily on nuclear industries, Canada has an important hydro-electric industry and New Zealand can access geothermal power.

The high emission intensity of the Australian economy reflects in part a constraint on the available technology options compared to other countries, as well as the choice in the use of available technologies. Australia does not use nuclear power, while its opportunities for utilising hydro power have been more limited than for many other OECD countries. If Australia and other OECD economies had been able to make the same use of nuclear or hydro power as, say, Switzerland or Norway, then the emission intensity of Australia's economy would be broadly comparable to that of the United States, Canada and New Zealand, but higher than the emission intensities of the EU, Japan, Norway and Switzerland (see Chart 5).

**Chart 5: CO2 emission intensity (allowing for nuclear/hydro policies): 1990**




Source: DFAT estimates. Derived from IEA 1994b.
Assumes that all countries have equal access to nuclear/hydro/geothermal power. A figure greater than one implies a higher emission intensity than the OECD average.

The second important factor affecting the fuel mix of individual countries and each country's ability to switch from coal to other fuels is the relative costs of individual fuels. For some OECD countries there is a positive economic benefit from switching from coal to other fuels because of the very high cost of local coal production. According to the International Energy Agency, the cost of producing coal in Britain and Germany has been four to six times the cost of production in Australia or the United States.

In these circumstances, there is a positive economic benefit, rather than an economic cost, to these European economies from reducing subsidies on coal production. In fact, Britain has taken the opportunity to wind back its support systems for coal, reducing the level of producer subsidy from US$75 a tonne to US$18 a tonne between 1990 and 1993 and halving domestic coal production.

It is significant that countries with the highest cost of coal production also tend to have the lowest emission intensities in their economies. Countries with a comparative advantage in fossil fuels and fossil fuel power generation, on the other hand, will find switching to non-coal-fired power generation stations relatively more expensive. Both the differences in the availability of technologies across Annex I and the relative costs of alternative fuels need to be taken into account in developing assessments of the national circumstances which affect the cost of reducing emissions.

**(h) Emission intensity of exports**

The emission intensity index in Table 8 below is an estimate of the emissions released in the production of a country’s exports divided by the value of that country’s exports. Differences in the index across countries will reflect differences in each country’s product composition of exports (i.e. how energy-intensive they are) and the carbon intensity of the fuels used in their production. The estimates presented here are based on merchandise export data from the UN trade database and emission coefficients (emission units per dollar of output) for the Australian economy. Details of the methodology used in these calculations are provided in the Attachment.

As noted in the attachment, slight variations to the assumptions underlying the methodology may be valid and, if adopted, would result in small changes to the numerical values presented here. Although there is consequently some uncertainty regarding the exact numerical value of the emission export intensity index, the relative magnitudes for different countries are relatively robust. The uncertainty of the exact numerical value should not, however, affect the usefulness of this indicator in guiding the negotiations on differentiated emission objectives. The importance of each factor will vary for different countries depending on their particular national circumstances and economic structure. Consequently, Australia has consistently argued that it will not be possible or desirable to integrate these different factors into a (magical) mathematical formula which will be able to address the various national circumstances and arrive at equitable differentiated emission objectives for different Parties. Rather, Australia has argued that these factors should be used as an important input in a systematic process of negotiation of differentiated objectives. Within such a negotiated framework, the exact numerical values of the indicators assume less importance; the relative magnitudes remain crucial.

The emissions intensity of a country's exports is an important determinant of the extent of economic welfare losses it experiences in the context of international emissions abatement action. For any one country, the emissions intensity of its exports will be a product of its resource base and industrial structure. The FCCC and the Berlin Mandate call for resource bases and economic structures to be taken into account, as well as the need to maintain strong and sustainable economic growth. In addition, Article 4.10 of the Convention and paragraph 1(b) of the Berlin Mandate recognise the vulnerability of parties particularly dependent on income generated from the production, processing and export of energy intensive products and the need for these considerations to guide the Berlin Mandate negotiations.

**Table 8: Emission intensity of Exports**

| | Index |
|---|---|
| Australia | 2.3 |
| Canada | 1.6 |
| Denmark | 0.7 |
| France | 0.5 |
| Germany | 0.7 |
| Iceland | 0.4 |
| Italy | 0.5 |
| Japan | 0.5 |
| Netherlands | 1.4 |
| New Zealand | 0.9 |
| Norway | 0.8 |
| Spain | 0.7 |
| Sweden | 0.4 |
| Switzerland | 0.3 |
| United Kingdom | 0.9 |
| United States | 1.3 |

Source: Derived from UN Trade Data Base

The Berlin Mandate outcome should provide a means for dealing with any economic welfare losses which derive from loss of international competitiveness flowing from the agreed abatement commitments, and the resultant displacement of emissions intensive activity to countries not undertaking emission commitments under either Article 3 or Article 10 of the draft text (i.e. carbon leakage). Using the emissions intensity of a country's exports as an indicator of the extent to which it will experience such adverse economic welfare impacts and factoring this indicator into the determination of a differentiated emission objective will be critical in achieving equitable differentiation.

The importance of international competitiveness and carbon leakage impacts for a country undertaking commitments will depend on the relative importance of energy intensive and other emission intensive goods in that country's economy, the direction of that country's exports and the significance of market competition in the supply of such goods from countries which are not undertaking commitments. The international competitiveness impacts will be particularly acute for countries with a relatively high emission intensity of exports and which have strong trade links with developing countries. The export sectors of such countries will be more vulnerable to adverse economic impacts from the implementation of measures to respond to climate change. Other things being equal, for these countries this will translate into relatively high economic welfare losses due to loss of international competitiveness and carbon leakage.

Table 9 below, sourced from the IMF direction of trade statistics, provides an indication of the strength of the trade linkages between different countries. It highlights that while the focus of European countries trade is mainly with other OECD and EIT economies, developing countries are much more important trading partners for non-European countries.

**Table 9: Direction of Trade Statistics**

| | **OECD** (% of total) | **Developing countries** (% of total) | **Economies in Transition** (% of total) |
|---|---|---|---|
| European Union | 77.1 | 15.6 | 6.6 |
| Australia | 50.0 | 46.8 | 1.0 |
| Japan | 47.8 | 51.4 | 0.8 |
| New Zealand | 62.5 | 32.5 | 1.9 |
| Norway | 91.0 | 6.3 | 2.7 |
| Switzerland | 77.2 | 18.9 | 4.1 |
| USA | 57.23 | 40.8 | 1.7 |

Source: Direction of Trade Statistics Yearbook, 1996 (IMF)

The Berlin Mandate outcome should be flexible enough to work with, and not against, the rapidly changing trading structures occurring as a result of global economic integration and the liberalisation of trade across the world. Using the emission intensity of export indicator combined with the importance of developing country competitors in a country's trade profile would explicitly take account of the structure of national economies and hence address international competitiveness and carbon leakage impacts as required by the Berlin Mandate.

**(i) Fossil fuel intensity of exports**

The fossil fuel intensity of exports indicator in Table 10 is designed to proxy the impacts of mitigation action of Annex I parties on the level of individual parties' national income through effects on export prices of fossil fuels. It has been calculated as the value of each country's fossil fuel exports expressed as a percentage of the value of total exports. This is a conservative methodology for calculating this indicator for countries with a predominance of coal exports in their export profile. Greater impacts are likely to be experienced by countries with a higher proportion of coal in their fossil fuel exports, relative to oil and gas, because of the greater emission intensity of coal as a fuel.

As identified in the Berlin Mandate (Paragraph 1 (b)) and the FCCC (Article 4.10) of the Convention, Parties particularly dependent on income generated from the production, processing and export of fossil fuels are particularly vulnerable to adverse terms of trade impacts and hence economic welfare losses. Action by parties to reduce emissions will tend to reduce the price and demand for fossil fuels. This will result in adverse terms of trade movements and resultant economic welfare losses for exporters of fossil fuels. In contrast, international efforts to reduce emissions will result in improvements in the terms of trade for importers of fossil fuels and, consequently, improvements in their economic welfare.

The significance of these terms of trade impacts on economic welfare will vary between parties undertaking commitments depending on the relative importance of fossil fuels in the party's export and import profile. It is important that this source of loss in economic welfare of fossil fuel exporters is fully accounted for in setting differentiated and equitable emission objectives.

**Table 10: Fossil fuel intensity of exports**

| | **Fossil fuel intensity of exports** *%* |
|---|---|
| United States | 1.8 |
| Canada | 1.2 |
| Japan | 0.6 |
| Australia | 16.8 |
| New Zealand | 1.6 |
| Norway | 46.8 |
| Iceland | 0.0 |
| Switzerland | 0.1 |
| Germany | 0.9 |
| United Kingdom | 6.2 |
| Netherlands | 7.1 |
| Sweden | 0.0 |
| Spain | 1.7 |
| France | 1.0 |
| Italy | 1.2 |
| Denmark | 2.4 |

Source: Derived from UN Trade Data Base

### (j) Share of renewable energy in energy supply

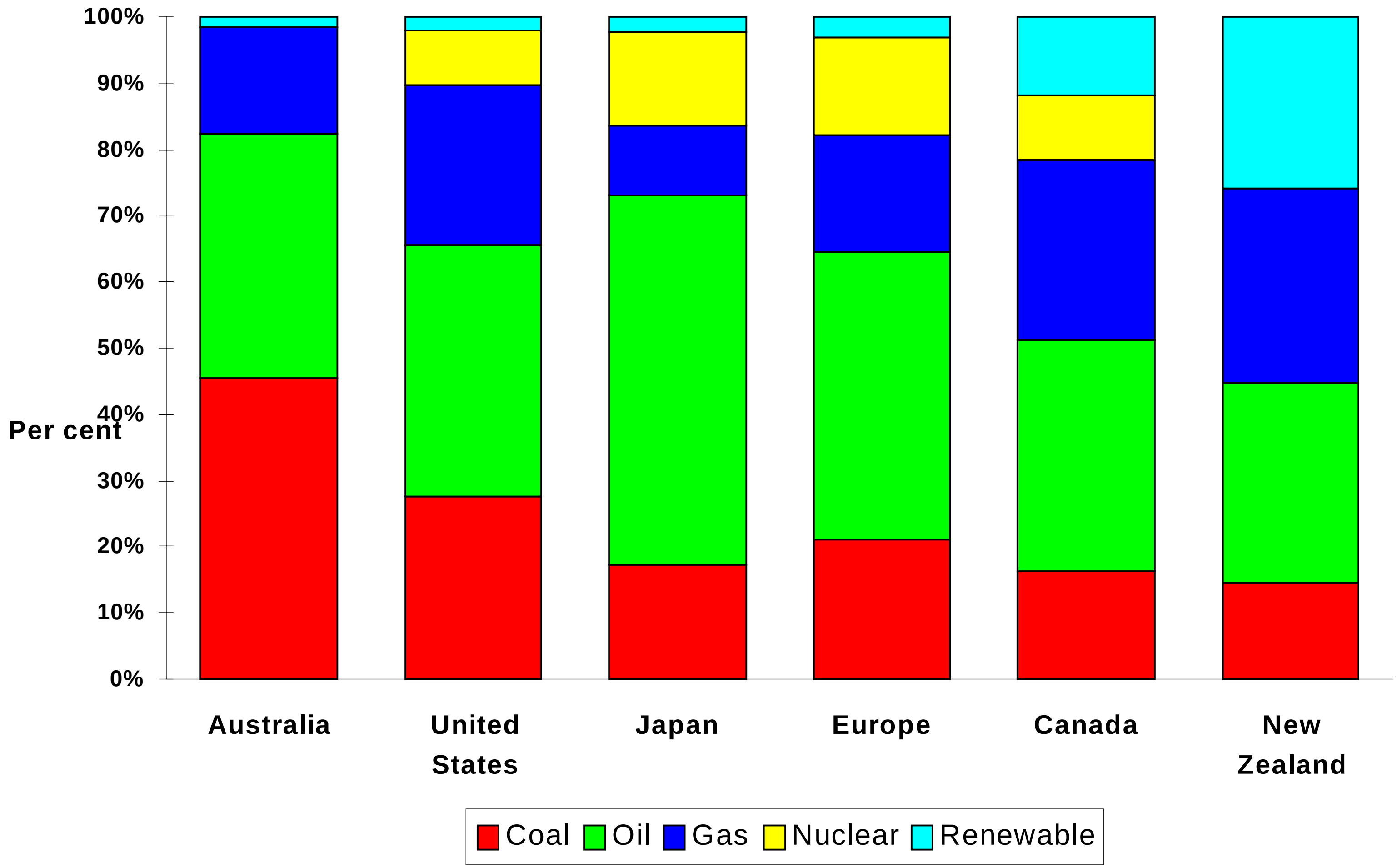
Information on the share of renewables in a country's energy supply can be found in IEA publications. Information on the energy supply by primary energy source for different countries is in Table 11 below.

**Table 11: Energy Supply by Primary Energy Source, 1993**

| | Coal (%) | Oil (%) | Gas (%) | Nuclear (%) | Hydro (%) | Other (%) |
|---|---|---|---|---|---|---|
| Australia | 40.7 | 36.9 | 16.1 | 0 | 1.5 | 4.8 |
| Austria | 11.1 | 43.6 | 21.5 | 0 | 12.0 | 11.7 |
| Belgium | 17.6 | 41.4 | 18.6 | 21.7 | 0 | 0.6 |
| Canada | 10.8 | 34.2 | 27.4 | 11.2 | 12.5 | 3.9 |
| Denmark | 36.7 | 44.2 | 12.3 | 0 | 0 | 6.9 |
| EU | 18.3 | 43.1 | 18.9 | 15.6 | 1.9 | 2.3 |
| Finland | 20.3 | 33.1 | 9.1 | 18.3 | 4.1 | 15.0 |
| France | 6.3 | 37.4 | 12.1 | 40.1 | 2.3 | 1.8 |
| Germany | 29.0 | 40.2 | 17.7 | 11.9 | 0.5 | 0.7 |
| Greece | 36.1 | 60.0 | 0.4 | 0 | 0.9 | 2.6 |
| Iceland | 2.0 | 34.8 | 0 | 0 | 18.4 | 44.8 |
| Ireland | 31.2 | 48.0 | 20.1 | 0 | 0.6 | 0.1 |
| Italy | 7.0 | 60.5 | 27.4 | 0 | 2.3 | 2.8 |
| Japan | 16.8 | 55.9 | 10.4 | 14.2 | 1.8 | 0.8 |
| Luxembourg | 29.6 | 55.8 | 13.8 | 0 | 0.2 | 0.7 |
| Netherlands | 11.4 | 36.7 | 49.8 | 1.5 | 0 | 0.6 |
| New Zealand | 7.6 | 30.1 | 29.5 | 0 | 13.5 | 19.3 |
| Norway | 3.7 | 36.2 | 10.9 | 0 | 44.7 | 4.5 |
| Portugal | 18.0 | 71.6 | 0 | 0 | 4.2 | 6.3 |
| Spain | 21.0 | 53.5 | 6.3 | 16.1 | 2.3 | 0.8 |
| Sweden | 5.8 | 31.3 | 1.5 | 33.9 | 13.6 | 13.9 |
| Switzerland | 0.7 | 51.1 | 8.0 | 12.1 | 24.1 | 4.0 |
| UK | 23.2 | 38.6 | 26.8 | 10.8 | 0.2 | 0.4 |
| USA | 23.2 | 38.0 | 24.2 | 8.3 | 1.2 | 5.2 |

Source: Energy Balances of OECD Countries, 1992-93 (IEA)

## Chart 6: Energy Input Fuel Mixes, 1993



**ATTACHMENT:**
**CALCULATIONS OF EMISSIONS INTENSITY OF EXPORTS**

The technique of analysing the quantity of energy consumed or carbon dioxide emissions released during the production of exports (or imports) has been widely used over the last few years. The technique has been used to analyse G-7 economies (Wyckoff and Roop, 'The embodiment of carbon in imports of manufactured products: Implications for international agreements on greenhouse gas emissions' Energy Policy, March 1994)); the UK economy (Gay and Poops) and the Australian economy (Common and Salma (1992)). The Danish statistical agency, Danmarks Statistiks, reports on an annual basis the energy content of Danish merchandise exports. They have produced a time series for energy content of Danish exports stretching back to 1966.

The emission intensity index is an estimate of the emissions released in the production of a country's exports divided by the value of that country's exports. Differences in the index across countries will reflect differences in each country's product composition of exports (ie how energy-intensive they are) and the carbon intensity of the fuels used in their production. The estimates presented here are based on merchandise export data from the UN trade database and emission coefficients (emission units per dollar of output) for the Australian economy.

The major sources of data are:

Export data: UN trade database, SITC Rev 3 three-digit level data.
Exchange rate: *OECD Main Economic Indicators.*
Price deflators: Australian Bureau of Statistics, *Export price index*, catalogue no. 6405.0
Emission coefficients: Common M. and Salma, U. 1992 'Accounting for changes in Australian carbon dioxide emissions,' *Energy Economics*, July.

<u>Trade data</u>

The UN SITC 3-digit trade data was aggregated into the following commodity groupings for which emission coefficients were available: electric current, other energy transformation (petroleum and coal products), other energy transformation (gas), basic metals, fabricated metal products, chemicals and plastics, minerals and resources (including oil extraction), agriculture and food, meat and milk products, machinery and miscellaneous manufacturing, transport equipment, textiles clothing and footwear, paper and paper products, wood and wood products, beverages and tobacco, non-metallic mineral products.

The classifications used for the various commodity groups were as follows:

- electric current: SITC Rev 3, 451
- other energy transformation (petroleum and coal products) SITC Rev3, 322-325;334, 335;
- other energy transformation (gas) SITC Rev 3, 342-349;
- basic metals SITC Rev 3 681-689, 971, 288
- fabricated metal products SITC Rev 3 671-679, 691-699
- chemicals and plastics SITC Rev 3 511-598
- minerals and resources SITC Rev 3 272-278, 280-287, 289, 321, 333
- agriculture and food SITC Rev 3 001, 041-098, 211-232, 411-431 268, 291-292
- meat and milk products SITC Rev 3 011-037

- textiles clothing and footwear  SITC Rev 3 261-267, 269, 831-851
- paper and paper products SITC Rev 3 251, 641, 642
- wood and wood products SITC Rev 3 244-248, 633-635
- transport equipment  SITC Rev 3 781-793
- machinery and miscellaneous manufacturing SITC Rev 3 711- 778, 811-813, 871-961
- non-metallic mineral products  SITC Rev 3 661-667
- beverages and tobacco  SITC Rev 3 111-122.

Emission coefficients

Emission coefficients were then applied to each of these groupings.  These were calculated from input-output data for the Australian economy and industry energy consumption data for the Australian economy (such as appears in the *IEA Energy Balances*).  Price deflators for Australian commodities were used to ensure consistency between the emission coefficients derived from the input-output tables and the trade data.  Australian dollar coefficients were converted to US dollar coefficients using the 1995 $A-$US exchange rate.  The resulting emission coefficients, expressed in terms of emission units per 1995 US dollar are reported in table x.

Calculation of emission intensity of  exports index

The calculation of the emission intensity index requires four steps for each country.

- **Step 1:**  Calculation of emissions released during production of exports for each commodity group.  For each commodity export group, the level of emissions released in their production can be calculated by multiplying the emission coefficient by the value of exports for that commodity group (for an illustration see tables 2-4.

- **Step 2:**  Calculation of total emissions released during production of exports (sum of emissions calculated in step 1) (see tables 2-4).

- **Step 3:**   Calculation of the energy intensity of exports index (reported in table x) which is the total emissions calculated in step 2) divided by the value of total exports  (for the results see table 5).  Differences in these indicators across countries only reflect differences in the product composition of country exports.  For example, a country with a high proportion of energy-intensive industries would have a higher level of emissions released during production of exports and consequently would have a higher index.  This index does not, however, take into account differences in the emission content of fuels used across countries.  The Australian emission coefficients are based on a high carbon content of fuels used relative to those of other countries.  Consequently the results of step 2 need to be adjusted to correct for differences across countries of the carbon content of fuels to calculate the emission intensity of exports index.

- **Step 4:**   Calculation of emission intensity of exports index (emission level calculated in step 2 multiplied by the ratio of each country's carbon intensity of the economy relative to that of Australia, and then divided by the total value of exports).  The final step is to multiply the estimates of total emissions calculated in step 2 by the carbon intensity of that countries' export industries' energy usage relative to that of Australia's.  This ratio is proxied by the ratio of each country's carbon intensity of the economy to the carbon intensity of the Australian economy.   The resulting new, adjusted emission level is divided by the total value of exports to produce the emission intensity of exports index (see table 5).

The adoption of the above approach assumed that estimates of emission coefficients for the Australian economy could be applied to the production processes of other countries. Across OECD economies, this is a reasonable assumption to make. Examination of Danish energy coefficients (Danmarks Statistik, Input-output tables and analyses 1992) showed little change in the rankings of commodities by energy intensity. In both cases, for example, manufactured goods have a much lower energy intensity than unprocessed or semi-processed goods. That is, in general, as a proportion of the value of final output, the importance of energy as an input becomes less and less for goods of higher and higher manufactured content. (Instead capital and labour become more important components of the final value of such goods).

The largest areas of difference between Australian and Danish coefficients include the groups of minerals and resources, basic metals and energy transformation. In each of these commodity groups Denmark has either a small industry or one which differs markedly in makeup from that of Australia's. Australia, for example, has a large proportion of its basic metals accounted for by the aluminium industry, which is very energy intensive relative to other metals and which would result in the energy coefficient for basic metals having a markedly higher value for Australia than is the case in Denmark. Consequently, use of the Danish coefficients would, in this case, understate the emission intensity of Australia's exports.

One difference in coefficients that stems from differences in technologies relates to the export of gas. In Australia, because of the large distances involved, natural gas must be liquified and transported by tanker to export markets. For other gas exporters, gas is often supplied to export markets by pipeline. While still an energy intensive process relative to say, manufacturing, the energy consumed and emissions released from transporting gas by pipeline would be far less than from using the liquification process. As a result, use of Australian coefficients would tend to overstate the emissions released by other gas exporters.

**Table 1 :Supporting data for the calculation of emission intensity of exports indices**

| *Commodity grouping* | *Emission coefficient (original) (emission units/$A 1986-7)* | *Price deflator* | *Exchange rate ($US/$A)* | *Emission coefficient (emission units/1995 US$)* |
|---|---|---|---|---|
| Electric current | 15.24 | 119 | 0.74 | 17.31 |
| Petroleum and coal products | 10.73 | 119 | 0.74 | 12.18 |
| Gas | 9.97 | 83 | 0.74 | 16.19 |
| Basic metals | 4.50 | 148 | 0.74 | 4.11 |
| Non-metallic mineral products | 2.20 | 133 | 0.74 | 2.23 |
| Fabricated metal products | 1.71 | 107 | 0.74 | 2.16 |
| Chemicals and plastics | 1.24 | 120 | 0.74 | 1.40 |
| Minerals | 0.99 | 118 | 0.74 | 1.14 |
| Meat and milk products | 1.04 | 124 | 0.74 | 1.13 |
| Wood and wood products | 0.88 | 135 | 0.74 | 0.88 |
| Beverages and Tobacco | 0.92 | 112 | 0.74 | 1.11 |
| Machinery and miscellaneous manufacturing | 0.88 | 112 | 0.74 | 1.06 |
| Transport equipment | 0.74 | 133 | 0.74 | 0.75 |
| Textiles, clothing and footwear | 0.56 | 122 | 0.74 | 0.62 |
| Paper and paper products | 0.87 | 138 | 0.74 | 0.85 |
| Agriculture and food products | 1.80 | 116 | 0.74 | 2.11 |

**Table 2: AUSTRALIA: Raw data for the calculation of the emission intensity of exports index**

| | **Exports $USmill** | **Emissions (units)** | **Emission Coefficient (Emission units /$US)** |
|---|---|---|---|
| Electric current | 0 | 0 | |
| Petroleum and coal products | 1,080,713 | 13,168,352 | 12.18 |
| Gas | 1,123,773 | 18,199,092 | 16.19 |
| Basic metals | 7,676,472 | 31,541,384 | 4.11 |
| Non-metallic mineral products | 502,684 | 1,121,122 | 2.23 |
| Fabricated metal products | 1,985,381 | 4,287,701 | 2.16 |
| Chemicals and plastics | 2,151,473 | 3,004,294 | 1.40 |
| Minerals | 12,955,449 | 14,741,701 | 1.14 |
| Meat and milk products | 4,585,008 | 5,203,744 | 1.13 |
| Wood and wood products | 556,114 | 489,870 | 0.88 |
| Beverages and Tobacco | 431,115 | 480,571 | 1.11 |
| Machinery and miscellaneous manufacturing | 7,557,682 | 8,024,566 | 1.06 |
| Transport equipment | 1,738,512 | 1,307,152 | 0.75 |
| Textiles, clothing and footwear | 1,236,130 | 767,725 | 0.62 |
| Paper and paper products | 239,291 | 203,861 | 0.85 |
| Agriculture and food products | 9,154,365 | 19,272,811 | 2.11 |
| **TOTAL** | **52,974,162** | **121,813,945** | **2.30** |
| **Energy intensity of exports index** | | | **2.30** |
| **Emission intensity of exports index** | | | **2.30*** |

* In Australia's case, the energy intensity of exports index is the same as the emissions intensity of exports index

**Table 3: UNITED STATES: Raw data for the calculation of the emission intensity of exports index**

| | **Exports**<br>**$USmill** | **Emissions**<br>**(units)** | **Emission coefficients (Emission units/$US)** |
|---|---|---|---|
| Electric current | 46,649 | 807,325 | 17.31 |
| Petroleum and coal products | 6,085,807 | 74,154,791 | 12.18 |
| Gas | 747,029 | 12,097,861 | 16.19 |
| Basic metals | 12,612,613 | 51,823,191 | 4.11 |
| Non-metallic mineral products | 6,708,391 | 14,961,534 | 2.23 |
| Fabricated metal products | 17,654,370 | 38,127,018 | 2.16 |
| Chemicals and plastics | 61,617,207 | 86,041,608 | 1.40 |
| Minerals | 9,176,306 | 10,441,503 | 1.14 |
| Meat and milk products | 10,572,339 | 11,999,052 | 1.13 |
| Wood and wood products | 7,384,575 | 6,504,931 | 0.88 |
| Beverages and Tobacco | 8,086,069 | 9,013,678 | 1.11 |
| Machinery and miscellaneous manufacturing | 276,664,556 | 293,755,803 | 1.06 |
| Transport equipment | 76,941,431 | 57,850,700 | 0.75 |
| Textiles, clothing and footwear | 24,332,123 | 15,111,977 | 0.62 |
| Paper and paper products | 15,954,242 | 13,592,039 | 0.85 |
| Agriculture and food products | 48,381,150 | 101,857,502 | 2.11 |
| **TOTAL** | **582,964,857** | **798,140,512** | **1.37** |
| **Energy intensity of exports index** | | | **1.37** |
| **Emission intensity of exports index** | | | **1.30*** |

* Calculated as the energy intensity of export index multiplied by the ratio of US to Australian carbon intensity of economies (ie 0.86/0.90)

**Table 4: SWITZERLAND: Raw data for the calculation of the emission intensity of exports index**

| | Exports<br><br>$USmill | Emissions | Emission coefficient (Emission units/$US) |
|---|---|---|---|
| Electric current | 0 | 0 | |
| Petroleum and coal products | 70,780 | 862,445 | 12.18 |
| Gas | 10,307 | 166,918 | 16.19 |
| Basic metals | 1,978,513 | 8,129,391 | 4.11 |
| Non-metallic mineral products | 2,629,592 | 5,864,704 | 2.23 |
| Fabricated metal products | 4,372,499 | 9,443,007 | 2.16 |
| Chemicals and plastics | 21,235,993 | 29,653,713 | 1.40 |
| Minerals | 217,808 | 247,839 | 1.14 |
| Meat and milk products | 519,277 | 589,352 | 1.13 |
| Wood and wood products | 481,482 | 424,128 | 0.88 |
| Beverages and Tobacco | 545,023 | 607,546 | 1.11 |
| Machinery and miscellaneous manufacturing | 40,500,062 | 43,001,996 | 1.06 |
| Transport equipment | 1,616,941 | 1,215,745 | 0.75 |
| Textiles, clothing and footwear | 4,321,665 | 2,684,061 | 0.62 |
| Paper and paper products | 1,559,266 | 1,328,399 | 0.85 |
| Agriculture and food products | 1,581,940 | 3,330,480 | 2.11 |
| **TOTAL** | **81,641,148** | **107,549,726** | **1.32** |
| **Energy intensity of exports index** | | | **1.32** |
| **Emission intensity of exports index** | | | **0.28*** |

* Calculated as the energy intensity of export index multiplied by the ratio of Swiss to Australian carbon intensity of economies (ie 0.19/0.90).

**Table 5: Emission intensity of exports indices and energy intensity of exports indices**

| | Emissions intensity of exports *index* | Energy intensity of exports *index* |
|---|---|---|
| Australia | 2.3 | 2.3 |
| Canada | 1.6 | 1.9 |
| Denmark | 0.7 | 1.4 |
| France | 0.5 | 1.6 |
| Germany | 0.7 | 1.3 |
| Iceland | 0.4 | 1.5 |
| Italy | 0.5 | 1.3 |
| Japan | 0.5 | 1.2 |
| Netherlands | 1.4 | 2.2 |
| New Zealand | 0.9 | 1.5 |
| Norway | 0.8 | 2.8 |
| Spain | 0.7 | 1.5 |
| Sweden | 0.4 | 1.4 |
| Switzerland | 0.3 | 1.3 |
| United Kingdom | 0.9 | 1.5 |
| United States | 1.3 | 1.4 |

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