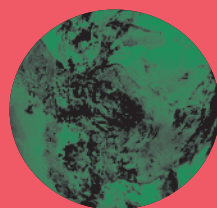
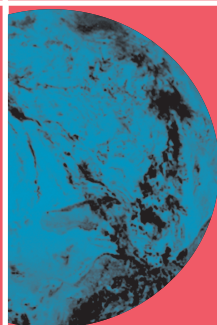
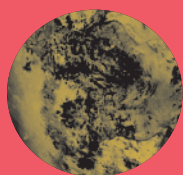
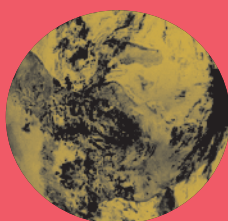
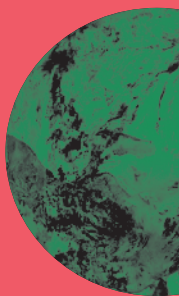




Sustainable Development in OECD Countries

GETTING THE POLICIES RIGHT



OECD



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Sustainable Development in OECD Countries

GETTING THE POLICIES RIGHT



ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

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Foreword

OECD work in the area of sustainable development has been primarily driven by the desire to advance member countries along a balanced path of economic, environmental and social development.

The OECD identified general priorities for action in *Policies to Enhance Sustainable Development*, published in 2001. The OECD Ministerial Council in 2001 asked the Organisation to further develop its work in this area, and several projects were initiated to respond to this mandate. The results of these different projects will be published in a series of books on sustainable development.

Based on thirty country peer reviews of sustainable development policies, which were published in the OECD Economic Surveys, this volume follows previous work by looking at the policies that have actually been implemented on a country-by-country basis and makes recommendations both for reforms of existing policies and for the introduction of new policies. The focus is on ways to lower the economic costs of improving environmental and social outcomes.

This report has been prepared by Richard Herd, Boris Cournede and Douglas Sutherland, with the assistance of Isabelle Wanner-Paoletti and under the supervision of Sveinbjörn Blöndal.

In 2005, further volumes on this topic will be published and will consider obstacles to reducing environmentally harmful subsidies and to the further use of economic instruments; sustainable resource use, including material flow accounting; and decoupling of environmental pressures from economic growth and resource productivity.

Table of Contents

Executive Summary	9
Chapter 1. Achieving Environmental Objectives in a Cost-efficient Way	15
1. Performance	16
2. Policies	26
Notes	44
References	45
Chapter 2. Attaining Social Objectives in a Cost-efficient Way	49
1. Ensuring adequate and sustainable retirement income	50
2. Improving living standards in developing countries	65
Notes	75
References	76
Chapter 3. Reducing Emissions of Greenhouse Gases	79
1. Introduction	80
2. Objectives and performance	80
3. Policies	89
Notes	104
References	105
Chapter 4. Reducing Air Pollutants	107
1. Introduction	108
2. Objectives and performance	108
3. Policies	118
Notes	130
References	132
Chapter 5. Reducing Water Pollution and Improving Natural Resource Management	135
1. Introduction	136
2. Objectives and performance	136
3. Policies	140
Notes	152
References	152

<i>Chapter 6. Reducing and Improving Management of Waste</i>	153
1. Introduction	154
2. Performance	154
3. Policies	154
Notes	167
Reference	168
<i>Chapter 7. Policy Integration for Sustainable Development Areas</i>	169
1. Introduction	170
2. Cost-benefit analysis	171
3. Alternative integration tools	173
4. National sustainable development policy frameworks	174
Note	176
<i>Annex A. Sustainable Development Indicators</i>	177

List of Boxes

3.1. Estimating the marginal benefit of reducing greenhouse gas emissions	81
3.2. The EU trading scheme	102
4.1. Integrating social and environmental concerns in air policy through cost benefit analysis	109
5.1. OECD countries' policies to tackle nitrate pollution from agriculture	144
5.2. Sustainability issues in fisheries management	149
6.1. The externality costs of landfills and incineration	161

List of Tables

0.1. Country coverage of topics for sustainable development reviews ...	11
1.1. Reducing greenhouse gas emissions: policy recommendations ...	17
1.2. Reducing air pollution: policy recommendations	19
1.3. Reducing water pollution: policy recommendations	21
1.4. Waste management: policy recommendations	22
1.5. Selected environmental performance indicators	23
1.6. Selected future targets for environmental policy	24
1.7. The use of voluntary agreements	28
1.8. The use of environmental taxes	34
1.9. The use of cost-benefit and environmental-impact analyses in OECD countries	40
2.1. Ensuring sustainable retirement income: summary of policy recommendations	51
2.2. Performance indicators: sustainable retirement income	52
2.3. Reforms to retirement income systems	56

2.4. Expected gross replacement rate in pension system over next five years	57
2.5. Standard and early ages of entitlement to old-age pension benefits ...	62
2.6. Implicit tax rates on continued work at older ages in old-age pension systems	64
2.7. Development indicators by geographical area and income level	66
2.8. OECD non-energy imports from developing countries	69
2.9. Official development assistance (ODA)	70
2.10. Domestic spending and donor assistance on health	71
2.11. Preferential tariff rates for developing countries	72
3.1. Countries' performance towards adopted objectives	83
3.2. Main indicators: climate change	86
3.3. Greenhouse gas emissions and sectoral indicators	87
3.4. Policy recommendations in Country Surveys	90
3.5. National climate change policies: a summary	92
3.6. Abatement costs of measures promoting renewable sources of energy	95
3.7. Rates of CO ₂ taxation in OECD countries that introduced carbon taxes	98
4.1. OECD countries' performance towards internationally agreed emission targets	112
4.2. Health-related air quality standards in selected OECD countries. ...	115
4.3. Main indicators: air pollution	116
4.4. OECD countries performance in curbing urban air pollution	117
4.5. Main policy recommendations in country surveys	119
4.6. Main policy instruments used to reduce air pollution	120
4.7. Permit prices and tax levels for air pollutants	123
5.1. Water pollution: main indicators	137
5.2. International water supply use comparison	138
5.3. Policy recommendations in country surveys	141
5.4. Main policy instruments used to reduce water pollution	142
5.5. Water management policies: a summary	146
5.6. Water management: policy recommendations in country surveys ..	147
5.7. Main indicators: fisheries	149
5.8. Fisheries management policies: a summary	150
5.9. Fisheries management: recommendations in country surveys	150
6.1. Performance indicators: municipal waste	155
6.2. Recycling rates for different categories of raw material	157
6.3. Recommendations on waste management in country surveys: a summary	158
6.4. Recycling targets in Europe	159
6.5. Waste disposal policy instruments	160

6.6. Recycling of packaging material: fees and operational characteristics	163
7.1. The use of cost-benefit and environmental impact analyses in OECD countries	172
A.1. Reducing emissions of greenhouse gases: main indicators	178
A.2. GHG emissions and sectoral indicators	179
A.3. Reducing air pollution: main indicators	181
A.4. Reducing air pollution in cities: performance indicators	182
A.5. Reducing water pollution: main indicators	183
A.6. Improving natural resource management: main indicators for water supply	184
A.7. Improving natural resource management: main indicators for fisheries	185
A.8. Improving natural resource management: main indicators for forestry	186
A.9. Reducing and improving the management of municipal waste: main indicators	187
A.10. Improving living conditions in developing countries: OECD non-energy imports from developing countries	189
A.11. Improving living conditions in developing countries: official development assistance (ODA)	190
A.12. Ensuring adequate and sustainable retirement income: main indicators	191

List of Figures

2.1. Bilateral development assistance, poverty and shortfall in life expectancy	67
2.2. The share of developing country groups in world trade	68
2.3. Average tariff rates by country	71
4.1. The damages from air pollution in OECD countries as a share of GDP	111
4.2. The pattern of marginal abatement costs with command-and-control regulation	122
4.3. The sulphur content of motor fuels	126
4.4. Vehicle emission standards	127
4.5. New standards for vehicles and fuels: impact on air pollutant emissions and concentrations	128
4.6. Car acquisition taxes and the average age of vehicles	129
4.7. Annual air pollution external costs of on-road vehicles registered in EU countries from 2004	130
5.1. Water abstraction by final use	139
5.2. Expenditure on wastewater	143
6.1. Waste disposal costs and recycling rates	165

Executive Summary

Since the Earth Summit of 1992, OECD countries have been intensifying efforts to promote global economic development that is environmentally and socially sustainable. What have they achieved so far? What steps have been taken to enable economic growth to satisfy current needs while using natural and social resources in a way that preserves the ability of future generations to prosper? Rising awareness of this crucial question has brought the promotion of sustainable development to the forefront of public debate. The OECD has contributed to this debate by reviewing the extent to which its 30 member countries are meeting their sustainable development objectives.

This publication presents the lessons learnt from the 30 country reviews that have been published since 2002 as part of the regular *OECD Economic Surveys*. This publication also looks at the concrete action that countries have taken to promote sustainable development whilst focusing on two central questions:

- What have been the results when objectives have been set and policies introduced?
- Have these results been achieved efficiently?

The first question examines progress towards a goal in “one-dimensional sustainable development”, whether economic, social or environmental. The second question focuses on the extent to which policy aims at attaining a goal in one dimension while minimising the adverse outcomes induced in other dimensions as a result. The policy goals themselves have been taken as given and this report does not attempt to assess their relevance.

Each country review focuses on three topics from a list of seven major policy areas, selected for their particular relevance to the country examined. These are as follows:

- **Improving environmental areas:**
 - ❖ Reducing emissions of greenhouse gases.
 - ❖ Reducing air pollutants.
 - ❖ Reducing water pollution.
 - ❖ Moving towards sustainable use of renewable and non-renewable natural resources.
 - ❖ Reducing and improving management of waste.
- **Improving living standards in developing countries.**
- **Ensuring sustainable retirement income policies.**

In accordance with the focus on sustainability, the topics involved issues of irreversibility or, at least, a strong degree of permanence. At the same time, the choice of issues was based also on their analytical content. To gauge performance in the seven policy areas, a series of performance indicators (see Annex) were used to allow for cross-country comparisons.

Table 0.1. **Country coverage of topics for sustainable development reviews**

	Reducing emissions of greenhouse gases	Reducing air pollution	Reducing water pollution	Sustainable use of renewable and non-renewable resources	Reducing and improving management of waste	Improving living standards in developing countries	Ensuring sustainable retirement income policies
Australia				X		X	X
Austria	X				X	X	
Belgium		X			X		X
Canada		X	X				X
Czech Republic	X	X					X
Denmark	X		X		X		
Finland	X	X		X			
France	X		X				X
Germany		X			X		X
Greece	X	X					X
Hungary	X	X					X
Iceland	X	X		X			
Ireland	X		X		X		
Italy	X		X				X
Japan		X				X	X
Korea		X			X		X
Luxembourg	X					X	X
Mexico		X	X	X			
Netherlands	X		X	X			
New Zealand	X		X			X	
Norway				X	X	X	
Poland	X		X		X		
Portugal		X	X	X			
Slovak Republic	X	X					X
Spain	X			X	X		
Sweden		X	X		X		
Switzerland	X		X		X		
Turkey	X	X		X			
United Kingdom	X					X	X
United States	X		X	X			
Total	20	15	13	10	11	7	14
Percentage distribution	22	17	14	11	12	8	16

The synthesis of the lessons learnt from the country reviews is presented in two parts. Part I gives the main conclusions and consists of two chapters: and. Chapter 1, “Attaining Environmental Objectives in a Cost-Efficient Way”, provides a synthesis across the different environmental areas and countries. Chapter 2, “Attaining Social Objectives in a Cost-Efficient Way”, gives separate syntheses of the country reviews on ensuring sustainable retirement incomes and improving living standards in developing countries, as the issues differ across the two areas. Part II consists of five thematic chapters that pull together the lessons learnt in each environmental policy area in greater detail.

Improving environmental areas

In the selected environmental areas examined in the country reviews, performance has improved in several respects since 1990, and governments are targeting further improvements in the next decade. However, **environmental protection costs** have risen throughout this period and are likely to be equal to around 2% of GDP or more in countries that have set comparatively demanding standards. For most of the OECD countries, the reviews highlighted that costs could have been kept lower by greater use of more cost-efficient instruments. An option not exploited in part because of a lack of integration of environmental and economic concerns in policy making. Concerns over the social consequences, in addition to political-economy considerations, also appear to have boosted costs. For the future, several country reviews noted that the **cost of pollution abatement** could rise markedly as standards become stricter, therefore emphasising the need to employ the most cost-efficient options in **reducing pollution** in the coming years. This is particularly the case with the **reduction of greenhouse gas emissions**, where policies to meet objectives at the least cost become increasingly urgent as the target date (2008 to 2012) approaches.

Recommendations: Against this background, country surveys have recommended fundamental changes in policy settings to achieve environmental objectives at a lower economic cost. In view of the **lack of effectiveness of voluntary agreements**, the reviews have called for a reassessment or a termination of such practices. Also, while recognising that regulations are the most appropriate instrument to control pollution in some cases, the surveys generally recommended that **less emphasis should be placed on such instruments** for the purpose of improving the environment. Mounting evidence has suggested that preventing companies from using the most efficient ways to reduce their emissions typically increases costs for society. Instead, the country surveys concluded that **greater use should be made of taxes or tradeable emission permits**. However, these instruments will only be cost efficient if they cover all sources of any given type of

pollution, and hence the surveys called for the removal of current exemptions from carbon and water pollution taxes in the most pollution-intensive industries. For dealing with **cross-border environmental problems**, the reviews often recommended taking advantage of **international agreements that allow abatement** to be concentrated in areas where it could be obtained at relatively low cost and noted the benefits of further international co-operation. Insofar as taxes and tradeable permits have adverse social consequences, these should be mitigated **through the standard social security system**. In some cases this could mean adjusting the way support payments are calculated or introducing new support instruments.

Improving living standards in developing countries

On the critical issue of improving living standards in developing countries, the surveys showed that there has been a certain amount of progress since 1990, but also noted that Sub-Saharan Africa has not shared in this general trend. In other developing country groups, improvements in **living standards have been accompanied by strong export performance**, which in part reflects falling protectionist barriers in the OECD countries in the wake of the Uruguay Round and unilateral measures to open up markets to the least-developed countries. However, **agricultural products from the developing countries still face problems** in accessing OECD markets because of trade restrictions and agricultural subsidies. Living standards in developing countries have also been lifted by **increased emphasis on poverty alleviation** in official development assistance.

Recommendations: The reviewed countries were encouraged to scale back support to agriculture. A number of the reviewed OECD countries had taken measures to make their official development assistance more targeted and efficient, and the surveys recommended further moves in that direction.

Ensuring sustainable retirement income policies

With respect to the social dimension of sustainable development, the reviews concluded that a number of countries have made substantial progress in **containing the fiscal pressures of ageing** in coming decades without compromising the level of income for the elderly. Common elements of reforms in most of these countries have been to: **reduce public pension replacement rates** in coming years, which will in turn reduce fiscal outlays; automatically **adjust pensions to changes in life expectancy**, while at the same time **increase private saving** for retirement either through mandatory means or by granting tax advantages to private pensions; and **establish**

minimum pensions to ensure adequate income. Countries are at different stages in the process of reform; most have further to go to offset the fiscal consequences of ageing, whereas some have hardly started to tackle this challenge.

Recommendations: In this area, the recommendations of the surveys were for countries to **strengthen their sustainability assessments** and to take swift corrective measures if needed. Corrective measures would most likely be a reduction in public pension replacement rates in addition to other changes in pension and income-replacement systems. With private pensions likely to play a bigger role in income provision in old age, some of the reviews also emphasised the need for appropriate prudential **regulation and supervision of private pension funds**. A few countries were even called on to reduce restrictions on the type and use of retirement saving in order to make it more attractive. Practically all countries reviewed on this policy topic were encouraged to **remove incentives that artificially shorten the working life of their citizens**, as earned income would provide the elderly with an additional resource and could reduce public spending on pensions and other transfers. Recommendations for this purpose included raising the standard age of entitlement to public pensions and reducing opportunities to withdraw from the labour force permanently at an early age via unemployment, disability or special benefit schemes.

Chapter 1

Achieving Environmental Objectives in a Cost-efficient Way

In the wake of the Earth Summit of 1992, OECD countries renewed their efforts to preserve the environment, adopting ambitious objectives and introducing new policy instruments. This chapter reviews performance and objectives in five key environmental areas: climate change, air pollution, water pollution, waste management and natural resource management, and provides data on the costs of environmental policies. On the basis of thirty country reviews, the chapter then examines the extent to which the various instruments used for environment protection (such as voluntary agreements, regulation, environmental taxes and tradeable permits) have been efficient. It also presents the recommendations adopted as a result of the peer reviews with a view to reducing the economic costs of environmental improvement.

OECD countries have taken a number of measures to strengthen the environmental pillar of sustainable development. For the five environmental areas chosen for the reviews, the country surveys examined if policy settings were attaining the environmental objectives at the least economic cost to society and made recommendations for policy changes to improve cost efficiency in these areas. The detailed policy recommendations by area and country are summarised in Tables 1.1 to 1.4. Chapters 3 to 6 provide a synthesis of the lessons learnt in the individual environmental policy areas. This section pulls together the overall lessons that can be drawn from the five different areas.

1. Performance

Performance has differed across the five environmental areas examined in the country reviews (Table 1.5 and Annex):

- *Greenhouse gas emissions* fell in the 1990s in almost half of all OECD countries. In the countries where emissions continued to rise, which included the United States and Japan, the rate of increase slowed down. Virtually all countries achieved a relative decoupling of emissions from economic growth. However, at the global level, the concentration of greenhouse gases continued to rise.
- *Emissions and concentrations of traditional air pollutants* fell in the 1990s in most OECD countries. Sulphur-dioxide emissions and concentrations fell strongly in virtually all countries, while those of nitrogen-oxides remained unchanged or even rose in a few countries. Relative to GDP, there was a notable fall in emissions in all countries.
- *Surface water quality* has generally improved in the OECD countries since the early 1980s. Pollution by organic matter and phosphates has declined in all countries (except Mexico), though some local problems remain in a few cities (Brussels, Milan, Porto). The average concentration of nitrate has fallen in the 22 countries for which data are available.
- *Natural resource use* in the areas covered by the reviews has shown mixed trends. Groundwater resources continue to be depleted rapidly in some countries, and only a few countries are managing their fish stocks in a sustainable fashion. On the other hand, water use has declined in absolute terms in many countries.¹

Table 1.1. Reducing greenhouse gas emissions: policy recommendations

	Austria	Czech Republic	Denmark	Finland	France	Greece	Hungary	Iceland	Ireland	Italy	Luxembourg	Netherlands	New Zealand	Norway	Poland	Slovak Republic	Spain	Switzerland	Turkey	United Kingdom	United States
Plan to import international emission permits					X					X	X			X			X	X			
Price emissions from power plants (with taxes or permits)	X			X					X		X	X			X	X	X	X		X	X
and suppress carbon taxes on electricity use	X			X					X		X	X								X	
and re-consider restrictions on the use of nuclear reactors																	X				
and stop subsidising, or exempting from tax, coal and peat		X		X				X	X	X							X		X	X	
Improve the cost-effectiveness of the renewables part of the climate change strategy		X	X	X	X	X	X				X	X	X				X	X		X	
by scaling down support to wind power and					X	X	X				X	X								X	
by scaling down support to biomass		X	X									X								X	
by aligning incentives across sub-national levels of government																					X
Reduce support to combined heat and power (CHP) plants			X								X	X									
Put a single price on industry emissions with taxes or permits	X			X					X		X	X		X		X	X	X			X
and wind down exemptions granted to industry				X								X	X	X							
and end voluntary agreements with industry					X				X			X									
Use fuel pricing instead of regulations and standards to improve energy efficiency in the residential and service sectors.	X	X		X			X				X					X			X		
Begin building an infrastructure for emissions trading	X										X			X	X	X		X			X
and use the price of permits to prompt the same level of efforts in non-covered sectors,	X		X		X	X					X	X		X	X	X	X	X		X	X
by adjusting fuel tax rates accordingly	X		X			X					X	X		X			X	X		X	

Table 1.1. **Reducing greenhouse gas emissions: policy recommendations** (cont.)

	Austria	Czech Republic	Denmark	Finland	France	Greece	Hungary	Iceland	Ireland	Italy	Luxembourg	Netherlands	New Zealand	Norway	Poland	Slovak Republic	Spain	Switzerland	Turkey	United Kingdom	United States
and, more broadly, by replacing voluntary and regulatory measures with economic instruments that make emitters pay a price close to that of permits in the emissions trading scheme.					X	X					X										
Tax permits, unless they can be auctioned in the first place, and use revenues to reduce distortive taxes		X	X				X				X				X			X			
Scale down abatement efforts in the road transport sector	X				X					X	X							X			
Tax emissions from air and sea transport					X			X													
Create efficient incentives for carbon sequestration								X					X								
Use specific instruments to address objectives of social and regional policies instead of skewing GHG abatement efforts				X												X			X		
Plan to import international emission permits					X					X	X			X			X	X			

Table 1.2. Reducing air pollution: policy recommendations

	Belgium	Canada	Czech Republic	Finland	Germany	Greece	Hungary	Iceland	Japan	Korea	Mexico	Portugal	Slovak Republic	Sweden	Turkey
Large stationary sources															
Unwind command-and-control regulations and rely more on economic instruments instead	X	X	X	X	X	X	X		X	X	X	X	X	X	
By introducing or raising emissions charges			X		X		X				X		X	X	
Or alternatively by introducing emissions trading	X	X	X	X	X	X	X			X		X			
Without restricting cross-regional trading	X	X								X					
While opting out from the EU LCP directive	X		X	X	X	X						X	X		
Reduce industrial emissions of PM		X													
Improve monitoring and enforcement capabilities															X
Mobile and diffuse sources															
Place higher taxes on more polluting fuels in the residential and transport sectors.															X
Abandon one-off taxes on the purchase of cars in favour of annual or mileage-based taxes						X						X			
Differentiate recurring car taxes according to emission characteristics			X				X		X			X	X	X	
Ultimately implement an emission-based mileage charge			X		X		X		X	X				X	
Continue to tighten engine emission standards								X	X	X					
Especially for heavy vehicles									X	X					
Reduce the sulphur content of fuels	X								X	X	X		X		

Table 1.2. **Reducing air pollution: policy recommendations** (cont.)

	Belgium	Canada	Czech Republic	Finland	Germany	Greece	Hungary	Iceland	Japan	Korea	Mexico	Portugal	Slovak Republic	Sweden	Turkey
More specifically to tackle PM pollution:	X	X		X	X	X		X	X	X		X		X	
Eliminate the tax advantage of diesel fuel over petrol	X			X	X	X				X		X		X	
Tax studded tyres								X							
Tighten vehicles PM emissions standards					X			X	X					X	
Reduce emissions from non-road sources, such as		X		X										X	
Off-road vehicles		X													
The burning of wood		X		X										X	
By taxing wood				X											

Source: OECD Economic Surveys.

Table 1.3. **Reducing water pollution: policy recommendations**

	Canada	Denmark	France	Ireland	Italy	Mexico	Netherlands	New Zealand	Portugal	Sweden	Switzerland	United States
Improve the availability of nation-wide information on water quality	X							X				
Better quantify the benefits of reducing pollution loads		X	X		X					X	X	X
Strengthen water basin authorities and develop integrated plans to reduce water pollution					X	X	X					
For industrial plant discharges,												
Strengthen the enforcement of existing controls and charges						X			X			
Introduce, or modify, emission taxes to generate a clear link between discharges and the amount of tax paid			X							X		
Allow trading in discharge permits within catchments								X	X			
For municipal sewage discharges												
Close gaps in wastewater treatment infrastructure					X	X			X			
Price the use of wastewater services in line with full costs	X			X	X	X		X	X			
For point discharges from large livestock rearing units,												
Enforce existing regulations and charges more strictly			X	X								
For diffuse on-farm emissions												
Reinforce controls on manure spreading and fertiliser use				X				X				X
Enforce existing legislation more effectively			X	X					X			
Make agricultural support payments conditional on good practice										X		
or scale them down											X	
Make greater use of economic instruments, notably by	X	X	X	X	X							
Taxing nitrogen surpluses, or		X	X	X	X				X	X	X	
Increasing the rates of existing charges, or							X					
Introducing (or expanding) tradeable discharge permits	X							X	X			X

Table 1.4. **Waste management: policy recommendations**

	Austria	Belgium	Denmark	Germany	Ireland	Korea	Spain	Sweden	Switzerland
Bring costs in line with benefits in different waste streams		X	X					X	
Base landfill taxes on the externality cost	X		X		X	X			
Better management of landfills							X		
Place a cap on recycling costs	X	X		X		X	X	X	X
Avoid ambitious recycling targets					X				
Lower costs of waste management									
Through increased competition		X		X					X
Through benchmarking		X							
Through trading across municipalities								X	
No discrimination against one-way beverage containers				X					
Establish appropriate waste disposal charges						X		X	X

- *Municipal waste generation* has remained on a rising trend in most member countries. However, relative to private consumption, it has fallen in just under half of all OECD countries.

The broad-brush picture painted above indicates that major environmental improvements have been achieved since 1990, the major exception being the continued rise in GHG emissions at the level of the OECD area as a whole.

For future performance, OECD governments have targeted a substantial fall in emissions of pollutants and greenhouse gases (Table 1.6). In the area of greenhouse gases, most member countries will have to reduce their emissions substantially if the targets set in the Kyoto Protocol for 2008-2012 are to be met. In subsequent commitment periods, abatement targets would have to become more ambitious to stabilise global temperatures,² with official documents in the United Kingdom and France suggesting targeted cuts in domestic emissions of half or more by mid-century. For air pollutants, most countries will also have to reduce their emissions of sulphur dioxide, nitrogen oxides and volatile organic compounds to attain their targets set for 2010. For water pollution, international conventions call for major declines in nitrate emissions to European coastal waters. And although municipal waste generation is likely to rise in the coming years, ambitious targets for more extensive treatment of waste (such as recycling) may reduce their environmental costs.

Table 1.5. **Selected environmental performance indicators**

1990 = 100

	Greenhouse gases	Sulphur dioxide	Nitrogen oxides	Volatile organic compounds	Nitrogen soil balance
	Emissions				
	2000	2000 or most recent year ¹			1997
Australia	118.2	103.5	117.0	106.7	105.6
Austria	103.1	44.9	91.0	66.4	72.5
Belgium	106.7	48.7	122.0	92.2	88.0
Canada	119.6	74.0	97.6	94.7	386.7
Czech Republic	76.4	14.1	53.5	56.7	59.1
Denmark	98.8	15.2	75.0	77.2	81.7
Finland	95.9	29.0	78.7	77.5	65.9
France	98.3	51.0	79.6	73.6	79.4
Germany	81.1	13.5	59.0	49.7	69.5
Greece	124.0	97.6	112.6	125.0	43.0
Hungary	83.0	48.1	85.5	74.0	−92.6
Iceland	106.9	114.2	98.1	64.0	103.3
Ireland	124.8	71.9	108.0	80.1	103.9
Italy	105.1	44.1	70.2	74.3	76.6
Japan	111.2	96.7	100.2	90.0	84.1
Korea	..	59.0	122.8	66.4	93.4
Luxembourg	44.4	21.0	73.1	69.9	..
Netherlands	103.6	43.9	68.0	53.7	96.1
New Zealand	105.2	119.9	118.4	107.8	587.1
Norway	106.3	50.6	99.6	119.0	160.0
Poland	84.0	47.1	65.5	72.1	53.8
Portugal	130.4	100.5	130.3	114.4	87.1
Slovakia	66.7	22.9	46.8	43.9	..
Spain	134.8	70.4	112.2	92.2	102.4
Sweden	98.3	54.9	74.6	79.7	102.6
Switzerland	99.1	45.4	62.5	57.6	88.3
United Kingdom	87.4	30.6	55.8	58.7	85.4
United States	114.2	79.0	103.0	96.8	107.9
Total of above OECD countries	106.7	63.0	94.4	86.3	97.8

1. Most recent year is 1999 for Australia, Japan, Korea and New Zealand.

Source: OECD Environmental Database, European Environmental Agency and European Monitoring and Evaluation Programme.

The general strengthening of the environmental pillar of sustainable development in the past has come at a cost to the economic pillar. Comprehensive data on the total economic costs, or on public and private outlays, associated with abatement are not available for OECD countries.³

Table 1.6. **Selected future targets for environmental policy**

	Kyoto Protocol				Air pollutants emissions			Waste	
	Agreed reduction in net emissions		Agreed minimum reduction in emissions		Agreed reduction in emissions			Minimum recycling rate	
	Kyoto	EU limits	Overall	EU limits	SO ₂	NO _x	VOC	Packaging	Any material
	2008-2012, per cent of 1990 level				2010, ¹ per cent of 2000 level			2006 ²	
Austria	-8.0	-13.0	-6.5	-9.0	95	56	67	55	20
Belgium	-8.0	-7.5	-6.5	-6.4	48	48	47	55	20
Denmark	-8.0	-21.0	-6.5	-19.2	196	61	65	55	20
Finland	-8.0	0.0	-6.5	1.8	145	72	80	55	20
France	-8.0	0.0	-6.5	1.6	45	49	45	55	20
Germany	-8.0	-21.0	-6.5	-19.6	63	64	60	55	20
Greece	-8.0	25.0	-6.5	26.3	97	90	66	55	20
Ireland	-8.0	13.0	-6.5	14.3	27	55	58	55	20
Italy	-8.0	-6.5	-6.5	-5.4	51	67	69	55	20
Luxembourg	-8.0	-28.0	-6.5	-26.7	133	65	69	55	20
Netherlands	-8.0	-6.0	-6.5	-5.0	50	64	66	55	20
Portugal	-8.0	27.0	-6.5	29.2	43	68	37	55	20
Spain	-8.0	15.0	-6.5	16.9	47	65	36	55	20
Sweden	-8.0	4.0	-6.5	8.0	94	55	56	55	20
United Kingdom	-8.0	-12.5	-6.5	-10.9	49	73	77	55	20
Canada	-6.0		5.0						
Czech Republic	-8.0		-6.4		107	72	89		
Hungary	-6.0		-4.0		93	90	92		
Iceland	10.0		20.2						
Japan	-6.0		-1.2						24
Korea									20
New Zealand	0.0		40.6						
Norway	1.0		5.0		79	65	56		
Poland	-6.0		-4.5		92	105	134		
Slovakia	-8.0		-4.4		61	100	139		
Switzerland	-8.0		-3.5		93	75	82		
United States									

1. 1998 for Belgium, France, Greece, Hungary, Slovakia, Spain, Switzerland. 1999 for Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Sweden, United Kingdom, United States.

2. 2010 for Japan, 2009 for Greece, Ireland and Portugal.

However, incomplete and patchy data suggest that environmental abatement costs could already amount to the equivalent of 2 percentage points of GDP or more in many countries:

- Total greenhouse gas abatement costs have so far been small in most countries, reflecting that major programmes to cut emissions have yet to be put in place. Thus, notwithstanding high costs of abatement in some GHG mitigation programmes (such as renewable energy and some regulations, see below), the induced emission cuts are small and hence the total costs are low. Indeed, major abatement in the past has arguably gone hand in hand with higher economic efficiency, since it has mainly come as a by-product of regulatory reforms of the electricity industry, improved resource allocation in the transition countries and a reduction in support to coal use.
- The estimated total costs of air pollution mitigation programmes are significant. For example, additional costs of the new air pollution policies introduced in the United States between 1990 and 2002 have been estimated at 0.25 per cent of GDP (United States Office of Management and Budget, 2003) coming on top of costs estimated at 0.5 per cent of GDP at the end of the 1980s (United States Environmental Protection Agency, 1990). In European countries, the annual costs of air pollution policies introduced between 1990 and 1999 have been estimated at 1 per cent of GDP (Holland, 1999).
- Water pollution control costs are high in several countries. Data collected by the OECD shows that expenditure on reducing pollution from wastewater exceeded $\frac{3}{4}$ per cent of GDP in 2000 in Denmark, France and Norway (see Table 5.2) and were at a similar level in the United States at the beginning of the 1990s.
- Waste collection and treatment outlays amount on average to 0.5 per cent of GDP in the OECD area. For Austria and Denmark, the cost exceeds 1 per cent of GDP; for Australia, Ireland, Japan, Mexico it is recorded to be lower than one-tenth of 1 per cent of GDP.

As noted below, these costs are likely to be unnecessarily high, with the reported evidence suggesting that cost reductions of more than one-quarter are possible in most established anti-pollution activities when efficient instruments are used instead.

In general, the failure of countries to systematically analyse cost and benefits (see below) makes it difficult to assess the overall welfare implications of environmental measures currently in place. However, the evidence reported in the surveys suggested consistently that marginal abatement costs for air pollution were significantly lower than the associated benefits obtained. By contrast, for greenhouse gas emissions, waste management and water pollution, there are doubts as to whether current programmes have delivered benefits at the margin that are commensurate

with costs (see discussions in Chapters 3, 5 and 6). Marginal benefit-cost ratios are likely to differ significantly across natural resource areas, depending *inter alia* on the method of management.

Environmental protection costs are likely to rise significantly in the future if technology does not change. Thus, greenhouse gas emission policies designed to reach Kyoto targets in the next eight years are just being implemented and will imply extra costs. Also, air pollution regulations are being tightened and will imply extra spending to refit or replace older plants. Moreover, water treatment facilities will need to be upgraded in a number of countries (Ireland, Mexico, New Zealand and Switzerland) at costs of between ½ and 1 per cent of GDP. In all of the above areas, and in the waste management sector, member countries adhering to the European Union shortly (Czech Republic, Hungary, Poland and the Slovak Republic) will face the extra costs of implementing EU environmental directives. The European Commission estimates that over the next 20 years the annual average level of expenditure on both investment and running costs for this purpose will have to rise by between 1.3 and 2.9 per cent of GDP in these countries. The prospect of rising costs in the future highlights the importance of using the most cost-efficient methods in improving the environment.

2. Policies

Achieving environmental goals at the lowest cost to society is an important goal of public policy. Keeping the economic burden of environmental improvement to a minimum requires that polluters pay for the harm that they inflict on the environment (the “polluter-pays principle”) and that the instruments used equalise the marginal cost of reducing a given type of pollution in all sectors of the economy.⁴ This section reviews the different instruments employed for improving the environment in this light and highlights the recommendations that country surveys have made concerning the choice of instruments. It also examines the analytical and administrative tools that would result in the employment of the most cost-efficient instruments, and how the choice is influenced by social and political-economy considerations.

2.1. The cost efficiency of different instruments

A wide range of instruments are available for attaining environmental policy objectives. *Voluntary approaches* constitute the broadest category, and are extensively used. They take many different forms, with varying degrees of legal force, as they range from unilateral pledges by companies, in which case public scrutiny is the only enforcement means, to commitments by business associations backed by peer surveillance and contracts. The public authorities can also subject companies directly to *environmental regulations*. These

administrative approaches are often structured around the specification of maximum quantities of pollutants that plants can release to the environment. If the authorities can define emission caps precisely, then they have the possibility to allow emitters to trade in their quotas. Such *allowance trading* schemes are gaining ground rapidly as their flexibility enables targets to be met at least cost. Another way to allocate pollution abatement efforts in an economically efficient manner is the imposition of *environmentally-related taxes* so as to make polluters pay in line with the costs that pollutants impose on society.

2.1.1. Voluntary agreements

The use of voluntary agreements has been widespread. Examples of such agreements include air-pollution control (Japan and Korea), greenhouse gas emissions (Canada, France, Korea and the United States), energy efficiency (Denmark and Germany), packaging waste (Australia and the Netherlands), pesticide control (United Kingdom), nitrate discharges from the farming sector (Italy, Netherlands and Sweden), selected chemical emissions (United States), and fuel efficiency of cars (cross-country agreement between the car industries of Japan, Korea and Europe and the European Commission). By the late 1990s, more than 300 voluntary agreements had been identified in the 15 countries of the European Union. While agreements covered all sectors, there was a preponderance of them in waste management and the control of greenhouse gas emissions (Table 1.7). Indeed, amongst the reviewed countries, voluntary agreements remained one of the most frequently used instruments in climate-change policy (Annex Table A3.5).

Voluntary agreements can be useful in revealing information on abatement costs and disseminating information on environmental costs and impacts. When they include targets for individual companies, pollution monitoring and trading provisions, they can also represent a first step towards a fully-fledged cap-and-trade scheme by helping to develop the necessary infrastructure, such as certified emission accounts. However, when concluding voluntary agreements, there is always an asymmetry of information between the government and industry. Private companies have a much better understanding of the evolution of pollution and energy consumption in their own sector and are more aware of the technologies than the government and so are often able to limit the targets under agreements to close to what might have happened in any case.

In most cases such programmes have not been found to be either effective or efficient instruments. In Germany, voluntary agreements seem unlikely to ensure least-cost solutions, as they often attribute identical targets to individual firms rather than ensuring that marginal abatement costs are the same for all firms (OECD, 2001). In the area of greenhouse gas emission reduction, Danish experience with voluntary energy audits designed to

Table 1.7. **The use of voluntary agreements**

	Climate change	Air pollution	Water pollution	Waste management
Australia	X			
Austria				X
Belgium				
Canada	X	X	X	X
Czech Republic			X	X
Denmark	X	X		X
Finland	X			
France	X			X
Germany	X			X
Greece	X			
Hungary				
Iceland				
Ireland	X		X	
Italy	X	X		X
Japan		X		
Korea	X			
Luxembourg	X			
Mexico				
Netherlands	X		X	
New Zealand			X	
Norway		X		
Poland				
Portugal				
Slovakia				
Spain	X			X
Sweden			X	
Switzerland	X			
Turkey				
United Kingdom			X	
United States	X	X	X	
OECD total				
EU				

Source: OECD Economic Surveys, OECD (2003b), OECD/EEA Economic Instruments Database.

improve energy efficiency suggests that, even when avoided externalities were taken into account, there are few areas where the cost of funding such projects was less than the value of reduced fuel consumption.⁵ While participants in Dutch energy saving agreements attributed 29 to 44 per cent of realised savings to participation in the programme, analysis based on performance relative to historical trends showed a more mixed picture (Rietbergen and Blok, 2000). Such a finding was repeated for energy-efficiency agreements in Canada (International Energy Agency, 2000). Moreover, studies

of policies in France, Germany, and Sweden suggested that voluntary agreements appear to induce only minor effects (Krarup and Ramesohl, 2000). Voluntary agreements aimed at reducing nitrate emissions from the farming sector have also been found to be costly (Sweden) or ineffective (Netherlands). Overall, the environmental effectiveness of voluntary agreements is often questionable and their economic efficiency is generally low (OECD, 2003b).

In view of the disappointing experience with voluntary approaches, the country surveys recommended moving away from them. This was notably the case in the area of climate change, where it was specifically recommended that Canada, France, Greece, and Luxembourg end voluntary agreements and replace them with more effective and efficient policy instruments. The review of the United States also concluded that the current voluntary approach to reduce the intensity of greenhouse gas emissions was a poor substitute for a cap-and-trade system. The reviews also noted that voluntary codes of good farming practices to reduce discharges of water pollutants had not proved effective, thus recommending alternative mandatory policies in this area for Ireland, Sweden and the United States.

2.1.2. Regulation

Regulation has remained a major instrument in the control of emissions or resource extraction over the past decade in most of the environmental areas considered in this study:

- *Greenhouse gas emissions.* Several countries have sought to reduce such emissions through mandated minimum energy standards and through the imposition of specific technologies for electricity generation.
- *Air pollution.* The predominant method to control emissions from stationary sources is to specify ceilings on permissible emissions or emission rates for each new plant, as in the United States (sections of the “Clean Air Act”), the European Union (“Large Combustion Plant Directive”, “Integrated Pollution Prevention and Control Directive” and the “National Emission Ceilings Directive”) and Japan (“Air Pollution Act”). For non-stationary sources, all countries have relied on a gradual tightening of vehicle emission standards to cut releases of air pollutants, notable examples being the Tier II standard in the United States and EURO4 in the European Union.
- *Water pollution.* Regulations affecting the quality of surface water include minimum standards for wastewater release from both industrial users and the public sewage system. Agricultural discharges of nitrogen and phosphorus are typically controlled by extensive regulations of farming practices, such as the timing of the spreading of slurry on fields. Suppliers of drinking water are also subject to strict controls with respect to quality, such as the maximum nitrate content.

- *Waste management.* In Europe, regulations have been used extensively to determine waste treatment. These include mandatory sorting of refuse by households, bans on landfills and incineration, and minimum recycling rates of various materials. In the United States, only the emissions to air or water from waste-management facilities are regulated.
- *Natural resource management.* Commercial fishing is subject to various operational controls, such as intensity controls and regulations on the equipment used for fishing, in addition to ceilings on fish catches. Water extraction is regulated by quantitative ceilings in several countries.

Regulatory control may be the only applicable instrument when a complete ban on certain activities is judged to be necessary or when monitoring or transaction costs are high. Examples of the former are the ban on the use (Austria) or, in some cases, expansion of nuclear energy in a number of the reviewed countries (Belgium, Germany, Italy and Spain). However, there is little agreement of the environmental cost of nuclear energy. For example, in Switzerland a national referendum has repealed earlier bans on commissioning new nuclear reactors and Sweden has postponed a scheduled closure. In waste management, some countries or regions have banned the landfilling of biodegradable waste (Austria, Belgium,⁶ Denmark, Finland, Netherlands, Sweden (as from 2005) and Switzerland) and of combustible waste (Denmark and Sweden).

An example of the use of regulation in the face of high monitoring costs is emission limits on cars. Such regulations have been the primary method for lowering pollution from cars in all surveyed countries, though the United States is attempting to reduce the costs of tightening standards by allowing trading in the potential emissions of new cars. The regulatory approach has led to a very low level of pollution from the current generation of gasoline-fuelled cars, and is likely to bring a reduction in aggregate emissions as cars are renewed. Typically, pollution limits are set on the basis of an allowable amount of emissions per kilometre travelled with a limited number of different categories based on engine size. An alternative to regulation would be to estimate charges for pollution based on the emissions of the engine and distance travelled. Indeed, model simulations have suggested that a kilometre-based tax on emissions could have achieved the goals of emission reduction at a lower resource cost than regulation. In practice, the administrative cost of reading distance counters for light vehicles, and ensuring that they were tamper-proof, might exceed the welfare gain from the regulatory approach (Jansen and Denis, 1998).⁷

The form of regulation has an important impact on the cost of abatement, with that based on the mandated use of a particular technology likely to be the least cost-effective and entail very high costs compared with other abatement measures. Such regulations are common in several areas.

- *Climate change.* The imposition of a chosen technology to reduce greenhouse gas emissions, such as the renewable energy targets that are in place in nearly all reviewed countries, has proved to be a very expensive method of reducing greenhouse gas emissions compared with other abatement options, costing several times as much as the carbon taxes that have been introduced and well above the likely price in cap-and-trade schemes (see Chapter 3). Apart from lowering carbon emissions, the expansion of renewable energy has been pursued for other reasons, such as reducing air pollution, strengthening energy security, raising employment levels and increasing innovations. There is little or no evidence that such non-GHG-related benefits justify the “excess” abatement costs or that special high support to renewables is the most efficient way to achieve such objectives.⁸
- *Waste management.* The practice of imposing quantitative targets for waste-management technology, which is common in most European member countries, has resulted in high costs in most countries (see Chapter 6). In particular, the cost of recycling has been much higher than the cost of alternative forms of disposal, even after accounting for the externalities associated with landfills and incineration.
- *Water pollution.* Simulations of the behaviour of farmers in Denmark suggest that the cost of imposing technical requirements to limit the application of nitrate fertilisers is much higher than applying taxes for the same purpose, since the regulator does not have the knowledge to design regulations that are optimal for each farm.

The greater the degree of flexibility given to polluters to vary technology, the more likely it is that costs can be contained. The freedom to choose technology depends on the details of the regulatory design. For example, for the control of air pollution from stationary sources, the regulatory system in the European Union provides companies with more flexibility than the traditional system in the United States, even if both are based on standards set by best available technology. In the European Union, the standard is set uniformly for the concentration of the pollutant in the flue gas of all large boilers, so companies have the possibility to move into compliance by changing fuels or by changing technologies. By contrast, legislation in the United States has been based on pollution produced from a given heat input, so adversely impacting on the freedom of companies to respond by installing higher efficiency boilers. In general, regulations that specify the processes to be used for abatement will discourage cost-saving innovations, while those focusing on performance outcomes provide an incentive to create new lower-cost technology to reduce emissions.⁹

However, the available evidence suggests that even the use of flexible regulatory instruments is generally not the most cost-efficient method of

dealing with environmental problems. Regulatory instruments typically result in very different marginal abatement costs across emitters as different plants vary in the extent to which they can reduce emissions. For example, uniform air-pollution regulations on electricity generators in Korea have resulted in marginal abatement costs that are estimated to vary by a factor of 4 for sulphur dioxide emissions and by a factor of around 15 for nitrogen dioxide, suspended particles and carbon dioxide over all plants (Kwon and Yun, 1999). Also, in the United States, data from 100 000 factories showed that there were very high inter-sectoral variances in marginal and average abatement costs for emissions of seven air pollutants. The ratio of the maximum to the minimum abatement costs was frequently near 10, and occasionally close to 100 (Hartman et al., 1997). Moreover, in the Netherlands, evidence of the large dispersion in emissions for a given process, pointing to variability in costs of abatement, has been known since the late 1980s (Dekkers, 1999). The existence of such heterogeneity in abatement costs points to the possibility of savings in pollution control costs, as the abatement effort could be re-allocated to obtain the same pollution reduction for less cost.¹⁰

The recommendations in the country surveys called for an overhaul of regulations or their replacement in a number of countries. The main recommendations in this area were as follows:

- *Climate change.* Given the high abatement costs of carbon-dioxide through the imposed build-up of renewable energy, the country reviews recommended the scaling down of support to, and hence lowering targets for, wind and other renewable energy in more than half of all the countries reviewed on this topic (Czech Republic, Finland, France, Greece, Hungary, Italy, Luxembourg, Netherlands, Spain, Switzerland and the United Kingdom). To encourage energy saving in a cost-efficient way, the country surveys recommended the use of fuel pricing instead of regulations in Austria, the Czech Republic, Finland, Hungary, Luxembourg, the Slovak Republic and Turkey.
- *Air pollution.* The growing evidence that regulations are not cost efficient in reducing emissions of air pollutants from stationary sources was reflected in recommendations to scale back such interventions in several country reviews (Belgium, Canada, Czech Republic, Finland, Germany, Greece, Hungary, Japan, Korea, Mexico, Poland, Portugal, Slovak Republic, Sweden). For mobile and diffuse sources of air pollution, the continued reduction in the sulphur content of fuel was recommended in the reviews of Belgium, Japan, Korea, Mexico, the Slovak Republic and Turkey.
- *Water pollution.* The evidence presented in the reviews suggested that regulations in this area were not being adhered to in all the countries concerned, resulting in recommendations to strengthen the enforcement of existing controls on industrial water discharges (Mexico, Portugal), large

livestock rearing units (France, Ireland), and diffuse on-farm emissions (Ireland, New Zealand, United States).

- *Waste management.* In light of the high costs and low environmental benefits of recycling, all nine country reviews on waste recommended reforms that would reduce the extent of recycling (Austria, Belgium, Denmark, Germany, Ireland, Korea, Spain, Sweden and Switzerland). In particular it was generally recommended that the costs of such programmes should be capped at levels no higher than the costs of the cheapest alternative technologies for waste disposal and the externalities due to that technology. However, in some of the reviews (including Austria and Belgium), such recommendations were conditional on recycling not being pursued as a goal in its own right. The surveys also called for relaxation of restrictions on landfilling in Spain and Sweden.

2.1.3. *Environmentally-related taxes*

There has not been a general use of taxation as a means of environmental control. The taxation of petrol, diesel and cars is ubiquitous. However, only about half of OECD countries levy charges for the extraction of surface or groundwater or the pollution of water (aside from charges for water use, sewage collection and wastewater treatment). Taxes on waste sent to landfills are employed in ten countries, while taxes on carbon emissions or releases of traditional air pollutants have been introduced in eight and ten countries, respectively. Overall, around 60 examples of taxation or charges are found in eight environmental domains and 30 OECD members (Table 1.8). However, in any particular environmental domain typically only about one-quarter of countries use such an instrument.

The most widely used environmentally-related tax instruments, carbon taxes and water-pollution charges, are also the least likely to reduce emission and discharges at the lowest economy-wide cost because they are generally levied at different rates across sectors. Indeed, in many cases the most pollution-intensive activities are exempted from the tax.¹¹ Thus, heavy and energy-intensive industries are typically exempted from the carbon tax, although there is strong evidence that abatement costs are particularly low in these sectors.¹² Similarly, agriculture generally pays little or no taxes on its discharges, even if it costs much less to reduce nitrogen runoffs in that sector than elsewhere. The country reviews highlighted the inefficiency of directing taxation at sectors where it was difficult and costly to reduce emissions, while exempting sectors where abatement was easier and less costly. The variation in tax rates also distorts incentives to create new cost-saving processes directing innovation effort into highly-taxed emission activities which do not necessarily offer the most promising return for society.

Table 1.8. **The use of environmental taxes**

	Climate change			Air pollution		Water		Waste	
	Specific carbon tax	Minimum rate on coal	Tax rate on petrol	SO ₂	NO _x	Abstraction charges	Pollution charges ¹	Landfill tax	Incineration tax
	EUR per tonne of CO ₂			EUR per tonne					
Australia			96	2.5 ²		X	X		
Austria	X	0	181					44	
Belgium			223			X	X	52 ³	13 ³
Canada			75			X	X		
Czech Republic			154	30	24	X	X		
Denmark	X	0.4	241				X	50	38
Finland	X	14.5	260					15	
France			253	38	46	X	X	9	
Germany	X	0	289			X	X		
Greece									
Hungary			160	215	515	X			
Iceland									
Ireland			177					19	
Italy			239	53	105	X			
Japan			201						
Korea			278				X		
Luxembourg			164						
Mexico			100			X	X		
Netherlands	X	3.8	281			X	X	65	
New Zealand			82						
Norway	X	0	251	2 000					18
Poland			168	0.1	98	X	X		
Portugal			207						
Slovakia			122	47	35	X	X		
Spain			174			X	X		
Sweden	X	17	227	1 500	4 400			31	
Switzerland			222						
Turkey			250			X			
United Kingdom	X	5.5	312			X	X	19	
United States			48	28	28				

1. Pollution charge for releases to water bodies (not for sewage collection or wastewater treatment).

2. New South Wales.

3. Flanders

The structure and design of taxes to control car emissions have also been inefficient. An example is the lower taxation of diesel fuel relative to gasoline in all OECD countries with the exception of Mexico, New Zealand, Switzerland,

the United Kingdom and the United States. While the combustion of diesel fuel releases less greenhouse gases than that of petrol, it results in significantly higher emissions of air pollutants, notably particulate matter that is very damaging to human health. On balance, there is no justification for differential tax rates of the two types of fuel. Another example of vehicle taxes having adverse environmental effects are car purchase taxes that delay the speed at which tougher emission standards have improved air quality in some of the countries reviewed (Belgium, Finland, Greece and Portugal).¹³ A number of countries (Austria, Germany, Switzerland and the United Kingdom) are introducing reforms in the way that road transport is taxed. Taxes on lorries in these countries will be collected on a kilometre basis and will vary with vehicle axle-weight, pollution characteristics and the time of using the road. Such charges may help to better align transport taxation with externalities, all the more so if they evolve in the direction of taking account of congestion. If at the same time, fuel taxes are lowered – as is being considered in the United Kingdom – incentives to save carbon in the transport sector would be brought closer to those in the rest of the economy. These schemes are limited to lorries at the moment due to high monitoring cost.

Another area where the structure of taxation or levies is not encouraging cost-efficiency is the abstraction of water resources, with a marked differentiation in tax rates according to sectors. In particular, agricultural users are usually charged a much lower rate than industrial users as in, for example, France, Mexico, Netherlands, Portugal and Spain. In some of these cases, groundwater is being depleted, suggesting that a much higher price level would be justified. Amongst the reviewed countries, this problem is particularly serious in the Netherlands, Mexico and parts of the United States. In the former country, groundwater depletion due to agriculture usage is threatening underground water sources with salt water intrusion. In order to counter this threat, the authorities are re-injecting drinking water into these natural underground reservoirs at a high cost but allowing extraction by farmers to continue. Low pricing can lead to over-investment in water irrigation projects, as has happened in the United States and may occur in Spain. Of the reviewed countries, only Australia and the United Kingdom were on the way to a solution based on trading water rights.

Taxes on the emission of air pollutants and on waste going to landfills have been fairly uniform across sectors despite some notable exceptions.¹⁴ This design feature has implied that the taxes are likely to have reduced emissions or waste destined for landfills at the lowest cost for the economy as a whole. A uniform tax on air pollutants has directed abatement effort to those activities where cuts could be obtained at a lower cost than the levy on emissions. By contrast, polluters with higher abatement costs would prefer to pay the tax rather than spending on emission control. Similarly, a uniform

landfill tax would tend to limit waste going to landfills to that where the cost of alternative modes of disposal exceeded the tax-inclusive cost of landfilling. While encouraging abatement at the least economy-wide cost, uniform taxes on emissions of air pollutants or landfilled waste are generally not set on the basis of the external costs associated with emissions or discharges. Emission charges on air pollutants are generally well below the benefits of abatement, with the notable exceptions of Norway and Sweden. By contrast, landfill taxes are often set at levels well above reasonable estimates of the externality costs linked to landfills (see Chapter 6). Indeed, the main purpose of landfill taxes in many countries appears to be to attain recycling targets. However, as there are uncertainties as to the extent to which producers and consumers respond to taxes, they cannot guarantee meeting quantitative targets on emissions or discharges.

Although the design of environmental taxes has often been suboptimal in the past, the potential gains of employing such an instrument led the country reviews to recommend the expanded use of emission charges. In the area of greenhouse gases, the further use of carbon taxation was seen as a means of ensuring that sectors outside the scope of future allowance trading (see below) faced the same abatement incentives as sectors within the system, leading to recommendations to introduce such taxation, linked to allowance prices, in Austria, Denmark, France, Greece, Luxembourg, the Netherlands, Norway, Poland, the Slovak Republic, Spain, Switzerland and the United Kingdom. The reviews also recommended that a single price should be put on industry emissions of greenhouse gases with taxes or permits for a number of countries (Austria, Finland, Ireland, Luxembourg, the Netherlands, Norway, Poland, Slovak Republic, Spain, Switzerland and the United States), noting in particular that exemptions to industry should be wound down in some cases (Finland, Netherlands and Norway). As noted below, countries were also called on to reduce subsidies that encourage the use of carbon-rich fuel. For air pollution, emission charges were advocated for the Czech Republic, Germany, Hungary, Mexico, the Slovak Republic and Sweden. The harmonisation of volumetric taxes on diesel and petrol based on their respective carbon content was called for in several countries (Belgium, Finland, Germany, Greece, Portugal and Sweden). In a number of cases, the surveys recommended the easing of abatement in the road transportation sector. For the purpose of reducing water pollution in a cost-efficient way, the country reviews suggested taxing nitrogen surpluses on farmland (Denmark, France, Ireland, Italy, Sweden and Switzerland) and establishing charges on wastewater treatment in line with costs (Canada, Ireland, Italy, Mexico, New Zealand and Portugal). The removal of exemptions from paying water abstraction fees was recommended in Mexico, the Netherlands, Turkey and the United States.

2.1.4. *The use of trading*

The use of markets to establish the price of freely-transferable rights to emit environmentally-harmful substances or to use a natural resource is a new development in the area of emission control or resource management. About one-third of OECD countries have used such instruments: examples are Australia (water resources); Denmark (greenhouse gases), Iceland (natural resources); Norway (natural resources); New Zealand (natural resources); Slovak Republic (air pollution); United Kingdom (greenhouse gases, recycling and use of landfills) and the United States (air and water pollution, natural resources). In addition, a few countries (Germany, Netherlands, Switzerland and the United Kingdom) have experimented with limited small-scale markets, either in the form of sector-wide trading or geographically-limited programmes that allowed exchange of emission reductions. The authorities in the United Kingdom have also proposed emission trading in sulphur dioxide and nitrogen oxides in order to meet national emission ceilings in the lowest-cost fashion. The use of markets in freely transferable emission rights is about to increase substantially with the proposed introduction of greenhouse gas trading in nearly all of the OECD Europe area as from 2005 (Turkey and Iceland being the only exceptions).

There are drawbacks and advantages to using tradable quota systems for controlling the environment. One problem is that there can be uncertainty about the price that will emerge in the market. A market may deliver the most efficient result for a given degree of abatement but the cost may be excessive in relation to the benefits that flow from the abatement. The possibility that trading systems might be inferior to taxation as means of controlling abatement in the face of uncertainty is illustrated by the Californian NO_x market in 2000 and 2001, where prices rose to ten times best estimates of the health benefit from reduced emissions due to unexpected shifts in the demand for allowances. In the United States, a proposal for a much extended market in air pollution quotas has dealt with this problem by imposing a price cap on the market, known as a “safety valve”. When market prices reach a pre-set level, the government will issue unlimited extra permits to keep prices at the pre-determined level. On the other hand, in addition to ensuring that marginal abatement costs are equalised across covered emitters and being neutral with respect to innovation incentives, an advantage of tradeable quota systems is that they guarantee that a quantitative target can be met. Another feature of trading schemes is that, compared to taxes, they tend to better cover all major emitters. For example, coverage of the EU greenhouse-gas trading system has no exemptions for particular sectors. However, the more uniform coverage of trading systems may reflect that such systems nearly always involve the free granting of allowances to companies on the basis of their past emissions (“grandfathering”). The transfer of the scarcity rent to the

companies boosts their profits, thus reducing the resistance of the most emission-intensive companies to the introduction of the system (see below).

The experience with trading systems shows that most have attained environmental objectives at a lower cost than regulation. Major reductions in abatement costs accompanied the introduction of the trading system for sulphur dioxide in the United States even when cost comparisons were based on modelled impacts of the likely evolution of pollution under a regulatory regime (Keohane, 2003). The sulphur emission permit market has proved to be deep, liquid and stable. Cost reductions have also been reaped in US markets for nitrogen dioxide. There are other less well-known examples of cost-reductions. In the Netherlands, a trading system covering sulphur emissions by power plants is estimated to have reduced compliance costs by half in the early 1990s (Klassen and Nentjes, 1997). In the same country, estimates based on plant-level data suggested that national trading would reduce compliance costs by 28 per cent for sulphur dioxide and 47 per cent for nitrogen dioxide (Inter Provincial Council, 1997). In the United States, experimental projects involving the trading of effluent allowances have resulted in up to a halving of water pollution abatement costs (United States Council of Economic Advisors, 2002) and similar results were found in a Canadian experiment (Conservation Ontario, 2001). There have been unsuccessful trading systems, mainly as a result of high transaction costs due in some cases to the need to have prior regulatory approval for each trade.

On the whole, the reviews judged trading systems positively and recommended developing the infrastructure for such systems in Austria, Luxembourg, Norway, Poland, the Slovak Republic, Switzerland and the United States. At the same time, the surveys recommended taking advantage of international allowance markets and financing projects designed to reduce emissions in developing countries in order to offset domestic emissions in France, Italy, Luxembourg, Norway, Spain and Switzerland. Such purchases would ensure that allowance prices did not rise unduly. As noted earlier, it was recommended for several countries to use taxes aligned to permit prices in activities not covered by trading. The reviews of Finland, Ireland, Luxembourg, the Netherlands and the United Kingdom called for the abolition of carbon taxes in the activities that will be covered by the EU trading allowance system. The surveys also recommended the introduction of allowance trading in air pollutants in a number of countries (Belgium, Canada, Czech Republic, Finland, Germany, Greece, Korea and Portugal).

2.2. The integration of economic concerns into environmental policy making

The low cost efficiency of many abatement programmes that has been documented in the economic reviews can, in part, be attributed to failure to

integrate the environmental and economic dimensions of sustainable development in environmental policy making. Indeed, the vast majority of OECD countries do not subject environmental protection laws to a systematic review of their economic consequences (Table 1.9). In New Zealand, the United Kingdom and the United States there is a quasi-systematic use of cost-benefit analysis (CBA) as part of statutory regulatory impact analysis. In the United States these tools have helped to move policy away from costly regulatory instruments to tradeable permits. The greater use of taxes and permits in the United Kingdom and New Zealand could similarly be linked to greater scrutiny of benefit and costs. The treaty governing the European Community mandates it to take account of “the potential benefits and costs of action or lack of action” when contemplating new environmental legislation. The use of this technique has increased in recent years, but existing European policies are rarely subject to re-evaluation (O’Brien and Vourc’h, 2001). Moreover, there have been instances when CBA has been poorly integrated into policy decisions, as illustrated by the EU directive on waste from electric and electronic equipment which was adopted despite the fact that the official study attached to the proposal found that costs exceeded monetised benefits by a factor of more than five.¹⁵

Cost-benefit studies are resource intensive and for this reason it is sometimes difficult to subject them to independent assessment. The reviews suggested, though, that the results of CBA tend to be influenced by the desired outcome when such studies are supervised by the agency sponsoring the regulation, as noted in the surveys of Austria, Greece, Spain and the United States. This problem has since been lessened in the United States with the reinforcement of the independent unit of the executive branch that is responsible for reviewing CBAs and for ensuring that a common set of assumptions on recurring parameters (such as the statistical value of life) are used throughout the administration. In Denmark an independent institution has been established to undertake cost-benefit analyses and it has concluded that costs outrun benefits in a number of policy areas. In European countries, the lack of independent review and of guidelines may diminish the impact of CBAs on eventual decisions and hence this is an area where progress could be made.

In contrast to the lack of systematic economic assessments of environmental programmes, the integration of environmental concerns in public decision-making processes at the project level is better established. All OECD countries have procedures for environmental impact assessments (EIA) of large projects that usually combine scientific evaluation and extensive public consultation before a final decision can be made. As a result of national and international law, citizens in OECD countries also have ample opportunity to access environmental information and to initiate court action if they consider that environmental consequences have not been given sufficient consideration. The main ongoing development is that these requirements which initially

Table 1.9. The use of cost-benefit and environmental-impact analyses in OECD countries

	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States
Environmental impact assessment of public projects (EIA)	X	XX	XX	XX	XX	XX	XX	XX	XX	XX	X	X	X	XX	X	XX	XX	X	XX	XX	XX	X	XX	X	XX	XX	X	XX	XX
Strategic environmental assessment of policies (SEA)	X	X	X	X		XX	X	X	X					X		X	X		XX		X		X		X	XX			
Monetary valuation of environmental effects in EIA or SEA	X		X					X							X					X								X	
Cost-benefit analysis of environmental policies (CBA)	X	X		X		X								X					X	XX	X			X	X			XX	XX
Statutory independent review of CBAs						X																							X

Note: XX = quasi-systematic; X = frequent.

applied to projects are gradually being extended to sectoral programmes and broader policies, under the name of “strategic environmental assessment” (SEA) in EU countries and Canada. However, much remains to be done to ensure that sectoral policies (such as agricultural and energy policies) take into account the induced environmental consequences.

2.3. Social and political-economy considerations in determining instrument use

2.3.1. Social concerns limiting efficient instrument use

Social concerns have sometimes been a barrier to the introduction of policies that would improve environmental outcomes or achieve them at lower economic costs. Objections have been the commonest in three areas: the impact of policies on low-income groups, the employment and profit consequences of higher costs in polluting industries and adverse regional impacts.

Concerns about the distributional impact of the pricing of environmental services have sometimes slowed or indeed stopped the introduction of environmental taxes on, or charges for, the use of natural resources. Policy changes that result in increases in energy prices have been particularly sensitive due to their impact on poorer groups in society. As reported in the country reviews, such concerns have led to decisions not to introduce carbon taxes on households in the Czech Republic, Hungary and the United Kingdom, and may have slowed down the process of aligning energy prices to costs in the transition countries. A significant group of countries (Belgium, Canada, Greece, Italy, Japan, Korea, Luxemburg, Mexico, Portugal, Spain, some parts of the United States and Turkey) charge lower prices to households that consume less water in an attempt to favour low-income groups and concessionary water charges are available through tariff capping (England and Wales).

In the areas where distributional concerns may have on occasion hindered the introduction of environmental control policies, governments have alternative and better targeted policies in place that can moderate accompanying social problems at lower cost. Governments already grant benefits to the poorest groups in society. Hence, a careful choice of the price index used to revalue transfers – using the consumption weights of the target groups – can alleviate distributional concerns stemming from increased prices caused by environmental policies. At the same time, by making payments in cash, the welfare of the poor would improve relative to receiving the same value as a benefit in kind. For the Czech Republic, Greece, Hungary, the Slovak Republic, Turkey and the United Kingdom, the reviews recommended that full-cost pricing should be established for households’ energy consumption and that direct income support should be used to mitigate any undesirable social consequences.¹⁶

Concerns about employment and profits in emission-intensive sectors have been at the origin of marked variations in carbon taxation where such taxes have been introduced (see above). Some of these concerns should be reduced when the European-wide trading system for greenhouses gases is introduced, as under this system all large European energy users will face the same increase in costs, provided that existing carbon taxes on the companies covered by trading are abolished, and their profits will be boosted by the grandfathering of emission permits (see below). Nonetheless, some employment losses may still occur in the steel, paper, plastics and fertiliser industries with jobs being transferred to less-energy intensive industries within Europe and also to energy-intensive industries in the United States and developing countries (De Groot, 2002). Such changes are necessary if emissions are to be reduced without incurring excessive economic cost.

In respect of possible adverse employment consequences of environmental policies, labour market policy settings need to avoid creating incentives that generate long periods of intervening unemployment or permanent withdrawal from the labour market by those affected by the changes. In this way the process of sectoral adjustment would be smoother. The costs could be significant if labour markets are rigid. For example, an OECD study concluded that the cost of meeting the Kyoto target would multiply in the presence of rigidities (OECD, 1999).

Subsidies to particular activities aimed at regional objectives have worked against environmental improvements. Thus, subsidies to the peat industry, that is concentrated in certain areas of Finland and Ireland, have boosted the market share of this particularly carbon intensive fuel, while the failure to charge correctly for irrigation water has led to investment in expensive water transport infrastructure in the drier regions of Spain and the United States. Also, support to the fishing sector has blocked rational harvesting of fishing stocks in some countries, such as Canada and Norway, in an attempt to maintain economic activity in small coastal towns and villages. Moreover, in the fuel sector, the expansion of the distribution network for natural gas has been limited in order to maintain the demand for domestic coal whose production is concentrated in certain areas (Greece, Spain and Turkey). However, coal subsidies in Germany and Spain have been reduced and transformed into production subsidies rather than demand subsidies. In effect, these countries now price domestic coal at world prices. Consequently the abolition of domestic subsidies and reduction of production would not have a direct impact on environmental externalities as demand would switch to foreign sources at the same price. The review of Finland recommended that energy subsidies or tax breaks aimed at maintaining employment in isolated areas should be replaced by direct payments or different regional policy measures.

2.3.2. Distributional consequences of allowance trading

Nearly all examples of the creation of quota trading systems in the area of the environment have involved the granting of allowances (or quota rights) free of charge, usually in proportion to past emissions or use of the natural resource. Such procedures were adopted for the federal sulphur dioxide programme in the United States (alongside a limited degree of auctioning), for nitrogen dioxide in various US states, for fishing quotas in Iceland and for water extraction rights in Australia. More recently, the proposals for new trading systems have reserved only a small proportion of quotas for sale by auction (maximum 5 per cent in the period 2005-2007 and 10 per cent in 2008-2012 in the case of the European Greenhouse Gas Trading System and 2 per cent, but increasing each year, in the case of the proposed United States air legislation). However, the Norwegian government proposes to sell all of its greenhouse gas allowances.

The free granting of tradeable quotas transfers substantial resources to the new owners of the quotas and raises the equity value of the companies concerned. In effect, as in the case of carbon taxation, a significant part of the price of greenhouse gas allowances will be shifted onto consumers by an increase in prices regardless of the method of allocation. In sectors, such as the European electricity industry, where there is little competition from outside the trading zone, the introduction of trading systems with freely allocated allowances will mean that profits rise substantially (International Energy Agency, 2003). Even generators using the most carbon-intensive sources of fuel (lignite and coal) will see major increases in profitability if allocations are based on past emissions. In industries such as steel, cement, paper and aluminium, where exposure to world markets limits the extent to which allowances prices will be passed on into output prices, would still see increased profits, given the scale of their likely allowance allocation. In practice, it has been estimated that a free grant amounting to less than 10 per cent of their previous emissions would be sufficient to compensate them for their loss of profit even in presence of competition from foreign firms with no abatement target (Quirion, 2003). Such a result has been reinforced in the United States, both for a potential greenhouse gas system (Congressional Budget Office, 2003) and for the actual sulphur dioxide scheme (Bovenberg *et al.*, 2003).¹⁷ Indeed, free allocations of allowances will result in supernormal profits that mainly accrue to people in the highest income groups (Dinan and Rogers, 2002).

On the other hand, while the free allocation of allowances will benefit shareholders, it will not change the marginal cost structure of a company whose plants emit greenhouse gases. Consequently, it will not affect the production decisions of firms and the employment impact of the trading system is unlikely to be lessened by grandfathering. However, if allocations of allowances are

conditional on the continued operation of a plant (as currently proposed for the carbon allocation system in the United Kingdom), then perverse abatement incentives will be introduced in exchange for lower employment displacement. Such a conditional allocation of allowances will keep high-emitters in business longer than would otherwise be the case under an outright grant.

While it may be argued that the willingness of companies to accept trading systems depends on generous grandfathering, this represents a cost to the government. The adverse effect on public finances of the loss of potential revenue is non-negligible. For example, the loss of potential revenue, and transfer to shareholders, in the new European trading system, if allowance prices were to settle at EUR 20 per tonne of carbon dioxide, would be equivalent to 0.4 per cent of GDP. Indeed, before the introduction of the trading system, a number of countries (Denmark, Finland, Germany, Italy, Sweden, the Netherlands, Norway and Sweden) had used revenues raised by environmental taxation to lower more distorting taxation, notably on labour (Bosquet, 2000). To allow national governments to retain some of the scarcity rent in the face of a requirement to grandfather the bulk of all the permits, the country reviews of the Czech Republic, Denmark, Hungary, Luxembourg and Poland recommended that the permits should be taxed. This introduces a distortion, however, which would not exist if the permits were auctioned.

Notes

1. The country reviews covering this topic had to focus on particular categories of resources. The most widely covered topics have been marine fish stocks and water resources but some reviews have also dealt with petroleum resources (Netherlands, Norway) and forests (Finland).
2. In the period 1990 to 1999, the annual increase in atmospheric content of carbon was 3.2 gigatonnes of carbon, against emissions of 6.3 gigatonnes. Hence a 51 per cent reduction of emissions would have been required to stabilise the carbon content of the atmosphere (Intergovernmental Panel on Climate Change, 2001).
3. The shortcomings of the available data are described in OECD (2003a).
4. If the cost of reducing a given form of pollution is higher in one sector than in another, then a given reduction in pollution can be achieved by allowing an increase in pollution in the high-cost area with a more than offsetting fall in the sector where costs are low.
5. See Larsen and Jensen (1999). The analysis was based on returns observed in over 7 500 energy audits. In many cases, the audit discovered projects that would have been undertaken in any case. Nonetheless, the programmes considered were expanded during the 1990s which the authors suggested reflected the interests to the companies undertaking the audits rather than society as a whole.
6. Refers to the region of Flanders.
7. Moreover this model uses a very discount rate for consumers that gives an advantage to regulation as a preferred solution.

8. For example, the ancillary benefits of lower air pollution have been estimated to be only a fraction of the “excess” abatement costs (see economic surveys of the Czech Republic and Poland). Also, while the expansion of renewable energy provides employment opportunities in the construction phase, higher electricity prices in the longer run to pay for the subsidies may tend to depress employment levels overall. Finally, while market failures may justify support to innovations in general, channelling subsidies towards particular technological innovations may not be the best use of such financial support.
9. Moreover in California, legislation has mandated the use of the least polluting technology. The result has been competition amongst suppliers to produce low-emission gas turbines, knowing that regulators were not concerned about costs.
10. If abatement costs are similar across all sectors and industries then regulation may not impose undue costs, producing the same result as more flexible instruments. The choice between instruments would then be based on their administrative costs.
11. Amongst other examples, the carbon taxes introduced in Austria, Germany and Norway included a zero rate for coal used in certain industrial activities.
12. See, for instance, Bruvold and Larsen (2002).
13. Kanemoto *et al.* (2003) conclude that purchase taxes in Japan are very inefficient in reducing carbon dioxide emissions from cars. For the same welfare cost of 100 billion yen a year, motor fuel taxes reduce car emissions by 7 per cent compared with only 0.4 per cent with purchase taxes.
14. For emission of air pollutants, the exceptions include Norway, where industries are exempted or pay a significantly lower rate. Also, in Sweden, fuels used for other purposes than for motors or for heating are exempted from the sulphur tax, and the very high NO_x charges only apply to energy producers.
15. The official analysis concluded that the benefits were worth the costs, however, on the grounds that there were benefits that could not be monetised and that costs may have been over-estimated because of economies of scale that could not be quantified.
16. Such increased redistributive transfers come at a welfare cost because they must be financed and existing tax systems involve economic distortions. Notwithstanding this effect, direct transfers are preferable to exemptions or special provisions in environmental policy because they allow the environmental benefits to materialise in full and make the costs of compensation transparent.
17. If the trading system is only expected to have a short life, then the grandfathered allocation may need to be substantially greater (Smith *et al.*, 2002).

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Chapter 2

Attaining Social Objectives in a Cost-efficient Way

Achievement of social goals is central to sustainable development. In this respect, OECD countries are faced with the challenge of ensuring adequate retirement income for the elderly in a way that is financially viable over the long term despite population ageing. Based on 14 country reviews that dealt with this issue, this chapter presents the main lessons that have been drawn from reforms in this area and the recommendations that have been made for further progress. On a global scale, the improvement of living conditions in developing countries is a vital part of the sustainable development agenda. The chapter presents the main findings from seven country reviews that have looked at how OECD countries can participate to achieving this goal through their trade and development assistance policies.

OECD countries have in place a number of social objectives that may entail costs for the economic pillar of sustainable development. The economic surveys examined policies to attain two of these objectives: adequate retirement incomes and increased living standards in developing countries. The focus of the reviews in both cases was on whether current policy setting was effective in reaching or maintaining these objectives, and on whether the least-cost options were being employed for this purpose. Given that the specific issues and policies differ significantly across these two areas, they are discussed separately in this section.

1. Ensuring adequate and sustainable retirement income

The main objective of the 15 country surveys that covered the issue of ensuring sustainable retirement income was to examine if measures had been taken to contain ageing-related fiscal pressures without compromising the income adequacy of the elderly. The reviews, which benefited from extensive work on the impact of ageing carried out by the OECD in recent years,¹ concluded that several countries had yet to tackle this challenge and that others were not yet on a sustainable path despite reforms that had been made. The surveys recommended wide-ranging reforms of retirement policies for the reviewed countries (Table 2.1). Apart from its impact on public retirement spending, ageing will tend to increase government outlays on health. While this aspect of ageing was not addressed in the country reviews on sustainable development, other work from the OECD has underlined the importance of reforms in this area as well.²

1.1. Performance

Thanks in large part to increased public pensions, income adequacy on retirement has improved significantly over the past decades, with average money income of the retired in the reviewed countries ranging between 68 and 97 per cent of that of all individuals (Table 2.2). In several countries (Belgium, Finland, Germany, Italy) the money income of those with low earnings capacity is unchanged or higher after retirement. Moreover, in a number of the reviewed countries, calculations of income replacement calculations should also include income in kind from owner-occupied housing (Australia, Greece, Italy, France and Germany). Once this is done, the evidence reported in the country reviews showed that average income of retired households is close to, or exceeds, that of working-age households in France,

Table 2.1. **Ensuring sustainable retirement income: summary of policy recommendations**

	Public pension system sustainability	Employment incentives	Additional saving
Australia		Align superannuation receipt with the standard retirement age; ease or abolish the asset test; reduce the pension withdrawal rate	Improve regulatory regime
Belgium	Set legal target for debt reduction	Strengthen job search requirements for receipt of unemployment benefits	
Canada	Index basic pension or means-tested benefit to wages	Increase standard age of retirement to 67	
Czech Republic	Introduce Notional Defined Contribution system or reduce replacement rate		Make sure incentives are targeted at additional private retirement saving
France	Introduce Notional Defined Contribution system; harmonise public and private sector state pensions	Link retirement age with life expectancy; reduce incentives for early retirement and introduce actuarial neutrality	
Germany	Use longer projection period to determine sustainability	Increase retirement age in line with life expectancy	Make additional saving more attractive (lump sums and higher ceilings)
Greece	Reduce high minimum pension and create better link between contributions and benefits.	Link special schemes to actuarial outcomes	Remove tax penalty to private pension saving; strengthen regulatory regime for occupational pensions
Hungary		Increase standard retirement age or make benefits actuarially neutral; reduce use of disability benefits;	Strengthen regulatory regime for private pensions
Italy	Reduce the replacement rate for seniority based pensions; Accelerate transition to notional defined contribution system	Improve incentives to continue working	Reform separation payment into a second tier pension
Japan	Revalue contributions on wage bill and index on prices	Improve incentives for female labour market participation	Strengthen regulatory regime for private pensions; reduce period required to meet solvency criteria
Korea	Reduce replacement rate; expand coverage; increase social assistance benefit		Reform separation payment into a second tier pension; strengthen regulatory regime for voluntary retirement saving
Luxembourg	Ensure balance is sustainable over a longer time horizon than 15 years	Introduce actuarial adjustment of benefits for early retirement; link standard age of retirement with life expectancy	
Slovak Republic		Increase standard age of retirement; introduce job search requirements for receipt of social transfers	Encourage private pension saving
United Kingdom		Close <i>de facto</i> early retirement routes	Design proposed pension default insurance to avoid excessive risk-taking by funds.

Table 2.2. **Performance indicators: sustainable retirement income**

	Projected increases in old age pension spending ¹	Primary government balance, cyclically adjusted, 2003	Low income rate of the elderly ²	Relative disposable income of the elderly ²	Private pension funds 1999	Average age of withdrawal, 1994-1999		Participation rate, 2001, per cent		
	Change in per cent of GDP	Per cent of GDP	Per cent of the elderly with income less than 50 per cent of median disposable income	Per cent of the disposable income of all individuals	Per cent of GDP	Male	Female	Aged over 65	Aged 55-64	
									Male	Female
Australia	1.6	2.9	16.1	67.6	63.8	59.7	61.3	6.0	60.0	36.9
Austria	2.2	1.8	14.9	86.6	3.6			2.8 ¹	42.1 ¹	17.5 ¹
Belgium	3.3	6.5	13.8	77.9	6.1			1.3	36.6	15.7
Canada	5.8	3.3	2.5	97.4	45.7	62.6	61.1	6.0	61.3	41.7
Czech Republic	6.8				3.8			4.0	55.0	24.5
Denmark	2.7	3.1	9.2	73.0	24.4	62.4	61.5	4.6	65.5	51.8
Finland	4.8	4.4	7.5	79.0	10.7	59.8	60.0	3.7	51.2	49.5
France	3.9	-0.2	10.7	89.7	6.3	59.3	59.8	1.2	43.8	34.1
Germany	5.0	0.3	10.4	85.6	3.2	60.5	60.8	3.0	50.6	32.4
Greece		3.3	29.2	76.8	4.6	61.7	62.2	5.0	57.0	23.6
Hungary	1.2		6.0	85.2	2.2	59.9 ⁵	56.6 ⁵	3.1	36.3	15.4
Iceland		0.2			86.0			19.9	92.8	81.7
Ireland		-1.7	16.7	74.6	57.8			7.9	66.1	29.5
Italy	-0.3	3.0	15.3	84.1	3.0	59.3	58.4	3.4	57.8	26.6
Japan	0.6	-5.3			18.7	69.1	66.0	21.8	83.4	49.2
Korea	8.0				3.2	67.1	67.5	29.6	71.3	47.9
Luxembourg			6.7 ³		..			0.0	38.1	14.3
Mexico			32.9	85.3	2.4			30.5	80.5	27.6
Netherlands	4.8	0.9	1.9	86.3	119.3	61.6	60.1	3.1	52.0	26.9
New Zealand	5.7	2.0			..			8.6	74.6	51.7

Table 2.2. **Performance indicators: sustainable retirement income** (cont.)

	Projected increases in old age pension spending ¹	Primary government balance, cyclically adjusted, 2003	Low income rate of the elderly ²	Relative disposable income of the elderly ²	Private pension funds 1999	Average age of withdrawal, 1994-1999		Participation rate, 2001, per cent		
	Change in per cent of GDP	Per cent of GDP	Per cent of the elderly with income less than 50 per cent of median disposable income	Per cent of the disposable income of all individuals	Per cent of GDP	Male	Female	Aged over 65	Aged 55-64	
									Male	Female
Norway	8.0	-7.2	19.1	74.1	7.4	64.2	64.7	13.2	73.6	63.2
Poland	-2.5		8.4 ³		..			7.5	41.5	24.1
Portugal		1.4			11.4	65.3	66.5	19.0	63.7	41.9
Slovak Republic								1.1	43.0	11.2
Spain	8.0	2.2	11.3 ³		2.3	61.1	61.1	1.6	61.4	23.6
Sweden	1.6	0.8	3.0	89.2	..	63.3	61.8	9.4	73.5	67.4
Switzerland			8.4 ³		97.3 ⁴			11.4	82.4	56.1
Turkey			23.1	92.7	..			18.1	50.8	18.4
United Kingdom	-0.7	-0.8	11.6	77.8	84.1	62.0	61.2	4.8	64.4	44.6
United States	1.8	-2.8	20.3	91.7	74.4	65.1	64.2	13.1	68.1	53.0

1. Deng *et al.* (2001).

2. Förster and Pellizzari (2000).

3. Smeeding (2002).

4. 1998.

5. 2002

Source: Förster and Pellizzari (2000); Jesuit and Smeeding (2002), Luxembourg Income Study; OECD Labour Force Statistics, Scherer (2002).

Germany, Hungary, Italy and Luxembourg. In addition, other forms of incomes that do not involve monetary transactions may be significant: government-provided health services (Australia), and agricultural activities (Greece). More generally, the change in living standards may be better measured by consumption levels that can be maintained by running down accumulated assets during working life, as in Japan. Despite favourable replacement rates for the population as a whole, the reviews noted that in some countries certain groups are at risk of poverty in old age: farmers and rural workers (Greece, Hungary), ethnic minorities (Hungary), single women (Japan) and, in Korea, people who retired before the present pension system was introduced.

A high level of non-employment income has been accompanied by the almost complete withdrawal of people over the age of 65 from the labour force in most member countries. Of the reviewed countries, only Japan and Korea had a high participation rate of older workers and that reflected continued participation of the self-employed in the labour force. In addition, non-reviewed member countries with relatively high participation rates of those aged 65 and over include Iceland, Mexico, Portugal and Turkey. These countries also have a large proportion of those aged 55 to 64 in the labour force. Elsewhere the proportion is low, ranging between one-quarter (e.g. Belgium, Hungary, Luxembourg and the Slovak Republic) and one-half (e.g. Australia, Canada and the United Kingdom) of the population. As reflected in these participations rates, the average age of withdrawal from the labour force varies between 67 in Japan, Korea and Iceland to under 60 in Belgium, Hungary and Italy.

In the reviewed countries, as elsewhere in the OECD area, high pensions and low effective retirement ages may not be sustainable in the face of ageing-related pressures on public finances in coming decades. The extent of the demographic shift will vary considerably across countries. The group of countries most severely affected by the increase in the number of elderly (Greece, Italy, Czech Republic, Poland, Korea and Japan) may experience close to a tripling of the ratio of people aged over 64 to those in the age-group 15 to 64. In Australia, Germany, Canada, France and Hungary, the old-age dependency ratio could double. Even the countries with the most favourable evolution (Belgium, Slovakia and the United Kingdom) may see a significant rise in the dependency ratio. However, reflecting differences in public pension rules, there is little apparent link between changes in the old-age dependency ratio and public pension outlays across member countries: projections of public pension increases relative to GDP until 2050 range from virtually zero or less in Italy, the United Kingdom and Poland to more than 6 per cent in, for example, the Czech Republic, Greece and Korea.

1.2. Policies

Since the mid-1990s, there has been a marked change in the policies of a number of countries with respect to public-pension spending and retirement-

income arrangements, with nearly all countries introducing changes in this area and several others beginning to seriously address the issue. Reforms have typically involved a mixture of changes in replacement rates, private pension arrangements and the incentives to retire at relatively young ages (Table 2.3).

1.2.1. The financial sustainability of public pensions and the pension replacement rate

The 15 reviewed countries can be divided into three groups depending on the progress achieved in stabilising the impact of ageing on pension outlays:

- A substantial degree of long-run stability has been achieved in Australia, Belgium, Canada, Italy, Hungary, Poland, the Slovak Republic and the United Kingdom. This has involved a fundamental change in public pension arrangements in Italy, Hungary, Poland and the Slovak Republic, with the replacement of defined benefit public pensions with notional defined contribution systems in Italy, Poland and the Slovak Republic and the introduction of a mandatory funded tier in Hungary and Poland. The strategy in Belgium and Canada has centred on pre-funding of future pension outlays, by running primary fiscal surpluses in the Belgian case and higher contributions to second-pillar pensions in Canada.
- Reforms have limited the projected deterioration in the financial position of the pension system without making it financially sustainable in France, Germany and Japan. In these countries, frequent incremental parametric changes to the existing system until recently still left them with increases in public pension spending of above 4 per cent of GDP from 2000 to 2050.
- Changes to pension systems have failed to address ageing-related fiscal pressures in the Czech Republic, Greece, Korea and Luxembourg. In the first three countries, pension outlays could rise by 7 percentage points of GDP or more from 2000 to 2050, while the rise could be contained to just over 3 per cent in Luxembourg on optimistic assumptions about continued inflows of foreign workers.³

While the first group of countries has taken measures to ensure the sustainability of the public pension system in the very long term, short-term pressures on public finances may still emerge because of transitional arrangements or the slow implementation of reforms. For example, where reforms have included the establishment of mandatory saving arrangements (see below), the pension authorities may lose revenues as pension contributions are lowered to make room for mandatory-saving contributions while outlays remain unchanged in the short term. Also, in Italy, the new pension arrangements will be only gradually phased in up to 2030, and in the short run the old system will continue to maintain acute pressure on public pension outlays.

Table 2.3. Reforms to retirement income systems

	Date of reform	Fiscal stability	National estimate pension spending increase % GDP 2000 to 2050	Saving incentive problems	Flat rate pension falls relative to wages	Government defined benefit PAYG	Reduced level of defined benefits	Government defined benefit, funded	Government defined contribution	Mandatory private defined contribution	Increased contribution rates	Adjustment for one year extra work per cent	Activity rate 55-64	
Poland ¹	1998	Yes	-2.5	No	n.a.	No	Abolished	No	Yes	Yes	No	6.3	33	
United Kingdom ²	2003	Yes	0.0	Yes	No	Partial	No	No	No	No	No	10.4	55	
Italy ¹	1995-98	Yes	0.0	No	n.a.	No	Abolished	No	Yes	No	No	57-64 65+	7.7 0.0	26
Canada	1997	Contingent	0.8	Yes	Yes	Partial	No	Off-budget	No	No	No	6.0	49	
Hungary	1998	Yes	1.3	No	n.a.	Partial	Yes	No	No	Yes	No	6.0	52	
Australia	1992	Yes	1.6	Yes	No	No	n.a.	No	No	Yes	No	9.4	43	
Slovakia	2004	Yes	2.0	No	n.a.	No	Yes	No	Yes	Yes	No	0.0	27	
Belgium	2000	Contingent	3.0	No	n.a.	Yes	Yes	Debt repayment	No	No	No	0.0	27	
Luxembourg	2002	No	3.2	No	n.a.	Yes	Increased	No	No	No	Yes		26	
France	2003	No	3.5	No	n.a.	Yes	Yes	No	No	No	Yes	Up to 60 60+	5.0 3.0	39
Germany	2002	No	4.9	No	n.a.	Yes	Yes	No	No	No	Yes	6.0	42	
Japan	2000	No	5.3	No	n.a.	Yes	Yes	Nominally	No	No	Yes	Up to 67 67+	12.0 26.0	66
Czech Republic	1995	No	6.0	No	n.a.	Yes	Yes	No	No	No	No	2nd tier	6.0	40
Korea	1988	No	8.0	No	n.a.	Yes	No	Nominally	No	No	No	5.0		
Greece		No	10.0	No	n.a.	Yes	No	No	No	No	No	Up to 64 65+	6.0 0.0	41
Memorandum item:														
Sweden ³	1998	Yes	1.6	No	n.a.	No	Abolished	No	Yes	Yes	No	6.2	70	
United States	1983	Yes	1.8	No	n.a.	Partial		Nominally	No	No	No	Up to 66 66+	5.8 8.0	61

Note: Annual age adjustment.

1. Assumes 2 per cent growth in the revaluation factor.

2. For people retiring after 2010.

3. Assumes a revaluation factor of 1.6 per cent.

In all of the countries where action has been taken to move towards long-term stabilisation of pension spending, the replacement rates of public retirement benefits have been, or will be, reduced. From 1990 to 2000, the expected replacement rate had fallen in a few of these countries (Table 2.4). In the coming five decades the declines are expected to be much more substantial. For example, average replacement rates in the standard public pension system in Italy and the United Kingdom are scheduled to fall by over 40 per cent in the coming 50 years with an even greater fall in Poland. As noted below, flanking policies have been introduced in most of these countries to reduce the risk that the fall in public pensions compromises income adequacy. If such supporting policies were to prove inadequate, reforms to ensure fiscal sustainability might turn out to be politically unsustainable in the long-run.

Pension replacement rates have also fallen, or are scheduled to fall, in the countries that have been limiting future growth in outlays but without yet achieving financial sustainability. Thus, relative to the pre-reform pension

Table 2.4. Expected gross replacement rate in pension system over next five years

Average across three earnings levels and two marital statuses, per cent

	At age 60				At age 65			
	1989	1995	1999	2003	1989	1995	1999	2003
Australia	0	0	0	30	36	36	35	64
Austria	0	0	0	0	0	0	72	74
Belgium	0	48	48	48	0	52	52	53
Canada	14	14	14	14	57	57	57	59
Finland	40	38	40	32	55	59	59	60
France	76	75	72	62	79	78	75	72
Germany	21	18	18	16	59	50	50	49
Iceland	0	0	0	0	0	47	50	63
Ireland	0	0	0	0	33	33	32	40
Italy	80	80	80	70	80	80	80	97
Japan	0	46	47	45	0	64	60	48
Korea	16	15	15	78	25	23	22	88
Luxembourg	0	87	86	94	0	95	95	108
Netherlands	80	80	80	80	63	59	61	62
Norway	0	0	0	0	36	32	32	36
New Zealand	56	31	11	0	38	42	53	53
Portugal	0	0	0	74	80	76	73	78
Spain	54	54	56	60	91	90	87	85
Sweden	51	51	49	44	75	74	70	78
Switzerland	0	0	22	22	63	66	66	66
United Kingdom	0	0	0	0	38	46	48	47
United States	23	23	24	23	53	54	56	48

system in the early 1990s, pension reforms in France are estimated to cut the average replacement rate by 13 percentage points by 2020. The German pension reform in 1993 reduced replacement rates significantly, but the 2001 reform involved only a minor cut in the full net replacement rate, from 70 to 68 per cent, partly because this was judged adequate to make the financial position stable over the 15-year horizon used by the government. The periodic adjustment of the pension system in Japan in 2000 also cut pensions in the long term by 20 per cent, reducing the replacement rate for married couples to 52 per cent. Notwithstanding the significant cuts in these countries, the drop would have to be much sharper if financial sustainability were to be attained by lower replacement rates only.

In those countries where pension reforms have yet to be put in place to meet the challenge of ageing, replacement rates have either been unchanged or risen. In the Czech Republic, after falling in the initial phase of the transition to a market economy, replacement rates have been relatively stable. In Korea, the maturing of the recently-established pension system implies that pension replacement rates have risen significantly in the recent past and that they will continue to do so in the future. In Greece, policy reforms since the early 1990s have aimed at improving income adequacy, and replacement rates at the lower end of the income scale have increased markedly. Pensions relative to income were also increased in Luxembourg in the late 1990s, mainly because this was considered to be affordable when looking at the likely evolution of the state pension fund over the coming 15 years.

The country reviews recommended that the replacement rate would have to be cut in a number of the reviewed countries as a part of a strategy to stabilise the financial position of the public pension system. This course of action was recommended for the Czech Republic, Japan (through indexing pensions in payment to prices rather than wages) and Korea (where it was judged to be urgent to reduce the generosity before the system matured). For France, it was recommended that pensions in the public sector should be aligned to the less generous pensions in the private sector, and the recent pension reform has already acted on this recommendation. It was also suggested by the country survey that Greece should reduce minimum pensions. As an alternative to parametric changes to the existing pension system, the introduction of a notional defined contribution system was suggested for France and the Czech Republic. To ensure that the scale of the ageing challenge is fully taken into account in official sustainability assessments, Germany and Luxembourg were called on to use a longer time horizon than the current 15 years in their pension-spending projections.

For the countries that have achieved a large measure of sustainability in their long-term pension finances, the reviews expressed some reservations about the manner in which the reforms were being carried through. In the

countries where pre-funding was part of the reforms, the specific measures needed to generate the required fiscal surpluses have been difficult to implement, leading to the recommendation that Belgium should establish a legally-binding path for debt reduction. In the case of Poland, there have been inadequate payments to the stabilisation fund designed to help finance the transition to the new pension regime. There has also been a move to reverse some of the initial decrease in pension benefits in Poland and Hungary, with the reviews suggesting that an increase in the effective retirement age was needed to offset these changes in Hungary. The review of Italy recommended that the switch to the new pension system be accelerated, going beyond the recent proposal to raise the standard retirement age.

1.2.2. Increased private saving

Measures to promote greater private saving have been important features of reforms introduced to start addressing the demographic pressures on pension systems. In the light of falls in the generosity of public pensions, many individuals will need to make additional saving (or delay retirement) to maintain living standards in retirement. In the absence of sufficient saving, governments could come under strong pressures to increase pension outlays and this could destabilise public finances. Increased saving for retirement has been either enforced through mandatory means or stimulated by financial incentives to invest in voluntary schemes.

In countries where the generosity of basic state pensions is projected to fall most markedly, additional saving has often been made mandatory (Australia, Hungary, Poland and under consideration in the Slovak Republic).⁴ The extent of the mandated saving differs across these countries. For example, it is 9 per cent of wages in Australia and 8 per cent of wages in Hungary. The contributions are invested in private pension funds, and on retirement the accumulated contributions and returns are transformed into an annuity in Hungary but more flexibility is allowed in Australia, with retirees being able to withdraw their accumulated contributions as a lump sum. Such mandatory saving is likely to be particularly important for lower-income workers who typically have low, if any, accumulated savings on retirement; higher-income workers with savings may simply replace discretionary with mandated saving. On balance, these arrangements are likely to increase total private and national saving as lower-income groups will be forced to save, and hence strengthen the income-generating capacity of the economy. Instead of introducing across-the-board mandatory saving, the authorities in the United Kingdom have required that employers not offering occupational retirement schemes must make available low-cost and easily-transferable retirement-saving products.⁵ A significant portion of lower-income people have invested in such products since their introduction in 2002. In a number of countries (Italy, Japan and Korea), the

reviews recommended that employment separation payment systems could potentially be transformed into additional private pension vehicles. Such a reform would not only strengthen savings for retirement but also reduce the default risk to employees by preventing firms from using these liabilities as a source of finance for their own purpose.

While recent reforms in many countries have increased the generosity of tax-favoured pension saving (Belgium, Czech Republic, France, Germany), there are serious doubts as to the effectiveness of such measures in either ensuring income adequacy on retirement or strengthening the economic pillar of sustainable development. In many cases, the tax preferences are largely enjoyed by those individuals who are already likely to make adequate provision for retirement.⁶ Furthermore, there is a risk that additional private saving due to tax privileges may be more than offset by falls in public saving (a problem identified in the review of the Czech Republic), thus reducing national saving. Hence, only in the case of Greece did the surveys recommend a more generous tax treatment of private retirement saving, as the Greek tax system still leaves such form of saving at a disadvantage compared with other forms. In Germany, rather than change any of the tax elements of the new voluntary saving scheme, the review recommended that it should be made more attractive by allowing lump-sum withdrawals at retirement. The risk to individuals of participating in private pension saving systems could also be reduced through improvements in vesting and portability arrangements (Germany, United Kingdom).

As income adequacy on retirement is increasingly based on private pension saving, there has been greater recognition that a strong regulatory framework and effective supervision of private-pension providers is important for the success of reforms.⁷ Compared with public pension arrangements, individuals covered by private pension schemes bear a larger share of the risk, and one that increases with age whilst elder cohorts tend to be more risk averse. Ensuring the sound functioning of private pension providers is therefore needed to encourage people to invest in such instruments and also to avoid the risk of defaults that might adversely affect public finances. A weak regulatory framework is one of the factors accounting for the limited development of private pension savings in Korea despite the various tax preferences afforded to such saving. Also, in the Czech Republic and the United Kingdom, the collapse of a number of private pension funds has prompted the strengthening of the regulatory regime and the powers of the pensions' regulator. As reported in the economic surveys, a variety of regulatory requirements for private pension providers have been introduced: putting risk management plans in place (Australia); the requirement of the pension fund to be independent of the pension sponsor (Japan); phasing out schemes that are held in book value only (Japan and, among the non-reviewed

countries, Spain); and requiring schemes to draw up plans to address prospective deficits (Japan) or to provide protection against fund default (United Kingdom). Nonetheless, the reviews recommended further strengthening of the valuation techniques used by the regulator in Japan and careful design of pension protection funds in the United Kingdom, taking into account possible insolvency in a way that avoids the encouragement of excessive risk-taking by pension funds.⁸ In Poland, it was suggested that more flexibility should be given to individuals to adjust the risk profile of their savings in private-sector accounts in line with the time to their retirement.

1.2.3. *The means-testing of pensions*

Means-testing of pensions in Australia and the United Kingdom will concentrate the necessary reduction of average pension replacement rates on those that are better off. In both Australia and the United Kingdom, state pensions are reduced by 40 per cent of the excess of other income over a certain threshold level. In the United Kingdom, up to 60 per cent of all retired households will be subject to such means-testing by 2050. The associated high marginal taxes on work after the pension entitlement age and the high marginal taxes on saving before the pension age will tend to discourage work and saving. Indeed, in Australia, there is evidence that these incentives are already inducing such behavioural responses and the review recommended that means testing should be limited to income and that the marginal withdrawal rate of the government pension should be lowered. In the United Kingdom, the disincentive effects will grow over time as more people become entitled to the Pension Credit, and could have serious effects in the longer term.

1.2.4. *Longer working lives*

There has been some tendency in the reviewed countries to adjust pension systems so as to encourage people to delay retirement, as this could help to increase incomes among the elderly, reduce pressures on public finances and increase the output capacity of the economy. Indeed, significant progress in limiting early retirement would alleviate, or even eliminate, needed cuts in public pension replacement rates to stabilise government finances. For males, the rise in the standard and early ages of entitlements to old-age benefits since the mid-1990s in the reviewed countries was confined to Hungary and Italy, and amongst the non-reviewed countries to New Zealand (Table 2.5).⁹ However, for females, the standard age is in a process of being raised to that of males in a few countries, including Australia, Belgium, Hungary and Italy. As discussed in the country review of Japan, creating a closer link between contributions and benefits for married women could raise the participation rate of women at all ages.¹⁰

The disincentives to work at older ages embedded in pension systems have also fallen in some of the reviewed countries. Judging by developments

Table 2.5. **Standard and early ages of entitlement to old-age pension benefits**

	Males								Females			
	Early				Standard age				Standard age			
	1989	1995	1999	2003	1989	1995	1999	2003	1989	1995	1999	2003
Australia	65	65	65	55	65	65	65	65	60	60	61.5	62.5
Austria	65	65	65	65	65	65	65	65	60	60	60	60
Belgium	60	60	60	60	65	65	65	65	60	60	61	63
Canada	60	60	60	60	65	65	65	65	65	65	65	65
Czech Republic	..	..	..	58.5	..	..	..	61.5	..	..	..	59.5
Denmark	67	67	67	65	67	67	67	65	67	67	67	65
Finland	60	60	60	62	65	65	65	65	65	65	65	65
France	60	60	60	60	60	60	60	60	60	60	60	60
Germany	63	63	63	63	65	65	65	65	65	65	65	65
Greece	60	60	60	60	65	65	65	65	60	65	65	65
Hungary	60	60	60	60	60	60	60	62	55	55	57	59
Iceland	67	65	65	65	67	67	67	67	..	..	..	67
Ireland	65	65	65	65	66	66	66	66	66	66	66	66
Italy	55	55	57	57	60	61	64	65	55	56	59	65
Japan	60	60	60	60	65	65	65	65	65	65	65	65
Korea	60	60	60	55	60	60	60	60	60	60	60	60
Luxembourg	60	60	60	60	65	65	65	65	65	65	65	65
Mexico	65	65	65	65	65	65	65	65	65	65	65	65
Netherlands	60	60	60	60	65	65	65	65	65	65	65	65
Norway	67	67	67	67	67	67	67	67	67	67	67	67
New Zealand	60	62	64	65	60	62	64	65	60	62	64	65
Poland	..	..	..	65	..	..	..	65	..	..	..	60
Portugal	65	65	65	55	65	65	65	65	62	63	65	65
Slovak Republic	..	..	..	60	..	..	..	60	..	..	..	57
Spain	60	60	60	60	65	65	65	65	65	65	65	65

Table 2.5. **Standard and early ages of entitlement to old-age pension benefits** (cont.)

	Males								Females			
	Early				Standard age				Standard age			
	1989	1995	1999	2003	1989	1995	1999	2003	1989	1995	1999	2003
Sweden	60	60	60	61	65	65	65	65	65	65	65	65
Switzerland	65	65	63	63	65	65	65	65	62	62	62	63
Turkey	55	55	55	60	55	55	55	60	50	50	50	55
United Kingdom	65	65	65	65	65	65	65	65	60	60	60	60
United States	62	62	62	62	65	65	65	65	65	65	65	65

Note:

Australia: Minimum retirement age (i.e. at which superannuation savings can be drawn) will increase to 60 over the period 2015-2025. Standard age for women to be increased from age 62.5 to age 65 between 2003 and 2013.

Austria: Early age of eligibility does not incorporate special early retirement for long insurance years, which will be progressively phased out (following the 2003 reform) but could still be accessed from age 61.5 in 2003 (60 in 1969, 1979 and 1989). Standard age for women to be increased from age 60 to age 65 between 2024 and 2033.

Belgium: Standard age for women scheduled to rise to age 65 by 2009.

Czech Republic: Standard and minimum retirement ages are scheduled to rise gradually to reach age 62 for men and age 61 for women (with no children) in 2007.

Greece: Standard age is 62 for men and 57 for women who first started to work before 1992.

Hungary: Standard retirement age for women is gradually rising to 62.

Iceland: Early retirement age in 2003 is still 67 for the basic pension. However, most occupational pension schemes, which are progressively maturing, set the minimum retirement age at 65.

Italy: Minimum retirement age is the minimum age of eligibility to a seniority pension, also equal to the minimum retirement age in the new pension system. Standard age is 60 (instead of 65) for women who first started to work before 1996.

Korea: Standard age scheduled to rise from age 60 to age 65 between 2011 and 2033.

Luxembourg: Early age of eligibility does not incorporate the special early retirement scheme ("pré-retraite"), which can be accessed from age 57 with 40 years of contribution.

Norway: Early age of eligibility does not incorporate the special early retirement (AFP) scheme, which can be accessed from age 62 in 2003.

Poland: Standard age is 55 for women with 30 years of insurance.

Slovak Republic: Standard age for women varies between 53 and 57 according to number of children raised.

Switzerland: Standard age for women will be 64 in 2005.

Turkey: Standard age is 55 for men and 50 for women who first started to work before 1990.

United Kingdom: Standard age for women will rise from age 60 to age 65 over 2010-2020 period.

United States: Standard age for both men and women scheduled to rise to age 67 over 2000-2022 period.

Source: US Department of Health and Human Services, *Social Security Programs Throughout the World*, various issues.

in the implicit tax on continued work for the countries for which such data are available (Table 2.6), decisive falls in the disincentives since the mid-1990s have been limited to Italy and France. However, the introduction of notional defined contribution systems in Poland and the Slovak Republic also implies that the implicit tax on continued work in the long term has been lowered in these countries. In Hungary, incentives to defer retirement have been increased in the pay-as-you-go system. By contrast, work disincentives are estimated to have risen significantly in Australia, due to the means-testing of pension benefits, and in Korea, due to the rise in pension benefits and hence the opportunity cost of foregoing such benefits.

Most of the reviewed countries have *de facto* early retirement benefit systems that create strong incentives to withdraw from the labour market before the earliest age of pension entitlement. Measures have been taken to tighten access to these benefit systems:

- The scope to use unemployment benefit systems as an exit route from the labour market has been reduced in France and Belgium by raising the age at

Table 2.6. Implicit tax rates on continued work at older ages in old-age pension systems

Single workers with average earnings, per cent

	At age 60				At age 65			
	1989	1995	1999	2003	1989	1995	1999	2003
Australia	1	1	1	23	22	22	5	33
Austria	0	0	10	9	0	0	84	67
Belgium	0	47	47	47	0	55	55	55
Canada	11	12	13	16	9	6	7	6
Finland	26	18	22	31	55	75	73	55
France	83	82	83	51	51	85	85	71
Germany	26	24	24	18	0	0	0	0
Iceland	0	5	5	5	0	27	27	19
Ireland	18	15	17	15	7	7	7	8
Italy	98	102	105	21	96	100	103	88
Japan	0	39	40	40	0	0	0	14
Korea	4	3	3	41	10	8	8	36
Luxembourg	0	79	79	76	0	0	0	0
Netherlands	86	90	94	94	0	0	0	0
Norway	15	14	14	21	47	38	35	39
New Zealand	30	17	6	1	29	29	0	0
Portugal	15	15	17	14	83	12	14	14
Spain	13	10	22	34	109	108	106	92
Sweden	0	0	0	35	0	0	0	44
Switzerland	19	18	23	23	28	29	19	19
United Kingdom	6	7	8	14	27	29	30	21
United States	7	6	5	13	34	31	27	14

which recipients are exempt from job-search requirements from 55 to 58. In Australia, those aged 60 to 64 entering the unemployment benefit system since mid-2003 have become subject to work tests, whereas they were earlier exempted from any job search obligation. Japan has cut the maximum length of unemployment benefit receipt for older workers from one year to six months.

- The entry of older people into disability benefit systems has been tightened by stricter eligibility criteria in Canada, Germany and the United Kingdom. Follow-up examinations have been started in Canada and Luxembourg to test the work capacity of recipients. The attractiveness of the disability benefit system for higher-income individuals in the United Kingdom has been reduced by the means-testing of benefits.
- Some special early retirement schemes have been closed to new entrants in Belgium, France, Germany and Luxembourg. In Poland, the closure of one scheme, however, was offset by the broadening of another scheme.

Notwithstanding these measures, disincentives to continued work in *de facto* early retirement systems are particularly strong in Belgium, France, Germany, and, especially, Luxembourg.¹¹

The country surveys made recommendations for almost all the reviewed countries aimed at lengthening working lives. An increase in the standard age of entitlement to pensions was recommended in Canada, Hungary and the Slovak Republic, while in Germany and Luxembourg it was suggested that the standard age should be raised in line with life expectancy. For France, Italy and Luxembourg, the country reviews recommended that the incentives for early retirement should be reduced and that actuarial neutrality should be established in the public retirement income system. In Poland, the review recommended ending the possibilities for early retirement and tightening the criteria for payment of disability benefits. The United Kingdom was invited to close *de facto* early retirement systems, while the recommendations concerning such systems were more specific in other countries: to strengthen job-search requirements for older people receiving unemployment benefits in Belgium and the Slovak Republic, and tightening access to the disability benefit system in Hungary. In the review of Japan, the importance of increasing incentives for women to participate in the labour market was highlighted.

2. Improving living standards in developing countries

Concern over poverty in the non-OECD area has received renewed emphasis in the past few years. OECD member countries have agreed to the Millennium Development Goals at the United Nations in 2000. These goals emphasise, *inter alia*, the importance of giving developing countries unrestricted access to markets in the industrialised countries and using

development co-operation policies to reduce poverty.¹² In view of the importance accorded to these goals, the country surveys of domestic policies to improve living standards in developing countries have focused on the extent to which policies are oriented towards their achievement. Only seven countries (Australia, Austria, Japan, Luxembourg, New Zealand, Norway and the United Kingdom) were reviewed under this heading; examples in this section are mainly limited to these countries but in many cases serve to make points that are applicable to a wider set of OECD countries.

2.1. Performance

Indicators of welfare in developing countries show substantial gains during the 1990s but there have been significant variations across groups of countries. Life expectancy has been rising in developing countries as a whole, but in Sub-Saharan Africa it has been falling in the past decade and is now one year below its 1980 level, against an increase of five years in other developing countries (Table 2.7). As a result, the number of potential years of life that are lost in

Table 2.7. **Development indicators by geographical area and income level**

	1980	1985	1990	1995	2001	Change from 1980 to 2001
Infant mortality rate¹						
Sub-Saharan Africa	117.7	113.5	110.2	108.3	105.4	-10.5
Low income	109.3	99.5	90.3	85.4	80.4	-26.4
Lower middle income	55.4	47.3	41.2	39	33.2	-40.1
Upper middle income	52.2	43.5	35.2	29.0	23.0	-55.9
Life expectancy²						
Sub-Saharan Africa	47.6	49.3	50	49.2	46.2	-2.9
Low income	53.2	55.4	57.2	58.4	58.9	10.7
Lower middle income	65.4	67.1	68	68.3	69.2	5.8
Upper middle income	66.3	67.8	69.1	70.2	71.6	8.0
Illiteracy rate³						
Sub-Saharan Africa	61.9	56.1	50.3	44.5	37.7	-39.1
Low income	50.4	46.9	43.4	40.0	36.2	-28.2
Lower middle income	28.4	24.0	20.3	17.3	14.3	-49.6
Upper middle income	16.0	14.3	12.3	10.6	8.8	-45.0

Note: The income categories used by the World Bank differ from those used by the Development Assistance Committee of the OECD. In particular, income is measured in 2001 in World Bank classifications rather than 1998 in the DAC classification. This has the effect of including China in the lower middle income group for the World Bank data rather than in the low income category in the DAC classification. Also, countries of the former Soviet Union are included in these data whereas some of these countries are classed as receiving development aid rather than development assistance in the DAC groupings. The above classifications are based on World Bank definitions of income categories.

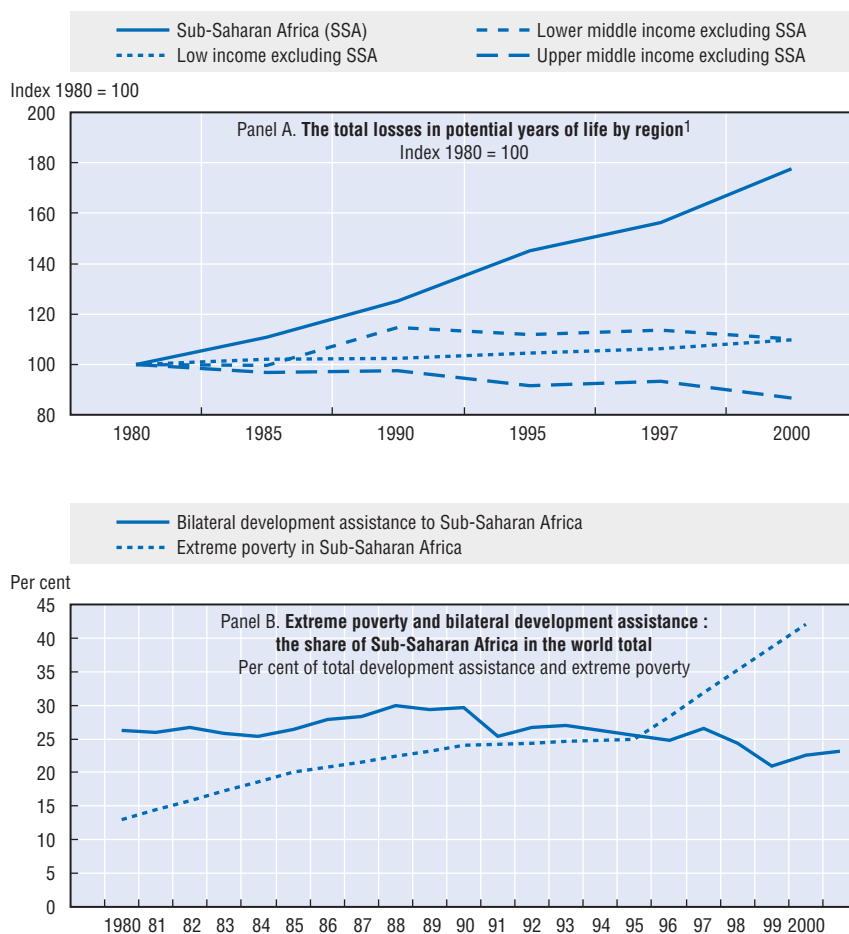
1. Infant mortality measured as deaths per 1 000 births.

2. Life expectancy measured at birth.

3. Illiteracy rate measured in relation to the population aged 15 and over.

Source: World Bank (2003) and OECD recalculations to exclude Sub-Saharan Africa and OECD members from the income categories.

Figure 2.1. **Bilateral development assistance, poverty and shortfall in life expectancy**

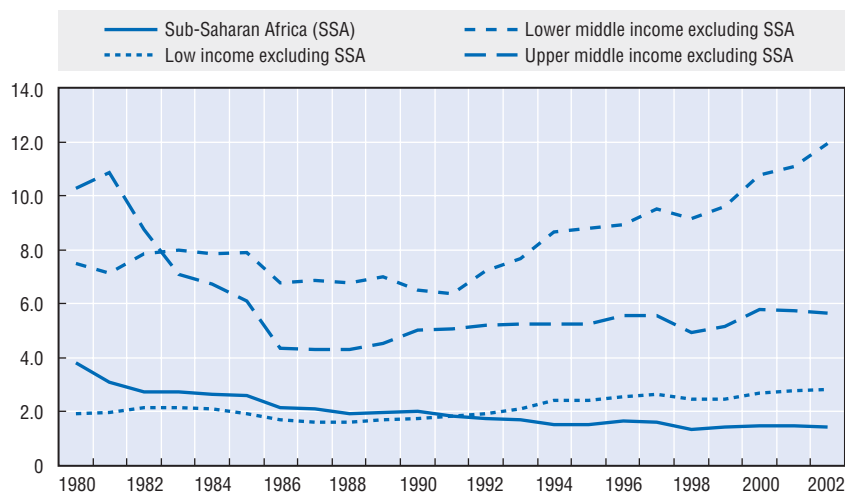


1. Potential years of life are measured by multiplying the difference between life expectancy at birth in the OECD area and life expectancy in the relevant country grouping and the number of births per year. The resulting number of years has been transformed to an index (1980 = 100) for each country grouping.

Source: Life expectancy: World Bank (2003); Bilateral Development Assistance: OECD Development Assistance Committee Database; Poverty: Artadi and Sala-i-Martin (2003).

Sub-Saharan Africa (relative to the experience in the OECD area) has almost doubled (Figure 2.1, panel A). Data on infant mortality paint a similar picture: a sizeable drop for developing countries as a whole, but show a disturbing rise in Sub-Saharan Africa. These disparities extend to extreme poverty, which fell by 10 per cent in the 1990s in general but rose by 38 per cent in Sub-Saharan Africa (World Bank, 2002). In 1970, one in ten poor citizens in the world lived in Africa; by 2000 the proportion was close to one half (Artadi and Sala-i-Martin, 2003).

Figure 2.2. **The share of developing country groups in world trade**
Per cent of total world exports



Source: WTO (2003).

The improvement in living standards in developing countries as a whole has been accompanied by rapid growth in their exports to OECD countries. After losing market shares until the mid-1990s, the least-developed countries have experienced a turnaround in performance (Figure 2.2). However, trends have been heterogeneous in this group of countries. The evolution of the market share of the Sub-Saharan African countries has been dismal, falling continually, with the exception of a few countries where oil resources have been better exploited. On the other hand, Asian and North African least-developed countries have doubled their share of world trade in the past decade. The performance of the least-developed countries in OECD markets has slightly lagged that on world markets, as they have performed well in the rapidly growing markets of South-East and East Asia (Table 2.8).

Flows of net Official Development Assistance (ODA) relative to gross national income (GNI) fell in the ten years to 2001 (Table 2.9), but there has been a tendency to make them more effective for poverty reduction. Even though ODA flows have increased in real terms since 1997, they amounted on average to only 0.2 per cent of GNI in 2000-01 for the principal 22 OECD donor countries, ranging from 0.1 per cent in Italy and the United States to more than 1 per cent in Denmark.¹³ However, over the decade, the composition of ODA flows moved towards making them more targeted on relieving poverty. Thus, greater weight has been given to projects aimed at improving the social and administrative infrastructure, which includes sectors such as education

Table 2.8. **OECD non-energy imports from developing countries**

	Least-developed countries		Other low-income countries		All developing countries	
	Share in total imports, percentage	Average nominal growth (dollar terms), per cent	Share in total imports, percentage	Average nominal growth (dollar terms), per cent	Share in total imports, percentage	Average nominal growth (dollar terms), per cent
	2001	1990-2001	2001	1990-2001	2001	1990-2001
Australia	0.2	7.9	12.6	15.1	22.1	11.8
Austria	0.3	13.1	2.7	9.1	7.6	5.8
Belgium	1.6	5.7	4.5	9.9	11.7	8.8
Canada	0.1	5.1	4.8	17.0	11.9	13.0
Czech Republic	0.1	8.9	4.1	39.7	7.7	20.5
Denmark	0.3	0.9	4.3	9.6	7.4	5.9
Finland	0.5	16.6	4.5	13.7	9.2	8.4
France	0.6	1.0	5.4	11.2	13.0	6.3
Germany	0.5	5.6	5.5	9.2	11.3	4.6
Greece	0.7	7.0	5.1	13.4	13.4	7.9
Iceland	0.1	20.0	4.2	21.7	10.4	19.0
Ireland	0.3	5.6	2.9	17.9	7.6	18.1
Italy	0.4	-1.1	4.9	9.8	13.4	3.7
Japan	0.2	-4.7	24.6	14.0	39.0	9.9
Korea	0.1	-2.6	14.3	12.1	24.5	9.2
Luxembourg	0.1		0.7		1.5	
Mexico	0.0	-6.3	0.6	13.5	4.0	14.9
Netherlands	0.4	5.9	7.7	12.3	16.2	7.5
New Zealand	0.1	4.2	10.2	18.6	17.2	12.6
Norway	0.4	-17.5	4.3	14.4	8.9	-0.2
Poland	0.4	12.4	4.9	22.7	10.3	18.5
Spain	0.5	3.2	5.5	13.9	13.1	9.3
Sweden	0.2	7.3	2.7	6.8	5.7	3.1
Switzerland	0.1	-1.2	2.5	10.2	5.8	2.7
Turkey	0.2	-2.4	5.7	11.4	12.7	6.7
United Kingdom	0.4	6.8	4.7	9.6	12.8	8.3
United States	0.5	9.1	12.6	16.8	35.2	13.3

Note: Starting point is 1992 for Poland; 1993 for Belgium and Czech Republic.

Source: OECD, Foreign Trade Statistics Database.

and health, in aid-receiving countries, and aid flows have been increasingly targeted at the lower-income countries. Bilateral aid to improve health in the least-developed countries, averaging USD 1.3 billion (Table 2.10) in the period 2000 to 2002 (2.7 per cent of total ODA), has proved to be insufficient to stem the increase of infectious diseases. In 2001 OECD countries devoted only 23 per cent of their bilateral aid to Sub-Saharan African countries, even though these countries account for 42 per cent of all people living in absolute poverty.

Table 2.9. **Official development assistance (ODA)**

	Total ODA as per cent of GNI		Average annual real growth of ODA	Social and administrative share in total ODA	Share of untied bilateral ODA	Share of ODA going to low income and least-developed countries
	1990-91	2000-01	1995-2001	2000-01	2001	2000-01
Australia	0.4	0.3	0.6	50.7	59.3	60.5
Austria	0.3	0.3	0.2	42.4	59.2 ¹	67.6
Belgium	0.4	0.4	3.5	42.3	89.8	70.9
Canada	0.5	0.2	-2.6	30.6	31.7	69.8
Denmark	1.0	1.1	4.4	22.8	93.3	76.1
Finland	0.7	0.3	5.0	42.2	87.5	67.9
France	0.6	0.3	-6.6	38.9	66.6	57.3
Germany	0.4	0.3	-1.2	42.3	84.6	58.1
Greece	..	0.2	8.2	70.9	17.3	23.7
Ireland	0.2	0.3	11.9	57.6	100.0	80.1
Italy	0.3	0.1	-2.3	23.4	7.8	62.9
Japan	0.3	0.3	3.0	20.6	81.1	70.1
Luxembourg	0.3	0.8	18.1	69.8	96.7 ¹	62.6
Netherlands	0.9	0.8	5.0	26.2	91.2	70.5
New Zealand	0.2	0.3	5.6	49.2	..	59.5
Norway	1.2	0.8	1.7	41.8	98.9	67.1
Portugal	0.3	0.3	6.7	36.7	57.7	85.7
Spain	0.2	0.3	7.3	34.9	68.9	55.7
Sweden	0.9	0.8	4.4	32.2	86.5	68.6
Switzerland	0.3	0.3	3.0	18.3	96.1	68.7
United Kingdom	0.3	0.3	5.8	25.3	93.9	73.6
United States	0.2	0.1	3.2	42.2	..	58.8
Total DAC	0.3	0.2	1.8	32.1		65.2

1. 2000.

Source: Development Assistance Committee Database.

2.2. Policies

Trade barriers against imports from the developing countries have fallen significantly for industrial goods, but with some notable exceptions. The general fall in most-favoured-nation tariffs on goods in the wake of the Uruguay Round (Figure 2.3) has benefited developing countries. Indeed, the level of tariffs is now sufficiently low that the concessions granted to all developing countries in the context of the generalised system of preferences (GSP) and special arrangements conceded to the least-developed countries have taken tariff rates for the latter group down to zero for the bulk of all tariff lines. Indeed, average tariff rates for imports from the least-developed countries in the reviewed countries ranged from close to zero in Australia,

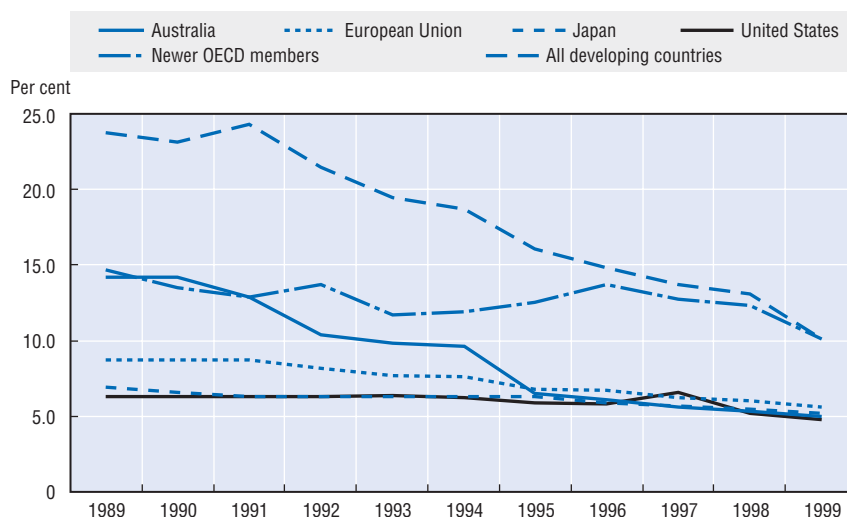
Table 2.10. **Domestic spending and donor assistance on health**
1997-1999

	Public spending on health per person, 1997, USD at current exchange rates	Total spending on health per person, 1997, USD at current exchange rates	Donor assistance for health (per person, average annual 1997-1999)	Bilateral donor assistance for health, annual average, USD millions at current exchange rates	
				1997-1999	2000-2002
Least-developed countries	6	11	2.29	1 129	1 329
Other low-income countries	13	23	0.94	1 091	1 300
Lower-middle-income developing countries	51	93	0.61	620	580
Upper-middle-income developing countries	125	241	1.08	47	52
High-income countries	1 356	1 907	0.00	0	0
Unspecified				591	1 072
All countries			0.85	3 479	4 333

Note: Unweighted averages for countries in respective categories. Includes only countries with population of 500 000 or more in 1997.

Source: World Health Organisation (2001), Development Assistance Committee, Creditor Reporting System Database.

Figure 2.3. **Average tariff rates by country**



Source: World Bank.

New Zealand, and the member countries of the European Union to 1 per cent in Japan, where tariff-rate preferences are significantly less favourable for agricultural imports (Table 2.11). However, a considerable portion of developing

Table 2.11. **Preferential tariff rates for developing countries**¹

Panel A				
	All products		Non-agricultural products	
	Simple average of all tariff lines			
	MFN	LDC	MFN	LDC
Australia	4.1	0.0	4.6	0.0
Canada	4.2	1.7	4.4	0.0
EU	4.4	0.0	4.2	0.0
Iceland	2.9	..	2.4	..
Japan	3.3	0.9	2.7	0.2
New Zealand	3.3	0.0	3.5	0.0
Norway	2.6	..	2.1	..
United States	3.9	1.9	3.8	1.9
Panel B				
	GSP tariff reduction, percentage points	LDC preferences	Other non-reciprocal preferences	
Australia	5	Duty and quota free since mid 2003	The South Pacific Regional Trade and Economic Co-operation Agreement (SPARTECA)	
European Union	3.5	Everything but Arms — duty and quota free, excluding arms and with a transition for sugar, rice, and bananas, since 2001	Cotonou Agreement with ACP countries	
Japan	2	Expanded coverage of duty and quota free to 90 per cent of LDC imports in 2001		
New Zealand	(80 per cent rebates)	Duty and quota free since 2001	The South Pacific Regional Trade and Economic Co-operation Agreement (SPARTECA)	
Norway	(2.8 ²)	Duty and quota free, excluding arms, since 2002		

1. Excludes tariff lines with an *ad valorem* duty.

2. Difference between average MFN tariff and average GSP tariff.

Source: WTO (2003b).

country exporters choose not to take advantage of GSP and other special tariff preferences because of rules-of-origin requirements and the cost of documentation necessary to take advantage of these concessions.¹⁴ An effective way to overcome the barrier due to rules-of-origin conditions is to lower the most-favoured nation tariff rate in order to stimulate imports from developing countries, as recommended in the New Zealand survey. In some of the reviewed countries (such as Norway) the drop in tariffs was accompanied by the elimination of quantitative restrictions, while in Japan such quotas

limited the possibility of the least-developed countries to take advantage of lower tariffs. In contrast to the general trend for manufactured imports, imports of textiles and clothing have remained subject to quantitative restrictions, but these will be changed to restrictive tariffs at the beginning of 2005; the review of Japan called for reduced tariffs on such products.

Trade-distorting support of agricultural production remains an obstacle to developing countries capitalising on their comparative advantage. These products are often subject to trade barriers, such as quantitative restrictions on some “sensitive” products in the form of tariff rate quotas with very high out-of-quota tariff rates and GSP rates that are aligned to MFN rates for many products. In comparison with the situation in the mid-1990s, both the aggregate level of support and use of the most trade-distorting types of support had declined by 2000 as a result of the Uruguay Round Agriculture Agreement. The degree of support remains particularly high in Norway and Japan among the reviewed countries, which prompted recommendations in the economic surveys to lower such support in the two countries. The EU’s agricultural reform in 2003 is likely to lead to some further decoupling of agricultural support from production, though this will be partially at the discretion of the individual EU member countries and will leave unchanged the overall level of agricultural support. The evidence from Austria, Luxembourg, and the United Kingdom shows that some EU member states have managed to use this discretion to shift agricultural support towards less trade-distorting methods, and the reviews encouraged these countries to move further in this direction. Elsewhere, the 2002 United States’ Farm Act expanded and increased production-linked support to shield farmers’ incomes from negative price shocks in commodity markets, so likely raising aggregate support to farmers as compared with previous policies (OECD, 2003). However, the level of support is considerably lower than in the European Union.

The gain to developing countries from lowering agricultural support in the OECD area would primarily accrue to existing food exporters (notably in Latin America). By contrast, a number of food-importing developing countries (including most countries in Sub-Saharan Africa) may face small losses in the short term as a result of increases in food prices, as might a number of countries that already have preferential trading agreements with developed countries. Overall, the net effect of agricultural liberalisation on the whole group of least-developed countries is estimated to be positive but with a gain of only USD 2 billion [Anderson *et al.* (2001); Roberts *et al.* (2002)].

In order to give a boost to living standards in the least-developed countries, a number of the reviewed countries have recently committed themselves to increasing the volume of ODA and its effectiveness. Overall, the principal donors are anticipated to increase aid by 18 per cent in real terms between 2002 and 2006 (OECD, 2004). In some cases, the increase in the volume of aid is significant (Luxembourg, Norway and the United Kingdom).

Furthermore, the United Kingdom has proposed the International Finance Facility as a means to raise the additional funds estimated to be necessary to meet the Millennium Development Goals by 2015. Other countries have also pledged to increase development assistance, with the United States committing itself to a USD 5 billion increase (to 0.15 per cent of GNI). The effectiveness of aid has also been a matter of concern, prompting a number of countries (Austria, Japan Luxembourg and the United Kingdom) to enhance evaluation and monitoring (including external audits) of their overall policies. Achieving further improvement in the monitoring and evaluation of policies was the recurrent recommendation of the surveys for Japan, Luxembourg, New Zealand and the United Kingdom.

In addition, programmes are becoming more targeted on meeting the Millennium Development Goals. Amongst the reviewed countries, Australia, New Zealand and the United Kingdom are setting poverty alleviation as the central goal of development co-operation policies. Austria and Norway have adopted all the Millennium Development Goals as key elements for framing their aid programmes, with the former raising the share of funds directed at the health and education sectors. Better targeting of development assistance to bring it more in line with the most pressing problems, as manifested in Africa, was the primary recommendation coming from the country reviews.

A stronger emphasis has been placed on the developing countries themselves taking greater responsibility in establishing poverty reduction strategies and implementing the associated policies. A number of the reviewed donor countries (Austria, Australia, Japan and the United Kingdom) are aiming at improving governance and institutions in recipient countries.¹⁵ Reviewed countries have generally managed intervention in such sensitive areas through partnership programmes. In other cases, countries are encouraging the strengthening of governance institutions. Once there is confidence in the overall policies of a government in aid-receiving countries, the United Kingdom will consider providing direct budget support to them, so making the recipient government more accountable for policy implementation. In addition, the United States has committed resources to the Millennium Challenge Account which will explicitly reward those low-income countries that perform well on selected governance indicators. Finally, some reviewed countries (Austria, United Kingdom) are supporting policies aimed at improving the capacity of countries to administer trade policy.

While good national governance is a critical framework condition for economic growth, there is also ample evidence that poor economic performance is linked to health conditions. In this context, amongst the reviewed countries, most have contributed to the Global Fund. In addition to contributing to this fund, Japan has raised allocations for health purposes through the 1998 Hashimoto Initiative and the 2000 Okinawa Infectious

Disease Initiative. Elsewhere, the 2003 United States' Leadership Act commits substantial spending increases for the purpose of the control and prevention of infectious diseases, particularly AIDS, tuberculosis and malaria.¹⁶ In Sub-Saharan Africa, malaria and AIDS are responsible each year for the loss of 36 and 72 million disability-free life years respectively, representing 16 per cent of potential life years in the area (World Health Organisation, 2001). If GDP rose in line with the induced rise in life expectancy, a two-thirds reduction in lost life years (suggested as a feasible target by the WHO) might boost welfare in the region by USD 30 billion, or even more on the basis of assumptions used in typical cost-benefit studies for OECD countries. Such potential gains appear to be much larger than the benefit to least-developed countries from a complete liberalisation of agricultural trade.¹⁷

Notes

1. See, for example, Casey *et al.* (2003), Burniaux *et al.* (2003) and Duval (2003). Also, country surveys generally discuss issues related to ageing as a part of the regular monitoring of macroeconomic and structural conditions.
2. See, for example, Docteur and Oxley (2003) for an overview. Further country-specific information on OECD work can be found in the bibliography to that paper. Most economic surveys also cover health issues.
3. Neither Greece nor Luxembourg participated in the public pension projection exercise in 2001, the results of which are presented in Table 12. However, projections by the national authorities in Greece, reported in the country review, suggest that the increase until 2050 could amount to 10 percentage points of GDP. Projections carried out by the Luxembourg authorities for the review indicate that pension spending could rise from 10 per cent of GDP at present to over 13 per cent by the middle of this century.
4. In Australia, the mandating of second tier pension saving is likely to increase income adequacy significantly from relatively low standards of living for the retired.
5. These product have a regulated cap on management expenses and incur no penalties for breaks in contributions or for switching between pension plans.
6. As pointed out in "Tax-favoured Retirement Saving Plans: a Review of Budgetary Implications and Policy Issues" (ECO/CPE/WP1(2004)4), the tax advantage is larger the higher the individual's income. However, the generosity may be partly offsetting progressive features of the broader tax and benefit systems. Furthermore, the tax advantage may provoke a positive labour supply response.
7. The OECD principles and guidelines on private pension regulation and supervision provide a benchmark to evaluate actual practice (OECD, 2002).
8. Iwry (2003) notes that defined benefit schemes have become more costly due to regulatory constraints including payments to the Pension Benefit Guaranty Corporation in the United States, and this has been a reason for the switch from defined benefit to defined contribution pension schemes, but not the main one.

9. As a result of reforms decided in the mid-1980s, the standard entitlement age in the United States is gradually being raised to 67.
10. See Jaumotte (2003).
11. See Duval (2003).
12. The Monterrey Consensus emphasised the importance of coherent trade and aid policies. A horizontal project is underway in the OECD to examine the issue of policy coherence.
13. That is the 22 countries that are members of the Development Assistant Committee in the OECD.
14. Rules of origin are designed to ensure that exported goods are mainly produced in the exporting country. They require that a minimum share of the value of product comes from the exporting country. In the case of New Zealand, a 50 per cent local share is required before tariff reductions for developing countries come into force.
15. Influential work from Burnside and Dollar (2000) and Collier and Dollar (2002) has been questioned by Easterly et al. (2003) and Sachs (2002) who argue that the empirical case for it is weak or that low growth is more related to disease and geography.
16. In some cases, the conditionality of such aid has reduced its effectiveness.
17. Success in reducing the cost of tropical infectious diseases would markedly lower the cost of global climate change, with increased deaths from these diseases estimated to represent 30 per cent of the total costs of global warming when costs are aggregated using population weights (Nordhaus, 1999).

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Chapter 3

Reducing Emissions of Greenhouse Gases

Climate change may impose very large costs in the second half of the century and later unless greenhouse gas emissions are kept under control. Given the magnitude of the emission reductions that are required in the long run, it is of paramount importance to ensure that the most cost-efficient measures are used. For this reason, the twenty country reviews dealing with the issue have focused on the capacity of climate change policies to deliver the highest possible amount of emission reductions for the cost incurred. The chapter reports the findings and recommendations from country reviews based on analysis for each policy instrument: voluntary agreements, regulations, schemes to promote the use of renewable energy sources, carbon taxes and tradeable permits. It also includes data comparing actual emissions against adopted objectives and provides insights about the extent to which emission trends have been decoupled from economic growth.

1. Introduction

This chapter provides a synthesis of the 21 reports on climate change policy that have been undertaken for OECD country economic surveys that have or will appear in the period October 2002 to the autumn of 2004.¹ The focus of these country sections has been the cost-efficiency of the greenhouse gas (GHG) abatement policies implemented by OECD member countries. They have also discussed the social consequences of climate change policies and how the perceived social implications have influenced the design of policies. Against the background of the policy analysis, the economic surveys have provided general and specific policy recommendations on the use of instruments. The sections have not addressed whether the objectives are appropriate given the expected costs and benefits of the policies. This issue will be important for the design of future greenhouse gas policies, but the benefits of abatement at global level are still uncertain though knowledge about the damage of climate change is improving (see Box 3.1). The examples given below are mostly drawn from the countries reviewed on this topic and therefore generally do not cover all OECD countries.

2. Objectives and performance

The international community has twice chosen quantity-based objectives to address the challenge of climate change. First, all OECD countries bar Mexico, Korea and Turkey set an indicative target of keeping their domestic emissions below 1990 levels by 2000 under the UN Framework Convention on Climate Change (UNFCCC) signed in Rio in 1992. Secondly, the same group of countries and a number of non-OECD countries (together known as Annex B countries)² accepted national emission limits for the 2008/2012 period during the Kyoto conference in 1997, with a view to lowering emissions to 95 per cent of their 1990 level by 2008 to 2012. Subsequently the international community agreed limits on the extent to which increased uptake of carbon in agriculture and forestry (sinks) could count against the emissions of Annex B countries and on the extent to which emission credits from developing countries could be set against national emission limits. The overall result of these changes is that if maximum use is made of sinks and imports from developing countries (both of which are difficult to monitor), then the minimum domestic emission reduction required for all Annex B countries was set at 2 per cent, against the reduction of 5 per cent in net emissions that was initially foreseen in the Kyoto Protocol.

Box 3.1. Estimating the marginal benefit of reducing greenhouse gas emissions

Man-made emissions of greenhouse gases (GHG) have been found to modify the earth's climate and will have contrasting consequences across countries according to the Intergovernmental Panel on Climate Change (IPCC, 2001a). Despite considerable progress in climate modeling in the past decade, impact forecasts are still marked by a high degree of uncertainty, especially with respect to the likelihood and nature of catastrophic occurrences. There is, however, a general consensus that climate change will affect ecosystems and human activities in many ways because mean temperatures will increase, the climate may become more variable, the sea level will rise and extreme climatic events may become more frequent (IPCC, 2001a). On the basis of numerous assumptions, these changes can be translated into economic gains and losses. Over the longer term, these estimates suggest that some countries stand to gain from climate change, notably because of higher farm productivity (Russia, Canada), a few others may be little affected (United States), while the majority of countries may incur losses, especially if they fail to improve their public health capabilities. At high levels of global warming (a temperature increase of 4 °C or more), which is projected by a few models for the second part of the 22nd century, impacts might become overwhelmingly negative on the assumption of little technological change (Smith and Hitz, 2003).

While there is considerable uncertainty surrounding the estimated benefits of a reduction in emissions, the country reviews showed that governments have used a central value for policy integration and project evaluation purposes. For example, the UK government has provisionally retained a damage estimate of GBP 20 per tonne of carbon dioxide, the French government uses a point estimate of EUR 27 and the European Commission has suggested a price range of EUR 21 to 54.¹

These values are based on research conducted in the early 1990s reported in IPCC (1995) and, since then, evaluation techniques have improved substantially. The rapid evolution of the state of knowledge meant that no update on consensual damage cost estimates could be included in the third assessment report issued by the IPCC (2001b). The main factors that influence the marginal benefits are better known. Thus, estimates will differ according to the choice of the discount rate, integration of catastrophes in the modelling scenarios, estimation of future income and rising damage estimates, the consideration of ancillary benefits, such as reduced air pollution and noise that arise from lowering greenhouse gas emissions,² and the choice of social welfare function that is used to aggregate income losses for different groups in the world economy. The median of 88 estimates surveyed by Tol (2003) is a marginal damage of emitting GHG of USD 1½ per tonne of carbon dioxide. It is, however, subject to a large degree of uncertainty and results are strongly dependent on the discount factors used in the analyses (OECD, 2004).³

1. All monetary quantities in source documents have been updated to 2003 prices and, where appropriate, converted into a currency other than that used in the source at average 2003 exchange rates.
2. Estimates of ancillary benefits range from USD 0.8 to USD 92 per tonne of carbon dioxide (OECD, 2001). Including ancillary benefits in estimates of the gains of reducing GHG emissions may not be warranted if other policies are in place to deal with such externalities.
3. For policy evaluation purposes, a positive discount rate is necessary.

Of the Annex B countries, the United States and Australia have re-examined their stance and both decided not to ratify the Kyoto Protocol. At present, the Protocol will only enter into force if it is ratified by Russia. Australia, however, retains a national emission target equal to that in the Kyoto Protocol and the United States has set a national goal to reduce the ratio of GHG emissions to GDP (emission intensity) by 18 per cent between 2002 and 2012. Such a reduction in intensity would permit an increase in emissions of 16 per cent in that ten year period, bringing the increase since 1990 to 31 per cent against a reduction of 7 per cent in the Kyoto Protocol.

The majority of OECD countries (14 out of 25 committed) did not attain the indicative objective of keeping domestic emissions below 1990 levels by 2000 (Table 3.1). Emission intensity diminished in virtually all OECD countries (Table 3.2) but, in many of them, not strongly enough to offset the effect of output growth. Thus, the level of GHG emissions in 2000 was more than 10 per cent higher than in 1990 in both the United States and Japan, and while significant cuts were achieved in the European Union as a whole over the same period, some EU member countries recorded particularly high emission increases. The sharp reduction in emissions in transition countries was primarily due to the economic contraction in the early 1990s combined with major cuts in emission intensity in the manufacturing sector following major industrial re-structuring. Falling emissions in Germany were also driven by industrial restructuring in the new *Länder*. Emission abatement in France and Switzerland was facilitated by increases in climate-neutral electricity production from uranium and water, respectively, while privatisation and regulatory reform of the power industry in the United Kingdom induced a switch to cheaper gas-based electricity with a by-product being a fall in emissions (Table 3.3).

Similarly, emissions are set to exceed Kyoto targets, on existing policies, in sixteen out of the 25 OECD countries that have ratified the Protocol and accepted emission ceilings (Table 3.1).³ However, if the Kyoto Protocol enters into force, countries may satisfy emission requirements by importing permits, a large supply of which can be found in Former Soviet Union countries. The difference between quotas and emissions in these countries is indeed forecast to be larger than the shortfall of permits that would arise in the 25 OECD countries party to the Kyoto protocol in a business-as-usual scenario (Böhringer, 2002). On the other hand, if countries retain their Kyoto targets in the absence of permit trade with the FSU countries, large further cuts in emissions would be required in the coming ten years and could prove very costly, especially if policies are not designed to be cost efficient. Looking beyond the current Kyoto commitment period (i.e. after 2012), emission abatement will have to be much more ambitious to stabilise carbon-dioxide concentrations in the atmosphere at levels that do not involve excessive temperature increases, implying that exploiting low-cost options will become more urgent with time.

Table 3.1. **Countries' performance towards adopted objectives**

Rio Convention			Kyoto Protocol						Projection on implemented policies
			Agreed reduction in net emissions		Maximum from sinks and Clean Development Mechanism		Agreed minimum reduction from emissions		
Rio indicative target	Actual		Kyoto	EU limits	Marrakech	EU limits	Overall	EU limits	
1990-2000			2008-2012, per cent change from 1990						1990-2010
Austria	0	3.1	−8.0	−13.0	1.5	4.0	−6.5	−9.0	12
Belgium	0	6.7	−8.0	−7.5	1.5	1.1	−6.5	−6.4	15
Denmark	0	−1.2	−8.0	−21.0	1.5	1.8	−6.5	−19.2	17
Finland	0	−4.1	−8.0	0.0	1.5	1.8	−6.5	1.8	17
France	0	−1.7	−8.0	0.0	1.5	1.6	−6.5	1.6	10
Germany	0	−18.9	−8.0	−21.0	1.5	1.4	−6.5	−19.6	−20
Greece	0	24.0	−8.0	25.0	1.5	1.3	−6.5	26.3	36
Ireland	0	24.8	−8.0	13.0	1.5	1.3	−6.5	14.3	40
Italy	0	5.1	−8.0	−6.5	1.5	1.1	−6.5	−5.4	4
Luxembourg	0	−55.6	−8.0	−28.0	1.5	1.3	−6.5	−26.7	−22
Netherlands	0	3.6	−8.0	−6.0	1.5	1.0	−6.5	−5.0	6
Portugal	0	30.4	−8.0	27.0	1.5	2.2	−6.5	29.2	41
Spain	0	34.8	−8.0	15.0	1.5	1.9	−6.5	16.9	48
Sweden	0	−1.7	−8.0	4.0	1.5	4.0	−6.5	8.0	1
United Kingdom	0	−12.6	−8.0	−12.5	1.5	1.6	−6.5	−10.9	−14
European Union			−8.0		1.5		−6.5		0
Canada	0	19.6	−6.0		11.0		5.0		26
Czech Republic	0	−23.6	−8.0		1.6		−6.4		−32
Hungary	0	−17.0	−6.0		2.0		−4.0		−9

Table 3.1. **Countries' performance towards adopted objectives** (cont.)

Rio Convention			Kyoto Protocol						Projection on implemented policies
			Agreed reduction in net emissions		Maximum from sinks and Clean Development Mechanism		Agreed minimum reduction from emissions		
Rio indicative target	Actual		Kyoto	EU limits	Marrakech	EU limits	Overall	EU limits	
1990-2000			2008-2012, per cent change from 1990						
Iceland	0	6.9	10.0		10.2		20.2		..
Japan	0	11.2	-6.0		4.8		-1.2		7
New Zealand	0	5.2	0.0		40.6		40.6		-15
Norway	0	11.2	1.0		4.0		5.0		22
Poland	0	-16.0	-6.0		1.5		-4.5		-15
Slovakia	0	-33.3	-8.0		3.6		-4.4		-25
Switzerland	0	-0.9	-8.0		4.5		-3.5		-4
Annex B without Australia and the United States			-4.8		3.6		-1.2		-11.6

Table 3.1. **Countries' performance towards adopted objectives** (cont.)

	Rio Convention		National targets	
	Rio target	Actual	National target	Projection on implemented policies
Total GHG emissions, percentage changes				
	1990-2000		1990-2010	1990-2000
Australia	0	-18.2	+8	+16
			National targets	
			National target	Projection on implemented policies as of Jan. 2002
			Ratio of emissions to GDP, percentage change	
			1990-2012	1990-2010
United States	0	+14.2	-33	-28

Note: Korea, Mexico and Turkey have no targets.

Australia: implemented policies as of 2002.

United States: implemented policies as of January 2002.

Source: OECD for emission data, European Environmental Agency for projections on existing policies for EU countries, national reports for projections for Canada, Hungary, Japan, New Zealand, Norway, Poland, Slovak Republic, Switzerland and the United States.

Table 3.2. **Main indicators: climate change**

	Total GHG emission intensity	CO ₂ emission intensity, electricity	CO ₂ emission intensity, transport	GHG emission intensity, other sources	Total GHG emission intensity	CO ₂ emission intensity, electricity	CO ₂ emission intensity, transport	GHG emission intensity, other sources
	2000, g CO ₂ per 1995 US\$ using PPPs				Percentage change 1990-2000			
Australia	1 061	360	159	542	-1.82	-0.46	-1.52	-2.70
Austria	403	66	96	241	-2.05	-3.20	-0.02	-2.42
Belgium	600	105	97	398	-1.47	-1.27	-0.19	-1.81
Canada	888	156	183	549	-0.94	0.24	-0.85	-1.28
Czech Republic	1 082	468	100	514	-2.77	2.54	6.33	-6.58
Denmark	501	171	88	242	-2.38	-2.73	-0.84	-2.64
Finland	597	178	99	321	-2.56	-0.17	-1.83	-3.84
France	402	30	102	271	-2.00	-2.60	-0.02	-2.57
Germany	519	168	91	260	-3.92	-3.57	-1.05	-4.95
Greece	819	275	122	422	-0.16	0.07	-0.02	-0.34
Hungary	747	192	79	476	-2.60	-1.30	-0.24	-3.40
Iceland	398	0	84	314	-1.82	..	-2.47	..
Ireland	643	152	98	392	-4.63	-2.97	0.23	-6.03
Italy	432	108	89	235	-1.06	-0.43	0.01	-1.70
Japan	441	132	81	229	-0.34	0.13	0.89	-0.99
Luxembourg	314	6	249	59	-12.47	-27.09	0.62	-23.13
Netherlands	553	138	80	335	-2.49	-0.95	-1.09	-3.34
New Zealand	1 078	82	179	817	-2.21	2.87	0.80	-3.12
Norway	454	3	97	354	-2.91	-1.57	-2.86	-2.93
Poland	1 109	458	74	576	-5.19	-6.48	-1.39	-4.46
Portugal	516	129	111	276	-0.06	0.85	3.47	-1.51
Slovakia	846	249	70	526	-5.21	0.98	1.98	-7.60
Spain	536	130	127	278	0.35	1.21	0.97	-0.28
Sweden	340	35	110	195	-1.91	-1.52	-0.77	-2.56
Switzerland	267	2	78	187	-0.94	-3.82	-0.40	-1.11
United Kingdom	512	137	106	268	-3.58	-4.30	-1.41	-3.94
United States	779	273	192	315	-1.86	-0.73	-1.30	-3.04
Total of above OECD countries	639	201	137	307	-1.81	-0.79	-0.58	-2.76
	CO ₂ emissions				CO ₂ emissions			
Non-Annex 1 countries								
Korea	679	232	134	..	0.33	4.49	1.08	..
Mexico	456	150	124	..	-1.22	2.86	-1.88	..
Turkey	488	178	84	..	0.47	4.52	-1.26	..

Source: Greenhouse gas emissions: national submissions to the UNFCCC and national publications. Carbon dioxide emissions for electricity and transport: IEA (2001). GDP: OECD, SNA database.

Table 3.3. **Greenhouse gas emissions and sectoral indicators**

Total GHG emissions			CO ₂ emissions per Kwh electricity	Manufacturing CO ₂ emissions per unit of output	Residential CO ₂ emissions per unit of private consumption	Road transport CO ₂ emissions per vehicle-kilometre	Electricity use per unit of GDP	Industrial output per unit of GDP
Level million tonnes CO ₂ equivalent	Annual average percentage change							
	2000	1990-2000	1990-2000	1990-2000 ¹	1990-2000 ²	1990-1999	1990-2000	1990-2000 ¹
Australia	502	1.7	0.1	-0.7	-1.1	-0.8	-0.6	-1.6
Austria	80	0.3	-2.2	-1.7	-2.4	-1.8	0.1	0.3
Belgium	152	0.7	-1.6	-0.2	-1.1	-0.8	-0.2	-0.5
Canada	726	1.8	1.0	-2.6	-2.0	-0.4	-0.5	1.0
Czech Republic	147	-2.7	-0.2	-7.7	-15.4	4.1	2.8	0.2
Denmark	69	-0.1	-3.4	-1.7	-4.0	-0.2	0.7	-0.6
Finland	74	-0.4	-0.9	-7.2	-7.0	-1.4	0.7	3.2
France	550	-0.2	-2.8	-2.4	-1.7	-0.5	0.6	0.3
Germany	991	-2.1	-1.3	-1.1	-4.0	0.7	-2.1	-1.8
Greece	130	2.2	-2.0	-0.4	2.6	-4.4	2.1	-1.7
Hungary	84	-1.8	-1.3	-12.7	5.4	-3.3	0.2	5.3
Iceland	3	0.7	4.9	..	-7.7	0.3	2.6	..
Ireland	67	2.2	-1.3	..	-6.2	4.8	-1.8	..
Italy	547	0.5	-1.2	-2.0	-1.4	-1.1	0.8	-0.2
Japan	1 386	1.1	-0.5	-0.8	0.1	0.3	1.0	-0.2
Luxembourg	6	-7.8	-24.5	-13.0	-2.3	3.8	-3.4	-2.2
Netherlands	218	0.4	-2.8	-1.8	-2.9	-0.1	1.8	-0.6
New Zealand	77	0.5	3.7	..	-3.2	-2.1	-0.8	..
Norway	55	0.6	0.5	0.8	-8.8	0.5	-1.9	-2.7

Table 3.3. **Greenhouse gas emissions and sectoral indicators** (cont.)

Total GHG emissions			CO ₂ emissions per Kwh electricity	Manufacturing CO ₂ emissions per unit of output	Residential CO ₂ emissions per unit of private consumption	Road transport CO ₂ emissions per vehicle-kilometre	Electricity use per unit of GDP	Industrial output per unit of GDP
Level million tonnes CO ₂ equivalent	Annual average percentage change							
	2000	1990-2000	1990-2000	1990-2000 ¹	1990-2000 ²	1990-1999	1990-2000	1990-2000 ¹
Poland	386	-1.7	0.5	-5.8	-6.7	-6.4	6.9	4.4
Portugal	85	2.7	-0.9	0.7	-1.0	-0.4	1.8	-0.6
Slovakia	49	-4.0	1.0	-4.7	-7.4	2.3	0.2	2.4
Spain	386	3.0	-0.2	-0.6	0.4	-0.3	1.2	-0.1
Sweden	69	-0.2	-2.3	-4.7	-4.1	-1.4	-0.5	2.5
Switzerland	53	-0.1	1.8	..	-1.7	-0.3	1.1	..
United Kingdom	649	-1.3	-4.1	-2.1	-1.9	-0.5	-0.7	-1.6
United States	7 001	1.3	-0.4	-4.0	-1.9	-0.2	-0.4	0.4
Total of above OECD countries								
	14 543	0.6	-0.7	-2.2	-1.8	-0.3	-0.2	0.0
OECD excluding US	7 542	-0.1	-1.0	-1.5	-1.7	-0.4	0.0	-0.3
EU countries	4 073	-0.3	-2.1	-1.8	-2.4	-0.4	-0.2	-0.7
Total CO ₂ emissions								
Other OECD countries								
Korea	444	6.5	-0.7	-2.3	-7.9	-4.3	5.2	2.0
Mexico	369	2.2	1.0	-6.9	-2.7	1.5	1.7	0.9
Turkey	206	4.1	0.2	1.2	-2.6	-5.0	4.3	0.4

1. 1991-2000 for Germany and Hungary; 1992-2000 for Poland; 1993-2000 for Slovakia; 1990-1999 for Portugal; no data for Iceland, Ireland, New Zealand and Switzerland.

2. 1991-1998 for Czech Republic; 1993-2000 for Slovakia.

Source: GHG National submissions to UNFCCC, national sources and UNFCCC; carbon dioxide data, IEA; industrial production, private consumption, OECD.

3. Policies

The assessment of current greenhouse gas policies in the country reviews concluded that the current policy stance is imposing excessive costs on the economic pillar of sustainable development for a given cut in emissions, or, in other words, a much greater emission reduction could be obtained for the same cost to society. This resulted in policy recommendations for almost all the reviewed countries that would involve a fundamental change in policies in this area, generally calling for the substitution of current voluntary agreements and command-and-control approaches with environmental taxes or permit trading where such instruments can be readily applied. The recommendations are summarised in Table 3.4 and are further discussed below.

3.1. An overview

At present, climate-change policies are in a state of flux. Climate strategies have been prepared for most OECD countries, setting out the objectives that countries hope to achieve but with little quantification of costs or details of the precise instruments that are going to be used to achieve these goals. As the date for meeting these goals draws nearer, countries are laying out more of the detail of the required policies but uncertainty about whether the Kyoto Protocol will be ratified is growing, despite the arguably marked watering down of required emission cuts agreed at the Marrakech conference in 2001.

Almost all OECD countries have responded to their objectives with piecemeal climate policies, often relying on varied sectoral measures. This is the case in eighteen out of the twenty examined countries. The exceptions are Denmark, which decided to apply a single cap to all its abatement efforts, and New Zealand, which announced a climate-change policy based on taxing GHG emissions at a rate set in line with international permit prices. In other countries, the authorities have concentrated on different policies to abate emissions (Table 3.5).

3.2. Traditional policies

3.2.1. Voluntary agreements and energy audits

Voluntary agreements to reduce emissions have been the major plank of climate change policies in many of the countries surveyed, but they have generally been found to be ineffective or costly. Companies have lobbied intensively to promote the use of voluntary targets or accepted negotiated agreements, especially when they felt the alternative was a carbon tax or increased regulation. Negotiated agreements that allow industrial firms to avoid paying the full burden of a carbon tax (see below) have been concluded in France, Germany, the Netherlands, New Zealand and the United Kingdom.

Table 3.4. Policy recommendations in Country Surveys

	Austria	Czech Republic	Denmark	Finland	France	Greece	Hungary	Iceland	Ireland	Italy	Luxembourg	Netherlands	New Zealand	Norway	Poland	Slovak Republic	Spain	Switzerland	United Kingdom	United States
Plan to import international emission permits					X					X	X			X			X	X		
Price emissions from power plants (with taxes or permits)	X			X					X		X	X			X	X	X	X	X	X
and suppress carbon taxes on electricity use	X			X					X		X	X							X	
and re-consider restrictions on the use of nuclear reactors																	X			
and stop subsidising, or exempting from tax, coal and peat		X		X				X	X	X							X		X	
Improve the cost-effectiveness of the renewables part of the climate change strategy		X	X	X	X	X	X				X	X	X				X	X	X	
by scaling down support to wind power and					X	X	X				X	X							X	
by scaling down support to biomass		X	X									X							X	
by aligning incentives across sub-national levels of government																				X
Reduce support to combined heat and power (CHP) plants			X								X	X								
Put a single price on industry emissions with taxes or permits	X			X					X		X	X		X		X	X	X		X
and wind down exemptions granted to industry				X								X	X	X						
and end voluntary agreements with industry					X				X			X								
Use fuel pricing instead of regulations and standards to improve energy efficiency in the residential and service sectors.	X	X		X			X				X					X				
Begin building an infrastructure for emissions trading	X										X			X	X	X		X		X
and use the price of permits to prompt the same level of efforts in non-covered sectors,	X		X		X	X					X	X		X	X	X	X	X	X	X
by adjusting fuel tax rates accordingly	X		X			X					X	X		X			X	X	X	

Table 3.4. **Policy recommendations in Country Surveys** (cont.)

	Austria	Czech Republic	Denmark	Finland	France	Greece	Hungary	Iceland	Ireland	Italy	Luxembourg	Netherlands	New Zealand	Norway	Poland	Slovak Republic	Spain	Switzerland	United Kingdom	United States
and, more broadly, by replacing voluntary and regulatory measures with economic instruments that make emitters pay a price close to that of permits in the emissions trading scheme.					X	X					X									
Tax permits, unless they can be auctioned in the first place, and use revenues to reduce distortive taxes			X				X				X				X				X	
Scale down abatement efforts in the road transport sector	X				X					X	X								X	
Tax emissions from air and sea transport					X			X												
Create efficient incentives for carbon sequestration								X						X						
Use specific instruments to address objectives of social and regional policies instead of skewing GHG abatement efforts				X												X				

Table 3.5. National climate change policies: a summary

	Austria	Canada	Czech Republic	Denmark	Finland	France	Greece	Hungary	Iceland	Ireland	Italy	Luxembourg	Netherlands	New Zealand	Norway	Slovak Republic	Spain	Switzerland	United Kingdom	United States
Cap-and-trade emissions from large sources	P		P	X	P	P	P	P		P	P	P	P		P	P	P	P	X	
Tax energy use with a view to reducing CO ₂ emissions				X	X					P			X	P	X				X	
Obtain voluntary commitments from industry		X				X	X			X			X	X				X	X	X
Improve energy efficiency	X	X	X			X		X			X	X				X				X
By subsidising the insulation of buildings	X	X						X				X								
By tightening efficiency and insulation standards						X		X			X									
By negotiating efficiency standards with carmakers	X	X		X	X	X	X			X	X	X	X				X		X	
By pricing energy in line with costs			X					X								X				
With energy audits				X	X															
Authorise utilities to build new nuclear reactors					X															X
Favour combined heat and power plants						X							X				X		X	X
Favour renewable sources of energy	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
With guaranteed feed-in tariffs or price premiums	X		X	X		X	X			X		X	X			X		X		
With tax breaks					X								X							X
With investment subsidies					X		X	X						X		X				
With tradeable renewable certificates											X								X	
Contain CO ₂ emissions from road transport	X					X			X		X				X					
Through road pricing																		X		
By taxing the purchase of new cars				X											X					
By subsidising rail and inland navigation	X					X					X				X					
By orientating urban planning towards higher density	X					X														
Increase forest cover								X	X					P			X			
Purchase foreign emission permits		P																		
Purchase of foreign, project-based emission credits	P			P							P		X				P			

Note: X indicates that the policy instrument is already implemented.
P denotes a plan to introduce such a measure.

European, Japanese and Korean car manufacturers have also signed voluntary agreements with the European Commission to pre-empt regulation (ACEA, JAMA and KAMA accords). Unilateral abatement pledges by firms constitute the central part of the climate policy change in the United States. In practice, voluntary agreements for environmental protection have often produced little demonstrable result, notably because the emission baseline presented by companies prior to the agreement is difficult to assess (O'Brien and Vourc'h, 2001 and OECD, 2003a). In addition, the costs of abatement efforts in voluntary agreements remain private information. This implies that abatement targets embedded in agreements may in effect correspond to trend (for example, in France and Germany) or, in other cases, be unduly costly, like the ACEA agreement which is estimated to implicitly price carbon dioxide at EUR 140 and EUR 250 per tonne for diesel and petrol cars respectively (OECD, 2003b). The lack of price mechanisms also means that marginal abatement costs can differ amongst participating firms and thus that efforts to reduce emissions are likely to be distributed inefficiently. The US voluntary registry may be somewhat more cost efficient because it certifies emission reductions in firms' unilateral pledges and enables them to trade in such verified reductions.

Policies designed to exploit perceived "no-cost" emission reduction options through voluntary energy efficiency audits have also played a role in government plans. Such policies take as given that there are energy-saving projects that would be profitable at normal rates of return but which entrepreneurs ignore due to various "barriers". The evidence from Denmark and the United States is that it is difficult to find such projects in the private sector. In Denmark, of over 7 000 energy audits undertaken in the private sector by a government agency, only 12 provided savings sufficient to cover the cost of the audit and the required equipment, even when the benefits included a credit for all reduced externalities (Larsen, 1999). Lack of information can be a barrier to uptake of energy saving projects but information is a commodity that specialised companies can be expected to exploit. Indeed, many service companies are specialised in managing energy use in enterprises. According to Lefevre (1996), the biggest gains from energy audits are to be found in the public sector.

In view of the disappointing experience with voluntary approaches, the surveys recommended that such instruments should not be employed in climate change policies. For Canada, France, Greece, Luxembourg, the Netherlands, Norway and Switzerland, it was specifically recommended to end voluntary agreements with industry as part of a strategy of putting a single price on industry emissions with taxes and permits or preparing the infrastructure for emission trading. The review of the United States also concluded that the current voluntary approach was a poor substitute for a cap-and-trade system.

3.2.2. *Expanding renewable energy*

Nearly all of the countries surveyed have introduced policies to foster renewable sources of energy, but such strategies have involved abatement costs that are usually far out of line with abatement costs in other programmes to reduce GHG emissions (Table 3.5). This policy has been pushed vigorously in the member countries of the European Union, where an indicative target has been set that 22 per cent of electricity production in 2010 should be based on renewables compared with 14 per cent at present. Several European countries have also expanded combined heat and power (CHP) plants with the aim of reducing GHG emissions. Both renewable and CHP sources remain costlier than fossil fuel- and nuclear-powered plants. Avoiding GHG emissions through generating electricity from wind, a policy option pursued in many countries, entails conceding a price premium of 180 per cent to renewable producers in member countries of the European Union and, as legislation ensures that electricity consumers bear the cost of this regulation, the wholesale electricity price may have been raised by 13 per cent in the area as a whole. The associated abatement cost for carbon dioxide saved is estimated at EUR 125 per tonne of carbon dioxide, with an overall cost to the EU economy of EUR 9.5 billion (0.1 per cent of GDP) (Table 3.6). Nevertheless, some support schemes have been more cost-effective than others. For instance, in Ireland competitive bidding for subsidies enabled the deployment of windmills at one of the lowest costs in the OECD area. However, competitive bidding and tradeable certificates only deliver low cost if the targets are kept within the expansion capabilities of the industry, allowing for the difficulties of establishing plants. When excessively ambitious targets are set, even competitive markets lead to high costs as in Italy and the United Kingdom. Equally, fixed buy-back prices for wind energy tend to be associated with very high costs, as is the case in Austria, Denmark, the Walloon region of Belgium, France, Germany and Portugal. However, in the case of Denmark, the costs were eventually judged to be excessive and the level of price support has been scaled back substantially. In general, from the standpoint of climate change policy, specific targets to expand the use of renewable sources appear to be less cost efficient than pricing emissions and letting market forces determine the appropriate energy mix.

Objectives unrelated to the aim of mitigating climate change are often invoked to justify support to renewables. They include reducing local air pollution, ensuring the security of energy supplies, raising employment levels and fostering innovation. However, although air quality benefits from using renewables vary depending on the energy source that is being displaced, they represent at most a fraction of the “excess” GHG abatement cost of this technology.⁴ Moreover, as regards employment and innovation objectives, it is doubtful that special high support to one particular industry could constitute the most efficient means of attaining them.

Table 3.6. **Abatement costs of measures promoting renewable sources of energy**

	Biomass	Photovoltaic	Dams	Geothermic	Wind	Wind
	Euros per tonne of CO ₂					Extra cost, per cent
Austria	341	1 454		114	134	212
Belgium						
Wallonia	63		125		125	168
Flanders	79	79	79		79	107
Czech Republic	64	153				
Denmark	149				91	174
Finland	20				52	89
France	86	328	155		154	264
Corsica		656				
Germany	195	1 217	118	163	167	264
Greece					60	62
Hungary					147	
Ireland	62		74		32	36
Italy	200	200	200	200	200	183
Luxembourg	63	1 265	63		63	100
Netherlands	87	87	87		87	103
Portugal	58	938	83		112	113
Spain	84	910	75		65	69
Sweden	25	25	25		73	121
United Kingdom	117	117	117	117	117	165
United States	39				39	48

Note: The extra cost column gives the difference between the price at which wind-based electricity is bought and the average wholesale price of electricity, in percentage terms. Abatement cost are calculated with the assumption that the displaced energy source is natural gas burnt in combined cycle turbines, because such plants represent the most profitable choice for additional investment in base or semi-base power generation.

Source: OECD estimates from data in country surveys and European Renewable Energy Federation (2003).

Given the high abatement cost of carbon-dioxide emissions through the build-up of renewable energy, the surveys recommended improved cost efficiency of such energy sources in 14 out of the 21 country reviews. The scaling down of support to wind power was recommended for France, Greece, Hungary, Italy, Luxembourg, the Netherlands and the United Kingdom. Similarly, reduced support for biomass energy was recommended for the Czech Republic, Denmark, the Netherlands and the United Kingdom. In the United States, it was judged important to align incentives across sub-national levels of government. In Finland, Spain and Switzerland, the recommendations in this area were more general, basically calling for lower incentives to expand renewable energy sources. Also, Denmark, Luxembourg and the Netherlands were encouraged to reduce support to CHP plants.

3.2.3. Abatement policies in the transport sector

Policies to reduce carbon-dioxide emissions from the road transport sector generally appear to have little effect and to entail relatively high costs. Even though the implicit tax on carbon is already much higher for diesel and petrol than for other fuels (Table 3.5), virtually all countries are implementing additional measures to curb emissions from vehicles. Measures to that end include taxing car purchases (Denmark, Greece, Norway, Portugal), financing investments in railways or waterways (Austria, France, Italy, Norway, Switzerland), subsidising biofuels (France, United States) and fuel cells (Iceland, United States). Although the costs are difficult to assess precisely for such measures, they are known to be quite high. For instance, the marginal cost of Austria's goal to reduce transport emissions from trend by one fifth has been estimated to exceed EUR 235 per tonne of carbon dioxide. In France, the climate strategy aims to reduce emissions from lorries by 10 per cent by rebalancing investment in rail and road, but the marginal cost of such a switch rises very quickly (MIES, 2000). Moreover, the surveys indicated that large price increases for private transport would be required to achieve modest absolute reductions in emissions in most countries, given that already high taxation meant that low-cost abatement methods had already been exploited. Again in France, the promotion of biofuels in road transport costs EUR 225 per tonne of carbon dioxide avoided. The use of high taxes on the purchase of new cars to discourage the use of private transport is difficult to assess since the sign of their effect on emissions is unclear. Indeed, such taxes may raise the average age of road vehicles because they penalise investment in new cars and delay reductions in air pollution (see Annex 4). Since fuel efficiency in the European member countries has improved since 1990 and is poised to increase even more before 2010, high purchase taxes might even result in higher emissions.

Specific recommendations for GHG abatement in transportation were confined to eight of the reviewed countries. Given the ambitious and costly abatement efforts in road transportation in Austria, France, Italy, Luxembourg and Switzerland, the scaling down of attempts to reduce emissions from vehicles was recommended for these countries. On the other hand, the surveys called for the stepping up of abatement efforts in road transportation in Greece, Iceland and the United States. For France and Iceland, it was recommended that policies should cut GHG emissions from air and sea transport, using taxes rather than regulatory measures and seeking the necessary degree of international co-operation.

3.2.4. Measures to increase energy efficiency

Measures to improve energy efficiency have brought contrasting results in terms of abatement costs, depending on whether they relied on reducing

below-cost pricing or on directly prompting specific investments. In transition countries, the surveys suggested that aligning energy prices to costs has reduced emissions while improving the allocation of resources in the economy (Czech Republic, Hungary, Slovakia). Inversely, regulatory measures and subsidies targeting specific means to save energy, such as investment in insulation, have proved a costly way of reducing CO₂ emissions in several OECD countries (Austria, Denmark, Italy, Spain, Switzerland), even reaching EUR 7 600 per tonne of carbon dioxide in Luxembourg. This lack of cost efficiency stems from the fact that energy efficiency was already high in these countries and that specific regulations, as well as subsidies directed at particular investments, are not needed for economic agents to identify least cost options to save energy.⁵ To stimulate energy saving in a cost-efficient way, the economic surveys recommended the use of fuel pricing instead of regulations in Austria, the Czech Republic, Finland, Hungary, Luxembourg and the Slovak Republic.

3.3. Taxes and subsidies

3.3.1. The taxation of carbon emissions

Many OECD countries have altered their tax systems to place a cost on emissions but have fallen short of establishing efficient, consistent price signals. In countries which have introduced explicit carbon taxes, rates vary markedly across fuels (Table 3.7). In addition, large emission-intensive sectors, particularly in industry, have obtained reduced rates or tax breaks in all of these countries. Differences in actual rates distort the allocation of efforts to abate emissions and place unnecessary costs on the economies. Indeed, emissions of carbon dioxide constitute one of the few cases where external effects are proportional to the quantity of fossil fuels used and that can therefore be addressed with uniform fuel taxes.⁶ Other external effects, such as emitting local atmospheric pollutants, contributing to congestion or deteriorating road infrastructure, can vary considerably in extent for the same amount of fuel burnt. The negative consequences from using fossil fuels other than emitting CO₂ are better dealt with by specific instruments (see Annex 4 on air pollution).

One of the most flagrant examples of tax differentiation is the gap between the excise on diesel and petrol fuel, as has been highlighted in the country surveys. Such differentials result in consumers gradually switching to diesel cars as the quality difference between models gradually shrinks. This switch involves considerable resource costs for the economy. Diesel engines cost, on average, in Europe almost EUR 1 100 more than their petrol counterpart and, over a typical lifetime, only generate pre-tax fuel savings of about one-third of that amount. The remaining differential can be seen as the

Table 3.7. Rates of CO₂ taxation in OECD countries which introduced carbon taxes

	Treatment of industry	Treatment of power generators	Electricity use		Coal	Natural gas	Fuel oil	Diesel	Petrol
			Euros per MWh		Euros per tonne of CO ₂			Euros per tonne of CO ₂	
			Households	Industry				Cars	
Austria	Tax payments capped at 0.35 per cent of firm's net production value	Untaxed	15	0	0	19	25	110	181
Denmark	Lower rates in exchange for abatement agreements	Untaxed	97	11	Between 0.4 and 131			141	241
Finland	85 per cent refund if energy taxes exceed 3.7 per cent of value added	Untaxed	7.4	4.5	14.5	8.7	23	121	260
Germany	Carbon tax payments capped	Taxed ¹	21	12	0	17	20	179	289
Ireland	Likely to receive exemption	Undecided	0	0	Tentatively € 15 to 20			124	177
Netherlands	No tax on quantities above 10 GWh or 1 Mm ³ per year for electricity and gas respectively	Untaxed	64	0	–	80	66	136	281
New Zealand	Only emissions above negotiated targets are liable to the tax	Taxed	0	0	To be set in line with Kyoto permit prices			–	93
Norway	Special rates for:	Untaxed	12	0	20		36	156	251
	Metals processing				0				
	Domestic aviation and shipping						14		
	Fishing						0		
	Pulp and paper, fish processing						10		
	Off-shore activities					40	35		
Sweden	Reduced rates	Untaxed	11	0	78		104	132	227
	Industry				17		19		
United Kingdom ²	Only 20 per cent of the climate levy if abatement targets are agreed to	Untaxed	0	4.8	5.5 ³	11	15	253	312

Note: All excise taxes on fuels are attributed to CO₂ unless they are adjusted to charge another pollutant in a direct fashion (e.g. sulphur in heating fuel for Norway).

1. At reduced rates.

2. The climate change levy applies only to businesses.

3. 0 for coal tailings.

implied marginal abatement cost for a switch from petrol to diesel engines amounts to about EUR 120 per tCO₂ (Bates, 2001). At European prices for coal and gas, the same reduction in CO₂ could be obtained for one-quarter the cost by replacing coal power stations with gas-fired plants. Moreover, a change to diesel cars worsens air pollution because of the induced emission of particulates. Holding the level of air pollution constant, through the compulsory installation of a particulate filter, would raise the abatement cost even further, to EUR 370 per tCO₂.

3.3.2. The difficulties in applying uniform carbon tax rates

The main reason behind reduced rates and exemptions is the desire to preserve employment in certain activities, especially in energy-intensive industries that compete with foreign firms not subject to any carbon constraint. Since exempting some sectors implies more costly abatement efforts in the rest of the economy, it reduces welfare compared with uniform taxation. As noted in some of the country reviews, the exempted sectors are often those likely to have the lowest abatement costs, implying particularly high economy-wide costs of non-uniform carbon taxes. Moreover, the efficiency costs entailed by varying tax rates will grow over time as innovation efforts to reduce costs will concentrate in highly-taxed emitting activities which do not necessarily offer the most promising return for society. On the other hand, the taxation of emissions of sectors facing intense foreign competition will result in deteriorating competitiveness for those sectors, but this is an efficient way to cut domestic emissions. Global GHG emissions will be less affected due to the so-called “leakage”, but with most trading partners now in the process of taking measures to contain releases of such gases, the replacement of domestic with foreign emissions is smaller at present than earlier. On the basis of such arguments, several country surveys hence recommended the unwinding of tax exemptions for heavy industry (Finland, Netherlands, Norway).

Regional and social policy objectives have also led to tax exemptions and subsidies for emitting activities. Fuel used to propel fishing boats is untaxed in Norway with the aim of preserving employment in coastal communities. Coal and natural gas used for home heating is not subject to taxation in the United Kingdom to avoid creating problems of “fuel poverty”. The Czech Republic, Greece, Hungary and the Slovak Republic regulate energy prices for households below costs, or exempt them from certain energy taxes, because of the burden that prices based on full cost recovery would put on the poor.

Similar social or regional concerns led to the subsidisation of activities that entail high GHG emissions. Even though they have, or plan to have, carbon taxes, Finland and Ireland keep subsidising the use of peat – a fuel even more carbon intensive than coal – in power generation to maintain jobs

in remote areas. Pursued for social purposes, these subsidies impose high costs on the environmental and economic pillars of sustainable development. In some countries, progress has been made in re-orienting and reducing subsidies to fossil fuel industries. In Germany, for example, the coal subsidy has become a producer subsidy designed to keep local production competitive, rather than to boost consumption. It is in any case in the process of being reduced. In the United States, federal subsidies granted to fossil fuel industries fell by a quarter between 1992 and 1999 and amounted to only 0.8 per cent of the value of the output of these industries in 1999 (EIA, 2000). Most of these subsidies were in the form of wealth transfers rather than subsidies that affected relative prices (Sutherland, 2001).

Social and regional objectives could be better served by direct budgetary support that did not impinge on the environment. Although direct transfers may imply higher labour taxes and associated efficiency losses, these are likely to be much lower than the welfare costs of exemptions in most cases (Bovenberg and Goulder, 2000). Moreover, direct transfers bring the additional benefit of making the costs transparent. Against this background, the surveys of the Czech Republic, Greece, Hungary, the Slovak Republic and the United Kingdom suggested to establish full-cost pricing for households' energy consumption and to use direct income support to mitigate any undesirable social consequences. As for regional policy objectives, the review of Finland recommended that energy subsidies or tax breaks aimed at maintaining employment in isolated areas should be unwound and replaced by direct payments or different regional policy measures. Even if such transfers would still lock resources in less productive activities and impose a cost of society, the cost would be lower and more transparent.

3.4. New developments: the trading of emission permits

3.4.1. The trading of carbon emission permits

Although the international community has chosen to regulate GHG emissions by quantitative targets, at present only Denmark and the United Kingdom have cap-and-trade schemes up and running. Operating since 2001, Denmark's trading scheme applies to emissions from the electricity sector and includes a feature designed to avoid excessive price hikes. Firms can emit more than the amount of permits they hold simply by paying the authorities a fixed price of DKK 40 per tonne of CO₂ (EUR 5.45) on the excess. Prices averaged EUR 4 per tonne of carbon dioxide in 2001 and EUR 2.7 in 2002. In the United Kingdom, trade occurs amongst firms bound by emission targets of two different types: targets set in negotiation with the government in exchange for an 80 per cent reduction in the climate levy, and targets committed in exchange for government subsidies on the basis of an auction.

The only auction cleared with the government paying a subsidy of GBP 16 (EUR 23) per tonne of CO₂ saved. Companies can then meet these targets either by reducing their own emissions or by buying certified reduction from other companies. Permit prices averaged GBP 2.7 (EUR 3.8) per tonne of carbon dioxide in 2002, implying a net gain for companies that have commitments to reduce such emissions. A shortcoming in the UK trading scheme is that it does not include electricity generation despite the sector being emission intensive.

Carbon trading is poised to gain in scope and to reduce abatement costs in many OECD countries when a recently approved EU cap-and-trade scheme starts to operate in January 2005 (Box 3.2). By putting a single price on CO₂ emissions in the covered activities, the EU trading scheme will bring considerable cost savings compared to current climate change policies which result in varied marginal abatement costs. The bulk of cost reductions comes from including power generators in the scheme because marginal abatement costs vary considerably across EU countries in the electricity sector and CO₂ emissions from power plants remained largely un-priced in most national climate change strategies. The extent of the savings are difficult to assess, primarily because it is not clear what would have been the cost of alternative policies. As an example, assuming that EU countries would otherwise have applied their burden sharing targets uniformly to all sectors within their economies, Capros and Mantzos (2000) estimate that the emissions trading scheme will divide the total cost associated with attaining the Kyoto target for EU countries by three.

Restrictions on international trade are likely to limit the gains that could be made and will have no effect on the amount of GHG emissions. In particular, the emissions trading directive does not allow firms to tap into the supply of Kyoto permits that might be available in FSU countries which could help lower prices to an estimated EUR 5 per tonne of CO₂ (Blanchard *et al.*, 2002 and IEA, 2002). The EU scheme also includes a provision that may limit the import of project-based credits from outside the EU (see Box 3.2). Such restrictions will not reduce global emissions as permits can be sold to other buyers (such as Canada and Japan) or banked for subsequent periods.

The EU trading scheme covers 40 per cent of total emissions but could be widened to transport and residential uses. The scheme may be extended to cover more gases in 2008. It could also be expanded to cover emissions from small, diffuse sources such as vehicles and small boilers as found in commercial premises and homes. Monitoring the emissions of these emitters would be impractical. However, given that there is a fixed relationship between the fuel used and emissions, there are other more practical ways in which these sectors could be covered. Refineries (and imported refined fuels) could be brought into the system and given the duty to match sales to final users with allowances.

Box 3.2. The EU trading scheme

The directive establishing a scheme for greenhouse gas emission trading was issued in July 2003. The trading scheme starts in January 2005 and regulates emission of carbon dioxide (CO₂) from energy activities, production and processing of ferrous metals, the mineral industry and the pulp and paper industry for installations of a certain capacity. The trading scheme is obligatory, but member countries can apply for national adjustment and exclude some emission sources under certain circumstances for the period 2005-2007. Member countries can apply for including more activities in the trading scheme during the second period 2008-2012.

Each member state is to develop a national plan stating the total quantity of allowances that it intends to allocate for that period and how it proposes to distribute them. The directive obliges member states to allocate at least 95 per cent of first-period allowances for free. For the following five-year period beginning 1 January 2008, member states shall allocate at least 90 per cent of the allowances for free. These provisions in effect force EU countries to give away the scarcity rent created by the carbon constraint to past polluters.

The EU trading scheme may be connected to external cap-and-trade regimes. Countries outside the European Union which have ratified the Kyoto Protocol can link their own trading schemes to the EU one after a procedure leading to common recognition of the systems.

The EU trading scheme will be partially open to project-based overseas credits. The European Commission put forward a proposal of a specific directive in July 2003 to link the trading scheme with the project-based mechanisms foreseen by the Kyoto Protocol, joint implementation (JI) and clean development mechanism (CDM). Although the emission trading directive recognises the use of external non-EU credits as important to achieve the goals of both reducing GHG emissions globally and reducing compliance costs in the European Union, the proposed "linking" directive includes several restrictions on the use of such credits. First, the proposed directive does not allow companies to meet their targets by buying assigned amount units (AAUs), the main category of emission allowances created by the Kyoto protocol, from non-EU governments despite the large supply in FSU countries. This means that AAUs from Russia and the Ukraine cannot be imported into the European system, so keeping prices higher than they would otherwise be. Secondly, under the proposed "linking" directive, the European Commission would have the power to limit the quantity of JI and CDM credits imported in the EU trading scheme to 8 per cent of the total volume of allowances. Thirdly, the proposed "linking" directive rejects certain technological options for avoiding emissions or reducing GHG concentrations, such as nuclear power and afforestation, any associated credits being declared not eligible for conversion into EU allowances.

Carbon trading should also gain ground outside the European Union as Canada, Norway and Switzerland intend to run cap-and-trade schemes. The Norwegian plan would first establish a limited trading scheme in the period 2005-2007 and then supersede the existing carbon tax as from 2008 and also include non-CO₂ greenhouse gases. Norway's authorities mean to sell most of the permits, primarily by means of auctions, in the second stage of the scheme (2008-2012). A permit market is to cover Canada's heavy industry and power generation with a price cap of CAN\$ 15 per tonne to keep abatement costs in check. In the United States, the infrastructure to support emission trading is being built up, but any decisions about further moves towards such a system will await a review in 2012.

More than half of all the reviewed countries received a recommendation in the country surveys to begin building or strengthening an infrastructure for emission trading (Austria, Canada, Denmark, France, Greece, Luxembourg, Netherlands, Norway, Slovak Republic, Spain, Switzerland, United Kingdom and the United States). Carbon trading in the European Union will allow France, Italy, Luxembourg, Spain and Switzerland to act on the recommendations given in the country reviews to import international emission permits.⁷ As recommended in several surveys of current and acceding EU countries (Czech Republic, Denmark, France, Greece, Hungary, Italy, Luxembourg, United Kingdom), a widened EU trading scheme provides an opportunity to re-think some of the policies used to curb GHG emissions in the area, notably regarding renewable sources and fossil fuel taxation. As permits put a uniform price on CO₂ emissions, market forces will bring about a socially efficient mix of fuels in power generation, provided that other externalities (mainly releases of local atmospheric pollutants) are integrated in production costs through environmental taxes or specific trading schemes. Hence minimum target levels of the kind embedded in the EU renewables directive are either irrelevant for being below optimum or wasteful because they force investment in renewable plants that are not justified by the avoided emissions of GHG and local air pollutants. Similarly, there would be no need for carbon taxes on fossil fuels used in sectors covered by the directive. The EU trading scheme will put a uniform price on emissions where carbon taxes resulted in emission costs varying across sectors and fuels, provided that these taxes are abolished (Table 3.7).

3.4.2. The allocation of carbon emission permits

The EU emissions trading directive obliges the authorities to allocate most permits free of charge (see Box 3.2), and provides past polluters with large wind-fall gains. Producers would in most cases be able to shift the extra production cost associated with the permits into the price of the products and hence onto consumers. The only net loss for the producers would occur if the

demand for their product were to significantly fall in response to the higher price. It is estimated that compensation for this loss could justify the grandfathering of around 10 to 20 per cent of past emissions. The “excess” grandfathering in the EU system would accordingly amount to 70 to 80 per cent, which is a transfer of wealth from the government to the emitting industries. The auctioning of permits would have left the scarcity rent with the government, and would have allowed it to be used to reduce other distortionary taxes. Goulder (2002) found that the choice to grandfather can almost double the welfare cost of capping CO₂ emissions.⁸ To allow national governments to retain some of the scarcity rent in the face of a requirement to grandfather the bulk of all the permits, the country reviews of the Czech Republic, Denmark, Hungary, Luxembourg and Switzerland recommended that the permits should be taxed.

The main reason behind the choice to grandfather allowances is the mistaken view that such a policy would preserve the competitiveness of emission-intensive industries. Certain industries such as steel, paper and pulp, aluminium and cement are part of markets where prices are set internationally in competition with companies that face no carbon constraint. But companies with allowances that were allocated on a free basis face exactly the same opportunity cost when emitting – equal to the market price of CO₂ – as if they had been obliged to buy the allowances. Therefore, competitiveness and employment in exposed industries will reach a level identical to what would occur with auctioning. In other words, grandfathering does compensate the owners of exposed firms but does not preserve jobs or activity. However, permits allocated free of charge may protect activity if they are conditional on keeping existing plants in business as is required by the UK national allocation plan for permits issued to implement the EU emissions trading directive. However, restrictions of this nature distort resource allocation by locking resources in less productive activities.

Notes

1. Climate change was one of three policy topics selected for the following countries: Austria, Czech Republic, Denmark, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, New Zealand, Norway, Poland, Slovak Republic, Spain, Switzerland, Turkey, United Kingdom and United States.
2. This broadly corresponds to the Annex I countries in the Rio Convention.
3. Korea and Mexico took no quantitative target under the Kyoto Protocol, which both countries ratified. The United States and Australia signed but decided not to ratify the Kyoto Protocol. Turkey did not sign nor ratify the Rio Convention. Hence, Turkey was not presented the Kyoto Protocol for signature nor ratification. But Turkey is now in the process of becoming a Party to the Rio Convention which is planned to be ratified by May 2004.

4. The review of Poland estimated the induced air quality benefits of avoiding the emission of one tonne of carbon dioxide from a typical coal power plant at EUR 17. However, in the same country, if the coal plant used state-of-the-art pollution scrubbers, the estimated air quality benefits would drop to EUR 1.8. Taking a longer view, were the plant to generate power using cost-efficient technology (such as combined-cycle gas turbines), avoiding one tonne of CO₂ would imply only EUR 0.7 in air quality benefits.
5. Another difficulty with using subsidies and regulations to improve energy efficiency is the so-called “rebound effect” by which lower unit costs of energy-based services translate into higher use, unless they are backed by higher fuel and electricity prices.
6. Sulphur oxides emissions from road vehicles are also directly proportional to the sulphur content of fuel, but the quantitative importance of this externality is very small (since low-sulphur motor fuels have become the norm) and is region-specific. Moreover, sulphur oxides emissions from other sources (such as ships and oil-fired power plants) are not proportional to the sulphur content of the fuel because technical options are available to scrub sulphur during the combustion process or at the end of pipe.
7. Even though not a member of the European Union, Switzerland has expressed interest in participating in the EU trading scheme.
8. Goulder’s work was carried for the United States. The welfare loss of grandfathering is likely to be greater in Europe where the deadweight cost of taxation is higher.

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Chapter 4

Reducing Air Pollutants

Air pollution inflicts considerable damage to human health and ecosystems. The data presented in the chapter show that great strides have been made in recent decades to cut emissions. However, further efforts remain warranted, as is apparent from the estimates of pollution costs reported in the chapter. The chapter then examines the various policy instruments the fifteen reviewed countries have used to reduce emissions, discussing their efficiency. It also presents recommendations on how to minimise the trade-off between the costs and benefits of cutting air pollutant emissions.

1. Introduction

Fourteen country surveys of sustainable development¹ examined the issue of reducing air pollution.² They focused on whether the policies in place seemed capable of attaining their objectives at least cost, and recommended changes to improve cost-effectiveness. Although the reviews drew attention to the high social and economic costs of air pollution in terms of adverse health effects and the derived impact on the economy, they did not address the issue of efficient target setting in this area, though the matching of the marginal benefits and costs of abatement is likely to become increasingly important in the future (Box 4.1). This annex reviews the key policy objectives and outcomes for air pollution abatement, the main policy instruments that have been employed and the recommendations contained in the country surveys. It should be noted that the selection of examples in this annex is not comprehensive, especially as only about half of all OECD was reviewed on this topic. Nonetheless, a few examples are taken from countries that were not reviewed for this project but where recent developments in clean air legislation are relevant for discussing policy settings in this area (Switzerland, United States). Besides, EU directives are discussed in this synthesis report in the same way as in country surveys, i.e. whenever it directly influences national policies in the area.

2. Objectives and performance

The most important negative consequence of poor air quality is that it harms human health, but it also affects ecosystems and can damage buildings. Air pollutants cause respiratory disorders, with particularly marked effects on infants and the elderly. SO₂ has been found associated with chronic bronchitis. NO₂ and ozone can inflict permanent damage to lung tissue. VOCs are known to cause lung cancer. Particles have been conclusively linked with various respiratory diseases (aggravated asthma, chronic bronchitis and reduced lung function) resulting in premature death (World Health Organisation, 2000 and 2003).³ In Europe, air pollutants were estimated to reduce average life expectancy by 500 days on constant 1990 concentration levels (Mechler et al., 2002). SO₂ and NO_x deposited by rain acidify soils, harming plants, trees and the ecosystems that depend on them. In addition, acid rain damages marble and limestone items because these materials dissolve when exposed to acidity. Buildings are also blackened by PM

Box 4.1. Integrating social and environmental concerns in air policy through cost benefit analysis

Social, economic and environmental concerns can be integrated in air pollution abatement policy by setting objectives that balance the cost of reducing emissions against corresponding benefits to human health, ecosystems and buildings.

Evaluating the health benefits from lower emission levels calls for modelling the causal chain that goes from emissions to concentrations and to health effects. Meteorological models have been supplemented with chemistry modules to quantify how emissions transform into concentrations. The next step, from concentrations to health effects, builds on the abundant scientific literature that is devoted to estimating dose-response functions. If agreed monetary estimates can be obtained, then a monetary value can be attached to any reduction in the risks of illness (morbidity) and premature death (mortality). Every step calls on recent advances in physics, medicine and economics, and the end result is therefore marked by uncertainty. In the economic step, the choice of the value of life directly determines the estimate of the value of the externality. But most of the literature on valuing life derives from labour market studies where the nature of risks, mainly occupational hazards, differs from that of being exposed to air pollution, which adds to the uncertainty of the final estimate.

Appraising the marginal benefits to ecosystems and buildings from reduced emissions also requires three steps. First, meteorological models must quantify the link between the emission of pollutants and their deposition on soils and buildings in a geographically detailed manner. Second, biological models are then needed to assess the impact of deposited pollutants on ecosystems. The effect of acid rain on buildings is easier to appraise technically and property prices allow to quantify the cost directly. Finally, economic studies are used to put a value on the improvements that are brought by emission reductions. Economic methods to value ecosystem services include polling households' willingness to pay for environmental improvement, observing actual expenses for recreational activities in preserved environments or estimating the direct cost of restoring the environment to a better condition. Although results may differ widely across studies, benefits to ecosystems and buildings are consistently found to be far lower than those to human health (Barker and Rosendahl, 2000).

An extended EU project yielded estimates of the benefits to health, ecosystems and buildings from reducing emissions of air pollutants. It showed that 97 per cent of the benefits are due to health effects, the rest being attributable to the consequences of acid rain on ecosystems and on buildings (Krewitt et al., 1999). The values vary across countries depending on their locations relative to densely populated areas. The figures for Finland and Sweden in the table below are understatements because they do not take into account marginal benefits that accrue to the former Soviet Union countries.

Box 4.1. Integrating social and environmental concerns in air policy through cost benefit analysis (cont.)

Marginal benefits of reducing air pollutant emissions in rural areas¹

	SO ₂	NO _x	VOC	PM _{2.5}
	EUR/tonne			
Austria	7 700	7 300	1 500	15 000
Belgium	8 400	5 000	3 200	23 500
Denmark	3 500	3 500	7 700	5 800
Finland	1 000	1 600	500	1 500
France	7 900	8 800	2 100	16 000
Germany	6 500	4 400	3 000	17 100
Greece	4 400	6 400	1 000	8 300
Ireland	2 800	3 000	1 400	4 400
Italy	5 300	7 600	3 000	12 800
Netherlands	7 500	4 300	2 600	19 200
Portugal	3 200	4 400	1 600	6 200
Spain	4 000	5 000	900	8 400
Sweden	1 800	2 800	700	1 800
United Kingdom	4 800	2 800	2 000	10 400
Average	5 600	4 500	2 200	15 000

Additional marginal benefits when reducing emissions that occur in cities

	SO ₂	PM _{2.5}
	EUR/tonne	
100 000 people	6 400	35 200
500 000 people	32 000	176 000
1 million people	48 000	264 000
More than 2 million people	96 000	528 000

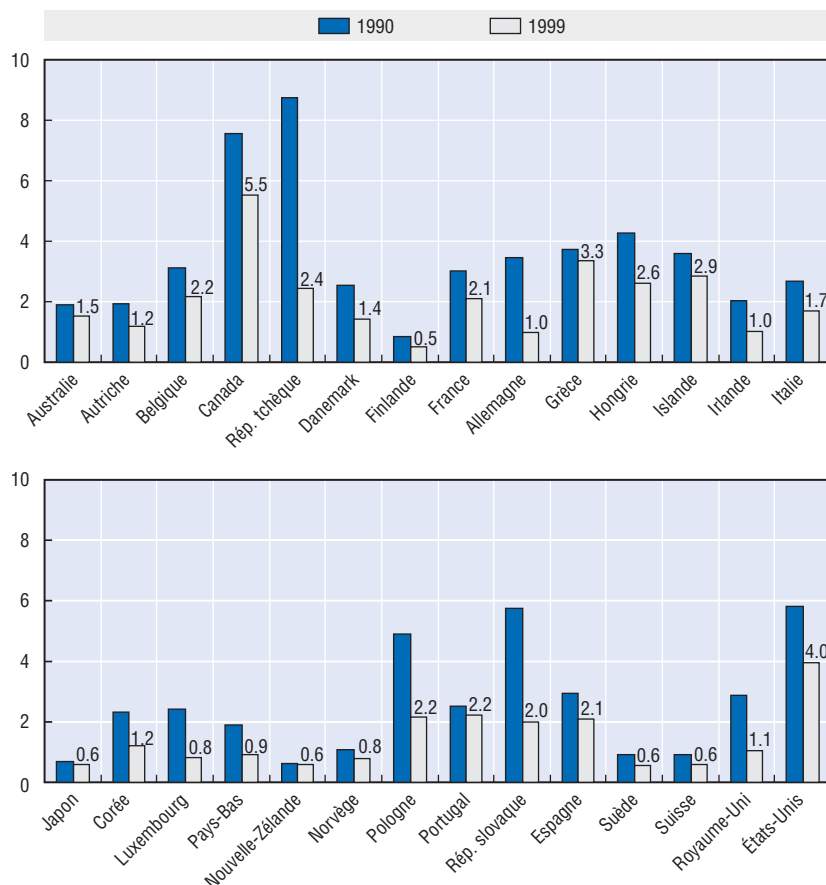
1. All monetary amounts listed in this chapter (including boxes, tables and figures) are in 2003 currencies unless otherwise mentioned.

Source: Holland and Watkiss (2000).

pollution. When, on the basis of a number of modelling assumptions, all these effects are aggregated in monetary terms, the resulting estimates suggest that the damages from air pollution are substantial (Figure 4.1).

The objectives of clean-air policies differ across OECD countries, with ecosystem preservation traditionally being the main driving factor in Europe while North American and Asian countries have given higher priority to

Figure 4.1. **The damages from air pollution in OECD countries as a share of GDP**



Source: OECD, UNFCCC, Eurostat.

reducing health risks. Air pollution abatement policy in Europe has been built through a series of commitments taken in protocols under the 1979 UNECE Geneva convention on long-range transboundary air pollution (LRTAP) with the primary aim of containing acidification. To that end, maximum deposition loads have been enshrined in treaties such as the 1994 Oslo Protocol, which stipulates specific caps on sulphur deposition for every cell of a 150 km by 150 km grid covering Europe. Another protocol (adopted in 1999 in Gothenburg) then set national emission targets to help meet the deposition caps. More stringent objectives apply to EU countries under the 2001 national emission ceilings (NEC) directive (Table 4.1). Conversely, in the United States, health concerns have to a large degree driven air policy objectives since the

Table 4.1. **OECD countries' performance towards internationally agreed emission targets**

Thousand tonnes per year

	SO ₂				NO _x				VOC		
	Emissions		Targets		Emissions		Targets		Emissions		Target
	1990	2000 ¹	2000	2010	1990	2000 ¹	2000	2010	1990	2000 ¹	2010
Austria	91	41	78	39	202	184	–	103	360	239	159
Belgium	327	205	248	99	314	364	–	176	277	295	139
Canada	3 300	2 500	3 200								
Stationary sources					853	866	870				
Eastern Canada ²		1 600	2 300								
Czech Republic	1 876	265	1 128	283	742	397	–	286	435	247	220
Denmark	181	28	90	55	277	208	–	127	169	131	85
Finland	260	76	116	110	300	236	–	170	209	162	130
France	1 269	837	868	375	1 882	1 654	–	810	2 957	2 341	1 050
Germany	5 321	831	1 300	520	2 706	1 637	–	1 051	3 221	1 651	995
Greece	506	540	595	523	326	382	–	344	334	397	261
Hungary	1 010	592	898	550	238	221	–	198	205	149	137
Ireland	183	158	155	42	116	119	–	65	110	95	55
Italy	1 719	923	1 330	475	1 944	1 485	–	990	2 041	1 671	1 159
Luxembourg	15	3	10	4	23	17	–	11	19	13	9
Netherlands	202	100	106	50	578	408	–	260	506	279	185
Norway	53	28	34	22	226	240	–	156	300	349	195
Poland	3 210	1 511	2 583	1 397	1 280	838	–	879	831	599	800
Portugal	359	375	304	160	317	369	–	250	380	484	180
Slovakia	543	179	337	110	226	130	–	130	148	101	140

Table 4.1. **OECD countries' performance towards internationally agreed emission targets (cont.)**

Thousand tonnes per year

	SO ₂				NO _x				VOC		
	Emissions		Targets		Emissions		Targets		Emissions		Target
	1990	2000 ¹	2000	2010	1990	2000 ¹	2000	2010	1990	2000 ¹	2010
Spain	2 136	1 592	2 143	746	1 226	1 299	–	847	1 936	1 820	662
Sweden	136	71	100	67	349	267	–	148	517	431	241
Switzerland	43	28	60	26	154	105	–	79	279	175	144
United Kingdom	3 754	1 187	2 449	585	2 760	1 603	–	1 167	2 477	1 566	1 200
United States					21 926	23 037	20 112				
Power plants	14 433	11 520	–	8 118	6 045	5 185					
Industrial firms	4 906	3 840	5 079	5 079	3 480	3 617					

Note: The targets are taken from the EU National Emission Ceilings directive, the Gothenburg Protocol, the Oslo Protocol, the US-Canada Air Quality Agreement, whichever is most stringent if more than one target is applicable.

1. 1998 for Belgium, France, Greece, Hungary, Slovakia, Spain, Switzerland. 1999 for Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Sweden, the United Kingdom and the United States.

2. Eastern Canada stands for the seven eastern most provinces, namely Nova Scotia, Newfoundland, Prince Edward Island, New Brunswick, Quebec, Ontario, Manitoba.

Source: OECD.

Clean Air Act was enacted in 1970, the main goal being to achieve national ambient air quality standards (NAAQS). Canadian provinces, which have the main responsibility for environmental matters in the country, have also set health-related pollutant concentration targets that largely guide policy in this area (Table 4.2). However, mitigating acid rain has also been an objective in North America while health concerns are gaining increasing importance in Europe's air pollution abatement policy (Table 4.2). Health-related concentration objectives embedded in EU directives are not fully consistent, though, with national emission targets and plant-level, technical regulations which do not concentrate abatement efforts where they could reduce concentrations most effectively, and thereby health damage.

Emissions of most air pollutants, both in absolute terms and per unit of economic output have diminished over the 1990s in most OECD countries, enabling them to comply with past international commitments to a large extent (Tables 4.1 and 4.3). Two dominant factors have caused this improvement. First, emissions from large sources, especially power plants, have diminished markedly, mainly due to the substitution of gas for coal and to the installation of scrubbers. Secondly, emissions from transport have been reduced considerably. The national caps applicable in 2000 under the Oslo Protocol have been met comfortably in 20 out of the 22 OECD countries that are party to the protocol.⁴ In North America, the objectives for SO₂ and NO_x embedded in the United States-Canada Air Quality Agreement have been attained apart from the ceiling on US nitrogen oxides emissions. The main reason behind this is that road transport emissions rose in the United States by 20 per cent between 1990 and 1999, in contrast with a large majority of OECD countries where such emissions diminished. In the current decade, Belgium and France are faced with particularly challenging targets as they must more than halve their emissions of each of the three main long-distance air pollutants (VOC, NO_x and SO₂). Spain and Portugal will have to cut their SO₂ and VOC emissions drastically while, by 2010, Ireland must reduce releases of sulphur dioxide by a factor of three from 2000 levels.

Despite the results achieved in reducing emissions, air pollutant concentrations in cities are still causes for concern, especially as regards nitrogen oxides and particulate matter (Table 4.4). Annual concentrations of NO_x increased in 30 per cent of the OECD cities for which data are available between 1990 and 2000 (OECD, 2002).⁵ During the same period, pollution from particles became more severe in 13 per cent of the cities for which data are available reflecting the increasing share of diesel-driven vehicles. By 2000, the mean annual PM concentration exceeded 50 µg/m³ in 22 per cent of reported OECD cities, located in Denmark, Finland, Greece, Hungary, Italy, Korea, Mexico, Slovakia, Spain and Turkey. Annual averages for total suspended particulates even reached 80 and 110 µg/m³ in Tampere and Turin respectively.

Table 4.2. **Health-related air quality standards in selected OECD countries**
Concentrations

Pollutant	Measuring period	Limit value	Date
United States			
SO ₂	24 hours	365 µg/m ³ : not to be exceeded more than once a year	2003
	1 year	80 µg/m ³	2003
NO ₂	1 year	100 µg/m ³	2003
O ₃	1 hour	235 µg/m ³ : not to be exceeded on more than one day per year	2003
	8 hours	157 µg/m ³ : not to be exceeded on more than three days per year ¹	2003
PM ₁₀	24 hours	150 µg/m ³ : maximum once a year	2003
	1 year	50 µg/m ³	2003
PM _{2.5}	24 hours	65 µg/m ³ : maximum once a year	2003
	1 year	15 µg/m ³	2003
Canada			
<i>Ontario</i>			
SO ₂	1 hour	690 µg/m ³	2001
	24 hours	275 µg/m ³	2001
	1 year	55 µg/m ³	2001
NO _x	1 hour	400 µg/m ³	2001
	24 hours	200 µg/m ³	2001
<i>Quebec</i>			
SO ₂	1 hour	1303 µg/m ³	1997
	24 hours	286 µg/m ³	1997
	1 year	53 µg/m ³	1997
NO _x	1 hour	415 µg/m ³	1997
	24 hours	207 µg/m ³	1997
	1 year	94 µg/m ³	1997
<i>Canada-wide</i>			
O ₃	8 hours	127 µg/m ³ : maximum 3 times a year ¹	2010
PM _{2.5}	24 hours	30 µg/m ³ : maximum 8 times a year ¹	2010
EU countries			
SO ₂	1 hour	350 µg/m ³ : not to be exceeded more than 24 times each year	2005
	24 hours	125 µg/m ³ : maximum three times a year	2005
NO _x	1 hour	200 µg/m ³ : maximum 18 times a year	2010
	1 year	40 µg/m ³	2010
O ₃	8 hours	120 µg/m ³ : not to be exceeded on more than 25 days per year	2010
	8 hours	120 µg/m ³ : no exceedence	2020
PM ₁₀	Phase 1		
	24 hours	50 µg/m ³ : maximum 35 times a year	2005
	1 year	40 µg/m ³	2005
	Phase 2		
	24 hours	50 µg/m ³ : maximum 7 times a year	2010
	1 year	20 µg/m ³	2010

1. On average over three years.

Source: EU directives 1999/30/EC and 2002/3/EC, United States Environmental Protection Agency (2003), ministère de l'Environnement et de la Faune (1997).

Table 4.3. **Main indicators: air pollution**

	Change in emissions per cent of GDP (1995, PPP), 1990-2001 ¹			Level of emissions, 2001 ¹			Change in sulphur dioxide emissions, 1990-1999, ² per unit of electricity output	Change in nitrogen dioxide emissions, 1990-1999, ³ per vehicle-km
	Sulphur dioxide	Nitrogen oxides	VOC	Sulphur dioxide	Nitrogen oxides	VOC		
	Per cent, annual change			Grams per unit of GDP, (1995 US\$ PPP)			Per cent annual change	
Australia	-3.4	-1.9	-2.9	4.0	5.7	4.2	-4.7	-5.2
Austria	-9.3	-2.9	-5.8	0.2	0.9	1.1	-11.0	-4.4
Belgium	-8.3	-0.5	-2.0	0.6	1.5	1.1	-7.3	1.5
Canada	-5.8	-2.8	-3.2	3.2	2.7	3.5	-6.8	-6.1
Czech Republic	-17.0	-5.6	-5.7	1.9	3.0	1.8	-17.0	-0.6
Denmark	-18.3	-4.9	-4.8	0.2	1.5	0.9	-17.0	-5.0
Finland	-11.0	-4.4	-4.2	0.7	1.8	1.3	-13.2	-5.1
France	-8.3	-4.0	-4.9	0.4	1.0	1.5	-5.6	-5.2
Germany	-18.0	-6.3	-7.8	0.4	0.8	0.8	-19.2	-5.2
Greece	-2.6	-1.1	-1.6	2.9	2.2	2.2	-0.7	-6.1
Hungary	-9.0	-2.4	-4.1	3.4	1.7	1.2	-2.5	-0.1
Iceland	-1.3	-2.8	-6.8	1.2	3.4	1.1	..	-2.6
Ireland	-9.8	-6.0	-8.8	1.3	1.2	0.9	-4.7	-0.8
Italy	-9.3	-5.0	-4.8	0.6	1.0	1.1	-8.5	-4.9
Japan	-1.6	-1.3	-2.4	0.3	0.6	0.6	-3.2	-3.4
Korea	-10.9	-5.2	-3.3	1.6	1.6	1.9	-7.9	-6.1
Luxembourg	-18.9	-8.1	-8.6	0.2	0.9	0.7	6.3	-4.6
Mexico	-0.4	-0.9	-9.3	1.6	1.6	1.4	-0.7	..
Netherlands	-9.9	-6.1	-8.2	0.2	1.0	0.6	-17.5	-6.6
New Zealand	-0.3	-0.5	-1.6	0.7	3.0	2.6	..	0.2
Norway	-9.8	-3.6	-1.7	0.2	1.8	2.9	0.2	-5.1
Poland	-9.4	-7.3	-2.9	4.3	2.2	2.4	-7.8	-12.7
Portugal	-2.2	-0.4	-1.4	2.3	2.5	2.7	-2.8	-2.4
Slovakia	-13.2	-7.7	-8.2	2.4	2.0	1.2	-12.5	-3.7
Spain	-6.3	-1.8	-3.4	1.8	1.8	2.3	-7.2	..
Sweden	-7.1	-4.6	-3.9	0.3	1.2	1.8	-3.5	-6.6
Switzerland	-7.0	-5.4	-6.4	0.1	0.5	0.7	-2.7	-6.9
Turkey	2.2	0.4	1.0	3.3	2.3	1.8	-2.1	..
United Kingdom	-12.7	-7.7	-7.4	0.8	1.1	1.0	-14.4	-7.8
United States	-5.9	-2.9	-4.9	1.8	2.5	1.6	-4.6	-0.6
EU	-10.5	-4.7	-5.4	0.7	1.1	1.2		
OECD Europe	-9.7	-4.6	-4.9	1.0	1.3	1.3		
OECD	-6.5	-2.9	-4.2	1.4	1.8	1.5		

1. 1998-98 for New Zealand and Mexico (nitrogen dioxide); 1994-98 for Mexico (sulphur dioxide and VOC); 1990-99 for Australia, Canada, Japan, Korea; 1990-2000 for Ireland, Italy, Luxembourg, Turkey and the United States.

2. Australia and Poland 1995-99; Mexico: 1994-98; Canada and Luxembourg: 1990-97; Belgium, Czech Republic, France, Greece, Hungary, Korea, Mexico, Portugal, Slovakia, Spain and Switzerland: 1990-98.

3. Germany: 1991-99; Hungary: 1993-99; Poland 1995-99; Slovakia: 1992-98; Korea: 1990-95; Canada: 1990-96; Belgium, France, Greece, New Zealand, Portugal: 1990-98.

Source: OECD Environmental Database, Cooperative Programme for Monitoring and Evaluation of Air Pollutants in Europe (EMEP), European Environmental Agency (EEA).

Table 4.4. **OECD countries performance in curbing urban air pollution¹**

	SO ₂		NO _x		Particulate	
	1990 ²	1999 ³	1990 ⁴	1999 ⁵	1990 ⁶	1999 ⁷
Average annual concentration in $\mu\text{g}/\text{m}^3$						
Australia	..	..	59.1	32.0	..	..
Austria	19.1	5.9	43.5	32.8	44.1	35.7
Belgium	26.0	13.0	51.0	43.0	31.0	27.0
Canada	16.0	14.7	40.0	32.3	39.0	35.4
Czech Republic	37.0	10.0	24.0	20.0	58.3	25.0
Denmark	16.8	3.8	47.6	46.4	66.4	47.5
Finland	12.7	3.4	36.2	30.6	59.8	38.7
France	34.0	20.0	46.0	36.0	24.0	22.0
Germany	55.0	7.0	44.0	38.0	46.0	30.0
Greece	39.4	19.2	63.2	58.8	48.0	54.6
Hungary	17.4	17.5	37.2	41.6	68.2	53.2
Iceland	3.8	3.7	14.8	29.0	23.6	27.0
Ireland	23.0	16.0	46.0	70.0	28.0	11.0
Italy	24.2	15.1	98.4	70.7	128.1	66.5
Japan	19.0	12.0	39.0	40.2	42.0	33.2
Korea	114.6	23.1	45.6	52.1	144.1	67.2
Luxembourg	28.3	9.6	51.3	43.1	15.0	11.0
Mexico	113.1	40.8	67.6	56.5	67.0	54.4
Netherlands	20.1	8.1	48.8	41.0	38.3	39.8
New Zealand	2.8	12.7	14.7	20.3	25.0	27.3
Norway	9.0	6.5	48.5	43.0	18.0	17.5
Poland	36.0	9.4	36.0	23.4	44.0	19.2
Portugal	35.1	6.2	25.4	37.6	72.0	42.0
Slovakia	29.0	19.8	40.1	39.3	54.0	43.6
Spain	38.0	16.6	80.3	58.6	55.5	41.2
Sweden	8.2	3.5	30.1	21.2	9.0	5.0
Switzerland	16.3	7.1	45.9	34.8	38.1	33.4
Turkey	206.9	55.8	58.0	45.0	108.6	48.4
United Kingdom	35.6	15.4	62.3	53.5	16.8	8.7
United States	23.0	15.0	44.0	39.0	30.0	24.0

1. National total except for Australia, Austria, Denmark, Finland, Hungary, Italy, Korea, Mexico, Netherlands, New Zealand, Portugal, Sweden, Switzerland, Turkey and the United Kingdom for SO₂; weighed average (by population of the cities) of concentrations in selected towns.
2. 1993 for Mexico (Guadalajara and Monterey); 1994 for Italy (Rome, Turin and Genoa).
3. 1993 for Norway; 1995 for France; 1997 for Hungary (Pecs and Gyor) and the United States; 1998 for Canada and Italy; 2000 for Austria, Japan, Luxembourg, Mexico, Portugal, Turkey and the United Kingdom.
4. 1991 for Finland (Turku) and Portugal (Porto); 1993 for Finland (Tampere), Mexico (Guadalajara and Monterey) and Slovak Republic; 1994 for Czech Republic and Italy (Rome and Genoa).
5. 1997 for Hungary (Pecs and Gyor), Norway, Turkey and the United States; 1998 for Canada and Italy; 2000 for Austria, Japan, Luxembourg, Mexico, Portugal and the United Kingdom.
6. 1991 for Austria (Graz) and Finland (Oulu); 1992 for Hungary (Budapest) and the Netherlands (Vlaardingen and the Hague); 1993 for Mexico (Guadalajara and Monterey) and Portugal (Lisbon); 1994 for the Netherlands (Rotterdam); 1995 for Hungary (Miskolc, Pecs and Gyor) and Mexico (Mexico City); 1996 for Belgium.
7. 1993 for Norway; 1996 for Hungary (Miskolc), Portugal (Lisbon) and Sweden; 1997 for Finland (Oulu), Hungary (Budapest, Pecs and Gyor), Italy (Rome), Switzerland (Zurich) and the United States; 1998 for Canada, Italy (Milan and Turin), Korea, Switzerland (Basle) and Turkey (Izmir); 2000 for Austria, Japan, Luxembourg, Mexico, Turkey (Ankara) and the United Kingdom.

Year-long pollution from particulate matter and nitrogen oxides therefore exceeds existing or future standards in many countries. Country surveys also reported that PM, NO_x and O₃ concentrations frequently exceed the air quality norms for episodes of acute pollution, that is to say during shorter time periods. In contrast, SO₂ concentrations fell in virtually all OECD cities (with the exception of some where initial levels were low such as Auckland, Budapest, Christchurch and Cork) over 1990s as low sulphur fuels became the norm for heating and motoring. As a result, sulphur dioxide now is at levels that no longer represent a major threat to human health in most OECD cities.

3. Policies

The country surveys concluded that existing policy settings were generally not attaining abatement objectives in the most cost-efficient way. The recommendations in the country reviews are summarised in Table 4.5. Policies differ significantly for stationary and mobile sources of air pollutants (Table 4.6). The authorities can directly monitor actual emissions from large, fixed installations by requiring their operators to install measuring equipment. With the exception of boats, this is much more difficult for mobile sources, such as vehicles, which are thus usually subject to more indirect policy instruments. Small fixed sources tend to be addressed in the same way as mobile sources because direct controls would be overly costly. Because of this deeply rooted differentiation of policies, the text will consider stationary and mobile sources in turn, though measures should aim at the same marginal abatement cost in similar areas, whatever the nature of the source.

3.1. Stationary sources

Command-and-control regulation is still the main instrument to reduce emissions from large sources in a majority of OECD countries but brings unnecessary costs for many reasons. Air-quality policy largely relies on the concept of best available technology (BAT) to specify what anti-pollution equipment to use or how to alter production processes.⁶ Specifying technologies is economically inefficient because it deprives firms from the flexibility to allocate abatement efforts where they are least costly and to devise new abatement methods. Subjecting plants to emission targets instead of technical requirements gives businesses some more leeway but still falls far short of being cost-effective. Indeed, the public authorities cannot distribute targets in such a way as to minimise the overall emission reduction cost by equalising marginal abatement costs across plants. Two reasons can be put forward for this. First, the authorities have no access to companies' emission reduction cost curves, which are private information. Secondly, even if they could at a given point in time the information would quickly become out of date because costs evolve over time as levels of activity vary and new

Table 4.5. **Main policy recommendations in country surveys**

	Belgium	Canada	Czech Republic	Finland	Germany	Greece	Hungary	Iceland	Japan	Korea	Mexico	Portugal	Slovak Republic	Sweden
Large stationary sources														
Unwind command-and-control regulations and rely more on economic instruments instead	X	X	X	X	X	X	X		X	X	X	X	X	X
By introducing or raising emissions charges			X		X		X				X		X	X
Or alternatively by introducing emissions trading	X	X	X	X	X	X	X			X		X		
Without restricting cross-regional trading	X	X								X				
While opting out from the EU LCP directive	X		X	X	X	X						X	X	
Reduce industrial emissions of PM		X												
Mobile and diffuse sources														
Abandon one-off taxes on the purchase of cars in favour of annual or mileage-based taxes						X						X		
Differentiate recurring car taxes according to emission characteristics			X				X		X			X	X	X
Ultimately implement an emission-based mileage charge			X		X		X		X	X				X
Continue to tighten engine emission standards								X	X	X				
Especially for heavy vehicles									X	X				
Reduce the sulphur content of fuels	X								X	X	X		X	
More specifically to tackle PM pollution:	X	X		X	X	X		X	X	X		X		X
Eliminate the tax advantage of diesel fuel over petrol	X			X	X	X				X		X		X
Tax studded tyres								X						
Tighten vehicles PM emissions standards					X			X	X					X
Reduce emissions from non-road sources, such as		X		X										X
Off-road vehicles		X												
The burning of wood		X		X										X
By taxing wood				X										

Source: OECD Economic Surveys.

Table 4.6. **Main policy instruments used to reduce air pollution**

	Belgium	Canada	Czech Republic	Finland	France	Germany	Greece	Hungary	Iceland	Japan	Korea	Mexico	Portugal	Slovak Republic	Sweden	Switzerland	United Kingdom	United States
Stationary sources																		
Command-and-control regulation	XX		XX	XX	XX	XX	XX	X	X	XX	XX	X	XX	X	X	X	XX	X
Emission charges			X		X									X	XX			
Emission trading		X									p			X				XX
Partial withdrawal of measures favouring coal																		
						X	X											
Mobile sources																		
Fuel and vehicle standards	XX	XX	X	XX	XX	XX	XX	X		X			XX	X	XX	X	XX	XX
Subsidies for scrapping old vehicles					X							X						
Emission-based mileage charge																XX		

Note: XX denotes a major instrument of the country's air policy.

X indicates an instrument in use.

p indicates plans to use such an instrument.

Source: OECD Economic Surveys.

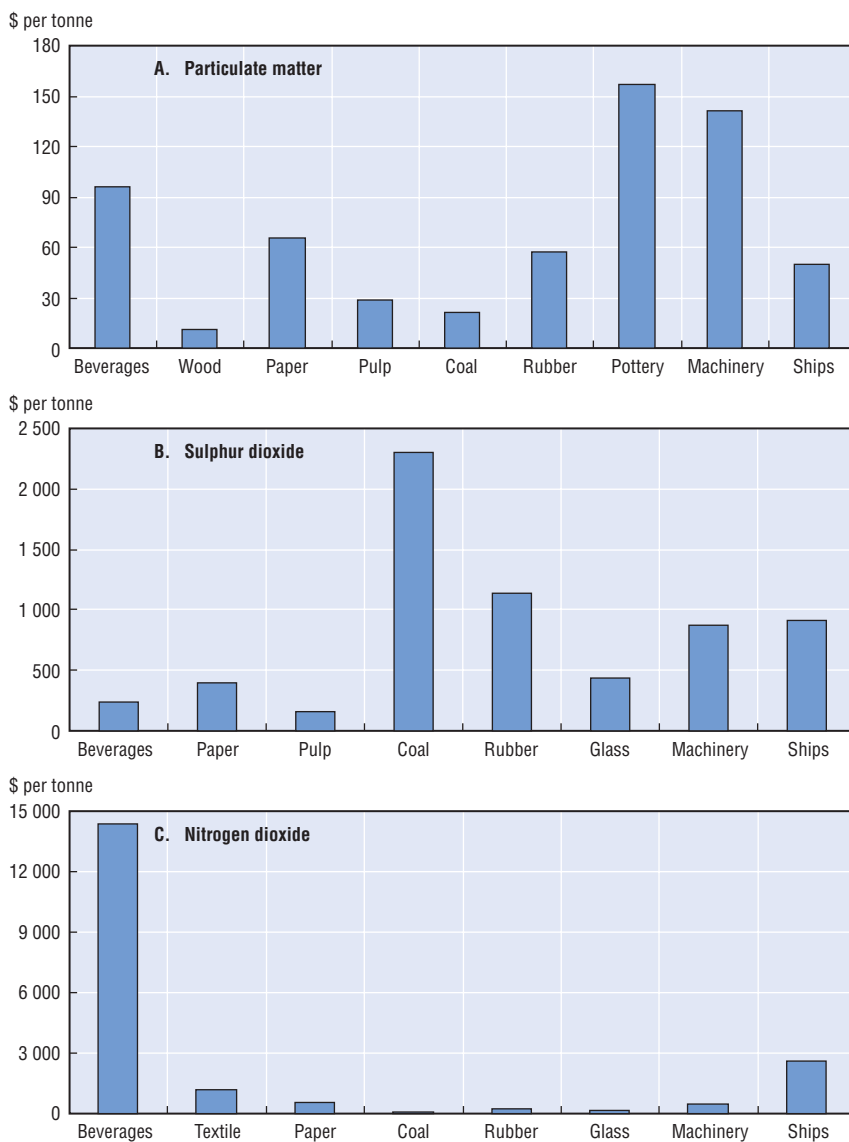
technologies appear. Country surveys have shown that, in practice, command-and-control regulations are associated with large differences in marginal abatement costs that bear no relation to possible differences in local benefits. For instance, marginal costs were found to vary by over 40 times for PM controls on power plants in Korea. A comprehensive *ex post* study of the costs that the US Clean Air Act placed on businesses between 1979 and 1985 was able to produce statistically robust estimates for actual marginal abatement costs which reveal large differences across sectors (Figure 4.2). Another source of economic inefficiency associated with command-and-control approaches is that incumbent polluters tend to have a significant say in designing the technical regulations and often obtain protracted exemptions for existing sources thereby creating a powerful barrier to entry (Stavins, 2003). Typical examples include the 1970 Clean Air Act in the United States and regulations on large sources in EU countries which have left half of all coal power stations operating with no SO₂ or NO_x scrubbers (Smith, 2003).

Tradable permits and emission charges have proved effective in reducing abatement costs. An example is the US SO₂ trading programme for power plants, which was instituted in 1990 and has been operating since 1995. *Ex post* assessments of the first three years of the programme showed that the choice of trading substantially reduced compliance costs, which are estimated to be 20 to 50 per cent lower than with the regulations that would have been enacted otherwise (Ellerman *et al.*, 2000 and Keohane, 2003). In particular, the flexibility inherent to the trading scheme encouraged Mid-western plant operators to substitute western, low-sulphur coal for local, high-sulphur fuel. This option, which became attractive due to rail deregulation, had not been foreseen in the command-and-control approach contemplated before the decision was made to go for a trading programme.⁷ The use of emissions trading has reduced compliance costs in another US air quality programme, the NO₂ Budget Program, which was formed to attain ozone standards in north-eastern states and allows trading since 1999 (Ozone Transport Commission, 2003). Common to both trading schemes is that allowances were allocated free of charge on the basis of past emissions, thereby leaving the scarcity rent with the producers.

Several OECD countries have used emission charges to reduce air pollutant releases from stationary sources (Table 4.7). *Ex post* evaluation shows that the Swedish NO_x charge has cut emissions by 35 per cent between 1992 and 2000 in a cost-efficient way (Roseveare, 2001, Sterner and Höglund, 2000 and OECD, 2003). At EUR 4 300 per tonne of nitrogen oxides, the levy is well in line with an estimated externality of about EUR 4 500 per tonne, therefore ensuring an efficient level of abatement.⁸ Other emissions charges, such as the French NO_x, SO₂ and VOC taxes and the Czech, Slovak and Swedish SO₂ taxes have also been found to minimise the cost of the resulting

Figure 4.2. The pattern of marginal abatement costs with command-and-control regulation

Estimated marginal abatement costs by sector under the US Clean Air Act in the period 1979-1985



Note: Following Hartman *et al.* (1997), marginal cost figures are plotted only for those sectors where the estimate is robust econometrically.

Source: Hartman *et al.* (1997).

Table 4.7. **Permit prices and tax levels for air pollutants**

	SO ₂	NO _x	VOC
	EUR per tonne		
Permit schemes			
United States	170		
North-eastern states		3 200	
Slovakia	6		
Emission taxes			
Norway	2 000		
Sweden	1 600	4 400	
France	38	46	
Slovakia	47		
Hungary	215	515	
Switzerland			2 000
Czech Republic	30	24	59

Note: US permit prices as of August 2003, Slovakia 2002.

Source: OECD, INERIS, Cantor Fitzgerald (2004).

pollution abatement but are set at levels well below the corresponding externalities. This implies that abatement efforts induced by these taxes are allocated cost-efficiently but that their overall level is sub-optimal.⁹

Taxes and trading schemes have also proved effective at reducing not only overall emissions but also pollution in highly polluted areas (“hotspots”). Such instruments were long subject to the criticism that they put a single price on externalities which may vary with location and that they were unlikely to cut concentrations in “hotspots”. With hindsight, these fears have proved unfounded, even for the US SO₂ trading programme which allows unrestricted trade across the continent (Burtraw and Palmer, 2003). Pollution has diminished in “hotspots” largely because the savings from free trade in permits enable environmental authorities to set more ambitious emission reduction targets. Another reason is that permit trading concentrates emission reductions in plants with the lowest marginal abatement costs, which are often those with the highest initial emission rates. This finding has led to the initially north-eastern NO_x budget programme being extended to most of the states east of the Mississippi river from 2004.¹⁰

The successful experience gained with actual trading programmes has led to the introduction of new cap-and-trade schemes in OECD countries in recent years (see Table 4.5). In Canada, Ontario has been running an emissions trading scheme since January 2002 with the aim to cut SO₂ and NO_x releases from power plants by 53 per cent and 25 per cent, respectively, by 2007. The trading regime offers emitters a high degree of flexibility as they can claim

credits for emission reduction projects in twelve US states and may bank allowances without restriction – a feature that the US experience has shown to be crucial to price stability.¹¹ The Slovak Republic has been subjecting all power plants generating above 50 MW to tradeable quotas for SO₂ since January 2002, in addition to the pre-existing emission tax. However, the permit price of about EUR 6 per tonne and the emission tax of EUR 50 per tonne do not add up to the corresponding externality of around EUR 5 600 per tonne (Box 4.1). In Korea, the Seoul metropolitan area authorities are in the final stages of setting up a cap-and-trade scheme that will include both point and mobile sources emissions for PM, NO_x and SO₂. The proposed US “Clear Skies” bill, if passed, would replace most of the many remaining command-and-control regulations under the Clean Air Act by tradeable caps for SO₂ and mercury and would integrate regional NO_x trading schemes in a nationwide market. Initially allowances will be allocated free of charge but 2 per cent of the allowances will be auctioned and this proportion will gradually increase.

Surveys of policies to reduce air pollution in nine member countries of the European Union suggest that emission trading could significantly reduce abatement costs in these countries. The 2001 large combustion plants (LCP) directive sets down stringent caps on SO₂, NO_x and dust emissions, which are expected to lead in 2010 to EU-wide SO₂ emissions from such plants being 69 per cent lower than what would have happened otherwise (Cofala and Amann, 2001). To achieve this, the directive requires plants to keep their emissions of each pollutant per cubic metre of exhaust below a specified limit which tightens over time. The lessons learned from command-and-control policies indicate that so uniform a mandate is bound to result in large differences in marginal abatement costs and hence will be unnecessarily costly. However, the LCP directive opens the possibility for EU member countries to opt out of the uniform emission limit values and to achieve the same reduction in emissions by other means, which could include cap-and-trade schemes. In the United Kingdom, the Environment Agency has proposed that tradeable quotas should be used to meet the country’s targets for SO₂ and NO_x.

The command-and-control approach also inspired the 1996 integration pollution prevention and control (IPPC) directive. Under the IPPC directive, national authorities must ask firms to install air pollution controls using BAT unless the associated costs compromise their financial health. The latter criterion requires environmental regulators to conduct complicated financial analyses on top of the already difficult, and expensive, task of determining what BAT means for each plant from a technical point of view (Keast and Verkaemst, 2002). Besides presumably high administrative costs, the IPPC approach is likely to entail efficiency losses because it cannot equalise marginal abatement costs across plants – and in fact does not even attempt to. The financial affordability criterion may also exacerbate the economic

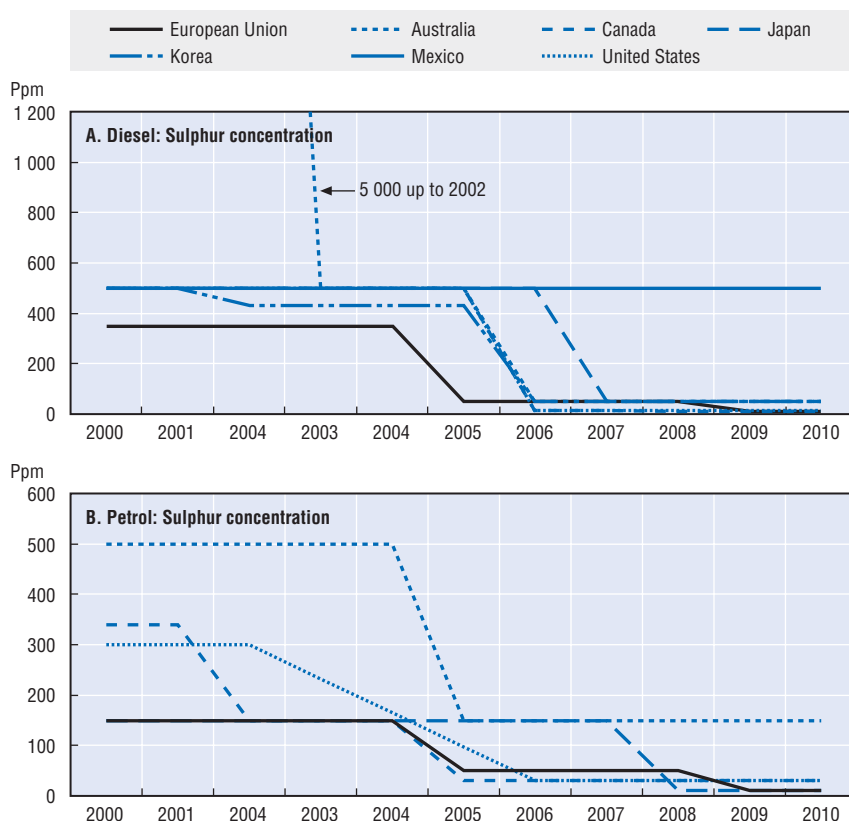
distortion associated with the regulatory approach by artificially supporting weak firms. Furthermore, because of its complication, this safeguard clause entails a risk of political interference.

In the light of the experience with different instruments to control emissions from stationary sources, the economic surveys recommended almost all the reviewed countries to reduce the reliance of command-and-control regulations in favour of the use of alternative instruments. The introduction of emission trading was recommended for nine of them (Belgium, Canada, Czech Republic, Finland, Germany, Greece, Hungary, Korea and Portugal) and the introduction of, or an increase in, emission charges were recommended for six countries (Czech Republic, Germany, Hungary, Mexico, Slovak Republic and Sweden). The removal of restrictions of trading between regions was called for in Belgium, Canada and Korea. In order to make their air pollution abatement more cost efficient, some EU and accession countries (Belgium, Czech Republic, Finland, Germany, Greece, Hungary, Portugal and the Slovak Republic) were called on to consider opting out of the uniform emission limit values embedded in the EU Large Combustion Plant Directive and achieve the same abatement with emissions charges or cap-and-trade instruments.

3.2. Mobile and diffuse sources

To tackle emissions from mobile sources, OECD countries have primarily regulated emission intensities of vehicles in combination with the chemical composition of motor fuels, a two-pronged approach that has provided tangible results and appears to have been relatively cost efficient. The sulphur content of fuels is being reduced everywhere in the OECD area, although on the basis of present policies some differences will remain across countries (Figure 4.3). However, the economic surveys of Belgium, Japan, Korea, Mexico and the Slovak Republic recommended further moves in this direction. In addition to bringing emission reductions in existing vehicles, cleaner fuels have also been a technical pre-requisite for introducing low emissions engines. Combined, the two measures lead to dramatic reductions in emissions per kilometre travelled (Figure 4.4) which will translate into lower total road transport emissions and ultimately lower concentrations even in scenarios where traffic continues to increase steeply (Figure 4.5). Independently reviewed economic analysis of the US Tier II motor vehicle emission standards (which are approximately comparable to the EU Euro IV standards) found that the benefits may exceed the costs by a ratio of 2.6 to 1 (Office of Management and Budget, 2002).¹²

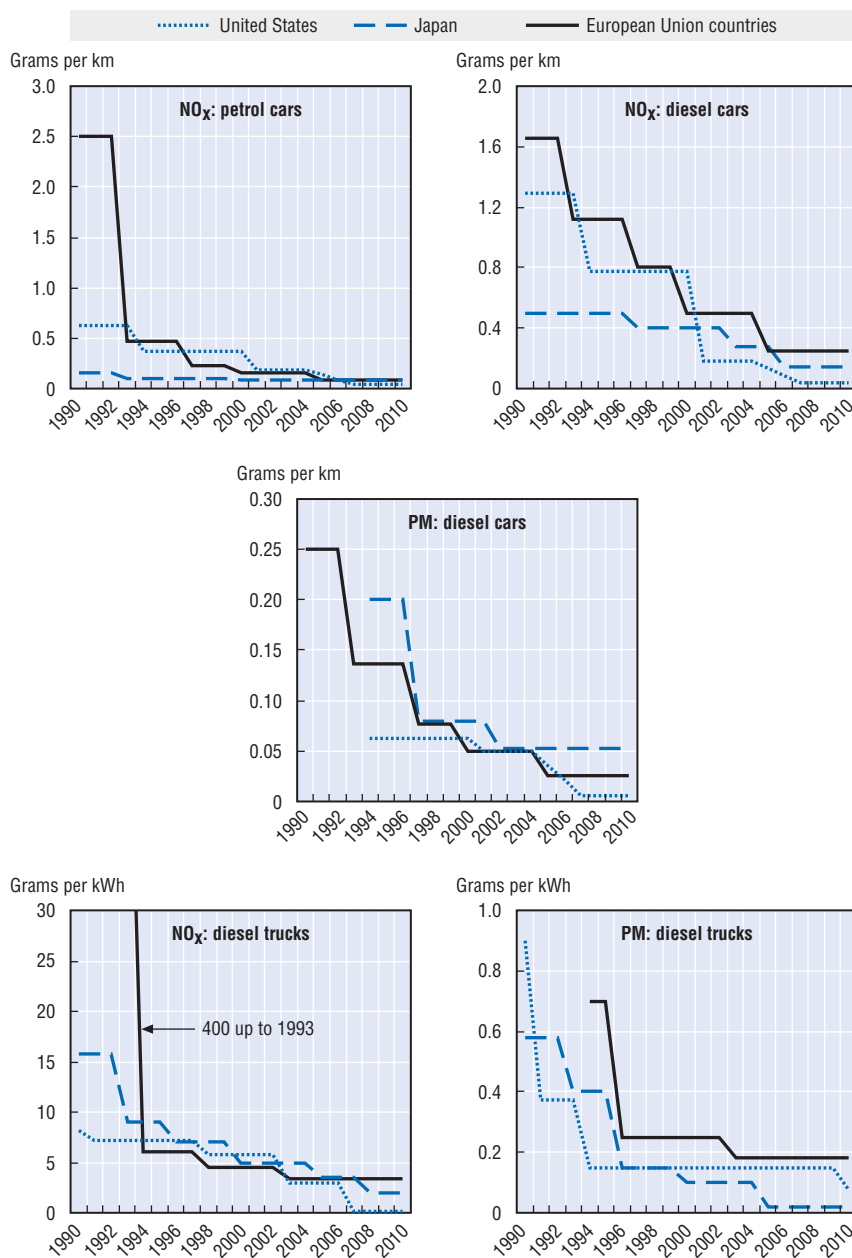
The speed at which tougher standards have improved air quality has been held back in many countries by high taxes on the purchase of new cars. High acquisition taxes entail lower turnover of the car fleet (Figure 4.6) and an

Figure 4.3. **The sulphur content of motor fuels**

Source: European Conference of Ministers of Transport, Environment Canada, United States Environmental Protection Agency, Australian National Environmental Protection Council.

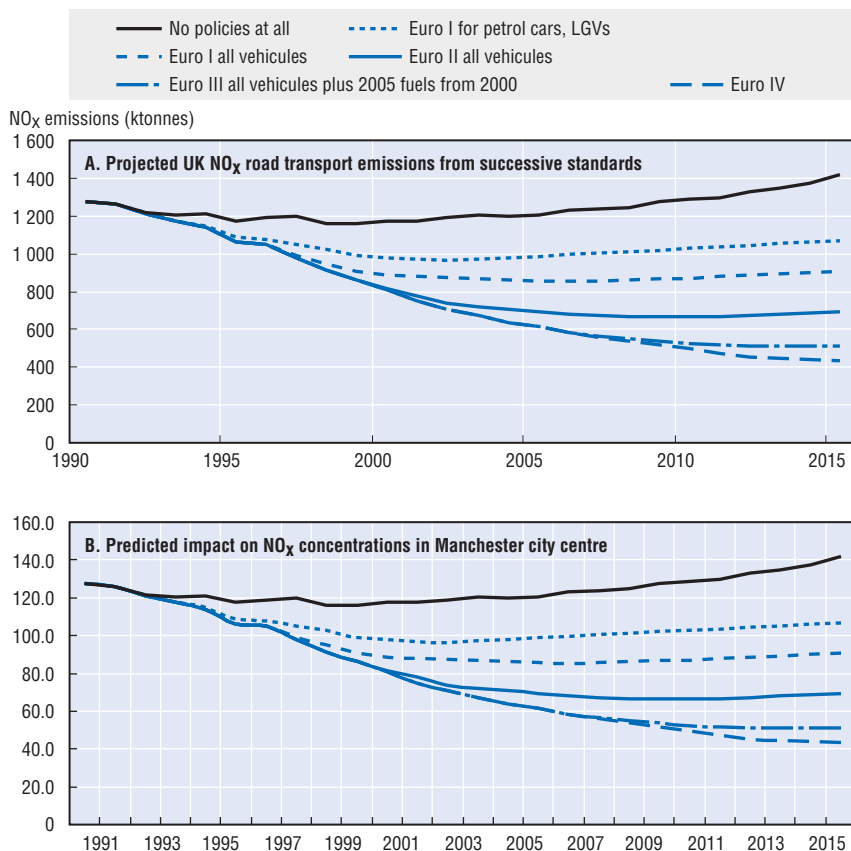
older vehicle fleet has higher emission intensity. Country surveys indicated that registration taxes may have such an effect in Belgium, Finland, Greece and Portugal.¹³ In the two latter countries it was recommended to abandon such practices in favour of annual or mileage-based taxes. In contrast, although they are costly and go against the polluter-pays-principle and were not always introduced for environmental reasons, subsidies or tax breaks for scrapping old cars have helped to lower the emission intensity of the road vehicle fleet in some OECD countries (France, Italy, Mexico).

The gap between excise taxes on petrol and diesel fuel has contributed to high PM emissions from vehicles. Concessionary rates now favour diesel-powered vehicles in all OECD countries but Australia, Iceland, Mexico, New Zealand, Switzerland, the United Kingdom and the United States. The use of diesel is taxed in a particularly efficient way in Iceland and New Zealand, two countries where the charge is based on mileage and not on fuel use, which

Figure 4.4. **Vehicle emission standards**

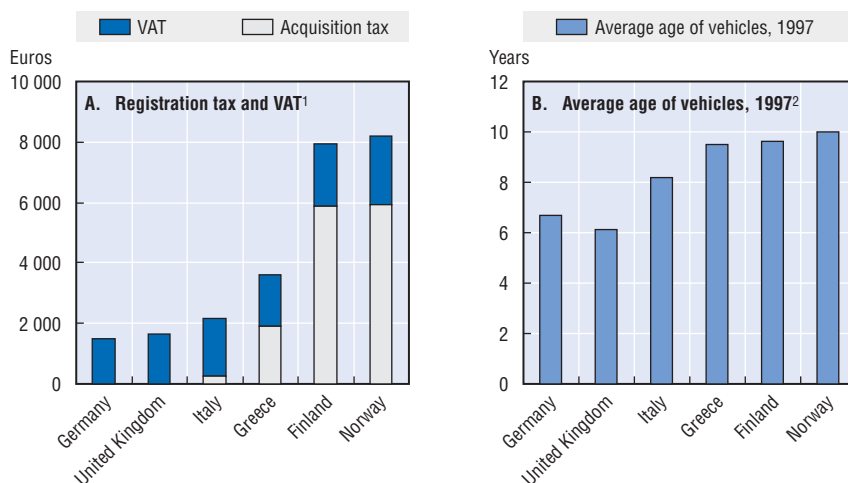
Source: European Conference of Ministers of Transport, OECD, Ford Co., DieselNet.

Figure 4.5. **New standards for vehicles and fuels: impact on air pollutant emissions and concentrations**



Source: Bush et al. (2001).

avoids creating an incentive to over-invest in fuel-saving (but not emission-saving) engines. The economic country reviews of Belgium, Finland, Germany, Greece, Portugal and Sweden recommended the elimination of the tax advantage of diesel. Another option would be to tighten PM emission standards and this was recommended for Germany, Iceland and Sweden. An alternative, more efficient, way to reduce PM emissions would be to impose an annual charge on diesel vehicles without particles filters so as to encourage manufacturers to equip new vehicles and owners to retrofit older ones. The efficiency and fairness of the instrument would be maximised if the charge on “unfiltered” vehicles was proportional to annual mileage, which would also avoid penalising owners of old vehicles that do not travel many miles, thereby re-inforcing the social acceptability of the measure. Such recommendations

Figure 4.6. **Car acquisition taxes and the average age of vehicles**

1. For a new vehicle of about 9 500 euros, 1 200 cm³, 43 kW, 930 kg.

2. 1999 for Norway.

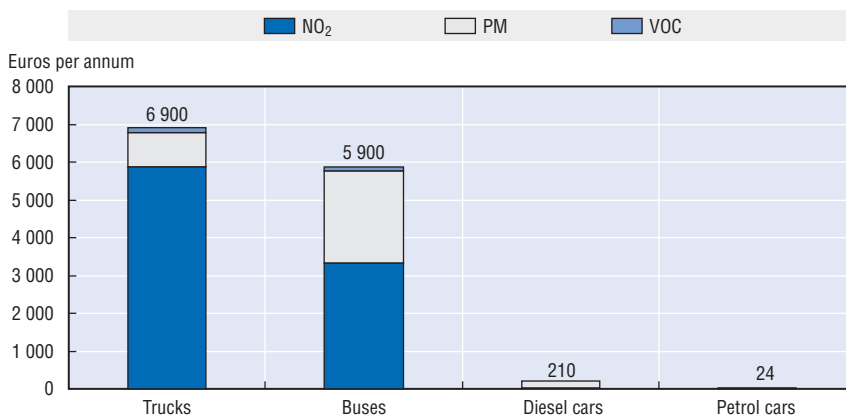
Source: European Commission: study on vehicle taxation in the member states of the EU. Statistics Norway.

were issued in the economic surveys of the Czech Republic, Germany, Hungary, Japan, Korea and Sweden.

Countries have imposed less demanding emission standards for buses and trucks than for cars. As a result, before the end of the decade, air pollution externalities from gasoline cars will be negligible compared to buses and lorries (Figure 4.7). However, countries are beginning to address pollution emission of heavy vehicles, sometimes taking advantage of advances in information technology to introduce cost efficient measures. Thus, since January 2001, Switzerland has been operating a system based on mileage and emission characteristics of heavy vehicles, the charge varying from CHF 0.0142 per tonne-kilometre for trucks that comply with Euro II emission standards to CHF 0.02/tkm for trucks that only comply with Euro 0. The tax has visibly accelerated the renewal of the lorry fleet and has reduced lorry traffic (Rapp and Balmer, 2003). Ideally, such charges could be made even more targeted by using the information on actual emission characteristics that is already obtained regularly during obligatory technical inspections of vehicles. Not every measure to reduce emissions from heavy vehicles is economically justified, though. In particular, country surveys found that air quality benefits justify the cost of equipping diesel buses with particle filters but not the cost of switching to buses fuelled by compressed natural gas (Korea, Mexico).

Non-road vehicles and other diffuse sources (such as domestic fireplaces) have been subject to comparatively lax measures and have accordingly

Figure 4.7. **Annual air pollution external costs of on-road vehicles registered in EU countries from 2004**



Note: Cars are assumed to drive 15 000 km a year in urban areas and 5 000 km in rural areas. Heavy vehicles are assumed to drive 20 000 km a year in urban areas and 80 000 km a year in rural areas. Buses are assumed to travel 60 000 km per year in urban areas.

disproportionately high emissions of air pollutants. On the basis of policies as of end-2002, PM and NO_x emissions from non-road mobile machinery are projected to exceed those from road vehicles in Europe before 2020 (European Commission, 2002). A proposal to tighten emission limits for such engines is under consideration in the European Union. Stationary but diffuse sources can also contribute substantially to air pollution when they are unchecked. Furthermore, SO₂ emissions from ships are forecast to account for more than three-quarters of overall emissions in the European Union by 2010 on unchanged policies (ENTEC, 2002). Surveys noted that the burning of wood in homes accounts for over one-third of all particulate matter discharges in Stockholm and for 40 per cent of PM_{2.5} emissions in Finland, two countries where no policy is in place to discourage such practices. Measures to reduce PM emissions from non-road sources were recommended in the reviews of Canada, Finland and Sweden.

Notes

1. The countries are Belgium, Canada, the Czech Republic, Finland, Germany, Greece, Hungary, Iceland, Japan, Korea, Mexico, Portugal, Slovakia and Sweden.
2. Although numerous substances can pollute ambient air, the analysis focused on a set of pollutants deemed most relevant: sulphur dioxide (SO₂), nitrogen oxides (NO_x), volatile organic compounds (VOC), particulate matter (PM), as well as their by-products ozone (O₃) and secondary PM. Nitrogen oxides consist of nitrogen

dioxide (NO₂) and nitrogen monoxide (NO). All numerical values in this chapter include both NO₂ and NO, with the mass of NO expressed in NO₂ equivalent.

3. For instance, Chay and Greenstone (2003) found a strong association between changes in suspended particles and infant mortality, even at the relatively low levels of concentrations observed in American cities. The link between mortality and PM concentrations had been long established at the high concentration levels (typically total suspended particulates above 100 µg/m³) that were recorded in OECD cities in the early 1980s (and that are still prevalent in metropolitan areas in developing countries).
4. Emissions were above targets in Ireland and Portugal, for different reasons. In Ireland, the overshoot was mainly due to exceptionally strong economic growth in the 1990s. On the other hand, implementation of EU environmental directives and energy deregulation have been comparatively slow in Portugal, leading to insufficient emission reductions in the electricity sector.
5. Annual NO_x concentrations were above 70 µg/m³ in Bratislava, Dublin, Guadalajara and Milan at the end of the decade.
6. The most relevant directives in this respect are the directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants (LCP) and the 96/61/EC directive on integrated pollution prevention and control (IPPC).
7. In dynamic terms, the SO₂ trading programme has also had a discernable, positive effect on innovation (Popp, 2003). Data on patents show that the introduction of trading has reorientated innovation efforts. While research and development mainly aimed at reducing the costs of a fixed sulphur removal objective in the era of command-and-control, R&D now focuses on improving the trade-off between removal efficiency and costs.
8. The actual level of the externality is indeed likely to be closer to the European average of EUR 4 500 per tonne than to the specific value of EUR 2 800 which appears in Box 1 for Sweden because the latter estimate does not take into account the effects of Sweden's emissions on non-EU countries.
9. The same conclusion may apply to the US SO₂ trading scheme where prices have fluctuated between USD 100 and USD 200 a tonne since 1998, while reducing SO₂ emissions has been estimated to bring marginal benefits in the range of USD 1 800 to USD 4 700 per tonne (Banzhaf et al., 2002).
10. An emission market for local air pollutants can be designed such that differences in marginal benefits are fully taken into account, by applying geographically-based conversion factors to trades (Førsund and Nædval, 1998). However, such features would also hinder trade and thus create costs that seem unnecessary in light of the successful experience with uncorrected trading.
11. Unrestricted banking in the US SO₂ programme has been accompanied by relatively smooth price developments. In contrast, California's cap-and-trade scheme for NO_x did not allow banking and this restriction resulted in wide fluctuations in permit prices which contributed to the energy crisis that hit the state in 2000 (IEA, 2002).
12. Continued tightening of engine emission standards were recommended in the reviews for Iceland, Japan and Korea. The United States limits differ from those in Japan and Europe in that they apply to the average vehicle sold by a manufacturer or importer and not to each model. This gives producers extra flexibility in meeting targets at low cost. Moreover, companies with below limit fleet average emissions can sell excess emission rights to other producers.
13. In Portugal, this may have been aggravated by large tax rebates for vehicles more than six years old.

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Chapter 5

Reducing Water Pollution and Improving Natural Resource Management

Adequate clean water is a precondition to human and ecosystem life. Eighteen country reviews looked at policies affecting the management of water resources and the control of water pollutant emissions. The chapter reports the conclusions from the country reviews as regards developments in water use, in the quality of water bodies with a focus on the capacity of policy instruments to encourage sustainable use and to reduce pollution in an efficient fashion. It also provides data and analysis on sustainability issues in fisheries management.

1. Introduction

This annex brings together the main lessons learnt from studies on reducing water pollution and improving natural resource management that have been or will be published in the *OECD Economic Surveys*. Twelve country studies dealt with policies to reduce water pollution, focusing on the cost-efficiency of the instruments used.¹ Nine surveys looked at whether measures were in place to ensure sustainable use of natural resources, especially freshwater stocks though fish and petroleum reserves have also been considered for some countries.² Issues relating to oil and gas resources are not covered in this annex since they were addressed in only two country surveys (Netherlands and Norway). The adequacy of different fish-harvesting policies in terms of sustainability was discussed in four country surveys and the main findings are summarised below. In the area of water, the broad conclusion from the reviews is that, notwithstanding the improvements over the past decades, threats to the quality and availability of the resource persist in some countries, mainly because not enough use is made of market mechanisms. To support this finding, the chapter first briefly presents the problem before commenting on the extent to which the performance has moved countries closer to their adopted objectives. It then discusses the policies behind the outcomes and the corresponding recommendations that have been made in country surveys. The examples reported in the annex are mainly limited to the reviewed countries.

2. Objectives and performance

Most surveyed countries now pursue an objective of good water quality for almost all streams although the corresponding targets have been formalised only recently in many European countries. In the United States, quality objectives were set for all streams following the enactment of the Clean Water Act in 1972. Virtually all streams were assigned to the two top categories – “swimmable” and “fishable” – out of the four available ones (the two other ones being “boatable” and no use). EU countries promulgated the objective of bringing all surface water bodies to good ecological quality by 2015 in the water framework directive, which was adopted in 2000. Switzerland also has very stringent standards of water quality for both surface and underground water bodies. Canada and New Zealand still have no nation-wide water quality standards for rivers and streams, primarily because hydrologic conditions vary considerably within these countries. In New Zealand, all regional councils have

Table 5.1. **Water pollution: main indicators**

	Biochemical oxygen demand		Nitrates		Total phosphates		Nitrogen balance on agricultural land	
	Average concentrations at mouth of selected rivers						National	
	Mg O ₂ /litre		Mg N/litre		Mg P/litre		Kg N/ha	
	Average 1980-85	Average last 3 years	Average 1980-85	Average last 3 years	Average 1980-85	Average last 3 years	1985-87	1995-97
Australia	..	..	..	..	..	..	7	7
Austria	2.2	2.2	1.2	1.3	0.2	0.1	35	27
Belgium	6.6	..	3.8	..	0.7	..	189	181
Canada	..	..	0.1	0.1	0.1	0.0	6	13
Czech Republic	8.5	4.6	5.1	3.5	..	0.3	99	54
Denmark	3.9	2.0	3.5	2.6	0.3	0.1	154	118
Finland	..	..	0.2	0.3	0.0	0.0	78	64
France	5.2	3.2	2.8	3.1	0.4	0.4	59	53
Germany	3.6	2.4	3.5	3.3	0.5	0.2	88	61
Greece	..	..	1.3	1.5	0.4	0.4	58	38
Hungary	4.4	2.9	2.2	1.6	0.4	0.3	47	-15
Iceland	..	..	..	..	..	..		
Ireland	1.7	1.8	2.2	2.9	0.1	0.1	62	79
Italy	..	..	2.0	2.1	0.3	0.2	44	31
Japan	2.3	1.4	..	..	..	..	145	135
Korea	..	2.8	..	2.6	..	0.1	173	253
Luxembourg	3.8	2.7	4.1	4.1	0.6	0.4		
Mexico	3.7	15.9	1.9	0.6	..	0.1	28	20
Netherlands	2.8	3.1	4.4	3.3	0.5	0.2	314	262
New Zealand	..	..	..	..	..	..	5	6
Norway	..	..	0.3	0.3	0.0	0.0	72	73
Poland	5.0	4.3	1.8	1.9	0.3	0.3	48	29
Portugal	2.6	2.1	3.6	4.4	0.1	0.2	62	66
Slovak Republic	5.1	3.3	2.0	2.2	0.1	0.2		
Spain	4.7	3.6	1.7	3.1	0.6	0.2	40	41
Sweden	..	..	0.4	0.5	0.0	0.1	47	34
Switzerland	..	..	1.5	1.5	0.1	0.1	80	61
Turkey	2.1	2.7	1.3	1.0	0.3	0.2	17	12
United Kingdom	3.4	2.9	4.6	5.2	0.8	0.9	107	86
United States	1.8	1.6	1.1	..	0.2	0.1	25	31

Source: OECD Environmental Database.

set water quality objectives. In contrast, in Canada quality standards for streams remain largely limited to regions neighbouring the Great Lakes.

The quality of surface water bodies has generally improved in the OECD area over the last two decades (Table 5.1). Pollution by organic matter and phosphates, which primarily originates from towns and industries, has

Table 5.2. **International water supply use comparison**

	Total freshwater abstractions				
	Amounts		Relative to renewable resources	Per unit of GDP	
	Billion m ³	Annual percentage change 1990-1999 ¹	Per cent	Litres per \$GDP	Annual percentage change 1990-1999 ¹
Australia	24.1	..	6.8	58.2	..
Austria	3.6	-0.7	4.2	18.9	-2.6
Belgium	7.4	..	45.1	31.8	..
Canada	47.3	1.2	1.7	72.4	-1.5
Czech Republic	2.0	-6.5	12.4	15.5	-6.3
Denmark	0.8	-6.2	12.3	5.9	-8.3
Finland	2.3	-0.1	2.1	20.0	-1.6
France	30.3	-3.0	15.9	23.9	-4.2
Germany	40.6	-2.3	22.3	22.2	-3.6
Greece	8.7	..	12.1	59.4	..
Hungary	5.7	-1.3	4.7	54.6	-2.7
Iceland	0.2	-1.0	0.1	21.9	-4.3
Ireland	1.2	..	2.6	20.1	..
Italy	56.2	0.0	32.1	45.0	-1.4
Japan	89.1	0.0	21.2	30.0	-1.8
Korea	24.8	2.7	34.3	42.8	-4.0
Luxembourg	0.1	0.2	3.7	3.5	-4.7
Mexico	78.4	..	16.2	102.7	..
Netherlands	4.4	-10.7	4.9	12.8	-12.7
New Zealand	2.0	..	0.6	34.8	..
Norway	2.6	..	0.7	26.0	..
Poland	11.3	-2.6	17.9	31.4	-6.0
Portugal	11.1	3.7	15.2	74.6	1.4
Slovak Republic	1.1	-6.6	1.4	22.5	-10.0
Spain	40.9	1.7	36.8	62.1	-0.2
Sweden	2.7	-2.1	1.5	14.2	-2.8
Switzerland	2.6	-0.5	4.8	13.2	-1.2
Turkey	38.9	3.2	16.6	100.1	-1.7
United Kingdom ²	11.2	-0.8	17.4	8.6	-3.0
United States	492.3	1.0	19.9	67.1	-1.4

1. 1989-99 for Luxembourg; 1992-99 for Iceland; 1990-98 for Belgium, Denmark, Hungary and Switzerland; 1991-98 for Germany and Portugal; 1989-98 for Italy; 1990-97 for Australia, Austria, France, Greece, Japan and Korea; 1991-97 for Spain and Turkey; 1991-95 for Canada; 1990-94 for Ireland and Norway; 1991-96 for Netherlands; 1990-93 for New Zealand; 1990-95 for Sweden and the United States.

2. England and Wales only.

Source: OECD Environmental Database.

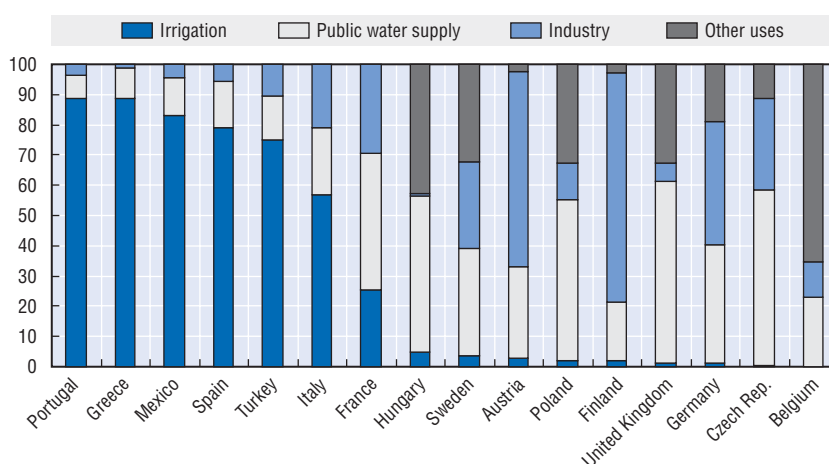
greatly diminished in all examined OECD countries bar Mexico, where four fifths of all sewage is discharged into rivers untreated. Surveys observed that this improvement has been brought about primarily by large investments in facilities for sewage collection and treatment. Some localised problems remain downstream of the few large cities that still release large quantities of

untreated sewage (Brussels, Milan, Porto). In addition, nitrogen surpluses from on-farm activities have declined in two-thirds of countries, sometimes substantially.³ However, there were some cases when concentrations in rivers rose even though nitrogen balances declined. Such results may occur because excess nitrogen can accumulate in agricultural soils over several decades before being released to water bodies.

Some de-coupling between economic activity and water abstraction occurred during the 1990s as the quantity used per unit of GDP fell in almost all countries (Table 5.2). Efficiency improvements in water-intensive industries (such as pulp and paper, chemicals and food processing), reduced leakage in public water supply and enhanced application devices in irrigation are the main factors behind this development (OECD, 2003a). However, surveys indicated that irrigation, which accounts for most of water consumption in water-scarce countries (Figure 5.1), still threatens the sustainability of groundwater resources in all reviewed countries:

- Australia, where 30 per cent of groundwater management units are over-using resources and another 32 per cent close to full use;
- Mexico, especially in the North Central region where abstractions from underground resources, nine-tenths of which go to irrigation, exceed recharge by 62 per cent;
- the Netherlands, where excessive pumping from aquifers can result in irreversible damage from saltwater intrusion due to the low-lying nature of much of the country;

Figure 5.1. **Water abstraction by final use**¹



1. Excluding temporary withdrawals for power plant cooling.

- Portugal, where the amount of water abstracted for agriculture rose by 72 per cent in the 1990-98 period and irrigation is shifting from regions that are best endowed with water to those that are facing water shortages;
- Spain, where saltwater intrusion is a problem in the south and the south-east of the country; and,
- the United States, where about 10 per cent of the country's water supply represents depletion of stored water.

3. Policies

3.1. Policies to reduce water pollution

Regulatory approaches, which form the main plank of OECD countries' policies to counter water pollution from industry and human settlements, have lowered pollution loads but do not appear to have done so at the lowest cost. The principal recommendations made to improve outcomes are presented in Table 5.3. Industrial plant discharges have been subject to emission limits that are often set on a case-by-case basis (Table 5.4). Central or regional governments typically mandate municipal authorities to expand sewage collection and treatment. Country reviews showed that these policy instruments have been effective in cutting pollutant discharges from towns and industries, except where enforcement is deficient (Mexico). The costs of these policies are difficult to assess, especially for businesses, because part of their expenditure to comply with wastewater permits is inextricably linked with general investment and operational spending. However, even on conservative assumptions, the associated costs appear to be sizeable in many OECD countries (Figure 5.2). Country surveys pointed out that costs are likely to have been higher than necessary because regulatory approaches do not generally equalize marginal abatement costs across sources within river basins. For instance, in the United States, the marginal costs of reducing organic pollution discharges from poultry processing have been estimated to vary across plants by a factor of 30 (Harrington, 2003).

Five reviewed countries have introduced *charges on effluents from industrial plants*. Such instruments have demonstrated their capacity to encourage cuts in pollution loads in an economically efficient way, as was found in the survey of the Netherlands. However, country reviews also noted that some implementation arrangements can blur the price signal conveyed to polluters and thus reduce the efficiency of the tax:

- in Denmark, major polluters get a tax rebate of between 70 and 97 per cent;
- in France, the tax is based on average pollution intensities for different products in a given industry unless firms specifically opt for the emission-based system, with the result that above average emitters have no incentive to reduce their discharges;

Table 5.3. Policy recommendations in country surveys

	Canada	Denmark	France	Ireland	Italy	Mexico	Netherlands	New Zealand	Portugal	Sweden	Switzerland	United States
Improve the availability of nation-wide information on water quality	X							X				
Better quantify the benefits of reducing pollution loads		X	X		X					X	X	X
Strengthen water basin authorities and develop integrated plans to reduce water pollution					X	X	X					
					X	X						
For industrial plant discharges,												
Strengthen the enforcement of existing controls and charges						X			X			
Introduce, or modify, emission taxes to generate a clear link between discharges and the amount of tax paid			X							X		
Allow trading in discharge permits within river basins								X	X			
For municipal sewage discharges												
Close gaps in wastewater treatment infrastructure					X	X			X			
Price the use of wastewater services in line with full costs	X			X	X	X		X	X			
For point discharges from large livestock rearing units,												
Enforce existing regulations and charges more strictly			X	X								
For diffuse on-farm emissions												
Reinforce controls on manure spreading and fertiliser use				X				X				X
Enforce existing legislation more effectively			X	X					X			
Make agricultural support payments conditional on good practice or scale them down										X		
											X	
Make greater use of economic instruments, notably by	X	X	X	X	X							
Taxing nitrogen surpluses, or		X	X	X	X				X	X	X	
Increasing the rates of existing charges, or							X					
Introducing (or expanding) tradeable discharge permits	X							X	X			X

Table 5.4. **Main policy instruments used to reduce water pollution**

	Canada	Denmark	France	Ireland	Italy	Mexico	Netherlands	New Zealand	Portugal	Sweden	Switzerland	United States
Industrial plant discharges												
Command-and-control regulation		X	X	X	X	–	X	X		X	X	X
Charges		X	X			–	X		–			
Permit trading												X
Municipal sewage discharges												
International and higher levels of government subsidies												
for sewage collection and treatment				X	X	X			X			
Long-run marginal cost pricing of wastewater services		X	X				X				X	
Charging of effluents from wastewater treatment plants		X	X			–					X	
Diffuse on-farm emissions												
Subsidies		X	X	X	X		X			X	X	X
Environmental conditionality of some support payments							X				X	X
Voluntary approaches for on-farm emissions	X	X	X	X	X		X	X	X	X	X	X
Regulation of nutrient management	X	X	–	X	X		X	X	–	X	X	X
Taxation of nutrient surplus		X					X					
Taxation of pesticides		X	X							X		

1. The symbol “–” denotes that instruments of the type concerned are on the books but that enforcement is limited.

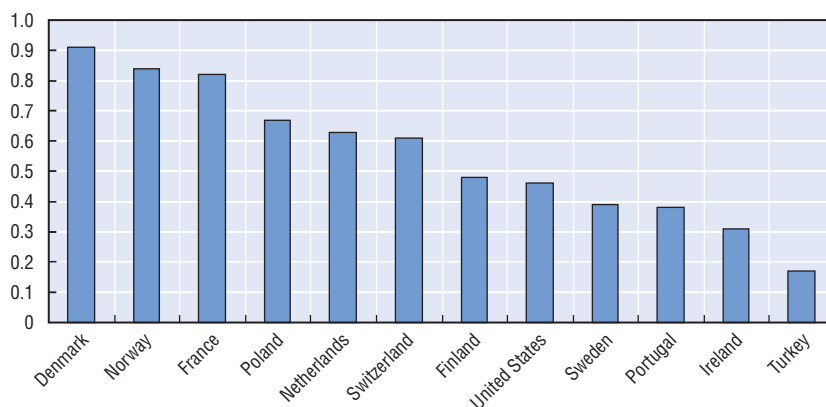
- in Mexico, the collection of effluent taxes on industrial plants is seriously incomplete; and,
- in Portugal, the 1994 decree-law creating water pollution taxes has never been enforced.

The surveys recommended making these taxes more effective by strengthening collection (Mexico, Portugal) or by reinforcing the link between discharges and tax payments (France).

The degree to which the polluter-pays principle is applied to *household effluents* varies considerably across OECD countries and, in many of them, there is scope for improving the efficiency of water pricing schemes by better reflecting wastewater treatment costs. Only a minority of surveyed countries price the use of wastewater services in line with long-run marginal costs so as to recover the full costs of the system (Table 5.4) and, in two of them (Italy, Netherlands), the costs do not include the environmental externalities of effluents from wastewater treatment plants. In many countries, sewage

Figure 5.2. **Expenditure on wastewater**

Public and private investment and operations expenditure on wastewater treatment as a share of GDP in 2000 or latest available year



Source: OECD (2003c).

treatment costs are recovered only partly or through flat-rate charges or levies that vary with property values which, in either case, give no incentive to reduce water use. In one case (Ireland), there is no cost recovery at all as water supply and sewage collection are financed through general tax revenues. Not only does under-pricing encourage inefficiently high water use, but it also puts a strain on public finances which must then bear the burden of wastewater expenditure. Surveys thus recommended moving towards volumetric water charges through combined bills that include a component based on sewage treatment costs (Canada, Ireland, Italy, Mexico, New Zealand, Portugal).

In the reviewed countries, water quality legislation controls *farming* less tightly than other activities. In a majority of cases the policy mixes include regulations but are primarily based on subsidies and voluntary approaches, which have not been effective in cutting discharges (Box 5.1). Indeed, voluntary codes of good practice have not proved able to remedy a problem that does not stem from a lack of information but from the absence of internalisation of pollution costs. Surveys noted that subsidy-based programmes (whether they make existing direct support payments conditional on environmental factors or are additional, specific financial assistance) did not deliver large cuts in pollution loads because they failed to target the most polluting farms.

Inversely, on the basis of their performance where they have been used, taxes and tradeable caps have proved capable of reducing farm effluents efficiently. The experience of nitrogen surplus taxation in the Netherlands shows that farmers respond to price signals. The survey of the United States reported that tradeable caps on farm nutrient surpluses are practicable and

Box 5.1. OECD countries' policies to tackle nitrate pollution from agriculture*

Farming can pollute water bodies with nitrates by discharging slurry from livestock units directly into streams and spreading excessive quantities of nitrogen inputs on land, in the form of inorganic fertiliser or manure. In countries with extensive livestock rearing, nitrate pollution can also occur if animals are frequently allowed to cross streams or to graze near banks.

Little information is available about the economic costs inflicted by nitrate pollution and existing estimates vary considerably. The survey of France reported a value, derived from expenditure data on drinking water purification, of EUR 0.75 per kilogram of nitrogen in nitrate runoff, which implied a total cost equivalent to 0.1 per cent of GDP. This may be a lower bound given that it neglects all effects on water bodies other than the extra cost of water supply treatment. However, few cost-benefit studies exist of the benefits of lowering nitrate concentrations in drinking water itself. At the other extreme, a study conducted in the Netherlands, using survey responses of willingness to pay for quality improvements, valued the costs of nitrate runoff at EUR 11 per kilogram of nitrogen, suggesting a national damage of 1.4 per cent of GDP (Howarth *et al.*, 2001). Even if geographical dissimilarities (such as the particular vulnerability of the areas where the surveys were undertaken) can explain part of the difference between the two values, such a divergence strongly suggests that estimates are not entirely robust yet and that further research is warranted in this area.

Direct discharges from large livestock rearing units can be monitored relatively easily and, in most surveyed countries, they are subject to the same regulations and charges as industrial facilities and municipal sewage treatment plants. Nevertheless, the reviews of France and Ireland noted that these instruments were incompletely enforced for livestock units and recommended to implement them as stringently as for industrial plants and wastewater treatment installations.

The spreading of manure and inorganic nitrogen fertiliser on fields is more difficult to keep in check. Not only is it more difficult to monitor, but its impact on water pollution depends on the amount of nitrogen absorbed by plants, the nature of the soil and the schedule of nitrogen application. Because of the inevitable complexity of introducing any regulation or charge, many countries preferred to address these sources of nitrate pollution by publishing codes of good practice for farmers to adopt on a voluntary basis (Canada, Italy, New Zealand) or in exchange of specific subsidies (France, Ireland, Sweden) or of higher agricultural support payments (Switzerland, United States). Those approaches have been found to have small impact on nitrogen pollution, even when they involved large subsidies. For instance, in

Box 5.1. OECD countries' policies to tackle nitrate pollution from agriculture* (cont.)

France where government payments for reducing nitrate runoffs have totalled EUR 190 million annually since 1994 for little demonstrable result. Because of the EU nitrates directive, some reviewed countries gave an obligatory nature to part of the codes of good practice in specific areas (Italy, Sweden) or nationwide (Denmark, Netherlands). In the Netherlands, farmers are required to keep nitrogen accounts and are allowed to trade in manure for reducing any surpluses, which are taxed. The Dutch programme has been effective in cutting pollution loads but costs have been high: the authorities spend EUR 24 million a year on implementing the scheme and farmers pay more than EUR 300 million yearly to test the chemical content of excess manure, weight it and transport it. Costs have also been large in Denmark at EUR 77 million annually where a mix of subsidies, regulations and assessed nitrogen surplus has been used to bring about a sharp reduction in nitrate runoffs from agriculture. In the United States, diffuse nitrate discharges are not systematically controlled nation-wide. But regional schemes have been introduced, notably in North Carolina and Connecticut, to cap on-farm nutrient surpluses (including not only nitrogen but also phosphorus) while allowing trade in permits amongst farmers, industries and municipal wastewater treatment plants. The survey of the United States observed that these trading regimes have reduced pollution loads at low cost.

* This box focuses on those policy measures that were discussed in the country surveys. A more detailed analysis of the issues at stake can be found in OECD (2001) and an in-depth case study of the water pollution impact of pig farming is available in OECD (2003b).

that trading may have cut the costs of meeting pre-existing voluntary targets by half in a scheme operating in North Carolina. Seven country reviews suggested taxing nitrogen surpluses (Denmark, France, Ireland, Italy, Sweden and Switzerland) and four recommended introducing, or generalising, catchment-level trading schemes that would cover on-farm nutrient surpluses and discharges from industries and municipalities (Canada, New Zealand, Portugal, United States).

The lack of quantitative information about the benefits of reducing pollution is a serious obstacle to the formulation of efficient water quality objectives. Indeed, monetary estimates of the advantages are needed if abatement targets are to balance costs and benefits. Whereas some information is available for costs (Figure 5.2 and OECD, 2003c), benefit valuation is still largely absent or highly uncertain. For instance (see also Box 5.1), in the United States, the Environmental Protection Agency considers that the Clean Water Act has provided benefits in line with costs but other authors have found benefit-cost ratios of 1:6

(Freeman, 2003) or even 1:20 for those Clean Water Act regulations that have been subject to regulatory impact assessment between 1981 and 1996 (Hahn, 2000). Six country surveys emphasised the lack of information about benefits as a serious problem and recommended further efforts to better quantify them (Denmark, France, Italy, Sweden, Switzerland, United States).

3.2. Policies to manage water resources

In reviewed countries, the two main families of instruments used to manage water resources are *property rights* and *taxation*, which often take the legal form of use permits and charges respectively (Table 5.5). The structure of incentives for end-users to save water was also examined in country surveys. Recommendations were made in these areas to enhance the capacity of water policies to contain water extraction within sustainable limits in an economically efficient manner (Table 5.6). This issue is of particular importance to EU member countries, which are compelled by the EU water framework directive to ensure that groundwater abstractions and natural recharge are balanced by 2016.

Country surveys observed that *property rights* have demonstrated their capacity to limit water use in an efficient fashion where they have been used but that their potential remains largely unexploited. Australia has been reforming its water policies since 1994 with the objective to obtain a fully market-based system before 2005 for apportioning the amount of water available after allowing for environmental needs. At the time when the review was conducted, in late 2002, the process was well advanced and had already

Table 5.5. **Water management policies: a summary**

	Australia	Mexico	Netherlands	Portugal	Spain	United States
Policies in place to manage water include:						
Abstraction charges for						
Industrial users	X	X	X			–
Municipal utilities		–	X		X	–
Irrigators	X		–		–	–
Phasing out subsidies to irrigators	X					
Trading in water rights	R	X				R
Consumption-based billing in urban areas	X	X	X	X	X	–
So as to recover the full cost of supplying water	X		X			
Pumping treated water to replenish depleted aquifers			X			

Notes: X indicates that the corresponding measure is implemented widely across the country;
 – indicates that the instrument exists but is used to a limited extent only;
 R denotes a regional measure.

Table 5.6. **Water management: policy recommendations in country surveys**

	Australia	Mexico	Netherlands	Portugal	Spain	United States
Give greater responsibility to river basin authorities		X	X			
Establish sustainable water allocations	X	X			X	
End subsidies to irrigation		X		X		X
Charge farmers and other users for the full, long-term cost of water abstraction		X	X			X
Remove barriers to trading in water rights	X			X	X	X
Charge households in line with the full costs of supplying water		X		X		X
Improve the collection of water charges		X			X	

demonstrated that trading in water rights was successful in allocating limited water supplies to its most productive uses in those regions that did not restrict transfers. In other reviewed countries, the efficiency of trading in property rights was found to be reduced by various factors. Water trading is common practice in Mexico amongst irrigators but its capacity to enhance resource allocation is seriously limited by the restriction that trade with other users, such as industrial plants, requires approval by the national water commission. In the US arid west, property rights exist for the abstraction of surface water and can be traded although this possibility is subject to complicated rules and, in some states, made difficult by poor documentation. As to groundwater, landholders have ownership over underground water in most US states but legal principles only partially account for the linkages between neighbouring properties, which in effect creates an incentive to pump the water before the neighbour does so. In Spain, the fact that abstraction rights are unclear for almost half of the irrigated acreage has created an obstacle to the implementation of effective water management policies. In consequence, surveys recommended clarifying water rights and removing any restrictions so as to facilitate water trading and to maximise its efficiency (Australia, Mexico, Spain, United States). In addition to impediments to trade, several reviews mentioned that current property rights entitlements were above the maximum environmentally and economically sustainable level of abstraction and suggested that entitlements should be reduced accordingly (Australia, Mexico, Spain).

Even though *abstraction fees* have shown that they can reduce water withdrawals, they have generally not led to a reversal of depletion trends, primarily on account of the widespread failure to charge irrigation at sufficiently high rates. In the Netherlands, the EUR 0.16 per cubic metre

extraction fee levied on households and industrial users has delivered a decrease in water abstraction by both categories of users (OECD, 2003d). However, the survey mentioned that Dutch aquifers continue to be threatened by saltwater intrusion due to excessive pumping by irrigators because only 2 per cent of them are liable to the water abstraction charge. Similarly, Mexico's extraction charge has not halted groundwater depletion in spite of a high rate of MXN 13.39 per cubic metre (USD 1.34) in dry areas because the tax exempted farmers⁴ and did not recover costs incurred by municipal utilities. In most regions of the United States that have water abstraction charges, farmers are exempted or benefit from preferential rates. Surveys recommended that exemptions should be withdrawn and that all users should be charged at rates that reflected the scarcity of the resource (Mexico, Netherlands, United States).

Country surveys also identified other factors that contribute to households and irrigators making excessive use of water.

- The scarcity value of water resources is rarely reflected in the prices faced by end-users connected to municipal water supply systems, the Netherlands being the only exception amongst reviewed countries.
- Beyond the missing scarcity value, many publicly-funded water supply systems do not price their own investment and running costs in full. Such below-cost pricing is prevalent for publicly-funded irrigation systems in all the surveyed countries bar Australia.⁵ Reviews noted that households' drinking water bills do not reflect actual supply costs in many municipalities of Mexico, Portugal, Spain and the United States.
- The EU common agricultural policy provides specific subsidies for irrigated areas in supplement to the regular support payments (Portugal) even though the EU water framework directive calls for full cost recovery by 2010.
- The EU cohesion policy is providing subsidies to large-scale irrigation projects (Portugal, Spain).
- Irrigators benefit from special, below-cost prices of electricity for pumping in e.g. Mexico.

In consequence, surveys included recommendations for moving towards the full recovery of costs (Mexico, Netherlands, United States).

3.3. Integrated water policies

A number of countries are using integrated water policies that aim at managing water resources and pollutant discharges in a common, consistent framework at the river basin level (Australia, France, Italy, Netherlands). Because they allow taking proper account of the linkage between water use and water pollution, such policies can be expected to bring more efficient results than in the absence of co-ordination. For instance, well-designed integrated water policies

Box 5.2. Sustainability issues in fisheries management *

The sustainability of marine, wild fish resources is a cause for concern as 18 per cent of the world's commercial species are fished beyond their maximum sustainable yield and 9 per cent are depleted (OECD, 2003e). In the exclusive economic zones of the reviewed countries, fish stocks are also declining in Norway, Portugal, Spain and the United States. In Norway, rising catches (see table below) have resulted in cod and haddock facing a risk of stock collapse. In Portugal and Spain, earlier over-fishing is reflected in catches that are 41 per cent and 12 per cent below their 1990 levels, respectively. In the United States, the number of species below their maximum sustainable yield rose from 56 to 71 between 1990 and 1999 (NMFS, 2000) and the proportion of over-fished stocks increased from 28 per cent in 1997 to 36 per cent in 2002 (NMFS, 2003). Iceland is a notable exception in this list of declining stocks since its fish resources are recovering, though at a slow pace as the most valuable species, cod, is forecast to be still 60 per cent below the maximum sustainable yield in 2005.

Table 5.7. **Main indicators: fisheries**

	Fish catch (tonnes)	Fishing fleet			Transfers to the fishing industry	Aquaculture
	Per cent change	Per cent change			Per cent of landed value	Per cent change
	1990-2000	Tonnage	Employment	Number of vessels	1999	1990-1997
Australia	1	78.1	11.6	-81.4	..	319
Belgium	-28	1.6	-33.8	-31.2	..	273
Canada	-39		-17.2	-31.6	42.1	1 301
Denmark	4	-29.9	-22	-46.1	7.4	80
Finland	15	140.4	-27		136.8	52
France	-4	4.2		-39.2	7.2	18
Germany	-37	-86	82	58.6	31.0	-2
Greece	-25	-38.7	41.7	238.1	47.3	3 261
Iceland	32	62.7	-5.1	8.5	4.4	3 418
Ireland	27			-65.7	51.3	328
Italy	-19	-12.3		-2.6	17.8	105
Japan	-48	-42.1	-35.6	-12.6	23.7	15
Korea	-26	15.6	-30.6	4.3	12.8	-18
Mexico	-3		29.5	102.5	..	379
Netherlands	22	20	12.8	-0.9	..	-35
New Zealand	63		-45.7	-18.3	..	624
Norway	69	-3.8	-22.5	-42.6	14.3	1 310
Poland	-51		-47.5	..	..	78
Portugal	-41	-39.3		-32.7	8.8	18
Spain	-12	-18.7		-2.6	13.8	17
Sweden	35				23.9	57
Turkey	33	21.4	159.2		..	2 827
United Kingdom	-2	-19.7	6.5		8	659
United States	-15		-76.9		30.8	32

Source: Food and Agricultural Organization (FAO), OECD and World Bank.

Box 5.2. Sustainability issues in fisheries management* (cont.)

Country surveys mentioned subsidies and a reluctance to enforce adequate cap on total catches as the main reasons behind the over-exploitation of fish stocks. Progress on both counts has been slow.

- Subsidies to the fishing industry remain high in many OECD countries (see table below on fisheries management). Iceland, however, provided an example of support transfers that have been brought to very low levels while the fishing industry remained profitable. In EU countries, supranational subsidies for the construction of fishing vessels are scheduled to be phased out from 2005. The survey of Portugal recommended scaling back fishing subsidies.
- Total allowable catches (TAC) are in place in all reviewed countries (see table below on recommendations concerning fisheries management) but they are set at levels that are too high to protect fish stocks except for Iceland. Although Icelandic TACs are sufficiently low to secure the viability of the species, they are still too high to restore stocks to a level that maximises long-term returns. The surveys of Iceland, Norway and Portugal suggested that TACs should be tightened.

Table 5.8. Fisheries management policies: a summary

	Iceland	Norway	Portugal	Spain	United States
Effort-based restrictions			X	X	X
Buy-back subsidies to reduce capacity					X
Total allowable catch	X	X	X	X	X
Individual quotas		X			
Free trade in individual quotas	X				R
Fishing fee	X				

Notes: : X = denotes a policy instrument in place nation-wide; R = indicates that the instrument is used in certain regions.

Table 5.9. Fisheries management: recommendations in country surveys

	Iceland	Norway	Portugal
Remove fishing subsidies			X
Lower total allowable catch limits	X	X	X
Allow free trade in quotas		X	X
Remove remaining restrictions on trade	X		

Box 5.2. Sustainability issues in fisheries management* (cont.)

Caps on total catches can be enforced by various technical or administrative restrictions to reduce the fishing effort (Portugal, Spain, United States) or by the allocation of individual quotas to owners of fishing boats (Iceland, Norway and some fisheries in the United States). Surveys observed that effort-based measures usually resulted in unnecessary costs. For instance, restricting the number of fishing days creates an incentive to over-invest in fishing vessels so as to maximise the quantity of fish that can be caught in a limited period. In contrast, individual quotas have proved able to deliver cuts in fish capture at low economic cost in Iceland where they can be traded relatively freely. In Norway and in most of the United States, the exchange of fishing quotas is subject to various restrictions that aim to preserve the geographical pattern of employment in fishing communities. Such limitations come at a substantial cost since they prevent market forces from reallocating resources in a way that minimises the cost of meeting a given TAC. The survey of Norway recommended allowing free trade in fishing rights and the review of Iceland suggested that the remaining restrictions on trade should be abolished.

* This box focuses on policies that were examined in the OECD economic surveys of Iceland, Norway, Portugal and Spain in the context of the Organisation's work on sustainable development. Some US policies are also mentioned here because the country's exclusive economic zone has the largest domestic marine wild fishery catch in the OECD area. Fisheries management is discussed in detail in OECD (2003e).

lead the authorities to compare the costs of cleaning water downstream before it is supplied with those of discouraging pollution upstream. Integrated policies also facilitate cost recovery. Supervising water supply operators provides the river basin authority with a wealth of information on the costs of upstream pollution, which they can use to estimate the rates at which pollutant releases should be charged. Moreover, integrated management makes it easier to add pollution-based charges to water bills. For those reasons, several country surveys recommended reinforcing integrated water management schemes (Italy, Netherlands) or introducing such arrangements (Mexico).

An important development in this area is the EU water framework directive which calls for the generalisation of integrated water management and full cost recovery in all EU member countries. Under this directive, management plans must be ready for all EU river basins by 2010. The directive also calls on EU countries to ensure that charges for water supply, sewage collection and treatment recover the associated costs in full. But countries that have a history of not pricing water can be exempt from this obligation if they demonstrate that they will achieve the environmental objectives set by the directive through other means.

Notes

1. The EDR Committee has released country surveys of policies to reduce water pollution for Canada, Denmark, France, Ireland, Italy, Mexico, the Netherlands, New Zealand, Portugal, Sweden, Switzerland and the United States.
2. Reviews of natural resources management policies have been conducted by the EDR Committee for Australia, Finland, Iceland, Mexico, the Netherlands, Norway, Portugal, Spain and the United States. The question of water supply was covered in all surveys except for Finland, Iceland and Norway because they are abundantly endowed with water and there are no concerns over excessive exploitation. The review of Iceland focused on the husbanding of fish stocks, an issue that was also addressed in the Norwegian survey though it dealt in more detail with the management of oil and gas resources. The survey of Finland looked at the question of whether forest resources are managed in a sustainable fashion.
3. The main sources of nitrogen inputs in agricultural soil are livestock manure and fertiliser. Other sources include deposition of air pollutants and sewage sludge spread on farm land.
4. Farmers have become liable to the tax since 2003 but at a rate of only MXN 0.1 per cubic metre.
5. Below-cost pricing can take different forms in different countries. In Mexico, Portugal and Spain, only a fraction of the investment costs are recovered from users. In the United States, farmers pay back the investment expenditure to the Bureau of Reclamations in full but over a 50-year period and with a zero interest rate.

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Chapter 6

Reducing and Improving Management of Waste

Reducing waste generation and increasing recycling rates have been considered as central objectives of many sustainable development strategies. This chapter provides data on performance towards these goals and on the associated costs, notably for recycling programmes. It examines which waste disposal options enable to prevent negative effects on the environment at least cost and then presents recommendations drawn from peer reviews on ways to increase the efficiency of strategies to reduce waste-related environmental degradation.

1. Introduction

This chapter provides a synthesis of a series of nine country studies on municipal waste management that have been included in the OECD economic surveys under the heading of sustainable development.¹ The main issues addressed were how to reduce the environmental cost of waste generation and treatment without imposing a high economic cost on society. The reviews did not cover industrial and toxic waste. The discussion below is based on the country reviews but also makes use of information with wider country coverage contained in the accompanying tables.

2. Performance

Since 1990, municipal waste generation has continued to grow in all OECD countries, but it has risen slower than private consumption in about half of them (Table 6.1). Korea, and, to a lesser extent, Poland and Ireland have been notably successful in decoupling waste generation from consumption growth, while Spain, Denmark, Italy and Sweden have recorded significant increases in waste generation per unit of private consumption. Relative to the level of consumption, waste generation around the close of the 1990s was relatively low in Japan and the United States, and relatively high in Turkey and Hungary.

The continued expansion of municipal waste generation was accompanied by a notable shift in treatment practices in many countries, recycling and composting replacing landfilling and incineration. Indeed, recycling and composting have become the dominant means to treat such waste in six European countries (Austria, Belgium, Denmark, Germany, Netherlands and Sweden) and recycling rates have become very high for some materials (Table 6.2). In many of the other countries, although the share of municipal waste going to landfills has fallen over this period, this traditional mode remains the most common means to dispose of waste. Incineration is the most important treatment stream in Denmark, Luxembourg and Japan.

3. Policies

The country reviews generally concluded that neither the mix of waste treatment methods nor policies within individual disposal streams were efficient in reducing the environmental cost of waste at a low cost. The reviews accordingly recommended corrective policy actions, recognising at the same time that countries might want to pursue particular waste policies

Table 6.1. **Performance indicators: municipal waste**

Waste generation						Initial treatment for waste disposal					Waste disposal costs	
Period		Relative to population	Relative to population	Relative to consumption	Relative to consumption	Year	Total	Recycling	Composting	Incineration		Landfill
		Kg per capita latest available year	Annual growth, per cent	Kg per USD 1 000, 1995 prices and PPPs	Annual growth, per cent		1 000 tonnes	Per cent				
Australia		..	..	..	..	..	..	..	..	..	..	0.10 ³
Austria	1990-1999	563	3.4	46.1	1.4	1999	3 096	37	17	16	31	1.47
Belgium	1990-2000	545	2.9	46.3	1.2	1999	5 473	40	16	27	17	0.83
Canada ¹	1992-1998	328	0.7	25.1	-1.0	1998	9 926	30	11	..	..	0.19 ³
Czech Republic	1996-2000	334	1.9	54.2	0.7	2000	3 434	..	..	..	..	..
Denmark	1995-2000	664	3.3	61.4	2.2	2000	3 546	22	16	52	10	1.08
Finland	1994-1999	465	2.4	49.0	-1.4	1999	2 400	32	0 ²	8	60	0.11
France	1989-1999	524	1.2	46.4	0.2	1999	30 744	10	8	33	48	0.57
Germany	1993-1998	538	0.1	45.1	-0.9	1998	44 094	34	7	21	37	0.85 ⁴
Greece	1990-2001	428	3.4	44.8	1.6	1997	3 900	8	0	0	91	0.38 ³
Hungary	1990-2000	445	-1.6	86.2	-2.2	2000	4 084	0	0	9	91	..
Iceland	1990-2000	704	0.8	52.4	-1.4	2000	192	9	2	9	81	0.26 ³
Ireland	1990-1998	555	0.6	53.0	-3.1	2000	2 302	8	1	0	91	0.10
Italy	1990-2000	507	3.7	39.9	2.1	1997	27 425	7	9	6	78	..
Japan	1990-1999	406	-0.1	34.6	-1.4	1999	51 446	13	0	78	9	0.07 ³
Korea	1990-2000	361	-6.6	50.3	-10.5	2000	16 950	41	0 ²	12	47	0.49
Luxembourg	1992-1999	642	1.8	38.7	0.8	1999	227	0	15	59	26	..
Mexico	1991-2000	316	2.5	63.5	1.3	2000	30 733	2	0	0	98	0.06 ³
Netherlands	1990-2000	609	2.0	53.3	-0.1	2000	9 691	23	24	41	13	0.58
New Zealand ¹	1990-1999	378	1.5	37.7	0.0	1999	1 450	0	0	0	100	..

Table 6.1. **Performance indicators: municipal waste** (cont.)

		Waste generation				Initial treatment for waste disposal						Waste disposal costs
Period		Relative to population	Relative to population	Relative to consumption	Relative to consumption	Year	Total	Recycling	Composting	Incineration	Landfill	
		Kg per capita latest available year	Annual growth, per cent	Kg per USD 1 000, 1995 prices and PPPs	Annual growth, per cent		1 000 tonnes	Per cent				Per cent of GDP
Norway	1992-2000	613	2.1	50.8	−0.9	2000	2 755	22	9	15	55	0.26 ³
Poland	1990-2000	316	0.8	64.0	−3.8	2000	12 226	0	2	0	98	0.27
Portugal	1990-2000	443	4.0	51.3	1.2	2000	4 531	6	6	21	67	0.24
Slovakia	1993-2000	316	0.7	58.2	−2.9	2000	1 706	3	6	15	76	..
Spain ¹	1990-2000	518	4.8	51.9	2.6	1999	18 377	5	18	6	72	0.25
Sweden	1990-1998	452	2.4	47.5	2.1	1998	4 000	25	8	35	33	0.37 ³
Switzerland	1990-2000	652	0.7	41.8	0.2	2000	4 681	32	14	48	6	0.30 ³
Turkey	1989-1998	385	0.9	101.4	−2.0	1998	24 945	0	1	0	99	..
United Kingdom	1990-1999	567	2.0	44.8	−0.2	1999	33 200	9	2	8	81	0.40
United States	1990-1999	764	0.3	35.7	−1.9	1999	208 520	22	6	15	57	0.25
OECD average		523	0.5	41.9	−1.2		566 052	17	6	20	57	
EU average		530	1.6	45.9	0.5		193 005	17	9	18	55	

1. Data exclude non-household waste.

2. Included in recycling.

3. For this country no information about business sector costs is available. An estimate based on the average for countries without private specialised enterprises has been added. This estimated correction amounts to 0.03 per cent of GDP.

4. For Germany, no figure for the costs incurred by private specialised waste companies was available. An estimated figure of 0.19 per cent of GDP has been added, based on the cost of the Duales System and estimates of the quantity of non-sales packaging that is recycled.

Table 6.2. **Recycling rates for different categories of raw material**

	Glass packaging	Plastic	Aluminium packaging	Steel Packaging	Paper	Municipal waste
	2000	2000	1999	2001	2000	Recent year
Australia	40	11	67		47	n.a.
Austria	84	19	50	77	66	34
Belgium	87	16	70	88	52	40
Canada		3	63	80	46	30
Denmark	65	7	0	54	48	22
Finland	89	14	95	25	67	32
France	55	8	19	55	50	10
Germany	83	29	72	78	70	34
Greece	27	2	36		35	8
Ireland	35	6	16	66	10	8
Italy	40	11	42	44	37	7
Japan	78	3	73	85	59	13
Korea	67				60	41
Mexico	13				7	2
Netherlands	78	15	70	77	45	23
New Zealand	42				65	n.a.
Norway	85	15	82	56	68	22
Poland						0
Portugal	40	3	20	28	40	6
Slovak Republic						2
Spain	31	14	19	46	48	5
Sweden	86	9	90	71	63	25
Switzerland	91	7	90	70	63	32
Turkey	31				40	n.a.
United Kingdom	34	7	36	37	41	9
United States	23		54	58	42	22

Source: Paper: OECD; Glass: OECD; Steel: Association of European Producers of Steel for Packaging; Plastics: Association of Plastic Manufacturers in Europe; Aluminium: European Aluminium Association.

to attain other objectives. The recommendations are summarised in Table 6.3 and are discussed below.

3.1. Targets of waste management policy

The shifts in waste treatment since 1990 have taken place against the background quantitative targets established by governments. At the level of the European Union, this process resulted in the adoption of the 1999 Landfill Directive that specified upper limits on the percentage of biodegradable and inert municipal waste that could be sent to a landfill, and some EU member countries have established more demanding targets in this area. Earlier, the 1994 EU Packaging and Packaging Waste Directive set a minimum total

Table 6.3. **Recommendations on waste management in country surveys: a summary**

	Austria	Belgium	Denmark	Germany	Ireland	Korea	Spain	Sweden	Switzerland
Bring costs in line with benefits in different waste streams		X	X					X	
Base landfill taxes on the externality cost	X		X		X	X			
Better management of landfills							X		
Place a cap on recycling costs	X	X		X		X	X	X	X
Avoid ambitious recycling targets					X				
Lower costs of waste management									
Through increased competition		X		X					X
Through benchmarking		X							
Through trading across municipalities								X	
No discrimination against one-way beverage containers				X					
Establish appropriate waste disposal charges						X		X	X

recycling rate, and recovery and recycling rates for all packaging materials, to be attained in 2001 (Table 6.4). Outside the EU, quantitative targets have been set in Japan and Korea and nearly all US states have indicative recycling targets. In contrast to other countries with high recycling rates, Switzerland does not generally set specific quantitative targets for recycling.

Looking forward, a planned new EU packaging directive will give additional impetus to recycling in member countries. It increases the minimum recycling rate for packaging material in general, to be attained in 2008, to well beyond past recycling targets and how they have been implemented at the national level. It also specifies recycling objectives for five specific materials: glass, paper, plastics, steel and aluminium that are more ambitious than current practice.

3.2. Instruments to discourage landfilling and incineration

To attain the objective of reducing the amount of waste going to landfills and incineration, countries have used a mixture of regulations and taxes. Most member countries have established regulations that ensure the environmental damage from landfills is reduced by capturing landfill gas and by cleaning water that seeps from decomposing waste, and this has raised the private cost of such disposal. The cost of incineration has also increased with tighter regulations on the technology used for burning waste and monitoring emissions. Other types

Table 6.4. Recycling targets in Europe

	All packaging		Any material	Specific materials (recycling rates)					
	Recovery rate	Recycling rate		Glass	Paper	Plastics	Steel	Aluminium	Composite
European Union									
EC Directive: objectives for 2001	50-65	25-45	15						
EU Environment Ministers and European Parliament: objectives for 2008	60	55-80		60	60	22.5	50		
National implementation									
Portugal	50	25	15						
UK	56	50	18						
Spain	50-65	25-45	15						
France	50-65	25-45	15						
Finland	61	42	15	48	53	45	25		
Belgium	80	50	15						
Denmark			15	65	55	15	15		
Austria	50	25	15	93	90	40	95		40
Netherlands	65	65	15	85	35	80			
Sweden			15	70	40 to 65	30	70	70	
Germany	65	45		75	70	60	70	60	60
Ireland	50-65	25-45	15	45	31	10	5	25	
Italy	50-65	25-45	15						
Luxembourg	55	45	15						
Greece	55	45	15						

of regulations used to discourage traditional modes of disposal include the introduction of a total ban on the landfilling of biodegradable waste in several countries in Europe (Austria, Belgium,² Denmark, Finland, France, Netherlands, Sweden³ and Switzerland) (Table 6.5). In these countries, such waste has to be treated before final disposal. Moreover, in Denmark and Sweden (as from 2005), the landfilling of combustible waste is prohibited.

In an effort to divert waste from landfill, some countries have introduced landfill taxes. The taxes vary significantly across countries and may increase the private cost of landfills from just under 20 per cent (in France) to close to, or more than, doubling such costs (Belgium, Denmark and the Netherlands). In the latter cases the tax exceeds the standard estimated externality costs associated with such disposal (Box 6.1) by a large margin.⁴ Two EU countries, the United Kingdom (not reviewed by the EDRC) and Ireland, initially based landfill taxes on estimated externalities but subsequently raised the tax substantially in order to divert waste from such form of disposal. In the United Kingdom, this policy did not achieve the objectives called for by the EU directive, prompting the government to introduce a tradeable quota system for landfill waste as from 2004. This instrument should ensure that the target is met at the lowest cost.

The private cost of incineration has also risen with the introduction of taxes on incineration. Such taxes are, however, confined to three countries in the OECD: Belgium,⁵ Denmark and Norway, and may raise the private cost of

Table 6.5. **Waste disposal policy instruments**

	Ban on landfilling of biodegradable municipal waste	Tradeable permits for landfill tonnage	Landfill tax	Incineration tax	Beverage container deposits
			Euro per tonne	Euro per tonne	Euro cent per container
Austria	Yes	No	44	0	40
Belgium (Flanders)	Yes	No	52	13	12 to 24
Canada	No	No	0	0	None
Denmark	Yes	No	50	38	27 to 98
Finland	Yes	No	15	0	11 to 45
France	Yes	No	9	0	None
Germany	No	No	0	0	25
Ireland	No	No	19	0	None
Korea	Yes	No	0	0	None
Netherlands	Yes	No	65	0	16 to 72
Norway	No	No	0	18	16 to 40
Sweden	No	No	31	0	7 to 56
Switzerland	Yes	No	0	0	16 to 40
United Kingdom	No	Yes	19	0	None
United States (10 states)	No	No	0	0	4

Box 6.1. The externality costs of landfills and incineration

Both landfilling and incineration can have damaging side effects for the environment. The main negative externalities connected with landfills comes from gas emissions (notably methane), the seepage of contaminants from decomposing waste into the water system and reduced amenity value of the areas surrounding landfill sites. Similarly, incineration is associated with the emission of toxic gases (principally dioxin) and loss of amenity value. As noted in the country reviews, these traditional modes of waste disposal have at times resulted in large costs on society in terms of contaminated sites (Austria and Spain) and health problems (Spain).

However, a number of studies^{*} have found that, as the result of increased regulation over the past decade, a significant proportion of externalities connected with landfills and incineration have been internalised. The lining of landfills has arrested seepage of contaminated water into the ground, and the capture of the emitted gas has stopped such harmful side effects. Similarly, dioxin emissions from incineration have been significantly reduced by burning techniques and filters. As a result the costs of the remaining externalities from modern landfill and incineration facilities are now reckoned to be quite small even if estimates are still marked by some uncertainty. Studies from the UK and Norway put the cost of these externalities for landfills at between EUR 7 and 20 per tonne, respectively (Davis and Doble, 2004; Martinsen and Vassnes, 2004). As to lost amenity values, a large study of house prices in the United Kingdom found that this externality of a landfill site was equivalent to slightly less than EUR 3 per tonne of waste per year. As the private costs of landfilling appear to be of the order of EUR 50 per tonne, the overall social cost of landfill is between EUR 60 and 80 per tonne of waste. This appears to be well below the social cost of incineration where a Norwegian study put externalities at EUR 40 per tonne of waste, while private costs are around EUR 80 per tonne net of electricity and heat that is sold (Martinsen and Vassnes, 2004).

Despite the moderate externality costs linked to modern landfill and incineration facilities, there is often significant local opposition to the establishment of new sites for such waste treatment purposes. For example, the review of Ireland noted the difficulties for the authorities to find sites for planned facilities and the review of Korea reported the public opposition to new waste treatment sites. This could reflect that the lower externality cost has not yet been recognised by the public at large. It could also mirror that the amenity costs are higher than estimated by the economic effects of these sites due to the importance of non-economic factors.

^{*} ECON (2001), COWI (2000).

incineration by 15 to 50 per cent. Unlike the tax on landfills, the taxes on incineration are probably lower than the cost of the associated externality.

In view of the discrepancy between landfill taxes and the externality costs, the country reviews of Austria, Denmark, Ireland and Korea recommended to bring taxes in line with the environmental damage caused by landfills. More generally, the surveys of Belgium and Sweden argued that costs should be aligned with benefits in all waste treatment streams. It was also recommended to relax the restrictions on waste disposal by landfilling in Spain, where it was suggested that compostable waste should be permitted if landfills had methane recovery, and in Sweden, where the prohibition of combustible waste was called into question. Spain was also encouraged to bring non-conforming landfills into line with minimum standards or close such sites.

3.3. Instruments to encourage recycling

A wide range of different policies have been introduced to reach recycling targets in addition to policies diverting waste from landfills and incineration. The principal approach in most countries has been to establish a system of extended producer responsibility and mandate packaging producers to recycle their products directly or indirectly. Alternatively, countries have sought to impose taxes on packaging material in order to attain recycling targets. For beverage containers in particular, many countries have also sought to stimulate recycling and reuse with mandatory deposit systems.

3.3.1. Mandated recycling and recycling organisations

In countries that have adopted relatively low recycling targets (e.g. Ireland, Portugal and Spain), the basic system is that business users of packaging (retailers, manufacturers and producers) are given the responsibility to recycle their own waste.⁶ However, this liability can be transferred to a collective organisation that subsequently takes responsibility for ensuring that packaging waste is recycled in exchange for a cost-based fee that differs according to the packaging material (a “green-dot” system). In other countries, the obligation of businesses is extended to include taking back household packaging, but once again the obligation can be transferred to a central organisation in exchange for a fee. In turn this requires obligatory sorting of refuse by households. Costs are particularly high in countries (such as Germany and Austria) where the central recycling organisation collects sorted waste. They tend to be relatively low when municipalities are responsible for collecting household packaging waste, with recycling organisation reimbursing them for the cost incurred.

The unit cost of recycling is very high relative to that for alternative means of waste disposal in some countries (Table 6.6). Thus, the average recycling fee per tonne of materials in Austria, Germany and Japan is several

Table 6.6. **Recycling of packaging material: fees and operational characteristics**

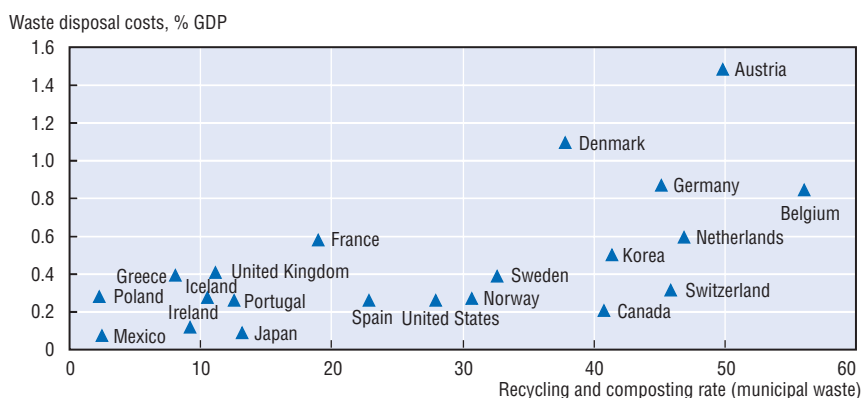
	Fees by material					All materials	Characteristics of recycling operations			
	Glass	Plastic	Aluminium	Steel	Cardboard	Weighted average	Recycling company collects	Commercial and industrial packaging covered	Household packaging covered	Kerbside collection
						Euro per tonne				
Producer recycling fee										
Austria	87	1 097	494	399	203	238	Yes	Yes	Yes	Yes
Belgium	19	348	171	58	38	50	No	No	Yes	Yes
Finland	10	20	20	20	3	4	No	Yes	Yes	No
France	2	116	32	14	74	56	No	No	Yes	Yes
Germany	81	1 504	975	387	191	254	Yes	No	Yes	Yes
Luxembourg	17	286	143	41	31	44	No	No	Yes	Yes
Portugal	1	40	37	17	10	11	No	Yes	Yes	No
Spain	7	118	54	31	15	16	No	No	Yes	No
Sweden	86	166	166	166	61	73	No	No	Yes	No
Japan	47	592			331	298				
Ireland	6	58	57	63	14	25	No	No	No	No
Memorandum items:										
Traded recycling allowance										
United Kingdom	17	8	18	14	9	10		Yes	No	No
Packaging tax										
Denmark	250	1 000	4 440	1 230	130	515				

times higher than the estimated social costs of landfilling of EUR 60-80 per tonne of waste or incineration of EUR 120 per tonne of waste. The cost differential is even more striking for some specific materials. For example, recycling fees for plastic and aluminium in Germany are more than ten and eight times, respectively, the cost associated with alternative disposal methods. The unit cost of recycling is even higher in countries where households are mandated to sort their refuse. For example, one Swedish study estimated the cost to households of the time spent for separation and transport at EUR 180 per tonne (Radetzki, 1999).

The high unit costs of recycling could be related to inefficient organisation of such activities, but is also likely to reflect intrinsic high marginal costs of recycling. As noted in the review of Germany, the monopoly granted to one organisation to administer the recycling system is unlikely to result in efficient outcomes. Greater competition in waste management, along the lines in Ireland, where packaging producers can shop around for the lowest-cost recycling option, could help to bring costs down. Also, the country survey of Belgium drew attention to the vast differences in unit costs of waste treatment and recycling across different municipalities within the country and the benefits that could be obtained by attaining country-wide the cost levels in the most efficient local authorities. However, the positive correlation between recycling activity and unit costs of recycling suggest that recycling activity is subject to high marginal costs. The Belgian experience also suggests that raising the recycling rate by 50 per cent will double recycling costs. In Germany, one estimate put the average marginal cost of recycling for the principal waste streams at over EUR 2 000 per tonne (Staudt and Schroll, 1999), which is more than ten times higher than the social costs of landfill and incineration.

The combination of relatively high unit costs of recycling and high recycling activity has meant high outlays in macroeconomic terms: the countries with the highest recycling rates have spent more than half a percentage more of GDP on waste management than other countries (Figure 6.1). With recycling targets becoming more ambitious in many countries that currently have low recycling rates, the cost of waste management is likely to increase appreciably in the coming years.

Against the background of the high costs, the country reviews noted that it would seem to be difficult to justify high recycling rates on economic grounds. An economic rationale advanced for recycling at a higher cost than in alternative waste treatment options after pricing the associated externalities is that recycled material provides a substitute for the extra production of the raw material and so reduces the adverse environmental impact of the production of this material. However, the primary externalities generated by the production of raw materials relate to the emission of

Figure 6.1. **Waste disposal costs and recycling rates**

greenhouse gases, small particles and other polluting gases. All of these emissions are, or will be, regulated or subject to taxes and emission permits (see Annexes 3 and 4), implying that the externality is already incorporated into prices to some extent. To the extent that externality costs are not fully covered, the increasing of charges or tightening of quantitative limits on emissions represents the first best solution to reducing pollution from the production of the raw materials used in packaging. Indeed, a policy that internalise pollution costs will favour recycling, as the price of recycled material should increase relative raises the price of recycled materials. However, studies from the EC and the UK suggest that internalising GHG costs would only have a small impact on the economics of recycling in general (AEA Technology, 2001 and Davis et al., 2004).

In the light of the high costs and low environmental benefits, the EDRC recommended in all the nine country reviews on waste recommended that recycling costs should be capped or that recycling should be scaled back. Ireland was warned against adopting ambitious recycling targets, while for the other countries (Austria, Belgium, Denmark, Germany, Korea, Spain, Sweden and Switzerland) it was recommended to put a ceiling on recycling costs, typically at the level of the costs (including taxes and fees to account for negative externalities) of incineration or landfill. However, in some reviews (including those for Austria and Belgium) it was recognised that countries could pursue ambitious recycling objectives in their own right. A few countries were also encouraged to take measures to lower unit costs of recycling through increased competition in waste treatment (Germany), the benchmarking of recycling costs in municipalities on the least costly one (Belgium) and greater trade in recycling services across municipalities (Sweden).

3.3.2. Taxes on packaging material

A few countries have introduced taxes on packaging materials in order to encourage the recycling of such waste, using the proceeds to finance the recycling of such products. However, Finland and Sweden abolished these taxes when packaging levies were introduced. Instead of establishing a green-dot system to stimulate recycling, Denmark has continued with its packaging tax, with particularly high rates on plastics and aluminium. The calculations that lay behind the establishment of this Danish tax were not based on a monetisation of environmental externalities and this would appear to have led to an over-estimate of the environmental damages. For example, an EC study⁷ put the externalities of aluminium at about EUR 1 000 per tonne (mainly due to particulate and heavy metal emissions), equivalent to around EUR 0.01 per aluminium can. However, the Danish tax is set at EUR 0.06 per can. Other countries have put a tax on specific packaging materials to discourage their use rather than increasing recycling. For example, Ireland introduced a Plastic Shopping Bag Levy to reduce litter that resulted in a 95 per cent reduction in the use of such sacks.

3.3.3. Mandatory deposit systems for beverage containers

A number of governments have introduced mandatory deposit systems for beverage containers both as a way to increase recycling and to increase reuse. Deposit rates vary considerably between countries (Table 6.3), as well as between the types of beverage containers. The incentives for users to bring back such containers is particularly high in Denmark and the Netherlands, while the container deposit is low in the ten US states that have a mandatory system. In several countries (including Denmark, Finland, Germany, the Netherlands and part of Canada), various restrictions have been placed on the use of one-way containers to encourage reuse.

Mandatory deposit systems have proved to be an expensive form to encourage recycling. The systems are expensive to administer, costing at least 2 cents per container across the United States and Europe. For aluminium cans (the most valuable form of used containers), such costs are higher than the scrap value of the cans when delivered in bulk to a recycling centre. For countries such as Denmark and Germany that already have high recycling rates for aluminium, the schemes represent a high administrative cost for very little recycling gains. Indeed in the ten US states that have mandatory deposits, the extra net cost of administering the programmes relative to states where there was voluntary recycling was estimated at almost USD 900 per tonne. In Germany, the government introduced mandatory deposits on beverage containers in 2003, but the scheme has proved difficult to operate, as retailers are reluctant to assume the administrative costs and have stopped

selling carbonated drinks in cans and one-way bottles (un-carbonated drinks sold in cans are not subject to the deposit regulation).⁸

The prime objective of mandatory deposit schemes in some countries is to reduce litter rather than to encourage recycling and reuse. Thus, in the Netherlands, the advance deposit system was expected to reduce the number of littered drink containers by 20 per cent, equivalent to 2 per cent of overall litter, at a cost of about 3 euro cents per can. Apart from the high cost of such systems, their effectiveness in reducing litter is uncertain. For example, in the Netherlands no estimates were made of the cost of alternative clean-up strategies when the deposit scheme was initiated.

3.4. Instruments to discourage municipal waste generation

With the aim of reducing the generation of municipal waste, the practice of weight or volume charging has gained ground in recent years. In the countries reviewed for this exercise, it was used in parts of Belgium, Denmark and Switzerland, while it will be introduced in Ireland in 2005. In the United States, quantity-related waste charges were paid by about 10 per cent of the population in 1998. In Korea, the simultaneous introduction of volume-related charging and free collection for selected recyclable materials led to a doubling of recycling, with landfilling being halved. The review of Sweden recommended that consideration should be given to introducing quantity-based pricing of waste, and the Korean authorities were encouraged to increase cost-recovery in waste. However, concerns that high charges were resulting in illegal disposal of waste, especially backyard burning, led to a recommendation in the review of Switzerland to reduce volume-based waste charges.

Notes

1. The countries covered were Austria, Belgium, Denmark, Germany, Ireland, Korea, Spain, Sweden and Switzerland.
2. Refers to the region of Flanders.
3. As from 2005.
4. The high tax in Austria was officially estimated to be close to the externality costs, but the latter was based on exceptionally high assumed costs of greenhouse gas emissions from landfills and on risks of contamination caused by, for example, leaky liners.
5. In the region of Flanders.
6. One country not surveyed with low targets (United Kingdom) has a markedly different system in which there is a market in recycling certificates, with each business responsible for delivering an appropriate quantity of certificates rather than actual ensuring its waste is recycled.
7. RDC PIRA (2003).

8. The scheme forces consumers to return the containers to the same shop where they were bought and to provide a receipt as proof of purchase. By October 2003, 80 per cent of deposits were unclaimed, amounting to unclaimed balance of EUR 450 million.

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Chapter 7

Policy Integration for Sustainable Development Areas

Sustainable development requires that policy decisions aimed at a specific goal take proper account of their effects in the environmental, economic and social dimensions. All country reviews of sustainable development have briefly reviewed the arrangements in place to promote policy integration. The chapter reports on the main findings and recommendations from the reviews which examined the extent to which sustainable development plans and institutions facilitate policy integration. It includes specific analysis on the role of various instruments such as cost-benefit analysis, cost-effectiveness analysis, systematic evaluation of legislation and environmental impact assessment.

1. Introduction

The integration of economic, environmental and social policies is necessary to ensure that policy settings aimed at reaching a goal in one domain of sustainable development take into account the effects on other domains. The country surveys briefly reviewed policy integration for all 30 member countries, focusing on the integration of economic and environmental concerns. The reviews looked at three types of methods to integrate cross-domain concerns in overall policy settings: cost-benefit analysis, other integration tools and sustainable development strategies. Within the environmental and economic domains of sustainable development it is, arguably, the absence of markets for many environmental services that creates the need for specific actions to integrate policies. Cost-benefit analysis represents one method of trying to mimic market conditions in the absence of markets. In principle, this evaluation tool is well suited to assessing the trade-offs between economic, environmental and social outcomes of policies in a systematic manner and so the extent of its use was reviewed in all countries. The prevalence of more procedural instruments was also documented. Finally, the reviews looked at the characteristics of countries' sustainable development strategies and related institutional arrangements.

On the basis of the information published in the OECD Economic Surveys, it appears that there is considerable scope for further improvement in the process of policy integration in governments. In particular, despite its limitations, cost-benefit analysis has offered a valuable framework for policymaking in the countries where it is used extensively. However, in most countries the use of such techniques continues to be the exception rather than the rule. While there are many factors that can lead to the adoption of policies that have unfavourable benefit-cost ratios, the more general publication of independently reviewed cost-benefit analyses would represent a significant improvement in the transparency of policymaking. Other instruments, such as environmental impact assessments, can offer a means to improve integration in decision making, but the impact of these approaches is often diminished by limited scope and failure to assess systematically the trade offs between the pillars of sustainable development. Sustainable development strategies have been issued in many countries with a view to integrating economic, social, and environmental concerns, but in many cases only establish a lengthy list of general objectives without any prioritisation or assessment of trade-offs.

Accompanying institutional arrangements can facilitate co-ordination across different ministries and levels of government, but their effectiveness seems to depend on the support of the centre of government.

2. Cost-benefit analysis

2.1. Cross-country utilisation

Few countries systematically require formal cost-benefit analysis for policies and projects (Table 7.1), though there has been increasing use of this technique. Cost-benefit analysis must be undertaken as part of a broader regulatory impact assessment in Canada, New Zealand, the United Kingdom, and the United States. In addition, the treaty governing the European Union requires that costs and benefits of policies be taken into account *ex ante*. Despite these requirements in various countries, cost-benefit analysis is not always used even though it is mandatory. Indeed, this often appears to be the case when new regulations are issued in Canada. In other countries, the adoption of policies in the absence of a cost-benefit analysis or when formal analysis shows that costs exceed benefits can require a minister to affirm that the benefits warrant the costs (United Kingdom) or lead to considerable debate (United States). The requirement by the European Union that EU-financed projects be accompanied by cost-benefit analyses has led to the spread of such techniques in Hungary, the Czech Republic and the Slovak Republic. Cost-benefit analysis cannot always quantify all the benefits flowing from a policy in an objective way and the conclusions of formal cost-benefit analyses are sometimes rejected because they are judged to ignore some benefits or attach low values to them. For example, end-of-life treatment of electrical and electronic waste in the EU was adopted despite costs being estimated to outweigh benefits by a ratio of five to one. A number of countries were found to use cost-benefit analysis on an *ad hoc* basis (Austria, Belgium, Spain, Korea) while a few countries mainly restrict the use of such analysis to transport and infrastructure policies and projects (Netherlands, Japan). In the case of Netherlands, parliamentarians are asking for greater use of such analysis. In Japan environmental costs and benefits are often omitted from formal cost-benefit analyses out of concern that net costs could provoke claims for compensation.

2.2. Problems with its utilisation

The country reviews detected three problems with the use of cost-benefit analysis as an integration tool.¹ Firstly, the analytical difficulties faced in quantifying some forms of environmental damage. Secondly, the often resource-intensive nature of quantifying damages. This was seen as a drawback in Australia and the United Kingdom. One means of speeding the process, though at the expense of a possible reduction in accuracy, is to

Table 7.1. The use of cost-benefit and environmental impact analyses in OECD countries

	Australia	Austria	Belgium	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Portugal	Slovak Republic	Spain	Sweden	Switzerland	United Kingdom	United States
Environmental impact assessment of public projects (EIA)	X	XX	XX	XX	XX	XX	XX	XX	XX	XX	X	X	X	XX	X	XX	XX	X	XX	XX	XX	X	XX	X	XX	XX	XX	XX
Strategic environmental assessment of policies (SEA)	X	X	X	X		XX	X	X	X					X		X	X		XX		X		X		X	XX		
Monetary valuation of environmental effects in EIA or SEA	X		X					X							X					X							X	
Cost-benefit analysis of environmental policies (CBA)	X	X		X		X								X					X	XX	X			X	X		XX	XX
Statutory independent review of CBAs						X																					X	

Note: XX = quasi-systematic; X = frequent.

employ information on benefits from other studies that have been undertaken in more depth. The European Commission has used this approach extensively, through the air pollution and life-valuation estimates generated by its ExterneE project. Thirdly, cost-benefit analyses are often undertaken by, or on behalf of, the sponsoring ministry or agency with little external review. In general, the auditing of proposals independently from the sponsoring ministry through either centralised auditing or review by an independent body can help raise the credibility of cost-benefit analysis. Examples where independent review might have been beneficial were found in Austria, Denmark, Spain and the United States.

3. Alternative integration tools

3.1. Cost-effectiveness analysis

A somewhat more common approach to the evaluation of policies is to examine the cost effectiveness of various policy options, as in Belgium and Norway. In these cases, the original policy target is often set on the basis of human or eco-system health and conservation objectives. The objective may also be set with reference to financial affordability, as is sometimes the case in Norway. While cost-effectiveness analysis in these cases should prevent highest cost policy options being chosen in meeting an already determined target, they do not ensure that the chosen policy targets reflect social preferences accurately. The priority given to the achievement of environmental goals is also sometimes incorporated into the constitution. For example, in Greece, the government has “a duty to protect the natural and cultural environment”. As no trade-off is mentioned in the law, costs are not required to be taken systematically into account in specifying targets.

3.2. Systematic assessments of legislation

An additional method of attempting to integrate policies has been to require that all legislation include an assessment of economic and environmental impacts of proposed policies at an early stage of the legislative process. This route has been adopted by Denmark, France, Italy and Switzerland in order that the legislator or cabinet be well informed before decisions are taken. In practise, this process appears to have fallen short of expectations. A common experience has been that the assessments tend to focus on the cost to the government budget, rather than providing a fully integrated analysis. In any case, when such analyses are undertaken it is important that they use a common framework and a set of stable economic assumptions. The reviews suggested that this was not the case in Italy. In Denmark the requirement that the Finance Bill evaluate the environmental consequences of economic policy was eventually dropped.

3.3. Environmental impact analysis

In contrast to the limited use of cost-benefit analysis, the use of environmental impact analysis (EIA) has become a very common decision-aiding tool at the project level. However, within EIAs there is often only a limited attempt, or indeed no attempt at all, to quantify environmental or other impacts. The reviews noted this was a feature of such procedures in Finland, Germany, Greece, Iceland, Ireland, Italy, Korea, Luxembourg, Portugal, Slovak Republic, Spain and Sweden. As a result, projects that are costlier than the likely benefits can and do emerge from this type of decision making.

4. National sustainable development policy frameworks

4.1. Different approaches to sustainable development policy frameworks

In the follow-up to the 1992 World Summit on Sustainable Development in Rio, many countries have adopted, or have prepared, overarching sustainable development strategies that are designed to integrate economic, social, and environmental concerns. This has been the case in Austria, Belgium, Finland, Germany, Iceland, Ireland, Luxembourg, New Zealand, Norway, Portugal, Slovak Republic, Sweden, Switzerland and the United Kingdom, while in Mexico and Turkey, sustainable development issues are now incorporated into national development plans. Some governments have limited their frameworks to facilitating the integration of environmental concerns into decision making (Czech Republic, Hungary, Italy, Japan, Korea, the Netherlands and the United States), partly because it was felt that legislators at the national level were already taking into account the social pillar of sustainable development and also because some had faced difficulty in identifying tractable goals for the social pillar of sustainable development. Another approach to incorporating sustainable development concerns into policy making is to enshrine them in the constitution (Greece, Switzerland). France is currently in the process of consultation about whether sustainable development concerns should be incorporated into the constitution.

4.2. Improving sustainable development plans

A general weakness of many national sustainable development strategies is that they often establish a lengthy list of desirable and general objectives without either a prioritisation of policies based on an analysis of the trade-offs between economic, social and environmental concerns, or an identification of appropriate policy instruments to address these objectives cost-efficiently. On the other hand, there have been attempts to develop indicators of progress towards goals in a number of countries. The reviews noted that Australia and Korea had mechanisms in place to ensure that such indicators feed back into the policy process. In other cases, an official standing committee or a national council

monitors progress towards goals (Austria, Japan and Luxembourg). In Canada, a commissioner for the environment and sustainable development monitors sustainable development plans and presents annual reports to parliament.

A number of countries have found that an improvement of their analytical and data bases was necessary to provide accurate indicators of movement towards sustainable development and thus strengthen policy making. For example, Canada has established an information base to assess past policies and highlight areas where change is needed. In France, the Ministry of the Environment strengthened its own economic analysis of environmental measures by establishing an economic department within the ministry. This should complement the traditional *ex post* analyses of policies carried out by the General Planning Commission (attached to the Prime Minister's office).

4.3. Institutional arrangements for policy integration

Institutional arrangements to ensure that policy integration takes place across the pillars of sustainable development are diverse. In a few countries, the early links between sustainable development and environmental issues have led to ministries of environment being assigned primary responsibility for sustainable development policy (Hungary, Spain, and the United Kingdom). In these cases, institutional backing is given to these arrangements by either the cabinet (Hungary and the United Kingdom) or sectoral conferences (Spain). Overall, it appears that policy integration is better ensured with the involvement of the centre of government, though the mechanism for achieving this varies across countries. In some, the office of the president or prime minister takes a leading role in efforts to integrate sustainable development policy (Germany and Korea; Sweden is considering taking this route). In others, governments rely on inter-ministerial co-ordination that varies in its degree of formalism. Thus, Norway and Sweden have long-standing traditions of the "collegiate approach" to government. A similar approach is used in the Netherlands, though in certain key areas legislation mandates consultation among certain ministries. In Hungary, Italy, and the Slovak Republic, standing commissions or councils serve as the fora for bringing together the various parties. In Finland a National Council, chaired by the Prime Minister, sets the agenda, through the preparation of "guidance" documents rather than through formal legislative powers. Finally, an alternative approach is to rely on *ad hoc* committees that are established when a cross-cutting issue arises (Czech Republic, Germany, Greece, Luxembourg). Some rely on different mechanisms simultaneously (Canada and Ireland).

Policy co-ordination across levels of government, particularly in federal states, is another important dimension. In Australia, Belgium, Canada, the Czech Republic, Germany, Italy, Spain, and Switzerland, addressing environmental (or less frequently other sustainable development) issues has been complicated by

the allocation of responsibility across levels of government. In these cases, decisions of bodies that bring together representatives of the different levels of government (Switzerland, Netherlands), new legislation (Australia) or constitutional changes (Spain) may be required to determine which level of government is best suited to responding to particular policy issues. In some cases forging sufficient sub-national government agreement is a prerequisite for adopting the most cost-effective policy instruments. In both Korea and Mexico, the weak presence of the central authorities coupled with the orientation of local governments towards economic development has lowered the attention given to environmental concerns.

Note

1. An additional problem was noted in the case of the United States: policies governed by the Clean Air Act may not be set on the basis of formal cost-benefit analysis.

ANNEX A

Sustainable Development Indicators

This annex presents the sustainable development indicators that have been assembled for the seven areas covered in the country reviews: reducing emissions of greenhouse gas, reducing air pollution, reducing water pollution, improving natural resource management, reducing and improving the management of municipal waste, improving living conditions in developing countries and ensuring sustainable retirement income.

Table A.1. **Reducing emissions of greenhouse gases: main indicators**

	Total GHG emission intensity	CO ₂ emission intensity, electricity	CO ₂ emission intensity, transport	GHG emission intensity, other sources	Total GHG emission intensity	CO ₂ emission intensity, electricity	CO ₂ emission intensity, transport	GHG emission intensity, other sources
	2000, g CO ₂ equivalent per 1995 US\$ using PPPs				Percentage change 1990-2000			
Australia	1 061	360	159	542	-1.82	-0.46	-1.52	-2.70
Austria	403	66	96	241	-2.05	-3.20	-0.02	-2.42
Belgium	600	105	97	398	-1.47	-1.27	-0.19	-1.81
Canada	888	156	183	549	-0.94	0.24	-0.85	-1.28
Czech Republic	1 082	468	100	514	-2.77	2.54	6.33	-6.58
Denmark	501	171	88	242	-2.38	-2.73	-0.84	-2.64
Finland	597	178	99	321	-2.56	-0.17	-1.83	-3.84
France	402	30	102	271	-2.00	-2.60	-0.02	-2.57
Germany	519	168	91	260	-3.92	-3.57	-1.05	-4.95
Greece	819	275	122	422	-0.16	0.07	-0.02	-0.34
Hungary	747	192	79	476	-2.60	-1.30	-0.24	-3.40
Iceland	398	0	84	314	-1.82	..	-2.47	..
Ireland	643	152	98	392	-4.63	-2.97	0.23	-6.03
Italy	432	108	89	235	-1.06	-0.43	0.01	-1.70
Japan	441	132	81	229	-0.34	0.13	0.89	-0.99
Luxembourg	314	6	249	59	-12.47	-27.09	0.62	-23.13
Netherlands	553	138	80	335	-2.49	-0.95	-1.09	-3.34
New Zealand	1 078	82	179	817	-2.21	2.87	0.80	-3.12
Norway	454	3	97	354	-2.91	-1.57	-2.86	-2.93
Poland	1 109	458	74	576	-5.19	-6.48	-1.39	-4.46
Portugal	516	129	111	276	-0.06	0.85	3.47	-1.51
Slovakia	846	249	70	526	-5.21	0.98	1.98	-7.60
Spain	536	130	127	278	0.35	1.21	0.97	-0.28
Sweden	340	35	110	195	-1.91	-1.52	-0.77	-2.56
Switzerland	267	2	78	187	-0.94	-3.82	-0.40	-1.11
United Kingdom	512	137	106	268	-3.58	-4.30	-1.41	-3.94
United States	779	273	192	315	-1.86	-0.73	-1.30	-3.04
Total of above OECD countries	639	201	137	307	-1.81	-0.79	-0.58	-2.76
Non-Annex 1 countries								
	CO ₂ emissions				CO ₂ emissions			
Korea	679	232	134	..	0.33	4.49	1.08	..
Mexico	456	150	124	..	-1.22	2.86	-1.88	..
Turkey	488	178	84	..	0.47	4.52	-1.26	..

Source: Greenhouse gas emissions: national submissions to the UNFCCC and national publications. Carbon dioxide emissions for electricity and transport: IEA (2001). GDP: OECD, SNA database.

Table A.2. **GHG emissions and sectoral indicators**

	Total GHG emissions		CO ₂ emissions per Kwh electricity	Manufacturing CO ₂ emissions per unit of output	Residential CO ₂ emissions per unit of private consumption	Road transpor CO ₂ emissions per vehicle–kilometre	Electricity use per unit of GDP	Industrial output per unit of GDP
	Level million tonnes CO ₂ equivalent 2000	Annual average percentage change						
		1990-2000	1990-2000	1990-2000 ¹	1990-2000 ²	1990-1999	1990-2000	1990-2000 ¹
Australia	502	1.7	0.1	-0.7	-1.1	-0.8	-0.6	-1.6
Austria	80	0.3	-2.2	-1.7	-2.4	-1.8	0.1	0.3
Belgium	152	0.7	-1.6	-0.2	-1.1	-0.8	-0.2	-0.5
Canada	726	1.8	1.0	-2.6	-2.0	-0.4	-0.5	1.0
Czech Republic	147	-2.7	-0.2	-7.7	-15.4	4.1	2.8	0.2
Denmark	69	-0.1	-3.4	-1.7	-4.0	-0.2	0.7	-0.6
Finland	74	-0.4	-0.9	-7.2	-7.0	-1.4	0.7	3.2
France	550	-0.2	-2.8	-2.4	-1.7	-0.5	0.6	0.3
Germany	991	-2.1	-1.3	-1.1	-4.0	0.7	-2.1	-1.8
Greece	130	2.2	-2.0	-0.4	2.6	-4.4	2.1	-1.7
Hungary	84	-1.8	-1.3	-12.7	5.4	-3.3	0.2	5.3
Iceland	3	0.7	4.9	..	-7.7	0.3	2.6	..
Ireland	67	2.2	-1.3	..	-6.2	4.8	-1.8	..
Italy	547	0.5	-1.2	-2.0	-1.4	-1.1	0.8	-0.2
Japan	1 386	1.1	-0.5	-0.8	0.1	0.3	1.0	-0.2
Luxembourg	6	-7.8	-24.5	-13.0	-2.3	3.8	-3.4	-2.2
Netherlands	218	0.4	-2.8	-1.8	-2.9	-0.1	1.8	-0.6
New Zealand	77	0.5	3.7	..	-3.2	-2.1	-0.8	..
Norway	55	0.6	0.5	0.8	-8.8	0.5	-1.9	-2.7
Poland	386	-1.7	0.5	-5.8	-6.7	-6.4	6.9	4.4
Portugal	85	2.7	-0.9	0.7	-1.0	-0.4	1.8	-0.6
Slovakia	49	-4.0	1.0	-4.7	-7.4	2.3	0.2	2.4
Spain	386	3.0	-0.2	-0.6	0.4	-0.3	1.2	-0.1

Table A.2. **GHG emissions and sectoral indicators** (cont.)

Total GHG emissions			CO ₂ emissions per Kwh electricity	Manufacturing CO ₂ emissions per unit of output	Residential CO ₂ emissions per unit of private consumption	Road transpor CO ₂ emissions per vehicle–kilometre	Electricity use per unit of GDP	Industrial output per unit of GDP
Level million tonnes CO ₂ equivalent 2000	Annual average percentage change							
	1990-2000	1990-2000	1990-2000 ¹	1990-2000 ²	1990-1999	1990-2000	1990-2000 ¹	
Sweden	69	–0.2	–2.3	–4.7	–4.1	–1.4	–0.5	2.5
Switzerland	53	–0.1	1.8	..	–1.7	–0.3	1.1	..
United Kingdom	649	–1.3	–4.1	–2.1	–1.9	–0.5	–0.7	–1.6
United States	7 001	1.3	–0.4	–4.0	–1.9	–0.2	–0.4	0.4
Total of above OECD countries								
	14 543	0.6	–0.7	–2.2	–1.8	–0.3	–0.2	0.0
OECD excluding US	7 542	–0.1	–1.0	–1.5	–1.7	–0.4	0.0	–0.3
EU countries	4 073	–0.3	–2.1	–1.8	–2.4	–0.4	–0.2	–0.7
Total CO ₂ emissions								
Other OECD countries								
Korea	444	6.5	–0.7	–2.3	–7.9	–4.3	5.2	2.0
Mexico	369	2.2	1.0	–6.9	–2.7	1.5	1.7	0.9
Turkey	206	4.1	0.2	1.2	–2.6	–5.0	4.3	0.4

1. 1991-2000 for Germany and Hungary; 1992-2000 for Poland; 1993-2000 for Slovakia; 1990-1999 for Portugal; no data for Iceland, Ireland, New Zealand and Switzerland.

2. 1991-1998 for Czech Republic; 1993-2000 for Slovakia.

Source: Greenhouse gas emissions, national submissions to UNFCCC, national sources and UNFCCC; carbon dioxide data, IEA; industrial production, private consumption, OECD.

Table A.3. Reducing air pollution: main indicators

	Change in emissions per cent of GDP (1995, PPP), 1990-2001 ¹			Level of emissions, 2001 ¹			Change in sulphur dioxide emissions, per unit of electricity output, 1990-1999 ²	Change in nitrogen dioxide emissions, per vehicle-km, 1990-1999 ³
	Sulphur dioxide	Nitrogen oxides	VOC	Sulphur dioxide	Nitrogen oxides	VOC		
	Per cent, average annual change			Grams per unit of GDP, (1995 US\$ PPP)			Per cent annual change	
Australia	-3.4	-1.9	-2.9	4.0	5.7	4.2	-4.7	-5.2
Austria	-9.3	-2.9	-5.8	0.2	0.9	1.1	-11.0	-4.4
Belgium	-8.3	-0.5	-2.0	0.6	1.5	1.1	-7.3	1.5
Canada	-5.8	-2.8	-3.2	3.2	2.7	3.5	-6.8	-6.1
Czech Republic	-17.0	-5.6	-5.7	1.9	3.0	1.8	-17.0	-0.6
Denmark	-18.3	-4.9	-4.8	0.2	1.5	0.9	-17.0	-5.0
Finland	-11.0	-4.4	-4.2	0.7	1.8	1.3	-13.2	-5.1
France	-8.3	-4.0	-4.9	0.4	1.0	1.5	-5.6	-5.2
Germany	-18.0	-6.3	-7.8	0.4	0.8	0.8	-19.2	-5.2
Greece	-2.6	-1.1	-1.6	2.9	2.2	2.2	-0.7	-6.1
Hungary	-9.0	-2.4	-4.1	3.4	1.7	1.2	-2.5	-0.1
Iceland	-1.3	-2.8	-6.8	1.2	3.4	1.1	..	-2.6
Ireland	-9.8	-6.0	-8.8	1.3	1.2	0.9	-4.7	-0.8
Italy	-9.3	-5.0	-4.8	0.6	1.0	1.1	-8.5	-4.9
Japan	-1.6	-1.3	-2.4	0.3	0.6	0.6	-3.2	-3.4
Korea	-10.9	-5.2	-3.3	1.6	1.6	1.9	-7.9	-6.1
Luxembourg	-18.9	-8.1	-8.6	0.2	0.9	0.7	6.3	-4.6
Mexico	-0.4	-0.9	-9.3	1.6	1.6	1.4	-0.7	..
Netherlands	-9.9	-6.1	-8.2	0.2	1.0	0.6	-17.5	-6.6
New Zealand	-0.3	-0.5	-1.6	0.7	3.0	2.6	..	0.2
Norway	-9.8	-3.6	-1.7	0.2	1.8	2.9	0.2	-5.1
Poland	-9.4	-7.3	-2.9	4.3	2.2	2.4	-7.8	-12.7
Portugal	-2.2	-0.4	-1.4	2.3	2.5	2.7	-2.8	-2.4
Slovakia	-13.2	-7.7	-8.2	2.4	2.0	1.2	-12.5	-3.7
Spain	-6.3	-1.8	-3.4	1.8	1.8	2.3	-7.2	..
Sweden	-7.1	-4.6	-3.9	0.3	1.2	1.8	-3.5	-6.6
Switzerland	-7.0	-5.4	-6.4	0.1	0.5	0.7	-2.7	-6.9
Turkey	2.2	0.4	1.0	3.3	2.3	1.8	-2.1	..
United Kingdom	-12.7	-7.7	-7.4	0.8	1.1	1.0	-14.4	-7.8
United States	-5.9	-2.9	-4.9	1.8	2.5	1.6	-4.6	-0.6
EU	-10.5	-4.7	-5.4	0.7	1.1	1.2		
OECD Europe	-9.7	-4.6	-4.9	1.0	1.3	1.3		
OECD	-6.5	-2.9	-4.2	1.4	1.8	1.5		

1. 1998-98 for New Zealand and Mexico (nitrogen dioxide); 1994-98 for Mexico (sulphur dioxide and VOC); 1990-99 for Australia, Canada, Japan and Korea; 1990-2000 for Ireland, Italy, Luxembourg, Turkey and the United States.

2. Australia and Poland 1995-99; Mexico: 1994-98; Canada and Luxembourg: 1990-97; Belgium, Czech Republic, France, Greece, Hungary, Korea, Mexico, Portugal, Slovakia, Spain and Switzerland: 1990-98.

3. Germany: 1991-99; Hungary: 1993-99; Poland 1995-99; Slovakia: 1992-98; Korea: 1990-95; Canada: 1990-96; Belgium, France, Greece, New Zealand, Portugal: 1990-98.

Source: OECD Environmental Database, Cooperative Programme for Monitoring and Evaluation of Air Pollutants in Europe (EMEP), European Environmental Agency.

Table A.4. **Reducing air pollution in cities: performance indicators**¹

	SO ₂		NO _x		Particulate matter	
	1990 ²	1999 ³	1990 ⁴	1999 ⁵	1990 ⁶	1999 ⁷
Average annual concentration in µg/m ³						
Australia	..	..	59.1	32.0	..	..
Austria	19.1	5.9	43.5	32.8	44.1	35.7
Belgium	26.0	13.0	51.0	43.0	..	27.0
Canada	16.0	14.7	40.0	32.3	39.0	35.4
Czech Republic	37.0	10.0	24.0	20.0	58.3	25.0
Denmark	16.8	3.8	47.6	46.4	66.4	47.5
Finland	12.7	3.4	36.2	30.6	59.8	38.7
France	34.0	..	46.0	36.0	24.0	22.0
Germany	55.0	7.0	44.0	38.0	46.0	30.0
Greece	39.4	19.2	63.2	58.8	48.0	54.6
Hungary	17.4	17.5	37.2	41.6	68.2	53.2
Iceland	3.8	3.7	14.8	29.0	23.6	27.0
Ireland	23.0	16.0	46.0	70.0	28.0	11.0
Italy	24.2	15.1	98.4	70.7	128.1	66.5
Japan	19.0	12.0	39.0	40.2	42.0	33.2
Korea	114.6	23.1	45.6	52.1	144.1	67.2
Luxembourg	28.3	9.6	51.3	43.1	15.0	11.0
Mexico	113.1	40.8	67.6	56.5	67.0	54.4
Netherlands	20.1	8.1	48.8	41.0	38.3	39.8
New Zealand	2.8	12.7	14.7	20.3	25.0	27.3
Norway	9.0	..	48.5	43.0	18.0	..
Poland	36.0	9.4	36.0	23.4	44.0	19.2
Portugal	35.1	6.2	25.4	37.6	72.0	42.0
Slovakia	29.0	19.8	40.1	39.3	54.0	43.6
Spain	38.0	16.6	80.3	58.6	55.5	41.2
Sweden	8.2	3.5	30.1	21.2	9.0	5.0
Switzerland	16.3	7.1	45.9	34.8	38.1	33.4
Turkey	206.9	55.8	58.0	45.0	108.6	48.4
United Kingdom	35.6	15.4	62.3	53.5	16.8	8.7
United States	23.0	15.0	44.0	39.0	30.0	24.0

1. National total except for Australia, Austria, Denmark, Finland, Hungary, Italy, Korea, Mexico, Netherlands, New Zealand, Portugal, Sweden, Switzerland, Turkey and the United Kingdom for SO₂; weighed average (by population of the cities) of concentrations in selected towns.

2. 1993 for Mexico (Guadalajara and Monterey); 1994 for Italy (Rome, Turin and Genoa).

3. 1997 for Hungary (Pecs and Gyor) and the United States; 1998 for Canada and Italy; 2000 for Austria, Japan, Luxembourg, Mexico, Portugal, Turkey and the United Kingdom.

4. 1991 for Finland (Turku) and Portugal (Porto); 1993 for Finland (Tampere), Mexico (Guadalajara and Monterey) and Slovak Republic; 1994 for Czech Republic and Italy (Rome and Genoa).

5. 1997 for Hungary (Pecs and Gyor), Norway, Turkey and the United States; 1998 for Canada and Italy; 2000 for Austria, Japan, Luxembourg, Mexico, Portugal and the United Kingdom.

6. 1991 for Austria (Graz) and Finland (Oulu); 1992 for Hungary (Budapest) and the Netherlands (Vlaardingen and the Hague); 1993 for Mexico (Guadalajara and Monterey) and Portugal (Lisbon); 1994 for the Netherlands (Rotterdam); 1995 for Hungary (Miskolc, Pecs and Gyor) and Mexico (Mexico City).

7. 1996 for Hungary (Miskolc), Portugal (Lisbon) and Sweden; 1997 for Finland (Oulu), Hungary (Budapest, Pecs and Gyor), Italy (Rome), Switzerland (Zurich) and the United States; 1998 for Canada, Italy (Milan and Turin), Korea, Switzerland (Basle) and Turkey (Izmir); 2000 for Austria, Japan, Luxembourg, Mexico, Turkey (Ankara) and the United Kingdom.

Source: OECD.

Table A.5. **Reducing water pollution: main indicators**

	Biochemical oxygen demand		Nitrates		Total phosphates		Nitrogen balance on agricultural land	
	Selected rivers						National	
	Mg O ₂ /litre		Mg N/litre		Mg P/litre		Kg N/ha	
	Average 1980-85	Average last 3 years	Average 1980-85	Average last 3 years	Average 1980-85	Average last 3 years	1985-87	1995-97
Australia	..	..	..	..	..	..	7	7
Austria	2.2	2.2	1.2	1.3	0.2	0.1	35	27
Belgium	6.6	..	3.8	..	0.7	..	189	181
Canada	..	..	0.1	0.1	0.1	0.0	6	13
Czech Republic	8.5	4.6	5.1	3.5	..	0.3	99	54
Denmark	3.9	2.0	3.5	2.6	0.3	0.1	154	118
Finland	..	..	0.2	0.3	0.0	0.0	78	64
France	5.2	3.2	2.8	3.1	0.4	0.4	59	53
Germany	3.6	2.4	3.5	3.3	0.5	0.2	88	61
Greece	..	..	1.3	1.5	0.4	0.4	58	38
Hungary	4.4	2.9	2.2	1.6	0.4	0.3	47	−15
Iceland	..	..	..	..	..	..		
Ireland	1.7	1.8	2.2	2.9	0.1	0.1	62	79
Italy	..	..	2.0	2.1	0.3	0.2	44	31
Japan	2.3	1.4	..	..	..	..	145	135
Korea	..	2.8	..	2.6	..	0.1	173	253
Luxembourg	3.8	2.7	4.1	4.1	0.6	0.4		
Mexico	3.7	15.9	1.9	0.6	..	0.1	28	20
Netherlands	2.8	3.1	4.4	3.3	0.5	0.2	314	262
New Zealand	..	..	..	..	..	..	5	6
Norway	..	..	0.3	0.3	0.0	0.0	72	73
Poland	5.0	4.3	1.8	1.9	0.3	0.3	48	29
Portugal	2.6	2.1	3.6	4.4	0.1	0.2	62	66
Slovak Republic	5.1	3.3	2.0	2.2	0.1	0.2		
Spain	4.7	3.6	1.7	3.1	0.6	0.2	40	41
Sweden	..	..	0.4	0.5	0.0	0.1	47	34
Switzerland	..	..	1.5	1.5	0.1	0.1	80	61
Turkey	2.1	2.7	1.3	1.0	0.3	0.2	17	12
United Kingdom	3.4	2.9	4.6	5.2	0.8	0.9	107	86
United States	1.8	1.6	1.1	..	0.2	0.1	25	31

Table A.6. **Improving natural resource management: main indicators for water supply**

	Total freshwater abstractions				
	Amounts		Relative to renewable resources	Per unit of GDP	
	Billion m ³	Average annual percentage change 1990-1999 ¹	Per cent	Litres per \$GDP	Average annual percentage change 1990-1999 ¹
Australia	24.1	..	6.8	58.2	..
Austria	3.6	-0.7	4.2	18.9	-2.6
Belgium	7.4	..	45.1	31.8	..
Canada	47.3	1.2	1.7	72.4	-1.5
Czech Republic	2.0	-6.5	12.4	15.5	-6.3
Denmark	0.8	-6.2	12.3	5.9	-8.3
Finland	2.3	-0.1	2.1	20.0	-1.6
France	30.3	-3.0	15.9	23.9	-4.2
Germany	40.6	-2.3	22.3	22.2	-3.6
Greece	8.7	..	12.1	59.4	..
Hungary	5.7	-1.3	4.7	54.6	-2.7
Iceland	0.2	-1.0	0.1	21.9	-4.3
Ireland	1.2	..	2.6	20.1	..
Italy	56.2	0.0	32.1	45.0	-1.4
Japan	89.1	0.0	21.2	30.0	-1.8
Korea	24.8	2.7	34.3	42.8	-4.0
Luxembourg	0.1	0.2	3.7	3.5	-4.7
Mexico	78.4	..	16.2	102.7	..
Netherlands	4.4	-10.7	4.9	12.8	-12.7
New Zealand.	2.0	..	0.6	34.8	..
Norway	2.6	..	0.7	26.0	..
Poland	11.3	-2.6	17.9	31.4	-6.0
Portugal	11.1	3.7	15.2	74.6	1.4
Slovak Republic	1.1	-6.6	1.4	22.5	-10.0
Spain	40.9	1.7	36.8	62.1	-0.2
Sweden	2.7	-2.1	1.5	14.2	-2.8
Switzerland	2.6	-0.5	4.8	13.2	-1.2
Turkey	38.9	3.2	16.6	100.1	-1.7
United Kingdom ²	11.2	-0.8	17.4	8.6	-3.0
United States	492.3	1.0	19.9	67.1	-1.4

1. 1989-99 for Luxembourg; 1992-99 for Iceland; 1990-98 for Belgium, Denmark, Hungary and Switzerland; 1991-98 for Germany and Portugal; 1989-98 for Italy; 1990-97 for Australia, Austria, France, Greece, Japan and Korea; 1991-97 for Spain and Turkey; 1991-95 for Canada; 1990-94 for Ireland and Norway; 1991-96 for Netherlands; 1990-95 for Sweden and the United States.
2. England and Wales only.

Source: OECD Environmental Database.

Table A.7. **Improving natural resource management: main indicators for fisheries**

	Fish catch (tonnes)	Fishing activity			Transfers to the fishing industry	Aquaculture
	Per cent change	Per cent change			Per cent of landed value	Per cent change
		Tonnage	Employment	Number of vessels		
	1990-2000	1985-2001 ¹			2001 ²	1985-2000 ³
Australia	1	78	12	-81	8	300
Belgium	-28	7	-19	-38	12	273
Canada	-39		-17	-32	38	1 267
Denmark	4	-26	-22	-52	4	83
Finland	15	140	-45		88	50
France	-4	15		-45	19	18
Germany	-37	-84	82	40	37	-2
Greece	-25	-40	42	241	67	3 900
Iceland	32	140	-29	15	4	3 900
Ireland	27			-67	75	325
Italy	-19	-27		-2	13	106
Japan	-48	-42	-41	-49	26	15
Korea	-26	6	-69	2	15	-18
Mexico	-3		36	104	..	390
Netherlands	22	45	13	5	..	-36
New Zealand	63		-46	-18	..	617
Norway	69	-4	-36	-16	8	1 294
Poland	-51		-54	..	10	80
Portugal	-41	-42		-38	9	33
Spain	-12	-27		-16	27	17
Sweden	35				31	67
Turkey	33	21	159		..	2 533
United Kingdom	-2	-18	7		12	660
United States	-15		-77		36	32

1. 1985-2000 for Japan (number of vessels); 1985-1997 for Australia (employment), Canada, Germany (employment), Greece (employment), Japan (tonnage), Netherlands (employment), New Zealand (tonnage), Turkey, United States.

2. 2000 for Belgium, Canada, Denmark; 1999 for Ireland.

3. 1990-2000 for Belgium.

Source: Food and Agricultural Organization, OECD and World Bank.

Table A.8. **Improving natural resource management: main indicators for forestry**

	Forest cover		Production of roundwood		Timber use
	Average annual change				
	Per cent		Thousand m ³		Harvest as per cent of growth
	Latest available year	1990-2000	1970	2000	
Australia	19.4	-0.2	12 033	30 493	
Austria	47.6	0.2	11 813	13 276	60
Belgium	22.2	-0.2		4 510	85
Canada	45.3	0.0	121 625	187 444	44
Czech Republic	34.1	0.0		14 441	74
Denmark	10.5	0.2	2 293	3 086	59
Finland	75.5	0.0	45 130	54 263	83
France	31.4	0.4	37 853	50 170	68
Germany	30.1	0.0	37 246	49 106	37
Greece	22.8	0.9	3 046	2 171	60
Hungary	18.9	0.4	5 034	5 902	57
Iceland	1.3	0.5	0	0	0
Ireland	8.8	3.0	382	2 673	65
Italy	23.3	0.3	11 667	9 329	27
Japan	66.8	0.0	49 802	18 121	32
Korea	65.2	-0.1	3 636	4 041	6
Luxembourg	34.4	0.3		259	52
Mexico	33.4	-1.1	31 601	45 666	17
Netherlands	9.2	0.3	945	1 039	62
New Zealand	29.5	0.5	8 706	18 898	57
Norway	39.2	0.4	8 542	8 173	41
Poland	29.7	0.2	18 473	25 652	60
Portugal	37.9	1.7	6 370	9 450	77
Slovak Republic	42.2	0.9		5 213	49
Spain	32.3	0.6	13 653	14 810	52
Sweden	73.5	0.0	59 967	61 800	66
Switzerland	31.7	0.4	4 190	10 428	53
Turkey	26.9	0.2	37 239	17 767	43
United Kingdom	10.5	0.6	3 492	7 451	68
United States	32.6	0.2	327 945	500 434	60

Source: OECD and Food and Agricultural Organization FORIS database.

Table A.9. Reducing and improving the management of municipal waste: main indicators

Waste generation						Initial treatment for waste disposal						Waste disposal costs
Period		Relative to population	Relative to population	Relative to consumption	Relative to consumption	Year	Total	Recycling	Composting	Incineration total	Landfill	
		Kg per capita latest available year	Annual growth, per cent	Kg per US\$ 1 000, 1995 prices and PPPs	Annual growth, per cent		1 000 tonnes	Per cent, total				
Australia		..	..	..	..	..	..	..	..	..	..	0.10 ³
Austria	1990-1999	563	3.4	46.1	1.4	1999	3 096	37	17	16	31	1.47
Belgium	1990-2000	545	2.9	46.3	1.2	1999	5 473	40	16	27	17	0.83
Canada ¹	1992-1998	328	0.7	25.1	-1.0	1998	9 926	30	11	..	..	0.19 ³
Czech Republic	1996-2000	334	1.9	54.2	0.7	2000	3 434	..	..	..	..	..
Denmark	1995-2000	664	3.3	61.4	2.2	2000	3 546	22	16	52	10	1.08
Finland	1994-1999	465	2.4	49.0	-1.4	1999	2 400	32	0 ²	8	60	0.11
France	1989-1999	524	1.2	46.4	0.2	1999	30 744	10	8	33	48	0.57
Germany	1993-1998	538	0.1	45.1	-0.9	1998	44 094	34	7	21	37	0.85 ⁴
Greece	1990-2001	428	3.4	44.8	1.6	1997	3 900	8	0	0	91	0.38 ³
Hungary	1990-2000	445	-1.6	86.2	-2.2	2000	4 084	0	0	9	91	..
Iceland	1990-2000	704	0.8	52.4	-1.4	2000	192	9	2	9	81	0.26 ³
Ireland	1990-1998	555	0.6	53.0	-3.1	2000	2 302	8	1	0	91	0.10
Italy	1990-2000	507	3.7	39.9	2.1	1997	27 425	7	9	6	78	..
Japan	1990-1999	406	-0.1	34.6	-1.4	1999	51 446	13	0	78	9	0.07 ³
Korea	1990-2000	361	-6.6	50.3	-10.5	2000	16 950	41	0 ²	12	47	0.49
Luxembourg	1992-1999	642	1.8	38.7	0.8	1999	227	0	15	59	26	..
Mexico	1991-2000	316	2.5	63.5	1.3	2000	30 733	2	0	0	98	0.06 ³
Netherlands	1990-2000	609	2.0	53.3	-0.1	2000	9 691	23	24	41	13	0.58
New Zealand ¹	1990-1999	378	1.5	37.7	0.0	1999	1 450	0	0	0	100	..

Table A.9. **Reducing and improving the management of municipal waste: main indicators** (cont.)

		Waste generation				Initial treatment for waste disposal						Waste disposal costs
		Relative to population	Relative to population	Relative to consumption	Relative to consumption	Year	Total	Recycling	Composting	Incineration total	Landfill	
							Kg per capita latest available year	Annual growth, per cent	Kg per US\$ 1 000, 1995 prices and PPPs	Annual growth, per cent	1 000 tonnes	
Period												
Norway	1992-2000	613	2.1	50.8	−0.9	2000	2 755	22	9	15	55	0.26 ³
Poland	1990-2000	316	0.8	64.0	−3.8	2000	12 226	0	2	0	98	0.27
Portugal	1990-2000	443	4.0	51.3	1.2	2000	4 531	6	6	21	67	0.24
Slovakia	1993-2000	316	0.7	58.2	−2.9	2000	1 706	3	6	15	76	..
Spain ¹	1990-2000	518	4.8	51.9	2.6	1999	18 377	5	18	6	72	0.25
Sweden	1990-1998	452	2.4	47.5	2.1	1998	4 000	25	8	35	33	0.37 ³
Switzerland	1990-2000	652	0.7	41.8	0.2	2000	4 681	32	14	48	6	0.30 ³
Turkey	1989-1998	385	0.9	101.4	−2.0	1998	24 945	0	1	0	99	..
United Kingdom	1990-1999	567	2.0	44.8	−0.2	1999	33 200	9	2	8	81	0.40
United States	1990-1999	764	0.3	35.7	−1.9	1999	208 520	22	6	15	57	0.25
OECD average		523	0.5	41.9	−1.2		566 052	17	6	20	57	
EU average		530	1.6	45.9	0.5		193 005	17	9	18	55	

1. Data exclude non-household waste.
2. Included in recycling.
3. For this country no information about business sector costs was available. An estimate, based on the average for countries without private specialised enterprises has been added. This estimated correction amounts to 0.03 per cent of GDP.
4. For Germany, no figure for the costs incurred by private specialised waste companies was available. An estimated figure of 0.19 per cent of GDP has been added, based on the cost of the Duales system and estimates of the quantity of non-sales packaging that is recycled

**Table A.10. Improving living conditions in developing countries:
OECD non-energy imports from developing countries**

	Least-developed countries		Other low-income countries		All developing countries	
	Share in total imports, per cent	Average annual growth, ¹ per cent	Share in total imports, per cent	Average annual growth, ¹ per cent	Share in total imports, per cent	Average annual growth, ¹ per cent
	2001	1990-2001	2001	1990-2001	2001	1990-2001
Australia	0.2	7.9	12.6	15.1	22.1	11.8
Austria	0.3	13.1	2.7	9.1	7.6	5.8
Belgium	1.6	5.7	4.5	9.9	11.7	8.8
Canada	0.1	5.1	4.8	17.0	11.9	13.0
Czech Republic	0.1	8.9	4.1	39.7	7.7	20.5
Denmark	0.3	0.9	4.3	9.6	7.4	5.9
Finland	0.5	16.6	4.5	13.7	9.2	8.4
France	0.6	1.0	5.4	11.2	13.0	6.3
Germany	0.5	5.6	5.5	9.2	11.3	4.6
Greece	0.7	7.0	5.1	13.4	13.4	7.9
Hungary	0.1	10.8	5.3	33.5	10.8	24.8
Iceland	0.1	20.0	4.2	21.7	10.4	19.0
Ireland	0.3	5.6	2.9	17.9	7.6	18.1
Italy	0.4	-1.1	4.9	9.8	13.4	3.7
Japan	0.2	-4.7	24.6	14.0	39.0	9.9
Korea	0.1	-2.6	14.3	12.1	24.5	9.2
Luxembourg	0.1		0.7		1.5	
Mexico	0.0	-6.3	0.6	13.5	4.0	14.9
Netherlands	0.4	5.9	7.7	12.3	16.2	7.5
New Zealand	0.1	4.2	10.2	18.6	17.2	12.6
Norway	0.4	-17.5	4.3	14.4	9.4	0.1
Poland	0.4	12.4	4.9	22.7	10.3	18.5
Portugal	0.6	-0.1	2.1	6.1	6.8	3.0
Slovak Republic	0.0		2.7		5.3	
Spain	0.5	3.2	5.5	13.9	13.1	9.3
Sweden	0.2	7.3	2.7	6.8	5.7	3.1
Switzerland	0.1	-1.2	2.5	10.2	5.8	2.7
Turkey	0.2	-2.4	5.7	11.4	12.7	6.7
United Kingdom	0.4	6.8	4.7	9.6	12.8	8.3
United States	0.5	9.1	12.6	16.8	35.2	13.3

Note: 1992 for Hungary and Poland; 1993 for Belgium and Czech Republic; 1994 for Korea.

1. Nominal, in dollar terms.

Source: OECD Foreign Trade Statistics Database.

**Table A.11. Improving living conditions in developing countries:
official development assistance (ODA)**

	Total ODA as per cent of GNI		Average annual real growth of ODA	Social and adminis-trative share in total ODA	Share untied bilateral ODA	Share of ODA going to low-income countries
	1990-91	2000-01	1995-2001	2000-01	2001	2000-01
Australia	0.4	0.3	0.6	50.7	59.3	60.5
Austria	0.3	0.3	0.2	42.4	59.2a	67.6
Belgium	0.4	0.4	3.5	42.3	89.8	70.9
Canada	0.5	0.2	-2.6	30.6	31.7	69.8
Denmark	1.0	1.1	4.4	22.8	93.3	76.1
Finland	0.7	0.3	5.0	42.2	87.5	67.9
France	0.6	0.3	-6.6	38.9	66.6	57.3
Germany	0.4	0.3	-1.2	42.3	84.6	58.1
Greece	...	0.2	8.2	70.9	17.3	23.7
Ireland	0.2	0.3	11.9	57.6	100.0	80.1
Italy	0.3	0.1	-2.3	23.4	7.8	62.9
Japan	0.3	0.3	3.0	20.6	81.1	70.1
Luxembourg	0.3	0.8	18.1	69.8	96.7 ¹	62.6
Netherlands	0.9	0.8	5.0	26.2	91.2	70.5
New Zealand	0.2	0.3	5.6	49.2	..	59.5
Norway	1.2	0.8	1.7	41.8	98.9	67.1
Portugal	0.3	0.3	6.7	36.7	57.7	85.7
Spain	0.2	0.3	7.3	34.9	68.9	55.7
Sweden	0.9	0.8	4.4	32.2	86.5	68.6
Switzerland	0.3	0.3	3.0	18.3	96.1	68.7
United Kingdom	0.3	0.3	5.8	25.3	93.9	73.6
United States	0.2	0.1	3.2	42.2	..	58.8
Total of above countries	0.3	0.2	1.8	32.1		65.2

1. 2000.

Source: Development Assistance Committee Database.

Table A.12. **Ensuring adequate and sustainable retirement income: main indicators**

	Projected increases in old age pension spending ¹	Low income rate of the elderly ²	Relative disposable income of the elderly ²	Private pension funds 1999	Average age of withdrawal, 1994-1999		Participation rate, 2001, per cent		
	Change in per cent of GDP	Per cent of the elderly with income less than 50 per cent of median disposable income	Per cent of the disposable income of all individuals	Per cent of GDP	Male	Female	Aged over 65	Aged 55-64	
								Male	Female
Australia	1.6	16.1	67.6	63.8	59.7	61.3	6.0	60.0	36.9
Austria	2.2	14.9	86.6	3.6			2.8 ¹	42.1 ¹	17.5 ¹
Belgium	3.3	13.8	77.9	6.1			1.3	36.6	15.7
Canada	5.8	2.5	97.4	45.7	62.6	61.1	6.0	61.3	41.7
Czech Republic	6.8			3.8			4.0	55.0	24.5
Denmark	2.7	9.2	73.0	24.4	62.4	61.5	4.6	65.5	51.8
Finland	4.8	7.5	79.0	10.7	59.8	60.0	3.7	51.2	49.5
France	3.9	10.7	89.7	6.3	59.3	59.8	1.2	43.8	34.1
Germany	5.0	10.4	85.6	3.2	60.5	60.8	3.0	50.6	32.4
Greece		29.2	76.8	4.6	61.7	62.2	5.0	57.0	23.6
Hungary	1.2	6.0	85.2	2.2			3.1	36.3	15.4
Iceland				86.0			19.9	92.8	81.7
Ireland		16.7	74.6	57.8			7.9	66.1	29.5
Italy	-0.3	15.3	84.1	3.0	59.3	58.4	3.4	57.8	26.6
Japan	0.6			18.7	69.1	66.0	21.8	83.4	49.2
Korea	8.0			3.2	67.1	67.5	29.6	71.3	47.9
Luxembourg		6.7 ³		..			0.0	38.1	14.3
Mexico		32.9	85.3	2.4			30.5	80.5	27.6
Netherlands	4.8	1.9	86.3	119.3	61.6	60.1	3.1	52.0	26.9
New Zealand	5.7			..			8.6	74.6	51.7

Table A.12. **Ensuring adequate and sustainable retirement income: main indicators** (cont.)

	Projected increases in old age pension spending ¹	Low income rate of the elderly ²	Relative disposable income of the elderly ²	Private pension funds 1999	Average age of withdrawal, 1994-1999		Participation rate, 2001, per cent		
	Change in per cent of GDP	Per cent of the elderly with income less than 50 per cent of median disposable income	Per cent of the disposable income of all individuals	Per cent of GDP	Male	Female	Aged over 65	Aged 55-64 Male	Female
Norway	8.0	19.1	74.1	7.4	64.2	64.7	13.2	73.6	63.2
Poland	-2.5	8.4 ³		..			7.5	41.5	24.1
Portugal				11.4	65.3	66.5	19.0	63.7	41.9
Slovak Republic							1.1	43.0	11.2
Spain	8.0	11.3 ³		2.3	61.1	61.1	1.6	61.4	23.6
Sweden	1.6	3.0	89.2	..	63.3	61.8	9.4	73.5	67.4
Switzerland		8.4 ³		97.3 ⁴			11.4	82.4	56.1
Turkey		23.1	92.7	..			18.1	50.8	18.4
United Kingdom	-0.7	11.6	77.8	84.1	62.0	61.2	4.8	64.4	44.6
United States	1.8	20.3	91.7	74.4	65.1	64.2	13.1	68.1	53.0

1. Deng et al. (2001).

2. Förster and Pellizzari (2000).

3. Smeeding (2002).

4. 1998.

Source: Förster and Pellizzari (2000); Jesuit and Smeeding (2002), *Luxembourg Income Study*; OECD Labour Force Statistics, Scherer (2002).

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