

Unclassified

ECO/WKP(2001)4



Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

26-Jan-2001

English text only

ECONOMICS DEPARTMENT

ECO/WKP(2001)4
Unclassified

ENCOURAGING ENVIRONMENTALLY SUSTAINABLE GROWTH IN THE UNITED STATES

ECONOMICS DEPARTMENT WORKING PAPERS No. 278

by
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ABSTRACT/RÉSUMÉ

This paper analyses aspects of US environmental policy, including, among others, policy on air and water quality, water supply in certain areas, climate change and greenhouse gas emissions. Particular attention is paid to certain policies in agriculture and road transport, sectors with an important influence on the environment, as well as to the use of cost-benefit analysis (and in some cases specific prohibitions on its use) and the role of the courts in designing and implementing policy. While “command and control” style regulations have produced significant improvements in environmental standards since the 1970s, increasing attention has been paid to the use of economic incentives - permit trading arrangements have been preferred to environmental taxes - and more flexibility in some regulatory policies. These trends towards more cost-effective policies should be extended to such areas as fuel economy, where increased fuel taxes would be more cost-effective than the “CAFE” standards, and water supply, where increased use of pricing and removal of impediments to water trading would improve the efficiency with which water- especially for irrigation - is used. The overall efficiency of policy would benefit from a rationalisation of the treatment and status of cost-benefit analysis in different policy areas.

JEL Classification: H23, Q00, Q20, Q28, Q40, Q48

Keywords: US, sustainable development, environmental policy.

Ce document analyse quelques aspects de la politique environnementale des Etats-Unis, concernant en particulier la qualité de l'air et de l'eau, la gestion de l'offre de l'eau dans certaines régions, le changement climatique et les émissions de gaz à effet de serre. Une attention particulière est portée sur certaines politiques dans les secteurs de l'agriculture et du transport routier, qui ont une influence importante sur l'environnement, ainsi que sur l'utilisation de l'analyse coût-bénéfice (ou dans certains cas son interdiction) et le rôle des cours de justice dans le développement et la mise en oeuvre des politiques. Tandis que les politiques de type "obligations et réglementations" ont permis une amélioration notable des standards environnementaux depuis les années 70, On a porté une attention croissante à l'utilisation d'incitations économiques - des marchés de permis plutôt que des taxes-, et à l'introduction de plus de flexibilité dans certaines réglementations. Ces tendances vers des politiques d'une plus grande efficacité-coût devraient être étendues aux domaines tels que les économies de carburants, où une augmentation des taxes sur l'essence serait plus efficace en termes de coût que les standards "CAFE", ainsi que la gestion de l'offre d'eau, où l'utilisation accrue de mécanismes de prix et le retrait des obstacles à l'échange des droits d'utilisation de l'eau améliorerait l'efficacité de son utilisation (en particulier pour l'irrigation). Rationaliser le traitement et le statut de l'analyse coût-bénéfice dans les différents domaines d'intervention améliorerait l'efficacité globale de la politique.

Classification JEL : H23, Q00, Q20, Q28, Q40, Q48.

Mots clés : Etats-Unis, développement durable, politique environnementale.

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ENCOURAGING ENVIRONMENTALLY SUSTAINABLE GROWTH IN THE UNITED STATES¹

Paul O'Brien²

1. The extent to which the world's advanced and developing economies alike have been progressing in a narrow material fashion at the cost of drawing on finite natural assets and damaging their ecologies is a subject of both popular and professional debate. The question of whether expectations of ever-increasing affluence can be met without irreversible environmental deterioration can be set against a belief that increasing incomes and wealth provide the wherewithal to pay for better environmental outcomes. Whether economic development is sustainable in both environmental and other social dimensions has become a focus of increasing attention in recent years, both in the United States and in the OECD more generally.³ In the United States a "President's Council on Sustainable Development" was set up in 1993; its recommendations were published in 1996 and were further developed in its report in 1999 (President's Council for Sustainable Development, 1999).

2. Sustainable development covers a very wide range of issues that cannot all be dealt with here. This paper limits discussion to a number of environmental and natural resource issues, highlighting their links with economic activity and economic policies, in particular investigating how well the implementation of environmental and economic policies are integrated so as to take account of externalities and spillovers between them. After presenting some background to the evolution of US environmental policy and the institutions charged with developing and implementing it, the paper outlines some of the most important current policy problems. Looking at how they are being tackled, the analysis will focus first on certain particular environmental or natural resource issues, then on the use of certain types of policy instruments, and finally on some specific economic sectors. A separate section discusses the role of cost-benefit analysis in the design and operation of environmental policy.

1. This paper was originally produced for the OECD Economic Survey of the US, which was published in May 2000 under the authority of the Economic Development Review Committee. OECD Economics Department Working papers on the same subject have been published for Norway, Finland, Germany and Denmark, and are forthcoming for a number of other countries.

2. Paul O'Brien is an economist in the Economics Department of the OECD. The author would like to thank Ann Vourc'h for ideas and advice and Annick Lotrous, Lili Kee and Veronica Humi for their technical support.

3. While there is a considerable degree of agreement on the kinds of indicators that are relevant in assessing sustainable development, there is no consensus on the quantitative comparison of indicators in different areas, economic versus social, for example. See U.S. Interagency Working Group on Sustainable Development (1998) for a qualitative assessment of a range of different indicators. While most "economic" indicators represented in that report were judged to be developing favourably, of 16 selected environmental indicators, six were judged to be developing unfavourably (most prominently those related to climate change), five (including urban air and surface water quality) favourably, while five were uncertain. See also OECD (2000a).

1. Environmental policy in historical perspective

3. A number of spectacular incidents in the late 1960s brought environmental problems to the attention of both policymakers and a much wider public than previously.⁴ The creation of the President's Council for Environmental Quality (CEQ) in 1969 and of the Environmental Protection Agency (EPA) in 1970 followed on from this. The Clean Air Act (1970) and the Clean Water Act (1972) were the first major pieces of comprehensive federal environmental legislation.⁵ The 1969 National Environmental Policy Act brought in a requirement for federal agencies to prepare an Environmental Impact Statement for any major federal action likely to have a significant impact on the environment; this did not, however, require an assessment of the costs of this impact.

4. The consideration of cost has been the source of some tension throughout the subsequent period. The legislation of the 1970s did not generally require proposed environmental regulations or action to pass any cost-benefit test although some legislation did specify cost, feasibility and cost-effectiveness in setting standards.⁶ According to Portney (1998), while legislation did not explicitly rule out the use of cost considerations, court cases have established the principle that unless such considerations are explicitly required, they are not allowed. Also, as in all other countries, the instruments used to implement policies were of the "command and control" type, where standards were set and "best available" technologies mandated without formal analysis of whether they entailed the most efficient use of resources.

5. Although concern with the costs of environmental policy was never completely absent, the environmental improvements that resulted from this wave of legislation were generally felt to be so substantial that their benefits exceeded the costs by a wide margin, even if the costs of the gains achieved could nevertheless have been lower. During the 1980s, concern with the possible costs of regulation (not only in the environmental arena) grew; the implementation of Regulatory Impact Assessments⁷ under which the costs and benefits of major proposed regulations must be assessed before they are introduced - is a response to this.

6. The setting-up of the Environmental Protection Agency (EPA) might have been expected to lead to a concentration of responsibility for all, or at least most, environmental issues in that agency. This did not occur, however, although the EPA does have responsibility for the major clean air, clean water and toxic waste programmes. Some sectoral agencies have responsibility for environmental issues relating to that sector or their own facilities, notably the Departments of Agriculture, Energy and Transportation. The Interior Department is charged with handling most conservation and natural resource management issues; it contains, for example, the Fish and Wildlife Service, although the National Oceanic and Atmospheric Administration of the Department of Commerce covers maritime fisheries.⁸

4. See Portney (1998) for a brief discussion of the influence of these incidents. The discussion in this section draws heavily on Portney (1998) and OECD (1996).

5. Others include: the Endangered Species Act (1973), the Safe Drinking Water Act (1974), the Resource Conservation and Recovery Act (1976), the Comprehensive Environmental Response Compensation and Liability Act ("Superfund", 1980). See OECD (1996, pp. 32-34) for a comprehensive list.

6. The Toxic Substances Control Act and the Federal Insecticide Fungicide and Rodenticide Act, for example.

7. Their origin can be traced back at least to 1978 or earlier, but Executive Orders 12291 of 1981 and 12866 of 1993 defined them in their present form. OECD (1999c) discusses Regulatory Impact Assessments in some detail.

8. OECD (1996, pp. 27-31) has more details.

7. In addition to federal legislation and agencies, individual States can set their own standards for many media. They are responsible for ensuring compliance with federal or local air quality standards, for example, following a State Implementation Plan that must be approved by the EPA. The enthusiasm with which compliance is enforced varies from state to state.

8. Although the CEQ exists to give the President advice on the general direction of environmental policy and often has a co-ordinating role in policy development, it is not an agency for co-ordinating the implementation of environmental policy with that of other programmes. This role falls to the Office of Management and Budget (OMB).⁹ A pilot programme of risk management budgeting (planned under the Bush administration for the 1992 budget) intended to direct resources to lower cost rather than high cost programmes was not implemented in subsequent years by the succeeding Clinton administration.

9. Quite apart from these government agencies in the executive branch, non-governmental organisations also play an important role. On the one hand, a variety of non-profit organisations engage in activities ranging from pressing for particular policies to disseminating information and undertaking research. On the other hand, the courts are involved in a large part of the policy implementation process on both sides: there are challenges to government environmental standards or actions that must be adjudicated, at the same time as environmental groups take legal action to force government agencies to take more vigorous regulatory and enforcement measures. In practice, the courts often play an important role, setting constraints on the EPA's interpretation of the Clean Air Act, for example, as well as having an important influence on its regulatory and enforcement priorities. The potential influence of the courts can be important also in the interpretation of legislation¹⁰ and may also affect the design of regulations – the need to reduce the possibility of ambiguity that court actions could expose may lead regulatory agencies to favour simple schemes over potentially more cost-effective schemes to reduce the possibility of disruptive litigation.¹¹

2. A brief overview of some major current environmental issues

10. The United States has examples of most kinds of environmental and natural resource problems. The OECD *Environmental Performance Review* of the United States (OECD, 1996) provided a comprehensive overview of most such problems, which vary enormously by region. The present paper focuses on:

- the economic and policy issues arising from particular environmental issues, specifically air and water pollution and global warming;¹²
- certain specific industries, agriculture and road transport; and

9. 1992 Budget documentation showed that the amount spent to save a “statistical life” under different regulatory programmes ranged from under \$100 000 to over \$20 000 000 (1992 prices).

10. In the case of interpretation see, for example, Melnick (1983, p. 113 *et seq.*) for a discussion of the courts' role in the development of the Clean Air Act.

11. In another aspect of this issue, high legal costs under the “Superfund” and toxic waste legislation may be partly attributable to the fact that whereas much legislation specifies the Washington D.C. circuit court of appeals as having jurisdiction over regulatory challenges in the first instance, this legislation increases the potential for long series of actions and appeals by allowing plaintiffs the possibility of taking action in state courts.

12. The choice of issues raised here is considerably influenced by the views of administration officials, expressed during Secretariat discussions with them, on what are currently the major challenges for environmental policy.

- certain issues common to all environmental policies, in particular the
- role of the courts and of cost-benefit calculations.

11. As in most OECD countries, levels of air and water pollution have generally been much reduced since the 1970s and are continuing to decline as revisions to the Clean Air and Clean Water Acts or periodic re-evaluation of regulations have progressively tightened standards. Nevertheless, air quality is still a major issue, with relatively more attention now being paid to ozone concentrations and fine particulate matter.

12. Global warming is a related issue, since the same emission sources are generally responsible for greenhouse gases (GHGs) and air pollution. The United States, along with most other countries, has not met the commitment made in 1992 (when the UN Framework Convention on Climate Change (UNFCCC) was established at Rio de Janeiro) that GHG emissions be no higher in the year 2000 than in 1990; however, it is a signatory to the Kyoto Protocol to the UNFCCC (though it has not ratified it), which would commit it to quite substantial reductions in emissions by 2008-12, compared with those projected in the absence of policy changes. The United States, with much higher emissions, both per capita and in absolute terms, than other countries, is a major contributor to increases in global concentrations of GHGs. It is also potentially quite sensitive to damaging effects of climate change on agriculture and on the sea level, for example. These impacts are rather uncertain and are the subject of ongoing research in the United States; some recent work suggests that the economy could adjust so that the economic costs of such changes in the United States might be lower than early estimates suggested (see Mendelsohn *et al.*, 1994 and Mendelsohn, 1999).

13. Given low population density, the disposal of non-hazardous waste appears to be less of a problem generally in the United States than in many other OECD countries (at least as far as the federal authorities are concerned), even though per capita municipal waste generation is the highest the world, and the waste recycling rate, especially for glass, is relatively low.¹³ Toxic waste, with its more obvious impact on health and well-being, has a higher profile. Dealing with existing contaminated sites raises somewhat different problems from preventing or cleaning up after new releases of toxic substances, even if the environmental impacts are similar. In both cases the United States is becoming “cleaner” after two decades of action under “Superfund” and other legislation.

14. Water supply (as distinct from its quality) poses a number of interesting questions throughout the western United States. The geographical distribution of rainfall, the structure of property rights governing water and changing population and industrial structures have made it hard for the competing needs of house-holds, agriculture, industry and wildlife to be reconciled.

3. Environmental policy in practice

15. By selecting the relatively narrow range of issues outlined in the previous section, the coverage of US policy presented here is necessarily incomplete. The aim of this section is to use these examples of US policy and the policy formation process to illustrate some of the strengths and weaknesses that have relevance beyond this immediate focus.

13. OECD data show that in the mid-1990s the United States generated 720 kg of municipal waste per capita, more than half again as much as the typical OECD Member country (461 kg per capita). Also in 1996 the recycling rates for paper and cardboard and glass were 41 and 26 per cent, respectively, in the United States, while the simple average rates for OECD Member countries were 41 and 51 per cent, respectively.

3.1 *Air quality standards*

16. The Clean Air Act (CAA) was originally passed in 1970. The legislation itself does not define what is “clean” air but requires the EPA to identify air pollutants that are harmful to human health and welfare and promulgate National Ambient Air Quality Standards (NAAQS) that protect human health with “an adequate margin of safety” – the primary standard.¹⁴ The EPA thus establishes air quality standards in the form of limits on concentrations of sulphur dioxide, nitrogen dioxide, lead, particulate matter, ozone, and carbon monoxide (CO)¹⁵ in the light of its own views on what is feasible and desirable. The NAAQS are indeed revised from time to time: those currently in force date from revisions promulgated in 1987. In 1997 the EPA promulgated tighter standards for two pollutants: ozone and particulate matter.¹⁶

17. A number of industry associations and two states appealed against these tightened standards, and in May 1999 the Washington D.C. circuit appeals court upheld the appeal, effectively preventing implementation of the new standards, pending action by the EPA to meet certain conditions or a successful appeal by the EPA to a higher court. Although this case may be rather special, it and its context reveal a number of important points about US environmental policy-making.

18. One is that air quality standards are being tightened while many states are not in compliance with the existing ones and while air quality is still generally improving as measures taken to meet existing standards take effect (Figure 1). The EPA appears to be aiming for a continuous improvement in air quality, while accepting that different states are more or less compliant with existing standards. It has in any case only limited, often indirect, means with which to enforce compliance by states – for example, making states ineligible for certain kinds of federal funding, such as for public transport infrastructure projects, unless they meet the NAAQS. It implicitly recognises that fully uniform standards cannot be achieved across all states.

19. Two further related points can be found in the written judgement of the Washington D.C. appeals court.¹⁷ The grounds on which the court upheld the appeal had practically nothing to do with the environmental issues; the court agreed only with the claim that the manner in which the EPA issued the new standards was unconstitutional, because it appeared to be following no clearly identifiable principle in setting the standards.¹⁸ The written decision notes that a candidate for such a principle would be the application of cost-benefit analysis; but the judgement further notes that – following earlier opinions of the same court – the application of cost-benefit analysis to setting standards is not allowed under the Clean Air Act.

14. Secondary standards are also set for pollutants’ impact on crops, property, etc., subject to a cost-benefit test.

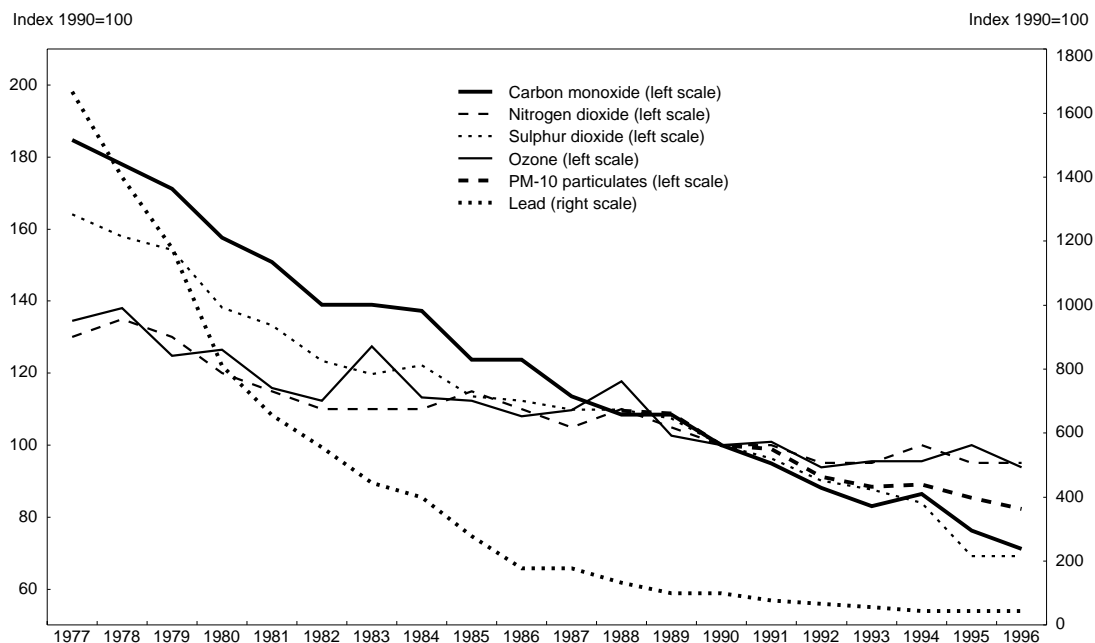
15. SO₂, particulate matter and ozone standards were promulgated in 1971; that for lead in 1978; and those for carbon monoxide and NO_x in 1985.

16. After promulgation, up to three years are allowed for designation of non-attainment areas and up to a further three years for submission of a State Implementation Plan for meeting the new standards. The CAA allows up to ten years, plus two one-year extensions for attainment of the new standards. Thus it allowed up to 2015 for full implementation of the 1997 standards.

17. This can be found in <http://www.epa.gov/ttn/oarpg/gen/97-1440a.txt> of 2 September 1999.

18. The constitutional issue is that while Congress cannot delegate too much policy-making legislative power to an agency, and the D.C. Circuit Court of Appeals believed that neither the statute nor the agency identified a determinate principle that would make the delegation permissible.

Figure 1. Air pollutant concentrations



Source: Council on Environmental Quality (1997).

20. This linking of the constitutional issue with the use of cost-benefit analysis is ironic, because a considerable amount of cost-benefit analysis was in fact carried out in support of the new standards – as indeed is *mandated* by Executive Order 12866¹⁹ – and was discussed between the EPA and other relevant agencies before they were issued.²⁰ The constraint on the use of cost-benefit analysis to help take decisions on environmental policy issues leads to somewhat bizarre results, where EPA departments sometimes carry out, or are aware of, cost-benefit analyses justifying their actions, but avoid making this known to the EPA Administrator,²¹ because the statute prohibits consideration of cost.

19. For example, regulatory impact assessments were carried out, as required.

20. A number of important government agencies – the Commerce Department, the Council of Economic Advisers and the Office of Management and Budget – in fact believed that the cost-benefit analysis showed that tightening the ozone standards did not have net benefits. Inter-agency discussion did not resolve this disagreement, and the issue was decided by the President.

21. The head of the EPA, appointed by the President, is known as the Administrator.

3.2 Emissions trading

21. A particularly innovative approach to pollution control – emissions trading – has been introduced in two programmes under the Clean Air Act. The SO₂ trading system, embodied in the Acid Rain programme, has been in operation since 1992. The year 1999 saw the start of full trading of NO_x emission permits in twelve eastern states; this is a seasonal programme, with trading in permits issued for emissions in May to September, when the incidence of smog and atmospheric pollution is at its greatest. Both programmes are restricted, so far, to emissions from power generation.

22. The SO₂ trading scheme was provided for in the 1990 amendments to the Clean Air Act. Although this was not the first time that permit trading had been used in the United States,²² it was the first time that unrestricted trading within an overall cap was made the sole means of meeting particular emissions targets.²³ A number of aspects of these trading schemes are noteworthy, particularly in view of current interest in such schemes at the international level, in the context of attempts to limit global greenhouse gas emissions (Box 1).

23. The SO₂ scheme is generally regarded as highly successful. The market for permits has been deep and liquid, with prices not showing excessive fluctuation and generally below earlier estimates of what abatement costs would be (Figure 2).²⁴ At the same time, emissions have fallen rapidly, resulting in reduced atmospheric SO₂ concentrations.²⁵ This is to some extent due to fortuitous circumstances: rail deregulation facilitated more rapid substitution of low-sulphur coal for its higher-sulphur counterpart than had appeared likely; and many facilities, worrying that they might not be able to trade if the planned market failed to materialise, over-invested in emission reduction equipment. Consistent with this, although permit prices are below earlier estimates of costs, estimates of actual abatement costs *ex post* appear to be within the range of *ex ante* cost estimates (Smith *et al.*, 1998). Nevertheless, although the low permit price cannot be taken to indicate that either marginal or average abatement costs are equally low, reasonable estimates are that considerable savings have been made compared with the previous command-and-control approach. The future may see a more severe test of the system, as smaller emitters are brought into the scheme and as the overall emission limit begins to bite more severely. The fact that emissions have actually been below the allowed limit is not so much a surprise as a logical consequence of the system: unused permits can be saved (“banked”) for future use and, since the overall emissions constraint will be tightened considerably in the year 2000, many permits have therefore been “banked” to cover future emissions.

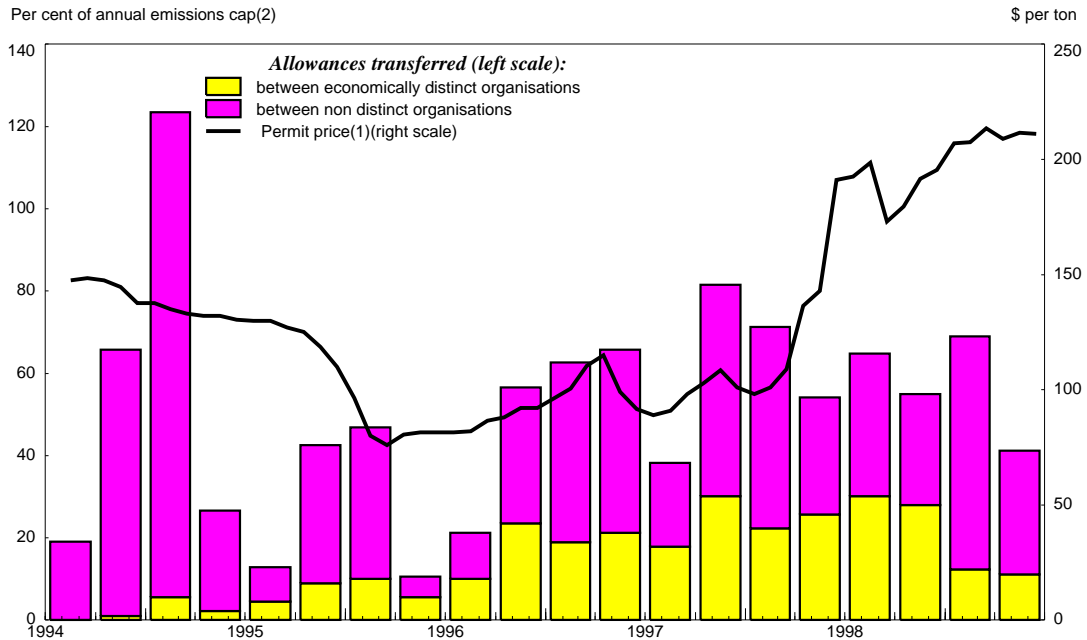
22. For example, it was allowed under the phase-out of lead in gasoline in the 1980s and of production of chlorofluorocarbons (CFCs) in the 1990s. It was also already used, though with many and evolving restrictions, in California’s implementation of the Clean Air Act (the “Offset” scheme) from 1976 onwards, leading to the present “RECLAIM” scheme.

23. Emitters trading under the SO₂ scheme remain nevertheless subject to other health-based regulations on their emissions.

24. In equilibrium, marginal abatement costs are equal to the permit price, since only at that price are buyers and sellers indifferent as to whether they should cut their pollution levels or buy the needed permits. Although there was wide variation in expectations about permit prices before trading began, \$400-500 per ton was generally thought to be a reasonable guess.

25. However, the actual outcomes have entailed smaller reductions than implied by the capped emissions, partly since these represent only one source of SO₂. Acidity in surface water – the main target of the programme – has not noticeably improved even though deposition rates have fallen.

Figure 2. SO₂ allowance transfers



1. Average of Cantor Fitzgerald EBS and Fieldstone Publications.
 2. Annual emissions, from 1995-1999, must not exceed 8.95 million tons.
 Source: Environmental Protection Agency.

24. The NO_x trading scheme has only just been brought into operation. Although both sets of gases were covered in the 1990 amendments to the Clean Air Act, only for SO₂ was a federal trading scheme mandated. The SO₂ scheme, developed and run by the EPA, covers the eastern half of the United States; but the current NO_x scheme covers only twelve states, which formed a “bottom-up” agreement on trading amongst themselves. A number of states that are home to heavy NO_x emitters border on the participants (they are generally upwind of them, in relation to “average” prevailing winds) but are not currently participating in the trading scheme.

Box 1. Cap-and-trade or tax?

When an activity is known to cause damage through pollution externalities, the damage will be reduced if polluters are given an incentive to reduce emissions. Economic incentives seek to do this in an efficient manner by trying to align the costs faced by individual polluters with the damage they cause. The latter may not be known with certainty, in which case economic incentives can at least ensure that all polluters face the same marginal cost for equivalent emissions, which should minimise the cost of achieving any particular amount of pollution abatement.

A simple way to achieve this, where emissions are relatively easily measured, is to impose an emissions tax. Simple though this may be, it is not without its complications: at what level should the tax be set? Who should pay the tax? Who should receive the revenue? How should the revenue be used?

Partly because of an inherent dislike of taxes in the United States, and partly because of uncertainty as to what level to set them at, two recent US pollution control measures under the acid rain programme have used a cap-and-trade approach, where instead of setting the cost faced by polluters, the government sets the total quantity of pollution to be allowed by issuing a fixed quantity of permits. This method has its own set of complications: how many permits? Who is required to have them? To whom are they issued? At what price should they be issued?

In the SO₂ trading scheme Congress decided to reduce emissions from power generation by half from the 1985 level, but to phase this in over the period to 2010; a tax could also be introduced with such a phase-in. Initially (as from 1995) only “large” emitters were required to hold permits to cover their emissions, with the scheme extended to all emitters as from 2000; again, a tax-based scheme could use the same approach.

Permits are allocated annually free (with minor exceptions) to existing emitters. This is not full “grandfathering” (where permits would be allocated in strict proportion to past emissions), however; permits are issued in proportion to what emissions would be if emitters had achieved a certain technological standard of emissions control (so that owners of facilities who had acted early to reduce emissions benefited from this action, thus reducing moral hazard). A tax-based scheme could allocate tax credits in proportion to the same hypothetical emission levels to achieve the same effect.

It seems that a cap-and-trade approach avoids the issue of who receives the tax revenue and what to do with it. In fact, this is the case only if permits are issued free: it would be perfectly feasible to auction the permits, treating the proceeds as general government revenue; equally, a tax-based system could refund aggregate tax revenues to the emitting facilities – provided this were done in a way unrelated to actual emissions. In both cases there is necessarily a transfer of resources among emitters, which may be large if abatement costs vary greatly.

Even the crucial difference between a tax-based approach and cap-and-trade – that with the former the marginal cost to emitters is known but total emissions are not, and vice-versa for cap-and-trade – is less clear once a medium-term view is taken. Over time, the emission limits of a cap-and-trade system will surely be re-evaluated in the light of the cost of meeting them (*i.e.* the market price of permits) and on-going assessments of environmental damage. Equally, a tax rate would be re-evaluated in the light of resulting emission levels. On economic grounds, and without external constraints, the choice may depend on how much is known about the environmental mechanisms involved. Where there is reasonable information on the marginal damage caused by emissions, a tax might be preferred; where this is not the case but health effects, for example, are known to become severe above a certain concentration level, cap-and-trade may be better.

Box 1. Cap-and-trade or tax? (*cont.*)

In the case of the US commitment to reduce emissions of greenhouse gases under the Kyoto Protocol, the existence of an external constraint may favour the adoption of a cap-and-trade approach domestically (though it does not *impose* this choice, since international trading by the government is feasible regardless of the domestic instrument employed). OECD estimates suggest that a tax-based solution would require a carbon tax of somewhere between \$10 and \$250 per tonne (1995 prices), depending on the degree of international trading (the lower figure for full worldwide trading, the latter with no trading at all), corresponding to between about 3 and 70 cents on a gallon of gasoline and between \$8 and \$210 on a tonne of oil delivered to power stations (whose average prices in 1999 were around \$1.20 per gallon – 32 cents per litre – and \$90 per tonne respectively). A more plausible figure than either of these extremes is a price of about \$90 per tonne of carbon, with full trading among Annex B countries.*

One difficult question raised by a cap-and-trade system is the question of at what point in the production chain to impose the requirement for permits. In the case of oil, for example, one possibility would be importers and domestic producers of crude oil, a second would be refiners and importers of refined products, a third would be on final sales. Each of these, while in principle and with efficient trading having the same effect on the price to the consumer, would have a different and substantial distributive effect: the market value of the US allocation (“assigned amount”) of permits, at \$90 per tonne of carbon, would be of the order of \$150 billion; if permit allocations were grandfathered, recipients with low abatement costs would be substantial beneficiaries, in effect receiving some of the “tax” that would be paid by consumers.

* This figure is roughly in the middle of the range spanned by results obtained from the main models. See OECD (1999*a*, Table 7).

25. The EPA suggested that the environmental effectiveness of the trading would be increased if these bordering states participated in it. Although this was initially challenged in the courts, the scheme is now to be extended to include a total of 22 states and Washington D.C. as from 2004.

3.3 *Water quality*

26. There are two main pieces of legislation covering water quality, the Clean Water Act, covering lakes and rivers, and the Safe Drinking Water Act. The range of activities that can create water quality problems is huge, and therefore only a certain number of issues can be dealt with here.

27. As far as surface water is concerned, the starting point for quality control is the designation of standards that particular bodies of water should meet. States are responsible for such designation, subject to approval by the EPA, and it is procedurally straightforward. As with air pollution, states are also primarily responsible for enforcing the standards, with the EPA monitoring states’ performance with the responsibility to step in where it is inadequate. Once a body of water has received its designation, however, it is procedurally extremely difficult to change.

28. This asymmetry may lead to cost inefficiencies. The legislation allows the costs and benefits of maintaining water quality to be taken into account when considering designation, but not subsequently when considering appropriate measures to achieve the required standard. In some cases designation took place in the 1960s before the introduction of Clean Water Act principle this makes sense, since it potentially cuts down the number of times court challenges of anti-pollution measures can be made – once the federal government has decided that the benefits of achieving a certain level of water quality in a particular area exceed the costs (during the designation process), it should logically follow that the benefits of actions taken to achieve those standards exceed the costs. (This conclusion depends on the assumption

that they are least-cost measures.²⁶) This does not allow for the possibility of mistakes being made in the initial cost-benefit assessment, which might have changed the designation if they had been known at the time.

29. In 1996, between one-third and one-half of surveyed bodies of water²⁷ did not meet their designated standards (OECD, 1996, p.75). There are a number of explanations for this quite widespread non-compliance, some of which amount to the EPA in practice taking the costs of compliance into account in an informal discretionary manner, avoiding or delaying enforcement proceedings where compliance costs are clearly high. Others are due to the nature of the water systems being dealt with or to the restricted instruments available. For example, the delay between a polluter making a decision to take effective steps to reduce its discharges, its implementing the decision and then having its full effect on the water body can obviously be significant: indeed, despite the “poor” performance in terms of meeting water standards, overall water quality has been increasing steadily. Instruments are restricted in particular because of the difficulty of dealing with non-point sources of pollution; while point sources are dealt with through a system of permits (discussed further below), non-point sources, which are mainly in agriculture (though also through deposition from air pollution), are subject to very little restriction.²⁸ The two main such non-point sources are silting due to soil erosion and leaching of nitrates and phosphates (related to fertiliser use), as well as herbicides and other chemical products. An obvious candidate for beginning to tackle some of these problems would be a fertiliser tax – a conclusion drawn, for example, in OECD (1996) – or, better, an excess nutrient tax,²⁹ but this has never been implemented, perhaps unsurprisingly given the strength of the farm and chemical lobbies. This is not to say that agricultural policy is designed without regard to environmental consequences. Indeed some programmes (discussed in Box 2) show that the Department of Agriculture is well aware of the environmental problems that agriculture can cause, but it prefers to tackle them only through conditional access to subsidies, rather than applying the “polluter pays principle”.

30. Tentative moves towards a more cost-effective approach are being made under the Total Maximum Daily Load (TMDL) programme. A TMDL for different pollutants of a particular body of water is calculated, given its designated use (and including a margin for error). Permits for discharges are then issued by the relevant State or local agency. In some states, non-point discharges (from agriculture) are brought into TMDL programmes. Currently the discharge permits are not auctioned, nor are penalties for violations necessary closely related to damage caused.

26. Other administrative law requires that regulations should not be introduced without a study of the costs of alternative means to achieve the same ends, which should show that feasible alternatives are more expensive.

27. The 1996 National Water Quality Inventory surveyed conditions in about half of the bodies of water that flow all year round.

28. Agriculture is not generally subject to the Clean Water Act; concentrated animal feeding operations (where the definition in terms of the number of animals varies by species) are an exception. Environmental Impact Statements are not required for agricultural policies generally, though large projects, such as irrigation schemes, might require them under the National Environmental Policy Act.

29. In the Netherlands, such a tax is applied to phosphates. See de Haan *et al.* (1997).

Box 2. Environmental programmes in agriculture

The Department of Agriculture runs a number of programmes that provide incentives to improve the environment or to reduce environmental damage caused by agriculture.¹ A number of them provide technical assistance or information services, though many use methods which give farmers economic incentives to improve the environment. However, despite the considerable use of economic instruments, it is notable that taxes, fees or charges are not used at all; incentives are given either by direct subsidies for particular measures, or by subsidies under some other federal programme (loans or insurance, for example) being conditional on respecting some environmental constraints.

Since agriculture is a recipient of large amounts of federal subsidies, incentives using the conditionality of such subsidies can be quite strong. A number of programmes use these methods so that cost-effectiveness of environmental policy within the agriculture sector is improving; the Conservation Reserve Program is a good example of this. However, the overall level of subsidy to agriculture seems to be determined largely without regard to environmental considerations, and the main subsidies are still tied to production; hence, a sector which is a major source of water pollution, and which is not covered by the main water quality legislation, operates under an incentive scheme that fails to discourage it from polluting.

The Conservation Reserve Program: cost-effectiveness without cost-efficiency

Recent developments in the administration of the Conservation Reserve Program (CRP) provide an interesting example of how cost-effectiveness can be achieved, or at least significantly improved, within a given programme by judicious use of economic incentives. At the same time they also illustrate the difficulties of working towards overall cost-effectiveness across sectors.

The CRP was set up in 1985, allocating subsidies – in the form of a rental payment – to farmers for taking land out of production with the aim of supporting farm incomes while improving the environment.² In the 1980s the only environmental criterion used in the selection of land to qualify for the CRP was the degree of erodibility of the land, on the assumption that relevant environmental benefits were highly correlated with soil erosion. Subsequently, a more sophisticated set of indicators was introduced, assessing points to potential programme acres according to a number of different attributes, combined in an “environmental benefits index” (EBI). This has been in use since 1991, though the weights have evolved. A cost factor – the rental rate the landowner bids (in the competition to qualify for the CRP) – is also part of the EBI (with a negative weight) in order to increase the environmental benefits per unit of outlay.

Since CRP acreage is “signed up” under contracts that last ten or fifteen years, it will be some time before the more sophisticated EBI approach is reflected in the actual distribution of CRP land. Feather *et al.* (1999) conduct a simulation of the environmental benefits to be expected if the current CRP acreage (34 million acres, about 10 per cent of total US cropland) were replaced with land selected using the most recent EBI, using a variety of valuation techniques to measure the monetary value of non-market benefits³ (the EBI itself is not yet explicitly based on such techniques). The results show that use of the EBI doubles the value (consumer surplus) of some environmental benefits, such as wildlife viewing, with very slight diminution in others. The study also estimates the overall costs and benefits of the CRP: of total benefits of \$46-58 billion over a ten-year period, \$31-43 billion is accounted for either by increased farm incomes (including increased timber growth) or reduced costs of other farm subsidy programmes and \$12-15 billion of strictly environmental benefits; total costs of \$44 billion are almost entirely attributable to budgetary costs or higher food prices (see Feather *et al.*, Table 2, p. 6). OMB (2000), however, attributes net present values of \$30 billion and \$13 billion for CRP benefits and costs respectively.

Box 2. Environmental programmes in agriculture (cont.)

Since not all the environmental benefits included in the EBI are valued in this study, the overall improvement in environmental effectiveness of its use cannot be assessed. However, if the magnitudes in Feather *et al.* (1999) are reasonable, it is clear *a)* that the use of the EBI does improve the cost-effectiveness of the CRP programme substantially, providing a good example of the usefulness of cost-benefit analysis; and *b)* that even when environmental benefits are optimised, the environmental benefits are a rather small proportion of the gross costs.

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1. In addition to the Conservation Reserve Program, Feather *et al.* (1999) list seven: the Environmental Quality Incentives Program; the Wildlife Habitat Incentives Program; Conservation Technical Assistance; Extension Education; Wetland Compliance; Conservation Compliance; and the Wetland Reserve Program.
 2. The seven goals of the CRP are listed as: reducing soil erosion; protecting soil productivity; reducing sedimentation; improving water quality; improving fish and wildlife habitats; curbing production of surplus commodities; and providing income support to farmers. But a table of costs and benefits expected at the time of the programme's introduction, Feather *et al.* (1999) show income gains (including savings to federal farm income support programmes) representing more than two-thirds of the total value of the expected benefits.
 3. These include wildlife viewing and hunting and freshwater recreation.

31. When violations do occur, enforcement action includes taking into account, in addition to the seriousness of the violation, whether it is deliberate or not, as well as the previous compliance record of the violator. This allows local cost conditions to be considered, though the procedures may not be fully transparent. Not all violations are prosecuted: enforcement action frequently occurs when local or national environmental groups take legal action to require the EPA to intervene. Current proposals for changes to the TMDL system do not include allocating permits by auction, but they do suggest development of an "offset" programme under which increases in discharges in one area could be "paid for" by reductions elsewhere – form of effluent trading. Eventually this might lead to prices being established for at least some permits, allowing some assessment of cost-effectiveness to be made.

32. Another important cause of water pollution, often by hazardous chemicals, and where the precise source can often be hard to identify, is seepage from waste dumps or from sites such as gas stations. Despite the Resource Conservation and Recovery Act (1976) and the Comprehensive Environmental Response, Compensation and Liability Act (1980) (see below), such discharges, along with those from agriculture, remain among the major sources of water quality problems. Another important source of water pollution is intensive livestock operations, particularly pig farms. This problem is particularly severe in North Carolina where hogs, out-numbering humans, produce some 19 million tons of waste per year, leading to nitrogen pollution, groundwater contamination, and threats to human health, other than the obvious odours – see Environmental Defense Fund (2000).

3.4 Water supply

33. Overall, the United States has abundant water resources, and, despite very high per capita consumption,³⁰ its intensity of use is similar to that in other major OECD countries.³¹ Nevertheless, in

30. So-called abstractions per capita in the mid-1990s were 1880 cubic metres per year, more than double the OECD population-weighted average (930 cubic metres), triple the simple average (618 cubic metres) and ten times the levels in those counties with the lowest intensity of use (Luxembourg, Denmark and the United Kingdom).

some parts of the country water resources are over-stretched, especially where there has been massive expansion of irrigated agriculture based on groundwater from aquifers (for example the Ogallala Aquifer, stretching from southern South Dakota to south-eastern New Mexico). In many cases aquifers are being rapidly depleted as extraction rates exceed recharge rates, and farmers are already being forced to abandon irrigation as pumping lowers the level of the water table (Postel, 1999). Only rarely, if at all, is pricing used to limit groundwater extraction rates. Without such pricing, aquifers are certainly being depleted too rapidly. Pricing the water would encourage more economical use of it, allowing irrigated agriculture to be sustained for a longer period and supporting a higher level of farm output over the longer term by encouraging the substitution of other inputs for water.

34. Overuse is often due to the structure of property rights, but inappropriate government action can exacerbate such problems. Examples of this can be found in California, where heavy use for irrigation has considerably depleted groundwater supplies. In response to the difficulties faced by farmers dependent on groundwater for irrigation, both federal and state programmes have been introduced to supply *subsidised* water for irrigation and for aquifer recharge. This provides quite the wrong incentives in a water -short area and where other users – industrial and household consumers – are prepared to pay high prices for water (implying, *ceteris paribus*, a higher return to its use); heavy use of river water can also damage ecosystems, as in the San Francisco Bay delta.³²

35. Property rights in respect of water are quite complicated. There exist two different bases for attribution of surface water rights –“riparian” and “prior use”³³ while groundwater rights generally accrue to the surface owner. Broadly speaking, prior use rights are enshrined in the constitutions of most western states, while riparian rights apply in the majority of eastern states.³⁴ Overlying these legal rights, however, is the common-law principle that owners of water resources hold them in trust for the community. Where water is scarce, its efficient use requires some means of allocating it to its most productive uses, and water trading provides, in some cases, a convenient way to accomplish this. In some parts of the United States active water-trading markets have existed for some time (on the Upper Snake River, Idaho, since the 1930s, for example), but they are rare.³⁵ In California, one of the few areas possessing very limited surface water resources, with a dynamic economy whose shifting structure suggests that a market in water would be beneficial, putting together a scheme to satisfy all the competing interests is proving very difficult (Box 3).

36. Revenue from the use of water pricing for demand management, in areas where the overall supply of water is the principal constraint (rather than charges for the construction or maintenance of physical infrastructure), would largely constitute a resource rent. Not charging appropriate resource rents

31. According to OECD figures, intensity of use, *i.e.* total consumption as a percentage of available resources, in the mid-1990s averaged 19.9 per cent in the United States, similar to Japan’s 20.8 per cent. France, 23.9 per cent, Germany 24.4 per cent and Italy, 32.1 per cent, had rather higher intensities. But the weighted average across all OECD countries was only 11.8 per cent.

32. A report by the General Accounting Office to the Senate (US General Accounting Office, 1996) detailed how federal subsidies to agricultural users of federally-sponsored irrigation projects have often amounted to almost 100 per cent of the costs attributed to irrigators.

33. Riparian rights are vested in the owner of a body of water or neighbouring land, whereas prior use rights depend on historical usage. In both cases, the rights tend not to be absolute: water resources are treated as being held in trust for the wider community.

34. Riparian rights for some – basically non-extractive – purposes are also recognised in California, for example.

35. Howe (1997) (quoted in OECD, 1999b, p.78) refers to the “long but narrow history” of water markets in the United States. For more detail, see OECD (1999b).

can lead to overuse, as in the example of groundwater mentioned earlier, but also in other cases. The management of federal lands – that make up almost one-fifth of the country – is often criticised for under-charging for grazing and mining rights, leading in the former to serious over-grazing and consequent soil deterioration. It may be felt that the federal government should not be profiting from its ownership of land held in trust (though it is hard to see who other than the federal government should profit from such ownership). The consequence is that the economic rents are appropriated somewhat arbitrarily (from an economic point of view) by those who first registered the rights to graze, mine or extract water. Although this may represent a significant transfer payment, it need not mean an inefficient use of resources, provided the relevant rights are tradable. With a large number of leases on federal land currently expiring, this issue may be important during their renewal period.

3.5 *Dealing with toxic waste*

37. The programmes for cleaning up past contamination and for regulating the generation and handling of toxic waste (CERCLA, the Comprehensive Environmental Response, Compensation and Liability Act, commonly known as “Superfund”, and RCRA, the Resource Conservation and Recovery Act, respectively) have frequently come in for criticism on the grounds of excessive cost. Superfund is particularly notorious, given its reputation for generating long and expensive litigation and other transactions costs, which have apparently absorbed one-fifth of its expenditure on compliance.³⁶ High costs have arisen partly from the law's insistence, and the EPA's interpretation of the law, that sites be cleaned up to very high standards, regardless of the cost or benefit, and partly from the liability provisions, under which even people or companies that had had only a minor connection with a contaminated site could, in principle, be held liable for the entire costs of cleaning it up, unless other “potentially responsible parties” could be identified. Liability is also strict, in the sense that parties are liable for cleanup costs even if they met legal requirements at the time.

38. This “joint and several” liability provision followed partly from the reluctance of the federal government to finance cleanups from general taxation,³⁷ even though using general taxation might be thought to be the “fair” approach for rectifying damage done by activities that were often not illegal when they occurred. This reluctance to tax may thus be responsible for imposing considerable costs on the economy. On the other hand, the threat of being found liable for environmental damage under the Superfund legislation has probably had a big effect in pushing companies into internalising the potential environmental costs of their activities.

39. The requirement under Superfund that sites meet high standards (often much higher than surrounding areas that were not contaminated) has certainly led to unnecessary costs. After 1990 procedures were implemented that allow clean-ups to be limited to containing health hazards rather than fully eliminating them. This has reportedly improved the cost-effectiveness of the programme during the 1990s. Another innovation in the early 1990s was the “brownfield” programme. Here the idea was to reduce the supposed burden on potential developers of contaminated land posed by possible Superfund liability. This was thought to be a factor impeding urban regeneration, particularly in poorer districts;

36. Sometimes these costs are exaggerated. For example, opponents of the Superfund legislation often refer to RAND research that shows that three-quarters of costs are absorbed by litigation. However, according to Probst *et al.* (1995), this referred to only part of total costs and covered non-representative sites. They estimate that about 20 per cent of total costs are absorbed by transactions costs, including litigation.

37. Tax revenue is generally used to finance initial cleanups, with the liability provisions used to recover costs from responsible parties. About three-quarters of these federal revenues are provided by specific taxes introduced under CERCLA: a chemical tax, a petroleum tax and an environmental income tax, intended to cover unrecoverable costs. These taxes expired in 1995 following Congress's refusal to re-authorise them.

improving this situation would represent progress in wider sustainable development goals. Some regeneration projects have subsequently succeeded, though take-up has been less than hoped. Some critics argue that, rather than the costs of environmental clean-up, it is the low incomes, poor infrastructure and social problems, often characteristic of the neighbourhoods of such sites, that are the real barriers to urban regeneration.

40. While Superfund and its costs have been subjected to intense scrutiny and criticism, the RCRA has been less closely analysed. Although Superfund has played a role in frightening potential polluters into “better” behaviour in their current operations, it is the RCRA that actually sets the constraints they face. OECD (1996) argued, along with other commentators, that RCRA is over-complicated and burdensome and could be reformed to improve cost-effectiveness without compromising environmental standards.

Box 3. Water in the San Francisco Bay delta area

Water resources are treated in the United States as being held in trust for society. Although extraction and use rights can be granted and, once granted, cannot be rescinded except under specific circumstances,¹ state governments therefore maintain the right to influence how the water is used.² They may therefore intervene in trading, since unrestricted trading may very well change the use of the water. Furthermore, although prior appropriation rights are well defined and farmers may not even be limited in the quantity they extract, they may lose the rights if they do not make “beneficial use” of the water themselves, for example if they sell it. This obviously makes trading hardly ever worthwhile and encourages farmers to use excessive amounts. During the 1987-92 drought the practical absence of trading in California became untenable, and a temporary trading (“banking”) scheme was introduced. Even though the California Water Bank acted as the intermediary in all trades (selling and buying at fixed prices), the efficiency of water use, at least in agriculture, improved markedly (OECD, 1999a, pp. 81-82).

Putting in place more permanent trading arrangements in California appears to be very difficult. This is partly a result of the nature of water trading, where the physical infrastructure and variability of supply (annual flow through the Sacramento/San Joaquin delta into San Francisco Bay can vary by a factor of ten, for example) constrain the kinds of trading that can take place. It is also a function of the large number of agencies that need to be involved in any comprehensive agreement on water strategy.³ It is likely that property rights and a conflict between established users (mainly agriculture) and newer industries are at the root of this. This makes it unlikely that a market can simply direct water to where its marginal productivity appears to be highest, since the state of California must also take into account non-market interests (such as fish and wildlife). Individual water districts also have some power and may argue against the “export” of water, even if the holder of the water rights would benefit; such arguments might be on externality grounds, for example, since water used for one purpose is frequently available for subsequent reuse.

The Bay-Delta Accord of 1994 was intended to work towards a more rational use of water in the Sacramento/San Joaquin watershed (which drains into San Francisco Bay) and to improve the aquatic environment in the delta, damaged by the much reduced flow of fresh water as a result of increased upstream uses. The CALFED Bay-Delta Program is still in the process of development – though it was intended to begin operation in 1999 – through a process of stakeholder consultation and, while in the long run it may lead to a system of water trading, use of market instruments seems to have been accorded a rather low priority in the ongoing discussions.⁴

1. As mentioned earlier, unused extraction or diversion rights can lapse.
2. See the California State Water Resources Control Board website for a discussion of this: <http://www.waterrights.ca.gov/application/forms/infobook.htm>. Permits to extract or divert water state for which uses the water is intended.
3. The CALFED Bay-Delta Program, which has been attempting “to address the tangle of complex issues that surrounds the [Sacramento/San Joaquin] Delta”, lists 15 federal and state agencies that have direct management or regulatory responsibilities in the area.
4. The revised (June 1999) Phase 2 report of this programme uses the term water transfers rather than trading and, while mentioning the need for cost-efficient sources of water supply, does not discuss water pricing as a demand-side measure.

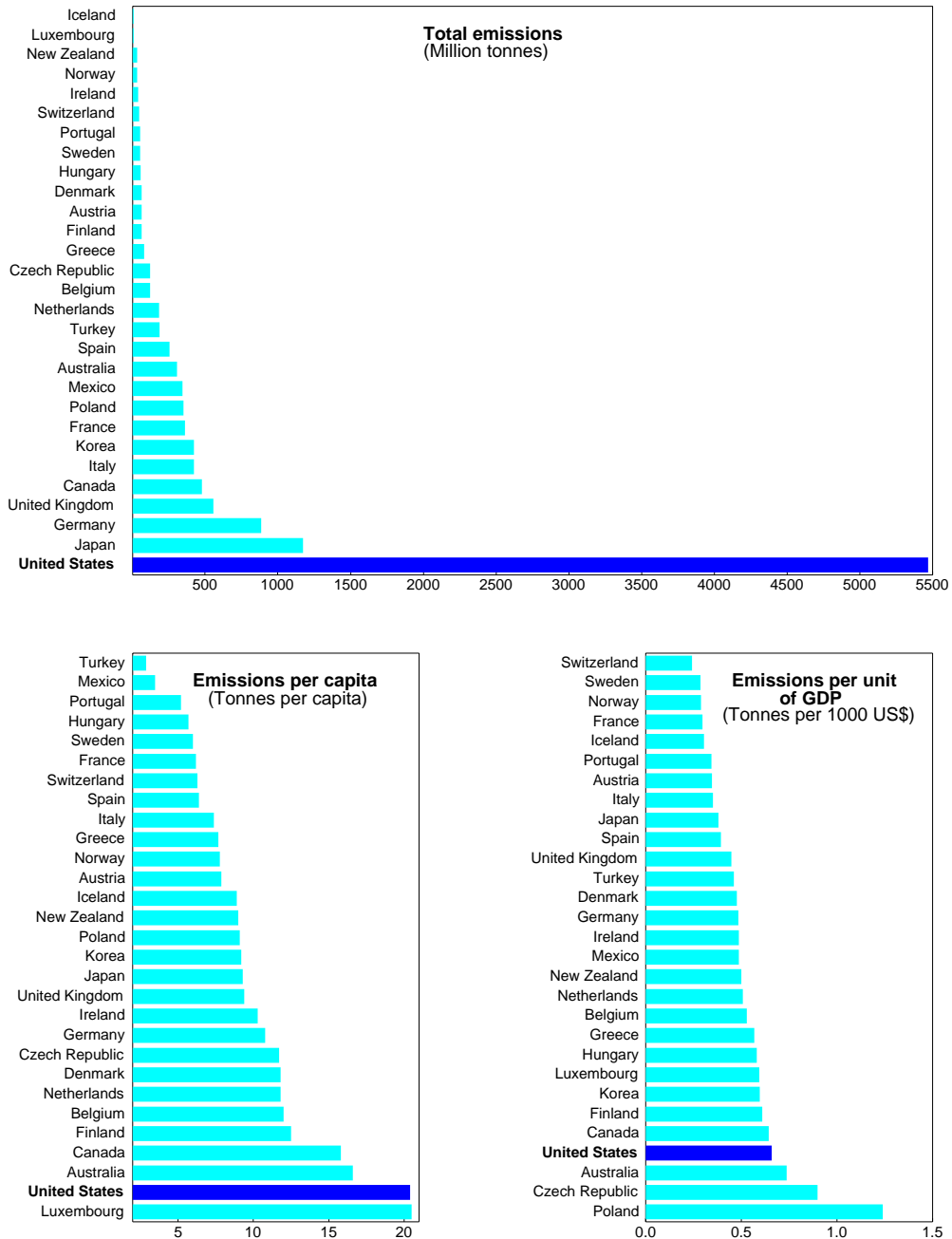
41. One of the interesting innovations in toxic waste policy is in the provision of information. Under 1986 legislation, industrial sites are required to report all releases of listed chemicals, whether accidental or otherwise, as well as information on off-site transfers for disposal, information that is then recorded in the Toxic Release Inventory (TRI). This can be thought of as lowering the cost (the Inventory covers substances that are regulated anyway under the RCRA and some other statutes) of enforcing regulations - the availability of information encourages enterprises to make sure they have a "clean" image and makes it easier for concerned members of the public to take legal action against violations as well as adjust their own behaviour if they wish, even when there are no violations. The effectiveness of the TRI is difficult to judge. In practice it covers only a small proportion of all environmental problems and could thus be criticised for drawing attention to these at the expense of less spectacular but perhaps more pervasive problems.

3.6 *Climate change: rational transport and energy policy?*

42. Many argue that the issue of climate change is currently one of the most important on the environmental agenda in the United States. US emissions of greenhouse gases (GHGs)³⁸ in general, and carbon dioxide in particular, are much higher than those of any other country, both per capita and in total (Figure 3). Under the terms of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), the United States is committed (once the Protocol is ratified by the United States and a sufficient number of other countries) to reduce its average emissions of greenhouse gases for the years 2008-12 to a level 7 per cent below that of 1990. Since carbon dioxide emissions in 1997 were some 11 per cent above the 1990 level and projections are that, on unchanged policies, emissions by the year 2010 might rise to as much as 30 per cent above the targeted level, this will be a difficult objective to meet.

38. Water vapour is the most important greenhouse gas, but its atmospheric concentration is little affected by human activity. Among GHGs whose presence is due to human activity, carbon dioxide is quantitatively the most important, followed by methane and nitrous oxide. Many other gases in the atmosphere have warming effects, but they are small compared with those of carbon dioxide and methane. See IPCC (1996).

Figure 3. Carbon dioxide emission intensities, 1997



Source: OECD .

43. One of the options under the Kyoto Protocol is to purchase emission permits from other countries. The United States is one of the principal supporters of the use of such mechanisms.³⁹ OECD simulations show that the annual cost to the United States, in terms of GDP foregone, of meeting the Kyoto targets would be some 0.27 per cent with no emissions trading but only 0.16 per cent with unrestricted trading among the so-called Annex B countries.⁴⁰ The same simulations show that the target would be met with the price of an emission permit (or implicit carbon tax) of \$228 per tonne (at 1995 prices) without trade or \$94 with full Annex B trading. Terms-of-trade changes associated with financing acquisitions of emissions permits and changes in world energy prices are likely to reduce the theoretical gains from trade measured in terms of real incomes, but the adjustment to output and employment patterns would certainly be less difficult with trade.

44. If trade in GHG emissions permits were to include developing countries, however, the carbon price would be lower. US Department of Energy officials give credence to a scenario in which a sufficient number of developing countries participate to allow a permit price as low as \$20.⁴¹ Compared with prices in the second quarter of 1999, this would imply an increase of over 40 per cent in the delivered price of coal to power stations, or of 20 per cent for oil. It would correspond to around 5 cents per gallon of gasoline, well under 5 per cent of the current gasoline price.⁴² However, under a more likely scenario, with emissions trading were restricted to Annex B countries, the increase would have to be nearly five times higher. This explains the importance to US policy-makers of convincing developing countries to enter into emission limitation commitments, of minimising restrictions on emissions trading and developing the Clean Development Mechanism.

45. Meeting the Kyoto target even with a substantial amount of trading will nevertheless require a renewed and quite rapid decline in the use of fossil fuels, since, even though the energy intensity of US output fell substantially during the 1970s and early 1980s, continuing a rather more gradual decline since the mid-1980s (Figure 4), per capita energy consumption has risen steadily since then. A similar trend can be seen in European OECD Member countries, but per capita consumption there is less than half that of the United States. Fossil fuels can to some extent be replaced in energy production by renewables,⁴³ though the scope for this is limited, or by nuclear power. In the transport sector, where fuel consumption is growing most rapidly, technological advances to increase the scope for switching away from fossil fuels (*e.g.* to fuel cells), or considerable improvements in fuel economy, or reductions in transport activity, will be required.

39. There are two in addition to straightforward permit trading: Joint Implementation, where an emitter in one country invests in emissions reduction in facilities in another country participating in the Protocol, earning credits for use at home, and the Clean Development Mechanism, which is similar except that the reduction takes place in a developing country without an overall ceiling on its own emissions. See OECD (1999*b* and 1999*a*).

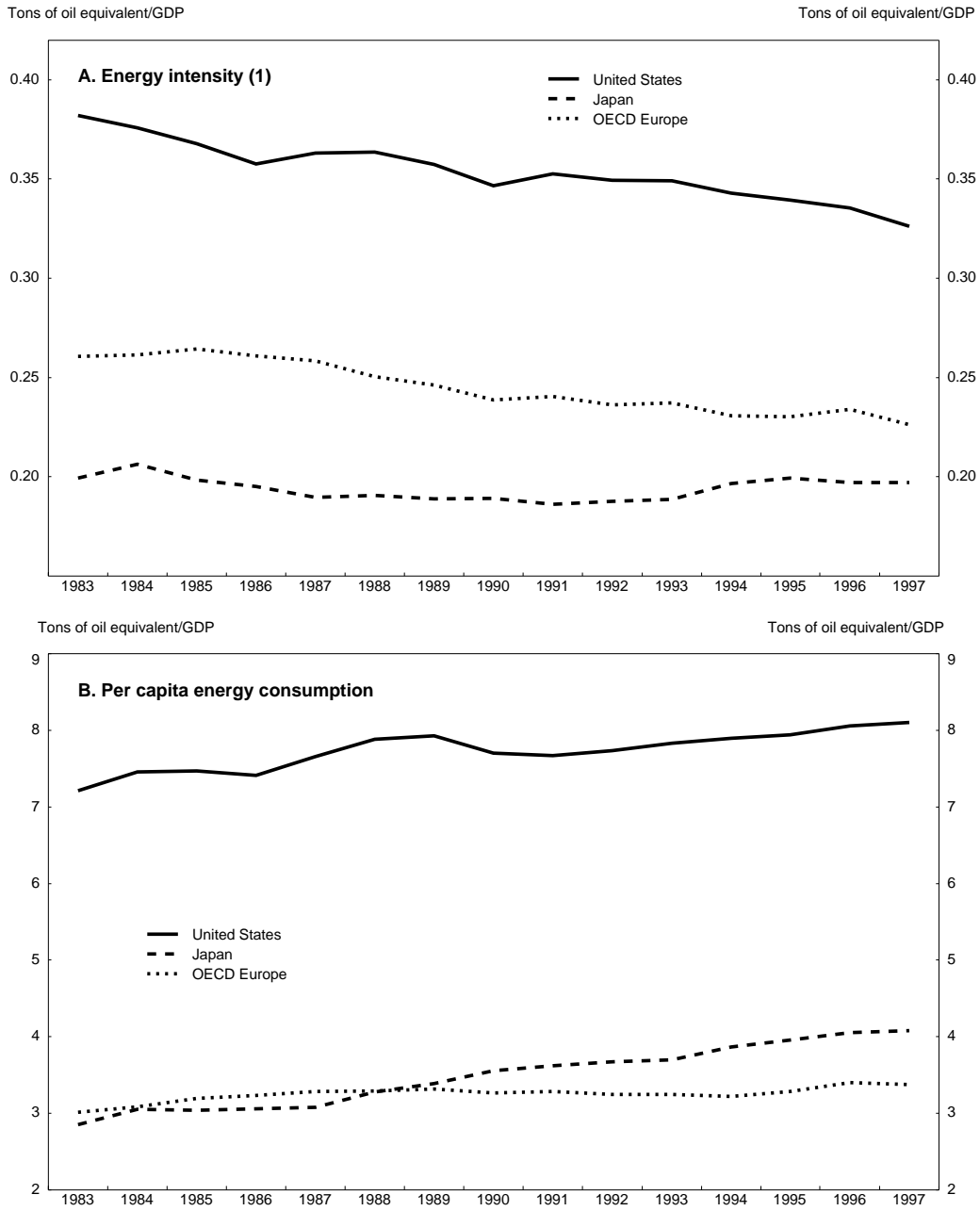
40. Annex B to the Protocol lists the countries accepting emissions targets, along with their targets. These figures are derived from the OECD's GREEN climate change model, assuming that labour markets adjust flexibly.

41. Simulations with the OECD's GREEN model suggest that if all non-Annex B countries participated in the Kyoto Protocol, with their assigned amounts of emission permits based on a "business as usual" baseline, then the permit price could be as low as \$10 per tonne in 2008-12.

42. This may not sound very much, especially in view of recent variations in oil prices, but a 1993 Clinton administration proposal to increase the gasoline tax by a similar amount was abandoned in the face of vociferous opposition, and it is now received wisdom in the US political realm that gasoline tax hikes are politically suicidal.

43. Windmills are a growing – though up to now costly – source of electricity in Denmark, for example see OECD (2000*b*).

Figure 4. Energy intensity and consumption

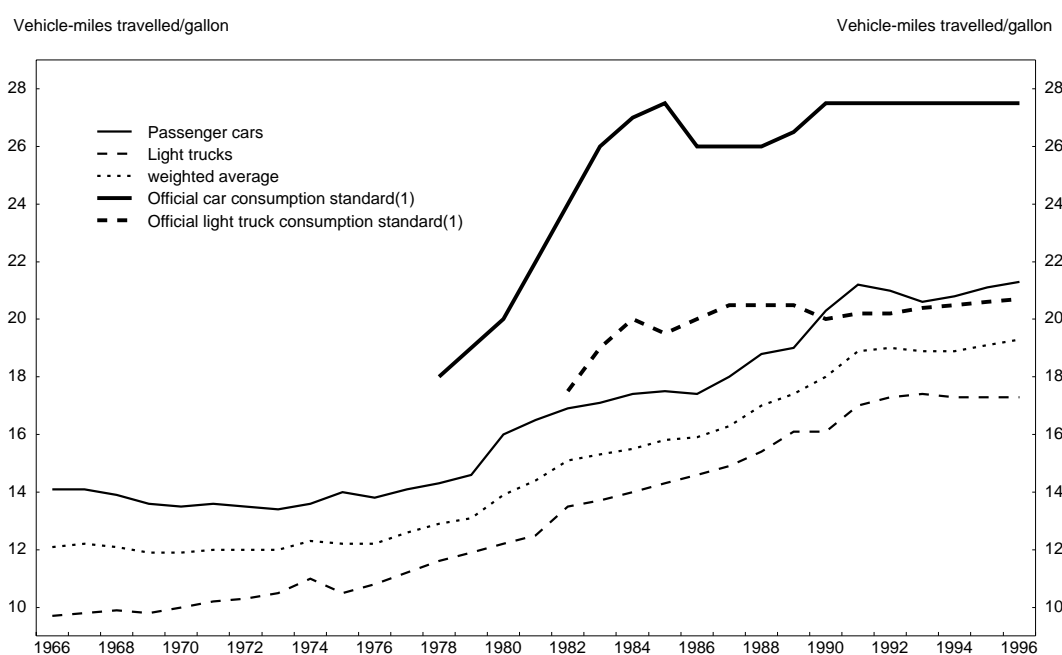


1. Total energy consumption per unit of GDP, tons of oil equivalent, 1990 \$, 1990 purchasing power parities. Source: IEA.

46. Fuel economy in private vehicles has been tackled largely through regulations on average fuel consumption for new car sales – the so-called CAFE standards. But these are not very effective in reducing fuel consumption when the price of fuel itself provides no incentive. Although average fuel efficiency of cars in use improved through the 1980s, there has been little change since 1991, either for cars or for vehicles classed as pickups and sports utility vehicles, which have a less stringent standard on new sales and towards which purchases appear to have shifted in recent years (Figure 5).

47. At the federal level, road users currently pay more for the facilities they use than the narrowly defined costs: the Highway Trust Fund (HTF), into which the gasoline and diesel taxes are paid and which finances the federal road construction programme, was in surplus until recently.⁴⁴ However, at the sub-federal level, and probably overall, such costs exceed revenue extracted directly from road users. Moreover, it is generally agreed that the cost of the externalities imposed by road users also significantly exceeds revenues from the gasoline tax, though the size of the excess is disputed.

Figure 5. Average fuel consumption of light vehicles



1. The official standard is the weighted average for the sales of vehicle producers, commonly known as 'cafe' standards. Source: Federal Highway Administration.

44. Extra spending on highways, and on mass transit programmes, was agreed in 1998 in order to absorb this surplus, while some had proposed reducing taxation. The Transportation Equity Act of 1998 now prevents funds in the HTF being spent on anything other than transport projects. Something under 20 per cent of the HTF revenue is allocated to mass transit projects, the rest to highway construction and maintenance.

48. One recent estimate, perhaps on the high side since it included costs of accidents which are probably mostly already internalised through insurance, puts the costs as the equivalent of \$1.60 per US gallon of gasoline consumed (see Cobb, 1999).⁴⁵ Delucchi (1996), on whose data Cobb (1999) is partly based, warns against this kind of calculation and the false inference that a tax at this level would be optimal – many costs are only loosely related, if at all, to fuel consumption. According to Delucchi (1996), external environmental costs of road users in 1991 were somewhere between \$69 billion and \$755 billion; the same study estimated total external costs (including uninsured accident costs and road construction and maintenance costs, but also such costs as the opportunity costs of parking space and travel time) at between \$1.6 trillion and \$3.3 trillion.⁴⁶ Much of the range of uncertainty in both these estimates comes from uncertainty over the calculation of the effect on health and mortality, and the valuation of those effects.

49. Some of the major road transport externalities come from NO_x, volatile organic compounds and particulate emissions where taxation is not really a feasible option because of the difficulty of monitoring actual emissions; the approach taken thus far of imposing technical standards – notably the catalytic converter for NO_x emissions, or the tailpipe emission standards averaged over new passenger vehicle sales recently announced by the EPA – is probably the most cost effective way to deal with this kind of pollution with current technology.

50. With the increasing importance of greenhouse gas emission abatement in environmental policy, the need to reduce consumption of hydrocarbon fuels will become more pressing and almost certainly necessitate higher fuels prices.⁴⁷ Since increasing taxation tends to be particularly difficult politically in the United States, the tendency may be to seek to improve fuel economy by subsidising research into more efficient engines;⁴⁸ however, without direct incentives to reduce fuel consumption itself, much of the potential for reductions could be absorbed, for example, in increased vehicle weights, power or distances travelled.

51. A phenomenon related both to the relatively high per capita energy consumption and to the resistance to higher gasoline taxation is the combination of spreading suburbanisation and the predominance in rural, suburban and nearly all urban areas of private over public road transport. Since mass-transit systems can never be efficient in low population-density areas, once such areas have been built, residents are dependent on cars and will resist proposals to increase the cost of driving. This also contributes to low short-run price elasticities of demand for fuel; thus, taxes have to be set quite high to get significant effects on consumption over such a horizon. Conversely, low fuel costs do nothing to discourage the continuing development of low-density housing. To break this circle would probably require a concerted effort in urban planning to restrict low-density development, something which is unlikely given the clear preference of many to live further from metropolitan centres.⁴⁹

45. The 1999 price of gasoline averaged around \$1.20 per gallon (32 cents per litre), with the Federal gasoline tax at 18.4 cents (the diesel tax is 24.4 cents) per gallon. The EPA does not have an official estimate of the external costs of road transport.

46. By way of comparison, in that year, the federal gasoline excise tax was 14.1 cents per gallon (21.1 cents for diesel), raising \$14.5 billion.

47. Other externalities, such as the cost of accidents, are related to frequency and distance of travel, which is obviously correlated – though not perfectly – with fuel consumption, so some improvement here could be expected as an ancillary benefit to higher prices.

48. For example, \$240 million per annum of public funds is spent on a programme of research into new-generation vehicles.

49. One potential problem in constraining low-density development could be court action by frustrated landowners. Since the value of land would be dependent on whether development permission was given or not, those refused permission could argue that this amounted to a government “taking”. Originally intended

52. Overall, the likelihood is that US greenhouse gas emissions will substantially exceed its Kyoto target in the period 2008-12, and compliance with the Protocol will require emission allowances to be purchased from other countries. Despite the popular aversion to raising gasoline prices, if full international emission allowance trading is implemented with some participation by developing countries, it should be feasible to impose the necessary price increases to pay for these allowances. If only limited international permit trading is permitted,⁵⁰ as currently proposed for example by the European Union, the permit price might be so high that general government revenues might be required to buy permits on the world market, allowing a gap between the world price and domestic price, if it were infeasible to impose the whole cost directly on domestic fuel prices.

4. Efficiency and implementation: cost-benefit analysis and the reinvention of regulation⁵¹

53. In the three decades since the major pieces of environmental legislation were enacted, the approach to this aspect of policy has gone through a number of phases, already outlined in the Introduction. The 1970s legislation generally concentrated on the environmental benefits of regulation, with cost considerations accorded only secondary importance. Much of the legislation included provisions for “citizen suits” allowing private citizens – in practice, environmental pressure groups – to take court action to require government agencies to enforce the law, reducing the ability of the EPA and other agencies to implement policies which take into account costs *de facto*, a practice prohibited *de jure* in certain cases; this prohibition was often intended to prevent the “capture” of the regulator by those being regulated.

54. The constant involvement of the courts on both “sides” has meant that the practical application of environmental law has evolved continuously. There is a considerable degree of variation in detail among the different states. This is partly because federal law generally specifies target levels for certain indicators, such as aspects of air or water quality, but leaves it up to individual states to decide how to implement these goals. In the case of the Clean Air Act, states must produce Plans (SIPs). The EPA has to agree to the SIPs, after which states are responsible for enforcing them, with the EPA empowered to move directly or through the courts where states appear not to be taking adequate enforcement action; if states do not produce a SIP, the EPA is supposed to develop one itself, a situation which the EPA tries to avoid. In a current court case a set of environmental pressure groups⁵² is trying to force the EPA to do this in the context of a number of urban areas that have not introduced anti-smog programmes in conformity with EPA requirements, but against whom EPA has not yet taken any action.

to prevent uncompensated expropriation of private land by the government, the constitutional prohibition on “takings” has been interpreted by the courts to include action that very significantly reduces the value of land, even if the land itself is not expropriated. Few examples of successful takings litigation against the government occur in this area however; see Congressional Budget Office (1998). A recent New Jersey programme to develop “green belts” surrounding urban areas is to be implemented by purchasing the relevant land, for which state borrowing of \$1 billion was recently authorised.

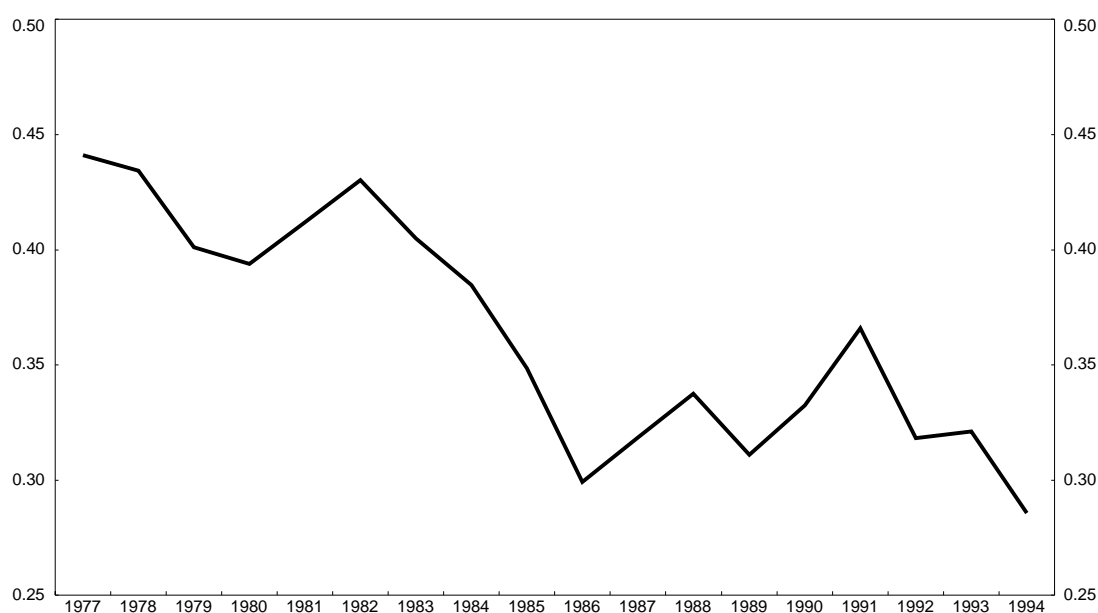
50. In fact, in such circumstances Congress may refuse to ratify the Kyoto Protocol, in which case it will probably not enter into force and its targets will not be legally binding.

51. For a discussion of regulatory reform more generally, see OECD (1999c)

52. The groups are the Clean Air Council, the Conservation Law Foundation, the Environmental Defense Fund, the Natural Resources Defense Council, the Natural Resources Council of Maine and the Sierra Club.

55. Some states have a more rigorous “compliance culture” than others. It is hard to quantify this, but there is indirect evidence that the degree of inter-state variation may be declining. A recent study (Levinson, 1999)⁵³ into the costs to enterprises of meeting environmental regulation in different states shows that variation across states was narrowing somewhat up to 1994, although not continuously (Figure 6). It may be speculated that actions in federal courts, creating precedents valid in all states, the wide availability of information,⁵⁴ as well as aspects of legislation designed to prevent internal “environmental dumping”,⁵⁵ have all been part of the process bringing this about.

Figure 6. Variation in compliance costs across states(1)
1977-94



1. Coefficient of variation of industry-adjusted index of compliance cost.
Source: Levinson (1999).

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53. The industrial census figures on environmental compliance expenditures used in this study have not been collected since 1994. In any case, the figures are unlikely to show the full economic cost of environmental regulation, since they are based on actual expenditures and would therefore not have included, for example, output lost through choice of production technique.
54. Official information on discharges and emissions by individual enterprises and on compliance of particular localities with clean air and water standards is available on the Internet.
55. The 1977 Clean Air Act, for example, included “prevention of significant deterioration” language which ensured that the clean parts of the country did not attract polluting manufacturers from the more stringently regulated dirty parts of the country on the basis of their weaker standards.

56. Opposition to proposed regulations is often based on claims that, even where benefits appear to exceed costs, their instigators underestimate the costs of implementation faced by the private sector. There are examples of regulations for which cost underestimates have been very large, often going hand in hand with overestimates of the benefits, but available evidence does not in fact suggest that this is a systematic tendency. A report by the Office of Management and Budget notes a road-safety case, the fitting of “center-high-mounted stop lamps”, where the costs are now estimated to be nearly twice the estimate in the Regulatory Impact Analysis (RIA), undertaken in 1983, whereas the number of crashes avoided is estimated to be only between 2 per cent and 10 per cent of that in the RIA; aggregate benefits nevertheless substantially exceed the costs, even when only property damage is considered. But in other cases costs have been overestimated by up to a factor of three or four.⁵⁶

57. Another recent study (Harrington, Morgenstern and Nelson, 1999) concludes that *ex ante* overestimates of the costs of compliance are actually more frequent than cost underestimates; however this is partly due the fact that compliance with regulations is rarely complete, so that even if per unit abatement costs were overestimated, actual costs could be underestimated. In fact, the study concludes that costs per unit of abatement for EPA and Occupational Safety and Health Administration regulations are as often overestimated as underestimated.⁵⁷ An interesting property of the examples covered in this paper is that in cases where economic incentives were used, it was always the case either that costs were overestimated or that total abatement achieved was underestimated. It was also frequently the case that cost underestimates were associated with unpredicted technical changes. While the rather small number (25, including three examples of non-US regulations) of cases in this study limits the weight that can be attached to these observations, they are consistent with the idea that economic instruments generate incentives to search for least-cost solutions.

58. Detailed comparisons of *ex post* with *ex ante* cost estimates are infrequently available, and it is not clear whether the trend is towards improvements in cost estimation or not. Although estimates made in the 1980s tended to be more accurate than those of the 1970s, there is little evidence of change since then - see also OECD, (1999c, pp.153-55).

59. Whether or not costs are being estimated more accurately than earlier, concern that they may be too high has motivated a series of measures designed to ensure that excessively costly regulations (not only those in respect of environment and natural resources, but in practice these are often the most important) are not implemented. Regulatory Impact Assessments (RIAs) have their origin in the year 1978, having been modified under successive presidencies since; they are currently being operated under Executive Order 12866 of 1993.⁵⁸ This Order requires any economically significant regulatory act⁵⁹ to be accompanied by an RIA, including a cost-benefit analysis, which is to be subjected to an inter-agency review, under the co-ordination of the Office of Management and Budget.

56 See OMB (1998, p. 36 *et seq.*), and OECD (1999c, p. 159).

57. Of course, a cost overestimate is no better than an underestimate – both (for given benefits) will lead to misallocation of resources.

58. They can also be traced further back to a requirement for “Inflation Impact Assessments”, which dealt with more than effects on inflation, introduced during the Nixon administration.

59. Executive Order 12866 defines such action to include not just proposed regulations but advance notice of, or inquiries into, proposed regulations. “Economically significant” means anything with “an annual effect on the economy of \$100 million or more or [which] adversely affect[s] ... a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities ...”.

4.1 Cost-benefit analysis

60. The result of this requirement is that, despite the earlier-noted prohibition on the use of cost-benefit analysis in the formal decision-making process for certain aspects of policy, a great deal of it is carried out. The Office of Management and Budget (OMB) has since 1997 published tables showing the monetised costs and benefits of “economically significant” rules (OMB, 1997; 1998; 2000).⁶⁰ However, these tables come with many caveats, mostly spelt out in the reports themselves (see, in particular, OMB, 1998 and OMB, 2000). The principal warnings are to do with valuation – some major benefits are not quantified in RIAs, and for some which are, valuation is subject to substantial uncertainty. In addition, the aggregate cost-benefit analysis used generally takes no account of who receives the benefits or pays the costs, meaning distributional consequences are ignored.

61. Uncertainty in valuation comes from many sources. In valuing, for example, a measure designed to reduce emissions of particulate matter one needs to estimate the reduction that will actually be achieved and what its effect will be on atmospheric concentrations (and where). The effect of that on people’s health then has to be estimated, and those effects valued along with possible benefits from improved visibility. The OMB does not carry out any cost-benefit analysis itself, but, in OMB (1998), it has completed valuations that the originating agency did not. For example, OMB applies a value to a “statistical life” when an agency submitting a RIA quantifies the number of lives saved but does not itself value them. Some ideas of the range of uncertainty can be seen in Table 1.

Table 1. Valuation ranges

1996 dollars

Value of life:	
A “statistical life”	2.5 million - 5million
A “life year”	116 500 - 368 000
Emission reductions, value of one ton of:	
Hydrocarbons	519 - 2 360
Nitrogen oxides	519 - 2 360
Sulphur dioxide	3 768 - 11 539

Note: The value of a statistical life is the value attached to a reduction of one in the expected number of deaths in one year; the value of a life-year is the average value attached to an additional year of life.

Source: Office of Management and Budget (1998).

62. Generally speaking, even when figures at the low end of ranges of uncertainty are used, the OMB finds that the quantified benefits of the regulations covered in its report exceed the quantified costs in aggregate. Overall the calculated benefits exceed the costs by a large margin, largely because of two sets of regulations – restrictions on tobacco sales and part of the acid rain programme.

60. Although Congress discontinued collection of statistics on expenditures by enterprises in meeting environmental regulations (see footnote 47), the Act governing the OMB’s cost-benefit publications extended the OMB’s remit in 1999 to include investigating the impact on State, Local and Tribal governments. Executive Order 13132 (“Federalism”) of August 1999 reinforces the requirement for federal agencies to consult with lower levels of government.

63. Although this kind of exercise is extremely valuable and shows that, in the case of the regulations surveyed, monetised benefits exceed monetised costs,⁶¹ this is still a long way from showing that the policies are efficient – it may be that benefits could exceed costs to an even greater extent. This requires calculations of the marginal costs and benefits of different policies or instruments. The inherent advantage of taxes and charges is that the marginal costs can be seen very easily in the level of charges themselves (adjusted for private and public administration costs), leaving the task (still by no means an easy one) of calculating marginal benefits.

64. Just as Regulatory Impact Analyses are intended to give information on the economic costs of regulations, so Environmental Impact Statements (EIS) (originating in the 1969 National Environmental Policy Act) list the environmental consequences of planned federal government policies or investments. The sponsoring agency is required to look at alternative actions and assess which would have the least damaging effects. The environmental impacts are not valued in the EIS, however. Generally, only if an outsider, such as an environmental pressure group, takes legal action, is some comparison of the economic benefits and environmental costs likely to be made.

4.2 *Project XL*

65. While the notion of cost-benefit analysis leads naturally to a preference for economic instruments, these are frequently difficult to design for real world problems, though perhaps not as often as many claim.⁶² Part of the “Reinventing regulation” programme, Project XL (for Excellence and Leadership) is an experiment in trying to make existing approaches more flexible and therefore to lower costs. Regulatory programmes are frequently criticised for not taking sufficient account of local conditions; under Project XL the EPA is empowered to waive regulations on particular sites, for example on technologies required to clean up air pollutant emissions, provided that the firm or facility concerned comes up with a plan that improves its environmental performance (which must already be in compliance with existing regulations). The plan must be drawn up between the facility and the EPA and be developed through a process of stakeholder consultation – with local government and communities.

66. Project XL was launched in March 1995. As of March 1999 only ten projects had been implemented, with another 14 at various stages of development, but by October these figures were 15 and 28 respectively. A study (Blackman and Mazurek, 1999), looking at progress up to March 1999, suggests that these initial experiments have been rather expensive, with discussions between the firms involved and the regional and central EPA offices absorbing a lot of resources. Costs averaged over \$450 000 per firm.

61. There remain some doubts. On the benefit side, researchers at Resources for the Future argue that the value of a life saved is often over-stated (perhaps by an order of magnitude) because the techniques used for eliciting subjective valuations (willingness to pay, or willingness to be compensated) do not take proper account of people’s tendency to believe that unlikely events occur more frequently than they really. do; nearly all the benefits of the major pieces of environmental legislation are linked to lives saved. On the cost side, while cash expenditures on monitoring, abatement and administration can be accurately measured (though no longer officially recorded, see footnote 53), it is doubtful whether the cost of a choice of technology constrained by legislation can be easily assessed.

62. It is often noted that firms who may be subject to restrictions say they prefer a regulatory approach over the use of taxes or charges on the grounds that this gives them greater certainty. One possible explanation for this is that the regulators’ interlocutors in enterprises are often not those within an enterprise who are most concerned with its profitability: it may make their lives easier to argue for “command and control” even though that is not necessarily in the best interests of the enterprise. Even when it is in an individual enterprise’s interest, this may be because it hopes to use the regulation as a way to reduce competition, for instance as a barrier to entry.

67. Although it seems that better co-ordination within the EPA, and between its regional offices and headquarters, could reduce costs, the prospect that this approach could produce substantial improvements in regulatory cost-effectiveness seems doubtful at the moment. On the one hand, as Blackman and Mazurek (1999) report, the more a scheme tries innovative and potentially cost-reducing approaches, the more costly it is to get actual approval. On the other, EPA officials feel that many of the Project XL plans, while being effective in local terms, are so site-specific that the gains to be made from learning-by-doing may be small: implementation costs may not decline very much as experience grows, and the lessons for regulation more generally may be limited.

4.3 *The limits of cost-benefit analysis*

68. Formal cost-benefit analysis has many limitations, and some legislation appears to have ruled out using it for fear that manipulation of the assumptions required for its use might lead to worthwhile policies not being carried out. This may have some foundation in the sense that where policies give a small benefit to many, but the costs are borne by few, the few are more likely to be able to organise themselves to lobby against the policy than the many are to lobby for it. However, the situation described earlier, where a federal court rules that legislation (and court precedent) prevents the EPA from using a rule (a cost-benefit criterion) that the court itself considers would otherwise be acceptable, makes little sense. On the other hand, while it seems unnecessary to prevent agencies from using cost-benefit analysis, it should not be the only criterion for decision-making: for example, the political process may judge some issues to involve rights (for example, to clean air, or at least to not having one's health threatened by air pollution) whose value – if they can be valued – does not necessarily correspond to the sum of individuals' willingness to pay or to accept compensation.

5. Conclusions

69. Because of the range and complexity of both the legislation and the underlying problems, this paper is not in a position to recommend comprehensive solutions across a whole range of issues. However, certain general points do stand out, or are at least suggested by some of the examples discussed.

70. US environmental policy appears to be evolving in a direction which will allow a greater integration of environmental costs into economic decision-making, which should in turn promote growth which is more sustainable. The increasing use of economic instruments is one aspect of this, and another is the amount of environmental information in the public domain. Where economic instruments are not used, Project XL marks an attempt to introduce greater flexibility into the “command and control” instruments, even if wider applicability of the approach seems unlikely at present, in large part because of the high costs involved. Nevertheless, the lessons that could be learned from persevering with the programme in the area of experimenting with different instruments and permitting regulatory flexibility in order to achieve a better cost-benefit trade-off in environmental policies seem to argue for its continuation for the time being.

71. The heavy use made of the courts in both developing and implementing policy has at times been rather costly, in some cases, perhaps – as for the Superfund legislation – because of the drafting of the laws, but, where it results from the establishment of legal liability for environmental damage, it makes a direct contribution to better integration of environmental consequences into economic decisions. However, since this is a desirable aim, it becomes increasingly anomalous that cost-benefit considerations – largely inescapable in an economic decision-making context – are given inconsistent treatment in different parts of the law. It may be true that preventing the use of cost-benefit analysis in some circumstances may help to defend valuable environmental interests that would otherwise be too weak. It is also true that the resulting

ambiguity and inability of the EPA and other agencies to explicitly prioritise on cost-benefit grounds may have helped to create the situation where many of the priorities of those agencies are set by the courts.

72. Restrictions on cost-benefit analysis should therefore be removed. The fact that valuations are uncertain, and that it may be impossible to value certain effects, does not mean that such analysis is useless. Legislative clarity should be improved, so that the courts are not forced to develop case law on what lawmakers intended. Use of cost-benefit analysis should be the norm, but provide for a “reasoned” rejection of the results of a cost-benefit analysis if non-quantifiable benefits or costs are judged to be more important than these quantified. Provision for reassessment after a certain period of time would also be useful. Renewed attention should also be paid to the analysis of risk, as recommended in the 1991 OECD *Economic Survey* and as planned in the risk management budgeting exercise in 1992.

73. The OECD Regulatory Performance Review of the United States (OECD, 1999c) noted that US regulations were generally excessively complex and that litigation resulting from their implementation and enforcement absorbed considerable resources. This is certainly true of that subset of regulations, a large, subset, concerning environmental and natural resource issues, and the inflexibility of many of these regulations further implies that environmental aims are often pursued in inefficient ways, while other policies have significant damage to the environment as side effects. The Review's further observation that a majority of regulations appeared to have costs which exceeded their quantified benefits does not appear to be true for environmental regulations. However the fact that the quantified costs of a regulation may exceed benefits does not imply that it is not worthwhile: this requires a judgement as to the importance of non-quantified benefits. Nevertheless, there is obviously substantial room for changes in environmental and natural resource legislation that would allow for further improvements in environmental performance without large costs, or for reductions in the cost of meeting existing standards.

74. The wide variety of pollutants and pollutant sources that affect water quality means that improving it requires action on a number of fronts, and maintaining consistency of treatment among them is not always easy. However, the special treatment of agriculture appears increasingly anomalous, in the United States as in many other countries. It is difficult to justify its exemption from most of the regulations faced by other economic activities. In a sector already in receipt of prodigious subsidies, often tending in themselves to increase aggregate amounts of pollution, it is especially important that externalities be internalised where possible. A tax on the excess nutrient content of fertiliser and feed use would be one important step towards this aim, as already argued in the OECD *Environmental Performance Review* (OECD, 1996). A flat tax would be the easiest to implement, though ideally its level could be set as a function of likely environmental damage, which would vary according to location. A substantial tax would of course be costly for agriculture, but justified under the polluter pays principle. The initial effect could be softened in various ways, through tax credits equivalent to the tax payable on a certain level of fertiliser application, for example, or by introducing the tax at a low level (this would reduce the burden but also reduce the initial effect on incentives, unlike tax credits). If taxes are not politically feasible, this is another area where tradable permits (to apply fertiliser) could be used.

75. The Total Maximum Daily Load programme appears to offer valuable flexibility in achieving water quality objectives. It should be pursued, wherever possible using economic instruments (for example by making discharge permits marketable, already possible under existing legislation) and linking them to measures of damage (provided this does not lead to excessive complexity). These should of course be consistent with measures taken in other domains (for example, incentives to reduce nitrate discharges should be similar in agriculture to those in industry or waste water treatment plants). Because of the local, one-off nature of many TMDL programmes, full valuation studies and cost-benefit analysis may be too expensive to undertake in every case. Evaluations of a sample of programmes should be carried out, with a view to assessing how well they succeed in aligning costs and incentives.

76. The example of water supply in one area of California discussed in this paper is too limited in scope to be able to draw clear and general lessons. However, it is certainly suggestive of the conclusion that the structure of water rights is frequently an obstacle to the rational allocation of water use. This is particularly true of rules whereby rights to water lapse if they are not exercised directly by the holder, so that trading implies permanent transfer of the rights. Some of these rules have their origin in the idea that water rights cannot be absolute, being held in trust for the community; it is surely possible to respect this tradition without making it so difficult to allocate scarce water resources to their most beneficial uses. The general subsidisation of agriculture and in particular the huge subsidies to irrigation water are clear examples of policies that do not take sufficient account of environmental externalities.

77. Superfund and its costs have been subjected to intense scrutiny and criticism, although even now it seems that there is disagreement about how litigation and other transactions costs add to its burden. In any case, reforms in Superfund operation introduced in the 1990s seem to have resulted in lower costs. The Resource Conservation and Recovery Act (RCRA), though pre-dating the Superfund legislation, has been subject to less searching examination. Since the RCRA sets the constraints on the handling of potential pollutants, (while Superfund deals with sites once they are contaminated), such scrutiny is overdue; indeed, the OECD *Environmental Performance Review* argued in 1996 that RCRA is over-complicated and burdensome and could be reformed to improve cost-effectiveness without compromising environmental standards.

78. The introduction of the Toxic Release Inventory is a potentially important innovation, providing information about the environment and what may affect it that would not otherwise be available on a systematic basis, although the number of people who can make effective use of the information may be relatively small. By concentrating attention on a certain, admittedly potentially acute, set of risks, disproportionate public attention may focus on these, to the partial exclusion of other environmental or non-environmental risks. The experiment should thus be pursued by expanding the range and nature of the risks covered in such publicly provided data bases.

79. Many countries consider that the United States has a particular responsibility, as by far the largest current emitter of greenhouse gases, to show that it is taking the threat of climate change seriously by taking concrete steps to curb its emissions. Under favourable circumstances, in particular if there is widespread participation by developing countries in GHG emissions allowance trading, the increase in the gasoline tax needed to meet the Kyoto target may not be very large (though the proportionate increase in oil and coal prices would be considerable). The US negotiating position on the Kyoto Protocol is based on efforts to encourage such participation by developing countries, but it is not clear that these efforts will be fully successful, particularly if it implies substantial cuts in developing country emissions relative to a "business-as-usual" baseline. Furthermore, the example of the abandoned BTU tax from 1993 suggests that public resistance (and pressure from heavy energy-using industries) to even these relatively small price increases might be considerable.

80. However, to meet its commitments under the UN Framework Convention on Climate Change (UNFCCC), and under the Kyoto Protocol to this convention, the United States will have to take steps to accelerate the reduction in its fossil energy consumption per unit of GDP, especially as it now seems likely that its trend output growth rate has increased in recent years. Automobile users probably do not pay their full external cost, even when climate change is ignored. Certainly, a number of other OECD countries have increased their already relatively high levels of gasoline taxation, on environmental grounds. The current set of US measures – the CAFE standards – do not establish the right incentives for fuel economy and seem to have reached the limit of their effectiveness at their current levels. Some gasoline price increase will be necessary, whether through taxation or through the cost of buying emissions allowances on the international market, and now is the time to think about implementing this. It would be feasible, for example, to set up a domestic cap-and-trade system for CO₂ emissions in advance of the international

arrangements under the Kyoto Protocol. Action in this area would also serve to increase the chances of successful agreement, on detailed measures to implement the mechanisms agreed at Kyoto in 1997.

81. The United States has successfully introduced SO₂ trading on a large scale, after a number of smaller scale experiments in different areas. The NO_x scheme among north-eastern states also appears to have started successfully, and will be enlarged to a number of other states (logically, the inclusion of some Canadian provinces would also yield cost-effective environmental benefits). The success of these schemes has been such as to win over many people who would earlier have opposed them, and it is to be hoped that other countries will recognise their attractions.

82. Permit trading schemes have certain advantages over tax-based schemes: notably, in a society suspicious of taxation, that they are not taxes. However, the equivalence is very close, especially over time when quantitative targets are likely to be revised in the light of the costs of achieving them, just as taxes would be revised in the light of their effects on quantities. In particular they do not avoid the question of redistribution. Even at relatively low prices for GHG emission permits under the Kyoto Protocol, the notional tax revenue corresponding to the implicit carbon tax will be quite large (about \$30 billion with a “low” permit price of \$20 per tonne of carbon equivalent). If the permits are issued free of charge, then trading will result in a redistribution of income from those with high to those with low abatement costs; the latter would include, for example, operators of coal-fired power stations whose capital stock is fully amortised. While issuing permits free of charge may be necessary initially, it would make sense for the government to collect some revenue from what essentially becomes a resource rent, allowing some of the rent to be returned to consumers (taxpayers), rather than being retained within the affected industry. This applies to all resource trading schemes, from water use to greenhouse gas emissions.

Box 4. Summary of conclusions and elements of a reform package

US environmental policy

- Has worked to increase flexibility under the reinvention of regulation programme although results are disappointing so far.
- Has increased its use of economic incentives, especially in the form of tradable quotas, though recourse to the command and control approach remains pervasive, frequently in the form of regulations that are complicated and expensive to administer.

The role of the courts

- Is a valuable part of the process of establishing, or enforcing, acceptable environmental standards.
- But it sometimes produces rather bizarre results, especially where the underlying legislation is unclear or incomplete; and can be expensive.

Cost-benefit analysis

- Is widely but not consistently used, often because different laws set different restrictions on its use and because the OMB is not strong enough to enforce consistent rules for its use.

Despite the increasing emphasis on economic instruments, which are often the ideal method for internalising environmental incentives, some sectoral interests are unjustifiably protected. This survey is not comprehensive, but notable examples are:

Agriculture

The United States has particularly perverse incentives for water use in agriculture. The sector also benefits from an effective exemption from most clean water legislation and, as in most OECD countries though less than in many, a high level of overall subsidy. This is ironic since a number of agricultural programmes successfully use quite sophisticated means to maximise environmental benefits.

Climate change

The United States is the most important per capita contributor to greenhouse gas concentrations (overwhelmingly deriving from fossil-fuel consumption) and a signatory to an agreement to cut emissions significantly compared with what they would otherwise be by 2008-12. But it seems reluctant to explain to the public the implications of this commitment: meeting its objectives will require considerable increases in carbon-based energy prices, and no steps to bring this about have been contemplated.

Road transport

Quite apart from its importance as a contributor to greenhouse gas emissions, the road transport sector has many other externalities. The costs of reducing some of these is borne by the sector itself (*e.g.* accident insurance and safety regulations, catalytic converters and emission regulation); but where the externality is closely related fuel consumption, increases in fuel taxation are likely to be both more effective and less costly than the existing CAFE standards.

Elements of a reform package

Accordingly, a reform package in the areas touched on in this paper should include:

- the early introduction of a CO₂ (GHG) trading scheme;
- an increase in fuel taxes, in lieu of the CAFE standards;
- a rationalisation of the treatment of cost-benefit analysis;
- implementation of a system of charging resource rents on water extraction and the removal of impediments to trade in water rights; and
- a careful evaluation of the environmental costs of agriculture to ensure that the subsidies it enjoys are set in full recognition of these costs.

BIBLIOGRAPHY

- Blackman, Allen and J. Mazurek (1999), “The Cost of Developing Site-Specific Environmental Regulations: Evidence from EPA's Project XL”, Resources for the Future Discussion Paper 99-35, Washington, D.C, April.
- Cobb, Clifford (1999), “The Roads Aren't Free”, *Challenge*, Volume 42, No. 3, May-June, pp. 63-83.
- Congressional Budget Office (1998), *Regulatory Takings and Proposals for Change*, Washington, D.C.
- De Haan, Cees, Henning Steinfeld and Harvey Blackburn (1997), *Livestock and the Environment. Finding a Balance*, Food and Agriculture Organisation, available at <http://www.fao.org/WAICENT/FAOINFO/AGRICULT/aga/LXEHTML>
- Delucchi, Mark (1996), “The Annualised Social Cost of Motor-Vehicle use in the US, 1990-1991: Summary of Theory, Data, Methods and Results”, Davis, California: Institute of Transportation Studies.
- Environmental Defense Fund (2000), “Environmental Impacts of Hog Factories in North Carolina”, available at <http://www.hogwatch.org/getthefacts/factsheets/enviroimpacts.htm/>.
- Feather, Peter, Daniel Hellerstein and LeRoy Hansen (1999), “Economic Valuation of Environmental Benefits and the Targeting of Conservation Programs: The Case of the CRP”, Agricultural Report, No. 778, US Department of Agriculture.
- General Accounting Office (1996), “Bureau of Reclamation. Information on Allocation and Payment of Costs of Constructing Water Projects”, GA/RCED-96-100.
- Harrington, Winston, R. D. Morgenstern and P. Nelson (1999), “On the Accuracy of Regulatory Cost Estimates”, Resources for the Future, Washington, D.C.
- Howe, Charles W. (1997), “Increasing Efficiency in Water Markets: Examples from the Western US”, in Anderson, Terry L. and Peter J. Hill (eds.) *Water Marketing – the Next Generation*, Larham, Rowman and Littlefield.
- Intergovernmental Panel on Climate Change (IPCC) (1996), *Climate change 1995: the science of climate change. Contribution of the Working Group I to the Second Assessment Report of the IPCC*, J.J. Houghton, L.G. Meiro Filho, B.A. Callander, N. Harris, A. Kattenberg and K. Maskell (eds), Cambridge University Press, Cambridge.
- Levinson, Arik (1999), “An industry-adjusted index of state environmental compliance costs” , National Bureau Of Economic Research Working Paper No. W7297, August.
- Melnick, R. Shep (1983), *Regulation and the Courts: The Case of the Clean Air Act*, Brookings Institution, Washington, D.C.

- Mendelsohn, Robert (1999), *Regulation and the Courts: The Case of the Clear Air Act*, Brookings Institution, Washington D.C.
- Mendelsohn, Robert, William D. Norhaus and Daigee Shaw (1994), "The impact of global warming on agriculture: a Ricardian analysis", *American Economic Review*, Volume 84, No. 4, September, pp. 753-71.
- OECD (1996), *Environmental Performance Reviews: the United States*, Paris.
- OECD (1999a), *Regulatory Reform in the United States*, Paris.
- OECD (1999b), *OECD Economic Surveys, United States*, Paris, May.
- OECD (1999c), *Action against Climate Change: the Kyoto Protocol and Beyond*, Paris.
- OECD (2000a), "Cellular Mobile Pricing Structures and Trends", OECD DSTI Working Paper, Paris, March.
- OECD (2000b), *Frameworks for measuring sustainable development*, papers from a workshop on sustainable development indicators, Paris (forthcoming).
- Office of Management and Budget (OMB) (1997), *Budget of the United States Government, Fiscal Year 1997*.
- Office of Management and Budget (OMB) (1998), *Report to Congress On the Costs and Benefits of Federal Regulation, 1998s*.
- Office of Management and Budget (OMB) (2000), *Report to Congress On the Costs and Benefits of Federal Regulations 2000*, forthcoming; available in draft for public comment.
- Portney, Paul R. (1998), "Counting the Cost: the Growing Role of Economics in Environmental Decision Making", *Environment Magazine*.
- Postel, Sandra (1999), "When the World's Wells Run Dry", *World Watch*, Washington, D.C.
- President's Council for Sustainable Development (1999), *Towards a Sustainable America*, May.
- Probst, Katherine N., Don Fullerton, Robert E. Litan and Paul R. Portney (1995), *Footing the Bill for Superfund Cleanups*, Brookings Institutional Resource for the Future, Washington, DC.
- Smith, Anne E., Jeremy Platt and A. Danny Ellerman (1998), "The Cost of Reducing SO₂ (It's higher than you think)", *Public Utilities Fortnightly*, 15 May 1998.
- US Interagency Working Group on Sustainable Development Indicators (1998/99), "An Experimental Set of Indicators", Washington, D.C.

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