Environmental Incentives

Australian Experience with Economic Instruments for Environmental Management

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Executive Summary

This report is an updated and expanded version *of Using Economic Instruments for Meeting Environmental Objectives: Australia's Experience*, an environmental economics research paper prepared by the author for the Department of the Environment, Sport and Territories (DEST) in 1993 (James 1993). Instruments for environmental and natural resource management can be defined as administrative mechanisms adopted by government agencies to influence the behaviour of those who value the natural environment, make use of it, or cause adverse impacts as a side-effect of their activities.

In the last few years there has been greater support for using economic instruments to manage the environment. In part, this has been the result of broader policy initiatives based on international and national commitments, as well as an increasing realisation that economic instruments offer scope to achieve environmental objectives in more cost-effective ways than traditional command-and-control or regulatory mechanisms. Thus the use of economic instruments for environmental management may be one way of achieving more efficient

government, and of encouraging environmental good practice while improving economic performance and international competitiveness.

An important development has been the greater use of economic instruments in managing natural resources that have significant environmental connections, for example, in areas such as forestry, fisheries, land conservation, water quality, river flows and the maintenance of biodiversity. The present report covers many of these areas.

The report discusses economic instruments in the international context, including recommendations made by the World Commission on Environment and Development, the United Nations Conference on Environment and Development and the Organisation for Economic Cooperation and Development. In the national context, it discusses economic instruments in relation to the Ecologically Sustainable Development Working Groups, the National Strategy for Ecologically Sustainable Development, and the Intergovernmental Agreement on the Environment.

The main instruments surveyed in this report follow the same classification system recommended by the Organisation for Economic Cooperation and Development. They are:

- emission and effluent charges
- user charges for the treatment and/or disposal of waste
- environment taxes and levies
- proportional non-compliance fees
- product charges
- deposit refunds
- tradeable discharge permits
- tradeable resource use rights
- user charges for natural resources and environmental amenity
- performance bonds
- other economic instruments.

Where possible, the report uses case studies to illustrate the practical application of economic instruments in Australia. The following format has been used in each case study to help compare instruments:

- problem identification
- instrument selection
- description of instrument
- assessment against criteria for evaluation
- concluding evaluation.

The report explains how economic instruments perform and where their potential advantages lie, compared to regulatory mechanisms. The main advantages are related to economic efficiency as economic instruments enable the achievement of environmental objectives at least cost to the community. The instruments do, however, have practical limitations and there is no guarantee that they will automatically result in the cheapest solutions. Poorly designed economic instruments can cost as much as command-and-control systems.

Emission and effluent charges are discussed as a means of encouraging better environmental performance, particularly in relation to pollution control. The South Australian Environment Protection Authority pioneered the use of this instrument in Australia with its charging system for discharges to the marine environment, and the same system is being maintained under the Environment Protection Act 1993 (proclaimed in May 1995). The New South Wales Environment Protection Authority is currently introducing another innovative charging system under its load-based licensing scheme.

A wide range of government agencies employ user charges for waste management. The Trade Waste Policy and Management Plan, introduced by Sydney Water in 1991, is presented as a case study. Water and sewerage authorities in other States have adopted similar schemes.

Environment taxes and levies are used in the water and sewerage industry, and increasingly by local governments. An important lesson, demonstrated by a case study of the Special Environmental Levy applied by the Sydney Water Board, is the need to assure those who pay the levy that the funds are allocated to the prescribed environmental purpose.

Product charges are not widely applied in Australia. There are, however, several examples, such as the tax exemption on recycled paper, which has now been abolished, and the differential tax on unleaded petrol. The report discusses both of these case studies, as well as a case study on ozone depleting substances.

Deposit refunds have been very successful in South Australia as a means of reducing litter from beverage containers, as the case study on the South Australian Beverage Container Deposit scheme illustrates. Deposit refunds could be applied more widely in Australia for waste management, on items such as motor vehicles, batteries and other consumer durables.

The report contains an extensive discussion of tradeable discharge permits. There is considerable interest in this instrument for environmental protection, particularly in New South Wales, and theoretically such permits offer many advantages. Case studies of the Hunter River Salinity Trading Scheme, the Murray-Darling Basin Salinity Scheme, bubble licences for the Hawkesbury-Nepean and Sulphur Dioxide Management in the Kwinana Industrial Area discuss practical experiences with permits.

Tradeable resource use rights are a commonly used economic instrument. The report provides a general summary of experience in Australia, with case studies on tradeable water entitlements in Victoria, individual transferable quotas in fisheries management, and log pricing and allocation in forestry. An important feature of all the resource systems in these case studies is that they are based on renewable natural resources with constraints on maximum allowable use rates. The main function of tradeable rights is that they encourage allocation of the resource to the highest valued purpose, while meeting the yield constraint.

The report briefly discusses user charges for natural resources and environmental amenity. We can expect wider use of this kind of instrument as governments increasingly implement the user pays principle to cover the costs of managing natural areas and resources.

Performance bonds involve an upfront guarantee by developers, mining companies or other users to ensure that, should they go bankrupt or otherwise neglect their environmental responsibilities, there will be funding available to cover the cost of rehabilitation. Queensland has an innovative performance bond system for its mining sector, which contains economic incentives designed to encourage companies to implement best practice mining and rehabilitation processes.

Other economic incentive systems discussed in the report include the Accredited Licensee System and Cleaner Production in Victoria. The report provides an extensive coverage of economic incentives for biodiversity conservation, including voluntary actions by the private sector, economic incentives for conservation management, application of the user pays principle, and taxes and charges designed to raise revenue specifically for biodiversity conservation.

The report discusses economic incentives being used by local government. Councils are increasingly meeting the challenge of designing and implementing conservation strategies and resource management plans at the local and regional scale, and using economic incentives to help achieve their aims. The main incentives used are environmental levies, rate rebates and in-kind contributions. Programs tend to focus on the protection of vegetation, natural habitat, heritage sites, water quality and land resources. Many of the local government initiatives are undertaken on a collaborative basis, including co-funding arrangements, with State governments and the Commonwealth Government, and with stakeholder groups such as catchment management committees.

The report concludes with a general evaluation of economic instruments in relation to several criteria.

In terms of **effectiveness** in achieving environmental objectives, it is evident that the most successful instruments are those that specify quantity or quality constraints or standards. Tradeable permits generally do this. Performance bonds also appear to be effective in meeting environmental objectives.

There may be some uncertainty about the effectiveness of pricing controls based on the user pays/polluter pays principles in achieving the desired level of environmental protection. Price increases may not always effectively promote conservation of resources because users may not change their behaviour when faced with an incremental change in their costs.

The South Australian deposit scheme for beverage containers suggests that deposit refunds can successfully reduce litter and encourage product and materials recovery.

In terms of **efficiency gains**, there is a general problem of determining how to assess such gain. Usually, the gains from economic instruments are claimed relative to those from poorly designed command-and-control systems. In the case of tradeable resource use rights, there

is evidence of improved economic viability in several industries. Efficiency gains have been reported by water supply authorities servicing urban areas and for irrigated agriculture. In fisheries using individual transferable quotas, rationalisation of fleets has led to higher economic returns to operators and the industry as a whole. There is some evidence that trade waste programs are resulting in greater efficiencies in industry, including reduced generation of waste and greater reclamation of materials.

Tradeable permits and user charges provide **ongoing incentives** for improved efficiency and environmental performance. The Queensland mining bond system provides effective ongoing incentives for sound environmental management. Self-regulation by industry is an important component of the Kwinana sulphur dioxide control scheme.

Equity aspects vary according to the type of instrument and the way it is designed and implemented. The objectives of efficiency gains and of social equity may at times be in conflict, and equity problems are probably the main obstacle to introducing user pays pricing to encourage better resource use. Adverse price effects may be cushioned by incorporating direct regulations and other policy measures to back up economic instruments. For example, in pollution control programs, economic charges may be supplemented by product, equipment or performance requirements as well as education, information exchange and training.

Community acceptance is essential to the success of any system of resource management or environmental protection. The community has generally been somewhat suspicious of economic instruments, but there is now greater understanding and acceptance of their use. Experience suggests that public support for economic instruments and financing mechanisms will be most favourable where it can be demonstrated that funds are being allocated to environmental programs and projects. Local councils and other water authorities have generally gained acceptance for environmental levies.

Industry acceptance is an essential aspect of implementing economic instruments. The important message to convey is not whether the instruments will result in any cost, but whether they are likely to enable industry to comply with the environmental objectives of government at a lower cost than those of alternative instruments.

Administrative feasibility depends on existing and proposed institutional structures, legislation and administrative procedures. Jurisdictional constraints may create particular problems of policy coordination.

Administrative costs of economic instruments are difficult to determine, especially on a comparative basis with other regulatory regimes. Economic instruments in principle should not cost more in administrative resources than command-and-control regulations, and there may be good reason to expect lower costs, depending on the design of any particular system. Provisions for cost coverage can be incorporated in the design and operation of instruments. Environmental and user charges of many kinds are imposed by governments to raise revenue to cover costs. Revenue can also be raised through licence fees or by auctioning user rights.

1. Introduction

1.1 Purpose and scope of paper

This report is an updated and expanded version of Using Economic Instruments for Meeting Environmental Objectives: Australia's Experience (James 1993), an earlier environmental economics research paper prepared by the author for the Department of the Environment, Sport and Territories (DEST). It focuses on the practical application of economic instruments rather than on theoretical appraisals. It aims to improve general knowledge about the use of economic instruments, identify their advantages and limitations in practice, and promote discussion on their potential for wider application in Australia.

The research paper published by DEST in 1993 was based on responses to an Organisation for Economic Cooperation and Development (OECD) questionnaire distributed to governments throughout Australia in 1992, and supplemented by information obtained directly from a desktop survey. A wide range of government agencies within Australia involved in environmental and natural resource management took a considerable interest in the paper. It listed a range of possible instruments, discussed their relative merits and limitations, and documented some of the practical experiences of government agencies in applying them to various kinds of environmental management problems in an Australian context.

In the last few years there has been greater support for using economic instruments to manage the environment. In part, this has been the result of broader policy initiatives based on international and national commitments, as well as an increasing realisation that economic instruments offer scope for achieving environmental objectives in more cost-effective ways than traditional command-and-control or regulatory mechanisms. Thus the use of economic instruments for environmental management may be seen as one way to achieve more efficient government, and to encourage environmental good practice while improving economic performance and international competitiveness.

Although many environmental management schemes have been proposed over the last few years and have received close attention from researchers and policy-makers, this report covers only those that have actually been applied in Australia or are due to be implemented shortly. The report thus omits a number of interesting schemes, such as emission charges and tradeable permits for greenhouse gases, trading schemes for non-point sources of pollution and economic instruments for effluent reuse.

An important development has been the increased use of economic instruments in managing natural resources that have significant environmental connections, for example, in areas such as forestry, fisheries, land conservation, water quality, river flows and the maintenance of biodiversity. The present report covers many of these applications.

The early sections of the report outline the various economic instruments, discuss their strengths and weaknesses, and consider them in the context of general environmental policy initiatives and regulatory frameworks. Subsequent sections provide detailed discussions of each kind of instrument, documenting, where possible, general applications in Australia and elaborating on selected applications as case studies. The report concludes with a general evaluation of the main findings. A comprehensive reference list covers the theoretical literature, overseas experience and specific applications in Australia.

1.2 International context

World Commission on Environment and Development

The World Commission on Environment and Development (WCED) was established in 1983 at the request of the General Assembly of the United Nations. Its report, commonly referred to as the Brundtland report, was a document of international significance (WCED 1987). The commission emphasised the need for environmental and economic policies to be mutually reinforcing to ensure sustainable economic and social development. The Brundtland report had an important effect on environmental policy in Australia.

United Nations Conference on Environment and Development

The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992 resulted in further commitment by the Australian Government to the principles of sustainable development. An outcome of the conference was Agenda 21, a blueprint for environmental action for the next century. Chapter 8 of Agenda 21, which deals with the integration of social, economic and environmental factors to achieve sustainable development, identified the need for making effective use of economic instruments and other incentives (Johnson 1993).

Organisation for Economic Cooperation and Development

Australia's involvement with the OECD has also helped to shape Australian environmental policies and practices. The OECD has been a strong supporter of the polluter pays principle and has for many years advocated the use of economic instruments for environmental management. It released publications on pollution charges in the 1970s and 1980s (OECD 1976, 1980).

In 1987 the OECD undertook a major survey of the use of economic instruments for environmental protection and published the results two years later (OECD 1989). The survey results revealed that the use of economic instruments had increased significantly over a period of 15 years. Within the 14 countries surveyed, there were more than 150 examples of the use of economic instruments.

This OECD publication was followed shortly by a set of guidelines on how to apply economic instruments in environmental policy (OECD 1991). In 1992 the OECD conducted an update of its 1987 survey by circulating a standard questionnaire among all member countries. The Australian results were incorporated in the 1993 research paper prepared for DEST (James 1993). The present report on economic instruments is based on the classification of instruments established by the OECD.

1.3 National context

Ecologically Sustainable Development Working Groups

The concept of ecologically sustainable development (ESD) has its origins in the 1972 United Nations Stockholm Conference. The principles were applied in an important policy document, the World Conservation Strategy, published in 1980 by the International Union for the Conservation of Nature and Natural Resources (IUCN 1980), the United Nations Environment Programme (UNEP) and the then World Wildlife Fund (WWF). The strategy provided the basis for the National Conservation Strategy for Australia (Commonwealth of Australia 1984). The Brundtland report and UNCED carried the concepts of sustainability further.

In 1990, the Commonwealth initiated a national program on ESD, with the release of a public discussion paper. Subsequently, nine ESD Working Groups were established to consider the implementation of ESD principles in sectors of the Australian economy, together with industry, government, conservation groups, research institutions and the general public. The ESD Working Groups were required to examine issues of sustainability, providing advice on future ESD policy directions and developing practical proposals for implementing them in Australia. During 1991 and 1992 the ESD Working Groups produced reports on agriculture, forestry, energy production, energy use, fisheries, manufacturing, mining, tourism and transport (Commonwealth of Australia 1991a), as well as reports on intersectoral issues, the greenhouse effect, economic modelling, and a compendium of ESD recommendations. Each of the reports considered economic incentives as a means of facilitating environmental and natural resource management.

In 1993, the ESD Steering Committee reviewed progress in implementing the National Strategy for ESD (Commonwealth of Australia 1994). The committee commented that there was still a lack of practical techniques and experience with economic instruments to achieve environmental objectives through these means rather than through regulation, and emphasised the need to develop economic instruments quickly to keep pace with the process of deregulation, privatisation and other market mechanisms. The committee noted that work had commenced on the development of economic instruments in a number of jurisdictions. The present report describes these and other subsequent developments.

National Strategy for Ecologically Sustainable Development

The National Strategy for ESD provided a comprehensive blueprint for achieving sustainable development in Australia (Commonwealth of Australia 1992a). Chapter 20 of the strategy, 'Pricing and Taxation', calls on governments to continue to develop practical experience in the use of pricing and economic instruments such as tradeable rights in managing resources. It also suggests that governments establish pilot programs within a number of specific natural resource sectors to test the practicability and effectiveness of different mixes of market and regulatory mechanisms. The strategy also advises governments to ensure that taxation regimes foster sound environmental practices.

Intergovernmental Agreement on the Environment

The Intergovernmental Agreement on the Environment (IGAE) was signed in 1992 by the Commonwealth of Australia, all States and Territories and the Australian Local Government Association. It achieved agreement by all governments in Australia to take a cooperative national approach to the environment (Commonwealth of Australia 1992b).

Section 3 of the IGAE calls for the effective integration of economic and environmental considerations in decision-making processes, in order to improve community well-being and to benefit future generations. It identifies the need for the nation's international competitiveness to be maintained and enhanced in an environmentally sound manner; and it requires that the measures adopted be cost-effective and not disproportionate to the significance of the environmental problems being addressed.

On the matters of valuation, pricing and incentive mechanisms, the IGAE requires that:

- environmental factors should be included in the valuation of assets and services
- the polluter should pay, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement
- the users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes
- once established, environmental goals should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, which enable those

best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.

The National Commission of Audit (1996) investigated the IGAE and concluded that, to date, it has not been an effective mechanism for encouraging action on environmental issues from a national and bilateral perspective. It considers that environmental protection is primarily a State responsibility. The commission noted that:

'there is a lack of progress in pursuing more cost effective ways of achieving environmental objectives such as improved valuation and pricing of resources and other incentive mechanisms. States have a vital role in the introduction and implementation of such mechanisms.' (p. 76).

Recommendation 4.36 refers specifically to economic instruments and states that:

'Commonwealth and State agencies should pursue greater use of economic instruments, such as appropriate valuation and pricing of resources and increased cost recovery, through purchaser/provider agreements' (p. 77).

The Productivity Commission also reviewed the IGAE and recommended that its implementation be accelerated. In its Stocktake of Progress in Microeconomic Reform, the commission noted that:

'the costs of meeting environmental objectives can frequently be reduced by employing outcome-oriented regulation and economic instruments that provide firms the flexibility to modify their production and/or consumption so that the requirement is met in a least-cost fashionÉTo date, governments in Australia have used economic instruments sparingly. There is scope for them to be used more extensively' (Productivity Commission 1996, p. 141).

The Minister for the Environment, in a recent statement titled Investing in Our National Heritage, indicated the Government's commitment to reviewing, in consultation with the States and local government, the effectiveness of the IGAE to achieve a clearer definition of the respective roles of the Commonwealth and the States in environmental protection (Commonwealth of Australia 1996).

1.4 Range of instruments covered

The economic instruments covered in this report correspond to those identified by the OECD. Not all of these instruments have been applied in Australia, but a full checklist of instruments is covered for the sake of completeness. The main instruments surveyed are:

- emission and effluent charges
- user charges for the treatment and/or disposal of waste
- environment taxes and levies
- proportional non-compliance fees
- product charges
- deposit refunds
- tradeable discharge permits
- tradeable resource use rights
- user charges for natural resources and environmental amenity
- performance bonds
- other economic instruments.

Subsidies in various forms, such as tax concessions, capital grants, reduced prices and support for research and development, may be another means of managing the environment. However, they tend not to be favoured from the viewpoint of economic efficiency. Indeed, subsidies that are used for other purposes often have unwanted adverse impacts on the environment. For example, underpricing of irrigation water may lead to overuse, resulting in waterlogging and salination.

1.5 Case studies

Where possible, the report uses case studies to illustrate the practical application of economic instruments in Australia. A common framework has been used to help compare instruments. The main features of the framework are as follows.

Problem identification

- Description of resource

- Need for management action (statement of management problem)

Instrument selection

- Existing system, if any, replaced by instrument
- Consultation with community, industry and special interest groups
- Selection of economic instrument (rationale, advantages, constraints, preference over other instruments)
- Response by government(s) and instrument(s) chosen

Description of instrument

- Design of management regime (including legislation, supporting regulations and official designation of regime)
- Designation of management agency(ies) and role of instrument in broader institutional context
- Commencement date
- Processes of monitoring and enforcement
- Administration costs
- Revenue effects
- Volume and value of trades (if relevant)
- Any major developments/modifications since commencement date of regime

Assessment against criteria for evaluation

- Effectiveness in protecting the resource/environment
- Efficiency gains (cost savings, added benefits)
- Ongoing incentives for improved efficiency and environmental improvement
- Equity aspects (including impacts on industry and consumer groups)
- Community acceptance (industry, environmental groups, general community)
- Administrative feasibility and costs (including concordance with institutional frameworks)

Concluding evaluation

- General evaluation
- Potential for innovation or improvement

1.6 Sources of information

The present report builds on the content of the 1993 research paper and incorporates additional information compiled in 1996. The 1993 report was updated and expanded using telephone discussions and direct consultations with personnel in relevant government agencies, many of whom followed up with useful documentation on topics discussed. Other information was obtained from a desktop survey of reports, research papers, academic texts and public information documents.

1.7 Government agencies covered

A wide range of government agencies are responsible for managing the environment and natural resources. This research report focuses on State, Territory and Commonwealth agencies. However, an important addition to the report is information from local government agencies, which are increasingly looking to economic instruments to support their environmental objectives at the local scale.

1.8 Experience of other countries

Economic instruments for environmental protection were scarcely used 20 years ago, but their use has increased steadily. Some of the first examples were the use of effluent charges in the management of water quality in France, Germany and the Netherlands (Kneese & Bower 1968; OECD 1976; Bower et al. 1981). Economic instruments now used in European countries include effluent charges, input taxes, user fees, noise taxes, product taxes and deposit refunds (OECD 1989, 1991; Opschoor & Turner 1994).

In the United States, the most notable use of economic instruments for environmental protection resulted from the United States Environment Protection Agency's emissions

trading policy, which evolved during the 1980s as a consequence of the Clean Air Act 1977. The emissions trading program has achieved significant cost savings and has given firms greater flexibility in meeting emission limits (Tietenberg 1985; Hahn & Hester 1989).

The Clean Air Act 1990 created the scope for using tradeable permits to reduce acid rain, but it has yet to take effect. According to Foster and Hahn (1995), the most vigorous application of the emissions trading program has been in smog control in the Los Angeles area. The analysis undertaken by Foster and Hahn indicates that the market for permits in Los Angeles has been active since the mid-1980s. A more extensive marketable credits program (RECLAIM) is currently being formulated for the Los Angeles area.

Evaluation of Economic Instruments

2.1 Definition of economic instruments

Instruments for environmental and natural resource management can be defined as administrative mechanisms adopted by government agencies to influence the behaviour of those who value the natural environment, make use of it, or cause adverse impacts as a side-effect of their activities.

A broad distinction can be drawn between direct regulations (commonly described as command-and-control mechanisms) and economic instruments. Command-and-control mechanisms are based primarily on legislative and regulatory provisions and are implemented through directives from regulatory authorities. Regulations alone may be used for environmental protection purposes. Indeed, until recently, they were almost the only instrument used.

Economic instruments operate through market processes or other financial incentives. Although they take effect through various price and/or quantity controls, they usually allow for adaptive choice and decentralised decision-making by those whose behaviour is to be modified.

In reality, the distinction between direct regulations and economic instruments is often blurred as any system of economic instruments usually requires appropriate legislative or regulatory backing. Wherever economic instruments have been used, in Australia and overseas, supporting regulations have been applied.

2.2 Environmental management objectives

For the purpose of this report, environmental management objectives are considered in the broad context of natural resource management and sustainable development. The World Commission on Environment and Development (WCED 1987) emphasised the need to achieve environmental protection as a means of supporting economic development and keeping options open for future generations.

All human and economic activity has some kind of impact on the environment. Production and consumption both rely on the use of primary resources such as energy, materials, biological resources and labour. Impacts include the exploitation of natural resources, modification of ecosystems and the discharge of solid, gaseous and liquid wastes to the environment. Other impacts include thermal pollution, congestion and noise.

Management objectives can be related to each kind of impact. The appropriate design and application of economic instruments to each of these areas require careful consideration of the special characteristics of each problem, the institutional setting and the likely responses of stakeholders.

2.3 The case for economic instruments

Many economists consider that natural resources and the environment are in limited supply. Their overuse and consequent resource degradation are seen to be symptomatic of ‘market failure’. Users of natural resources and the environment are not held responsible for the full costs of resource use. This occurs primarily because of the ‘public goods’ characteristics of the environment, which make it difficult to control access or exclusivity of use. The problems associated with inadequate regimes of use rights or property rights have been long recognised in the professional literature (Bromley 1989; Boer & James 1990).

In the past, governments have relied heavily on direct regulations to achieve environmental management objectives. While such regulations have generally been effective in meeting environmental objectives, they tend to be inflexible and can impose high costs on the community. They can also be expensive to administer. There is substantial evidence that command-and-control systems can be extremely costly if poorly designed and administered (Hufschmidt et al. 1983; Tietenberg 1985; Bureau of Industry Economics 1992).

In the wider context, using economic instruments for environmental protection is seen as a practical means of implementing the principles of sustainable development. The most persuasive case for the use of economic instruments is the claim that they help to achieve environmental objectives at least cost to the community.

Economic instruments rely more on decentralised decision-making and market mechanisms than do direct regulations. By creating markets for natural resources and the environment, the instruments can signal true resource scarcities to users, creating economic incentives for wiser management. In simple terms, governments can influence usage patterns by controlling the quantities/qualities of environmental or natural resource attributes that are traded, or by controlling their prices, either directly where there is a mandate to set prices or indirectly through charges, taxes, subsidies and other economic incentives. These management systems are considered to result in a more efficient use of natural resources and the environment, commonly referred to as the 'efficiency gains' from using economic instruments.

2.4 Theoretical foundations

The theory supporting the use of economic instruments is described only briefly here. Detailed treatments of the theory are provided by Howe (1979), James (1985), Bohm and Russell (1985), Tietenberg (1985), Pearce and Turner (1990) and Opschoor and Turner (1994), among others.

Efficiency gains are derived from a trade-off between the value of economic damage potentially inflicted on the community by human activity and the costs of preventing, mitigating or rectifying such damage. Achieving an efficient solution requires that the sum of these two costs be minimised. This, in turn, requires that marginal environmental damage costs be equated with the marginal costs of environmental protection. Economic instruments are, in theory, capable of achieving this condition, especially when used for their 'incentive effect'.

Pollution charges and tradeable pollution rights are relevant examples of two different kinds of economic instruments designed to control environmental damage. Essentially, what is being traded on the market is the assimilative capacity of the environment to receive wastes from human activities.

The imposition of a charge (emission or effluent fee) on pollutants discharged to the environment operates through the 'price' effect within the market. It will provide an incentive for dischargers to reduce the quantities discharged and implement pollution abatement technology and/or management practices. The total reduction in discharges will be met at least total cost because all dischargers will tend to equate the charge with their marginal abatement costs.

If, instead, tradeable pollution rights (permits) are used, the maximum total allowable discharge load will be determined by the control authority. This represents a 'quantity' control within the market. Dischargers are allowed to compete in a market for rights to discharge wastes to the environment. When the market reaches an equilibrium, the price of permits will be equated to the marginal abatement costs of all dischargers, thus once again the environmental objective will be reached at least total cost to the community.

In the case of natural resources management, the problem of overexploitation of resources can have various causes. An inappropriate allocation of property (or use) rights is frequently the basic problem. Users of the resource are able to exploit the resource 'free' or at a reduced price, leading to resource depletion or degradation. Overuse of open-access fisheries or water resources are common examples. By introducing an economic rationing system, resulting in higher prices (either implicit or explicit) for the resource, a more conservative use of the resource may be achieved. Rationing systems may take various forms, such as tradeable quotas or use rights.

2.5 Some practical limitations

Despite the relative simplicity of the underlying theory of economic instruments, various practical limitations must be taken into account in their design and implementation.

The task of identifying and valuing environmental damage costs is usually complex and surrounded by uncertainty. Techniques have been developed to value environmental impacts and they are being used increasingly in policy applications. Relevant references and guidebooks include those produced by the Department of the Environment, Sport and Territories/Department of Finance/Resource Assessment Commission (1995), Dixon et al. (1994), Hufschmidt et al. (1983), James (1994), New South Wales Environment Protection Authority (1993), Organisation for Economic Cooperation and Development (1994) and Sinden and Worrell (1979). It is difficult enough to obtain point estimates of environmental damage in existing situations, let alone to predict and estimate other points on a damage cost function. Empirically, therefore, estimation of marginal damage costs, on which 'optimal' economic instruments and outcomes should be based, can be expected to provide major challenges for the economic analyst.

The theory explaining how total discharge loads can be controlled at least cost is straightforward, but the conditions for achieving economically efficient outcomes become more complicated where environmental objectives are specified in terms of ambient environmental quality. Under these circumstances, the major problem is identifying the linkages between sources and receptors of environmental damage and implementing effective controls over specific sources. The management of pollution, for example, may call for the use of differential charges or, in the case of tradeable rights, trading rules that apply different ratios between different sources or zones (Bohm & Russell 1985; Tietenberg 1985). When designing systems of instruments, particular attention must be paid to recognising environmental 'hotspots' representing points of intense environmental impact.

It cannot be assumed that the use of economic instruments will automatically result in least cost solutions. There is evidence that poorly designed economic instruments can cost as much as command-and-control systems, as reported in a study on controlling ambient concentrations of nitrogen oxides in the Chicago Air Quality Control Region (Hufschmidt et al. 1983).

A strong argument in support of economic instruments is that they provide incentives for ongoing improved efficiency and environmental performance, for example, in relation to innovation, environmental protection technologies and environmental management practices. The same incentives may not be apparent in command-and-control systems.

However, there are counter-arguments. For example, environmental control costs may not represent a large proportion of total cost, so there may be little incentive to respond to price signals. In the management of some environmental problems, direct regulations have often been needed to provide the stimulus for improvement, economically as well as environmentally. Regulations governing motor vehicle emissions are one example, with significant cost savings and improved energy efficiency resulting from better engine and motor body design, prompted by the need to reduce combustion emissions.

It should be recognised that, in practice, incentive effects may not be the primary objective in using economic instruments. Economic instruments can also be used to cover the administrative costs of regulatory functions, such as standard setting, monitoring and enforcement. In this context, economic instruments are used as a redistributive device.

It is possible to design economic instruments mainly aimed at revenue raising, rather than behaviour modification. Environmental taxes are an example of this kind of instrument. Whether such revenue raising is effective in meeting environmental objectives depends to a large extent on how the revenue is spent. If it is allocated to environmental improvement programs and projects, beneficial effects may be expected. However, if revenue is simply directed to consolidated revenue, environmental benefits may not be achieved.

A possible disadvantage of using economic instruments in managing natural resources and pollution is that they may not guarantee the attainment of management objectives. The effects of the price mechanism, for example, may still not result in sustainable use of resources. With some environmental problems, such as the management of intractable wastes, specific regulations may be the only effective way of ensuring public safety. Another problem with economic instruments is that the distributional effects may be unacceptable, as in the case of taxes on fossil fuels to curb the greenhouse effect or to conserve the use of energy.

Some critics of economic instruments argue that administrative costs will be increased because of an additional overlay of regulation (that is, controls over markets for the environment or natural resources), as well as direct regulations required to support the use of economic instruments.

2.6 Criteria for evaluating instruments

At present there are many uncertainties about how to design appropriate administrative systems for achieving environmental objectives. It is not at all clear that any particular economic instrument is the best one to use; whether combinations of economic instruments can and should be applied; whether direct regulations can and should play a supportive role; or whether economic instruments will necessarily be better than other administrative arrangements for environmental and resource protection.

Although economic efficiency may be one important criterion in evaluating economic instruments for environmental protection, in practice a wide range of criteria must be taken into account. They include the following.

Effectiveness in protecting the resource/environment

This refers to the extent to which environmental objectives are achieved. Performance criteria, monitoring and enforcement are functions that are required to ensure the effectiveness of economic instruments. The type of environmental or natural resource system may be critical in the success or failure of particular instruments. In cases of pollution management, for example, much depends on whether it is a 'uniform mixing' situation or a more complex, dynamic situation. Whether pollutants act as conservative substances in the environment or synergistically or antagonistically with other substances may have a direct bearing on the practicability of using economic instruments.

Efficiency gains (cost savings, added benefits)

The preceding section addressed efficiency aspects of economic instruments. Such gains include reductions in total abatement costs on a regional basis or among a set of dischargers in reaching prescribed environmental quality standards. Benefits may also comprise improvements in the quality of the environment or natural resource stocks, resulting in measurable increases in sustained yields, as in fisheries and forestry. For water resource systems, evidence of improved efficiency may be reflected in the allocation of water to higher valued uses and in increases in productive performance on a regional or sectoral basis.

Incentives for improved efficiency and environmental performance

These refer to incentives to improve technical and managerial efficiency in achieving environmental protection and to continue reducing the costs of attaining environmental objectives. It is contended that economic instruments provide an ongoing incentive to improve environmental technologies and management practices because of cost savings and improved efficiency in the use of natural resources and the environment.

Acceptable burden of costs

A well-designed system of instruments of any kind should take into account the costs imposed on dischargers or resource users, and this will inevitably involve costs of research, administration and enforcement. Sometimes, these costs may be allocated to industry, especially under a policy of self-regulation. To be successful, however, self-regulation must be monitored stringently by impartial industry associations and by government.

Equity aspects (including impacts on industry and consumer groups)

The incidence of benefits and costs can vary significantly for different types of instruments. The equity impacts of economic instruments may be a major impediment to their introduction. Impacts on low-income groups may be a matter of special concern, as well as effects on the profitability and competitiveness of industry. In some situations, the price changes required to achieve incentive effects may be so great that the equity impacts are unacceptable.

Compatibility with existing institutions

To be effective, instruments should fit with existing or proposed legislation, institutional frameworks and administrative structures. Jurisdictional constraints may affect the design and performance of economic instruments. Particular difficulties may be experienced in coordinating instruments at different levels of government, from Commonwealth to State, Territory and local.

Acceptable administrative costs

Administrative costs should not be excessive, and sources of funding for administration should be identified. It is often argued that the information requirements are less for economic instruments as compared with other administrative arrangements because it is not necessary to have complete information on the costs of environmental/resource protection technologies and management practices.

Community acceptance (industry, environmental groups, general community)

Success in implementing systems of instruments will be achieved only if the community understands the functioning of instruments and the objectives that management agencies are attempting to meet. There may be inherent conflict between different interest groups, depending on the allocation of rights and responsibilities that different types of instruments bestow. For example, with emission fees the asset values represented by the assimilative capacity of the environment remain in public ownership, whereas with tradeable permits the asset values are transferred to dischargers. Notions of fairness must therefore be addressed as a prerequisite to any system of economic instruments.

To overcome problems of acceptability, the environmentally beneficial effects of economic instruments (particularly the incentive and efficiency effects) must be demonstrated through public consultation and information programs. Similar programs may be required to persuade industry of the advantages. Where changes in economic instruments are made without warning, the problem of sovereign risk may be encountered — for example, altering the charge rates for effluents or emissions, or reducing the allowable quotas for water use or harvests of natural stocks (forests and fish stocks).

3. Overview of instruments

3.1 Areas of application

Each class of environmental or natural resource management problem has its own special properties or attributes, thus the suitability and kind of economic instrument must be considered on a case-by-case basis. General areas of application are:

- pollution control (discharge of solids, effluents and gases)
- noise and thermal pollution
- physically renewable resources (water, renewable energy)
- non-renewable resources (minerals and other materials)
- semi-renewable resources (agricultural land, groundwater supplies)
- biologically renewable resources (forestry, fisheries)
- conservation reserves and natural areas (national parks and wilderness areas)
- areas of aesthetic or heritage value
- biodiversity and natural ecosystems.

3.2 Management of pollution

Command-and-control systems of regulation have been the most commonly used instrument for the management of pollution in all States and Territories in Australia. Controls are usually enforced at source, with prescribed conditions of discharge, although ambient pollutant concentration standards frequently form the basis for determining discharge limits. Dispersion models may be applied to analyse the linkages between emission/effluent rates at discharge points and ambient concentrations. This approach is common in the management of airsheds and catchments.

Command-and-control systems for managing pollution usually involve regulatory constraints on licensed premises, with prescribed upper limits for the mass or volume of pollutants discharged. Revenue is collected from licences and other fees, on a fixed charge basis.

Economic instruments for pollution control are designed to ‘internalise’ the external damage costs of pollution. The aim is to create economic incentives that induce dischargers to change their behaviour, production technology, pollution controls or management practices. The main objective in controlling discharges is to limit the impacts on ambient environmental quality and meet air and water quality objectives. To be effective, such systems of instruments should be designed and implemented on a catchment or airshed basis.

Several States have recently adopted newer approaches to pollution control based on economic incentives. South Australia established a system of effluent fees for discharges to marine and coastal waters under its Marine Environment Protection Act 1990, and Victoria has introduced a load-based licensing system for effluent discharges. New South Wales is introducing a similar scheme. In all three cases, instead of a fixed licence fee, payments are

linked to the kind of economic activity, the kinds of pollutants discharged, the level of discharge and the sensitivity of the receiving environment.

Tradeable permits for pollution control are not yet common in Australia. They have been introduced for salinity control in the Murray-Darling Basin, but the prospect for trades is at present quite limited. The New South Wales Environment Protection Authority (EPA) has, however, introduced a pilot scheme for tradeable permits for salinity control in the Hunter Valley and is investigating the prospects for a 'bubble' approach for nutrient control in the Hawkesbury-Nepean area. The New South Wales EPA is considering other potential applications of tradeable permits.

The last few years have seen an extension of polluter pays or user pays systems of pricing for the treatment and disposal of solid and liquid waste. They range from charges for municipal waste disposal, to charges for the discharge of trade waste to sewerage systems, to charges for sewage treatment. The basic purpose of economic instruments in these instances is to cover the costs of management incurred by disposal authorities, to ensure that best practices and technologies can be implemented. To some extent, the newer pricing regimes have also encouraged dischargers to carry out abatement themselves, rather than pay the cost of having waste treated and/or disposed of by waste management authorities.

Materials reclamation and the recycling of materials and products are now important management objectives in solid waste management. Economic benefits associated with these objectives include conservation of materials from primary sources, reduced environmental impact and rationalisation of landfill areas, which are becoming increasingly scarce in urban regions of Australia. The National Waste Minimisation and Recycling Strategy and initiatives to achieve 'clean production' are supporting these management objectives. In many cases, economic benefits accrue to firms implementing the new techniques.

Governments have recently shown much interest in exploring the prospects for effluent reuse, particularly from sewage treatment plants, to conserve water supplies and to reduce the environmental impacts of effluent discharges to the environment. At present, however, the price structure tends to mitigate against the widespread implementation of effluent reclamation schemes, as follows:

- reticulated supplies of potable (drinking) water in many cases do not reflect the full cost of water supply (especially if allowing for investments in future storage schemes)
- the costs of treating effluent to an acceptable standard for reuse are currently several times the supply price of potable water
- usually a second reticulation system is required to carry treated effluent to points of consumption, adding to the costs of supply, especially where retrofitting is required in existing urban areas
- there is no internalisation of environmental costs in pricing regimes
- households generally have a lower level of acceptance and willingness to pay for recycled effluent than for potable water from reticulated supplies.

With continuing improvements in treatment technologies, there has been increased interest in treating effluent to a potable standard and using it in the existing reticulation systems. As well as costs, it seems that community concerns and health regulations are significant obstacles to adopting such technologies at present in Australia. It is unlikely that effluent reuse will occur on a large scale in Australia until appropriate prices are charged for potable water from primary sources and for the environmental damage costs resulting from effluent discharges to the environment.

Noise is one area where economic charges have been applied. A relevant example is the noise tax imposed on aircraft using airports under the control of the Federal Airports Corporation.

Policy initiatives of the kind discussed above, especially where designed to have an incentive effect, represent an important step towards the adoption of economic instruments for pollution control by environmental agencies in Australia. Further details are provided later in this report.

3.3 Management of natural resources

Many natural resources are publicly owned and managed. The usual management aim is to control rates of exploitation of the natural stocks. Maintaining or enhancing the quality of natural stocks may be another kind of management objective. In practice, it may be difficult to trace the connections between management actions and the impact of those actions on

resource stocks. Qualitative and quantitative constraints may affect the use of many natural resources.

There are major conceptual and practical difficulties in determining how economic instruments can be related to the objective of achieving ecologically sustainable management of natural resources. One policy problem is the extent to which management agencies should aim to cover the costs of management and the extent to which particular environmental attributes should be maintained or provided as a public good. These matters are of considerable importance in pricing policies for public forests and other natural areas.

In the case of mineral resources, environmental protection may require restoration and rehabilitation programs after temporary disturbance to the land. Most Australian States and Territories now use performance bonds for this purpose.

A commonly used economic instrument is tradeable water entitlements for inland rivers and streams, which a number of Australian States have recently established (ABARE 1993a).

With biologically renewable natural resources, such as forests and fisheries, the main management objective is usually to control harvest rates, allow regeneration or enhance natural stocks.

All States in Australia now have strategies to achieve sustained timber yields, and public forest management agencies have adopted innovative log pricing and allocation mechanisms to ensure that resource rents are fully paid. Increasingly stringent codes of forest management practice have led to the internalisation of environmental protection costs in pricing regimes (RAC 1992).

With fisheries, the main environmental threats are overfishing, stock depletion and dissipation of the resource rent generated by the resource. Rent dissipation can be attributed to a lack of control over access to the resource, too high a level of fishing effort and high average costs of operation resulting from stock depletion. These effects are well documented in the literature (Clark 1976; Lecomber 1979; Clark 1985; Munro & Scott 1985; Conrad 1995).

Various controls have been introduced to fisheries throughout Australia (Commonwealth of Australia 1989a). The aim has generally been to limit the catch and ensure that fishing effort is undertaken at least cost to the industry and community. Tradeable permits have formed the basis of management regimes in certain fisheries. In some cases, such as with southern bluefin tuna, the South East Trawl Fishery (ABARE 1993b) and abalone in New South Wales, management systems have been designed around the concept of tradeable catch quotas. Elsewhere, such as in the Northern Prawn Fishery (Haynes & Pascoe 1988), tradeable quotas have been used to limit fishing effort. With the Northern Prawn Fishery, quotas on fishing effort were recently reduced in an attempt to increase the resource rent within the industry, even though there was no real threat of resource depletion.

Various kinds of economic incentives have been adopted as a means of encouraging better land management. They include tax concessions for the maintenance of remnant vegetation and direct grants for land rehabilitation.

3.4 Management of natural areas and biodiversity

Natural environments are capable of sustainable use with appropriate management inputs. If managed carefully, the use of environmental amenities can be non-degrading. Natural areas support commercial activities (especially tourism), ecological functions (preservation of habitats and biodiversity), catchment protection, active and passive recreation, and education and research. Some values associated with natural areas may comprise ‘existence’ or ‘option’ values for which a financial return cannot be appropriated. Existence values usually are associated with ecosystem functions and characteristics, aesthetic attributes and heritage features. The commercial and economic values of natural areas have been well documented in a number of studies (Driml & Common 1995; Preece, van Oosterzee & James 1995).

Economic instruments can assist management programs designed to meet community uses and values for natural environments. Where there is active use of such environments, management actions should ensure that congestion does not become a serious problem and that the maximum carrying capacity for recreation and other activities is not exceeded. The preservation of biodiversity may be an additional management objective.

Economic instruments are widely applied in Australia on a user pays basis for the use of environmental amenities such as national parks, nature reserves and recreation areas. The instrument most commonly used is user fees. In the case of national parks, for example, fees may be imposed for gate entry, for the use of facilities or in the form of concessions for private

operators. Fees have been used for some years by the Great Barrier Reef Marine Park Authority, with an increase in fees for visits to the marine park being announced in the August 1996 Commonwealth Budget.

4. Emission and effluent charges

4.1 General application

Emission charges, when used as an economic instrument, should be applied according to the level of emissions. Such charges may consist of a charge per unit of mass, volume or concentration of pollutant emitted. Depending on the levels at which they are set, they can provide strong incentives for dischargers to reduce their discharges to the environment. Dischargers face the option of paying the charge or of reducing the quantities emitted, thus responding to an economic incentive to carry out abatement.

Generally, charges are applied to point sources, which are relatively easy to monitor. Charges may also be applied to non-point sources such as farms and urban areas, although they have yet to be applied in this context in Australia.

Variations of charging systems include the use of zoned charges, variable rate charges (increasing as the levels of discharge increase) and charges applying above a threshold level of discharge.

Charges can provide a powerful ongoing stimulus for firms to undertake research and development for environmental control and to adopt better abatement technology and practices. These incentives stem from the cost savings that are potentially achievable from improved pollution abatement measures. Materials, energy and product recovery and recycling often result from these processes.

Charges can in some circumstances be used as a means of raising government revenue, rather than acting as an economic incentive for pollution abatement. However, by allocating these funds to environmental improvement projects or to other environmental functions such as monitoring and enforcement, governments may achieve environmental objectives.

The cost functions of dischargers may not be known, thus it may be difficult initially to set the correct scale of charges and obtain the desired environmental improvement. However, it may be possible to experiment with the level of charges, and observe the effect on the environment. By announcing a progressive scale of charges, increasing over time, some of these problems may be avoided. It is important, however, not to disrupt long-term investment plans within industry (especially in environmental control measures) and create opposition to a charging system.

Emissions (Air)

Examples of emission charges are rare in Australia. The predominant form of environmental management consists of command-and-control systems, under which licences are issued to dischargers, with permits to emit specified volumes or loads of pollutants up to a maximum limit. These permits are usually tied to the licensee and are non-tradeable. Licence fees are charged primarily for revenue reasons rather than acting as economic incentives for the abatement of emissions.

The environmental protection and revenue effects of emission charges may move in opposite directions. Any system of charges that totally eliminated emissions would yield no revenue to the enforcement agency, but this is unlikely since a certain level of emissions is usually acceptable.

From an industry viewpoint, international competitiveness may be affected by the imposition of pollution charges. Emission charges could also create problems of commercial competitiveness if different systems were developed and applied in different States and Territories. Nevertheless, individual States and regions may wish to define their own levels of charges, taking into account possible differences in assimilative capacities of local environments and differences in community preferences for their beneficial uses.

Queensland has a licensing system for airborne emissions, administered by the Department of Environment and Heritage. The system is currently under review as part of the preparation of new environment protection legislation.

In South Australia, a licence is required for discharges to air. The fee is based on the annual production rate of the product, not on the quality or quantity of pollutant.

New South Wales uses a licensing system for air, water and noise, administered by the Environment Protection Authority (EPA).

Effluents (Water)

Effluent charges operate in a similar way to emission charges. As in the case of air pollution management, the usual instrument in Australia has been a licensing system, with fees designed to cover administrative costs.

Noise

In most cases, noise is controlled largely through direct regulations. Penalties are imposed for non-compliance, but these cannot be described as an economic instrument in the accepted sense.

In South Australia, penalties were previously applied for breaches of the Noise Control Act 1977, but the Act was repealed following the introduction of the Environment Protection Act 1993. The new Act covers noise as well as other forms of pollution.

Similar regulations are used in other States. In Queensland, licences to create noise are issued without any charge, but the system is under review.

An example of the application of economic charges to noise is the noise tax imposed on aircraft using airports under the control of the Federal Airports Corporation (see section 4.4). The charge is levied via airlines and added to the price of a ticket.

4.2 Discharges to the marine environment in South Australia

Problem Identification

An important objective of environmental management in South Australia has been to ensure that the quality of marine waters is suitable to protect the beneficial uses sought for those waters. Criteria have been developed to define appropriate water quality parameters for marine waters. All discharges to the environment in South Australia must be licensed. One of the relevant regulatory tasks has been determination of an appropriate system of charges to be applied in the context of the licensing system.

Instrument Selection

A pioneering application of an effluent charge in Australia is the system of fees introduced in South Australia to support the Marine Environment Protection Act 1990. Regulations were gazetted in 1992 and came into effect in 1993. The Act has subsequently been repealed and superseded by the Environment Protection Act 1993 (proclaimed in May 1995).

The system of charges operates under the Environment Protection (Fees and Levy) Regulations 1994, within the new legislative framework established by the Environment Protection Act 1993, and will be administered by the South Australian EPA. The fee structure is currently under review.

Description of Instrument

The fee structure discussed here is the schedule of charges introduced under the Marine Environment Protection Act 1991 and further dealt with in the Guidelines for Licensing Discharges to the Marine Environment (South Australian EPA 1993) specified by the Marine Environment Protection Committee. The guidelines discuss the required conditions for transitional licences to meet the following objectives and priorities:

- to improve identification of matter discharged, and the operational conditions that control those discharges
- to develop audits for monitoring those discharges, to establish a baseline to measure change in water conditions
- to encourage introduction of Best Available Technology Economically Achievable (BATEA); application of BATEA to any licensed discharge should follow a plan submitted by the licensee and incorporated as a condition of the licence
- to use water quality guidelines consistent with the National Water Quality Strategy as the basis for assessing receiving water quality
- to test the effectiveness of BATEA against targets derived from water quality guidelines
- to review water quality improvement programs in sufficient time to introduce any necessary changes before the end of the transitional licensing period

- to review targets to be met at the end of the transitional licensing period, taking account of management of other sources of land-based marine pollution introduced during that time.

In the schedule of fees, discharges are described as 'emissions' rather than 'effluents'. They are measured for every point source discharge to any South Australian tidal waters. The charge is levied according to the impact level which is computed by means of the formula:

impact level = flow x salinity factor x pollutant class factor x impact area factor

where

- **flow** is the average discharge in megalitres pursuant to the licence during the licence year, as measured in the manner specified for that purpose by conditions of the licence
- **salinity factor** is the factor determined by reference to the number of parts by weight of dissolved salts in the discharge pursuant to the licence during the licence year, as measured in the manner specified for that purpose by the conditions of the licence
- **pollutant class** factor is the factor determined by reference to the class of pollutants present in the discharge pursuant to the licence during the licence year
- **impact area factor** is the factor determined in accordance with reference to the area of marine environment determined by the Minister to be subject to environmental harm caused wholly or in part by the discharge pursuant to the licence during the licence year.

Table 4.1 shows the existing schedule of charges.

Table 4.1: Licence fees for discharges to South Australian tidal waters

Impact level (range)	Fee ($)
less than 0.1	no fee
0.1–50	300
100.1–200	600
201–500	1,200
501–1,000	6,000
1,001–2,000	12,000
2,001–5,000	30,000
5,001–10,000	60,000
10,001–20,000	120,000
20,001 or more	240,000

Source: South Australian EPA 1993

Assessment Against Criteria for Evaluation

The scheme has been operating for the last three years and has been considered sufficiently successful to be embraced by the Environment Protection Act 1993. Environmental objectives are met through compliance conditions and monitoring requirements that regulate discharges to the environment. The Act also provides for security bonds to cover potential rehabilitation/ restoration costs.

The Marine Environment Protection Committee established general principles for setting fees in their Guidelines for Licensing Discharges to the Marine Environment (South Australian EPA 1993). It is instructive to note the committee's comments on the general objectives of the system of fees:

'In recommending these principles for setting fees, the Marine Environment Protection Committee acknowledges that it is not attempting to set a fee which reflects the actual impact and costs to the community of any activity or category of activity, only that it is recovering some of those costs to the community in approximate proportion to the overall impacts and costs.'

The scheme clearly has the potential to reflect potential environmental damage costs to the community, and could provide positive economic incentives for improved technologies and management practices for effluent management.

A general review of the licence fee system is under way. It is designed to achieve greater application of the polluter pays principle in South Australia, and will include a revision of the fees for discharges to the marine environment. The Objects of the Environment Protection Act include:

'to allocate the costs of environmental protection and restoration equitably and in a manner that encourages responsible use of, and reduced harm to, the environment, with dischargers bearing an appropriate share of the costs that arise from their activities, products, substances and services.'

It is anticipated that the licence fee reform program approved by the State Government will increase the average annual licence fee from about $486 in 1993–94 to about $780 in 1999. The charging system can thus be expected to evolve in the direction of an incentive-based effluent management system rather than one designed to cover administrative costs. The reforms will also increase average annual licence revenue from its current level of about $850,000 to about $1.6 million in 1999, expressed in current dollar values.

Concluding Evaluation

The fee system introduced by South Australia is a pioneering example of an effluent charge in the accepted economic sense. One of its most innovative features has been the use of index values as a proxy for environmental damage costs. The strategy of increasing fees over time will provide anticipatory economic incentives, allowing dischargers to adjust to the changing regulatory environment and to implement cost-effective effluent management plans in the future. Sufficient revenue will also be generated to cover administrative and enforcement costs. Some other States in Australia have since adopted a similar approach in establishing fee structures to support their discharge licensing systems.

4.3 New South Wales Load-based Licensing Scheme

Problem Identification

When the New South Wales EPA took over the functions of the State Pollution Control Commission, it inherited a licensing system for discharges to the environment that can be described as 'command-and-control'. The authority has been investigating various proposals to achieve the advantages of economic incentives as part of its regulatory functions. The options have included effluent or emission charges, 'bubbles' and tradeable discharge permits.

Instrument Selection

The instrument discussed in this case study is a system of load-based licence fees for discharges to the environment. At present, the system is only at the proposal stage, but considerable progress has been made in consulting with relevant stakeholders, establishing principles on which the scheme may be based, and drawing up a schedule for implementation.

Description of Instrument

The Load-based Licensing Scheme under development by the New South Wales EPA is an excellent practical example of an effluent or emission fee. The system incorporates targets and the level of the fee depends on the discharge load and its potential impacts on the environment.

A Steering Committee, with representatives from Sydney Water, the New South Wales Chamber of Manufactures, New South Wales Treasury and the Total Environment Centre, has overseen the development of the proposed scheme. A model has been developed to assess alternative designs for the scheme.

The general principles of the scheme are noted in a background paper (New South Wales EPA 1996a) presented to a special workshop on load-based licence fees held in January 1996. They are as follows.

- Licence fees should be based on the polluter pays principle and applied within an equitable framework.
- Emissions of pollutants to air, water and land should be reduced to harmless levels at lowest possible cost to the community.
- Industry should have incentives for ongoing improvements in environmental performance and adoption of cleaner technologies.
- The incentives should be complementary to existing regulation and education programs for environmental protection.

Table 4.2 shows the pollutants to be covered by the scheme.

Table 4.2: Pollutants to be covered by the scheme

Air pollutants	Water pollutants

coarse particulates	suspended solids
sulphur oxides	Biological Oxygen Demand
fluorides	salinity
fine particulates	oils and greases
hydrocarbon	nitrogen
nitrogen oxides	phosphorus
hydrogen sulphides	organic toxics (some)
metals (some)	metals (some)
organic toxics (some)	
polycyclic aromatic hydrocarbons	

The basis for calculating fees is similar to the system introduced by the South Australian EPA for its marine waters protection. The fees are determined in conjunction with a set of index values reflecting initial loads and subsequent environmental impacts. The index values therefore act as a proxy for environmental damage costs.

The proposed scheme has two levels of fees and two emission targets. The short-term targets are achievable by Australian industries in the short to medium term. The long-term targets reflect desired environmental outcomes that may be achievable over time through changes in technology and management practices.

The emission targets are calculated for each licensee using a ‘target calculation factor’. Each factor is specific to a particular industry and is linked to the activity level of the discharger, measured in terms of tonnes of output, stocking rates (for example, for grazing), equivalent persons for sewage treatment plants, and square metres of land for diffuse sources such as factory storage areas or farm land.

The ‘unit fees’ for each pollutant are calculated as the product of a ‘base fee’ and the ‘pollutant weighting’. The pollutant weighting indicates the relative harm to the environment of the particular pollutant. The fees also incorporate ‘pollutant critical zone weightings’ which reflect the state of the receiving environment.

The fee to be imposed on emissions above the short-term target will be set at a higher level than the fee for emissions between the two targets. The aim is to encourage firms to act promptly and to complete any existing pollution reduction programs. No fee will be charged on emissions below the targets.

The base fees can be varied to control the general level of economic incentive. It is proposed that the base fee will increase to full value over five years.

Loads will be determined through monitoring data where available, and otherwise through the application of ‘emission factors’. Emission factors indicate the loads of various pollutants per unit of activity level for each discharger. The pollutant load is estimated by multiplying the activity level by the emission factor.

Options for implementation of the scheme, including the timing and integration with existing regulatory arrangements, are still under consideration. It is proposed that the industries initially falling within the scheme will be:

cement works	electricity generation	petroleum works
ceramic or glass works	extractive industries	sewage treatment
chemical works (some)	livestock processing	incinerators
coal and other mines	mineral/metallurgical	bulk shipping facilities
coal works	paper production	

The industries to be covered next by the scheme comprise:

agricultural industries	Chemical storage	livestock intensive
aquaculture	contaminated soil	marinas, boat/ship works
bitumen pre-mix	crushing, grinding industries	wood/timber milling
breweries	drum/container reconditioning	wood preservation
chemicals (other)		

Industry, environment groups and the community have been asked for their comments on the structure of the proposed scheme, including targets, pollutant weightings and pollutant critical zone weightings.

There will be provision for a formal review of the scheme every five years in consultation with stakeholders. There will be ongoing review of methods for determining loads.

Assessment Against Criteria for Evaluation

As the scheme is still in the planning stages, it is not possible to conduct a full assessment of its features and likely operation. However, it should be acknowledged that the scheme has many desirable properties, including the potential for encouraging more effective and economically efficient management of discharges, allowance for environmental impacts, cost coverage for administrative purposes and opportunities for stakeholders to participate in formulating the scheme. An important advantage of the proposal is that it builds on the existing system of discharge licences. Transition to the scheme should thus involve only modest legislative and administrative costs.

Concluding Evaluation

The New South Wales EPA's load-based licence fee system is a positive innovation in pollution management in Australia. While it is similar to the system of fees introduced in South Australia for marine waters protection, it will apply to a much wider range of industries and affected environments.

4.4 Charges on noise

In some countries, charges are imposed on levels of noise nuisance. Charges are levied on aircraft, for example, on a per aircraft or per passenger basis, according to the type of aircraft and the noise level that is reached during take-off and landing.

The Aircraft Noise Levy Act 1996 was passed in August 1995, establishing a regime for the imposition and collection of an aircraft noise levy. The levy applies at designated airports as a means of recovering costs of Commonwealth noise amelioration programs involving the acquisition and insulation of homes and certain public buildings in high noise areas near those airports.

The levy has been applied to landings of jet aircraft at Sydney Airport since 1 October 1995. It applies to aircraft on both domestic and international routes, regardless of whether they are carrying passengers.

The amount of levy payable for each landing is calculated using a formula specified in subsection 6(1) of the Act which takes into account a 'levy unit' and the 'assessed noise' of the jet aircraft. The levy unit (currently $162.12) is the minimum amount payable by a jet aircraft required to pay the levy. Assessed noise is a combination of three certification levels for aircraft measured at three points (the lateral reference noise measurement point; the flyover noise measurement point; and the approach noise measurement point) specified under the provisions of Volume 1, Annex 16 to the Chicago Convention. The three certification levels vary for each model of aircraft and type of engine. The formula is designed so that the amount of levy payable doubles for each additional 5 EPNdB (Effective Perceived Noise Level in decibels) of noise generated by the aircraft. A typical levy would be $228 per landing for a particular Boeing 737-300 aircraft.

The rate of levy is adjusted with increases in the consumer price index. Revenue estimated for 1996–97 is $37 million, which is expected to recover the costs of the Sydney noise abatement program over 12 years.

5. User charges for waste management

5.1 General application

Wastewater Treatment and Disposal

State and local governments throughout Australia apply user charges for the treatment and disposal of household and industrial wastewater. The Industry Commission (1992) undertook a comprehensive review of issues, practices and potential improvements in the management of water supply and wastewater disposal.

In many instances, water authorities are responsible for water supply, the treatment and disposal of wastewater, the sale of treated effluent and sludge, and treatment and disposal of liquid trade wastes via the sewerage system. Water authorities may also have additional environmental responsibilities, such as control of stormwater run-off and water quality in receiving waters.

A major environmental problem requiring the attention of water management authorities for inland rivers in Australia is eutrophication and toxic algal blooms associated with effluent discharge. Salinity is sometimes also linked to effluents. In near-shore ocean waters, the discharge of sewage effluent, often subject only to primary treatment, has resulted in beach pollution, and adverse health and aesthetic effects. There have also been concerns about concentrations of pesticides, intractable wastes and heavy metals resulting from the discharge of industrial wastes to the sewerage system.

The complex interrelations among the multiple functions of water agencies create difficult problems of pricing for water authorities. Effluent volumes and quality may be affected by the pricing policies that are applied to inputs to the sewerage system. The pricing of potable water, for example, can have significant effects on the total volumes of water used by households and industry. Pricing policies for discharges of trade waste can affect the volumes and quantities of wastes carried by the sewerage system. Other prices to be taken into account include charges for sewerage services and for reclaimed saleable products such as effluent and treated sludge. The effectiveness of recycling programs will depend strongly on the pricing regimes that are implemented.

If separate pricing functions are adopted for water supply and wastewater treatment, efficiency gains may be achieved for the separate activities. However, it is essential to develop consistent approaches to water management functions, including appropriate environmental protection measures and strategies.

Environmental protection may be deliberately factored into the pricing policies of water authorities and/or enforced through environmental standards imposed by an environment protection agency or by the water authority itself. Such standards may relate to total loads and concentrations of pollutants for inputs entering the system (especially from industry), as well as to effluents discharged to the environment. The management of environmental quality in relation to wastewater treatment and disposal may thus be achieved through a combination of pricing and environmental regulation. Outright bans may be imposed on the discharge of some substances, such as intractable waste, to the sewerage system.

It is evident that the user pays and polluter pays principles have been applied on a rather ad hoc basis by water authorities in different parts of Australia. In the past, water and sewerage charges were based heavily on property values, with water being supplied virtually as a free resource, leading to profligate use. Cross-subsidisation among different sectors was another outcome of property-based charges. Some water authorities still follow these pricing practices.

Two-part tariffs, consisting of a property value (or service access) component and a user charge, have the potential to overcome some of the disadvantages of charging systems based solely on property values, and are widely used. However, the user pays component has often not been sufficient to have an impact on the level of demand. There is little doubt that considerable improvements in resource use efficiency, such as the postponement of new reservoirs, higher levels of materials recovery and reuse, and more efficient use of infrastructure, could be achieved through more rational pricing policies.

In theory, maximum economic efficiency would be achieved through marginal cost pricing, although there are a number of practical difficulties in implementing the principle. Marginal cost pricing for water services is discussed by the Organisation for Economic Cooperation and Development (OECD 1987) and the Industry Commission (1992), among others.

Some water authorities have succeeded in implementing user pays pricing policies that have had demonstrable effects on the level of demand for water services. Some examples are the Hunter Water Corporation, the Water Authority of Western Australia and ACT Electricity and Water.

In moving to a user pays pricing system, water authorities may face constraints of a political nature, as well as problems of explaining the benefits to the community. Equity effects have been cited as an additional constraint, but these can be overcome by means of rebates, minimum fixed charges and educating the community on water conservation programs. It is important for authorities to communicate clearly any proposed changes in charges to customers to encourage shifts in behaviour. Education about pricing policies is an important way of gaining public acceptance of proposed changes.

An unresolved problem in pricing is the use of subsidies to offset ‘community service obligations’ (CSOs). Most governments recognise the place of CSOs in pricing policies, although the definition of CSOs in the context of water services is somewhat contentious. In broad terms, CSOs refer to measures that do not generate revenue directly for water

authorities, but nevertheless result in benefits of various kinds to the community. Such benefits may relate to equity effects and considerations of ‘fairness’.

Protection of environments affected by wastewater should be a goal of sustainable resource use, and is recognised as such, but whether environmental values should be incorporated in CSOs is a contentious policy matter. Some water agencies are moving towards an essentially corporate approach to their management functions, requiring prescribed rates of financial return on their investments. However, it is often possible to demonstrate broader community environmental benefits of improved effluent treatment, based on benefit-cost analysis, that are not matched by financial returns. Water authorities can still meet environmental targets, provided block grants are made by Treasury and finance departments to cover the relevant costs.

An alternative approach to the problem is to designate the water authority as an ‘operator’ and ensure that environmental standards are appropriately set by the relevant environment protection agency (the regulator). The function of the operator would be to supply basic water and sewerage services at least cost to the community, subject to its normal operating conditions and environmental constraints. Economic instruments may of course be used instead of, or in conjunction with, direct regulations for this purpose. Any additional direct costs of pollution control would be passed on to the community by way of higher water and sewerage rates, based on the user pays principle. In reality, equity effects may force some compromise.

The Sydney Water Corporation has had a policy objective of discouraging excessive consumption of water. In the past, the pricing structure adopted by the former Sydney Water Board did not encourage water conservation and reuse as charges were based primarily on property values. Incentive effects were evident only in the industrial sector where, for example, BHP in Port Kembla uses reclaimed effluent as a cost-effective source of water for slag heap cooling.

Environmental groups in the Sydney region are generally in favour of full cost recovery through pricing reform for water, and the community has supported the principle of saving water. The charging system now used by the Sydney Water Corporation involves a constant rate per kilolitre consumed. The level of the charge has had some success in encouraging water conservation, but the impacts appear not to have been as large as those achieved by the Hunter Water Corporation.

The system used by the Hunter Water Corporation was specifically designed to have a demand management effect. Initially, there was community resistance to the user pays system, but it is now generally supported. Water consumption per household has declined from 300 litres per day to 220 litres per day. Wastewater charges adopted by the Hunter Water Corporation are also based on the user pays principle. The demands on the sewerage system are estimated indirectly, using formulas based on the kind of activity and the volumes of reticulated water used.

In South Australia, the Engineering and Water Supply Department considers its system to be well accepted by the community and to be fair. The use of property values to calculate charges contains an element of income redistribution, but does not affect water demand.

The economic efficiency of wastewater management may be improved by the sale of commercially viable by-products. Melbourne Water has provided recycled water (purified effluent) to golf clubs, orchardists and gardeners since 1975. Users bear the costs of an independent pipeline, pumping equipment and maintenance costs. Effluent is of high quality, but is supplied only for uses approved by the Health Department, such as industrial and agricultural applications.

Trade Waste (Discharged to Sewerage System)

Of particular interest are systems of industrial user charges that relate to the disposal of waste through the sewerage system. Numerous examples can be found in Australia.

The Trade Waste Policy and Management Plan introduced by the Water Board (now the Sydney Water Corporation) has had incentive effects, resulting in reduced quantities of substances discharged to the sewerage system. This can be expected to increase as the charges are raised in future years.

Melbourne Water receives significant revenue from trade waste charges, with collective treatment of effluent within Melbourne Water suggesting economic efficiencies of scale. Regular amendments to charges have been made based on yearly increases in treatment costs. It is intended to address the problem of cross-subsidies between different classes of dischargers as there have been frequent comments from clients and political sources about

rates of charges and their equity aspects. However, comparisons with European standards appear to indicate parity. The effect of the charges has been to encourage waste minimisation among clients, but there has not yet been an observable reduction in concentrations or flows.

The Hunter Water Corporation also has a system of trade waste charges. Anecdotal evidence is available indicating that particular firms are taking the costs of trade waste disposal into account and are modifying their discharges accordingly. Administration costs are recouped as revenue from trade waste charges. There is general community acceptance of a polluter pays approach to trade waste charging.

The Industry Commission (1992) describes details of trade waste systems used in other States.

5.2 Sydney Water Trade Waste Policy and Management Plan

Problem Identification

The detection of toxic substances such as heavy metals and organochlorines in marine biota near Sydney's sewerage outfalls resulted in strong public demands for an improvement in controls over effluent quality. The main source of these substances was discharges to the sewerage system by industries in the Sydney region. To overcome this problem, the Water Board (now the Sydney Water Corporation) introduced the Trade Waste Policy in 1988. The policy was supplemented by the Trade Waste Policy and Management Plan in July 1991.

The aim of the Trade Waste Policy was to promote ecologically sustainable development. It was designed to ensure continued protection of the environment, the safety of Water Board employees and the protection of community assets.

Instrument Selection

The policy consists of a combination of direct regulations and user charges, aimed at controlling the quality of trade wastes discharged to the sewerage system. Regulations control the quantities and types of substance that are permitted to be discharged. Discharges of intractable waste are strictly banned. Charges are imposed on a user pays basis, according to type of substance, effluent concentrations and total load.

This combination of instruments should ensure that the environment will not suffer damage from intractable wastes and high levels of toxic substances, provided illegal dumping does not occur. The system has been accepted by industry and there is an inducement for dischargers to improve the quality of waste and reduce the quantities of waste discharged to the sewerage system. The levels of the charges will be increased over time to create a stronger economic incentive effect.

Description of Instrument

The official designation of the program is the Trade Waste Policy. It has been administered by the Wastewater Source Control Branch by means of negotiated agreements with industry. The branch is also responsible for monitoring, enforcement and the keeping of performance records.

The Trade Waste Policy and Management Plan 1991–1994 was released in July 1991. It defines a set of Trade Waste Acceptance Standards applicable from July 1994. The standards have been designed to move one step closer to optimum levels of 'residential sewage equivalence'. The standards are intended to provide maximum limits on effluent quality. Dischargers are expected to achieve at least the prescribed standards.

The plan also defines a scale of charges for substances discharged to the sewerage system. The system of charges is described as 'liquid waste charges'.

As stated in the Trade Waste Policy and Management Plan 1991–1994, the Water Board Act 1987 empowered the board to manage the discharge of trade waste into the board's sewer and prohibit the discharge of trade waste to stormwater systems. Subordinate legislation included:

- prohibitions against discharging trade waste to any service of the board, except in accordance with a written service agreement of permission between the customer and the board
- procedures concerning trade waste applications, and conditions of service agreements and permissions
- standards for the acceptance of wastes
- powers to assess trade waste charges.

The policy strictly bans the discharge of intractable wastes to the sewerage system, and prohibits discharge of other prescribed hazardous substances. Trade waste, however, excludes domestic waste.

Properties discharging trade waste are classified in terms of the following four discharge categories.

- Category One — broadly commercial properties, for example, fast food outlet, retail butcher, shopping complex, restaurant.
- Category Two — small businesses producing low annual mass loads of residential type substances and low daily mass loads of non-residential type substances, for example, service station, vehicle washing operation, dental surgery, panel beater.
- Category Three — all customers whose discharge cannot comply with conditions relating to Categories One or Two and whose property is serviced by a sewerage system on which the equivalent of primary sewage treatment is provided.
- Category Four — all customers whose discharge cannot comply with conditions relating to Categories One or Two and whose property is serviced by a sewerage system on which the equivalent of secondary or tertiary sewage treatment is provided.

Trade waste quality charges are based on the concentration and total mass of substances discharged. For Categories One and Two, charges are based on an estimate of average and 95 percentile concentrations or on a 'discharge factor', defined as the percentage of the metered water supply to the business process which is discharged to the sewer as a trade waste. For Categories Three and Four, charges are calculated according to schedules forming part of the service agreements or permissions granted to each customer.

The formulas used to calculate the cost to the customer depend on the type of substance and the kind of sewage treatment plant to which it is disposed. Substances are classified as residential (Biological Oxygen Demand, suspended solids, grease and sulphate) or non-residential (metals and compounds). Charges for acidity/alkalinity are based on pH levels. The level of charges has been designed to increase annually by 15 per cent on the 1991 level. This will create strong incentives for dischargers to improve their treatment processes.

As well as user charges on discharges to the sewerage system, other fees are payable under the plan. They include agreement and permission fees and inspection fees.

Between 1991 and 1994, every customer or potential customer whose trade waste discharge did not meet the July 1994 standards was required to develop an Effluent Improvement Program. This was to ensure at least full compliance on or before that date and indicate how the disposal of substances produced as a consequence of the improvement program would be addressed.

Where a customer is required to undertake an Effluent Improvement Program as part of a service agreement or permission, they must lodge a bond or security. They do not have to lodge a security if the program is to be completed within six months of the commencement date of the service agreement or permission, or if the amount of the security is $1,000 or less.

Any customer or person breaching the conditions of an agreement is liable to prosecution. Maximum penalties under the Trade Waste Regulation are $10,000 for individuals or $20,000 for companies per offence. In addition, the New South Wales Environmental Offences and Penalties Act allows for fines of up to $1 million and/or up to seven years imprisonment.

Assessment Against Criteria for Evaluation

The Trade Waste Policy and Management Plan has been a successful application of pricing policies. The announced schedule of increasing charges has provided strong economic incentives for industry to improve the quality and reduce the quantity of waste discharged to the sewerage system.

Monitoring results indicate that discharges of certain pollutants have declined since the plan was introduced. The effectiveness of the plan in achieving environmental protection can be expected to improve over time. A large number of small commercial properties are not metered for water use, and this makes it difficult to adopt a polluter pays approach to these properties.

The plan has had a largely positive reaction from industry and commerce. If particular customers are faced with cost difficulties, the arrangements for Effluent Improvement Programs provide for such customers to receive special consideration.

Concluding Evaluation

The Trade Waste Program appears to be a successful application of an economic instrument to a service function provided by government. The structure of the charges has provided incentives for dischargers to reduce the quantities of waste discharged to the sewerage system. Additional regulations, monitoring and compliance have been required to support the program. There have already been improvements in the environmental quality of receiving waters achieved, and this improvement is expected to continue.

5.3 Other charging systems

Solid waste generated by households and industry is handled largely by local councils, but State governments may also carry out certain functions, including the setting of standards for disposal and charges to be applied. Some States tailor charges and regulations to reduce the bulk of material generated and to encourage recycling. One of the risks of user charges, particularly for household waste, is that it may encourage illegal dumping of waste and degradation of the environment.

In New South Wales, a Waste Disposal Levy is applied to household and industrial waste. It is expected that the levy will be increased progressively. The levy has had incentive effects, such as an increase in rates of recycling.

In Tasmania, the Department of Environment and Planning is investigating the implementation of a waste disposal fee on a per tonne basis. This system is considered to be more equitable, and may also encourage waste minimisation and recycling.

In South Australia, the Waste Management Act 1987 has been repealed. Henceforth, charges will be applied under the Environment Protection (Fees and Levy) Regulations of the Resource Management Act. The previous system of flat fees, administered by the South Australian Waste Management Commission, will be replaced with a system relating the fees to the volume of waste to be treated or stored. A proposal is also under consideration to increase the solid waste charge to subsidise the cost of establishing a kerbside recycling scheme.

6. Environment taxes and levies

6.1 General application

Environment taxes consist of a special levy to finance environmental improvement programs and projects. A potentially efficient instance of such a tax, unrelated to incentive effects, is a levy designed as a front-end capital financing measure. An example of such a levy is the Special Environmental Levy introduced by the then Sydney Water Board. One of the main conclusions that may be drawn from this case study is that, to gain public acceptance of the scheme, the funds must be spent and be seen to be spent on environmental improvement programs.

The Hunter Water Corporation uses an environmental levy. Improving efficiencies within the corporation in recent years have enabled it to pass on the benefits to its customers, and reduce the levy significantly.

A number of local councils now impose environmental levies to raise funds specifically for environmental improvement programs under their jurisdiction (see Chapter 15 of this report). Generally, local citizens seem to support these levies.

6.2 Sydney Water Board Special Environmental Levy

Problem Identification

This case study is included as a matter of historical interest, since the Sydney Water Board has been replaced by the Sydney Water Corporation and the environmental levy is no longer applied. The cost of environmental protection programs and projects by the corporation is now absorbed within the general rating structure.

The Sydney Water Board was responsible for the treatment and disposal of wastewater for the Sydney, Illawarra and Blue Mountains area. In the late 1980s, serious water pollution problems resulted from inadequate methods of sewage disposal. The problems included algal blooms and eutrophication of the Hawkesbury-Nepean River, pollution of other waterways and faecal contamination of Sydney beaches. There was strong public pressure to improve the environmental quality of the beaches and waterways in the region, including mass public meetings and representations from community groups.

In 1989, the New South Wales Government committed itself to clean up, and keep clean, the oceans, beaches, harbours, estuaries, rivers and waterways. This decision resulted in the Clean Waterways Programme (CWP). The vision of the CWP was clean and healthy waterways in the Sydney, Illawarra and the Blue Mountains achieved in partnership with the community. The mission of the Sydney Water Board in realising this vision was to develop and implement technical and social solutions to current and evolving water pollution problems in conjunction with the community (Water Board 1992a).

The CWP involved a planned expenditure of approximately $7 billion over 20 years, the largest environmental improvement program ever proposed in Australia.

The Special Environmental Levy (SEL) was introduced as a financing mechanism to support the CWP. Funds raised under the levy were expended under the Special Environmental Programme, implemented as part of the CWP.

Instrument Selection

An environmental levy was selected for several reasons. Extensive consultation with the community revealed strong public support for a special fund that would be allocated, and seen to be allocated, specifically to environmental improvement of the region's beaches, rivers and waterways.

Revenue from water and sewerage charges was considered inadequate as a source of funds to support the entire CWP. There were urgent needs for front-end financing in the initial phases of the program. The SEL was an appropriate mechanism to meet this need, as prospects for increasing ordinary water and sewerage rates were subject to various limitations.

Description of Instrument

The SEL was designed to be applied for five years, raising $485 million over that period to facilitate implementation of the CWP. The levy was $80 per household, with pensioners being granted an exemption.

The Sydney Water Board introduced the levy in 1989 in conjunction with its general rate collection functions. The first public report on the SEL appeared in the Report on the Special Environmental Programme, released by the board in September 1990.

In The Special Environmental Levy: Update Report (Water Board 1992a), the aims of the levy were to:

- encourage source control and waste minimisation
- improve the quality of sewage effluent discharged to coastal and inland waterways from the board's sewage treatment plants
- increase the reliability of the operation of sewage treatment plants so that plant bypasses, which lead to raw sewage discharges, are reduced to a minimum
- improve the management of sludge and other wastewater and stormwater residuals so that they are either used beneficially or disposed of in an environmentally sound manner
- reduce the impact of odours and emissions from the board's sewage treatment and disposal activities to an acceptable level
- reduce overflows from the sewerage system and minimise the damage they cause to the environment
- provide additional sewerage services to reduce the pollution of waterways caused by run-off from on-site sewage disposal systems, for example, septic tanks
- improve the management of urban run-off from areas under the board's jurisdiction, including removing and reducing stormwater pollutants and reducing the consequences of urban flooding
- improve the quality of bushlands and wetlands under the board's jurisdiction, or affected as a result of board activities.

Revenue raised from the SEL amounted to $176.57 million by 30 June 1991, and a further $95.7 million was collected in 1991–92. By 30 June 1992, cumulative revenue from the fund totalled $289.56 million, including interest.

Expenditure on the various programs was $140.94 million in 1990–91 and $97.69 million in 1991–92, resulting in a cumulative expenditure of $238.63 million by 30 June 1992.

At the end of 1990–91, unexpended funds from the levy amounted to $48.48 million, due to time lags involved in planning and implementing projects. In 1991–92, unexpended funds were $2.44 million. The unexpended cumulative balance at the end of 1991–92 was $50.93 million.

Assessment Against Criteria for Evaluation

The SEL supported a wide range of projects designed to improve water quality in the Sydney/Illawarra/Blue Mountains area. Improvements were achieved in environmental monitoring, community participation, effluent quality, sludge management, odours and emissions, sewage overflows, additional sewerage services, urban run-off, bushland and wetland management and source control.

A major problem with the SEL was to allocate the funds effectively within a short time frame to achieve environmental improvement. More than 460 projects were undertaken, creating many administrative problems. Schemes should have had more realistic time frames for the expenditure of funds, including longer lead times for planning and appraisal. Economic analysis of proposed projects would have helped to allocate funds to the areas with greatest benefits to the community.

Most of the programs funded under the CWP occurred in areas where it was difficult to demonstrate the benefits to the community. For example, fine screens and sludge recycling significantly improve the quality of sewage treatment, but this was not readily understood by the public.

It is possible that the benefits of the CWP accrued mainly to residents and visitors in coastal areas of Sydney, as compared with communities further west. There may have been a perception that the distribution of benefits was inequitable.

Community participation was an important feature of the SEL. In the initial stages of the levy, the public contributed to the formulation of priorities for the program of works through seven public forums.

Adverse publicity for the SEL was created early in 1993 when the media reported that a dividend of approximately $100 million had been paid by the Sydney Water Board to State Treasury, the equivalent of the annual revenue raised under the levy. The public interpreted the SEL to be a general tax designed to contribute to consolidated revenue. The scheme received so much criticism that it was abandoned in favour of a user pays system of pricing.

Concluding Evaluation

The SEL was a successful way of raising revenue for environmental projects. The most important aspect of the levy, at least initially, was community acceptance. Consultation with the community ensured that the levy would be an acceptable instrument. However, the acceptability of the levy came under question when it was suggested that levy funds had been paid into consolidated revenue. Although this suggestion was incorrect, the experience underlines the importance of proving to the community that funds raised for environmental improvement projects are expended for those purposes.

7. Proportional non-compliance fees

7.1 General application

Proportional non-compliance fees consist of penalty payments that are imposed if maximum limits on emissions or effluents are exceeded. To constitute an economic instrument, such fees must be linked to the rates by which prescribed limits are exceeded. The fee may be applied at the same per unit levels by which limits are exceeded (constant average and marginal rates), or may comprise a sliding scale under which the unit charge increases the greater the limits are exceeded (increasing average and marginal rates). Fixed penalties, such as fines for non-compliance, are not classed as economic instruments.

No examples of proportional non-compliance fees have been found within Australia. Proportional non-compliance fees may represent an anomaly in rational approaches to environmental management. If a threshold (safe standard) can be defined, the basis for exceeding the standard may be difficult to justify. Such systems are likely to be opposed strongly by environmental groups and the general community. They would also be extremely difficult to monitor and enforce.

8. Product charges

8.1 General application

Product charges may be imposed on inputs to economic activities as a means of indirectly controlling adverse environmental impacts. In some European countries, for example, charges are levied on fuels according to their sulphur content, as an incentive to reduce emissions of sulphur oxides. Concessional taxes are also imposed on recycled lubricating oils to promote resource conservation and reduce adverse environmental impacts.

Differential taxes have been applied in Australia on recycled paper, to encourage reuse of paper, conserve timber supplies and reduce waste disposal and litter.

Proposals have been considered in Australia to impose product charges on phosphorus in detergents and on agricultural fertilisers to control excess levels of nutrients in inland lakes and rivers. Introduction of such charges is within the jurisdiction of the Commonwealth, but they could be administered by the States. The main disadvantages are that such charges may not be linked to environmental damage in specific locations, and may also add unnecessarily to the cost burdens of efficient and non-polluting producers.

One example of a product tax is the system of charges for ozone depleting substances, administered by the Commonwealth Government and State governments. The following case study describes Australia's experience in using charges for ozone depleting substances. As a case study it illustrates a number of important issues.

First, there is the problem of coordinating policies among the Commonwealth and the States. Not all States have introduced specific controls and, where legislation has been passed, it differs between States. Second, there is the question of interstate competitiveness and trade. Some States have banned the import of ozone depleting substances even though their use is permitted in others. Third, the appropriate form of control must be determined. Originally, it was proposed to have a comprehensive system of tradeable quotas. Within the States, direct regulations have been introduced governing the phase-out of scheduled substances, supported by charges to cover administrative costs.

In the case of ozone depleting substances, agreement by industry to comply with phase-outs proposed by the Commonwealth obviated the need for economic instruments such as tradeable quotas or product charges; indeed, the phase-out rate has exceeded the formal requirements.

8.2 Direct regulation of ozone depleting substances

Problem Identification

Scientific evidence has proven that the natural balance of stratospheric ozone has been upset by the production and release into the atmosphere of certain chemicals that destroy ozone. These ozone depleting substances include chlorofluorocarbons (CFCs), halons, methyl chloroform, carbon tetrachloride, hydrochlorofluorocarbons (HCFCs) and methyl bromide. The substances are widely used in refrigerators, air conditioners, fire extinguishers, in dry cleaning, as solvents for cleaning electronic equipment, and as agricultural fumigants.

The increase in UV-B radiation associated with ozone depletion is likely to have a substantial effect on human health. Potential risks include increases in the incidence of eye diseases, skin cancer and infectious diseases. Additional environmental risks include damage to plants, crops and marine life.

In March 1985, an international treaty, the Vienna Convention for the Protection of the Ozone Layer, was agreed. Following agreement that concrete measures were required to curb the increasing use of ozone depleting substances, the Montreal Protocol on Substances that Deplete the Ozone Layer was finalised in September 1987. The protocol has been signed by over 150 countries, including Australia.

In Australia, the main policy document guiding response to ozone depletion is the Ozone Protection Strategy, approved by the Australian and New Zealand Environment and Conservation Council (ANZECC) in 1989 and revised in 1994. ANZECC endorsed an additional strategy for HCFCs in 1995. The revisions reflected the broad-ranging nature of changes in Australian environmental policy and incorporated changes made to the Montreal Protocol at London (1990) and Copenhagen (1992).

Instrument Selection

The instrument selected by the Commonwealth Government to control ozone depleting substances was direct regulation, supported by legislation. During the policy formulation phase, there were close consultations with industry, resulting in general agreement on the phase-out recommended under the Ozone Protection Strategy.

As part of the regulations accompanying the relevant Acts, the Commonwealth and the relevant States have levied fees on ozone depleting substances. The fees represent one of the few examples of a product charge applied in Australia as part of programs to meet environmental objectives. However, the fees have been designed only to cover administrative costs.

In 1995, the Ozone Protection Act 1989 was amended to implement Commonwealth Government policy and Australia's international obligations under the Montreal Protocol which were outlined in the ANZECC Strategies. The Commonwealth Act continues to control the import, manufacture and export of ozone depleting substances. State and Territory environment protection authorities and environment departments agreed to complementary legislation and are responsible for controlling the sale and use of ozone depleting substances. They also ensure proper training and accreditation of the people who service equipment containing these substances. State and Territory legislation controls sale and use.

The amended Ozone Protection Act has two broad objectives:

- to cater for a new era in respect of those substances already covered by the Act and regulations
- to develop new control regimes for substances relatively recently incorporated into the Montreal Protocol.

The new control regimes called for a ban on domestic consumption of:

- CFCs, methyl chloroform, carbon tetrachloride and hydrobromofluorocarbons (HBFCs) after 31 December 1995
- methyl bromide after 2010
- HCFCs after 2030.

'Consumption', the term used by the protocol, is defined as the total quantity of substance manufactured plus imports less exports in a given year.

Description of Instrument

Although the approach adopted by the Commonwealth to phase out CFCs was based on regulation and voluntary cooperation, it allowed free trading in the quota between licensees for the import, export or manufacture of CFCs. However, there were only about a dozen licensees; the market was quite thin; only a dozen trades occurred after 1989; and trades virtually ceased.

The targets set for phasing out HCFCs will result in minimal consumption levels being achieved by the end of 2014, 18 years after controlling legislation was first introduced. This lead time is more than twice that applying to earlier controls over CFCs, and seems likely to reduce any restructuring costs incurred by industry through providing substantially greater scope for alternatives to emerge and phasing out equipment in line with standard depreciation formulas.

The development of new control regimes benefited from lessons learned from earlier experiences with CFCs. The CFC phase-out experience generated a wealth of experience among stakeholders which proved to be valuable in determining how best to phase out HCFCs. In summary, the Commonwealth decided to set stronger upper limits wherever possible on the quantities that could be manufactured or imported. The new licensing system also will provide industry with more flexibility in the HCFC user industries. The approach is based on the principle that total HCFC emissions should be the main focus of controls and that end-use controls, such as bans on refrigeration equipment, are administratively complex and difficult to enforce.

The amendments, which took effect from 1 January 1996, ban the import and manufacture of CFCs, halons, carbon tetrachloride and methyl chloroform, with limited exceptions. Provisions for those exceptions establish a system of 'essential uses licences' for the import, export and manufacture of CFCs, halons, carbon tetrachloride and methyl chloroform (currently only issued for manufacture of medical dose inhalers and specific laboratory uses); and establish a system of 'used substances licences' for the import and export of used or recycled CFCs, halons, carbon tetrachloride and methyl chloroform.

The amendments also introduce a system of 'controlled substances licences', quotas and reporting for the import, export and manufacture of HCFCs, limiting the quantity per year to

that permitted under the amended Act in accordance with a timetable set by the Montreal Protocol; and for methyl bromide, limiting the quantity per year to that permitted under the Montreal Protocol.

In addition, the Act imposes a two-yearly administration fee for each licence issued under the Act, set by regulation at $10,000 until the year 2000, except for essential uses licences, for which the fee is $2,000. The licence fees are based on cost recovery and are substantially higher than those applying under earlier legislation.

Industry representatives were consulted on the level of fees, which are levied according to the quantity and ozone depletion potential (ODP) of HCFCs imported or manufactured, and the amount of methyl bromide imported or manufactured.

The Ozone Protection Trust Fund was established to allow the revenue from the licensing schemes to be directed into ozone protection programs. This will ensure that revenue collected from licensees at the time of peak activity (1996–2000) can be expended at the times of low activity (2000–2030), when the need for information programs will be most critical.

To establish funding for the new licensing scheme, the Ozone Protection (Licence Fees-Imports) Act 1995 and Ozone Protection (Licence Fees-Manufacture) Act 1995 allow for non-refundable licence fees (activity fees) to fund administration of the legislation and industry and public awareness programs; and enable the setting of fees by regulation.

The legislation establishes an Australian cap for HCFC consumption, set at 300 ODP tonnes in 1996, three ODP tonnes in 2015 and zero ODP tonnes in 2030. This is well within levels permitted under the Montreal Protocol and was set in accordance with industry estimates of the shifts in consumption which could reasonably be absorbed by firms, given the expected availability of alternatives.

In direct contrast to the Commonwealth's previous approach, quotas are to be introduced only if voluntary efforts by industry to curtail imports/manufacture within the limits set under the Act are unsuccessful. The 'trigger' for quotas is 90 per cent of the industry limit specified in the Act. The majority of industry licensees are anxious to avoid quotas in the early years of the HCFC system, so quotas are not expected to be in place before 1999.

Assessment Against Criteria for Evaluation

The relatively stringent regulatory measures, in the form of licences, substance quotas and end-use bans on equipment, provide a high degree of assurance that Australia's domestic legislative and international treaty obligations have been or will be satisfied. These measures could place a heavy adjustment burden on companies, particularly if few alternatives are available. Commonwealth Environment Protection Agency consultative approaches and education campaigns have attempted to limit these pressures to a sustainable level for a majority of firms and contain costs to relatively few areas of the economy. Overall, the restructuring pressures faced by industry as a whole appear to have been within reasonable limits up to the present time.

Concluding Evaluation

Australia continues to be a world leader in phasing out ozone depleting substances, in many cases ahead of requirements. The use of licence fees and other administrative charges, however, has been incidental to the main process of achieving targeted reductions. Active participation by industry groups in administering the regulations has meant low government costs and effective self-regulation by industry. Australia's approach has been based on a highly cooperative partnership between industry, the community, and all levels of government.

8.3 Differential taxes on petrol

Problem Identification

Australia has used high levels of lead in petrol, the permitted level being 0.3–0.84 grams per litre. Very few Organisation for Economic Cooperation and Development (OECD) countries allow lead concentrations exceeding 0.15 grams per litre. It was estimated that 90 per cent of lead emissions in urban areas in Australia could be attributed to petrol use, posing serious threats to health, especially in children. In 1993, the National Health and Medical Research Council recommended a national goal for lead concentrations in blood of less than 10 micrograms per decilitre. It estimated that between 25 per cent and 50 per cent of Australian children aged zero to four years had blood lead levels exceeding this concentration (NHMRC 1993).

Instrument Selection

Until 1993 there was no economic incentive for motorists to use unleaded in preference to leaded petrol. Until 1993 Australia was only one of three OECD countries that did not apply differential excise taxes on these fuels. In other OECD countries, unleaded petrol sells for between 6 and 12 cents per litre less than leaded petrol, as a consequence of differential product taxes.

In the 1993–94 Budget, the Government announced its intention to increase the excise on all dutiable petroleum products, other than aviation turbine fuel and aviation gasoline, to phase in a tax differential between leaded and unleaded petrol (Department of Finance 1994).

Description of Instrument

The proposed differential announced in the Budget was 5 cents per litre by February 1995, ignoring price index adjustments. There was strong opposition by the public, mainly because of the perception that it was a regressive tax. Lower income earners were considered to be more likely to own and operate older vehicles, which used leaded petrol. This led the Government to decide to reduce the tax differential from 5 cents per litre to 2 cents per litre.

Assessment Against Criteria for Evaluation

The full effects of the tax differential have yet to be observed. It is technically feasible for many vehicles to switch from leaded to unleaded petrol in some models, but most older vehicles can operate only on leaded petrol. It is worth noting that, when proposals were first made to introduce unleaded petrol in Australia, the petroleum companies strongly resisted the policy, arguing that it would result in increased costs for refinery operations and for distribution at retail outlets. Motor vehicle manufacturers also claimed that they would face increased costs from re-tooling.

Extensive public information campaigns were conducted to inform motorists of the technical prospects for switching fuels. It was estimated that, of the one million vehicles capable of using both fuel types, about 250,000 switched to unleaded petrol within a month of the scheme's introduction. After one year, sales of leaded petrol declined from 52.2 per cent of the market to 49.1 per cent. By 1995 leaded petrol sales had declined to 43 per cent of the market.

Continuing improvement can be expected only over time, as older vehicles are replaced by new vehicles running on unleaded petrol. Direct regulations requiring new vehicles to use unleaded petrol will help this trend. The average age of the vehicle stock in Australia is one of the highest among OECD countries.

Concluding Evaluation

As an economic incentive, the differential tax has clearly encouraged a switch in fuel use from leaded to unleaded petrol where this has been technically possible. Public information programs have helped this process. It is possible also that information campaigns informing people of the health dangers of using leaded petrol have contributed to the success of the instrument.

The potentially regressive impacts of the tax differential impose social and political constraints on the use of this economic instrument. Long-term, permanent improvement will be achieved mainly through direct regulations requiring new vehicles to use unleaded petrol.

8.4 Sales tax on recycled paper

Problem Identification

Each year, Australia exports 5 million tonnes of woodchips valued at $400 million, yet imports about one-third of the paper consumed domestically and has a trade deficit in the pulp and paper sector exceeding $1 billion (RAC 1992). This has raised important economic policy questions about value adding and use of the nation's plantation and forest resources.

A number of environmental issues were perceived to have been associated with the production and use of paper in Australia. The disposal of waste paper represents the loss of a potentially valuable resource, as well as contributing to disposal problems at landfill sites. The production of pulp logs for paper products was also seen to add to harvesting pressures on native forests.

The reclamation and recycling of waste paper offered one prospect for alleviating these problems. Until the late 1980s, however, there was little economic incentive for this to occur. Most paper recycling programs in Australia up to that time were the result of local government initiatives and community cooperation.

Instrument Selection

On 20 July 1989, the then Prime Minister announced, in his Statement on the Environment (Commonwealth of Australia 1989b), that the Government would exempt certain printing and writing paper, tissue paper, toilet paper and paper bags from sales tax where these were made of wholly recycled paper.

Description of Instrument

The tax exemption created significant economic incentives for paper manufacturers to use recycled paper, and this led to major investments in manufacturing facilities specially designed to handle recycled paper inputs.

On 25 June 1992, the Commonwealth Government introduced the Sales Tax (Exemptions and Classifications) Amendments Bill. The Bill removed the sales tax exemption for certain wholly recycled paper products, including toilet and facial tissues, exercise books and some types of paper bags. A general rate of 21 per cent was applied.

In September 1992, the Government provided temporary transitional assistance to specialist manufacturers of 100 per cent recycled paper used in products affected by the removal of the sales tax exemption. These producers were adversely affected by the change in tax regime and needed time to adjust to the new economic circumstances. Traditional assistance was made available for three years, calculated on a decreasing basis.

The Commonwealth Environment Protection Agency reviewed the transitional scheme, concluding that the scheme had provided sufficient short-term assistance and therefore should be discontinued at the end of the three-year period. The remaining wholesale tax exemption was abolished on 1 November 1995.

Assessment Against Criteria for Evaluation

The tax exemption was abandoned for a number of reasons. According to Treasury, the tax created the following market distortions.

- The exemptions did little to increase the use of waste paper, especially as the exemptions favoured single-use goods such as tissues.
- There was a disadvantage to partially recycled papers.
- The exemptions increased the demand for high quality waste paper, to the extent that such waste paper began to be imported, and resulted in the diversion of high quality waste paper away from more efficient uses such as the production of industrial and packaging papers.
- The exemptions resulted in supply of imported recycled paper products and thus represented a subsidy to the reduction of waste paper in other countries.
- As those imported products could not be tested for 100 per cent recycled content, they may have had some virgin fibre content and thus competed unfairly with domestic products which sought the exemption.
- The exemptions provided no incentive to increase the demand for waste newsprint, which accounts for a greater proportion of waste paper in landfills.
- The exemptions did little to conserve Australia’s native forests because the types of paper products targeted for the exemption, such as toilet tissue, were produced from plantation timber rather than from forest timber.

The Commonwealth Environment Protection Agency review of the transitional assistance scheme concluded that the scheme had resulted in significant environmental benefits, but recommended its abolition because it had been proved administratively inefficient. The review recommended that the scheme should be replaced by a broader strategic mechanism to support the recycling of post-consumer high grade waste paper. It advised that the mechanism should seek to:

- encourage the expansion of existing markets or development of new markets for recycled paper products, although manufacturers presently using post-consumer high grade waste paper should also be eligible for assistance
- provide financial assistance to manufacturers of paper products containing recycled fibre, on the basis of the quantity of post-consumer high grade waste paper used by the manufacturer.

The outcome from this recommendation was the High Grade Waste Paper Program.

Concluding Evaluation

Differential taxes on products should, in principle, be an effective mechanism to encourage shifts in producer and consumer behaviour to conserve resources and improve the environment. This case study has demonstrated, however, that indirect impacts on behaviour

may not be foreseen and this can lead to inefficiencies in the operation of markets, inappropriate investments within the private sector and additional costs to government. Furthermore, environmental objectives may not be met effectively.

9. Deposit refunds

9.1 General application

Deposit refunds on recyclable containers were once commonly used by Australian manufacturers. The advent of disposable containers saw the disappearance of these arrangements and consequent problems of environmental degradation caused by improper disposal of containers to the environment.

The introduction of modest payments by manufacturers for recycled cans and bottles has resulted in improved collection services. South Australia is the only State that has introduced specific legislation for deposit refunds. Details of the South Australian deposit refund scheme are presented as a case study in the next section.

The South Australian study raises questions about the cost burden and its incidence. Costs to government are small, but the cost to industry could not be ascertained. The prospects of recycling and energy saving might have entailed efficiency gains; but, on the other hand, a High Court challenge by a major brewery indicated that the system may have created market impediments for beer producers in South Australia compared with producers in other States.

The South Australian scheme nevertheless has wide public acceptance and has resulted in high return rates for beverage containers. An extension of the concept to kerbside recycling is under consideration.

Deposit refunds could usefully be applied in other areas of waste management, such as deposits on car batteries, tyres and car bodies.

9.2 South Australian beverage container deposit system

Problem Identification

Deposit refunds on beverage containers in South Australia have existed since the last century. They were traditionally used on a voluntary basis by beverage manufacturers and bottle handling enterprises. The Adelaide Bottle Company has collected, washed and hired refillable ‘Pick Axe’ beer bottles to the South Australian Brewing Company, Coopers Brewery and other breweries since 1897 (Beverage Container Unit 1991).

An extensive system for the return of containers evolved in South Australia, based on collection depots known as ‘marine store’ dealers. The success of this system was evidenced by high return rates for beverage containers in South Australia and less litter from containers than in other Australian States.

The advent of disposable containers in the late 1960s posed a threat to the return system. As noted by Lenehan (1992), concerns expressed by the Government related to:

- the changed consumer attitude resulting in the littering of disposable containers
- the added cost to the public of solid waste management
- the direction of resources and energy into disposable containers
- the potential for increased cost to the consumer due to less cost-efficient packaging
- the potential for destruction of an efficient existing recycling system developed by industry and supported by the public.

The aim of the Government was to ensure continuation of the existing system of container returns, to prevent a litter problem from developing, to encourage more efficient use of resources and energy, and reduce the need for waste collection and landfill.

Instrument Selection

The instrument selected by the South Australian Government was legislation. The Beverage Container Act was passed in 1975 and came into effect in 1977. It was repealed in 1993. Beverage container deposits are now handled under the Environment Protection Act 1993. The schedule of fees reported here is currently under review.

The deposit refund system was an important component of the Beverage Container Act. This instrument was intended to provide ongoing economic incentives for the return, refilling and

recycling of beverage containers. Although not described in the same terminology, the legislation was designed to internalise the costs of litter and waste handling.

Description of Instrument

The Act applied to containers for some soft drinks and alcoholic beverages. Some containers, such as refillable glass soft drink bottles with a voluntary deposit, are exempt from the Act. Ring pull containers have been banned as being environmentally unacceptable. The prescribed deposits range from 5 cents for containers for beer to 20 cents for refillable glass containers for soft drinks and mineral water.

The Act required that a retailer must not sell a beverage in a container unless the container is marked in a manner and form approved by the Minister, with a statement indicating the refund amount applicable to that container.

Depending on the type of container, returns could be made to retailers or to collection depots. There were 31 depots in the metropolitan area, spaced no further than five kilometres apart and 76 depots in major and minor country centres. The depots supplied their containers to five industry super collection agencies under a system of secured agreements.

The system was self-supporting, with only two persons employed within the Government for administrative purposes.

In 1990, Castlemaine Tooheys challenged the State of South Australia in the High Court of Australia, claiming that certain provisions of the Beverage Container Act and its amendments were contrary to section 92 of the Constitution. The presumption was that the competitive status of Castlemaine Tooheys was considered to be disadvantaged by the existing legislation.

The High Court ruled that section 5b of the Act was invalid. This section contained a clause to the effect that a Minister may exempt glass containers (including those for the purpose of containing beer) from the regulations of the Act if the Minister is satisfied that 'proper arrangements have been made for the re-use of the containers when returned to collection depots by refilling as referred to in paragraph (a) and by re-use of the glass of which they are made'. Paragraph (a) specified that 'the containers are made so as to be refilled not less than four times' (South Australia 1975). However, the remaining sections of the Act to which objection had been raised were ruled to be valid.

This change in the legislation meant that the Act would not regulate refilling and recycling practices of brewers, but that containers for beer would still be subject to the deposit system.

Assessment Against Criteria for Evaluation

Various Australian studies have looked at the economic efficiency effects of container deposit legislation. They include a study on the glass industry by the Industries Assistance Commission (1987) and on recycling by the Industry Commission (1991). The Business Regulation Review Unit (1989) has also undertaken an assessment of container deposit legislation, arguing that such legislation resulted in significant costs to the community. However, the scope, methods, assumptions and data of the latter study have been criticised by Hatch (1990), who places little credibility on its findings.

The two main economic impacts of container deposit legislation are:

- effects of the deposits on the litter habits of consumers
- effects on equilibrium market prices in markets for beverages.

It is not easy to estimate the effects on littering. Indeed, even estimating changes in the level of littering is problematical. One approach is to take litter counts, and estimate shifts in behaviour as a result of the legislation. A more reliable approach is to use statistics on return rates for containers. Figures published by the Beverage Container Unit on return rates for South Australia indicate return rates ranging from 61.7 per cent for PET containers to 96 per cent for refillable glass containers. These rates are well in excess of the national targets recommended by the Industry Commission (1991).

Neither is it easy to estimate the effects of the legislation on equilibrium market prices in markets for beverages, and hence on economic welfare. As argued by the Business Regulation Review Unit (1989), the Industries Assistance Commission (1987) and Hatch (1990), the economic welfare effects of an instrument such as container deposit legislation may be measured in terms of the resulting changes in producers' surplus and consumers' surplus in the market for beverages. The magnitude of such changes depends on the changes in production cost, changes in consumers' willingness to pay, and the elasticities of market supply and demand. Hatch (1990) was critical of the elasticities assumed in the Business Regulation Review Unit report (1989).

There are various effects on production costs. All other factors remaining constant, the imposition of deposits can be expected to result in an upward shift of the industry supply curve. Additional costs may also be incurred from collection and handling. Once the system is in place, this cost becomes a fixed rather than a marginal cost. Cost savings may, however, result from the use of refilling and recycling technology as compared with raw materials.

As pointed out by Hatch (1990), the return of containers does not guarantee that they will be refilled or recycled. However, there is the opportunity for litter reduction and resource conservation.

According to Lenehan (1992), there is no evidence to show that the retail prices of beverages in South Australia are any higher than in other States. This may, however, result from lower profit margins in the industry.

Other community benefits may be attributable to a successful beverage container return system. They include cost savings from reduced dependence on landfill sites, resource conservation and the 'external' benefits of reduced litter in the environment. Studies of the economic impact of deposit container legislation have not estimated these benefits, although Hatch (1990) has noted them.

Return of beverage containers is now under investigation in conjunction with kerbside recycling. Significant economic efficiency gains have been demonstrated in the United States from such schemes (Ackerman & Schatzki 1991; Franklin 1990, 1991). Preliminary advice from a local council (Tea Tree Gully) in South Australia suggests that container deposit legislation products generated approximately 60 per cent to 70 per cent of the revenue during a recent Kerbside Recycling Trial.

There is strong public support for the deposit refund system. According to a survey undertaken in 1981, 72 per cent of respondents considered the Beverage Container Act to be effective in reducing litter, and 65 per cent wanted the Government to take further measures to reduce the sale of non-returnable containers. In addition, 77 per cent did not regard convenience packaging to be superior to returnable containers. Subsequent surveys have upheld these community opinions (Beverage Container Unit 1991).

Concluding Evaluation

The experience with the South Australian beverage container legislation demonstrates that deposits on potentially polluting items can create strong economic incentives for their collection and return. Recycling is not guaranteed, but favourable conditions are created to reuse containers or the materials from which they are made. The instrument is under consideration for other items and materials. Difficulties encountered with the scheme, such as the possibility of unequal cost conditions in different States among competitive manufacturers or distributors, could be overcome by means of a common policy among the States and Territories.

10. Tradeable discharge rights

10.1 General application

Tradeable discharge rights consist of quantity and/or quality permits on emissions and/or effluents. The mechanisms are relatively simple. The control authority determines the total load to be borne by the environment for a particular catchment, river segment, water body or airshed, and issues a set of discharge rights (permits or entitlements). These rights may then be traded in a market, subject to any special conditions specified by the control authority.

In principle, tradeable discharge rights should be effective in meeting environmental management objectives, since the environmental tolerance is (or should be) built into the design of the system. They should also be economically efficient by leading to an equalisation of abatement costs by all dischargers trading in the market.

Various provisions may be made by the control authority for tightening the total constraint — reduction of the allowable quotas when trades take place, uniform cutbacks on a prescribed time schedule for all owners of rights, or buy-backs by government entering the market.

Tradeable discharge rights have various advantages and limitations. The main advantage is that permits are converted to a capital asset that can be bought and sold by companies, individuals and government authorities. In principle, the assimilative capacity of the environment will be allocated to its highest valued uses. An interesting prospect is that of allowing recreational users or environmental groups to enter the market and purchase rights.

Tradeable rights may have a number of practical limitations. One of the most important considerations is whether a market can be established and whether sufficient trades would occur to achieve efficiency gains. This is sometimes described as the 'thinness' or 'thickness' of the market. The costs of maintaining the market are known as 'transactions costs'.

It is possible that in some markets government agencies may dominate the market and distort the prices at which trades take place, preventing the equalisation of marginal abatement costs that is required to achieve maximum efficiency gains.

Trading between point and diffuse sources may be required to achieve both an active market and significant cost savings. Efficiency gains may be achieved by introducing zoning restrictions, special trading ratios between sources, and 'bubbles' for total loads or ambient concentrations in specific areas (James 1990).

Tradeable rights do not normally yield revenue to the control authority or government. However, there is no reason why an annual fee should not be imposed to cover administration costs. The level of the fee can be expected to affect the capital values of rights traded in the market.

Funds can also be obtained by auctioning rights or calling for tenders. This raises questions, however, about the most appropriate mechanisms for the initial allocation of rights. As well as auctions and tenders, rights can be distributed according to existing levels of discharge. The equity aspects of the allocation system may present problems. If rights are simply allocated to existing dischargers, the gains will be distributed to incumbents.

Equity problems are unavoidable with any allocation system. If rights are allocated by 'grandfathering' them to existing activities, capital assets will be allocated to incumbents, and new entrants to the market will have to pay the price to achieve rights to discharge. (In addition, there may be a 'rush' by existing dischargers to maximise their initial allocations, possibly adding to environmental problems. This effect is similar to the 'sleeper' effect that may take place with tradeable water entitlements.)

If auctions are used to allocate rights, a double investment outlay by dischargers may be required. The reason is that the formerly 'free' use of the assimilative capacity of the environment would have been capitalised in the initial investment value (purchase price) of the activity.

A number of Australian States are considering tradeable discharge rights, and the New South Wales Environment Protection Authority (EPA) has introduced a pilot system for salinity control in the Hunter Valley. Tradeable rights have also been introduced for the Murray-Darling Basin, providing for salinity trades between New South Wales, Victoria and South Australia. New South Wales is adopting a supplementary scheme, but it is limited in scope and potential impact.

10.2 Hunter River Salinity Trading Scheme

Problem Identification

The Hunter River is characterised by naturally saline conditions. Many tributaries have high salt loads resulting from natural processes. The salinity problem is exacerbated by discharges of saline waters to the river by coalmines, power stations, irrigation and other industry in the catchment, which impose external environmental costs on various groups in the community. It has been estimated that for each unit increase in salinity, measured in terms of electrical conductivity (EC), a $10,000 loss occurs throughout the catchment per annum from reductions in agricultural yield and increased costs of water supply and treatment (New South Wales EPA 1994a).

Under the provisions of the Clean Waters Act 1970, the EPA has licensed 11 coalmines to discharge saline waters to the Hunter River. The licences specified (i) a limit on the maximum allowable increase in conductivity in the river of 700 EC units after the discharge, and (ii) a limit on the maximum allowable increase in conductivity of 40 EC units caused by the discharge. This kind of discharge is described as 'trickle' discharge.

Pacific Power, which operates two large electricity generating stations at Liddell and Bayswater in the Hunter region, was also subject to EPA licence conditions. Pacific Power was permitted to discharge up to 700 megalitres per day from Lake Liddell to the Hunter River when the flow at Jerry's Plains was less than 2,000 megalitres per day, provided the salinity level in the Hunter River did not increase to more than 700 EC units. When the flow exceeded 2,000 megalitres per day, Pacific Power was permitted to discharge up to 700 megalitres per day with no salinity restrictions.

Instrument Selection

After investigating the prospects of using economic instruments to control salinity in the Hunter, the EPA decided to introduce a system of tradeable salt discharge credits. The system was developed in consultation with the Department of Land and Water Conservation, the Coal Industry Association, the Hunter Catchment Management Trust and Pacific Power.

Description of Instrument

Details of the scheme are available in a number of documents published by the New South Wales EPA (1994a, 1994b, 1995a).

The scheme was developed from the existing licensing system and was introduced in 1995 on a trial basis. The broad objectives of the scheme were to:

- ensure discharges of saline water have a minimal impact on riverine ecosystems, irrigators and other water users by encouraging sources to discharge during high-flow conditions
- improve irrigation water quality during periods of low flow in the river
- achieve better environmental quality in a cost-effective manner.

The scheme was designed to:

- eliminate discharges during periods of low river flow, when their environmental impact is greatest
- limit the total of individual discharges so that the target salt levels are not exceeded during periods of high flow, the limits being 600 EC at the junction of the Goulburn and Hunter Rivers; 900 EC at the junction of Glennies Creek and the Hunter River; and 900 EC at Singleton
- allow trading of high-flow discharge entitlements between licence holders, such that the target salt levels are not exceeded and tributaries conveying the discharges to the river are protected
- maximise use of flood flows for necessary saline discharges when their environmental impact is minimal.

The following new features were introduced with the scheme.

- Encourage discharge of saline water during times of high-flow conditions and phasing out of discharges under low-flow conditions by December 1999.
- During high-flow conditions, there would no longer be a licence limit on the maximum allowable increase in conductivity caused by an individual discharge (previously 40 EC). However, the receiving water conductivity threshold would vary at different points along the river to reflect the lower background salinity in the upper reaches of the river.
- Under the proposed scheme, each discharge source would be entitled to discharge a specified percentage of the total allowable salt load. The total allowable salt load is the amount of salt that may be discharged collectively by all sources without exceeding the designated in-stream salinity levels at any point in time. The percentage of the total that each source in entitled to discharge is called the proportional discharge credit.
- A source could trade discharge credits with other sources.
- No new ‘trickle’ licences would be issued.
- During low-flow conditions, there would be a stricter ‘interim receiving water conductivity threshold’ for saline discharges above the Goulburn River junction.
- The new threshold would be 500 EC units (previously 700 EC).

The scheme has been initially limited to coalmines and Pacific Power. It is expected that diffuse sources will be brought into the scheme in the longer term to ensure effective control of salinity levels.

The total allowable load is calculated in relation to conductivity levels and, indirectly, is related to river flows. Salinity becomes a problem mainly under low-flow conditions. In high-flow periods, the river is least sensitive to discharges and irrigation usually ceases under these conditions, thus there is no need to restrict discharges.

For the purpose of determining discharges, the river is divided into three sectors — upper, middle and lower. Each licence holder is associated with a relevant sector. Water flowing in the river is divided into ‘blocks’, with each block consisting of the body of water that passes the Singleton gauging station during any 24-hour period in 1995. Thus in 1995 there were 365 blocks.

Each credit entitles the holder to discharge 0.1 per cent of the total allowable discharge for each block. There are 1,000 credits, each of which has a unique registration number which remains unchanged regardless of who owns the credit.

After determining the total credits available, a fixed proportion was allocated to individual mines and to Pacific Power. The EPA retained 20 per cent of the credits as an environmental buffer.

The number of credits allocated to each discharger was determined by means of a 'merit formula' which takes into account:

- environmental management — assessed on capability at 1 January 1995, this rewards mines that have previously invested in sound environmental management
- output — a proxy for contribution to the State economy
- employment — a proxy for contribution to the local economy
- gross minewater 'make' — this recognises site difficulties for operators.

The environmental performance score is derived from:

- an effective water management plan
- saline water storage capacity
- level of discharge and receiving water monitoring
- discharge control capability
- a recent record of compliance with licence conditions.

Trades must be for whole credits and for whole blocks. Holders of credits are free to trade with other credit holders, but all trades must be registered with a Credit Register and a River Register. The EPA reserves the right to refuse approval of a trade if it detracts from the effective environmental operation of the scheme.

A bonus entitlement may be earned by a discharger if they purchase a special release of water from the upstream storage operated by the Department of Land and Water Conservation. The extra discharge allowed in conjunction with such releases is determined in relation to the dilution achieved, subject to the constraints that 'normal' discharge opportunities are not reduced and that the sector thresholds are not transgressed.

Monitoring is required at discharge points during discharge, for volume and conductivity. Real time monitoring must also be conducted upstream and downstream of the discharge point in the Hunter River, and upstream and downstream of discharge points in tributaries, where relevant. The permit holder is responsible for these functions. All monitoring data must be submitted to the EPA.

Permit holders must prepare and submit quarterly reports to the EPA, and keep records for two years. The EPA will conduct regular audits of the scheme. All requirements and conditions of the scheme are set down in a rule book for use by participants in the scheme (New South Wales EPA 1995a).

Assessment Against Criteria for Evaluation

A recent paper by Gilligan, Hannan and Smith (1996) documents experience with the scheme, which has now operated for more than a year. In its first year, it performed well and gave considerable promise for its continuation. In general, conductivity levels in the river remained within the targeted limits. Due to extended dry periods, it was decided, following a public consultation process, to test the scheme for another year. It was also agreed that the threshold at which discharges could occur should be reduced from 3,000 to 2,000 megalitres per day.

In the second year, only about 35 per cent of the total potential discharge opportunity was used and this subsequently led to an accumulation of wastewater by some mines. The stored water was later discharged to the river during a flood flow period.

Thus far, several dischargers have offered to sell their entitlements, but only one trade has taken place. The reasons for this are that dry conditions have created water shortages rather than a need to discharge; most mines are not prepared to trade because of uncertainty about long-term needs; and there are also uncertainties regarding the value of entitlements and arrangements for longer term allocations (Gilligan, Hannan & Smith 1996).

The EPA considers that the scheme has been superior to the previous system of licences and expects it to operate more fully after 1997. Industry has not taken maximum advantage of the provisions of the scheme and has been somewhat cautious about relinquishing options

for discharge. However, industry still strongly supports the scheme and is evaluating the relevant financial costs and benefits.

There have been some difficulties with data collection and monitoring, and operation of the system is not yet fully automated. It is expected that these problems will be overcome within the coming year.

It is not possible to conduct a full assessment against the relevant criteria. However, it is possible to report that the stakeholders have been willing to participate in the scheme and trades have already taken place.

Concluding Evaluation

The scheme is a successful example of what can be achieved through an effective consultation and consensus process regarding environmental objectives and outcomes. Dischargers have more flexible options for meeting environmental targets, with a high degree of accountability.

Since the scheme is still in an evolutionary phase, it is difficult to assess its success in terms of efficiency gains. Further refinements and a widening in its scope of application can be expected in the future. The incorporation of non-point sources of salinity in the scheme, if that can be achieved, will be a major innovation in water quality management in Australia and internationally.

10.3 Murray-Darling Basin salinity scheme

The system of tradeable rights in salinity for the Murray-Darling Basin came into force in 1992 as part of the Murray-Darling Basin Salinity and Drainage Strategy. The administering agency is the Murray-Darling Basin Commission. Participation in the scheme at present is limited to New South Wales, Victoria and South Australia. Trades are permitted in terms of salt concentrations, measured in EC units.

'Salt credits' can be generated by investing in capital works to manage salt entering the river system and enhance river flow. Credits are tradeable between States, but are generally applied within each State to offset debits from drainage entering the river system. New South Wales has a credit of 6.15 units; and Victoria a credit of 5.92 units. South Australia and the Commonwealth have also earned credits, but it is not contemplated that they will be used to offset debits. In South Australia, salinity has been reduced by 50 EC units.

The salinity and drainage strategy is a limited form of tradeable discharge rights. The rights are not freely traded by industries or individuals, but are exchanged between governments within a constrained strategic framework. Greater flexibility is intended to be introduced to the scheme within the next five years.

New South Wales is about to introduce its own system of tradeable salinity rights for all water users contributing saline drainage to the Murray-Darling and for all water users diverting dilution flows from the Darling Basin. The rights will be issued by grandfathering. The total amount of rights initially will be 15 EC units as measured at Morgan on the River Murray in South Australia. The system is separate from the Salinity and Drainage Strategy. Only a small bundle of EC credits will be involved, and market interactions are not expected to be significant.

10.4 Bubble licences for the Hawkesbury-Nepean River system

Problem Identification

The Hawkesbury-Nepean river system is experiencing significant environmental stress as a result of high nutrient loads, mainly phosphorus and nitrogen. This has led to algal blooms and eutrophic conditions, especially during low-flow periods. Sewage treatment plants are a major source of nutrients, although discharges occur also from other point sources and non-point sources in the catchment.

Instrument Selection

Over the last two years the New South Wales EPA, in consultation with Sydney Water, has been developing a bubble licence incorporating a number of Sydney Water sewage treatment plants within the Hawkesbury-Nepean river system. The framework is being developed by operational, economics and environmental policy staff from the EPA and Sydney Water (Izmir & Shepherd 1995; New South Wales EPA 1995c). The scheme has aimed to help reduce nutrient loads in the river in a cost-effective manner.

The EPA has decided to introduce a bubble licence, designated the South Creek Bubble Licence, incorporating the St Mary's, Quakers Hill and Riverstone sewage treatment plants which discharge into South and Eastern Creeks. The New South Wales EPA (1996b) recently published details of the proposed scheme.

Licence conditions associated with the scheme have been applied to Sydney Water's licences from 1 July 1996 for the 1996-97 licence period. The bubble pollution control licence is underpinned by a strong regulatory framework, which is essential for effective functioning of the economic instrument and to ensure attainment of environmental management objectives.

Description of Instrument

The term 'bubble' is used to describe an imaginary bubble placed over a number of discharge points. The main attribute of a bubble licence is that the regulator controls the aggregate load generated within the bubble, rather than controlling emissions or effluents from individual sources. The advantage of such a scheme over more traditional regulatory approaches is that the operator is given more flexibility in finding cost-effective solutions, while ensuring that the overall discharge targets set by the regulator are achieved. Environmental gains can be made at lower costs because relatively greater reductions can be undertaken by plants with lower abatement costs.

Bubble licences involve the regulatory authority setting a limit (that is, imposing a bubble) on the aggregate discharge load for a discharger or group of dischargers, allowing free choice in how the limit should be met (New South Wales EPA 1995c). The advantages of such a system over the traditional command and control approach are that:

- the operator is given flexibility in finding cost-effective solutions to meeting target discharge limits
- environmental gains can be made at lower overall cost because there will be greater reductions from sources where the costs of discharge are low.

The following management issues were addressed in developing the scheme:

- reductions in nitrogen and phosphorus, with load limits for both
- identification of baseline loads which incorporate current monitoring results, expected reductions from pollution reduction programs, and potential increases resulting from population growth in the catchment
- determination of the time frame of the bubble and the targets for emission reduction, with due consideration of the lead times required for plant upgrades and new capital works
- identification of the geographic extent of the bubble and the sewage treatment plants, diffuse sources of pollution and potential impacts on ambient water quality.

A number of potential configurations of plants that could provide the basis for a bubble licence were investigated. The sewage treatment plants considered are major contributors to water quality problems in particular stretches of the river; have the technical capacity for significant reductions in discharges; and have varying abatement costs for further reductions in nutrient discharges.

One of the key tools used in the analysis of potential bubble configurations was the Hawkesbury-Nepean Nutrient Management Model developed by the New South Wales EPA (1995c). This is a compact environmental-economic model which was used to assess the potential for abatement at different sewage treatment plants, the cost of abatement and the corresponding impact on river quality.

The aim of the scheme is to reduce high nutrient loads within the creeks and the main stem of the river. It is estimated that the three sewage treatment plants currently contribute around 60 per cent of the phosphorus load and around 75 per cent of the nitrogen load in the section of the Hawkesbury River at Wilberforce Reach, downstream of the junction with South Creek. High nutrient concentrations occurring in this stretch of the river are causing eutrophication problems. The environmental outcomes to be achieved by the bubble licence are reduced potential for excessive growth of algae and other water plants, and improved protection of aquatic ecosystems.

The aggregate load limits for the bubble licence for phosphorus and nitrogen are to be reduced significantly over an eight-year period. Load targets specified for the year 2004 will result in an 83 per cent reduction in predicted phosphorus loads and around a 50 per cent reduction in predicted nitrogen loads. Interim targets are also set to ensure continuous environmental improvement. The nitrogen target is to be reviewed at the end of 1997, following a period of monitoring and research. While annual load limits will restrict the load discharged to the environment, additional regulatory control in the form of maximum

concentrations are to be set for each sewage treatment plant to ensure that any operating difficulty at a particular plant is promptly recognised and rectified.

Assessment Against Criteria for Evaluation

It is not possible to fully assess the scheme at present, as it has only just been introduced. However, it is estimated that cost savings from the bubble licence scheme, compared to uniform discharge concentration limits, are in the order of 10 per cent to 20 per cent. The load-based licensing aspect of the scheme is also expected to provide considerable incentive for Sydney Water to investigate innovative alternatives to traditional technologies, which could result in additional savings in abatement costs.

Concluding Evaluation

The South Creek Bubble Licence is the first of its kind to be applied to water quality management in Australia. While it is currently being applied only to sewage treatment plants in Sydney Water's sub-catchment, there is also scope for incorporating other point and non-point sources at a later date. Other point sources include sewage treatment plants at McGraths Hill and South Windsor, which are operated by Hawkesbury Shire Council.

10.5 Management of ambient sulphur dioxide concentrations in the Kwinana Industrial Area

Problem Identification

The Kwinana area, south of Perth, is heavily industrialised. Emissions of sulphur dioxide were a major form of air pollution in the 1970s. Ambient concentrations declined with the advent of natural gas from the North West Shelf, but this was not enough to guarantee acceptable air quality in the future. The Western Australian Department of Environmental Protection (DEP) decided to take pre-emptive action and established an Environmental Protection Policy designed to control air quality in the Kwinana area.

Instrument Selection

The instrument selected by the DEP is based on the bubble concept, which limits emissions from point sources, subject to meeting ambient concentration targets for specified air pollutants. The Kwinana scheme applies to sulphur dioxide and total suspended particulates.

Description of Instrument

The scheme has been described by the Western Australian EPA (1992). The material presented here draws on a paper by Rayner (1995).

The targets for controlling sulphur dioxide in the area, specified as standards and limits, are shown in Table 10.1. 'Standard' is defined as the concentration of atmospheric waste which it is desirable not to exceed, and 'limit' as the concentration of atmospheric waste that shall not be exceeded.

The areas referred to in the table are different land zonings:

- Area A is the area of land on which heavy industry is located
- Area B is the buffer area surrounding industry
- Area C is the land beyond Areas A and B, predominantly rural and residential.

Table 10.1: Sulphur dioxide standards and limits (micrograms per cubic metre) for specified averaging periods

Region	1-hour	24-hour	Annual
Area A			
standard	700	200	60
limit	1,400	365	80
Area B			
standard	500	150	50
limit	1,000	200	60
Area C			
standard	350	125	50
limit	700	200	60

Source: Rayner (1995)

Dischargers in the area are responsible for controlling emissions so as to comply with the ambient standards and limits. DEP assists them by using a dispersion model to estimate the

contributions to ambient concentrations from each source. Industry has agreed to comply with the emission constraints, in the expectation that it will be able to optimise their operations in a cost-effective manner.

The steps taken in implementing the scheme are as follows.

- Develop and apply a procedure based on the computer model to determine the emission limit for each significant industrial source so that the sulphur dioxide standards and limits can, in the opinion of the Chief Executive Officer of DEP, be complied with.
- Enforce these emission limits via licence conditions on industries.
- Require industries to undertake ambient monitoring of their source emissions to demonstrate compliance with licence conditions.
- Investigate any exceedance air quality standards and limits which appear in the monitoring data to see whether industries were complying with emission limits at the time and, if they were, review the adequacy of the procedure and decide whether a redetermination of emissions is necessary. If they were not, take appropriate action.
- Use the combined monitoring results to improve the procedure (for example, to improve the predictive capability of the model) and to assess the need for a redetermination of emission limits, either upward or downward.

This procedure ensures feedback between the predictions of the computer model and the environmental performance of industry. It also allows for flexible trade-offs in emissions from individual sources while complying with the overall standards and limits in the area. Although industry does not have ownership of the rights to discharge, it nevertheless has ownership of the final result.

The scheme involves a number of complexities. A major point source is the Alcoa refinery, which has the capability of switching between oil and gas as a source of fuel. When oil is burned, sulphur dioxide emissions from Alcoa are higher than when gas is burned. Two different patterns of adjustment are thus required by other dischargers in the area, according to Alcoa's choice of fuel. Cement works in the area are also a significant source of sulphur dioxide emissions. Special negotiations are being undertaken with cement works to help reduce total loads.

Another aspect of the scheme is that the predictive capability of the dispersion model in relation to the effects of sea breezes could be improved. The CSIRO Division of Atmospheric Research is working to improve the performance of the model.

The Kwinana Industries Council represents industry's views and negotiating positions with DEP. The council conducts monitoring operations for ambient sulphur dioxide concentrations on behalf of all participating industries and shares its data with the results of monitoring undertaken by DEP. Stack monitoring has not been required from all dischargers.

Assessment Against Criteria for Evaluation

The scheme has gained general acceptance by industry in the area and has led to a sense of joint ownership of the management regime between industry and DEP. There is cost sharing for compliance and monitoring. Negotiations among individual dischargers, and between dischargers as a whole and DEP, appear to be working smoothly.

Further refinements of the dispersion model and more extensive model simulations are expected to show that there is still room, within the prescribed standards and limits, for further industrial development within the area. This represents a potential economic gain at no expense to the environment or to industry, assuming that the standards and limits have been appropriately set.

Concluding Evaluation

The scheme adopted for the Kwinana industrial area is inherently flexible and allows for the prospect of agreements among individual dischargers that are cost-effective and commercially practicable. Its requirements for monitoring and compliance indicate that it is also effective in meeting air quality standards. The scheme could easily be extended to a system of tradeable permits for sulphur oxide emissions.

11. Tradeable resource use rights

11.1 General application

A number of Australian States have introduced tradeable rights for the use of natural resources. These rights include transferable rights for water use, and tradeable quotas for renewable resources such as forestry and fisheries.

11.2 Transferable Water Entitlements

Tradeable rights in water use are commonly described in Australia as transferable water entitlements (TWEs). The ability to transfer water use rights has a number of economic advantages, the main one being that water allocations are no longer linked with land rights, but are traded in a separate market for water as a commodity. In fact, water is traded as a range of commodities, differentiated in terms of location, quality, environmental constraints and security of supply. Transfers may be restricted to a single year, or may be multi-year leases or permanent transfers.

The main rationale for permitting trades is that water, as an input to production activities, will be allocated to the activities with the highest rates of return on water inputs (that is, the highest marginal revenue product).

Initial allocations have usually been made according to land-based entitlements. Where new rights are issued, methods employed include shelf prices, tenders and sale of rights. Equity problems may arise, as in the case of tradeable discharge rights.

Allocations of water that otherwise would not be used can be sold and put to economic use. This bestows benefits on the buyer, who is able to expand production or produce a higher value product, as well as on the seller. For temporary transfers, sellers earn a monetary return, enabling them to boost cash flows for investment, land improvement or other activities.

Permanent transfers may achieve long-term structural adjustments of production within catchments. Evidence on the price of trades (which is not always readily available) suggests that the price per megalitre for permanent trades may be of the order of 100 times the price for temporary trades. Some States, such as New South Wales, allow for trades in allocations of varying security. Thus water entitlements may be bought and sold to suit specific forms of agriculture or other activity.

Nowhere has a completely free market been allowed to function for trades in water rights. Restrictions imposed by water management agencies include spatial conditions (for example, river basins or prescribed zones), volume controls, environmental considerations (for example, preservation of river flow, control of salinity, and protection of wetlands and riverine ecosystems) and prevention of monopoly behaviour in the market for rights.

Agencies play a role of facilitation rather than direct participation in the market for rights, although they usually are empowered to veto trades if the conditions are unacceptable. Most agencies keep registers of buyers and sellers.

Water transfers have increased in most schemes since their introduction. It is evident that most trades have occurred in temporary transfers, in terms of both number and volumes traded.

The workability of markets for transferable water entitlements may be subject to a number of limitations. The prices of trades are generally not publicly revealed. Water rights constitute a valuable capital asset. They may be traded by non-landholders. Sellers reaping capital gains incurred through the buying and selling of rights would be liable for capital gains tax.

One problem that has been encountered is that of ‘sleeper’ allocations, although this occurs only when the allocated rights exceed the resource availability. Sleeper allocations consist of unused allocations that enter the market once an economic value for entitlements has been demonstrated. The activation of sleeper allocations may place an unexpected demand on the resource, creating new scarcities and difficulties in river management. To overcome this problem, some States have imposed a reduction percentage for trades. Reductions may also be applied on water transfers from irrigation to other economic sectors.

11.3 Australian experience with Transferable Water Entitlements

The Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ 1995) has produced guidelines for the implementation of property rights in water. A thorough review of Australia’s experience with TWEs can be found in the Industry Commission report,

Water Resources and Waste Water Disposal (1992). Other surveys undertaken on TWEs include those by Delforce et al. (1990) and Pigram et al. (1992). The Murray-Darling Basin Commission has described experience with water use in the Murray-Darling Basin, including trades in entitlements (1995).

As documented by Pigram et al. (1992), New South Wales, South Australia, Victoria and Queensland have introduced legislative provisions for transferable water use rights. In Western Australia, trial schemes have been established (Collie and Harvey Irrigation Districts) and temporary, permanent and intersectoral transfers are being considered for the south-west, the Carnarvon region and the Ord River Scheme. In Tasmania, a temporary transfer scheme has been introduced in the Winnaleah Irrigation Scheme, and similar schemes may be extended to other parts of the State.

11.4 Transferable Water Entitlements in Victoria

Problem Identification

The Victorian Rural Water Corporation (RWC) manages irrigation water in Victoria. Historically, irrigation water in the State has been in a situation of oversupply, due to an allocation system featuring inflexible administrative procedures, rules and regulations, and water charges at below-cost levels.

Tight budgetary conditions have now placed severe constraints on any further expansion in water supply capacity. Although water is still abundant relative to requirements, there is a foreseeable need to economise on further infrastructure investments and to encourage allocation of water to uses with the highest rates of return. In recent years there has thus been a shift in water policy away from supply augmentation to demand management by promoting more efficient water use.

Instrument Selection

Water in Victoria is allocated at two levels. First, there is a bulk allocation of water to various sectors, such as public irrigators, private diverters and rural towns. There is also an explicit allocation to protect the environment. At the second level, water is allocated within each broad sector of use. The RWC has introduced TWEs to improve water use within one of these sectors — the irrigation sector.

Description of Instrument

Prior to 1886, individuals in Victoria whose property was located beside a river had full riparian rights to use river flows. The Irrigation Act 1886 abolished riparian rights and provided for the State to confer further rights by granting a permit or a licence (Mulligan & Pigram 1989).

The introduction of TWEs created a new phase in the evolution of water management in Victoria. Implementation of TWEs required a new legal framework. A new Act, the Water Act 1989 (proclaimed in December 1990) was introduced. This Act allows for licences, that is, entitlements direct from a river within an irrigation district, to be transferred.

The Act also allows for bulk entitlements, which may be held only by water authorities, to be transferred, subject to parliamentary approval. The legislation applies to permanent and temporary transfers. Permanent transfers meet the needs of farmers wishing to undertake extensive on-farm improvements, expand activities or to leave the irrigation sector. Water licences are issued for 15 years but are expected to be re-issued at the end of this period (Hill 1992). Temporary transfers serve a different market by meeting seasonal demands (Pigram et al. 1992). Temporary transfers are only permitted within seasons.

The legislation does not provide for intersectoral transfers to other non-irrigation users. Trade can occur only within the same bulk supply system, and transfers are subject to approval from the RWC (Hill 1992).

In public irrigation systems, irrigators pay for a water ‘right’ based on the amount of land they hold that is suitable for gravity fed irrigation and the irrigation district in which they are located. An annual charge must be paid for the right whether it is used or not (Pigram et al. 1992). The RWC allocates these rights each year. For areas outside public irrigation districts, water can be taken from requested streams under a diversion licence (Pigram et al. 1992). Finally, sales of water are available over and above the water right, with total sales dependent on availability of water each year.

Stock and station agents act as brokers for transfers and have information about previous transfers. Prices for transfers are negotiated between the buyer and seller. There are no restrictions on the volume which can be transferred, although owners must retain stock and domestic allocations of water. The RWC must approve all transactions.

Assessment Against Criteria for Evaluation

It is an important point to note that the 'commodity' for which trades are permitted is really a range of commodities, differentiated according to location, volume, environmental constraints and different levels of security. Environmental considerations require that an allocation be made to protect the riverine ecosystems, allowing trading in remaining allocations. The environment should have its own bulk allocation, leaving other water users to trade what is left.

Bulk allocations can be based on various resource attributes, such as volume, capacity shares, salinity, nutrient and pesticide levels, and location.

The effectiveness of TWEs in Victoria may be gauged by the number of transfers and volumes of water traded since the introduction of the scheme. The majority of trades have been for temporary transfers.

It is difficult to assess with any reliability the gains in economic efficiency since the introduction of TWEs. The trend in prices for trades is one indicator of the changing economic value of water to irrigators. If water were allocated to more valuable uses, it is logical to expect that the price would rise over time. The general trend in prices, however, has been downward, reflecting the conditions of oversupply.

According to Pigram et al. (1992), prices paid for temporary transfers have typically been around $18 to $20 per megalitre early in the season when there has been uncertainty concerning total seasonal supply, but they have fallen to around $8 to $10 into each season when excess allocations have been announced. These prices are consistent with figures from the RWC.

Trades have not been common for permanent transfers as irrigators have been reluctant to give up long-term rights for water. The asset price of permanent transfers in the Goulburn-Murray district was around $400 several years ago and has fallen to $270 in high availability areas and $350 in low availability areas. Prices of permanent TWEs at auction for new supplies of water have been between $100 and $775 per megalitre.

While interstate transfers are considered a natural extension of TWEs, there are a number of impediments to trade. In particular, as the States are at different stages of development of TWEs and have different water subsidy regimes, inefficient trade in water may occur.

Administrative structures were established in 1987–88 to process temporary transfers of water rights, and the RWC (1991) did not anticipate that the implementation of permanent transfers would require significant increases in staffing, workload or funding.

The introduction of TWEs is not seen as a revenue raising mechanism by the RWC, although the fee for processing transfers and issuing certificates is being increased to obtain full cost recovery (RWC 1991).

All trading is handled through brokers (such as stock and station agents), which reduces administrative costs incurred by the RWC. Costs are also minimised by achieving a high approval rate for requested transfers, which has been encouraged by a non-refundable application fee and through the availability of regional staff to advise on potential transfers.

Distributional effects of TWEs result from the allocation of water resources away from less productive uses of water to more productive uses and users. The RWC reports a movement of water entitlements away from mixed farming and towards dairy farming, away from saline to less saline areas and from poorer to more profitable farmers. Concentrations of buyers or sellers in particular areas could have broader economic impacts on rural regions.

Individual farmers might face adverse financial conditions if the sale of permanent use rights resulted in a significant decline in farm values. This could affect borrowing potential from commercial banks.

Special concerns are faced by mortgage holders such as banks. Land values generally fall after water is transferred and this may result in reduced equity on loans (Delforce et al. 1990). To safeguard the equity of mortgage holders, the RWC requires written permission from lending agencies or any parties with a financial interest in the irrigation business before the business is allowed to permanently transfer water entitlements (Pigram et al. 1992).

In terms of community acceptability, all parties concerned agree that introduction of the instrument has been a progressive step in the reform of the water sector.

Concluding Evaluation

Although the introduction of TWEs in Victoria has the promise of improving the efficiency of water use, this case study has shown that various factors are vital to its future success. Major issues include the limits placed on transfers with other States due to different subsidy regimes, restrictions on trade between regions or between sectors, and the possibility of rural

decline in some areas. Removal of some of these impediments is likely to result in greater efficiency gains than have so far been achieved.

11.5 Individual Transferable Quotas in fisheries management

Without some kind of management control, most fisheries constitute an open-access common property resource. A fundamental theory in fisheries economics is that if the fishing effort and/or catch are not controlled, the economic rent accruing to the industry (that is, the difference between total revenue and total costs from fishing) will be dissipated by excessive numbers of boats and overfishing. Stock depletion can also occur, leading in some cases to commercial extinction of the resource. These fundamental economic aspects of fisheries management are explained by Munro and Scott (1985), Clark (1976), Lecomber (1979, Fisher (1981), and many others.

Regulation of fisheries in Australian waters is usually a joint responsibility of State and Territory governments and the Commonwealth Government. Commonwealth jurisdiction applies between the 3-nautical mile and 200-nautical mile limits, although Offshore Constitutional Settlement arrangements between the States and the Commonwealth vary the 3-mile limit off every State and Territory. This variation may be by methods of fishing or for specific fish species. The Commonwealth also represents Australia in various international forums concerned with the management of fisheries in international waters.

A key agency in fisheries management is the Australian Fisheries Management Authority (AFMA), which was established under the Fisheries Administration Act 1991 as a Commonwealth statutory authority. AFMA operates at arm's length from the Government and the Department of Primary Industries and Energy (AFMA 1995).

Each fishery has a Management Advisory Committee with representatives from State or Territory governments, AFMA and relevant stakeholders. Each committee provides advice on managing the fishery to the AFMA Board of Directors, but ultimately decisions are made by AFMA in accordance with its legislative objectives.

For fisheries involving international agreements, AFMA is an important Commonwealth representative, but other Commonwealth departments may also be involved, including the Department of Primary Industries and Energy, the Department of the Environment, Sport and Territories and the Department of Foreign Affairs and Trade.

An important application of economic instruments for the management of natural resources has been the use of individual transferable quotas (ITQs) for the Southern Bluefin Tuna Fishery and South East Trawl Fishery. In general, AFMA manages ITQs within the Australian Fishing Zone, but in some cases it manages the fishery to the low-water mark in collaboration with the States.

Transferable quotas have also been used in other fisheries within Australia, including abalone fisheries in New South Wales, South Australia and Tasmania, and in the Australian pearl industry.

11.6 Individual Transferable Quotas in the Southern Bluefin Tuna Fishery

Problem Identification

Southern bluefin tuna spawn in open waters to the north-west of Australia and migrate in a southerly and south-easterly direction. Within the Australian Fishing Zone, catches are made by Australian and Japanese fleets, while outside the zone tuna are caught by fleets from Indonesia, Japan, Korea, New Zealand and Taiwan.

A number of factors influenced the need for improved management of the Southern Bluefin Tuna Fishery. First, the fishery was subject to increased fishing effort, leading to declining catches by the Australian fleet and concerns about a reduction in fish stocks. It was evident that the size of the total catch would have to be controlled. Second, earlier controls over fishing concentrated on regulation of inputs and fishing practices, such as restrictions on the type of gear and size of boats. In general, these controls were unsuccessful in regulating the catch. Third, the question of the economic efficiency of the industry was at stake, particularly in terms of profit levels in the industry and sustainable rates of exploitation of the resource.

Instrument Selection

ITQs were introduced to the Australian industry in 1984 and have operated since then. AFMA has managed ITQs for the Southern Bluefin Tuna Fishery within the Australian Fishing Zone

since 1991. A new management plan for the fishery was introduced in 1995, further specifying the conditions for the transfer of quotas and the role of AFMA in administering the system of ITQs.

ITQs replaced a pre-existing system of competitive quotas that had been established under an interim management plan in 1983. The competitive quotas resulted in overfishing and overcapitalisation of the industry. Because there was also a minimum size restriction, many fishers carried out 'upgrading' (discarding smaller fish and retaining larger fish to increase the value of their quotas).

Description of Instrument

The system of ITQs for the Australian Southern Bluefin Tuna Fishery must be evaluated in the context of international agreements involving the fishery. Management plans for the fishery are complicated by the fact that the species migrates over long distances and is fished on the high seas as well as within New Zealand's 200-nautical mile limit.

International management arrangements were introduced in 1982, when concerns were expressed about the long-term sustainability of the fishery. This subsequently led to a series of agreements on catch limits by Australia, Japan and New Zealand, as shown in Table 11.1. The 1989 catch limits represent current agreements.

Table 11.1: International quotas for southern bluefin tuna (tonnes/year)

Year	Australia	Japan	New Zealand
1983	21,000	no limit	10,000 fish
1984	21,000	no limit	10,000 fish
1985	14,500	no limit	10,000 fish
1986	14,500	23,150	1,000
1987	11,500	19,500	1,000
1988	11,500	19,500	1,000
1989	6,250	8,800	450
1990	5,265	6,065	420
1991	5,265	6,065	420
1992	5,265	6,065	420
1993	5,265	6,065	420

Source: Neave (1995, p. 55)

The Australian authorities issued ITQs to 136 individuals and companies in 1984. The industry undertook forced rationalisation in the ensuing three years, with the number of quota holders declining to 63. This has increased to 109 quota holders in 1996. Most of the quotas were bought by South Australian operators and Port Lincoln became the main base of the Australian Southern Bluefin Tuna Fishery.

ITQs are fully transferable among operators in the Australian fleet. The total volume of quotas has been reduced in accordance with the reductions in the total allowable catch by Australia determined by international agreement. Quotas may be used in joint venture arrangements between operators from Australia and those from other countries. Several joint ventures have been established with Japan.

Assessment Against Criteria for Evaluation

The use of ITQs for the Southern Bluefin Tuna Fishery provides interesting insights into the operation of systems of tradeable rights for natural resource management. The system has provided strong incentives for fishers to increase their returns from the resource. The system appears to have worked effectively for the Australian fleet, which has been able to adhere to its total quota, restructure its fleet by using more efficient equipment and harvesting methods, and earn higher estimated profits.

The price of quotas has increased dramatically. In 1984, quotas traded for $800–$1200 per tonne, but by 1992 they were worth $20,000 per tonne or $12,200 per tonne measured in 1984 values. Due to appreciation of the yen, lease values in joint venture arrangements have been worth $3,400 per tonne, which capitalises to a value of $34,000 per tonne, assuming a 10 per cent discount rate. The current selling price for southern bluefin tuna is $26,000 per tonne. This may reflect the higher discount rate used by banks for tuna assets, which typically is 14 per cent.

Distributional effects have been significant, with many marginal producers being forced to leave the fishery. In addition, the quotas have been consolidated within the South Australian fleet at the expense of New South Wales and Western Australia, with adverse regional economic impacts in some communities.

Allowable catches have been restricted to low levels to achieve regeneration of the stock. The long-term effects of ITQs on the fishery have yet to be assessed. It has been difficult to estimate stock levels and population dynamics. Prediction of future changes in the stock are complicated by long time lags in the response of the stock to management actions, the effects of which may last for up to 20 years.

The meeting of the Scientific Committee of Commission for the Convention of Southern Bluefin Tuna (CCSBT) in August 1996 discussed the status of the southern bluefin tuna resource. Estimates of historical stock size suggest that a minimum was reached in 1994, following which there are signs of a slow recovery. The CCSBT has set an objective of rebuilding the southern bluefin tuna stock to its 1980 level by 2020. Proposals are also being discussed for an experimental fishing program to resolve some of the uncertainty surrounding stock assessments.

Monitoring and compliance are carried out differently in the various States. For the Australian fleet, the catch is checked at the point of landing or in fish markets. Japanese boats are also subject to in-port pre- and post-fishing inspections.

An interesting side-effect of the system has been the encouragement of fish farming for tuna. Wild stock is captured and conditioned in ponds, with the Japanese sashimi market a profitable outlet.

'Free rider' behaviour could become a management problem, with other countries, particularly Taiwan, harvesting fish outside the system. In addition, there is no quota for recreational fishing, which could assume increasing importance in future years.

Concluding Evaluation

ITQs in the Australian Southern Bluefin Tuna Fishery have been successful in controlling catch levels and achieving maximum economic returns from the resource. The main difficulty with the fishery has been uncertainty about the long-term population dynamics.

11.7 Individual Transferable Quotas in the South East Fishery

Problem Identification

The South East Fishery covers a wide range of commercial fish species, harvesting more than 90 species of finfish and invertebrates. The main species include blue grenadier, blue warehou, blue-eye trevalla, eastern gemfish, eastern school whiting, jackass morwong, john dory, ling, mirror dory, ocean perch, orange roughy, redfish, royal red prawn, silver trevally, spotted warehou, tiger flathead and western gemfish. Ten species account for more than 80 per cent of the catch and one species, orange roughy, provides one-third of the catch (Staples & Tilzey 1995).

The main fishing method is demersal trawling, with Danish seining also occurring off Victoria. Other methods include drop-lining and gill-netting. The total recorded catch increased from the early 1980s — largely due to the significant increase in catches of orange roughy — reached a peak in 1990, and has continued to decline since.

Instrument Selection

Until 1992 the fishery was controlled mainly through restrictions on effort. In 1991, under the provisions of the Fisheries Act, the Minister for Primary Industries introduced the South East Fishery (Individual Transferable Quota) Management Plan 1991 (Commonwealth of Australia 1991b), which changed the management focus from input controls to output controls in the fishery. The plan provided for total allowable catches and ITQs to be applied to trawl fishing. The scheme was amended in 1992 and discontinued at the end of 1992.

As from 1 January 1993, AFMA became responsible for managing the fishery under the provisions of the Fisheries Management Act 1991. AFMA has managed the fishery since then by means of administrative arrangements, which rely on the issue of permits under section 32 of the Fisheries Management Act. These permits function in the same way as ITQs. The conditions applying to the permits are defined in section 32(6) of the Act. Fees and levies are collected on permits, which include an application fee, an issue fee, a general boat levy, and a research and development levy.

A new management plan is currently being prepared for the fishery, to take effect in 1997. For species such as blue-eye trevalla, blue warehou and ling taken by non-trawl methods, total allowable catches and ITQs are expected to be introduced by 1 January 1998.

The reasons for introducing ITQs in the South East Fishery were similar to those for the Southern Bluefin Tuna Fishery — overfishing of certain species, inappropriate fishing methods, stock depletion, declining catches and decreasing profits in the industry. Earlier attempts to regulate the fishery, including a boat replacement policy, restrictions on the size of vessels, limitations on entry to the industry and various kinds of input controls, failed to prevent economic deterioration of the industry and threatened stock depletion for some species.

Description of Instrument

ITQs are currently applicable to 16 species or species groups. Each fisher has been allocated a given number of quota units for each species, determined in accordance with a formula, taking into account the number of boat units (based on boat size and engine power) as well as recorded historical catches from 1985 to 1989. The total number of permits available to the South East Fishery in 1995 was 151, of which 29 were inactive. Quota units are transferable, subject to approval by the management authority.

The total number of quota units for each species is limited by its total allowable catch, which is determined annually for each species. Each quota unit represents 1 kilogram liveweight, but this is adjusted in proportion to any change that may be announced in the total allowable catch. Some of the quota species are caught by recreational fishers, but these are exempt from the quota system.

AFMA's management objectives in managing the South East Fishery are:

- to ensure that the resource is utilised in a manner consistent with the principles of ecologically sustainable development and to maximise the economic efficiency in the utilisation of resources
- to promote the rebuilding of depleted fish stocks and to promote the identification and development of additional or underutilised fish resources of the industry
- to implement effective and efficient fisheries management on behalf of the Commonwealth.

The immediate objectives for the management of quota species are to ensure:

- the spawning biomass of specified species does not significantly decline below their 1994 level
- the spawning biomass of specified species does not significantly decline below a percentage of biomass at the onset of significant commercial fishing
- recruitment so the spawning biomass does not collapse
- the resources in the South East Fishery are utilised to their full economic potential.

Assessment Against Criteria for Evaluation

Although it is too early to assess the full effects of the new management regime, there are already signs of industry restructuring and improved profitability. Fishing effort has not altered greatly since 1986, but the efficiency of operations has increased.

Monitoring and stock assessment procedures have been improved in recent years, thus predictions of population dynamics should improve and lead to better management of the fishery.

Since the introduction of ITQs to the South East Fishery, there has been considerable restructuring of the orange roughy fleet, with a number of vessels leaving the fishery and others diversifying to fish the upper slope fishery. In assessing the effects of management systems on natural resources, the possible boundaries of effect should be taken into consideration in the design phase.

Concluding Evaluation

The system of ITQs applicable to the South East Fishery is potentially an effective and economically attractive method of controlling the catch and ensuring long-run sustainability of the resource. Economic efficiency appears to be improving in the industry as a consequence of the new management approach. Although total allowable catches/ITQs are relatively successful in the South East Fishery, the multi-species nature of the fishery makes it difficult to extend the system on a species basis. More novel approaches to managing species outside the quota system may need to be considered.

11.8 Control of fishing effort in the Northern Prawn Fishery

Problem Identification

The Northern Prawn Fishery operates in an area extending from Cape York Peninsula in the east to Cape Londonderry in the west, including the Gulf of Carpentaria. The main species caught include the banana prawn, tiger prawn and endeavour prawn.

The industry began in the mid-1960s, operating from the port of Karumba. Many of the boats entering the industry came from waters off east Queensland, following a decline in catches from that area. These boats were primarily small boats, described as 'wet boats'. They were constructed of wood and stored their catches in brine. Since then, new vessel types known as 'dry boats' have entered the industry. These boats are large freezer trawlers with a capacity for large catches and product storage.

Management controls were introduced by the Australia Fisheries Council in 1977. During the 1980s the Northern Fisheries Committee managed the fishery, with representatives from Queensland, Western Australia, the Northern Territory, the Commonwealth Government, the fishing industry and CSIRO Division of Fisheries and Oceanography. Since 1991 AFMA has managed it, with advice from the Northern Prawn Fishery Management Advisory Committee.

Instrument Selection

The Northern Prawn Fishery Management Plan 1995 was introduced in February 1995 under the provisions of the Fisheries Management Act 1991. Haynes and Pascoe (1988), Pascoe (1988), Collins and Kloessing (1988), and Pascoe and Scott (1989) have described the operation of the management regime before 1991.

The primary focus for managing the fishery has been on fishing effort rather than on catch. Such an approach is common in fisheries, where it can be difficult to estimate stocks and enforce compliance with catch quotas. Conservation of the stock has not been considered to be a problem in managing the resource, as a range of management controls has been in place, such as seasonal restrictions and regulations governing gear and fishing methods.

Description of Instrument

The fishery is a limited entry fishery. Each boat operating in the industry requires a class B unit (bestowing the right to one class B unit) giving an entitlement to fish. The number of active licence entitlements has decreased from between 250 and 290 in the mid-1980s to 130 active vessels as a result of buy-back schemes introduced in the late 1980s and early 1990s, combined with a compulsory surrender of 30 per cent of units in 1993. An additional 10 licences were issued for a subsection of the fishery.

Class B licences failed to control the growth of fishing effort, as they did not allow for the increased size of vessels or for increased fishing power. It was estimated that the effective level of effort per unit of time more than doubled since 1979 and increased more than tenfold since 1970 (Buckworth 1987). The average catch per unit effort remained constant in the mid-1980s, although it decreased for tiger prawns and increased for banana prawns (Collins & Kloessing 1988).

To control fishing effort, it was decided to introduce additional controls, implemented through a system of class A units. Each class A unit is a measure of fishing effort, calculated as the sum of the engine power (in kilowatts) and hull size (in cubic metres of underdeck volume).

The average size of vessels in the industry increased to around 427 class A units in the 1980s. Boats are classified in terms of two main groups: those less than or equal to 375 class A units and those above this size. By the late 1980s the estimated capacity of the fleet was 100,000 class A units.

The main provision for reducing the fishing effort was through buy-back arrangements known as the Voluntary Adjustment Scheme. This scheme was initially funded with a grant of $3 million by the Commonwealth Government, but was then funded entirely by the operators. It covered both class B and class A units. Once purchased through the Voluntary Adjustment Scheme, the units ceased to exist. Unit holders are also repaying the loan required to purchase units from the buy-back schemes, which was a total of approximately $20 million in addition to the direct government grants.

To cover the costs of administration and compliance for the management system, each operator pays a levy according to the number of class A units held. The levy rate is lower for boats equal to or smaller than 375 class A units. Contributions to the scheme have been around $4 million per year.

Assessment Against Criteria for Evaluation

The Voluntary Adjustment Scheme initially aimed to achieve a target of 70,000 class A units by 1993, a decrease of 46,000 units from the 1985 level. It also aimed to reduce the number of class B units to 160, representing a 40 per cent reduction.

Policy evaluations conducted with a linear programming model by the Australian Bureau of Agricultural and Resource Economics (ABARE) in the late 1980s indicated that the industry could earn a higher level of economic rent by reducing fishing effort below 70,000 units (Haynes & Pascoe 1988). ABARE's model simulations revealed that the feasible range of values that maximises economic rent extends to quite a low level — 24,000 class A units in some simulations; 30,000 in other baseline simulations; and 19,000 in sensitivity analyses. The upper end of the range of values extended to 48,000 units. The ABARE analyses indicated that an appropriate target to control fishing effort and increase economic rent in the industry would be 50,000 class A units.

AFMA made a policy decision in the early 1990s to cancel up to 30 per cent of class A units and reduce the number to around 50,000 units. This resulted in legal challenges by some operators in the industry, but the courts have upheld the decision as equitable.

There is strong support in the theoretical literature for this kind of policy action. Munro and Scott (1985, p. 624), for example, have stated that:

'If the authorities, i.e. the government, should intervene in the fishery to conserve the resource by imposing seasonal or yearly limits on the total harvest, but do nothing to restrict the number of fishers and vessels competing for the limited harvests, then excess capacity is almost certain to emerge in the fishery.'

The theory indicates that a significant reduction in fishing effort is generally required to restore resource rents in the industry. Furthermore, it is common for the level of effort required to achieve an economic optimum (that is, the maximisation of rent for the fishery as a whole) to be lower than the level of effort that results in the maximum biological sustained yield.

The application of models in the management of renewable resources such as fisheries is a complex task. The process involves conceptualising the problem to be addressed, identifying its main characteristics and management controls, formulating the mathematical specifications of the model, fitting the model to available empirical evidence, simulating the effects of management options, and interpreting the results for policy purposes. At each of these stages judgements are required.

Prediction of the optimal level of harvesting and fishing effort can depend on whether the underlying model is static (that is, repeats a given set of bioeconomic conditions) or dynamic (that is, takes into account changing conditions and required adaptations in management controls). Dynamic models of fisheries are largely confined to the theoretical literature. They are mathematically complex and are difficult to apply to real-world management problems. In practice, much greater reliance has been placed on static models.

The Haynes-Pascoe model is a static model. The theoretical principles underlying the model are widely accepted. Linear programming models have, furthermore, been widely applied in the management of natural resources, including fisheries.

One of the claims made against the Haynes-Pascoe analysis was that their modelling work did not specify probability distributions for costs within the industry and for other management variables such as yield-effort relationships. The management decision in relation to the Northern Prawn Fishery, however, involved uncertainty rather than risk in assessing the effect of restricting fishing effort on economic rent in the industry. 'Risk' in economic decisions is usually defined in conjunction with known probability distributions for the system variables. When uncertainty prevails, the probability distributions are unknown.

Uncertainty is endemic in nearly all natural resource management problems. Uncertainty in fisheries modelling can arise from several sources. It may refer to ignorance about the variables to include in the model; to inadequate information about the parameters or functional forms determining the interrelations of variables in the model; and to limitations in the data concerning variables that affect the model's predictions, such as costs, prices, the technology of harvesting and the biological behaviour of the fishery.

There are several ways of dealing with the problem of uncertainty in natural resource and environmental management when the relevant probability distributions are unknown (Norton 1984; Dixon, James & Sherman 1989; OECD 1994). Haynes and Pascoe applied the technique of 'sensitivity analysis'.

An important factor taken into consideration in interpreting the results of the Haynes-Pascoe modelling work is the prospect of technological change in fishing methods, resulting in an increase in fishing power in the future. This is an additional source of uncertainty in

interpreting the model results. It suggests that, to maintain effective control over fishing effort in the future, the fleet size should be even smaller than that predicted by the model. The required compensation for this effect, in terms of reduced fleet size, is a matter of judgement, but the direction of required change in fleet size is clearly downward. This does not take into account additional input controls imposed by AFMA that are being used to restrict effort, including area and time closures, where the current fishery operates for just over six months of the year.

Concluding Evaluation

Use of restrictions on harvesting effort as a means of regulating the Northern Prawn Fishery has been well suited to the particular characteristics of the natural resource. In this case, where the level of economic rent earned by the industry rather than sustainability of the resource has been the major issue, it has been more effective to apply restrictions on inputs rather than on outputs of the industry.

The system of class B and class A units has enabled management authorities to control both the number and size of vessels. The case study provides an interesting example of how formal economic modelling, in this case the use of linear programming, can be used to facilitate the formulation of management targets. Uncertainties over the appropriate level of input control originally created some difficulties in achieving acceptance of the management policies by all operators in the industry, when the process was implemented in 1993. In 1996, industry acceptance and support for the approach is markedly different, with significant economic improvements resulting for both the fishery as a whole and individual operators.

11.9 Log pricing and allocation

Pricing forest products involves complex considerations affecting management of the forest estate, harvesting strategies, environmental protection, the development of plantations, the financial performance and future development of the wood processing industry, and the economic and social aspects of communities dependent on forest resources.

Pricing and allocating logs from publicly owned forests are essentially the responsibility of the States and Territories. The Commonwealth, however, is involved in processes such as approvals of prices and volumes for export woodchips. The Commonwealth can also influence the pricing practices of the States and Territories by way of nationally agreed principles and policy statements. The National Forest Policy Statement, for example, which has been endorsed by the Commonwealth and all States and Territories, includes recommendations on log pricing and allocation (Commonwealth of Australia 1992c). The commitment of the Australian Government to the National Forest Policy Statement was reaffirmed in a recent statement by the Minister for the Environment (Commonwealth of Australia 1996).

In the past, forest agencies adopted pricing policies described as ‘administrative pricing’, under which log prices were determined almost unilaterally by the agencies themselves. This led to perceptions of financial inefficiency and subsidisation of forest products supplied from public lands, loss of opportunity to achieve high value adding in the timber industry, and impediments to the development of plantations, particularly those dependent on private investment.

Markets for timber are inherently competitive. While logs themselves are not generally traded interstate or internationally because of high transport costs, the intermediate and final products produced from logs and thinnings are vigorously traded commodities. There is competition also between sawn timber and other construction materials, such as steel, house bricks and concrete. Within sawlog markets, it is possible to substitute hardwood and softwood timbers; this is already occurring at a rapid rate.

Over the last few years there has been a move towards market-based mechanisms for pricing forest products from publicly owned native forests and plantations. Several important inquiries, reports and policy processes have led to these changes, which are briefly discussed below.

Pricing must be considered simultaneously with volume and the duration of contract periods over which supplies are guaranteed. The price that industry is prepared to pay for wood will depend on the degree of confidence that is placed in the capacity of the forest agency to guarantee delivery of contracted volumes. Investment in the industry, job creation and value adding all depend critically on industry perceptions of security of supply.

In conjunction with pricing reforms, governments have made strong commitments to meet forest-related environmental objectives. The Commonwealth Government and State governments are proceeding with Comprehensive Regional Assessments, agreed under the

National Forest Policy Statement, to establish a world-class system of conservation reserves. Governments are also implementing stringent codes of management practice and other regulations to ensure ecologically sustainable management of areas available for timber production.

An important principle is that the full costs of forest management should be incorporated in log prices, including research and development costs, external environmental damage costs (for example, those related to off-site sedimentation of streams or adverse impacts on water supply or quality) and the costs of meeting environmental regulations. Many environmental costs are already incorporated in pricing regimes. As noted by the Resource Assessment Commission in its Forest and Timber Inquiry (RAC 1992), if satisfactory performance is achieved in meeting codes of forest practice and other environmental regulations, the compliance costs will automatically be included in the cost structure for wood production. Agencies frequently incur additional costs not related to timber production, such as maintenance of roads and fire management, and these are being met largely through direct appropriations from State Treasuries as community service obligations.

Ecologically Sustainable Development Forest Use Working Group

The Ecologically Sustainable Development (ESD) Forest Use Working Group made five major recommendations on ways of optimising economic benefits of forestry within ecological constraints (Commonwealth of Australia 1991b). Recommendations 18 and 19 relate to pricing and allocation functions.

Recommendation 18 is that wood harvesting rights and wood volumes from public forests be allocated to wood processors through a system which is based on:

- a competitive open market-based process as a general rule, recognising the need for reasonable certainty of resource availability, the imperfections in regional markets, and the need to remove impediments and improve the flexibility in the sale and resale of logs and wood products
- flexibility to enable entrance to new processors
- transferability of rights
- meeting the full social costs of management attributable to wood production and a fair return on capital
- published information on future supplies of timber available to the market.

Recommendation 19 is that this market-based approach to wood sales be progressed over a short transition period, with a view to having a substantial proportion of wood from public forests allocated according to a competitive-based system by the year 2000:

- with the amount going through auction being sufficiently large to provide an indication of market value for wood being allocated by non-market mechanisms.

Resource Assessment Commission

The RAC made the following key recommendations in relation to log pricing and allocation (RAC 1992).

- Greater use of market processes and tradeable use rights will help to improve the efficiency of wood production and distribution.
- The movement towards a more commercial basis for log pricing should aim at emulating the prices that would be achieved in a competitive market.
- Where appropriate, increased reliance on market-clearing mechanisms such as auctions and tenders would lead to greater allocative efficiency.
- Security of investment for industry is essential to the future of a competitive wood and wood products industry based on public native forest resources.
- The inquiry's preferred approach to resource security is to strengthen and revise agreements between forest management agencies and industry, particularly through the development of enforceable contracts that make clear provision for compensation. The inquiry considers that governments should carefully consider a system of long-term rights incorporating periodic review.
- The introduction of long-term use rights, with provision for roll-over, is an appropriate mechanism for providing long-term resource security to industry, while maintaining the possibility of altering the conditions of contracts with adequate notice of intent.

National Forest Policy Statement

The National Forest Policy Statement recommended the following principles for wood allocation and pricing.

- Prices will be market-based, at least cover the full cost of efficient management (including regeneration) attributable to wood production, and include an adequate return to the community from the use of a public resource.
- Harvesting rights will reflect security of supply for wood users, will be clearly defined, and will be transferable when this does not result in the creation of excessive market power.
- The allocation system will be flexible and will involve competitive bidding arrangements for appropriate amounts of the resource, thus enabling the entry of new processors and allowing small operators to compete for niche markets.

Recent trends in pricing policies and practices of individual States are discussed below.

Queensland

Queensland has extensive native forest resources and a rapidly expanding plantation estate. The Forest Service was recently transformed into a commercial agency, with its policy and regulatory functions being transferred to a separate management unit in the Department of Primary Industries.

Market mechanisms (auctions and negotiations between the Forest Service and wood purchasers) have been used for some years to price plantation products. This is consistent with the aim of having the agency function according to commercial principles.

More commercial pricing practices have been difficult to implement for native forest products. The native forest sector has an inherited industry structure with small-scale producers, strong socioeconomic links with regional communities, traditional approaches and mechanisms for pricing and allocation, and prospects of a shrinking resource base.

Stumpage values are estimated in the usual way by subtracting extraction costs from the value of the mix of timber products supplied to final markets. Extraction costs include the costs of harvesting, snigging, environmental protection, labour on-costs, infrastructure and mill processing. The aim is to produce a single price for sawlogs within each predetermined supply zone.

New South Wales

New South Wales is moving rapidly towards a commercial approach in its wood pricing policies. Since 1988, State Forests has been required to be self-funding. The Government has made it clear that the timber industry should not be subsidised.

To date, quota quality logs have been allocated under annual and long-term wood supply agreements, with other logs being offered on a tender basis. State Forests recently attempted to introduce a competitive tendering process, including clawbacks, in the Casino Supply Area. The proposed system featured tradeable rights for specified volumes over agreed time intervals, roll-over provisions and no restrictions on end uses of logs. The proposal was met with strong resistance by industry, and was abandoned.

Conditions relating to contracts for log allocations, including pricing, volumes and length of contract, are currently under review, in parallel with assessments being undertaken as part of the process to implement the National Forest Policy Statement.

Victoria

In Victoria, industry development is a stated aim of government policy. The main guidelines for implementation of pricing and allocation policies are contained in the 1986 Timber Industry Strategy (Victorian Government 1986).

Allocations are 15 years and upwards, with provisions for renewal. Conditions are re-negotiated after 10 years. Contracts must satisfy the requirements of the Value Adding Utilisation system. Allocations are put to tender if forfeited, with matching bids by the holder allowed.

Separate fees are payable for access (under licence conditions) and for timber extracted. The ‘price’ of timber on nearly all logs sold consists of a royalty payment, determined under the royalty equation system. In principle, the royalty rates are fixed so that the royalty (stumpage price) plus transport costs will be equal for all areas supplying a particular market.

Royalties are based on agreements, some have automatic indexing arrangements and others may be referred to arbitration. Prices are determined for different grades of logs, with price differentials designed to encourage buyers to take the lower grades.

Tasmania

Tasmania became a signatory of the National Forest Policy only recently. The focus of its policy on pricing and allocation is transparency and reliance on market signals. Policy requires that a fair rate of return be earned on public assets employed, and that any subsidies should be identified and publicly reported. Community service obligations are funded directly on an annual basis.

Allocations comprise a mix of administered, closed and open tenders. The system allows free entry and exit from the industry with tradeable quotas. There will be a progression from historical allocations to roll-over evergreen contracts in the near future.

Prices take the form of royalty payments. Where royalties are established by direct negotiation or under a review process, market factors are taken into account, such as changes in the consumer price index, state of the market, industry's capacity to pay, comparative royalties on the mainland, import parity and export product values.

South Australia

South Australia has an extensive plantation estate, and virtually no native forests. The State supplies 50 per cent of the softwood trade in Australia. Approximately 30 per cent of the resource is privately owned.

South Australia is the only State in Australia where the Government owns and operates downstream processing plants as well as managing the raw resource. All of its operations are managed on commercial lines, with an acceptable rate of return being one of the management objectives. Total quality management principles are adopted.

Allocations are given with terms of 10 to 20 years and are transferable, but only with departmental approval. Most of the wood from plantations is sold to the department's own processing plants. Licences are granted to other buyers, with conditions relating to volume and quality of logs. The Government has indicated its willingness to enter into long-term supply agreements with pulp mills.

Prices for both sawlogs and pulp logs are determined by negotiation, based on what the market will bear.

Western Australia

Western Australia has an integrated system of logging, whereby the Department of Conservation and Land Management (CALM) delivers all softwood and hardwood to the mill door. The department organises and manages contracting teams to conduct harvesting operations. The two main management objectives are to maximise profit and to encourage industry development.

Allocations are made in terms of volume. The length of contracts varies from 5 years for small firms to 15 years for larger firms. Some contracts are backed by legislation under the State Agreements Act. Special consideration is given to purchasers who can demonstrate value adding and efficient marketing (for example, producers of Valwood).

Auctions and tenders are being used to top up allocations, and all new resources becoming available are sold through tender.

Prices are determined as royalties, based on the highest price industry can afford to pay. The target price varies according to the particular class of log. Prices are indexed annually to maintain the real value of logs.

Prices are required to cover the basic costs of production and ensure a reasonable rate of return. An important principle underlying pricing in Western Australia is that royalties/stumpages should be high enough to make each forest rotation financially viable in its own right. That is, the discounted value of all costs required to establish and manage a forest stand over one rotation should equal the discounted value of revenues over the same rotation.

12. User charges for natural resources and environmental amenity

12.1 General application

User fees are applied by Commonwealth, State, Territory and local government agencies for the use of natural environmental amenities for recreation, scientific research and education.

Areas for which fees may be charged include national parks, recreation areas and conservation reserves.

In principle, fees could be used to ration use of such resources, especially to reduce congestion and resource degradation. However, this is rarely the case in practice. Mostly, fees are imposed to help cover management costs. Deficits are common among conservation reserve management agencies, as documented by the Resource Assessment Commission (1992).

12.2 National parks and conservation reserves

The Great Barrier Reef Marine Park Authority applies fees and charges to users to partially offset the costs of management of the park. These charges supplement funds provided by the Commonwealth and Queensland Governments. An Environmental Management Charge applies to all commercial operations in the marine park, including tourism, mariculture and commercial construction. A permit system also applies to users of the park. Some of these permits are long-term and can be transferred. A new tourist visitor charge of $4 will be applied to all tourists visiting the marine park who use commercial facilities and craft from 1 January 1998.

13. Performance bonds

13.1 General application

Performance bonds are being used as an economic instrument in a number of applications for environmental protection in Australia. They have been chiefly used in the mining industry to encourage land rehabilitation, but other applications include pollution reduction programs in New South Wales and effluent control programs in South Australia.

The general principle of performance bonds is that the supervising government agency is guaranteed sufficient funds, in the form of a bond or security, to cover the cost of rehabilitation in the event of failure by the enterprise concerned. One potential disadvantage of performance bonds is that they may not be able to compensate for irreversible environmental damage. Thus where large-scale irreversible damage is possible, it may be more effective to rely on direct regulations.

There are various ways in which such finance may be provided. One is the provision of upfront capital funding. This, however, may place severe constraints on the cash flow position of enterprises. A company may reduce strains on working capital by taking out a loan with a financing body, in which case the annual cost would be the interest on the loan. The main requirement of a performance bond, however, is that government has a guarantee against the risk of default of conditions prescribed for environmental safeguards. Arrangements have thus evolved similar to risk insurance, whereby guarantees of rehabilitation or restoration are obtained by payment of a risk premium to a bank, insurance company or other financial institution.

Queensland and New South Wales have introduced performance bonds to induce mining companies to rehabilitate mined areas. Extensions of mining leases depend on compliance conditions for staged rehabilitation according to a mine development plan.

The next section describes the operation of the performance bond system for the mining industry in Queensland. The bond system will henceforth be covered under new management arrangements, but its basic features will remain. Of particular note in the Queensland system is the encouragement of self-regulation and monitoring by the mining industry. This has advantages for government by cutting the costs of administration, but the success of this policy will clearly depend on the environmental integrity of industry and the efficacy of supervision.

In New South Wales, performance bonds for mining must be lodged with the Department of Natural Resources. Bonds may be forfeited as a result of failure to comply with the environmental protection, management and rehabilitation conditions of an exploration or mining title, or with related provisions of the Mining Act 1992. Bonds are designed to ensure compliance with environmental conditions and ensure that the community is not burdened with the costs of rectification. There have been few transgressions. The effectiveness of bonds depends on the appropriateness, detail and wording of the environmental conditions.

The introduction of mining, rehabilitation and environmental management plans has helped to prescribe environmental conditions.

In New South Wales, bonds are applied under the Trade Waste Program. Bonds may also be prescribed by the New South Wales Environment Protection Authority (EPA) in pollution reduction programs negotiated with industry. There are currently $5.5 million in performance bonds associated with these programs.

In South Australia the Marine Environment Management Act 1990 provided the power to require the lodging of a bond or pecuniary sum to secure compliance with the Act. The value of the bond was specified as directly proportional to the total likely costs, expenses, loss and damage that might be incurred or suffered by persons as a result of a failure by the licensee to satisfy the conditions of discharge or repayment of the bond or pecuniary sum. The Act has since been superseded by the Environment Protection Act 1993, proclaimed in 1995.

Bonds may be used from time to time for other environmental protection measures. For example, a feedlot in the Murrumbidgee Irrigation Area had to lodge a bond of $2 million with the Department of Water Resources and the EPA as security against environmental damage.

It is clear that performance bonds could be extended to a wide range of natural resources where proper rehabilitation or restoration is required, for example, public forests logged by private contractors, national parks or recreation areas leased by private operators, and public lands leased for grazing or agricultural activities.

13.2 Rehabilitation of mine sites in Queensland

Problem Identification

The Queensland Government recognises the importance of mining activity to the Queensland economy. At the same time, it accepts the need for all mining developments to assess the likely environmental impacts of a proposed mining project and plan to avoid or minimise these impacts. The Government has sought an acceptable balance of public interest, environmental protection and industry development.

Positive action has been facilitated by the Mineral Resources Act 1989, which came into force in 1990. The Act represents the outcome of years of extensive negotiation between the State Government and mining and rural groups.

The Act encourages explorers and miners to assess, develop and use the State's mineral resources and supports the concept of sustainable development. It emphasises environmental responsibilities at all stages of mining, from exploration and mining to the expiry of activity.

Rehabilitation of mine sites is an important component of strategies to protect the environment. Land disturbance at mine sites can result in air pollution from dust, while water pollution can result from leachates of heavy metals and acid waters. Increased sediment loads in rivers and alteration of groundwater tables are other potential environmental impacts.

Up to the late 1980s, requirements for rehabilitation were enforced by direct regulations, with a security deposit scheme involving a flat rate per hectare, regardless of the cost of rehabilitation.

A problem facing government was how to encourage improved performance of rehabilitation and environmental protection without adversely affecting the economic viability of mining operations. An additional aim has been to guide environmental management towards industry self-regulation, with government ultimately playing an advisory and monitoring role. Self-regulation has a number of advantages, including incentives for industry to improve their environmental performance, lower costs for government and less intervention by government in the resource management practices of mining companies.

Instrument Selection

The Queensland Department of Resource Industries administers the Act. The department has introduced a new policy, the Environmental Policy for Mining, which was prepared by the State Government in cooperation with the Queensland Mining Council. The policy defines environmental performance criteria and details the setting of securities for mining operations. It is being administered within a broader framework of planning and environmental management for the mining industry.

Description of Instrument

The department uses the term ‘environment’ in a broad sense to include the natural environment of land, plants, animals, water and air as well as social matters. The impact of a project also relates to the conservation, heritage and cultural values of the environment.

The objectives of the Environmental Policy for Mining, defined in the policy booklet issued by the Department of Resource Industries (undated), are as follows.

- Achievement of acceptable post-disturbance land use capability. Mining and rehabilitation should aim to create a landform with land use capability and/or suitability similar to that before disturbance, unless other beneficial land uses are predetermined and agreed.
- Stable post-disturbance landform. Mine wastes and disturbed land should be rehabilitated to a condition which is self-sustaining, or to a condition where the maintenance requirements are consistent with an agreed post-mining land use.
- Preservation of downstream water quality. Surface and ground waters that leave the leased area should not be degraded to a significant extent. Current and future water quality should be maintained at levels which are acceptable for users downstream of the site, and contaminated water shall not unlawfully leave the site.

Environmental management is to be conducted in the context of an Environmental Management Overview Strategy (EMOS), which provides a mechanism that links any study of environmental impact with the Plan of Operation. An EMOS consists of:

- a project description
- management programs
- an overview strategy.

Regulatory controls incorporated in the Act will be used, if necessary, to ensure that the objectives are achieved. Compliance is required also with other Acts, including:

- State Development and Public Works Organisation Act 1971–1981
- Rural Lands Protection Act 1985–1990
- Clean Waters Act 1971–1989
- Water Resources Act 1989
- Cultural Record (Landscapes Queensland and Queensland Estate) Act 1989
- Rural Fires Act 1946–1987
- Forestry Act 1959–1990
- Beach Protection Act 1968–1986
- Noise Abatement Act 1978–1983
- Nature Conservation Act (proposed).

Other measures that the Department of Resource Industries may adopt in implementing the Act include providing education programs for leaseholders; lowering security deposits for competent planning and performance; fostering better rehabilitation and pollution control technology; issuing cautions for poor performance; taking Notice to Show Cause action; imposing penalties for non-compliance with the Act; and refusing tenure where there is demonstrated non-performance.

Economic incentives for the mining industry to implement environmental safeguards are provided under the arrangements for the lodgement of a security with the department.

The alternative forms of the security are:

- a cash payment (on which interest will be paid)
- a guarantee or indemnity from a bank, insurance company or other financial institution
- a written guarantee from a company provided that the shareholders’ equity of the company as disclosed in its latest audited balance sheet is at least five times the value of the security
- a combination of the above.

The maximum amount of the security depends on the real cost of rehabilitation. This may be estimated from the leaseholder’s own experience, advice from other miners, quotes from contractors or advice from district offices of the Department of Resource Industries.

A category system has been established to determine the risk of leaseholder non-performance on a particular lease. The categories range from Category 1 leaseholders, who demonstrate that they are able to meet or have met their responsibilities in terms of

environmental management, to Category 6 leaseholders, who are unable to demonstrate these attributes.

Performance discounts apply to all new mines and to existing mines (except those that will be ceasing operations before the end of the phase-in period and have the choice of continuing with the pervious security deposit scheme). Changes from one performance category to another can be achieved by submitting a new Plan of Operation or by submitting a notice to vary the current Plan of Operation. For mines already in existence, a further discount may be obtained, based on the phasing in of a new Plan of Operation.

Environmental auditing of operator performance will be carried out to ensure compliance with the Plan of Operation and to determine an operator's performance category. Auditing will be carried out by persons with suitable qualifications and experience, which may include full-time employees of the leaseholder. This provision is designed to support the move to industry self-regulation.

In addition to audits, the department is empowered to make site inspections to ensure that activity complies with the Plan of Operation. Failure to comply with the plan may result in a penalty or cancellation of the mining lease. The maximum penalty is $90,000.

Assessment Against Criteria for Evaluation

There is clearly a strong economic incentive for leaseholders to improve their environmental performance.

The compliance, auditing and inspection provisions should ensure sound control over protection of the environment.

Industry has accepted the policy and indeed has contributed significantly to its formulation. The policy has the added attraction of industry self-regulation, but strict monitoring by an external body will be needed to ensure compliance with the conditions of the scheme.

Details of administrative costs have not been provided, but the policy is clearly administratively feasible. It represents an extension of responsibilities and functions already borne by the Department of Resource Industries.

Concluding Evaluation

The bonding system adopted by Queensland for the environmental management of mining represents an innovative application of regulations and economic incentives. The use of performance standards to reduce the size of the bond offers a strong inducement for operators to comply with the conditions of the scheme and improve their environmental management practices. The move towards self-regulation should produce cost savings in government administration, but there is a risk that self-regulation could reduce the effectiveness of environmental controls. It is clear that the success of the scheme in meeting environmental objectives will require adequate monitoring and enforcement mechanisms within government.

13.3 Lender liability in Victoria

A further related initiative introduced by the Victorian EPA is the limiting of lender liability for the clean-up of contaminated sites. Increased liability for the cost of cleaning up land held by borrowers has caused great concern among lending institutions worldwide. As a result of increased exposure, lending institutions have become more cautious about lending to businesses they perceive to be risky from an environmental viewpoint. This trend could have serious consequences, particularly for environmentally important sectors such as the waste management industry.

The Victorian approach to dealing with this problem was to harness some of the power of financial markets for environmental purposes. The Environment Protection Act was amended in 1994 to exclude 'passive lenders' from the definition of 'occupier' under the Act. The amendments limit the liability of financial institutions that act as mortgagee in possession, controller or managing controller to:

(a) making the site safe (that is, abating any existing hazard)

(b) ensuring that any further operations do not cause pollution.

This approach represents an appropriate balance of liability while also achieving environmental protection. It ensures that lending institutions will not be subject to unlimited liability as a consequence of the actions of others.

A further benefit of this approach is that good environmental performers may be able to obtain finance at a lower cost than competitors who do not perform as well. A difference of 0.5 per

cent or 1.0 per cent in interest rates can have a marked effect on the financial profitability of a project. This is a message that the business community can readily understand and should act as a strong economic inducement for them to implement sound environmental management.

14. Other economic instruments

14.1 Victorian Accredited Licensee Scheme

Problem Identification

The Victorian Environment Protection Authority (EPA) has had 25 years experience in dealing with industrial pollution problems. Over this period, the EPA's licensing and works approval system has been a powerful tool in controlling industry emissions to air, land and water.

A number of factors have also acted to increase business awareness of their impact on the environment. These include increased public awareness and concern, and increased international pressure from treaties and agreements. As a result, many businesses have changed the way they operate in relation to the environment. A number of businesses subject to licensing and works approval under the Environment Protection Act have dramatically improved their environmental performance. To consolidate these gains and provide further incentives, the licensing and works approval system was modified to reward those businesses that have established a high standard of environmental performance and to focus EPA resources where they can make the greatest difference.

Instrument Selection

The modified licensing and works approval system is known as the Accredited Licensee Scheme. It came into existence in 1994 when the Environment Protection Act was amended to allow for the accreditation of licensees who can demonstrate an ability and commitment to effective environmental management. The scheme was established to take advantage of the existing framework for environmental protection in Victoria by providing good performers with increased flexibility.

The Accredited Licensee Scheme represents an appropriate mix of regulatory framework and economic incentives to achieve improved environmental protection. This highly innovative approach to regulation will provide Victorian businesses which are scheduled premises with the opportunity to move into a form of co-regulatory partnership with EPA and the community.

Description of Instrument

Under the Accredited Licensee Scheme, businesses with demonstrated capabilities and commitment to environmental protection are given greater scope to manage their own environmental performance within the framework provided by the Environment Protection Act 1970. These businesses can apply for accredited EPA status, which offers a number of advantages, many of them financial.

The scheme represents a major attempt to harness commercial forces by providing greater economic incentives for good environmental performance. For example, accredited licensees will have greater scope to manage their environmental performance for a site in the most cost-effective manner. Advantages accruing to accredited licensees include:

- a simplified licence which outlines broad performance criteria for the site as a whole
- no additional approval requirements for most new works
- a 25 per cent licence fee reduction
- the ability to place environmental management in the mainstream of the company's decision-making processes.

The reduced demand on EPA resources in servicing the system will enable pressing problems such as diffuse source pollution to be dealt with more effectively within existing resource allocations. It will also free EPA resources to provide additional assistance to small companies experiencing environmental problems.

The community will have improved access to information about the operations, forward plans and performance of accredited licensees, as well as greater opportunities to discuss their concerns with companies through forums such as local community liaison committees. All these are essential if this co-regulatory approach is to receive sustained community support.

Accredited licensees will be able to devote their efforts to more creative and cost-effective approaches to environmental management, as they will be operating under a less prescriptive,

whole-of-site licence and will not require works approval for most plant improvements. Realising the importance of protecting their accredited licensee status and commitment to continuing improvement is expected to produce better environmental performance and fewer mishaps.

In particular, significant benefits will accrue to an accredited licensee from having a sound environmental management system (EMS) in place — one of the requirements of accreditation. From an environmental perspective, it is expected that the discipline imposed by an EMS will lead to increased environmental awareness and hence to better environmental outcomes. The number of environmental incidents should be reduced and waste minimisation opportunities should be more readily identified.

From an economic perspective, an EMS should generate significant benefits to the accredited licensee. Operational efficiencies will be created as companies spend less time, especially senior management time, on crisis management because an EMS introduces a proactive approach. The cost of pollution incidents and hence any resultant legal action should be reduced. The increased likelihood of identifying waste management opportunities should also result in cost savings from lower costs of raw materials and waste management processes.

Companies using an EMS may also gain a competitive edge in terms of international trade and investment because markets, especially in Europe, are increasingly looking for proven environmental credentials before doing business. A certified EMS provides evidence of such credentials. It also places a company in a better position to take advantage of international developments.

In addition, the Accredited Licensee Scheme builds on, and can be integrated with, quality management approaches already being adopted by business, rather than adding new layers, costs or requirements. Checks and balances will be provided by the following prerequisites for accreditation:

- third-party accreditation of environmental management systems by independent accrediting bodies
- an environmental audit program approved by the EPA, with the participation of an independently appointed environmental auditor
- annual public reports of environmental performance signed by the site's senior executive
- implementation of an Environmental Improvement Plan involving the local community.

Should an accredited licensee betray the trust involved in the system, accreditation will be withdrawn and a more prescriptive licence and control system will be reimposed. The licensee would lose some of the cost advantages of greater flexibility and the market advantages derived by being formally recognised as a good environmental performer.

The Accredited Licensee Scheme represents a further step towards a partnership with industry and the community that will deliver both environmental improvements and more freedom from regulatory control. In short, the scheme should help deliver better environmental outcomes at less cost to the Victorian community.

Assessment Against Criteria for Evaluation

The Accredited Licensee Scheme uses the existing regulatory framework and sets environmental outcomes or boundary conditions within which businesses are required to operate. The regulatory framework allows the EPA to issue notices and otherwise ensure compliance if these boundary conditions are transgressed.

The scheme ensures a high standard of environmental performance as the licensee is required to have a sound EMS, and Environmental Improvement Plan and environmental audits. It is believed that these requirements will increase environmental awareness and will result in better environmental outcomes.

The scheme promotes efficiency gains for both business and the EPA. Cost savings accrue from the less prescriptive approach, whole-of-site licence, and flexibility in the choice of environmental performance. Savings will also flow from the removal of the requirement for additional approval for most new works and from the 25 per cent reduction in the licence fee extended to accredited licensees.

Long-term financial benefits are expected from the integration of environmental management into the mainstream decision-making processes of business. Other benefits will accrue from the avoidance of environmental incidents, opportunities for improved environmental outcomes, lower materials costs and lower costs of waste treatment.

Accredited licensees will also be well placed in terms of competitive advantage and international marketing opportunities.

The scheme gives greater access to information about the operations of accredited licensees and provides the community with an opportunity to make an input to the environmental performance of businesses.

It also bestows efficiency gains on the EPA, allowing it to redirect its own resources to other environmental management problems, such as diffuse source pollution and provision of assistance to small and medium-sized businesses experiencing environmental problems.

Concluding Evaluation

The Accredited Licensee Scheme represents a major initiative to use market forces within a regulatory framework. It provides strong economic incentives for businesses to become good environmental performers. As well as providing benefits to business, the scheme helps to allocate resources where they are most needed. The fact that it is voluntary is important. The expected benefits will accrue only if the company is committed to best practice environmental management and consultation with interested parties.

14.2 Cleaner production facilitation in Victoria

Cleaner production represents one of the principal ways in which economic incentives can help to meet environmental objectives. A major initiative of the Victorian EPA over the past decade has been helping to promote the adoption of cleaner production technologies and management practices.

A critical factor in encouraging businesses to adopt the philosophy of cleaner production is the financial gain that can accrue to firms that implement it. Since the mid-1980s it has become clear to many sectors of industry that there are significant commercial opportunities as well as environmental advantages in minimising wastes, or avoiding them altogether, by adopting cleaner production technologies and management practices.

It has also been recognised that cleaner production can overcome the operating and financial limitations of the more traditional end-of-pipe technologies that deal with waste after it has been generated. This realisation that a win for the environment can also be a win for shareholders has been very attractive to business.

In Victoria, cleaner production has become a key feature in all EPA processes and activities. Helping companies to identify opportunities for cleaner production is now an important part of the licensing and works approval process. The following case studies present numerous examples of its application. They demonstrate that cleaner production can deliver significant financial benefits to companies as well as significant environmental improvement. It is expected that as the philosophy of cleaner production permeates all commercial sectors, there will be major economic and environmental gains.

Waste Minimisation Plan by Ford Australia

Ford requires each of its plants to develop and implement a Waste Minimisation Plan. Under these plans, Ford has adopted a number of cleaner production initiatives to reduce the generation of solid wastes, increase water reuse, increase recycling and promote energy conservation.

One of these initiatives was to assess the process for cleaning paint from skids and booth grates, which was done traditionally with caustic soda. An opportunity to implement cleaner production was found in blasting the paint off with a high-pressure jet of water.

The new process is saving Ford approximately $300,000 per year in reduced heating costs and disposal of caustic residues. The capital outlay for the blasting equipment was $120,000, giving a payback period of less than five months. Additional benefits included cost savings of $100,000 per year, resulting from a 2 per cent to 3 per cent reduction in the reprocessing of reject items.

Environmental benefits were obtained by eliminating the use of caustic soda, avoiding the need for acid neutralisation of the waste, and reducing the amount of energy consumed in the process.

Cadbury Schweppes Cleaner Production Project

In 1992 Cadbury Schweppes began a Cleaner Production Project to improve its waste minimisation activities. Twelve areas of its operations were identified for immediate action, and staff were invited to contribute ideas for improvement.

At the end of the first year, the project resulted in significant financial benefits to the company. For an initial capital outlay of $1.25 million, the project has already created savings of $780,000. Environmental benefits achieved by the project include reductions in solid and liquid wastes and dramatic reductions in water use and energy consumption. The company expects similar gains from cleaner production initiatives planned for the future.

14.3 On-ground works in the Murray-Darling Basin

The Murray-Darling Basin Commission recently introduced a program on cost sharing for on-ground works (Murray-Darling Basin Commission 1996). The works are intended to:

- reclaim salt-affected land
- diminish sheet, gully, rill and tunnel erosion
- lower watertable recharge
- lower salt, particulate and nutrient discharge into water supplies
- reduce soil acidity and declining crop yields
- conserve ecosystems and biodiversity
- efficiently allocate benefits and costs to preserve intergenerational equity.

The commission's Integrated Catchment Management funding program provides about $13.8 million annually to develop and implement action plans in the basin. Action plans are designed to obtain funds from various sources, including Commonwealth and State programs, the corporate sector, communities and landholders. This process involves, among other things, evaluating the full range of actions to address the problems.

The cost sharing program for ground works is a mechanism to facilitate the formulation of an action plan where on-ground works are one of the actions to be implemented. The cost sharing framework is used to assess the benefits and costs and most appropriate mix of the various types of works under consideration. Benefit-cost analysis, and in some circumstances multi-criteria analysis, is the method recommended to carry out the evaluation.

Relevant steps in the process include:

- consultation with stakeholders
- agreeing on cost sharing principles
- selecting an analysis method
- identifying and valuing benefits and costs
- identifying and quantifying levels of public and private benefits derived from on-ground works
- selecting the mix of works
- assembling a cost sharing framework for consideration in the next phase
- assembling the cost sharing framework showing the recommended cost shares as a basis for negotiation.

The program applies the following principles for cost sharing agreed by the Council of Australian Governments (COAG).

- The full cost of providing services to specific identifiable beneficiaries or dischargers should be recovered by way of charges to them.
- Costs or public benefits or impact management which are unable to be attributed and charged to specific beneficiaries or dischargers should be treated as community service obligations.
- Where costs are subsidised by government, they should be defined explicitly so that unsustainable precedents are not established.

The cost sharing framework recommends that governments contribute to the cost of on-ground works only where there has been progress towards satisfying the following criteria.

- Community awareness of land and water degradation issues and remedial actions has been increased.
- Community awareness about off-site impacts and other economic externalities associated with land and water degradation has been increased.
- Policy and legislative impediments to addressing land and water degradation have been removed.

- Point source dischargers have been identified and measures have been imposed to ensure that they pay the full cost of their actions.
- Governments have agreed to invest in implementation of action plans, on a 'beneficiary pays' basis, on behalf of the broader community (Murray-Darling Basin Commission 1996).

The on-ground works program is a clear example of a funding program designed to achieve environmental protection objectives through the application of economic concepts of efficient resource management. It internalises external costs where possible, applies the user pays principle where beneficiaries are identifiable, and specifies the role of public funding where broader community benefits are involved.

14.4 Incentives for biodiversity conservation

Biodiversity is usually defined as comprising three categories: genetic diversity, species diversity and ecosystem diversity. Biodiversity is potentially affected by a wide range of human and industrial activities, ranging from those that directly exploit natural species, as in the case of forestry, fisheries and pharmaceuticals, to more general activities that may indirectly affect biodiversity through the destruction or modification of habitat such as farming, land clearing and industrial production.

Impacts on biodiversity are pervasive and cross many jurisdictional boundaries. Management controls must therefore be comprehensive. The declaration of conservation reserves is only one of many options for managing biodiversity. Off-reserve management is also essential. This inevitably means introducing incentives and controls in the private as well as the public sector.

The use of economic incentives to protect and encourage biodiversity is a comparatively recent focus of policy. Such incentives are usually implemented in conjunction with a wide range of regulatory and other measures, including voluntary schemes. The Biodiversity Unit of the Commonwealth Department of the Environment, Sport and Territories has recently published a comprehensive review of incentives for the conservation of biodiversity in Australia (Young et al. 1996). The report identifies the range of incentives that can be used, relevant Australian experience and opportunities for future application. Preece, van Oosterzee and James (1995) discuss more specific incentives applicable to the nature-based and ecotourism industry.

Incentives Directly Affecting Species

This report has already discussed the use of economic instruments to manage populations of species harvested commercially in connection with fisheries management. The use of individual transferable quotas and controls over harvesting effort are relevant examples. There are many opportunities to extend property rights or use rights regimes to other species. The allocation of licences to professional cullers of natural populations (for example, kangaroos) is one example.

Commercial breeding and management of natural species is another means of ensuring their survival, for example, emu, crocodile and fish farming. The drawback with this measure from a conservation viewpoint is that the species are not protected in the context of whole ecosystems. Furthermore, the genetic characteristics of farmed species are likely to be deliberately controlled, so that over time their natural characteristics are lost or are significantly modified.

Voluntary Economic Measures

Donations may be sought from the general public, through fundraising for specific causes. For example, tourists may make direct personal contributions at particular sites. Donations may be sought through animal sponsorship schemes, under which a person 'adopts' a particular animal in a species conservation or rehabilitation program.

Incentives can include personal identification with ecosystems, places, animals or plants. Certificates, badges and other tokens can be used to reinforce the identification.

Private corporations wishing to demonstrate their environmental responsibility frequently provide direct financial support for the protection of natural species and habitats. Funds may be allocated to research programs and management schemes. Some companies in the ecotourism industry in Australia have allocated a percentage of their revenue to ecological research, and support may also be organised at the industry level.

An example is the Mala Fund, established by the Central Australian Tourism Industry Association (CATIA) and the Pacific Asia Travel Association. This fund is now inoperative but,

when it was established in 1991, it was an innovative and successful marriage between industry and government which succeeded in raising $33,000 for research into the mala, or rufous harewallaby, an endangered marsupial found in the central Australian deserts. CATIA used the symbol of the mala on their letterheads for some time, accompanied by the words 'Save the Mala'.

Management of Protected Areas

The management of national parks and conservation reserves offers special advantages for funding the management of biodiversity. To limit potential adverse impacts of visitors, funds should be raised to pay for site development and infrastructure such as walking paths, toilet amenities and fireplaces, fuel and accommodation. Funding is required also for monitoring and research and other tasks such as fire management and visitor management.

Visitor fees can be an effective means of raising funds to support management, although in Australia the revenue gained from this source has usually been insufficient for full cost recovery. Funds may be raised through park entry fees or annual permits. Any system of fees should be feasible and enforceable. It is not practicable in some cases, particularly for large natural areas with low visitation rates, to administer a system of fees because the management costs may exceed the revenue collected.

In some cases a special levy may be applied to visitors and collected by tour operators, as in the case of the per capita charge levied by the Great Barrier Reef Marine Park Authority. The logic behind this is that operators are identifiable and subject to rules and regulations. They are also easier and more available to educate on appropriate practices.

The user pays principle can be applied to commercial operators making use of conservation reserves by applying licence fees and commercially realistic rental charges on leases and concessions. Rights to operate within park boundaries may be offered to the private sector on a competitive auction basis, to raise capital funding for environmental protection.

Goods and services offered on-site in parks and protected areas should be operated on a profitable basis with the net returns being allocated to conservation measures. Commercial products and services include educational programs, consulting services, books, videos, paintings and photographs.

Economic Incentives for Off-Reserve Management

Removal of Perverse Incentives

An important objective in off-reserve management of biodiversity should first be to remove perverse incentives that are likely to cause environmental degradation and loss of biodiversity. Tax concessions used to be given to rural landowners for clearing land. This provision was abolished because it encouraged loss of vegetation and soil erosion, but on-farm costs of vegetation clearing can still be deducted. Land tax policies in some States still act as a positive inducement for land clearing, accentuating the risks of adverse habitat modification, species loss and ecological damage in local areas.

Government Support for Environmental Protection

Governments may directly support the protection of natural habitats on private lands in view of their external economic benefits. Native vegetation, wetlands and other natural features may provide valuable protection for endemic species, act as buffer strips and prevent habitat fragmentation.

Governments should recognise the significance of attractive and ecologically interesting landscapes and ecosystems as a positive benefit to the community. Some of the gains are commercial, as in the case of tourism.

In some cases, direct subsidies or capital grants may be paid to assist conservation measures, such as tree planting under the Landcare program or the eradication of weeds under rural protection schemes.

Governments can encourage conservation measures on private lands by offering tax concessions for the reconstruction of natural habitats. Tax write-offs have been allowed, for example, for fencing to encourage revegetation and land restoration. An extension of this policy to cover other forms of nature conservation would be highly desirable.

Performance Bonds

Performance bonds may be introduced to ensure that, where commercial operators disturb the land or natural habitats, the costs of rehabilitation are covered in advance. As noted earlier in this report, performance bonds are widely used in the mining industry to protect natural environments.

Concessions for proven compliance with codes of practice may be introduced to encourage environmental responsibility, as in the case of the Queensland system of bonds for the mining industry. Industry can assist the adoption of best management practices by setting a good environmental example for others to follow. One example is the program for the rehabilitation of jarrah forest in Western Australia undertaken by Alcoa, for which the company received a United Nations Environment Programme Global 500 Award.

Restrictions on Property and User Rights

Entire systems of resource management can be designed around an accepted set of ecological management objectives before allowing commercial use of natural resources. An example is the specification of environmental flows to protect aquatic ecosystems in riverine environments as a design parameter in schemes for transferable water entitlements.

Ecosystems can be protected also by attaching special conditions to other kinds of user rights for publicly owned resources. Examples include codes of management practice for logging contractors working in native forests, and regulations prohibiting damage to associated species in fisheries operations (for example, dolphins).

Private Investment in Conservation

The private sector may see direct commercial value in managing land especially for conservation purposes. Commercial operations within the private sector based on the protection of natural species or ecosystems may comprise study centres, exhibitions, demonstration sites, visitor facilities and research activities. Appropriate sites in private ownership include rainforests, rangelands, wetlands and alpine areas. Environmental rehabilitation is used frequently as an attraction for visitors, for example, rainforest sites.

Another possibility for investment in conservation is for conservation groups or similar organisations to raise funds for the direct acquisition of sites with high conservation value. This practice has occurred in other countries, but has not been common in Australia.

Other Economic Instruments

Indirect Taxes and Charges

Revenue for environmental protection can be raised from taxes on goods used in conjunction with natural areas, such as camping gear, fishing equipment, diving equipment and similar items. In the Northern Territory, a bed tax is collected by the hospitality industry, but the revenue is used mostly for marketing rather than for environmental management purposes.

Treasuries and finance departments that apply such charging systems should be aware of the importance of ‘earmarking’. Funds should be allocated specifically for the purpose of establishing, enhancing and maintaining natural environments instead of being placed in consolidated revenue. People are often willing to support conservation causes provided there is some guarantee that their money will actually be spent on such programs. The experience with the environmental levy administered by the Sydney Water Board provides strong evidence of the need for earmarking.

15. Use of economic instruments by local government

15.1 Environmental initiatives at the local scale

Local governments are becoming increasingly involved in environmental protection and management. In some instances their involvement is quite specific, but there are now some notable cases where councils are playing an important role on a larger scale, by facilitating the formulation and implementation of comprehensive environmental management plans for catchments, farmlands, residential areas and public open spaces. Protection of natural vegetation and land resources, including attributes of ecological, scenic and heritage value, is often an important objective. Various economic and financial incentive are being used to support these initiatives.

In Melton Shire, Victoria, economic incentives are being used as part of an Environmental Enhancement Policy which focuses on sustainable land management. Bendigo City Council has introduced incentives to support management objectives that have close association with the Loddon and Campaspe Dryland Catchment Salinity Management Plans.

Cooloola Shire Council, Queensland, has introduced a comprehensive package of measures for environmental improvement and beautification of the local area, in which economic incentives play a major role. The mayor strongly believes in meeting environmental objectives

by means of education, financial assistance and community conservation projects and is quoted in a recent media release as saying: 'We've opted for the big carrot, rather than the big stick.' Initiatives undertaken by Cooloola Shire Council include rate relief, an environmental levy, environmental awards, co-funding arrangements, design bonuses and a comprehensive, community-based conservation strategy.

15.2 Environment levies and special charges

Environment Levies

Environment levies are charged by many local governments in Australia. Brisbane City Council has an environment levy that is used to purchase bushland remnants. It was $20 per year in 1990–91 and has now been increased to $30. Cooloola Shire has an environment levy of $10 per year. Ratepayers can complete a survey questionnaire to indicate their priority order for the expenditure of the funds raised by the levy. Redland Shire has an environment levy for ratepayers in the Koala Coast Planning Area.

Other examples of environment levies and special environmental charges include:

Eurobodalla (NSW) Environment Levy

Caloundra (Qld) Environment Levy

Logan (Qld) Environmental Initiatives Charge

Johnstone Shire Council (Qld) Green Levy (under consideration)

Toowoomba (Qld) Parkland Charge

Albert (Qld) Open Space Preservation Levy.

Catchment Levies

Catchment levies are applied to landowners in a catchment to fund works and land management practices to deliver environmental benefits. Mobbs (1996) gives several examples of such levies. New South Wales provides for its catchment management trusts to raise funds via a catchment levy. The Hunter Catchment Management Trust has established an annual levy which is collected by the Hunter Water Corporation.

Hornsby Shire Council, New South Wales, applies a 'stormwater connection fee' to new subdivisions to protect river waters from pollution and sediment run-off. The fee is calculated on the basis of estimated pollution loads, with an allowance for pollution control measures installed by the developer. Funds raised from the levy are used for nutrient and sediment control works.

Murray Council, New South Wales, applies a levy to farmers to fund farm works such as tree planting, drainage infrastructure and watertable works. The Water Supply Authority Act confers power on the council to apply the levy. Co-funding is expected from the New South Wales Government and the Commonwealth Government.

15.3 Rate relief

Local governments commonly use various kinds of rate concessions to encourage ratepayers to adopt environmental protection measures. The most common form of concession is 'rate rebates'.

The legislative provisions enabling councils to use this power vary between States. In Victoria, powers for variations in rates are conferred under the Local Government Act 1989. Examples of rate rebates in Victoria include the following.

- The City of Greater Bendigo has introduced a rate rebate scheme to fund the revegetation of groundwater recharge areas, to combat salination in the region. The scheme applies only to farmland properties and operates in the context of the Loddon and Campaspe Catchment Salinity Management Plans. Rate rebates are payable for 10 years where trees are planted and for one year to offset the cost of perennial pasture.
- Melton Shire Council has introduced a rate rebate scheme applicable to non-urban properties larger than 2 hectares. The rebates are given for completed works designed to discourage land degradation, such as for the control of noxious weeds, pest animals and soil erosion. The rebate is up to 38 per cent of normal rates where the landowner is resident, and up to 78 per cent where the landowner is an absentee. Failure to undertake an approved program of works attracts a substantial financial penalty.

In Queensland, local governments face special problems in implementing conservation policies as there are no provisions for covenants in land titles. Economic incentives are thus

an important mechanism for achieving environmental protection. Incentives for nature conservation activities on rateable land are available under the Local Government Act 1993. Landowners can obtain rate relief as an exemption under a regulation; under a differential rating scheme; or as a remission of rates. A remission in rates may be made for the preservation, restoration or maintenance of structures or places of cultural, environmental, historic, heritage or scientific significance to the local government area. Some examples of rate relief in Queensland include the following.

- Cooloola Shire gives rate relief to landowners who undertake conservation and sustainable farm management practices. The rebate scheme aims to encourage the conservation of high value vegetation and wildlife habitat on private land, as well as to promote the establishment of farm forestry plots in the shire.
- Johnstone Shire Council has prepared a draft document for proposed rate rebates to be applied in perpetuity for landowners entering into conservation agreements. The rebates are targeted at floodplain and habitat management (especially cassowary habitat), scenic resources, soil erosion, slope stability and water quality. The shire may apply for some reimbursement from the State Government and the Commonwealth Government, and may also apply a Green Levy to cover the loss in revenue.
- Logan City Council offers a rate rebate for landowners who rezone their land as Residential Conservation Zone. The rate rebate varies from 25 per cent to 50 per cent, depending on the conservation value of the land.
- Brisbane City Council pays a 'cash grant' to landholders who enter into a Voluntary Conservation Agreement and have their land reclassified as a conservation zone. The grant is paid as a cheque at the end of each financial year. The council considers that this has a stronger incentive effect than a reduction in rates payable under a rebate scheme.
- Brisbane City Council also has provisions for exemption of its environment levy under its Vegetation Protection Ordinance. The exemption applies to vegetation on private land.

15.4 In-kind incentives for environmental improvement

Free Tree Programs

Many councils have programs for providing free trees to local residents. The Cooloola Shire gives each resident two free trees and also gives trees to randomly selected respondents to the council survey on how they would like their environment levy spent.

Environmental Monitoring Programs

Local councils frequently support environmental monitoring programs, either by undertaking monitoring themselves or by supporting local schools and other interest groups. Cooloola Shire Council supplies Landcare groups with water quality testing equipment to participate in the Waterwatch scheme and be involved in the shire's ambient water monitoring program.

15.5 Other incentive schemes

Design Bonuses

Cooloola Shire Council will consider providing bonuses for development proposals that include design features which are of general benefit to the community. Such features may comprise retention of significant bushland in open space areas; implementation of local traffic management schemes; provision of on-site treatment or reticulated sewerage; and implementation of innovative stormwater systems.

Co-Funding Arrangements

Local governments are increasingly becoming involved in co-funding arrangements for environmental protection purposes. This is particularly evident in catchment management programs, which are commonly funded from local, State and Commonwealth sources, as well as by local landowners. An important example is the Cost Sharing for On-ground Works Program by the Murray-Darling Basin Commission, which encourages joint funding and participation by relevant stakeholders.

Cooloola Shire is a partner, together with the Mary River Catchment Coordinating Committee, in the Voluntary Riverbank Restoration Grant Scheme, designed to protect rivers in the locality by tree planting, streamside fencing, weed eradication and erosion control. Cooloola Shire contributed $50,000 to the fund and an additional $140,000 was received from Landcare.

15.6 Initiatives for public participation and awareness

Environment Awards

Cooloola Shire Council has introduced an innovative scheme of environmental awards, co-sponsored with Gympie-Cooloola Rotary and Gympie and District Landcare. The awards recognise and reward people, community groups and businesses who have made significant contributions to improve the local environment through their actions at home, at work, on the land or in the community.

Community and School Workshops

Cooloola Shire Council conducts community and school workshops to facilitate the implementation of its conservation strategy. As an incentive for people to participate, the council offers to pay $10 towards an environmental project in the local area for every adult who attends the meetings. The project is to be chosen, organised and implemented by the group in association with the council. Each school wishing to be involved will be offered $300 for a similar project on public land.

State of the Environment Reports

State of the environment reports are used widely by councils to inform ratepayers of environmental conditions in their locale and measures taken by councils to protect and improve the local environment. Such reports are an important component of the shire conservation strategy.

Reports and Media Coverage

Brisbane City Council issues a statement on its environmental programs in its annual budget report and issues brochures intermittently. The council obtains frequent publicity for its environmental programs on television and in the printed media.

16. Evaluation of findings

16.1 Lessons from Australian experience

This report reveals that Australia has made considerable progress in applying economic instruments for environmental protection and natural resource management. Government agencies appreciate some of the advantages of economic instruments and have taken steps to adopt them in many of their regulatory regimes.

Innovative systems have been introduced in water resources management, fisheries, forestry and mining. The introduction of load-based licence fees and tradeable permits for pollution control provides positive evidence of the political will to achieve cost-effective solutions to environmental management problems.

It is encouraging also to note that governments are beginning to realise that many core economic instruments, such as the taxation system and pricing regimes for the use of natural resources, can have significant, and often detrimental, effects on the natural environment. Closer scrutiny of potential impacts will hopefully lead to more rationally based economic policies that address external environmental effects.

Protection of biodiversity is an emerging area in environmental policy, with work on the identification and valuation of the benefits of biodiversity conservation only just beginning. Australia is rich in biodiversity, yet has one of the worst records of extinction on a global scale. The formulation and implementation of appropriate conservation policies can be expected to present formidable challenges to government and the wider community.

16.2 Advantages and limitations of instruments used

The relative strengths and weaknesses of the instruments surveyed can be assessed in terms of the evaluation criteria listed in the introduction to this report.

In terms of effectiveness in reaching environmental objectives, it is evident that the most successful instruments are those that specify quantity or quality constraints or standards as one of their operating characteristics. Tradeable permits generally do this. In the market for trades, overall quantities are specified within the permit system, and adjustments take place mainly in prices of trades. This may have detrimental effects from an equity viewpoint, and could affect the competitive position of economic activities obliged to manage any significant

price increases. The Industry Commission (1992) has noted such effects in markets for transferable water entitlements.

Performance bonds also appear to have been effective in meeting environmental objectives. The incentive for companies to cooperate is strong, as the penalty for non-compliance (refusal of permission to continue mining operations) is high. The Queensland scheme contains an innovative system of economic incentives, with concessions for improved performance in environmental management. Because mining companies can furnish the bond by way of insurance premiums or other asset-backed guarantees, the strains on cash flows should be minimised. It would seem that performance bonds could be applied in many other situations. The survey revealed that they are in fact used in Australia as a component of environmental protection programs.

There may be some uncertainty about the effectiveness of instruments that operate through pricing controls based on the user pays/polluter pays principles in protecting the environment. Price rises may not always effectively promote conservation of resources because users may not change their behaviour when faced with an incremental change in their costs. There is evidence, for example from the Hunter Water Corporation, that pricing policies can lead to more conservative use of reticulated water supply, but these regimes require community acceptance and provisions to protect adverse economic effects on low-income groups. User pays charges applied in trade waste programs have been reported as having incentive effects, but these are only in the beginning phases and the full impact has yet to be observed.

As regards deposit refunds, the South Australian scheme for beverage containers indicates that these schemes can be successful in reducing litter and encouraging product and materials recovery.

In terms of efficiency gains, there is a general problem of determining how such gains may be assessed, for example, relative to a previous resource use pattern or to a projected resource use pattern under different types of environmental management regimes. Usually, the gains from economic instruments are claimed relative to poorly designed command-and-control systems. They typically consist of lower compliance costs and/or of improved efficiency (including productivity) benefits in resource management.

In the case of tradeable resource use rights, there is evidence of improved economic viability in several kinds of industry. The Industry Commission (1992) noted economic benefits of $40 million accruing in the agricultural sector of New South Wales over seven years, and efficiency gains in other States. Rationalisation of fleets in fisheries using individual transferable quotas has led to higher economic returns to operators and the industry as a whole.

Water supply authorities servicing urban areas have reported efficiency gains. The Hunter Water Corporation has managed to reduce the demand for water by 30 per cent and postpone costly increased reservoir capacity. The treatment and sale of sludge and effluent are positive signs of improved resource use efficiency and implementation of the principle of sustainable development.

There is some evidence that trade waste programs are resulting in greater efficiencies in industry, including reduced generation of waste and greater reclamation of materials.

Tradeable permits and user charges provide ongoing incentives for improved efficiency and environmental performance. With tradeable permits, the ultimate gains will depend on market structure and adjustments. With user charges, the largest gains can be expected where increasing rates of charge over time have been announced. This approach to a charging system gives industry and the community time to adjust, but at the same time provides an ongoing incentive for improved resource use and environmental protection. It will be instructive to monitor the future environmental performance of dischargers subject to the newer systems of tradeable permits and load-based licence fees in States that are introducing these management systems.

The Queensland mining bond system provides effective ongoing incentives for sound environmental management. Self-regulation by industry is an important component of the Kwinana sulphur dioxide control scheme. In both cases there are strong incentives for industry to work in a collaborative partnership with the environmental authorities to achieve flexible and cost-effective emission controls.

Equity aspects vary according to the type of instrument and the way it is designed and implemented. The objectives of efficiency gains and of social equity may at times be in conflict and equity problems are probably the main obstacle to introducing user pays pricing to encourage better resource use. Proposed price increases may be strongly opposed through

the political process, regardless of the fact that high costs (of inefficient resource use) may be imposed on the community.

These considerations partly explain the reluctance of water service authorities to apply full cost recovery pricing. Corporatisation and privatisation of such authorities may be the only politically and publicly acceptable means of achieving improved resource management. Whether equity objectives may be handled effectively, and in what way, through community service obligations is a matter that has not been resolved.

Equity effects appear to be an important obstacle to introducing product charges for environmental protection purposes. Charges that have been introduced, such as charges on ozone depleting substances, have been designed to raise modest amounts of revenue to cover administrative costs, rather than have an incentive effect.

Adverse price effects may be cushioned by incorporating direct regulations and other policy measures to back up economic instruments. For example, in pollution control programs, economic charges may be supplemented by product, equipment or performance requirements as well as education, information exchange and training.

Cost impacts in industry are also important from an equity viewpoint. The reluctance of governments to charge full cost for irrigation water for political reasons is well known, despite inefficiencies in the use of infrastructure and adverse environmental effects such as waterlogging and salinity. By establishing systems of tradeable rights for water, government agencies can be placed at arm's length from the operations of markets. Nevertheless, it has been apparent that supervising agencies should have the power to monitor and veto trades if the socioeconomic consequences are deemed to be unacceptable. These functions are provided for in most schemes for transferable water rights that have been introduced in Australia.

Community acceptance is essential to the success of any system of resource management or environmental protection. Before introducing any instrument, extensive public consultation should be carried out. Further efforts may be needed to inform the public of proposed schemes and invite feedback so that backlash can be avoided.

The community has generally been somewhat suspicious of economic instruments, but there is now greater understanding and acceptance of their use. Public awareness and information programs can help to overcome some of the difficulties. Conservation groups are more strongly advocating economic instruments as a means of protecting the environment. Industry has taken a keen interest and is actively participating in the design of management regimes. It appreciates the advantages of being able to make flexible commercial decisions regarding environmental protection, and is more amenable to operating under market conditions rather than under rigid controls of government regulators.

Strong community support can be expected where government agencies are seen to be meeting community goals, values and aspirations. In South Australia, the refund deposit system for beverage containers has received strong public support because of a community desire to prevent littering and promote recycling. The Special Environmental Levy introduced by the Sydney Water Board was also initially strongly supported by the community. Experience suggests that public support for economic instruments and financing mechanisms will be most favourable where it can be demonstrated that funds are being allocated to environmental programs and projects. Local councils and other water authorities have generally been successful in using environmental levies.

Industry acceptance is an essential aspect of implementation. The important message to convey is not whether economic instruments will result in any cost, but whether economic instruments are likely to enable industry to comply with the environmental objectives of government at a lower cost than under alternative systems of instruments. Where capital assets are handed to the industry sector, as under systems of tradeable rights, industry may actually gain from the introduction of such instruments, especially when compared with command-and-control systems or with effluent/user fees.

Administrative feasibility depends on existing and proposed institutional structures, legislation and administrative procedures. Jurisdictional constraints may create particular problems of policy coordination.

Specific legislation may be required to introduce new systems of economic instruments. This is likely to be the case for new taxes or charges and systems of tradeable rights. In other contexts, government agencies may have regulatory powers that encompass economic instruments. Alterations to charging systems may be introduced fairly easily, for example, to achieve incentive effects.

Administrative costs of economic instruments are difficult to determine, especially when compared with other regulatory regimes. Economic instruments in principle should not cost more in administrative resources than command-and-control regulations, and there may be good reason to expect lower costs, depending on the design of any particular system. Provisions for cost coverage can be incorporated in the design and operation of instruments. Environmental and user charges of many kinds are imposed by governments to raise revenue to cover costs. Revenue can also be raised through licence fees or by auctioning user rights.

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