European environmental taxes and charges: recent experience, issues and trends

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Abstract

The use of environmental taxes and charges in OECD countries increased by over 50% between 1987 and 1994. While revenues raised by environmental taxes and charges remain small relative to overall taxation, they comprise a rising proportion in most European countries. Several European countries have either undertaken or are considering systematic shifts in taxes away from labour and onto the use of environmental resources. Potential negative effects on competitiveness, and regressive distributional effects, are the major cause of concern with regard to the introduction of environmental taxes. A number of ways of mitigating such effects exist and have been implemented. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Environmental tax; Systematic shift; Negative effects; Distributional effects; Competitiveness

1. Introduction

Environmental policy in the 1970s and 1980s was almost wholly driven by systems of regulation—of emissions and environmental quality, of processes and technologies—which are sometimes described as instruments of command and control.

However, during the 1980s the interest of policy makers in environmental taxes, and other market-based instruments of environmental policy (for example, tradable permits or deposit refunds) was kindled by a number of factors:

1. Increased awareness of the power and potential of markets and a new orientation towards markets in public policy.
2. Increased recognition of the limitations of government in general, and of traditional command and control systems of environmental regulation in particular.
3. Increased concern that such systems were not adequately coping with environmental problems but were imposing substantial economic costs, leading to a new interest in other instruments that might offer more cost-effective environmental policy.
4. Desire to make further progress with the implementation of the polluter pays principle, to internalise environmental costs into the prices of the relevant products and activities, and increased desire, as part of a more cost-effective approach, to integrate environmental policy into other policy areas.

In short, it became increasingly recognised that traditional regulatory environmental policy, despite some successes, was not managing to prevent further unacceptable environmental damage, and it was feared that the costs of attempting to make it do so would be great. Economists had long said that in many areas (but not all) environmental goals could be achieved more cost-effectively through appropriate taxes and charges. In the new market-oriented atmosphere of the 1980s, with its associated consciousness of cost and the need for competitiveness, policy makers began to take them seriously.

One of the early indications of this change was the emphasis given to economic instruments in environmental policy by the report of the World Commission for Environment and Development in 1987. Another impetus was provided in the early 1990s, when recession resulted in unemployment moving up the public policy agenda; while continuing globalisation and intensifying competition in global markets focused attention on the impact of tax-benefit systems on competitiveness. Both these developments resulted in increased interest in the possibility that a green tax reform, whereby environmental taxes replace employers' taxes on labour, could achieve an employment dividend as well as an environmental dividend of improved environmental quality. A substantial quantity of theoretical research into and modelling of this issue, discussion of which is beyond the scope of this paper (but see Ekins, 1997), has so far proved inconclusive. However, enough of it has indicated the likelihood of at least a small double dividend for this to remain one of the keenest areas of policy making interest in environmental taxation. The OECD (1996, pp. 71) has concluded on this issue: 'Evidence suggests that a significant revenue-neutral cut in social security contributions could increase employment over the medium term in those countries where wages and prices are sticky.'

In the context of the European Communities, the new interest in economic instruments was both reflected in and amplified by the Commission's Task Force Report on the environment and the internal market from 1989, the European Parliament's hearing on economic instruments in June 1990, as well as the decision in Rome by the Environment Council in September 1990 to develop a proposal for a European carbon-energy tax. Both the European Council's Dublin declaration from 1990, as well as the Fifth Environmental Action Programme from 1992 (EC, 1992) pointed more formally to the need for adopting such new approaches in the use of policy instruments, while the Delors' White Paper on Growth, Competitiveness and Employment signified the wider positive macro-economic implications of such an environmental policy.

The rather limited progress in the use of economic instruments at the EU level since then can sometimes give the impression that these instruments have been more characterised by discussion and rhetoric than practice. However, such an impression underestimates the significance of the developments that have taken place at the national level during the last 5–6 years.

In a number of countries the use of economic instruments has spread widely, among EU member states in particular in the Benelux and the Scandinavian countries, but also to some extent in larger European countries such as the UK, France, Italy and Germany. In transitional economies, such as Poland, Hungary and Estonia, environmental charges and taxes, despite many implementation problems, are seen as a promising mechanism to integrate economic and environmental policies (OECD, 1994a). In Asian economies with rapid industrialisation, such as Taiwan, Korea, Malaysia, Thailand and Singapore, market-based instruments have over the last 5 years become frequently applied alongside the traditional command-and-control regulations still prevailing in these countries (OECD, 1994b).

At the EU level the Packaging Waste Directive has provided leeway for individual member states to apply economic instruments in this field, until a more harmonised approach is defined, but apart from the minimum excise rates that have been
settled, this is about the only progress that can be noted. The reason for this development is not least that the use of economic instruments is tied in with the wider issue of tax policy at the European level. The EU is a supra-national institution in which the harmonisation of taxes requires unanimity among member states, and while common environmental taxes, such as a Europe-wide CO₂ tax, would represent a step forward in the integration process, they have not received unanimous support. The present efforts at the EU-level are thus targeted towards improving the conditions for individual member states that wish to take the opportunity of the advantages for environmental policy implementation offered by the use of economic instruments, although a proposal for minimum harmonised excise duties on energy has also been put forward.

The purpose of this paper is briefly to set out the rationale for environmental taxes, to classify them so that their purpose and motivation can be understood, and to identify the environmental themes towards which they are directed (Section 2). The paper then provides an overview of the national applications of economic instruments in industrialised countries. The OECD has produced comprehensive listings of the application of economic instruments based on surveys in 1987 and 1992 (OECD, 1989, 1994c), and a further listing in 1997 (OECD, 1997a). While this paper updates this information to some extent, using a database recently produced for the European Commission (ECDGXI, 1999), it also offers some observations on the acquired implementation experiences with economic instruments, including where countries have experimented with a more general tax shift from labour to resources and pollution and green tax reform (Section 3). Tax rates and revenues, where given, are converted into ECU to provide comparability, using ECU exchange rates that existed in 1997, and which are set out in Appendix A. Section 4 addresses the major issues that are raised by the imposition of environmental taxes, including effects on competitiveness and distribution. Section 5 concludes.

2. Classification of environmental taxes

2.1. The rationale for environmental taxes and charges

Since the birth of modern environmental policy in the early 1970s, the industrialised countries have endorsed the polluter pays principle. OECD countries embraced the principle in 1972, it was recommended by the Council of Ministers in the European Community's First Environmental Action Programme in 1973, and at the intergovernmental conference in 1985, it was laid down in the Treaty of Rome. Its original intention was to put restrictions on subsidies for environmental protection and to ensure that polluters paid the costs of such protection made necessary by their activities. A wider interpretation, sometimes put on the principle, is that polluters should pay the costs of the environmental damage they cause. Either interpretation justifies the appropriate imposition of environmental taxes and charges. A distinction between taxes and charges is drawn in the next section.

The basic rationale for the use of taxes and charges in environmental policy is provided by the existence of environmental externalities: impacts on the environment, and perhaps thence on people, which are side-effects of processes of production and consumption and which do not enter into the calculations of those responsible for the processes. Where the effects are negative, externalities are costs. By levying a tax or charge on the activity giving rise to the effect, the external cost can be partially or wholly internalised. There is increasing evidence that environmental externalities, in terms of their effects on human health, buildings and ecosystems are now very substantial, especially in such areas as transportation, which increases the inefficiency and inequity of not internalising them, and the desirability of doing so.

Provided the tax or charge is levied on the cause of the environmental damage (for example, on emissions to air, water or land) in such a way that a reduction in the cause (for example, a reduction in the volume or toxicity of the emission) reduces the tax liability, then there will be an
incentive for the cause to be reduced. A producer facing an emissions tax will seek to abate the emissions or change to inputs or processes that cause them less or not at all. Such tax as is paid will increase the price of the relevant product, giving consumers the incentive to switch away from it. Moreover, the incentive to reduce the taxed effect is operative at all levels of the effect, unlike with conventional environmental regulation, when the improvement incentive ceases to operate once the regulatory standard has been reached.

Given that producers and consumers will probably not cease entirely the activities that are being taxed, the taxes and charges will raise revenues. These may be used to address environmental problems directly; or they may be used to subsidise producers or consumers to shift to more environmentally-benign activities, providing a second incentive for environmental improvement; or they may serve to prevent regressive effects from the taxes and charges, by compensating those on low incomes; or they may be applied to other government purposes, allowing, for the same level of government expenditure, other taxes to be reduced.

The essential elements of environmental taxes and charges are therefore that:

1. They incorporate the costs of environmental damage into the prices of the goods, services or activities which give rise to them.
2. Thereby they create incentives for producers and consumers to shift away from environmentally-damaging behaviour, so reducing the damage.
3. Because each producer faces the same incentive, they act to equalise the marginal cost of environmental improvement across the tax base, thereby achieving the improvement at least cost.
4. For producers they may act as a spur to innovation even in the short term. When energy, water and raw materials, as well as solid, liquid or gas emissions become taxed, taxpayers will develop new modes of production, transportation, housing, energy use and general consumption to reduce their liability. The stimulus to such an ‘ecological modernisation’ is significant both to sustainability and to long run international competitiveness, where tomorrow’s products depend on today’s innovations.
5. They raise revenues which can be used for a variety of purposes, some of which improve the environment or give further incentives to do so. Alternatively the revenues may be used to reduce labour taxation with the objective of increasing employment, or to correct undesirable distributional effects.

2.2. Classifying environmental taxes and charges

Classifying environmental taxes is rather a complex task, due to both the different forms they can take and the different functions they can perform. The following classification distinguishes between the incentive and revenue-raising functions of a tax, and between the main uses to which the revenues can be put.

2.2.1. Cost-covering charges

Ironically the earliest experience of environmental taxes actually arose from the implementation of traditional regulatory environmental policy. Regulating emissions to land or water costs money. In accordance with the polluter pays principle, it seemed appropriate that the regulation should be paid for by those being regulated. Hence the first category of environmental taxes and charges, still important today, is that of cost-covering charges, whereby those making use of the environment contribute to or cover the cost of monitoring or controlling that use.

Cost-covering charges can be of two types: user charges, where the charge is paid for a specific environmental service (for example, treating the waste-water, disposing of the waste of the charge-payer, or covering the administrative costs of regulation); and earmarked charges, where the revenue from the charge is spent on related environmental purposes but not in the form of a specific service to the charge-payer (for example, general water treatment or land remediation). The level of a cost-covering charge is determined by the service it is intended to deliver or the other purposes to which its revenues will be put.
2.2.2. Incentive taxes

An environmental tax may be levied purely with the intention of changing environmentally damaging behaviour, and without any intention to raise revenues. Such a tax may be termed an incentive tax. The level of an incentive tax can be set by one of two considerations. Where both the cost of the environmental damage, and the economic benefit deriving from it, per unit of the cause of damage (i.e. the marginal damage cost and the marginal benefit) can be reliably calculated, then the tax should be set at the level at which the marginal cost and benefit are equal. The tax will then be the optimal tax. This might be termed the optimal approach to incentive taxes. Where it is not possible to estimate the marginal damage cost, or the numbers generated are too uncertain, then the tax can be used as an instrument, probably one among others, to achieve environmental objectives set according to other criteria (for example, environmental sustainability or the precautionary principle). In contrast to the optimal approach, this may be termed the instrumental approach to incentive taxes (in the literature this has been termed the ‘standard pricing’ approach, following the paper which first described it, Baumol and Oates, 1971).

2.2.3. Revenue-raising taxes

It may be that a tax will change, and be intended to change, behaviour but will still yield substantial revenues over and above those required for related environmental regulation (i.e. the tax is not a cost-covering charge). Such revenues may be desirable to government in themselves; or they may be the means of bringing about a desired tax shift away from fiscal reliance on, for example, high marginal rates of income tax or high non-wage labour taxes on employers. Environmental taxes, the principal purpose of which is to raise significant revenues, are here termed revenue-raising taxes.

Clearly these three types of environmental tax are not mutually exclusive: a cost-covering charge may have incentive effects, as may a revenue-raising tax, or the revenues from a revenue-raising tax may be partially used for related environmental purposes. But there is a two-fold reason for classifying environmental taxes and charges into these three types. First, the classification clarifies the main objective of a tax, over and above the general objective of all environmental taxes, that of environmental improvement. These objectives may not be entirely consistent. For example, a charge that covers the cost of related environmental policy may not be at a sufficient level, or may not be designed, to have an incentive effect. An incentive tax may be so successful at changing behaviour that it ends up raising substantially less revenue than was anticipated (the Swedish SO2 tax fell into this category, see EF, 1996, pp. 114, OECD, 1997b, pp. 30).

Secondly, the intention behind a particular kind of tax will, to a large extent, determine the level at which it should be set. A cost-covering charge needs to cover the costs of related environmental regulations, but no more. An incentive tax needs to be set at the appropriate optimal or instrumental level. As to the required level of revenue-raising taxes, they obviously need to be set such that they will generate the desired quantity of revenue.

It is therefore important, both for the choice of what is to be taxed and at what level that, the objective of the tax according to this classification is determined in advance.

2.3. Environmental taxes in relation to environmental problems

In the European Environment Agency’s (EEA) Report for the Review of the European Commission’s Fifth Environmental Action Programme (EEA, 1995), the EEA’s key conclusion was: ‘Without accelerated policies, pressures on the environment will continue to exceed human health standards and the often limited carrying capacity of the environment. Actions taken to date will not lead to full integration of environmental considerations into economic sectors or to sustainable development’ (EEA, 1995, pp. 1). A further conclusion was that ‘the efficiency issue (i.e., maximising the environmental benefits and minimising the economic costs) is hardly addressed’ (EEA, 1995, pp. 2) in current approaches to environmental policy.
The rationale behind environmental taxes suggests that they have a potentially important role to play in both economy-environment policy integration, by seeking to incorporate environmental costs into prices, and in achieving cost-effectiveness in environmental policy, by equalising marginal abatement costs across polluters, as noted earlier. It has also been seen that the revenues accruing from environmental taxes can be used to make environmental improvements beyond their incentive effects, or to achieve other goals of public policy while allowing other taxes to be reduced.

Environmental problems are inter-related. Often a single pollutant will contribute to several different environmental problems. Reducing this pollutant is therefore likely to ameliorate several problems, although the effects from combinations of pollutants can be complex and no automatic relationship of this kind can be assumed. The EC’s Fifth Environmental Action Programme grouped key environmental concerns into environmental themes. In reviewing the Fifth Environmental Action Programme, the EEA Report assessed environmental progress, and the key EU environmental measures, against these themes (EEA, 1995, Chapter 4, pp. 45–116, and Appendix A, pp. 145–147). It is interesting also to see how the main environmental taxes and charges which have been introduced relate to these environmental themes, which are climate change, ozone depletion, acidification, air pollution and quality, waste management, urban issues, inland water resources, coastal zones and marine waters, risk management, soil quality, nature and biodiversity.

Specific taxes are described in more detail in the next section, but Table 1 illustrates in a general way some of the multiple effects which can be expected from a range of environmental taxes.

2.3.1. Carbon/energy/fuel taxes

The principal environmental motivation behind the introduction of carbon/energy/fuel taxes has been the desire to control CO₂ emissions, the main greenhouse gas responsible for global warming and climate change. In mitigating climate change, these taxes also reduce environmental risks and threats to ecosystems. Reduced fossil fuel use also leads to the reduction in polluting emissions apart from CO₂, such as SO₂, NOₓ, particulates and volatile organic compounds,

Table 1
Multiple impacts of some environmental taxes

<table>
<thead>
<tr>
<th>PRIVATE</th>
<th>Carbon/energy/fuel tax</th>
<th>NOₓ/SO₂ tax</th>
<th>Waste tax</th>
<th>Surplus manure tax</th>
<th>Tax difference on unleaded petrol</th>
<th>CFC tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate change</td>
<td>*</td>
<td>**</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ozone depletion</td>
<td></td>
<td>**</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acidification</td>
<td>*</td>
<td>**</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air pollution/quality</td>
<td></td>
<td>**</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste management</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban issues</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inland waters</td>
<td></td>
<td></td>
<td></td>
<td>**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coastal/marine waters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk management</td>
<td>*</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil quality</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Nature/biodiversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* a, the main target of the environmental tax.
* b, other environmental themes where the tax is likely to have an effect.
which between them contribute to acidification, poor air quality, especially in urban areas, and eutrophication of inland waters. Because of the multiple environmental externalities caused by burning fossil fuels, they are a principal target of environmental taxation, with the significant exception of aviation fuel and international marine fuel. There are increasing calls that these fuels too should be taxed, on an internationally harmonised basis.

2.3.2. NO\textsubscript{x}/SO\textsubscript{2} tax

It can be seen from Table 1 that even single pollutants like NO\textsubscript{x} and SO\textsubscript{2} are implicated in a number of environmental problems, including acidification, poor air quality, again particularly in cities, eutrophication of inland waters and effects on ecosystems.

2.3.3. Waste tax

Waste taxes seek to promote more effective, sustainable waste management through a reduction in the amount of waste going to landfill and increased recycling and waste reduction. By reducing the amount of landfilled waste, they will reduce the emission from landfill sites of methane, a greenhouse gas contributing to climate change; they will reduce the amount of pollutants leaching into groundwater; and they will reduce the noise, smell and loss of amenity that frequently occur around landfill sites. If the tax leads to reductions in incinerated as well as landfilled waste, concerns about possible toxic pollution from incinerators (for example, from dioxins) will be allayed as well.

2.3.4. Surplus manure tax

Surplus manure derives from intensively farmed livestock, and its main environmental impact is the pollution of inland waters. Thence it affects coastal waters. Ecosystems are also affected in both fresh and marine environments. Surplus manure also has negative effects on soil quality. Farm animals are major emitters of the greenhouse gas methane, so that taxing surplus manure may be expected to have a positive (if small) effect on this cause of climate change.

2.3.5. Tax differential on unleaded petrol

This tax differential is mainly aimed at improving air quality by reducing lead levels, which is principally a concern in urban areas. However, reducing lead emissions from motor cars will also reduce lead pollution of soil and water. Because the effects of lead pollution are still subject to substantial uncertainty, reducing it will also diminish the risks associated with that uncertainty.

2.3.6. CFC tax

This tax is mainly aimed at the problem of ozone depletion with its consequences for human health. It therefore contributes to managing the risk involved in ozone depletion, not least with regard to possible effects on ecosystems. CFCs are also a greenhouse gas.

Broadly, the level of an environmental tax should reflect the severity of the environmental problem to which it is directed. The fact that an environmental tax can have beneficial effects on a number of environmental problems should be taken into account when the rate of the tax is being set.

3. Current tendencies and practices

3.1. Environmental taxes in practice

This section of the paper describes current practice in the levying of environmental taxes and considers how this may develop in the future. A comprehensive database of environmental taxes and charges in EU-15, plus Norway and Switzerland, has been developed with European Commission funding (hereafter referred to as ECDGXI, 1999). The database may also be found on the European Commission’s website at http://europa.eu.int/comm/dg11/enveco/index.htm. Comprehensive lists of environmental taxes and charges can also be found in OECD (1994c, 1995, 1997a). Much of the basic information in this section is taken from these sources.

The review of environmental taxes and charges in this section does not seek to be comprehensive. Rather Table 2 here presents selected environmental taxes and charges according to the classifica-
Table 2
Classification of selected environmental taxes and charges

<table>
<thead>
<tr>
<th>Type of tax or charge</th>
<th>Pollution</th>
<th>Products</th>
<th>Depletion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Air</td>
<td>Waste</td>
<td>Noise</td>
</tr>
<tr>
<td>Cost-covering charges:</td>
<td>Waste-water charges (Var)</td>
<td>Waste charges (Var)</td>
<td>Water supply charge (D, UK)</td>
</tr>
<tr>
<td>user charges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost-covering charges:</td>
<td>Emission charge (F)</td>
<td>Waste-water charges (Var)</td>
<td>Surplus manure tax (B, NL)</td>
</tr>
<tr>
<td>earmarked charges</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal incentive</td>
<td>NO$_2$ tax (S)</td>
<td>Waste tax (DK) landfill tax (UK) (after 4.99)</td>
<td>Unleaded petrol (Var) product taxes (Var)</td>
</tr>
<tr>
<td>taxes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrumental</td>
<td>Fuels tax (NL) road fuel duty (UK)</td>
<td>Waste tax (NL)</td>
<td>Uranium tax (NL) CFC tax (DK, US)</td>
</tr>
<tr>
<td>incentive taxes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
tion given in Section 2, in order to elucidate why the taxes were imposed, what was their intended objective, and what was the justification for both the tax rate and the tax base. Section 4 then considers the major issues that arise in connection with the taxes’ implementation.

The intention behind Table 2 has been to select the clearest example of a particular kind of tax or charge, but even so, as will be seen from the discussion below, several taxes actually span several categories. However, for the reasons given above, it seems important to classify them under the principal motivation for their introduction (in addition to benefiting the environment). For several of the taxes listed, their motivation seems inseparably mixed. For example, a charge may be explicitly intended to have incentive and cost-covering functions. Such mixed motives are identified in the following discussion of the instruments. In general, it may be noted that, almost by definition, revenue-raising environmental taxes are always introduced with an incentive effect in mind as well, but it is envisaged that the shift in behaviour will not be so large or so fast as to preclude the generation of substantial revenues.

The rows of Table 2 give the three types of environmental tax or charge, with cost-covering charges split into user charges and earmarked charges, and incentive taxes split according to the optimal:instrumental distinction, as discussed earlier. It is interesting how, up until April 1999, there was only one example of an optimal tax (the UK landfill tax), the rate of which was explicitly based on a calculation of externalities. Thereafter, with the increase in the tax rate, even this became instead an instrumental incentive tax (see below). This seems to illustrate the difficulty of giving a monetary value to environmental costs, and the uncertainty of such monetary valuations. It also reflects policy makers’ desire to use environmental taxes and charges to achieve environmental policy goals rather than some notional state of economic optimality.

The columns of Table 2 distinguish between the environmental problems towards which environmental taxes and charges are directed. Most generally these are pollution of the environment and depletion of resources. Within pollution, a distinc-

Economic theory suggests that, for maximum efficiency, an environmental tax should be levied actually on the substance that is causing the environmental problem (for example, the actual emissions to air, water, or land). However, it may be either technically difficult (with small or diffuse emitters) or expensive to carry out the monitoring of emissions that an emissions tax entails, so that it may be more appropriate to tax a proxy for the emissions if one exists. Such a proxy may be an input into a product or process that is related to the environmental damage (for example, the carbon in fossil fuels is closely related to the CO\textsubscript{2} emissions that contribute to global warming); or it may be a product itself (for example, batteries which contain heavy metals). The products column in Table 2 therefore relates to the taxation of products which either deplete resources or which contribute in some way to pollution, where the taxation of the pollution itself is either infeasible or more expensive.

The depletion columns in Table 2 relate to taxes which seek to limit resource-depletion, either by ensuring that consumers pay the full costs of extraction where they might not otherwise do so; or by ensuring that the full economic rent of the resource, reflecting its scarcity, is included in its final price; or by encouraging the use of secondary rather than primary materials where the extraction of the primary material is associated with unaccounted environmental damage; or by raising the price of the resource to encourage conservation. Of course, if markets for resources were perfect, and their prices captured all the internal and external costs of extraction, and the scarcity rents, there would be no need for taxes on resource depletion. However, where this is not the case, as sometimes with water, landfill and road space, and quarrying, these taxes become justified on the grounds of economic efficiency.

Given that an early concern of environmentalists was that the world would (relatively) soon run out of oil and other fossil fuels, it is notable that there are no depletion taxes on fossil fuels to encourage their conservation. Policies for such
conservation are today motivated by a desire to reduce the post-combustion emissions of fossil fuels, rather than to conserve the resource per se, indicating how perceptions of environmental problems have changed in the last 25 years. Oil markets probably do capture scarcity rents, and markets do not perceive oil to be scarce. On the contrary, there are substantially more fossil fuels underground than can be accommodated, after they are burned, in the atmosphere, if a stable climate is to be maintained. However, the taxes on fossil fuels to reduce emissions have the same conserving effect as if they were depletion taxes.

The following discussion relates to the taxes and charges in Table 2, proceeding down each column. The letters in brackets in the table are the usual initials of OECD countries, with Var standing for various countries. Unless otherwise referenced, the information about particular taxes below is taken from OECD (1994c, 1995, 1997a), or from the database ECDGXI (1999).

1. Emission charges (F). France’s charges on polluting atmospheric emissions (SO₂, NOₓ, HCl, H₂S, VOCs), introduced in 1985, are Europe’s earliest air emission charges. Revenues (FF 169 [ECU 25.8] million in 1994, FF 220 [ECU 33.5] in 1996) are spent on atmospheric pollution prevention, reduction, monitoring and control.

2. NOₓ tax (S). The Swedish NOₓ tax, announced in 1990 and introduced in 1992, is payable, on a per plant basis according to the plant’s emissions, by a relatively small group of large producers of heat and power for final use (initially those producing more than 50 GWh per year, with the threshold lowered to 25 GWh per year in 1997). Revenues from the charge of SEK 40 [ECU 4.7] per kg NOₓ are recycled to each charge-paying plant according to the proportion of the group’s energy that the plant generated. The net effect is for each plant to seek to minimise its NOₓ emissions per unit of energy output. Perhaps as a result of this, at least in part, total energy output from the plants has increased even as their NOₓ emissions have declined. By 1995 NOₓ emissions from the plants per unit of energy input had fallen by 60% from 1990s level. Illustrating the potential importance just of announcing an environmental tax, between the year of announcement of the tax and its introduction emissions of NOₓ from taxed installations fell by 35% (Cansier and Krumm, 1997, p.63). However, these emissions only comprised about 6.5% of Sweden’s NOₓ emissions, most of which come from motor cars.

3. Fuels tax (NL). The Netherlands has two revenue-raising taxes on energy use. The general fuels tax, introduced in 1992, and the small energy users’ tax, introduced in 1996, are two of five taxes with an environmental base. The fuels tax is based on the carbon and energy contents of different fuels with lower rates on or total exemptions of energy-intensive industries. The revenue from the fuels tax goes into the general budget and its revenues in 1997 were expected to be HLF 2.1 [ECU 0.96] billion the following year (OECD, 1997b, p.25). The small users’ tax was designed with special consideration given to distributional concerns, as will be discussed in Section 4.

4. Road fuel duty (UK). The United Kingdom government made a commitment in 1993, as part of its CO₂ reduction programme, to increase road fuel duties, then about 60% of the price of road fuels, by 5% per annum in real terms until further notice. This was increased to 6% p.a. by the new Labour Government in 1997. The increase for petrol in the 1998 budget amounted to 4.9p [ECU 0.066] per litre, or 22.2p [ECU 0.3] per gallon, when duty comprised about 80% of petrol’s retail price. The first evidence of an incentive effect appeared in 1995, with the overall demand for petrol and derv (diesel) falling by about 1% from the previous year, but over the subsequent 2 years it increased by 5.0% (CE, 1999, pp. 80, 82).

5. Waste-water charges (Var). Most OECD countries have charges for the treatment and disposal of either sewage or other water-carried effluents or both, with examples of both user charges and earmarked charges. Charges for sewage are normally based on water
usage and may or may not be related to volumes discharged; those on other effluents are more often based on actual measurements of pollution load. For example, both Belgium and Germany base their charges on a menu of different pollutants, weighted to derive general ‘pollution units’ (see Smith, 1995, pp. 26 for the German weights). While waste water charges are always used to cover associated treatment costs, Andersen (1994) found, in a detailed comparison of the systems of France, Germany and the Netherlands, which have charges related to pollution load or volume, and Denmark, which does not, that the charges can have significant incentive effects. This was most apparent in the Netherlands, for institutional reasons and because of the higher level of the charge.

6. Surplus manure tax (B, NL). Both Belgium and the Netherlands levy surplus manure charges on the basis of emissions of phosphorus and/or nitrogen in excess of environmentally acceptable maximum manure loads per hectare. Because it is surplus manure that is being taxed, this is a genuine pollution charge, in contrast to the fertiliser charges levied by Norway, Sweden and the USA, which are (input) product taxes and therefore belong in the products column.

7. Waste charges (Var). Practically all OECD countries levy user charges to cover the costs of the collection and disposal of waste. In the great majority of them the charge to households is unrelated to the quantity of waste, and therefore has no incentive effect. For firms, charging based on quantity is more common, but by no means universal, except where firms dispose of their own waste to landfill sites. More interesting from the point of view of environmental taxes are those cases where taxes are imposed on top of these user charges, as discussed next.

8. Landfill tax (UK). The UK landfill tax was introduced at £7 [ECU 9.5] per tonne for active waste and £2 [ECU 2.7] per tonne for inert waste in October 1996. As noted earlier, the £7 rate was motivated by a study of the externalities relating to landfilled waste (DOE, 1993), but this link with economic theory was broken when the tax rate for active waste was raised in the 1998 Budget to £10 [ECU 13.5] from April 1999. The charge is payable by operators of landfill sites, who may pay up to 20% of their due tax to specially sanctioned environmental trusts for the purposes of land remediation. The remaining tax revenues have been used to reduce employers’ National Insurance contributions. The tax is also part of the UK Government’s strategy of driving waste up the hierarchy of disposal options, away from landfill, although it remains to be seen whether it is high enough to do this. This tax therefore has elements of all three types of environmental tax.

9. Waste tax (DK). The Danish waste tax was introduced in 1986 at DKK 40 [ECU 5.4] per tonne, a level rather below the initial UK rate. However, by 1998 this had risen over sevenfold to DKK 335 [ECU 45] per tonne for landfill (DKK 260 [ECU 35] for incineration). This increase has not been related to any calculation of externalities. Rather the tax is used as an instrument of environmental policy to help achieve the goals set out in Denmark’s Waste Action Plan (MOE, 1992), which specifies target levels for reductions in landfill through recycling, reuse and waste reduction. These targets in turn do not derive from a cost-benefit analysis, but are the result of considerations of what is required to achieve sustainable development. The revenues from the Danish tax go into the general state budget. Since 1993 they have been used, as part of the green tax reform, to reduce direct taxation. Because the Danish waste charge was introduced in 1986, it is possible to assess its effectiveness in meeting its environmental goals. According to recent evaluation studies (Christensen, 1996; Andersen, 1998), waste delivered to landfill sites in Denmark fell by 26% between 1987 and 1996. Between 1985 and 1993 landfill fell from 39 to 26% of the waste stream, while recycling increased from 35 to 50% over the same
period (Christensen, 1996, pp. 5), and to 61% by 1995. Within this, the reuse of construction waste rose from 12 to 82%. While the other instruments in the Action Plan, including voluntary agreements and regulations, will undoubtedly have contributed to these results, the waste charge is likely also to have played a major role.

10. Waste tax (NL). The Dutch waste tax, introduced in 1995, is another of the Netherlands’ taxes with an environmental base. The charge rate in 1998 for combustible waste was HFL 64.2 [ECU 29.4] per tonne. Like the UK and Danish taxes, the tax is intended to reduce the amount of waste going to landfill. However, as with all the Dutch taxes with an environmental base, its principal purpose is revenue-raising.

11. Aircraft noise tax (Var). Belgium, France, Germany, Japan, the Netherlands, Norway, Portugal, Sweden and Switzerland all have a charge on aircraft noise. With the exceptions of Japan and Portugal, revenues from the tax are used for noise abatement. None of the charges has an incentive effect.

12. Batteries tax (DK, S). Both Denmark and Sweden levy a charge on batteries. The revenues are used to fund collection and/or recycling of old batteries. In Sweden the charge is also intended to contribute to the government’s objective of phasing out the use of lead and mercury entirely (OECD, 1996, pp. 25, 27).

13. Unleaded petrol tax differential (Var). Practically all OECD countries which still allow leaded petrol (Japan, Sweden and USA do not, nor will the UK from January 2000) have a tax differential between leaded and unleaded petrol. Although, as with all environmental taxes, it is difficult to disentangle the effects of taxes from other policy instruments that are introduced at the same time, the OECD (1997b, pp. 26) considers that ‘it is widely acknowledged that the tax was successful in accelerating the substitution of unleaded gasoline for leaded.’ As an example of this substitution, between 1986 and 1992 the share of unleaded petrol in Germany went from 11 to 88%. Many OECD countries also vary their car sales tax in accordance with some aspect of the vehicle’s environmental performance (for example, fuel efficiency in USA and Canada, emissions standards in Greece, Germany and several others).

14. Product taxes (Var). There is a wide variety of incentive taxes on different products in different countries, in addition to those already mentioned, including pesticides (Belgium, Denmark, Sweden), beverage containers (Belgium, Finland, Norway, Sweden), plastic bags (Denmark, Iceland) and certain packaging (Belgium, Denmark). The intention of such taxes in Belgium is purely incentive-based: by changing the relative prices of goods, in particular by increasing the prices of less environmentally desirable products in a situation where some more environmentally desirable substitutes exist, the tax is intended to bring about a shift away from less to more environmentally desirable consumption. It is acknowledged, hoped for even, that revenues from the taxes would be small because this would indicate that the desired incentive effect was working. Currently taxes have been imposed on all drink containers, throw-away cameras and razors, industrial packaging, batteries, some pesticides and phytopharmaceutical products and paper. It is too soon to judge the incentive effects of these taxes, although potential market sensitivities to them have been illustrated by a number of cases where producers have withdrawn goods from the market or otherwise modified their behaviour on the expressed intention of introduction of the tax, but before its implementation. The soft signalling effect of the discussions prior to implementation of the tax may be at least as important in the tax’s significance as the actual price discrimination.

15. Uranium tax (NL). The Dutch Government is introducing a tax on uranium in 1997 at the rate of HFL 31.95 [ECU 14.6] per gram as another of its taxes with an environmental base. This will mean that nuclear electricity will bear a similar tax to that generated by fossil fuels.
16. CFC tax (DK, US). Both Denmark and the United States tax ozone-depleting chemicals including CFCs. The incentive effects of the taxes are uncertain, because the products are under stringent, quantity-reducing restrictions from the Montreal Protocol. Indeed, two sources (OECD, 1994c,d) say that the purpose of the US tax was actually to capture some of the excess profits of companies due to the production cut-back (and consequent high CFC prices). However, it seems that the full extent of this cut-back was not anticipated in the projections of revenue from the tax, which were forecast to rise from US$ 890 [ECU 785] million in 1991 to US$ 1380 [ECU 1217] million in 1996 (OECD 1994d, pp. 114). In fact, 1991 revenues were US$ 886 [ECU 781] million, but those in 1992 were only US$ 580 [ECU 511] million (OECD, 1995, pp. 89). The US tax is interesting because it is also applied to imports containing or manufactured with CFCs. Such border tax adjustments are discussed below in the section on environmental taxes and competitiveness (Section 4).

17. Water supply charge (D, UK). Maintaining an adequate supply of water throughout the year is becoming increasingly problematic in a number of countries. Many countries levy charges for water supply. In Germany 90% of households pay a volumetric charge per m³ consumed. In the UK, by contrast, most households pay a charge that is unrelated to consumption. German household water consumption per head is thought to be 8–12% below that in the UK, and to have been broadly static for some time, whereas UK water demand grew by 16% from 1980–1991 (Smith, 1995, p.43)

18. Groundwater extraction charge (NL). Dutch provinces have levied a groundwater extraction charge since 1983. In 1995, as another tax with an environmental base, the central government levied a further tax on groundwater of HFL 0.34 [ECU 0.16]/m³ for water companies and HFL 0.17 [ECU 0.08]/m³ for other large companies. Revenues raised by the tax are estimated at HFL 310 [ECU 142] million for 1996.

19. Landfill charge (D). Germany is proposing to levy a waste charge on landfill at rates that are higher than the UK rate given under 8 above (DM 15 [ECU 7.7] for inert waste, DM 25–75 [ECU 12.9–38.6] for other, non-hazardous waste, with much higher hazardous waste charges, see Smith, 1995, pp. 60). While this tax is clearly intended, like the other landfill taxes already discussed, to reduce the quantity of waste going to landfill, Smith considers that the relatively high tax rate is because ‘the proposed charge is intended to raise the cost of disposal to reflect both the scarcity value of disposal space and the present and future environmental externalities involved in landfill disposal... (T)he “scarcity rent” argument for the German charge reflects the specific institutional rules and relationships in Germany which prevent appropriate charges being levied to cover landfill scarcity.’ (Smith, 1995, pp. 60, 61).

20. Traffic congestion charges (I, N). Probably the most important depletion of space, especially in cities, is caused by motor traffic and is reflected in congestion on the roads. The conventional economic solution to traffic congestion is road pricing, whereby road users pay a charge that is temporally varied according to congestion conditions during the day. Road pricing has been under active discussion and study for many years but, according to Button (1994, pp. 207–208), as yet ‘no form of what economists would strictly call road pricing has been introduced into any city in an OECD member country.’ However, there has been some relevant experience. In Norway the cities of Bergen, Trondheim and Oslo charge vehicles for entry to the urban area. The schemes are intended to be revenue-raising and despite fairly low tolls they have generated substantial revenues for the city authorities. The schemes have no time differentiation and they have had little incentive effect. Car traffic in Bergen declined by 6% in the first year (from a rising base) and that in the other cities fell by 5% at the outset, ‘but soon returned to its pre-toll growth trend’ (Button,
In Italy Milan has introduced a peak period area licensing scheme whereby ‘car owners must buy a permit to take their vehicles into the city, and it has been estimated that there has been a 50% reduction of traffic in the urban centre, with some 16% of trip makers delaying their travel, 36% parking outside of the control zone and 41% switching to public transport.’ (Button, 1994, pp. 210)

Minerals tax (DK). Denmark levies an excise duty on the extraction and export of sand, gravel, etc. at the rate of DKK 5 [ECU 0.7]/m³, raising DKK 20 [ECU 2.7] million in 1993. The Canadian province of Manitoba also levies a charge on quarry minerals of CNS 0.10 [ECU 0.064]/tonne (OECD, 1995, pp. 86–87). The effect of the taxes will be to reduce demand for the minerals concerned, but it is not clear whether this is their intention or whether they are really revenue-raising taxes or cost-covering charges.

This selection of environmental taxes illustrates most of the motivations and characteristics of those instruments that have been introduced in recent years, with the exception of the five carbon or carbon-energy taxes that have been so far introduced, which are discussed in Section 4. The rest of this section goes in some detail into the extent to which environmental taxes have been used explicitly as part of a green tax reform and then summarises the recent trends in the use of these instruments.

### 3.2. Towards green tax reform?

The possibility of new environmental taxes raising substantial revenues, which can then be used to reduce other taxes which are perceived as distorting or otherwise undesirable has led to increasing interest, as noted earlier, in the idea of a double dividend from environmental taxation: the achievement of both environmental benefits and gains in economic efficiency. The main motivation for trying to achieve these efficiency gains is usually the desire to reduce unemployment or, at least, reduce the tax burden on labour. This idea of using the introduction of environmental taxes to achieve a tax shift was behind the introduction of the taxes with an environmental base in the Netherlands and the tax reforms of several Nordic countries in the early 1990s. The idea was also endorsed by the UK Chancellor of the Exchequer in his 1994 Budget, when he stated: ‘Taxes can play an important role in protecting the environment… But I am determined not to impose additional costs on business overall… In brief, I want to raise tax on polluters to make further cuts in the tax on jobs.’ (Clarke, 1994, pp. 35). Chapter 10 of the Delors White Paper Growth, Competitiveness, Employment went even further: ‘If the double challenge of unemployment/environmental pollution is to be addressed, a swap can be envisaged between reducing labour costs through increased pollution charges.’ (EC, 1993, pp. 150)

Green, sometimes called Ecological, Tax Reform has thus come to mean a systematic shift of the tax burden away from labour and, perhaps, capital, and onto the use of environmental resources. In 1997 the OECD (1997b, pp. 35) reported that seven OECD countries had implemented such a tax shift to a varying extent: for example, Sweden shifted SEK 15 [ECU 1.75] billion in 1991; Denmark had shifted DKK 12.2 [ECU 1.6] by 1998; and Finland plans to shift FIM 5.6 [ECU 0.96] in a reform that started in 1997. Belgium, Denmark, the Netherlands, Norway, Sweden have investigated the idea of Green Tax Reform through special government commissions (OECD 1997b, pp. 25). The remits and preliminary work of these commissions were described in papers presented to the workshop on Environmental Taxes and Charges, organised in Dublin in February 1996 by the European Foundation for the Improvement of Living and Working Conditions (EF) and reported in EF (1996). All the countries concerned bring to their different commissions a lot of common experience, in terms of energy taxation, early experimentation with carbon taxes and a variety of other green taxes, and a long-standing commitment to environmental improvement and sustainable development. They had all arrived more or less simultaneously at a similar point, asking whether they had essentially done green taxes, or whether
A more fundamental approach to structural taxation reform could yield further economic and environmental benefits.

A basic question for all the commissions is whether the potential exists for these countries to push on with implementing green taxes more and more widely on a unilateral basis, or whether some wider EU action is now necessary to take the process forward. Denmark is one of the countries with the most experience of environmental taxation. Although there is no evidence that green taxes have damaged Danish competitiveness, the paper by Kristensen in EF (1996) expresses the view that ‘in view of the competition aspects, it is essential to the enterprises that the (European) Community is prepared to act as well.’ (Kristensen, 1996, pp. 134).

An Environmental Tax Commission was established by the Norwegian Government in 1990 and, as a result of its first series of recommendations in 1992, a number of green taxes were both proposed and introduced. Subsequently the Norwegian Green Tax Commission was set up in 1994 specifically to examine the opportunities to restructure the tax system to make the use of labour less costly, by replacing taxes on labour with green taxes, taxes on resource rents and with other taxes as appropriate. The Commission was also charged to identify all those subsidies that have an environmentally damaging effect.

From its simulations, using the substantial Norwegian modelling expertise in this area, the Commission concluded that the prognosis for a green tax reform, in which the revenues from green taxes are recycled by reducing payroll taxes, is good in both the short and medium term. By 2000 CO₂ emissions are down by 3.7% (6.0% by 2010), employment is up by 0.3% (0.7% in 2010), unemployment is down by 0.2% (0.3% by 2010), consumer prices are down by 0.6% (1.2% by 2010) and output is down by 0.1% (but up by 0.2% by 2010) (Moe, 1996, Table 3, pp. 185). The emission reduction is significant. The other numbers are small but, by 2010 at least, all economically positive. The Commission considers it plausible that, in a situation of unemployment, green tax reform will yield ‘positive effects on both overall employment and environment in a medium-term perspective (5–15 years)’ (Moe, 1996, pp. 186).

As with the Norwegian Green Tax Commission, the Dutch Green Commission was established out of substantial experience with environmental taxes, most importantly the five taxes with an environmental base discussed in Section 3. In 1996 revenues from these taxes were HFL 2.8 billion, or 1.8% of tax revenues, and were expected to rise to 2.5% by 1998 (Leder, 1996, pp. 160). The revenue-raising basis of all these taxes, except the small energy users’ tax, with the revenues going to the general budget, is a conscious attempt to shift the base of general taxation, albeit slightly, towards the use of environmental resources. The Commission was set up in 1995 to discuss how to make further progress in this area. Its first report concentrated on the fiscal treatment of transport and advocated giving further encouragement to public transport and cycling. The second report focused on further opportunities for shifting taxation from labour onto use of the environment (with energy taxation remaining the basis of any such tax shift), and on the opportunities for encouragement of environmental investment.

Sweden’s Green Tax Commission was also set up in 1995 and, again, has the issue of a green tax shift as its central agenda item, envisaging a possible marriage between two areas of tax policy: environment and employment. In this context it is undertaking several special projects, including analysis of the development of energy and environmental taxes, the functioning of the labour market and investigations into possible impacts on competitiveness and income distribution.

A series of similar concerns is under investigation in Denmark, which is seeking ways of building on the tax reform it enacted in 1993/94. This reform increased the energy tax rate on households. On the grounds of economic efficiency, the 1996 Energy Package increased the CO₂ and energy tax rates on Danish industry, with recycling of the revenues back to industry, via reductions of social security contributions, to limit effects on competitiveness. Modelling of the Danish Energy Package came up with results that are very similar to Norwegian modelling of its possible green tax reform: by 2005 CO₂ emissions are down by 5%, employment is up by 0.1%, GDP is up by 0.1%.
Table 3
Employment benefits from green tax reform in Europe

<table>
<thead>
<tr>
<th>Study</th>
<th>Region</th>
<th>Scenario</th>
<th>Employment dividend</th>
</tr>
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<tbody>
<tr>
<td>Quest 1992</td>
<td>EU-12</td>
<td>Carbon/energy tax with 10% reduction in employers’ SSC(^b)</td>
<td>1.0% increase after 7 years</td>
</tr>
<tr>
<td>Quest 1992</td>
<td>EU-12</td>
<td>Target reduction(^c)</td>
<td>3.0% increase after 7 years</td>
</tr>
<tr>
<td>Hermes 1992</td>
<td>EU-6</td>
<td>As for row 1</td>
<td>0.64% increase</td>
</tr>
<tr>
<td>DRI 1994</td>
<td>EU-12</td>
<td>Environmental taxes recycled via employers’ non-wage labour costs</td>
<td>2.2 million jobs by 2010</td>
</tr>
<tr>
<td>MDM 1996</td>
<td>UK</td>
<td>Carbon/energy tax with reduced NIC(^d)</td>
<td>2.0% increase by 2005</td>
</tr>
</tbody>
</table>

\(^a\) Source, Barker (1996), pp. 236.
\(^b\) SSC, social security contributions.
\(^c\) The reduction of SSC was targeted on the low paid.
\(^d\) NIC, National Insurance Contributions.

Again the environmental benefit is significant while the macroeconomic changes are small but positive.

It may be noted that these employment results of green tax reform are very similar to those of a number of other European modelling exercises presented in Barker (1996, pp. 236) and reproduced in Table 3. Of course, these results are not conclusive. Moreover, they would be very difficult, if not impossible, to refute or confirm after the tax shift had been introduced because levels of employment and unemployment are subject to so many influences. But the possibility of a significant gain in employment, as well as in terms of environmental sustainability, in a Europe in which unemployment and environmental degradation are two of the most pressing acknowledged problems, makes green tax reform a policy option that is hard to ignore.

3.3. Trends in the introduction of environmental taxes and charges

The OECD’s first review of the use of environmental economic instruments in member countries (OECD, 1989) identified about 150 instruments in use in 1987, or 100 if subsidies, purely administrative charges and liability are excluded (OECD, 1994c, pp. 22). However, the significance of these instruments was not very great. Only about a third may have had some incentive impact and the OECD (1994c) review concluded: ‘Basically, then, in 1987 environmental policies in the OECD Member countries were command-and-control policies with some financial and economic add-ons.’ (pp. 177).

By 1994 the number of instruments had increased by over 50%, with the most growth in product charges and deposit-refund systems (the latter of which are outside the scope of this report). Moreover, five countries (those in Table 4) had introduced carbon or carbon-energy taxes (discussed in Cansier and Krumm (1997), pp. 65–68), four countries had conducted a limited green tax reform (Denmark, the Netherlands, Norway and Sweden), eight had set up official task-forces or commissions to explore further opportunities for such reform, or for implementing environmental taxes in general, and a further six had announced an intention to make an increased use of economic instruments in environmental policy. In 1997 Finland implemented a green tax reform. Italy did so in 1999, with half the revenues from its new carbon tax going to reduce labour taxes (ENDS, 1999). Germany also implemented a green tax reform in 1999.

Thus it is clear that, at the national level in OECD countries, economic instruments in general and environmental taxes in particular, are commanding greater attention than they were 8 or 9 years ago. Given that the factors identified at the beginning of this section that stimulated new consideration of environmental taxes in the first place are as relevant now as they were then, if not more
Table 4
Percentages of taxes/excises, including energy taxes, with environmental implications^a

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<tbody>
<tr>
<td>Energy taxes (% of total tax revenue)</td>
<td>3.94</td>
<td>4.13</td>
<td>4.92</td>
<td>4.27</td>
<td>2.25</td>
<td>3.0</td>
<td>5.71</td>
<td>7.62</td>
<td>3.83</td>
<td>5.39</td>
</tr>
<tr>
<td>Energy taxes (% of environmental tax revenue)</td>
<td>53</td>
<td>57</td>
<td>68</td>
<td>79</td>
<td>52</td>
<td>49</td>
<td>66</td>
<td>71</td>
<td>73</td>
<td>85</td>
</tr>
<tr>
<td>Environmental taxes (% of total tax revenue)</td>
<td>7.5</td>
<td>7.3</td>
<td>7.21</td>
<td>5.4</td>
<td>4.34</td>
<td>6.12</td>
<td>8.64</td>
<td>10.75</td>
<td>5.27</td>
<td>6.34</td>
</tr>
<tr>
<td>Environmental taxes (% of GNP)</td>
<td>3.41</td>
<td>3.65</td>
<td>2.66</td>
<td>2.47</td>
<td>1.94</td>
<td>2.94</td>
<td>4.07</td>
<td>4.92</td>
<td>2.57</td>
<td>3.17</td>
</tr>
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</table>

so, one may expect this attention to continue to increase.

The other development since 1989, which has significantly retarded the pace of introduction of environmental taxation, and limited the prospects for green tax reform, is the failure of the US government to introduce its proposed BTU tax in 1994, and of the European Commission to win acceptance for its EU-wide carbon-energy tax proposed in 1991. The European Commission’s most recent proposal, in March 1997, is for a harmonised minimum excise duty on energy products across the EU. While still under discussion, the proposal cannot be implemented without the unanimous agreement of EU member states, which still looks unlikely to be achieved.

Apart from energy taxes, environmental taxes do not tend to raise much revenue. Table 4 shows that, even in those countries that employ environmental taxes most extensively, environmental taxes still only raise a small proportion of overall tax revenues, and that the majority of environmental tax revenues usually come from energy taxes. Moreover, despite the increased interest in environmental taxes since 1980, revenues from both energy taxes and environmental taxes as a proportion of total tax revenues have increased little in these countries, if at all.

For reasons of competitiveness, it is very difficult for individual countries to increase, through taxation, the price of an input as industrially important as energy. The failure to achieve a minimum level of harmonisation of energy taxes across Europe, and to introduce broad energy taxes in the US, which is the OECD’s largest economy and has its lowest energy prices, is undoubtedly a major reason why green tax reforms to date have been limited.

4. Implementing environmental taxes: major issues

4.1. Environmental taxes and competitiveness

Competitiveness at the level of the firm is the ability of a firm to sell its goods in a competitive market. If the firm’s activities make intensive use of an environmental resource, for example, use a lot of energy, then imposing a tax on that use of the environment may increase the firm’s costs substantially. In this case, either the prices of the firm’s goods will rise, or its profits will decrease, or both. The firm’s competitiveness will decline.

If the environmental tax is imposed nationally in a small, open economy (as EU economies generally are), then the whole sector in that economy which makes intensive use of the taxed environmental resource may experience a decline in competitiveness. Demand for that sector’s good may fall, exports from it decreasing and imports increasing. Workers may lose their jobs. Some firms may go out of business. Adjustments will take place. Workers will move into other sectors. The country’s exchange rate may depreciate, improving the competitiveness of other exporting sectors, but also raising the price of imports and causing inflation. Adjustment costs incurred by the affected firms and workers, and by the social security system, may be substantial. Where the sector concerned is economically important, politicians are likely to be sensitive to these effects. This is the issue that has become the single most important debating point concerning the introduction of environmental taxes, and especially carbon or energy taxes.

With regard to experience of past environmental taxes and regulation, the record is relatively conclusive and has been summarised by the OECD thus: ‘The trade and investment impacts which have been measured empirically are almost negligible.’ (OECD, 1996, pp. 45). However, this is not necessarily going to be the case in future. Firstly, the environmental instruments applied so far have been relatively modest compared to those sometimes considered necessary to move towards environmental sustainability. Secondly, the instruments have not predominantly been in the form of green taxes. These may impose higher costs on seriously affected sectors because the firms concerned will pay for abatement (up to the level of the tax) and for residual emissions (although these payments should be regarded as transfers through the tax system rather than macroeconomic costs as such). Modellers of the imposition of carbon taxes have produced widely differing results for their impacts on trade and competitiveness, rang-
ing from small and positive to substantially negative.

Possible competitiveness effects are important not only because of their economic implications. Were they to lead to the relocation of production, with its associated environmental impacts, they could also mitigate the environmental effectiveness of a tax. Of course, if the taxed environmental effect is purely local, then the country levying the tax and losing the business through relocation will experience local environmental improvement (and the country to which the activity is relocated will experience environmental deterioration). But if the environmental effect is global (e.g. climate change from CO₂ emissions), such that it is independent of where emissions take place, then the leakage of emissions from one country to another may mean that there is no environmental gain from the tax at all.

Attempting to mitigate or compensate for competitiveness effects can distort or reduce the effectiveness of environmental policy in at least three ways:

1. For economic efficiency all emitters of a taxed emission should face the same tax rate. Yet, because of fears about competitiveness, the tax rate on high emission sectors can be well below that on smaller emission sectors or households. This means in turn that, in order to achieve a certain emission reduction, the tax rate on lower emission sectors and households is higher than it would otherwise need to be, which introduces further inefficiency. For example, when Sweden restructured its CO₂ tax in 1992, and reduced it substantially on industry and commercial horticulture, it raised it from SEK 250 to SEK 320 per tonne CO₂ for other users in order to make up for the fall in revenue (OECD, 1994d, pp. 95). The spread of the CO₂ tax was then SEK 80 (for industry and horticulture) to SEK 320 for everyone else. This is a source of economic inefficiency. The inefficiency was reduced somewhat when, in 1996, the tax rate was raised to SEK 370 [ECU 43] per tonne CO₂, with industry and horticulture receiving only a 50%, rather than a 75% reduction. The issue of exemptions from environmental taxes is explored in more detail in Ekins and Speck (1999).

2. An environmental tax should be levied as close to the actual environmental effect as possible. For CO₂ emissions the most convenient and efficient tax base is the primary fuel source. Because different fossil fuels have different carbon intensities, a tax on these fuels based on their carbon intensity will encourage switching towards low carbon fuels. Such an effect may be particularly important with regard to reducing carbon emissions from electricity generation because electricity can be generated using all the fossil, as well as some non-fossil, fuels. Yet Finland, which initially taxed the fuel inputs into electricity according to their carbon content, has decided to tax electricity directly because its system of taxing imports of electricity at some average level based on its domestic taxation, in order to neutralise the competitiveness effects, does not conform to EU trade regulations, which stipulate that there may be no difference between taxes on domestic and imported like products. This is an example of free trade rules acting against environmental policy efficiency.

3. A core component of the rationale for environmental taxes is that, by bearing most heavily on the most environmentally intensive sectors, and therefore raising the prices of those sectors’ products, they encourage structural change in the economy away from those sectors. By taxing high energy, and therefore high CO₂ emitting, sectors less heavily, or by reimbursing tax revenues, this incentive for structural change is reduced.

There are two means of mitigating competitiveness effects apart from exempting environmentally intensive industries. One is through border tax adjustments, whereby environmental tariffs ensure that imports pay a similar level of tax to domestic industries, thereby neutralising any competitiveness effects in the domestic market, while export rebates ensure that taxed domestic industries’ ability to compete abroad is unimpaired. But there are two problems with border tax adjustments. Firstly, it is very difficult to calculate what the environmentally appropriate tariffs on imports should be, especially when the environmental tax base is an industrial input, such as energy,
rather than a final product. There are fears that such tariffs would be abused for economic protectionist, rather than environmental protection, purposes. Secondly, border tax adjustments may run counter to international trade rules (designed to prevent protectionism), especially where, because of a focus on industrial inputs or processes, they end up treating domestic and foreign like products differently. As mentioned earlier, however, the US tax on CFCs is levied on imports on the basis of calculations of CFCs used in the imports' manufacture, as well as content, and the US has yet to be challenged on the compatibility of this tax with World Trade Organisation rules. However, CFCs may be a special case both because they are the subject of a widely supported multilateral environmental agreement, and because they are due to be phased out rapidly anyway. It is likely that import tariffs based on imputed carbon or energy content would not be so readily accepted.

The second means of mitigating competitiveness effects is through the international harmonisation of environmental taxation. This is the theoretically ideal solution. It was promoted by the European Commission with regard to its carbon-energy tax proposal in 1991, and is supported by a number of EU countries. The argument against it, based on the principles of sovereignty and subsidiarity, is that countries have a right to determine their own taxes. Failure to reach unanimous agreement in the EU on this issue has left the EC proposal unimplemented, but even if it had been agreed at the European level, there would have been concerns about competitiveness at the OECD and global levels. The international harmonisation of environmental taxes, if it proceeds at all, will clearly be a long and difficult process.

Despite the undoubted importance of competitiveness issues for a few, predominantly highly energy intensive sectors, these issues are often exaggerated with regard to environmental taxation. Firstly, if the tax revenues are redistributed to industry, either directly (as with the Swedish NO\textsubscript{X} charges), or through the reduction of other taxes on business (as with the UK landfill tax), business, and a country, as a whole need suffer no loss of competitiveness at all, because environmentally intensive sectors' loss of competitiveness will be balanced by a gain in competitiveness in other sectors. Secondly, some business writers, such as De Andraca and McReady of the Business Council for Sustainable Development, emphasise the competitive benefits to be gained by innovation and eco-efficiency induced by stringent regulations and high prices of environmental resources. They state bluntly: 'Concerns about pollution havens, free riders or an exodus of capital and jobs from countries with tough standards are unsubstantiated' (De Andraca and McCready, 1994, pp. 70). On this view, if environmental taxes are imposed gradually in a pre-announced way, they could actually foster competitiveness by encouraging the development of the resource-efficient products and processes that will be in increasing demand as perceptions of the need to move towards sustainable development intensify.

It is not possible to come to any general judgement at present as to how much weight to give to continuing business worries about the effects of environmental taxation on competitiveness. If fears about environmental degradation (and, specifically with regard to carbon-energy taxation, about global warming) prove to be exaggerated, then industrialists' caution may prove justified. If, on the other hand, environmental concerns increase and compel governments to take more stringent measures, including the imposition of environmental taxes, then those companies and countries which have already fostered a culture of eco-efficiency and an innovative approach to environmental problems are likely to be well placed to profit from the market opportunities that will then be offered. If the coming age is one of ecological scarcity, then political and corporate leadership in the efficient use of resources and the achievement of environmental quality are likely to pay dividends in terms of reputation, influence and business success.

4.2. Environmental taxes and distribution

Environmental taxes, like practically any other policy, will impose different costs and benefits on different groups of people. Indeed, the concerns
with competitiveness discussed above arise because of the uneven impact of environmental taxes, falling relatively heavily on environmentally intensive sectors. As was seen, although the impact of the tax on business may be neutral overall, especially if the revenues taken from business are recycled to it in some way, and some sectors may benefit from the policy, there will also be losing sectors. Where the losing sectors are economically or politically significant, these distributional results of the tax may increase the difficulty of introducing it.

Another group that is potentially vulnerable to environmental taxes is low income consumers and households. This is because some environmentally sensitive goods, such as energy or water, may be relatively more important in the expenditure or consumption of low income groups than of richer groups. Studies such as Pearson and Smith (1991) have shown that the EC carbon-energy tax could be regressive (interestingly this study showed regressive effects only in Ireland and the UK; in France, Germany, Italy, the Netherlands and Spain the proportion of carbon tax payments to household total expenditures is hardly related to income, if at all (Pearson and Smith 1991, Figure 5.2, pp. 43).

As with issues of competitiveness, these possible distributional effects on low income groups warrant serious political attention when environmental taxes are being designed, if public support for the taxes is to be secured. The inability of the British government in 1994 to raise VAT on domestic fuel from 8 to 17\% was at least partly due to concerns about the impact of this tax increase on the poor. In retrospect, a more gradual imposition of the tax, together with measures to offset the regressivity of the tax announced at the same time as its imposition, might have made the tax easier to introduce.

Two brief general points about these distributional concerns may be made. The first, relatively obvious but sometimes overlooked, is that with any tax that raises revenue from both the better and the less well-off, it is always possible to fully compensate the latter from the revenue raised. The second is that an effective compensation scheme may be complex and not easy to design in order to avoid distorting secondary effects. An example of such distortions, where the compensation is effected through the social security system, may be a reduction in the difference between low wages and the benefit level, reducing the employment incentive or, equivalently, increasing the marginal tax rate for low-income jobs.

One way of mitigating regressive distributional effects is to have a tax-free threshold for essential use of the taxed product. Another is to introduce the tax progressively, with higher taxation on successive blocks of consumption. An example of the latter is the water tax at Setúbal in Portugal, which has a progressive scale for charging households for both water consumption and waste-water treatment. For a monthly water consumption of 25 m$^3$, the first 5 m$^3$ are charged at ESC 67.5 [ECU 0.34] per m$^3$, the next 10 m$^3$ at ESC 102.5 [ECU 0.52] per m$^3$, and the next 10 at ESC 162.5 [ECU 0.83] per m$^3$ (EF, 1996). Such a progressive scale clearly prevents charges bearing too heavily on the essential use of water.

The Dutch small energy users’ tax (see (3) in Section 3, Table 2), introduced in 1996, was designed with special consideration given to distributional concerns. Revenues are recycled separately to businesses and households, corresponding to their respective tax payments. For businesses the recycling is mainly effected through a reduction in employers’ non-wage labour costs. For households, a tax-free threshold of energy use has been introduced which avoids a regressive burden on low-income households. In addition, households get income tax relief such that an average energy user in each of four income groups will be made no worse off from the tax (higher and lower than average energy users in each group will be worse and better off, respectively). It is likely that this transparent and specific revenue-neutrality, with regard to particular groups as well as overall, contributed substantially to the tax’s acceptability in the Netherlands. It is also the major component in the government’s attempt to win social consensus on the tax, and in particular to persuade employees not to claim further compensation for it in their wages than is already in the recycling package. Any such double compensation would, of course, have negative
macroeconomic effects, risking a wage-price spiral, and abort any potential employment benefits from the change in the relative prices of energy and labour facing low energy using businesses.

5. Conclusions

The 1990s have seen green taxes firmly established on the public policy agenda. Recommendations for the internalisation of externalities or the use of market-based instruments for economic efficiency, which languished for many years as arcane concerns of academic environmental economists, are now the established concern of Ministries of Finance and the Environment, as has been seen. It is a development that results in a richer, more balanced approach to environmental policy that is likely also to be more cost-effective. This discovery of economic instruments for the environment seems to have been driven by an increasing awareness of the power and potential of markets, and of the limited performance of conventional environmental regulations, combined with the need of governments to find new, or different, sources of revenue.

The experimental phase in the imposition of environmental taxes and charges is by no means over. While a few countries now have substantial experience in all kinds of green taxation—cost-covering charges, incentive-taxation, revenue-raising taxation—most still have considerable scope for adapting these to their own national circumstances. Such adaptation appears to be crucial for the successful application of these taxes. The various national experiences show that there is no one successful model. Rather the principles of green taxation are implemented, and widely modified, in accordance with national priorities and perspectives.

While business-environment bodies have been generally welcoming to the shift in environmental policy that a greater use of economic instruments represents, this welcome has been cautious and has been extended on two clear conditions. First, the introduction of economic instruments must not increase business’ overall burden of taxation. This condition can, in principle, always be met, although it may be expected that governments, especially when in difficult budgetary circumstances, will wish to retain the option of introducing environmental taxes as new sources of revenue.

The second condition is that environmental taxes do not worsen business competitiveness. For business as a whole, this condition would be met by fulfilment of the first condition, whereby businesses with lower environmental impact would gain at the expense of those with a higher environmental impact. For the latter sectors, however, there is the clear prospect of losses from environmental taxes, especially where the tax falls on an input, such as energy, which comprises a significant proportion of a sector’s costs.

It must be remembered that this impact on environmentally intensive sectors is part of the fundamental purpose of environmental taxation, both to encourage the sectors to make more efficient use of environmental resources and to introduce new, less environmentally intensive products and processes, and to encourage consumers to shift away from these sectors to less environmentally damaging products. The effect on producers can in principle be achieved through voluntary agreements, and there are a number of countries where these have been substituted for environmental taxes to mitigate competitiveness effects in vulnerable sectors. But exempting environmentally intensive sectors from environmental taxes blunts the effectiveness of the taxation from a consumer point of view, and slows down the changes in consumption, and therefore production, patterns that are widely considered necessary if a process of sustainable development is to be achieved.

The Western European experience of green taxation could now develop in one of several different directions. Several countries clearly desire to push ahead with more ambitious schemes of green tax reform, but what they are likely to enact unilaterally is bound to be constrained by concerns about national competitiveness and distortions in the EU single market. However, if the EU were to introduce minimum energy taxes and a carbon/energy tax along the lines of the European Commission’s 1991 proposal, as a majority of EU
countries seem to desire, a further range of opportunities for unilateral innovation and experimentation would open up, and some of the more ambitious schemes for green tax reform might start to be implemented.

But it is still not clear whether and how such a common introduction of taxes at the European level will come about. For the present, it only seems certain that governments will continue to introduce environmental taxation bit by bit, attracted by the combination that such taxation seems to offer of cost-effective environmental policy and a source of government revenue, which can possibly be used to make some inroads into unemployment.

Acknowledgements

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Appendix A. ECU exchange rates used in the conversion of national currencies

<table>
<thead>
<tr>
<th>Country</th>
<th>Exchange rate 1997</th>
<th>1 ECU corresponds to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>OS 13.688</td>
<td>ESC 195.850</td>
</tr>
<tr>
<td>Belgium</td>
<td>BFR 40.079</td>
<td>PTA 163.924</td>
</tr>
<tr>
<td>Canada</td>
<td>CNS 1.570</td>
<td>SFR 8.586</td>
</tr>
<tr>
<td>Denmark</td>
<td>DKR 7.442</td>
<td>SF 1.686</td>
</tr>
<tr>
<td>Finland</td>
<td>FMK 5.813</td>
<td>UKL 0.740</td>
</tr>
<tr>
<td>France</td>
<td>FF 6.562</td>
<td>US$ 1.134</td>
</tr>
<tr>
<td>Germany</td>
<td>DM 1.945</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td>DRA 309.475</td>
<td></td>
</tr>
<tr>
<td>Ireland</td>
<td>IRL 0.747</td>
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</tr>
<tr>
<td>Italy</td>
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<tr>
<td>Luxembourg</td>
<td>LFR 40.079</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td>HFL 2.183</td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>NKR 7.8002</td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>ESC 195.850</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>PTA 163.924</td>
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<tr>
<td>Sweden</td>
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<td>UK</td>
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<tr>
<td>USA</td>
<td>US$ 1.134</td>
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References

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