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**Current and Potential
Uses of Economic Approaches
to
Environmental Management**

by

**Anton Meister
and
Basil Sharp**

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**Current and Potential
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by

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and
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August 1993

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FOREWORD

The Resource Management Act of 1991 states that one of the functions of the Minister for the Environment is the consideration and investigation of the use of economic instruments (including charges, levies, other fiscal measures, and incentives) to achieve the purpose of this Act (section 24(h)). This discussion paper is a direct consequence of this requirement of the Act.

In late 1992 a research project was undertaken for the Ministry for the Environment to look at the current uses of economic instruments around the world and to comment on their suitability for use in New Zealand. The mention of the term 'economic instrument' in the Act has caused much confusion in the minds of those involved in resource planning and environmental management as to what these new tools really were, what they could or couldn't do and how relevant they might be to the New Zealand resource management situation. Claims were being made about the efficiency and effectiveness of these policy instruments in resource and environmental management. The evidence for this came from the myriad of applications of these instruments overseas.

This discussion paper briefly looks at some of this evidence. The application of a range of economic instruments is discussed and the successes and failures of them in terms of a series of criteria are highlighted. The major groups of economic instruments are charges (or levies), subsidies, deposit-refund systems, market creation (transferable rights or permits) and enforcement incentives. For each group, examples of overseas applications are presented and possible potential for application in New Zealand is discussed.

It is important to make the following points or disclaimers:

1. Due to limited time available, the coverage of actual applications of economic instruments is far from complete.
2. Economic instruments, in the main, are a recent phenomena and for that reason little in-depth analyses were available as to the full impact of the policy instruments in those countries where they had been applied.

3. This paper is a **discussion paper**. For that reason some of the suggestions for potential application in NZ should be taken with a grain of salt. The report points out in several places, that more research needs to be conducted before even considering the use of these policy instruments. This does not take away however, the need to do some of this research as potential does exist for these policy instruments as adjuncts to the existing regulatory system for resource and environmental management.
4. This report is, to some extent, already out of date as this year much more work on the use of economic instruments has been published, here and overseas. It is felt however, that the information in this report can still serve a useful purpose in providing details not found in other published material. Also, the authors feel that their conclusions need not change in light of more recent work on economic instruments.
5. The term economic instruments is used because in the main they are the instruments the report is dealing with and also because it seems to be the 'in' term. For this report a broader title has been chosen to indicate that economic approaches to environmental management do not finish and end with economic instruments.

The authors are grateful to the Ministry for the Environment (as well as the Ministry of Commerce and The Treasury) for this research contract and they hope that the results go some way towards easing the minds of all those involved in the large, but important, task of managing the environment and the resources of New Zealand as far as economic instruments are concerned.

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CHAPTER 1

1.0 INTRODUCTION

Current interest in N.Z. regarding the use of economic approaches to environmental management is a reflection of similar interest in the rest of the developed (as well as developing world). The standard approach to environmental management has been the 'command and control' or regulatory approach, adopted in an effort to bring a quick halt to major pollution problems. The expanding cost of pollution control under this approach, the lack of success in many areas of attempts to stem increasing levels of pollution, the increasing complexity of regulatory regimes, and the failure of regulation to encourage technological innovation beyond what was required by law, have all caused governments to look for new policy tools.

The 'new' economic approaches are directly derived from the economic theory of externalities: pollution and environmental damage arise from the fact that environmental resources are not priced. By pricing such resources, their users (including polluters), instead of wasting them on the grounds that they are 'free', are encouraged to take suitable measures to limit consumption and deterioration.

Economic approaches have as a major goal the establishment of an economic interest in efficient environmental protection and rational use of resources. This goal involves, therefore, economic incentives in the use of natural resources, in reducing the quantity and degree of pollution, in recycling, in effective reclamation, and in compliance with the general principle of minimisation of human intervention in the environment. The advantages for economic approaches can be summarised as:

- they are more **cost-effective**. Effluent charges, at a suitable rate, or emissions trading, can minimise the total cost of pollution control.
- they offer a **permanent incentive** to reduce pollution for the period of time that a payment is made. They also lead to further encouragement for technical change through research and the development of non-polluting products or better and more effective processes of pollution control.
- they increase **flexibility**. For the authorities, it is easier to modify or adjust a charge than to modify legislation; for polluters, freedom of choice and adjustment is preserved.
- they provide a **source of finance**. In most cases, economic approaches play an important role in the collection of funds, which may or may not be used to fund pollution control facilities or other environmental projects.

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As the rest of this report will indicate, achievement of these advantages in real life applications has been scant (or hard to prove). At the same time there are also some disadvantages one of which is that, for some instruments, application of the instrument will not give certainty as to what will be achieved. By leaving the polluters the freedom to react to the policy instrument as they see fit, environmental management becomes a 'wait-and-see' situation. This may not be satisfactory in some particular environmental management situations. Therefore, as will be discussed, economic instruments are mostly applied within a regulatory framework, and as such they become complementary to that policy approach rather than being a substitute for it.

1.1 AN OVERVIEW OF TYPES OF ECONOMIC APPROACHES

Economic incentives (or approaches or instruments) can come in the form of a financial transfer (tax, charge or subsidy), a modification of relative prices (taxation on certain products), or a clear specification of rights (transferable emission permits, or resource rights). These instruments operate as financial incentives to polluters, who select the most advantageous solution: polluting and paying, or investing in pollution control to avoid paying. In other words, they are intended to modify behaviour (to induce a switch from polluting to pollution control or prevention) merely through financial incentives and market forces.

In then, the common elements of economic approaches are:

1. The existence of a financial incentive;
2. The possibility of voluntary action;
3. The involvement of government (related) authorities;
4. The intention of (directly or indirectly) maintaining or improving environmental quality by applying the approach.

Approaches that fit the above description are described below. An overview of the extent of their use in OECD countries is provided in Appendix 1.

1.1.1 Charges

These are the most widely used form of economic instrument. Central to their implementation is the ultimate destination of the revenues collected. For the **revenue raising charge** this destination is to pay for investment and

maintenance cost of some collective form of treatment measures. This instrument is useful when there is a situation where collective treatment facilities present a reasonable approach to dealing with environmental quality problems (even though there is little to encourage preventative measures here). If individual treatment or prevention measures are possible and the charge is high enough, then this economic instrument can also have some regulatory side effect.

Examples of this approach are: co-responsibility charges (such as effluent charges), user charges, administrative charges, product charges, and tax differentiation.

With these applications the linkage between the revenue raised and the environmental objectives pursued is not always direct. With many applications there is not a connection between actual damage caused and the level of the charge.

The alternative to revenue raising charges are **regulatory charges**. These are similar to the examples mentioned above, but revenue raising is not of primary importance, rather the regulatory effect is. For that reason, the charge rate is set at such a level that prevention (eg. in-house treatment facilities and substitution) is made financially attractive. Other examples are the existing charge on leaded petrol to bring about substitution or a charge on pesticides to bring about volume reduction and/or substitution.

The distinction between the two approaches is not always clear and charges, purely put in place for revenue raising purposes, can also have a regulatory effect. Regulatory charges of course also raise revenues. Therefore for both approaches, the destination of these revenues is of quite some importance and will have an influence on the success of this policy instrument.

1.1.2 Subsidies

Subsidies can take many forms, including grants, soft loans, tax advantages etc. Their purpose is to make environmentally friendly activity cheaper. This is in contrast to most other economic instruments which make environmentally damaging activities more expensive. Subsidies can be effective when they are given in proportion to the reduction in environmental damage. It is desirable that subsidies have a short term duration and are only obtainable by economically viable enterprises.

Introduction

These instruments have received much criticism. Although they provide a carrot and therefore, hopefully, a greater chance that pollution control facilities will be put into place or environmentally degrading activities will be reduced, the whole concept flies in the face of the polluter-pays principle.

Experience round the world has been that equipment tied subsidies have led to capital intensive pollution control facilities. Further, subsidies for particular kinds of activities on for example particular lands, will become capitalised into the price of the land. Harrington et al. (1985) list the following undesirable effects subsidies may have:

1. They can provide payments to people to do things they would have done anyway;
2. They can distort the mix of inputs used to achieve the desired objective (the capital intensive programmes mentioned above);
3. Once established, subsidy policies are extremely difficult to revise or abandon;
4. All subsidy programmes have the problem of defining the baseline against which future performance is to be measured;
5. A subsidy programme can have unintended effects that negate some or all benefits. These unintended effects have plagued agricultural programmes in the past. An example of this is discussed by Kirby and Blyth (1987) when discussing the economic aspects of land degradation in Australia (for a brief see Meister (1990)).
6. They have to be financed from other sources.

1.1.3 Deposit-refund schemes

Most economic instruments are based on the principle of internalising environmental costs. Deposit/refund schemes are put into place to get people to pay for the environmental costs of wrongly disposing of wastes (bottles, cans, cadmium, batteries, etc.). The deposit money is an advance paid at purchase which is refunded when the commodity (or material) is handed back in. On return, the costs to the user are zero and the producer or shopkeeper is now responsible. The deposit rate must be such that a high return percentage is achieved. The deposit is independent of the environmental cost of not returning the commodity (or material). Hence, no real internalisation takes place if the commodity (or material) is not returned.

The environmental goal is to separate the goods (to be recycled or disposed of) from the general waste stream and to direct them to recycling or to other means of disposal. Besides the traditional deposits on bottles other possibilities for

deposit/refund applications are also found with goods such as batteries and cars and even certain minerals or materials (e.g. heavy metals, sulphur, etc).

Preconditions for successful implementation are:

- clear definition of the product;
- environmental problems clearly related to use of the product;
- recycling opportunities;
- reasonable measurability;
- stability of the product throughout the production and consumption process.

Some of these preconditions are less important by the "half deposit refund schemes", consisting only of a delivery (handing-in) premium. This can also be seen as a form of subsidy and avoids the problem of monitoring and balancing the books for deposits and refunds between producers and retailers. This delivery premium scheme is also an effective approach for goods already in circulation.

Deposit-refund systems may perform better than alternative instruments in that:

1. they also work when the act of environmental degradation is not directly observable or when the potential injurers are numerous and/or mobile;
2. they simplify the proof of compliance in some cases;
3. they specify the (maximum) economic consequences of noncompliance;
4. actual or expected damages are covered by actual payments (at least in principle), and
5. in certain applications they may stimulate people other than those directly involved to reduce the effects on the environment (such as scavengers, school groups, scouts, etc. in the case of refunds on littered items).

The use of this type of instrument depends on a compromise between fine tuning the incentive structures and keeping administrative and enforcement costs as low as possible.

1.1.4 Transferable rights

Environmental policies using transferable rights seek to create a structure of property rights that, through the process of trade, will signal information on the relative scarcity of environmental assets. Existing, and potential, users of the asset have the choice of paying the market price for a right or implementing an innovation that will reduce their use of the natural resource.

Introduction

Successful outcomes using this class of economic instrument depend on both the dynamics of the market place and the management agency and/or the legal framework used to delimit the market.

Transferable rights cannot be viewed in isolation from legal and government agencies. For example, the total quantity of water rights for abstraction could be defined for a given geographical area.

Transferable water rights, within a competitive market, move to their highest valued use. This will lead to more efficient resource use. Because the market will be constrained in some way - e.g. with respect to transfer, or certain classes of trade are excluded in the market - it is not possible to claim that the instrument is allocatively efficient. At best, it will achieve targeted outcomes - e.g. sustainable harvest, reduction in emissions - at least cost.

Overseas examples of this approach are air pollution emission trading rights, acid rain allowance trading, tradeable consumption and production rights for CFCs and halons, tradeable water pollution rights and trading in lead-additives. The NZ examples to be discussed are transferable rights for fisheries, radio spectrum frequencies, water and development rights.

1.1.5 Performance bonds, non-compliance fees and offsets

These are legal instruments to achieve physical regulations. Application of these instruments is either ex-ante or ex-post, and the level can be based on damage compensation. The instruments can, depending on the level set, have a preventative effect.

Performance bonds are ex-ante payments to authorities in expectation of compliance with imposed standards. This deposit is refunded upon satisfactory compliance, usually at the end of the project. The security deposit or bond is held until the project is finished and the development has been undertaken in accordance with pre-specified conditions. If the conditions are not satisfied, work required to achieve the standard will be paid out of the bond. The remainder is refunded. Throughout the world there are many cases where firms have decided to walk away from their obligations and lose their deposit. Under the performance bond system, firms have a right to do this and, hence, it is important that performance bonds are of sufficient size to cover the cost of meeting any obligations associated with resource use and development.

Non-compliance fees are imposed as an ex-post payment (fine) when polluters do not comply with certain regulations. The amount charged usually relates to

the profits made through non-compliance. The fees give a developer or resource user the choice between meeting a pre-specified standard on their land or paying a fee that represents the cost of replacing the environmental functions and benefits lost. The choice is up to the developers, but usually there is much less incentive to find the most innovative and cost-effective solution. In particular, there is no dynamic or continuing incentive to improve nearby land (Young, 1992:166).

Offset arrangements. Offsets are a developing concept. Many development decisions lead to natural resource depreciation. In such cases the Offset Principle suggests that significant adverse effects on environmental quality should be balanced by complementary investments that lead to natural resource appreciation or environmental improvement elsewhere. The more efficient of these programmes give developers the choice between offsetting any lost environmental and ecological functions themselves and contributing to a fund established for that purpose.

1.2 GENERAL EXPERIENCE WITH ECONOMIC APPROACHES

OECD countries, in particular, have turned increasingly to the use of economic approaches (see Appendix 1 for a reasonably complete list of applications by type of approach). Environmental taxes and charges and deposit-refund schemes were among the early approaches, followed, more recently, by the use of tradable emission permits and transferable rights. Within the last 4-5 years there has been an explosion of the use of these economic instruments. Charges and taxes are mainly found in the Scandinavian and West European countries. Deposit-refund schemes are found in Scandinavia and the US and are being considered in western Europe. Marketable emission permits are very much an American invention but are now also being considered in Europe. Transferable resource rights are found in Australia (water), the US (air and water) and New Zealand (fish and others). Financial enforcement incentives are of many shapes and forms and are found everywhere.

Although there is widespread interest and application, the place of economic approaches should not be judged simply by the number of them deployed. Rather it should be judged by how effective the approaches have been in achieving stated goals, by their cost of implementation and by their long-term durability.

Little in-depth analysis of most of the instruments documented in Appendix 1 is available. The reason for this is that not enough time has passed to get a clear

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indication of the full impact (this is so except for a few instruments which are included among the cases studied). Further, in many cases where the instruments have been applied, they have **not** substituted for, for example, regulatory approaches, rather they have been added onto the regulatory approach to achieve greater efficiency and effectiveness in environmental management. For that reason, few if any, studies have been conducted to compare different instruments in terms of achieving environmental management goals (most of that work has been theoretical e.g. all the work on charges versus standards). With regard to practical applications, most of the research has concentrated on describing the applications and the failures or successes in achieving stated goals.

In this report a series of case studies is presented. Each case study presents the application of an economic approach to a particular environmental problem. Sometimes the case study deals with one single application while in others a group of applications in different countries is discussed. Full details of the case studies are documented in a series of appendices. The case studies are summarised in the next section and the relevance of each particular approach to N.Z.

The case study summaries will briefly describe the particular economic approach to environmental management, and discuss (wherever possible) the following aspects:

- institutional context;
- effectiveness in achieving the intended policy outcome;
- impact on general allocative efficiency and equity;
- public finance implications;
- merits of the instrument relative to alternatives;
- special factors that helped contribute to the outcomes;
- preliminary assessment of the potential for applying the economic instrument in New Zealand.

CHAPTER 2

2.0 CASE STUDIES

In what follows the case studies are summarised, evaluated and the possible potential for application in NZ looked at. The cases are chosen so as to cover the major categories of economic approaches. As charges are the most widely used economic approach in managing the environment, several examples are discussed. The case studies chosen are two product charges (fertiliser and pesticides), an effluent charge (effluent into surface waters), and a user charge (rubbish).

For the deposit refund category, two examples are discussed, and for the transferable rights five NZ applications are discussed. Finally, some examples are given of subsidies, grants, compliance schemes and offsets.

For each of the case studies, the details are contained in the appendices.

2.1 FERTILISER CHARGE

Experience with a charge on fertiliser inputs is widespread in Nordic countries. In terms of implementation (institutional arrangements) little difficulty has been experienced. The charge is levied at the top of the distribution chain (the producers and importers). Acceptance of the charge by farmers has been good, but the level of acceptance depends very much on what is done with the revenues obtained (the question of restitution). In appendix 2 more detail is provided on experiences in individual countries.

The charge level has not been high (between 10-40 percent of the base price¹), and has been based on the content of N and P (the charges are differentiated).

¹ None of the reports consulted published actual price levels or charge amounts. We have tried to calculate some actual figures. The Swedish nitrogen tax amounted in 1991 to NZ\$0.82. A typical nitrogen fertiliser used in Sweden is calcium ammonium nitrate (price NZ\$260/ton), containing 26% of N by weight. This implies a cost for N of NZ\$1/kg. If we now add the charge (NZ\$0.82 x 260) we get a final price of NZ\$473. The charge represents 45% of the final retail price (which is what the IVM (1992) report mentions to be the average situation in Sweden).

Case Studies

The regulatory effect in terms of a reduction in use has been small or insignificant. The charge, has in the main worked as a revenue raising instrument. However, the charge has raised consciousness with regard to over-fertilisation and this may have contributed to the reduction in fertiliser use in some of the countries mentioned.

A study, quoted in the Economist (1990), shows what would happen if the government (UK) decided to tackle nitrates in the water supply by imposing a nitrogen tax at various levels. As this study summarises to a large extent the findings for the other countries as presented in Appendix 2, the table of results (Table 1) is presented below. The model used, makes the assumption that, if the price of fertiliser rises by 1%, farmers will buy only 0.3% less fertiliser (Economist, 1990).

Table 1. The effects of a nitrogen tax

Tax rate	Revenue collected (£m)	Change in total farm output (£m)	Reduction in farm profits (£m)	Change in nitrate concentrations (%)
5%	15.2	na	15.5	-0.7
10%	31.4	-17.7	31.1	-1.4
20%	65.8	-37.4	62.5	-2.6
40%	142.0	-82.3	126.3	-5.0

Fertiliser is cheap compared with the increase in yield it causes. So farmers will pay the tax, continue to use almost as much fertiliser as before, and suffer a cut in profits. The impact on pollution would be small - only a 5% cut in the concentration of nitrates in water supplies.

To use a fertiliser charge as the only policy to achieve a decrease in non-point source pollution is difficult for the following reasons:

1. the charge has to be very high (100% or more of the base price) to achieve a significant reduction in fertiliser use;
2. the linkage between use and pollution is not a direct and clear one;
3. the charge also affects those farmers who don't over-fertilise.

A fertiliser tax may still be worth applying. The fact that the farmers are not willing (or able) to change their ways does not show that such a tax is pointless - indeed, it could be a way of making sure that polluters pay the costs of cleaning polluted water.

The main alternative to a tax is regulation and, while imposing quotas on fertiliser would cut its use more effectively, the impact on farm incomes would be much more severe.

In west European countries the situation is slightly more complicated in that N and P come from both artificial fertiliser and manure. The current trend in environmental policy with regard to N and P (and hence non-point source pollution) is to require farmers to keep a mineral account for their farms (paddock by paddock). The Government sets threshold levels of acceptable fertiliser applications for each type of land, and a charge is placed on any mineral surplus (calculated from the mineral budget) generated.

2.1.1 Overseas experience with fertiliser charges: evaluation

As demonstrated, fertiliser charges have been widely used in OECD countries. From the experience documented above the following general conclusions can be drawn.

Effectiveness

For the charge to have a regulating impact (i.e. to lead to a reduction in the use of the product), the charge would have to be high. The ultimate impact on use will be a function of available substitutes, the price elasticity of demand (which appears to be low), and other cultivation and management techniques. Experience and research indicate that a price increase of close to 100 percent would be required to make any impact on use. Smaller increases will have little regulatory impact in the short run, but do seem to raise awareness and may lead to changes in use in the longer run.

Efficiency

In most of the situations discussed, the charge is to be seen as an addition to the existing regulatory system (not a substitute). The charge makes the current regulatory system more efficient, but there are no major savings to governments from implementing a charge system. From the affected groups' point of view, there are administrative costs and income changes. However, when the charge is levied at the importer/producer level, as is done in nearly all cases, the administrative costs are judged to be very small. With regard to income changes, it is difficult to draw conclusions in general as this is a function of the restitution system in place. Research completed using econometric and linear programming models shows relatively small income effects at charge levels of close to 100 percent. The income effect increases rapidly at higher charge levels.

Equity

The principle of polluter-pays would be followed if the charge was based on the damage caused to the environment by the product. This is not so with the currently implemented charges. The charge is paid at purchase and there is a presumption of use. A direct relationship between use and environmental damage is missing, this is even more obvious when the tax is not differentiated. In some cases a uniform charge per unit of active ingredient, irrespective of the environmental effects of the ingredients is used. There is clearly here a tradeoff between equity and efficiency². In terms of neutral income effects between sectors, this also is not possible since restitution of revenues requires that information is available on which sectors use what. This information can only be obtained by monitoring and charging individual users.

Acceptability

Acceptability is very much dependent on a clear purpose and goal. In general there is much opposition to an increase in the tax burden. There are two developments that may reduce this resistance:

1. the restitution element;
2. a clear commitment by governments to achieve a reduction in the use of pesticides and fertilisers and this programme being sold as more efficient than one not using economic instruments.

Acceptability is increased if the tax is imposed on those users that apply levels over and above acceptable application levels (especially for fertilisers). The current system of taxing importers and producers is very efficient, but conflicts with taxing the over-users.

² This point is also made in a recent report on 'Incentive-based approaches to regulating toxic substances' by Macauley and Palmer (1992) when they write "...a tax targeted at specific production stages or end uses may entail significant administrative and enforcement costs. In contrast, a blunt instrument - such as a tax on all production of a chemical - may be easier, thus less costly, to administer.....However, such blunt intervention would reduce use of chemicals in those applications for which there are more substitutes rather than in those applications for which risks of human or environmental exposure are greatest." (page 6).

With regard to the competitive position of agriculture, there may be a reduction in terms of competitiveness, but a gain in terms of international acceptability of an environmentally friendly agriculture. The EEC currently is working towards harmonization of rules.

Public Fin.

The aim is to make the impact neutral by means of restitution of the revenues. This is also behind the concept of an 'ecotax'. However, restitution does not always occur and in cases the charge has represented a significant source of income to Governments.

Legal/Institutional

In most of the cases discussed, few legal problems were encountered in introducing the tax and other existing institutions (such as the customs and inland revenue system) have been used to implement the charge system.

Trade Implications

Trade implications are hardly ever mentioned in the studies analysed as the products under consideration are not major export products for the Nordic countries. However at a recent conference on Trade and the Environment in The Netherlands, this was a topic often raised by western European Countries, and the general feeling was that the EEC should look at harmonising economic approaches for environmental management. But "this will not be an easy task. It is not clear yet what types and applications of environmental instruments have to be harmonized in order to protect national environments." (Arntzen et al. 1992; 36). The implications for agricultural trade of a tax on N fertiliser in the EC was analysed and it was found that the tax had to be very high before there was a substantial impact on production and world agricultural commodity markets (Gunasekera et al., 1993).

Long term maintenance

In the EEC context with the charge levied at the top of the distribution pyramid (importation and production), the forming of the Common Market in 1992 has destroyed the concept of national boundaries and this may require that the charge is to be levied on users. Charges do have a long term dynamic effect since there is a constant financial incentive to make more efficient use of the product.

2.1.2 Potential for NZ

The NZ situation differs significantly from the European situation. Our farming systems are more extensive, and our product prices are not supported by subsidies (or as Gunasekera et al.(1993) write, the high level of producer support in EC agriculture has great impact on the effectiveness of fertiliser charges). On the one hand that means that levels of fertiliser application per hectare are quite different while on the other hand, the relationship between fertiliser costs and income will differ. Therefore it would be dangerous to translate the European experience directly to the NZ situation.

With regard to the NZ situation, fertilisers do affect the environment, directly through topdressing and indirectly through nutrient run-off with soil erosion and drainage. The main source of pollution is non-point source, and, even though fertilisers do contribute to environmental degradation, it is difficult to determine on a one to one basis a relationship between fertiliser applications and environmental damage. As in the European situation, not all fertiliser applied leads to environmental problems. It is over-fertilisation and the lack of surface cover, the presence of soil erosion potential, the farmers' management systems, and the presence or absence of nutrient stripping barriers that determine environmental degradation (especially of our waterways). To deal with this situation a systems approach is needed and a fertiliser tax on its own would achieve little.

Under the Resource Management Act regional authorities will have the responsibilities of setting environmental standards subject to national policy directives. In terms of fertilisers, this would require setting nutrient load standards for waterways. To be able to achieve such standards would require some description of desirable land use (i.e. in terms of some of the things mentioned above, such as cover crop, erosion control measures, nutrient stripping barriers, and stock management). Without such preventative management, fertiliser use will clearly contribute to environmental degradation, and in which case individual farmers could be taxed on the basis of fertiliser use. However, the definition and the monitoring of such a system would require much scientific input and high transactions costs. We feel that this would not be an efficient environmental management option.

Alternatively, a uniform tax could be levied on fertiliser, part of which could be returned to achieve some of those desired management actions as described above. The tax would, in the first place, make the users of fertilisers more aware of the environmental costs that fertiliser use can cause (and the expectation would be that in the NZ situation a reasonable price increase could have significant impact on use, judging from the volatility in fertiliser application levels with product price changes). Secondly, there would be a carrot in terms

of 'good' behaviour. Farmers who put in place measures to minimise the possible environmental consequences of fertiliser use, will get part or most of the charge refunded (either directly or in terms of grants to put into place and maintain such measures). Finally, there would be a clear application here of the polluter-pays principle.

The tax could be levied at the production and import level with farmers submitting an annual record of application levels indicating application rates and times. Monitoring of farming systems would be by regional authorities. The scheme could be made to be self funding.

The suggestions made above should be seen for what they are, suggestions. They are based to some extent on the overseas experience documented (including the Dutch effluent charge to be discussed later), but adapted to the NZ situation where extensive livestock farming systems create a very different situation. Further, although the suggestions would fit in well with the legislative framework of the Resource Management Act and institutions are already present to implement such a scheme, much research would be required to define the parameters for a 'desirable' system and to calculate the transactions costs involved. Ideas of a similar nature but within terms of a new property system, have been discussed by Bromley and Hodge, (1990).

Possible implications for trade would not to be researched.

In an age of greater accountability and transparency, the suggested approach would achieve both to a greater extent than current approaches.

2.2. A PESTICIDE CHARGE

This charge (like the fertiliser charge) is based on the polluter-pays principle, although in both situations a direct relationship between the charge level and the environmental damage does not exist. The presumption of use and damage is made.

The pesticide charge, in practice, has, just as the fertiliser charge, been implemented at the top of the distribution chain (see appendix 2 for more details). By charging the importers and producers, the number of participants is small and easy to monitor.

In terms of its effectiveness the charge has achieved little in terms of a change in the usage of pesticides. It mainly has raised money that can be used for

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other environmental purposes. The cost to the government has not been high, and the income effect on users has been small as long as the charge is less than 100% of the base price. As with the fertiliser charge, the restitution of the revenue is of great importance to the success of the charge.

Overall the charges have been good revenue raisers but have had little impact on the total usage of pesticides. To make any impacts on use levels, the increase in the charge level would have to be unacceptably high (from the users as well as government point of view) and would have severe effects on producer incomes.

Alternatives to a pesticide charge are regulation, differentiated registration fees, and education. Many of the problems caused by pesticide applications could be reduced if applicators followed label recommendations, observed withholding periods, avoided spray drift and disposed of containers and wastes in a proper way. The question of obsolete and unwanted chemicals can be dealt with through education and amnesty periods (as recently held in NZ) and through 'half deposit/refund' schemes (see section 2.5).

Evaluation in terms of the criteria set lead to conclusions nearly identical to those for the fertiliser charge and will not be repeated, except for one additional comment which refers to trade implications. From experience it is obvious that pesticide use (and residuals) can have devastating impacts on trade, and for a country so heavily dependent on trade this weighs much heavier as a consideration than it would in some of the European countries. For that reason pesticide control is important and using charges on their own would create a level of uncertainty that simply may not be acceptable in the NZ situation.

2.2.1 Potential for NZ

The possible application of a pesticide tax for N.Z. has been discussed in some detail in a report by MacIntyre et al. (1989). They propose a differentiated tax on active ingredients. Since nearly all ingredients are imported, a mechanism for the collection of the tax is already in place. The differentiation would be on the basis of the different risks of various uses and applications. Since there are no substitutes to active ingredients in the process of pesticide formulation the tax would not create anomalies and would provide a predictable source of revenue for administrators (MacIntyre et al. 1989: 115).

In light of the case studies discussed above, a pesticide tax for NZ would have as its major objective the raising of funds to finance monitoring, research, education and development. The impact on total pesticide use (depending on the level of the charge) would be small. Differentiation of the charge may lead

to a shift in use pattern away from the most damaging pesticides. Overall the charge would, like it did overseas, raise consciousness about more careful use of pesticides.

Again, in light of previous discussion, regulation should prohibit the most damaging pesticides (this cannot be left up to the vagaries of a charge system). In an ideal situation only levels of pesticides beyond acceptable application levels should be charged as would be applications that don't follow set application standards. As this would be impossible in reality, a flat rate on all pesticides (per kg of active ingredient) is the most likely approach. This, however, would impose an extra cost on users of pesticides and could affect the competitiveness of our exports. The importance of this varies between crops and users.

A differentiated charge on pesticides is something that should be further researched for the NZ situation. Although, as explained earlier with the fertiliser charge, there are significant differences between the NZ and European situation (subsidies being one of them), there are lessons that can be learned. Therefore the statement that "differential fees are a powerful policy instrument in terms of their ability to alter pesticide user behaviour at minimal cost while being socially equitable" (McIntyre et al. 1989), needs to be researched in terms of price elasticity of demand (will the behaviour really be affected?), and overall cost to producers, trade effects and transactions costs, before such a policy should be considered in NZ.

2.3 AN EFFLUENT CHARGE (Surface water pollution control in The Netherlands)

In The Netherlands a charge, specified in the Act on the Pollution of Surface Waters, is levied for collective purification (a fuller description of the charge and its implementation is provided in appendix 2). This charge, initially introduced as a financing tax, has the right structure to satisfy the requirements of a regulatory charge, and has therefore had a substantial regulative effect. The charge is imposed on the biochemical and chemical oxygen demand of the effluent and on the amount of heavy metals in the effluent. Firms pay the charge or invest in effluent treatment facilities (in-house) or put into place preventative measures to reduce the volume and composition of the effluent. The money raised by the charge is used to build and operate state treatment facilities.

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A typical example of the impact of the charge as quoted by Huppés (1988) is the following:

"In the early 1970s, the multinational bio-technology firm of Gist-Brocades made a profit of approximately \$10 million. The newly-introduced tax would have cost them roughly that amount. At first they thought of building their own purification plants, but as this would have cost the same amount of money, they turned their attention to research and development. They redesigned their product mix and production processes and started an investment programme of over \$100 million. Fifteen years later their emissions had been reduced by 92 percent. They now pay about \$1 million in emissions taxes, which compares well with the costs incurred in other countries because of regulative environmental policies." (Huppés, 1988; 44)

The charge is based on an extensive monitoring of all industrial sources. The charge was successful because:

- of the presence of a well functioning and accepted institution system (water boards);
- it was introduced equitably (every one was to pay);
- it was not sold as a tax but rather on the basis "we will do for you what you don't do yourself";
- there was widespread public and political agreement that something needed to be done about water quality;
- monitoring was straight forward;
- the relationship between taxed emissions and environmental harm was clear; and
- a strict adherence to the polluter-pays problem.

2.3.1 Overseas experience with an effluent charge: Evaluation

Although this evaluation is based on one application only, it is a successful one by several criteria and compares well with similar types of applications in Europe (this is briefly discussed in appendix 2).

Effectiveness

The evidence presented in the appendix clearly shows that the effluent charge scheme has been very effective. A decoupling of waste production from increasing output production has taken place and environmental quality has improved.

Efficiency

There is no research to determine if this is the most cost-effective approach to water pollution control. The charge system was placed on top of a regulatory system. No bureaucratic costs were saved. However, because of the up-front payments, the self-monitoring and the policing, the overall monitoring and enforcement costs could be lower. Further, the increased effectiveness of the whole scheme due to the economic incentive, has probably led to more pollution control per dollar invested.

Acceptability

Acceptability is very high. This is due to the seriousness of the environmental problem, and the clear indication that this was going to reduce the problem. The way the system was introduced with, in the early years, a return of revenues as subsidies for pollution control measures and the equitable way in which the charge was levied all contributed to overall acceptance.

Equity

The charge fully corresponds to the polluter-pays principle with all pollution control costs paid from the revenues. Further everyone is charged, with households only being charged a lump sum, while firms are charged on the basis of pollution volumes and content.

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While at the beginning of the programme charge revenues were reimbursed to the sector as subsidies, this is now no longer true and the charge is a pure tax to pay for environmental pollution control.

Long term/Maintenance

The scheme is well established. The charge will keep on increasing in line with environmental policy demands in The Netherlands. Hence, there will be a continuing incentive for firms to reduce wastes.

2.3.2 Potential for NZ

N.Z. has a similar set of water authorities (Regional Councils) that could implement such a charge. However, in N.Z. we do not have collective treatment facilities (although to some extent the sewage charge by regional sewage plants serves a similar role). The industrial situation is very different in NZ from the one in the Netherlands. Also, a great source of water pollution is non-point source.

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In N.Z. charges are levied on those who have water rights (to use or discharge). These charges are "payment by users ...on the basis of their contribution towards meeting the cost of managing, protecting and allocating the resource to which they seek and enjoy legal status and access" (Lex Rennes in an interview with David Young, 1991). This charge does not create the incentive that a proper effluent charge would. In contrast a charge based on effluent quantity and quality would force polluters more closely to consider their end-of-pipe output. The incentive would also be there to make adjustments, something that the fixed charge for the permit does not provide. Such a charge could also be applied to non-point source such as dairy farm effluent. Here the charge would be based on the 'quality' (BOD - biochemical oxygen demand, etc.) of the effluent emitted. The better the effluent treatment on the farm, the lower the biochemical oxygen demand (even though the same volume) and the lower the charge.

Implementing such a system would raise few problems. Under the Resource Management Act Regional Councils are required to set environmental parameters and enforce them. It is not clear whether the RMA will allow councils to impose charges which exceed administrative costs, but this could be clarified and changed, if necessary. The institutional structure is there to administer an effluent charge system. Regional Councils already monitor all polluters (regular farm visits to check effluent ponds and other systems, and industry). Hence the system would be no more expensive, but would at the same time bring in money to pay for the monitoring and enforcement. Such an approach would satisfy the polluter-pays principle.

The system would not be possible where for example most of the effluent in the water body should be eliminated (e.g. for cultural reasons under the Treaty of Waitangi). In such cases direct regulation will be needed to be certain of the final outcome.

In terms of relevance to NZ, the Dutch example shows that economic instruments, when set at the right level, and monitored and enforced carefully, can have a significant effect on the production of effluent by firms. The decoupling of output growth from effluent production growth has been the success story of this case. It is that regulatory impact that may be of great relevance also to NZ.

2.4 A CHARGE ON RUBBISH (DENMARK)

In Denmark, a country short of space for landfills and a country determined not to dump in the North Sea, a tax on rubbish (including building rubble) was

introduced in 1987. The Government is keen to encourage recycling and reuse. The charge started low (approx \$14/ton) but tripled in 1991 to over \$40/ton. The charge is paid on weight and is a fixed charge. The charge is reduced according to the amount of material removed from landfills or burning sites to be reused or reconstituted (eg. re-usable material and compost).

While the rubbish charge increased so did a tax on raw materials. The result of this has been that less material is being dumped and burned. More waste, especially heavy waste, is being re-used. The scheme has also led to households working together in areas to separate out their rubbish so as to minimise the charge.

With the increase in tax on raw materials, the charge will be effective in achieving the stated goal of recycling or re-using at least 50% of all waste by the year 2000. After initial opposition, it appears that the charge is now accepted. Its long term effectiveness looks assured and the charge provides a continuing incentive for people to reuse and recycle waste.

The institutional arrangements to implement the charge were simple and most of it is effected through the Tax Department. The annual cost is NZ\$47,000.

It is expected that the differentiation between burned and dumped rubbish will increase the effectiveness of the charge. The overall economic impact has, as yet, not been evaluated.

The success of the charge must be seen in the wider context of Danish policies with regard to waste. Without the charge on raw materials (implemented in 1990) the rubbish charge would not have been successful.

2.4.1 Overseas experience with a charge on rubbish: evaluation

Effectiveness

The amount delivered to burning or dumping places has decreased (between 1987-89) by 9.4% while the amount removed from these places (for reuse or use) has increased by 7% over this period. In 1990, the tariff increased significantly and the expectations are that these percentages will increase. Early indications are that the amount of rubbish delivered to dumping and burning places has decreased by one third between 1988 and 1991. The regulatory effect has especially been significant with regard to building rubble. The uniform tariff (by weight) on everything that is delivered for

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burning or dumping, has made the system simple to operate and little fraud has been discovered. A side effect is that many new uses of building rubble have been discovered (eg. noise barriers, and road building).

Efficiency

In terms of efficiency, the charge imposed has led to a better use of resources. In terms of allocative efficiency, since the charge is not based on the marginal cost of rubbish disposal and environmental costs, it is difficult to say anything about allocative efficiency. The scheme has also restored some balance in the relative costs of recycled versus new materials.

Equity

The scheme affects all according to the amount produced, hence user-pays. There are therefore incentives to minimise rubbish. The industries most affected are the iron and steel, cement, and glass and building materials. Several smaller dumping depots have had to close since the costs of scales was too high (this has improved the ability to monitor closely).

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The revenues go into the consolidated funds. However, the amount is accounted for and some of it goes to the Ministry for the Environment and is used for recycling schemes, the encouragement of clean technology and the control of eutrophication. There is no automatic requirement that all revenues are directed to environmental purposes. The percentage directed this way is determined anew every year by Parliament.

Acceptance

There is still some opposition, first of all by local councils (the owners of rubbish tips) who would like to see more of the revenues used for waste prevention purposes, and by others who are concerned about double taxation on products that have already a product charge (or tax) associated with them.

Legal/Instituti

No new institutions needed to be created. Inland Revenue collects the tax and exercises control over and monitors the scheme. The Ministry for the Environment helped to set up the scheme but now only plays a small role (collection of statistics). The scheme was started with a Law on Rubbish and Resources, which forms the legal basis for the scheme. Penalties for false declarations are high (2 year jail sentence), and Inland Revenue has at all times the right to enter premises the check the books and correspondence.

Long term maintenance

It is expected that the tariff will in the future differentiate between burnable and non-burnable rubbish. This will not be put into place until the regulations for emissions from burning places have been put into place. It is also expected that burning of rubbish will lead to the generation of heat for household use. Prices of resources are still low in Denmark, and this probably will mean that the Danish Government will not reach the target of 50% recycling of all waste by 2000.

2.4.2 Potential for NZ

With regard to N.Z., we have landfill charges, these however, do not reflect the true costs of environmental impacts and the future cost of finding new sites. Rubbish is also not calculated by weight, neither do we burn our waste. The relevance of this case is simply in seeing that the rubbish charge fits into a system of wider charges and regulation (such as a resource tax) and as such can be effective. Implementations would present no institutional or legal problems.

N.Z. has not of course the space pressure of many European countries and hence this example may not be as relevant. However, to quote from the draft NZ National Report to UNCED, " Landfill sites are becoming increasingly difficult to find, especially in the heavily populated areas such as the cities. In Auckland the selection of new sites is a particularly vexing problem. Neighbourhoods do not want landfill sites in their vicinity and not all sites have appropriate conditions for use as landfills. As increasing numbers of sites are moved to city boundaries, the costs of transporting waste are also increasing, In addition, as we grow more concerned about the treatment of toxic substances in the interest of human and environmental safety, further costs are added to waste disposal."

Therefore even though the costs of disposal are still low in most regions, and there is thus no incentive to reduce the amount of waste being sent to landfills, in the medium and longer term there will be call for measures to reduce wastes. Also in terms of the wider picture of sustainable resource use, a scheme that both limits the use of natural resources and encourages recycling and reuse should be of interest. The Danish scheme shows us feasible ways to do so.

2.5 DEPOSIT-REFUND SCHEMES

Two deposit refund schemes are discussed (Appendix 3). They are briefly summarised here and an overall evaluation is given for deposit-refund schemes in general.

The **Swedish system** of deposits of NZ\$0.15 per can has been very successful, with a return percentage of greater than 80 percent (there is hope to raise this to 90 percent). The Swedish system is implemented by a private firm and depends on the voluntary action of all involved. The Government has only fixed the level of return to be achieved (85% return and recycling by 1991 and 90% by 1993).

In this system the 'handling fee' for the producers and retailers is of great importance, because they have to accept not only their own cans but also cans of others.

The presence of steel cans poses a real problem as most of the cans are returned to crush 'vending' machines.

The Swedish system until recently has been self financing due to the fact that not all cans were returned. Therefore part of the deposit money has been used for handling fees, transport and administration costs. The 'break even point' appears to lie at a return rate of 75 percent. At higher return rates money has to be added to the system.

In Sweden few cans are imported. In countries where imports are large, a relatively high deposit would seriously affect the competitiveness in the market of local products.

While in several countries charges are placed on **batteries** (Norway and Sweden), in The Netherlands a deposit-refund scheme or a delivery premium is being considered. The Dutch research contrasted, in terms of costs, three systems. The first one is a deposit-refund system, the second one a 'half deposit-refund' system (a delivery premium system) and the third one an environmental box system. The third system (currently in operation) is taken as the benchmark. This system simply has boxes placed in shops and other strategic places where people can drop off rechargeable or disposal goods (among which are batteries) and those goods are deposited in those boxes which have separate divisions to already separate the goods.

The two proposed systems seem to have similar costs. Neither system will be self financing (although the deposit-refund scheme could be for some time while the return rate is low). The Dutch estimated that the price increase required,

in 1994, to make the system operational would have to be approx. 30 cents (of which 15 cent is the deposit) rising to 50 cents (of which the deposit being 30 cents) in the years to 2000. The systems are not easy to introduce and the deposit-refund system requires a complex financing system to balance the books between all those involved.

The schemes can be effective in raising the return rate of recyclable and other goods. For a \$0.15/battery deposit, a return rate of 75% is expected, for \$0.30/battery, 90-95%. Differentiated tariffs are being considered with rechargeable batteries having a lower rate than non-rechargeable. However, research has shown that this, in light of a low price elasticity of demand, is only effective at high deposit rates. The scheme cannot deal with built-in batteries, while the delivery premium scheme can. There are currently insufficient environmental grounds to put into place such high deposit rates.

2.5.1 Overseas experience with deposit-refund schemes: evaluation

The tables in the appendix show that many deposit-refund schemes are in place and that many others are being considered. Thus deposit-refund schemes hold attraction as approaches to environmental management. Schellberg and Atri (1991) in summing up their proposal for a tax/refund schemes for waste management describe most of the advantages of this economic approach to environmental management when they state,

"A properly designed tax/refund system would, by internalizing the costs of disposal, reduce the volume of waste, while discouraging the consumption and production of those products that generate waste with high disposal costs. It would also promote efficient recycling through cost-based market signalling among households and recyclers, with government acting only as a facilitator. The tax/refund system would replace existing less efficient lump-sum taxes and flat fees. Moreover, this scheme would allow the private sector to provide for most of the collection and disposal services, while leaving the government with more of a supervisory role. Finally, it would likely encourage innovation in waste disposal technology" (p. 15).

The experience of the two cases discussed leads to the following evaluation:

Effectiveness

Experience has shown that where the scheme has been applied it has, in some cases, been very effective. For aluminium cans in Sweden a return rate of 82.5% was experienced in 1991. See also table A3.3. However in

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other situations the approach has not been so successful. It appears that effectiveness is not purely a matter of the level of the cost of the deposit. On the whole, deposit-refunds appear to be more effective than voluntary systems.

Efficiency

In terms of being a least-cost approach to solve an environmental problem, little evidence is available. The Dutch research shows that the costs of a scheme to collect batteries is equivalent to that of other schemes. However, a full evaluation of the efficiency of a deposit-refund scheme would need to compare the net cost of recycling plus the value of household's sorting time and transport cost, with the cost of disposal in a landfill or incinerator³.

Two additional points should be made here:

1) in cases where monitoring is difficult, this may be the only type of scheme (or economic approach) feasible (for example, freons from automobile air conditioners; improper disposal of batteries or waste lubrication oil and other hazardous material by individuals; or littering, be it beer cans or abandoned cars (Bohm and Russell, 1985:429);

2) the system may be expensive in terms of administration. Opschoor and Vos (1989, 118), already mentioned this when they wrote.. "From a private point of view, deposit-refund systems for containers have now lost much of their economic efficiency, because production costs are low, while transportation and storage costs are high. Therefore, new deposit-refund systems are less acceptable, because firms and distributors expect administrative and logistic problems."

Finally in terms of efficiency, in terms of the polluter-pays-principle, in the cases studied, the relationship between environmental damage and the level of deposit is not explicitly taken into consideration hence an efficient allocation of the resource will not result. It may not be possible to reflect the environmental damage costs in the deposit as this would decrease the competitive position of the item relative to non-returnable (non returnable items without deposits).

³ Schellberg and Atri discuss this in some more detail in an essay on "A recycling model with Pigovian taxes: a market-based approach" (Schellberg and Atri, 1991, 13-14). In this essay they show how a deposit-refund scheme could work for solid wastes, and how an efficiency evaluation could be conducted.

Equity

The deposit-refund scheme is equitable in that the deposit and refund are balanced which would leave nominal income unaffected. However, if the scheme is very effective, then the deposit may have to be higher than the refund (to be able to finance the scheme). Alternatively, the government can subsidise the scheme, in which case the income distributional consequences are different.

Acceptability

The acceptability of these kinds of approaches is high. Deposit-refund schemes are relatively attractive. They appear fair schemes (no-one is made worse off except by choice). Whereas charges are seen as "penalties on bad behaviour", deposit-refunds have an element of "rewarding good behaviour". The self-funded characteristic (at least up to a certain extent) makes them also politically acceptable. Another reason for political acceptability is that the schemes could nearly be run completely by the industry itself with no or little government input (the Comalco scheme in NZ).

Competitiveness

If a country imports many cans, a deposit-refund scheme on local cans alone could seriously affect the competitive position of the local industry.

Trade Implications

Deposit refund systems for returnable containers may lead to a segmentation of markets. Imports may be discouraged if initial deposit or taxation has a high rate compared to the total value of the goods marketed or contained. Setting up a costly local distribution system will then be required. Non returnable containers are an important condition for the competitiveness of imports. The same problem would hold for non-returnable containers by foreign producers (Arntzen et al., 1992; 30).

Bohm and Russell (1985) summarise the advantages of deposit/refund schemes over alternative instruments:

- 1) they also work when the act of environmental degradation is not directly observable or when the potential injurers are numerous and/or mobile;
- 2) they simplify the proof of compliance in some cases;
- 3) they specify the (maximum) economic consequences of noncompliance;
- 4) actual or expected damages are covered by actual payments, at least in principle;
- 5) in certain applications they may stimulate people other than those directly

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- involved to reduce the effects on the environment (such as scavengers in the case of refunds on littered items);
- 6) they are politically acceptable as they leave nominal income unaffected. (Bohm and Russell, 1985; p. 429)

The schemes, however, have a beguiling attractiveness and they clearly encourage environmentally friendly behaviour, but there are several hidden costs which need to be carefully researched (as is currently done in several OECD countries).

2.5.2 Potential for NZ

In NZ we have already a can collection and recycling scheme which works reasonably well (this is a "half deposit-refund scheme"). We also have deposit refund systems for milk bottles and beer bottles. The institutional structure is there and also the acceptance of society. A deposit-refund scheme would only make the scheme work more effectively by increasing the percentage returned because of the incentive of the refund. However, to see if this really would be desirable requires a comparison between the current incentive provided by can crushing machines. Further, a deposit-refund scheme will increase the administrative cost of the scheme. This may not be very serious.

If the aim is to recycle the maximum amount of aluminium cans, then a deposit-refund scheme should be considered as a complement to the current scheme as operated by industry. What holds for cans also can be applied to bottles (plastic and glass) and others (such as toxic wastes, MacCauley and Palmer, 1992, discuss the possibility of a deposit-refund scheme for chlorinated solvent wastes).

2.6 TRANSFERABLE RIGHTS

In some areas of environmental management New Zealand stands out as being a leader in the use of transferable rights. Other countries, especially the U.S., have a long history of using transferable rights. Characteristics of the five case studies presented in Appendix 4 are summarised in Table 2. They cover a range of resource types, externalities, treaty obligations and levels of market activity. In each case, at the time of implementing the tradeable rights system, the resource was depleted/scarc and the level of economic rent low.

Table 2: Characteristics of case studies

CASE STUDY	RESOURCE	EXTERNALITY	TREATIES	MARKET TRADING
Fishery	national renewable	intertemporal	international Waitangi	frequent
Radio spectrum	national renewable	contemporaneous	international Waitangi	reasonably frequent
Ozone	global stock	intertemporal	international	not frequent
Water	national renewable stock	contemporaneous intertemporal	no	reasonably frequent
Development rights	local stock	contemporaneous intertemporal	no	not frequent

Table 3 summarises some of the general outcomes associated with the use of transferable rights. Where it was necessary to reduce harvest rates - e.g. fishery - to sustainable levels this has been achieved. In other cases - e.g. radio spectrum, water resources, ozone - transferable rights have replaced bureaucratically determined allocation mechanisms. In the majority of cases, economic performance improved with the use of transferable rights. All markets are constrained, to varying degrees, by law and public policy, and most policies are not self-funding.

Table 3: Summary of outcomes

CASE STUDY	DEPLETION RATE	CONSTRAINTS ON MARKET	ECONOMIC PERFORMANCE	SELF FUNDING
Fishery	reduced	yes uncertainty	improving	no
Radio spectrum	n.a.	yes def. of rights	improving	unknown
Ozone	reduced	minimal	unknown	unknown
Water	no change	yes uncertainty third-party market definition	improving	no
Development rights	n.a.	yes market definition	unknown	no

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Designing and implementing tradeable rights as an instrument of environmental policy must focus on the inherent characteristics of the resource, law, custom and the incentives/expectations created in the market place. The practical lessons, arising out of these case studies, for New Zealand environmental policy follow.

- (a) Allocative efficiency has improved as a result of market activity generating better information on the demand for environmental assets. By pricing the right to use a resource there is a built-in incentive to account for opportunity costs and seek out innovations that economise on resource use.
- (b) It is clear that markets perform best when there are explicit statements of the objective toward which use and management are directed. Prior to implementation particular attention has to be given to satisfying the Crown's treaty obligations. When implementing tradeable rights the Crown has not performed well in respect of its obligations under the Treaty of Waitangi. Uncertainty at this level will reduce efficiency gains.
- (c) The case studies point to a need to recognise, when setting up the system of transferable rights, where appropriate, the stochastic nature of resource supply. This is particularly evident where biological resources are involved, or where resource supply is part of a natural cycle. The market mechanism facilitates a great deal of flexibility with respect to demand. Policy advisors should look to tailor the definition of rights to the situation. If government wishes to achieve a clearly defined objective e.g. reduction in ozone depleting substances, then it makes little sense to define the right as a percentage of a stochastic target i.e. as in the fishery.
- (d) In all cases government agencies had a role to play and, therefore, an opportunity to affect the market. There is no general rule regarding the (optimal) functions of environmental management agencies. A major criticism of all literature reporting the operation of tradeable rights is the failure to make the agency endogenous to the framework of evaluation. Most policies fail to put incentive compatible mechanisms in place, incentives that guide agency behaviour toward efficient and effective outcomes. Trends toward contracting in the public sector create an opportunity for this to occur.
- (e) The case studies suggest that policy will not "get it right" the first time. This is not sufficient to dismiss tradeable rights, the same criticism holds for other instruments such as polluter pays taxes. Rather, it suggests that the framework for administering the policy must include monitoring and

evaluation, remain sufficiently flexible to change, and not to create unreasonable expectations in the market.

- (f) There should be a continuing concern about whether the instrument (tradeable rights and other economic instruments) captures the broad range of values associated with the use and preservation of environmental assets. The water resource, fisheries and radio spectrum case studies clearly show the importance of incorporating values beyond those directly associated with use.
- (g) New Zealand relies heavily on trade for its economic growth. Its stand on global issues should be carefully researched before unilateral action. Although the ozone policy is to be applauded on moral grounds the economic impact of the policy on trade has not been studied. Transferable rights offer a great deal of flexibility to producers adjusting to the dynamics of relative prices in world markets.
- (h) As a brief of overseas experience (not dealt with in this report), the "grandfathering" approach has raised serious equity considerations. Spatial aspects with regard to tradability also raises problems and there is a trade-off between market size (which becomes small when there are serious spatial concerns) and the number of traders in the market.

Monitoring and maintenance costs are similar to regulatory systems, and both systems are highly dependent for their success on monitoring and enforcement. The tradable rights system has an advantage in terms of dynamic efficiency. With economic growth the scarcity of environmental assimilative capacity will be automatically reflected in increasing prices for rights. Overall the experience with trading has not been very large as the freedom to trade has been very much restricted by regulations.

2.6.1 Potential for NZ

It seems almost obvious to say "yes" to the potential for using economic instruments in NZ. Evidence from their operation in NZ and elsewhere points to favourable outcomes (efficiency gains). This may be so especially with regard to transferable water rights. As pointed out the current water permit system simply aims at recovering costs and is not a direct attempt to make the user and polluter pay.

The Resource Management Act places a duty on administrators to consider economic instruments. However, with regard to transferable water rights,

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although transfers of water permits are permitted within catchment areas, out-of-basin water transfers are not allowed neither are the transfer of discharge permits. The existing legislation places bounds on what can and cannot be done and there does appear to be a built-in bias for the status quo, ie. regulation. It is not clear from the Act either if water can be sold.

The potential for transferable water rights needs to be considered further. Much can be learned from the overseas experience. The points about thin markets, third party effects and Treaty issues are all important but not insurmountable. It is clear, however, that from the initial enthusiasm to implement transferable water rights, only restrictive types of water markets have developed. The realisation that markets do understate the public values attached to the water resources and that transfers can have serious effects on communities and third parties has led to the development of limits on water markets. The 'no damage principles' is important in this respect. Some of these issues are currently being researched in New Zealand and work going on the Nelson/Malborough region into the feasibility of transferability of water should help in seeing to what extent overseas examples can be followed here. The longer experience of the Australians with water market is illuminating.

Other potential opportunities for NZ have been raised in the literature. For example, Reeve and Kaine (1991) recommend the establishment of a market in fertiliser inputs for nutrient-overloaded waterways. A set of traded permits in phosphate discharges could be devised which did not exceed the absorptive capacity of the waterway and which could be adjusted to the total quantity of water available. The level of phosphate fertiliser use in the catchment would have a constant relationship to the level of water-borne discharge with allowance for different periods of flow (as explained in Johnson, 1992).

Much research is currently under way to look at the possibility of transferable water rights. The most significant impediment may not be the instrument as such but the institutional design.

2.7 SUBSIDIES, GRANTS, COMPLIANCE SCHEMES, OFFSETS, ETC.

In appendix 5 a short overview is given of financial incentives (subsidies in some cases, performance incentives in others) used to achieve a variety of environmental purposes. Examples are discussed from several countries dealing mainly with subsidies for conservation purposes. The US compliance scheme is discussed and so are offsets, non-compliance fees and performance bonds. All of these instruments are covered very briefly.

From a purely financial incentive point of view, the instruments have not always

been effective. Where they have brought about change, this has been often only partly due to the incentive and partly due to a variety of other reasons. In terms of efficiency, effectiveness, and the polluter-pays principle, none of these instruments score well. However, the reality of the situation is that they are still very popular with politicians, and that in some situations they may be the only feasible tool or instrument to bring about change. In nearly all cases, the magnitude of the subsidy or the fee needs to be substantial to bring about change.

In NZ we have plenty of experience with subsidies and the impacts of them. Still our distaste for subsidies should not lead us to throwing out the baby with the bath water. There may still be opportunities where this economic approach can be helpful and provide the a means to bring about environmentally desirable changes.

CHAPTER 3

3.0 SUMMARY AND CONCLUSIONS

What the case studies have shown is that:

1. Economic approaches are applied to only a limited extent in most OECD countries, with the notable exception of the Scandinavian countries where they are used extensively.
2. Revenue gathering has been the predominant motivation in the choice of the economic approach, however, the regulatory effect has, in some cases, by no means been negligible.
3. Official interest in the use of economic approaches is increasing everywhere.
4. In new proposals, the regulatory effect now predominates, i.e. the economic approaches are now introduced with the clear purpose of bringing about environmentally desirable changes and less emphasis is placed on the revenue gathering effect.
5. In all situations the economic approaches are complementary to a regulatory system. It is hard to imagine economic approaches without a regulatory system. What is emerging appears to be a *de facto* hybrid system with governments using command and control regulation to set long term performance standards and targets (i.e. setting the wider framework), while looking to market instruments to find the most cost-effective pathways. Or quoting a recent OECD report on environmental taxes "Environmental taxes will not provide the unique solution to environmental problems and will usually have to be used in combination with direct regulation of environmental damaging activities. But they may contribute to a more efficient solution to national and international environmental problems." (Barde and Owens, 1993)
6. Economic approaches score well, relatively speaking, in terms of efficiency and can be very effective. The level of effectiveness is a function of the way the approach has been implemented, the particular environmental problem, and the level of the financial incentive, i.e. effectiveness is very country and problem specific.

Summary and Conclusions

7. The acceptability of economic approaches has been a function of how, in the case of taxes and charges, the tax revenues have been used and on direct linkages being present between the tax or charge and the environmental objective.
8. While for efficiency and equity purposes charge or tax policies should be implemented in a way that respects the basic principles underlying modern taxation systems (Barde and Owens, 1993), most of the case studies discussed have not achieved this. Four issues have become very important in the application of charge or tax policies: the earmarking of tax revenues, fiscal neutrality, revenue neutrality and fairness. The case studies discussed nearly all had the tax revenues earmarked to build up popular support. The current trend is away from earmarking.
9. In terms of revenue neutrality, there is much talk in OECD countries about an 'ecotax', a tax on pollution which can replace taxes on labour and capital. In Sweden this has gone part of the way with the major fiscal reform of 1990-91 in which income and corporate taxes were reduced (respectively from 22.5 to 19.5% and from 2.8 to 1.9% of GDP) and new eco-taxes introduced on emissions of CO₂, SO₂ and NO_x (Barde and Owens, 1993).
10. In terms of farmers or equity in most of the cases discussed the charges or taxes were not high enough to have any significant distributive consequences. However, environmental taxes high enough to have a real impact on the environment will have distributive consequences by pushing up the cost of fuel, agricultural products and other goods and services. These taxes can be regressive and therefore unfair. Redistributive measures can be undertaken by Governments, separately from the tax, to offset the impacts. At the current levels of pollution taxes and charges, this has not been an issue.
11. In terms of polluter-pays-principle, in very few cases is the level of the incentive (charge) related to the environmental damage caused by the product or activity.
12. Within the EEC much work is also going on with regard to harmonisation of taxation approaches in the environmental area, this in light of the relative competitiveness of industry and agriculture. Harmonisation is also now constantly talked about in connection with trade liberalisation.

With regard to NZ we can conclude that:

1. The overseas experience was helpful in understanding the potential of economic approaches. At the same time, however, the findings of the case studies need to be reinterpreted for the specific NZ conditions, which include among others a more extensive agriculture, an unsubsidised agriculture, fewer major industrial concentrations, the Treaty of Waitangi, low population density, and different existing laws and institutions, etc.
2. Each example of an economic approach studied raised potential for application in NZ. In commenting on potential applications no original analyses were conducted. Most of the suggestions made are simply based on the authors' experiences and some secondary sources.
3. With regard to charges, there is the potential for a fertiliser charge to be placed in a modified scheme in which 'good' behaviour is basically not charged and only environmentally unsound behaviour is. A similar scheme for a pesticide charge would be more difficult to envisage, but the possible application of a differentiated charge (applied to all) should be further investigated. Similarly with regard to effluent charges, current discharge permits do not give proper price signals to the users of resources. More needs to be done to decouple waste production from output production, and only by indicating this through price signals, leaving the options open to the polluters, can this be achieved most efficiently. There is still an outstanding question of how much of this would be possible under the current institutional framework as set by the Resource Management Act.
4. Changing the relative prices of inputs or charging effluent, can, in some cases, affect international competitiveness. More research needs to be conducted with regard to such issues. At the same time, there is a trade-off here in terms of international competitiveness for our products and international competitiveness in attracting tourists to a clean environment.
5. With regard to deposit-refund schemes, there are also many possibilities. One of the disadvantages NZ has is the lack of great concentrations of people. Deposit-refund schemes require that something can be done with the goods handed back. Recycling in NZ suffers from transportation costs, and finding markets for recycled products. A deposit-refund scheme cannot simply be considered on its own but must be evaluated in the wider context of recycling and market opportunities, as well as the costs of operating such schemes. Still overseas examples have shown that such schemes can be successful and are of similar costs to voluntary schemes.

Summary and Conclusions

6. With regard to transferable permits, NZ has to some extent led the way in using this instrument. There are however other areas of potential application and these are in the water rights area and in pollution control. The research conducted showed clearly what has been achieved overseas in this area and what some of the pitfalls and difficulties have been. Also here we see institutional design as a major impediment to implementation of transferable permits.
7. There is little to conclude with regard to the mixed bag of subsidies, non-compliance fees, performance bonds and offsets. There is scope for all of them to be applied in environmental management in NZ. Most of them are used already and local authorities have experience with them. There are, however, serious implications in terms of the polluter-pays principle and equity.
8. As a final conclusion, legislation currently exists in NZ that would enable the use of some economic instruments at local/regional level (although as pointed out the same legislation also places constraints on the actual implementation of them). This report clearly identifies the parameters that should be considered when contemplating application of economic approaches to specific situations. Of necessity this has only been an overview of some actual applications and potentials for NZ. Any serious attempt to use economic approaches in environmental management needs more research to discover the impacts of the use of such approaches in line with the criteria used in this report. Much can be learned from overseas experience but the NZ situation is different and with regard to some parameters, unique. For that reason we would applaud more in-depth research into economic approaches (some of which is going on). But, irrespective of all the research that can be conducted, the most important issue is ultimately going to be the creation of incentives for administrators to use economic approaches that will achieve the purpose of the Act with a reasonable degree of efficiency. This is a central issue and is discussed in places in this report. To resolve the issue will require education that will bring greater understanding of the approaches and will help remove some of the bias that still exists in favour of the status quo in terms of environmental management, i.e. regulation.

**APPENDIX 1 OVERVIEW OF THE APPLICATION OF ECONOMIC
INSTRUMENTS IN OECD COUNTRIES**

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1.0 OVERVIEW

The economic approaches (and instruments) discussed in the introduction have been applied in a variety of situations and countries. In this appendix an overview is given of the extent of the use of these instruments, their particular applications and the objectives pursued (all the tables in this appendix were taken from the following source, Milieuprogramma 1991).

The categories chosen for presentation are those given by Opschoor and Vos(1989): emission charges; user charges; product charges; administrative charges; tax differentiation; deposit/refunds; and transferable emission rights. The applications are all taken from OECD countries.

In the table below "X" indicates that one or more of these instruments are present in the country mentioned. "(X)" indicates that the instrument is currently being considered for introduction.

Table A1.1 Environmental charges in OECD countries

Country	Air	Water	Waste	Noise	Use Charge	Prod Charge	Admin Charge	Tax diff
Australia	-	X	X	-	X	-	X	-
Belgium	(X)	X	X	-	X	-	X	X+(X)
Canada	-	-	-	-	X	X	-	X
Denmark	(X)	X	X	-	X	X+(X)	X+(X)	X+(X)
Germany	-	X	(X)	X	X	X+(X)	X	X
Finland	(X)	X+(X)	-	(X)	X	X+(X)	X	X
France	-	X	(X)	(X)	X	X+(X)	X+(X)	X+(X)
Greece	-	(X)	-	-	-	-	-	X
Ireland	-	-	-	-	-	-	-	X
Italy	(X)	X	-	(X)	X	X+(X)	-	-
Japan	X	-	-	-	-	X	-	X
New Zealand	-	-	-	-	X	-	-	X
Norway	-	-	-	-	X	X	X	X
Austria	-	(X)	X	-	X	X+(X)	(X)	X
Portugal	X	-	-	-	X	-	-	X
Spain	-	X	-	-	X	X	-	-
Turkey	-	-	X	-	-	-	-	-
U.K	-	X	-	X	X	-	X+(X)	X
U.S.A.	-	-	-	(X)	X	X	X	-
Sweden	X+(X)	-	X	(X)	X	X+(X)	X	X+(X)
Switzerland	-	-	-	X	X	X+(X)	X	X

In the following tables, charges by type are documented. Proposed new instruments are indicated by brackets such as (), (Sweden) or (X). The abbreviations in the action column stand for:

F - financing purpose mainly
R - regulating purpose

F/R - financing purpose but with regulatory impacts as side effects

F+R - financing and regulatory objective

- or O - unclear or unknown

Appendix 1

Table A1.2 Emission charges in the OECD

Country	Media	Objective	Parties affected	Effect
Australia	Water	-	Industry	F
Belgium ()	Waste Water Land Air	Volume Effl. Emiss. Animal nos -	Waste processors Firms Lvst Producers -	R F/R F -
Denmark ()	Waste Water Air	Volume Effl.Emiss SO ₂	Waste Collection Firms -	R F/R -
Germany ()	Water Noise Waste	Effl.Emiss Aeroplanes Chemic.waste	Firms Air traffic Waste recyclers	R F F
Finland ()	Water Land Water Air Noise	Effl.Emiss Nuclear waste P,N,COD,AO _x SO ₂ ,NO _x -	Firms Nucl.Power Stns Firms Firms -	F/R F F/R R -
France () () ()	Air Water Noise Waste	SO _x ,NO _x ,H ₂ S,HCL Effl. Emiss - -	Industry Households/Firms Air Traffic Households/Firms	F F F F
Greece	Water	Effl.Emiss	-	-
Italy () () ()	Water Land Air Noise	Effl.Emiss Animal nos SO ₂ ,NO _x Air traffic	Firms Lvst Producers Firms	F/R - F -
Japan	Air Noise	SO _x -	Firms -	F -
Austria ()	Waste Waste Water	Solid Waste Chemic.waste Effl.Emiss	Households Firms -	F F O
Portugal	Air	SO ₂ ,NO _x ,VOS	Firms	O
Spain	Water Sea water	Effl.Emiss Effl.Emiss	- -	O O
Turkey	Waste	-	-	-
U.K.	Noise Water	- Effl.Emiss	Air Traffic Firms	O F/R
(USA)	Noise	-	Air Traffic	-
Sweden (Sweden) () ()	Waste Air Air Air Water Air Noise Air	Volume SO ₂ NO _x NO _x and C ₂ H ₄ Cl-emission SO _x ,NO _x Landing rights Landing rights Landing rights	- Industry Industry Air Traffic Paper Industry Ships Air traffic Air traffic Air traffic	F R R R R - - - F

Table A1.3 User charges in OECD countries

Country	Media	Object	Group Affected	Effect
Australia	Waste	Fixed tariff	HHs/Firms	F
Belgium	Water	Fixed tariff	HHs/Firms	F
Canada	Water Waste	Water use -	HHs/Firms Hhs	F F
Denmark	Waste Water Waste	Waste volume Fixed tariff Chem. wastes	HHs/Firms HHs Waste producers	F F F
Germany	Water	Effl.Emiss	HHs/Firms	F
Finland	Water Waste Waste	Solid Waste volume Chem.wastes	HHs/Firms HHs/Firms Firms	F F F
France	Water Waste	Water use Construction	HHs/Firms HHs/Firms	F F
Italy	Water Waste	- Construction	HHs HHs/Firms	F F
New Zealand	Water	-	HHs/Firms	F
Norway	Water Waste	- -	HHs/Firms HHs/Firms	F F
Austria	Waste	-	-	F
Portugal	Water	-	-	
Spain	Water Water Waste	- Water use -	- - -	F F
U.K.	Water Waste Waste	Water use Fixed tariff Waste volume	HHs HHs Firms	F F F/R
U.S.A.	Waste Water Water	Chem.wastes Fixed tariff Effl.emissions	Waste Firms HHs Firms	F F F/R
Sweden	Water Water Waste	Fixed tariff water use -	HHs Firms HHs/Firms	F F/R F
Switzerland	Water Waste	- -	HHs/Firms HHs/Firms	F F

Appendix 1

Table A1.4 Product charges in OECD countries

Country	Product	Effect
Denmark ( ( (	Beer, Wine and beverage containers Sand and gravel Disposable cutlery Packages small chemical wastes CKCs and halogens Light Bulbs Fertiliser CO ₂ charge on coal, oil, gas and electricity Imported cars which do not satisfy emission standards	F/R F F+R F R O - F/R R
Germany	Lubricating oil CO ₂ charge on fossil fuels	F F
Finland ( ( (	Fossil fuels (CO ₂ , NO _x , C _x H _y) Fertiliser (P) Lubrication oil Unrefined oil and oil products One-way beverage containers Sand and gravel; CFCs and halogens Pesticides	F+R R F F F+R F+R R
France ( (	Lubrication oil Car tires, PVC, construction materials, sand and grave, fertiliser, NiCd-batteries	F -
Italy ( ( ( (	Lubrication oil Plastic bags plastic polymers CFCs and halogen CO ₂	F R F+R R F
Norway ( (	Mineral oil (incl. CO ₂ charge) Lubrication oil electricity Batteries with Cd and Hg Fertiliser Pesticides one-way beverage containers;CFCs	F+RF F F+R F+R F+R F+R
Austria ( (	Fertiliser (N,P,K) One-way beverage containers, car tires fridges, freezers, fossil fuels	F/R O
Spain	Lubrication oil	F
U.S.A	Petroleum, basic chemicals, CFCs and halogens	F R

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Sweden	Mineral oil Ni-Cd and Hg batteries Non-recyclable beverage containers Fertiliser Pesticides CO ₂ charge on fossil fuels Wood preservatives Choline based solvents CFCs CO ₂ charge on internal air traffic	F F/R O F+R F+R R F R F -
Switzerland	VOS, fuels with S content > .1% fertiliser Pesticides, Cars	O

Table A1.5 Administrative charges in OECD countries

Country	Object
Australia	Waste Effluent emissions
Belgium	Waste recyclers
Denmark ()	Registration pesticides Imported car that do not satisfy emission standards
Germany	Permits
Finland	Registration and control of pesticides Car bodies Protection of fisheries Chemicals Regulations of water levels Water protection
France ()	Permits Registration pesticides
Norway	Permits
(Austria)	(Road transport)
U.K.	Dumping of waste Dumping in sea Permits
Sweden	Permits Registration pesticides registration chemicals New car types (in connection with emission standards)

Table A1.6. Tax differentiation in OECD countries

Country	Object
Belgium ()	Leaded/lead-free petrol Cars with/without catalytic converter
Denmark	Leaded/leaf free petrol Cars with/without cat. Pesticides
Germany	Lead/lead-free petrol Car tax according to emission level
Finland	Lead/lead-free petrol Cars with/without cat.
France	Lead/lead-free petrol Cars with/without cat.
Greece	Car tax according to level of emissions
Ireland	lead/lead-free petrol
Japan	Cars and electric vehicles, and car driven on alternative fuels and which satisfy emissions standards
New Zealand	Lead/lead-free petrol
Norway	Motor tax for light and efficient cars Lead/lead-free petrol Austria's lead/unleaded petrol Car with /without cat. Car tax according to emissions
Portugal	Lead/unleaded petrol
U.K.	Lead/unleaded petrol
Sweden	Lead/unleaded petrol Car tax according to emissions Car tax according to the amount of petrol used
Switzerland	Lead /unleaded petrol

Table A1.7 Deposit/refunds in OECD countries

Country	Object
Belgium	Beer and beverage containers
Denmark ()	Beer, wine and beverage containers Cd and Hg batteries, car batteries
Germany ()	Beer and beverage containers Packaging for washing and cleaning materials paint packaging
Finland ()	Packaging for beer, wine, distilled and other drinks Recyclable household wastes
France	Beer and beverage containers
(Yugoslavia)	Packaging
Norway () ()	Packing for beer, wine, distilled and other drinks Car wrecks Snowmobiles PET return bottles
Austria ()	Refillable plastic drink containers TL-tubes
Portugal ()	Glass bottles Metal cans
U.S.A.	Beer and beverage containers
Sweden ()	Beer, wine, spirits and beverage containers Car wrecks Aluminium cans PET bottles, car tires, car batteries, other batteries
Switzerland	Glass bottles

Table A1.8. Transferable emission rights in OECD countries

Country	Object
U.S.A.	Water Air Pollution Lead in Petrol CFCs Acid Rain (power stations)

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1.0 CHARGE ON ARTIFICIAL FERTILISER

1.1 Introduction

Non-point source pollution is a major contributor to environmental problems in OECD countries. Agricultural inputs, in several countries, are a significant source of environmental problems. Standards are used in all countries to control specific problems, especially those associated with the use of pesticides and fertilisers. There is a considerable divergence in input and pricing policies (quotas, charges, levies and taxes) as mechanisms to reduce the off-site impact of these inputs. Several countries use charges on inputs to simultaneously reduce agricultural surpluses and improve the environment. There is, however, a general consensus that farmers should be encouraged to avoid the over-use of inputs.

In this case study the experience of using fertiliser charges is documented for a series of OECD countries. In Table A2.1 a summary is given of the charges levied and the purpose for which they are levied.

Table A2.1 Fertiliser charges as implemented in some OECD countries

COUNTRY	PRODUCT	OBJECTIVE	INTRODUCED	PAYERS	INCOME	RAT E
Sweden	N & P	F + R	1984 changed in 1988	Importers and Producers	Env'l research; conservation instruments; monitoring; etc.	10% of retail price
Norway	N & P	F + R	1988	Importers and Producers	NOK 160 mill/yr 70% back to Agriculture Seen as fiscally neutral tax red'ns elsewhere	11%
Finland	N & P	F + R	Started as a tax in 1970, but in 1990 changed to regulatory instrument.	Importers and Producers	650 mill FIM 1992 90% back to Agr. (export subsidies, env'l works)	40% retail price
The Netherlands	P	F	1986, a manure policy. Part of a package. Tax purely to finance research.	Farmers	Tax is very small; (Production - 125) per ha	
Denmark	N proposed	R	To be enacted if N red'n below 20% by 1990 By 1990 enactment defeated in Parliament			

1.2 Individual Country Approaches

1.2.1 Sweden

The tax is part of a total policy package consisting of information, education, export-subsidies, development of marginal lands etc.

An Agricultural Board manages the tax. Every two months those charged inform the Board of the amount of fertiliser (by type) produced or imported. At the end of the year a total list is presented and the tax is based on that amount. If the tax is not paid in time, a 6% penalty is added, this is seen as an important incentive for payment. Total administration costs is approx. SEK 600,000 per year.

The economic impacts are not easy to determine, but they appear to be minimal. The sale of fertiliser has been constant during the period 1982-1987 but has, in the last three years, declined by 10-15%. Part of this reduction is attributed to farmers being better informed regarding nutrient requirements by plants and optimal application rates. It is possible, however, that the tax has played a role in bringing this better understanding about, but many other factors have also contributed to the decline, eg product prices and EC policies.

Some studies were conducted before the measures were introduced, but these had little influence on the way the tax was introduced. Farmers are supposed to have been informed about the purpose of the tax and regular communication is supposed to take place (little of this has happened).

There are no evaluative studies of the tax.

1.2.2 Norway

The tax was introduced in 1988. 70% of the tax is used for specific environmental purposes (mainly in the agricultural sector), the remaining 30% goes to general purposes.

Ninety percent of the fertiliser market is supplied by Norsk Hydro (local factory). Norsk Hydro pays the tax directly the Ministry of Finance, the importers pay the Agricultural Inspection Service. No operational problems have occurred. The single producer and the 5 importers are assessed on the basis of predicted turn-over for the next four months. At the end of the year the books are balanced between predicted turn-over and actual turn-over.

The tax is reasonably well accepted, but any further increases will be strongly resisted. The current acceptance of the tax has been helped because the tax

is fiscally neutral. The income leads to lower taxes elsewhere and the tax is not seen to be used simply as a source of income for the government.

The impact, according to the Ministry for the Environment, is real. However, the Ministry of Agriculture is of the opinion that the price elasticity for artificial fertiliser is overestimated. P use has been declining since 1980 and no accelerated decline has taken place since 1988. The use of N has not changed significantly.

The current system is simple and efficient (both from the point of view of the Government and those who have to pay). However, the regulatory effect is judged not to be enough. There are proposals in place to raise the tax to 300% of the base price. These proposals are also in connection with the North Sea Declaration in which Norway accepts to achieve a 50% reduction in N-emissions to the sea. To achieve that target a 20% reduction in fertiliser use is required. Farmer organisations are working on an alternative proposal that is based on a tax on fertiliser use above a certain threshold level (i.e. an acceptable level of fertiliser use per ha). Norsk Hydro is of the opinion that the current charge together with more information and extension will be able to achieve the above target. To that end Hydro has started a major campaign to help farmers with fertiliser use plans for their farms.

1.2.3 Finland

Already in the late 1970s a charge was placed on artificial fertiliser. This charge was not motivated by environmental considerations. Since 1990, however, an additional tax, based on P, was introduced to act as a regulatory device to reduce P use for environmental purposes. In 1992, the two charges were combined and extended to N.

The money is collected by the Customs office from the producers and the importers on the basis of regular reports regarding production and importation. No operational problems have been experienced and no fraud has been observed. Non-agricultural uses of fertiliser are exempted from the charge.

The current purpose is clearly regulatory. A large part of the income is channelled back into the agricultural sector and only a small part goes to general government expenses. The use of the charge monies is still hotly debated by Government and the farmer organisations. This discussion is closely connected to using some of the money for export subsidies.

With regard to impact, there has been a clear reduction in the use of P, but it is not clear how much of that is due to the tax, since other policies regarding

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agriculture had been implemented at the same time. Also more information has been provided to farmers about over-fertilisation. No evaluation has been conducted to show the impact on N use.

Economic consequences appear to be very small (although no evaluative research has been done). Because a major part of the tax is returned to the agricultural sector, the impact has appeared to be only small.

Although farmer were initially against the tax, it now has been fully accepted since most of the money comes back in any case.

1.2.4 Denmark

An input tax was first brought forward politically in 1986 (8% of the retail price of N). The proposed tax had a purely fiscal purpose.

When presenting the Aquatic Environment Action Programme in 1987, the Minister of the Environment "foresaw" that the implementation of the programme would lead to a reduction in the use of nitrogen by about one third between 1987 and 1990. To bind the Government to decisive action the "Green Majority" in Parliament passed a resolution demanding that a tax on nitrogen should be imposed in case agriculture failed to meet the required reduction in N use. The tax rates suggested would increase the price of N by about 150 per cent in the worst case.

When in late 1989 it became clear that the programme had failed to achieve the targeted reduction in nitrogen use, the Social Democrats demanded the immediate imposition of a nitrogen tax in accordance with Parliament Resolution of 1987. This proposal was opposed by the (minority) Government and it did not gain sufficient parliamentary support (Dubgaard, 1991).

1.2.5 The Netherlands

A charge was placed on surplus P. It was acknowledged that N in manure also caused environmental problems but the volatile nature of this element was thought to cause unsurmountable problems for the design of efficient regulation. It was believed that by regulating the use of manure, the N application would also be restricted.

Basically the charge was part of a package to deal with the manure surplus. The levy was based on the P in excess manure.

The programme failed for a variety of reasons, some of the major ones being; that the levy was not extended to artificial fertilisers; the lack of dealing with the

nitrogen content in manure; the lack of support from the different groups (farmers, politicians, and environmentalists), and the lack of a direct linkage between manure application and nutrients in the water ways (Meister, 1991, Dietz, 1992).

1.2.6 Postscript

It appears that both in Denmark (1993) and The Netherlands (1994) a mineral accounting system and a tax on the surplus of minerals (N and P initially) will be introduced (calculated as mineral applications over and above a set of environmental standards for P and N). Research in both countries has shown that mineral accounting on a firm (farm) level is feasible and that it also serves as an extension type tool. The information provides the farmer with information regarding the mineral cycles on his farm and should increase efficiency in use. To what extent the accounting loss will correspond to the actual loss is currently being researched. One of the difficulties will be fraudulent behaviour. Further in the Netherlands the Ministry is still studying the introduction of transferable manure production rights.

2.0 CHARGE ON PESTICIDES

2.1 Sweden (DHV, 1991)

In 1984 and 1985 a programme was put together in Sweden to reduce the risk of health and environmental effects due to pesticides. The programme consisted of:

1. substitution of pesticides with other (less health and environmental damaging) means;
2. regulations to reduce use;
3. education;
4. stricter monitoring of food and water.

The aim was to achieve a 50 percent reduction in use by 1990 (cf mean use in 1981-85).

Use of pesticides in Sweden is influenced by administrative and product charges. The administrative charge consists of a one-off component and an annual registration charge. The product charge is more directly associated with use and was introduced in 1986. It also consists of two components, an environmental charge and a surplus charge. The environmental charge is put on the price and raises the price by approximately 10%. The funds so obtained are used for research and education but some of it goes into general

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government funds as well. The surplus charge is a fixed amount based on a standard dose per hectare. A standard dose is understood to mean, the dose that is needed to treat one hectare of crop. This dose is determined (for different crops) by the producer and approved by the Swedish Agricultural Board. This charge led to a price increase (on average) of 30-40%. The funds so obtained are used to subsidise the export of grains and oil-seeds.

Currently the total product charge is approximately 40 percent of the price. The main purpose was the financing of the above mentioned activities. However, a side objective was to achieve a reduction in use. The results to-date are given in table A2.2.

Table A2.2 Use of Pesticides and Growth Regulators in Swedish agriculture and horticulture expressed in 10³ kg active ingredient.

Years	Fungicides	Herbicides	Insecticides	Seed treatment	Growth regulators	Total
1981-85	599	3536	151	161	82	4529
1986	869	4207	160	199	243	5678
1987	470	1781	63	119	84	2519
1988	662	2029	112	101	75	2982
1989	445	1871	50	120	35	2521
1990	608	1685	38	97	49	2450

The announcement of the surplus charge (per 1 July 1986) led many farmers to stockpile pesticides, which is the reason for the large numbers in 1986.

According to the National Agr. Board, the goal of use reduction has been achieved. A major reduction has taken place in the use of herbicides. It has been estimated that approx 30-50 percent of the reduction can be attributed to use of lower dosage rates of existing pesticides. Also the introduction of new pesticides with a lower dose rate/ha had an influence and this is estimated to have contributed 25-30 percent of the total reduction. The use of growth regulators has reduced because most applications are no longer allowed. Further reasons are a greater awareness by users of environmental problems, a better calibration of sprayers and the set-aside programme.

The overall conclusion of much of the research on pesticide charges is that the charges (at their current level) have had little impact on total pesticide use. The

adjustment to lower dosage would, seeing the economic advantage it brought to growers, have occurred even without the rise in input prices.

A further objective is to reduce use by another 50 percent by 1995. From research completed (e.g. Petterson et al., 1989), achievement of this goal, using charges only, would require a charge of 850 Swedish kronen per treated hectare. This level implies a price increase of 200 percent.

Attention is currently focused on using a differential charge with the goal of not only reducing total use, but also encouraging substitution to less damaging means.

Further research in Germany, Denmark and The Netherlands discovered that the price elasticity of pesticides lies between -0.30 and -0.50 .

2.2 Pesticide Regulation in Denmark

Dubgaard (1991) investigated the use of a pesticide tax for Denmark. Although not an actual application, the finding of the research may be of importance.

Some research, using linear programming models, investigated a 60% and a 120% increase in the price of pesticides. The estimated total effect of levying a tax would be a reduction in pesticide use of 20-25% for the 60% increase and 40-45% for the 120% increase. The estimated response is equivalent to a price elasticity of demand for pesticides of -0.3 . Econometric studies indicated that the price elasticity of demand may actually be greater than -0.3 .

For a 120% price increase it was estimated that land rents would decline by 15% on good soils, and considerably more on many poorer soils. Cropping patterns were expected to change significantly.

The income transfer effect (from agriculture to society) of taxing pesticides could be neutralised by reimbursing the tax revenue. Reimbursement would not affect the incentives to decrease pesticide intensity, provided tax proceeds were reimbursed in the form of lump-sum payments (lump-sum payments have no substitution effect since price relations are unaffected).

A fairly simple scheme, in administrative terms, would be to reimburse the tax revenue at a flat rate per hectare. Due to the uneven distribution of the tax-burden between crops, this would result in a redistribution of income from farmers specialising in crops like winter cereals and sugar beet to farmers specialising in roughage and dairy production.

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From a social point of view the taxation solution would probably be the most efficient way of reducing pesticide application leaving the adjustment process to market forces.

2.2.1 Conclusion for Denmark

To realise the political intention of substantially reducing the intensity of pesticides in Danish agriculture it would most likely be necessary to apply economic instruments in the form of an input tax on pesticides. However, for the time being it seems unlikely that the Danish Parliament will introduce measures which would significantly increase production costs in agriculture - probably for fear that the competitive position of the nation's agricultural industry would deteriorate.

From a theoretical point of view it could be argued that national environmental policies should be designed to correct market failure arising from externalities regardless of the structural impacts. However, politicians do care about competitiveness and employment in agriculture. Consequently, at the national level, approaches to the control of the adverse environmental effects of agricultural production will often be 'second-best' solutions - primarily subsidies to environmentally favourable practices. This is a violation of the Polluter Pays Principle. For the EC as a whole it is a rather inefficient way of dealing with agricultural pollution.

2.2.2 Postscript for Denmark

Currently proposals are again being put forward to introduce farm chemical levies. The expected income is Dkr 1.6 billion. It is believed that this will be ploughed back into environmentally friendly agricultural production. However, in Denmark there is opposition to the introduction of such a proposal, unless the regulation is adopted for all EC countries. It will mean that pig and crop growers will be indirectly subsidising cattle farmers. The effect of the proposal are documented in the table A2.3.

**Table A2.3 Effect on Danish farm incomes of chemical levies on agricultural sprays (Dkr/ha)
(Proposal: Dkr200 per standard dose of chemical spray)**

	Arable	Dairy	Pigs
Income change with levy	-510	-295	-460
Change if levy returned to environmentally friendly farming	-130	+ 85	- 80

Source: Danish Agricultural Economic Institute.
Reported in *Agra Europe*, No 1518, November 20,
1992:N/4

3.0 CHARGE ON THE DUMPING AND BURNING OF RUBBISH (DENMARK)

In 1987 the Danish Government introduced a law that placed a charge on rubbish (dumped or burned) to stimulate recycling and re-use. The Danish goal is that by the year 2000, 50% of all rubbish will be recycled (at the moment 40% is; 30% is burned and 30% is dumped). The charge has also a revenue raising function. The money is used for recycling, for the development of clean technology and the cleaning up of eutrophication. Yearly revenue, approx. NZ\$600 million.

Some rubbish is exempted (clean soil, untreated wood, chalk, straw etc.). The charge is by weight irrespective of composition. From 1987 until 1989 the charge was NZ\$13.00/ton. Since 1 Jan 1990 it has been \$43/ton. The tariff is not based on the marginal cost of avoided dumping cost. The charge has to be paid every three months. The charge is paid by firms involved with collecting, dumping and burning of rubbish. They all are to be registered with the Inland Revenue department and have to have an approved set of scales. They are required to keep accounts on the amounts in and out. The tax department collects the money and monitors.

There are penalties for late payment and penalties for failure to record appropriate amounts. The tax department has permission at all time to enter premises to check books, correspondence etc, and if necessary they will be supported by the police. Fraudulent behaviour carries a jail penalty.

There was and still is a lot of opposition to the rubbish charge, both by the firms and the Councils (who are often the owners of rubbish tips). The Councils' reason for the opposition is that it is felt that more of the revenue should be spend on waste prevention. The firms are concerned about double charging, when products (e.g. beverage containers which are already lumbered with a product charge) are charged again.

During the years 1987/89 (tariff \$13.00) total rubbish delivered to landfills and burning places reduced by 9.4% from 4.7 to 4.26 million tons. In the same period the total amount taken away from those places (in the form of compost, building materials etc.) increased by 7%.

Since 1990, the tariff has increased and now also building rubble is charged. Because the tariff base is weight, the tariff has had a large impact on building rubble. This has had the result that today more and more building rubble is used as a fill material for road building, and noise barrier.

Because the cost is passed on to the consumers, it has become profitable for areas in cities to organise waste separation systems. It has been calculated that such a system (run by a manager) in an area with 1200 households can save \$167,000 in rubbish charges per year. Other ways to deal with the charge are being experimented with.

There was concern that the high charges would lead to illegal dumping. Until now this has not been the case.

The economic impact on industry varies between industry. The hardest hit are iron and steel, cement, glass and building material industries. Further, several small rubbish depots had to close because the required scales were too expensive. This of course made monitoring easier.

The implementation costs have been \$1.4 million/year.

The problem that could have arisen as to what is or is not rubbish, has been solved by calling nearly everything rubbish that is brought to a dumping place or a burning installation. Little fraud has been detected.

It is expected that soon there will be a differentiated tariff between dumped and burned rubbish (\$43 for burned material and \$76 for dumped material).

3.1 Conclusions

In general it appears that the Danish waste charge has been implemented reasonably smoothly. Little fraud has been detected and there has been no increase in illegal dumping. The effect of the charge has been a significant increase in the recycling of building wastes. The reason for this has been the uniform charge per ton of waste.

The expected differentiation between tariffs for burned and dumped materials will lead to a further reduction in the amount of rubbish dumped. Burning of rubbish (with the heat used for heating of local houses and industry) will become more attractive. The burning of rubbish in Denmark is not controversial. The country has 38 modern burning installations, all of which are equipped with smoke stack scrubbers.

4.0 EFFLUENT CHARGES. TAXING WATER POLLUTION IN THE NETHERLANDS

4.1 Introduction

In The Netherlands by 1970, the year the Pollution Surface Water Act went into effect, industry and private households were producing roughly 45 millions of population equivalents (p.e.'s) of oxygen-consuming organic pollution¹. As a result, overall water quality in the country had, in plain terms, become rotten - both figuratively and literally! Fish, marine animals, plant and algae died, causing offensive odours. In areas with potato flour and strawboard industries, bio-gas production from rotting waters was so intense that residents became ill. Some water-filled ditches actually could be set afire. Public opinion became supportive of more aggressive and more costly regulation (Bressers, 1988)

The Act that was enacted in 1970 called for construction of public waste water treatment facilities, the upgrading and extension of sewage systems, and mandatory permits to govern discharges from industrial sources, which would be compelled to install in-plant treatment systems and/or link up to public sewer and treatment facilities. The public installations were to be financed via emissions charges imposed on effluent (measured in terms of p.e.'s) discharged into the sewer system or into surface waters. In contrast to pollution from industrial sites, discharges from individual households and small firms would not be individually monitored and charged: these would pay a flat fee.

4.2 The Water Management Structure

In The Netherlands, a distinction is made between 'state water surfaces' (the large rivers and other large water surfaces) and 'regional water surfaces'. While the management responsibility of the latter lies with 31 water authorities (water boards), the Ministry of Public Works and Transportation manages the former.

The reason for locating the responsibility for water purification with the water boards was that the water boards already existed, in many cases for centuries, with main responsibilities for dikes and quantitative management. Over the course of time, water boards, together with municipalities, have started in many cases to build and manage sewage and waste water treatment plants. It was therefore logical, for historical reasons, to give the function of collective water treatment to the water boards. Responsibility for the sewerage network, however, remains with the municipalities (Janssen, 1991).

¹ A population equivalent (p.e.) is the amount of organic pollution equivalent to the average organic pollution caused by one person in a normal household.

The day to day administration, therefore, of the issuing of licences for discharge and the setting of the effluent charges is the responsibility of water boards. Every one who discharges in sewers or surface waters needs a licence. This licensing authority is delegated to them by the Provinces who are under the Ministry of Transport and Public Works and its operational wing the Rijkswaterstaat. Although the structure is a little bit more complicated than the simple explanation above, the explanation will do for the purposes of this discussion. What is noteworthy, however, is the highly decentralised nature of the Dutch system for taxation negotiation of permits, enforcement, and construction of treatment plants. While some would argue that local administrators would give in to the technical and economic arguments of corporate polluters and get consequently tied up in endless permit negotiations, applications for exceptions, or disputes about correct monitoring of discharges, the Dutch experience has disproved this. Why this has been so will be discussed in more detail.

Although decentralised, some important tasks were performed at a more centralised level. The Rijkswaterstaat earlier had established an institute (the RIZA) for water quality issues. RIZA coordinated the formulation of the Act and today, its administration. Together with a central body of the water boards (the "Unie van Waterschappen"), the Rijkswaterstaat trained local water board officials for their new tasks, established uniform methods of water quality measurement, and developed general policies for issuing industrial permits and for the pace of construction of treatment plants.

The primary implementation for water quality is, however, with the water boards² who are responsible to the Provinces, who approve the plans put forward by the water boards on a yearly basis. The Provinces in turn are bound by a five year programme for water management made up by the Ministry of Public Works and Transportation. Criteria for water quality are drawn from, among others, the EEC directives and the international so-called black and grey list of polluting substances. On the basis of this central government policy document, Provinces make their own water management plans, which form the basis for the plans of the water boards.

² Water boards have a council which is elected by the polluters. The provincial authorities determine how many representatives of each group (industry, farmers, households) will be on the council. The composition of the council varies by water authority, depending on the local importance of the groups.

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Water board officials, as a first step toward issuance of permits, visit all industrial firms in their region, offering assistance in formulating reduction schedules. Licences are very detailed, carefully laying down how much of the specified polluting substances an enterprise is allowed to discharge. The criteria for the licence are BAT (best available technique, irrespective of costs) for substances on the 'black list' and BPM (best practical means, affordable) for substances on the 'grey list'. For large polluters, it is quite normal that the licence requires that the enterprises have their own waste water treatment installation.

4.3 The Effluent Charge

Every year each water board develops a plan for the coming year in terms of the work to be completed. The objective of the water charge is to raise money to finance this plan. The current policy's aim is to reduce water pollution levels to 50 percent of the 1985 level. The charge therefore was intended to be a financing charge. However, as will be discussed later, at the inception of the charge it was made clear that there was intended to be a regulatory side effect, by the charge providing a financial incentive to polluters to reduce pollution. This side effect has indeed occurred.

The polluter-pays-principle was the reason for financing the costs of water purification from a charge rather than from the general government budget. The charge is a payment for services rendered.

4.3.1 Calculation of the charge

The charge is levied on a 'pollution (or population) equivalent' (p.e.) and based on the following formula:

$$\text{p.e.} = [(\text{mg/l COD} + 4.75\text{mg/l N}) \times Y\text{m}^3]/13$$

Where:

p.e. = Population (or pollution) equivalent

COD = chemical oxygen demand

N = Keldall Nitrogen

136 = the average amount of waste water (24 hours)
by one inhabitant

Y = the total m³ of waste water discharged per year

This number is divided by 365 to get to population equivalents (p.e.'s). Added to these are the p.e.'s of other oxygen demanding residuals such as:

1. For arsenic, chromium, copper, lead, nickel, silver, and zinc, every kilogram discharged is equal to one p.e. (the grey list)
2. For mercury, and cadmium every 100 gramme is equal to one p.e. (the black list)

Currently the treatment plants are also taking out P (phosphate) and plans are being made to adjust the formula to include P also.

The charge is levied on all households (3 p.e.'s, but application can be made to have this reduced to 1 p.e. for single people), enterprises and municipal treatment plants. For very small enterprises the p.e.'s are also set at 3. For farms, 3 p.e.'s are charged for the home and 3 p.e.'s for the farm (but if holding tanks for waste have been installed on the farm, the 3 p.e.'s for the farm are removed). For smaller industries, the calculations are done on the basis of a table of waste water discharge coefficients. For example:

Industry	Unit to which the coefficient relates	Coefficient
Mushroom farm	100 m ² area	0.4
Fruit canning factory	1000kgs pears/strawberry	0.63
	1000kgs apples	0.63
Auto mechanic shop	1 m ³ used water	0.031
Perfume industry	100 man-days	3.6
Poultry abattoir	1000kgs slaughter weight	0.18
etc.		

For larger industries (p.e.'s >1000) the number of p.e.'s are actually measured.

The charge per p.e. unit is calculated by dividing the total cost of the water quality management plan by the total number of p.e.'s generated in the Waterboard's area. (Note that the level of the charge does not relate to the estimated damage due to water pollution).

As an example, the total cost of water quality management for the Rijnland water board for 1991 was budgeted at 94 million guilders (\$1 New Zealand = approx 1.10 guilders). This is made up of:

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- 94% investment, running cost of treatment plants and pumping stations;
- 4% monitoring, control and laboratory costs
- 2% administration and enforcement of licences costs.

The total number of p.e., estimated for the area, was 1,300,000. The charge was therefore set at 72 guilders per p.e.. This represents an increase of 9.1% over 1990. The reasons given for this increase were the need to put into place dephosphatising measures, to deal with increases in house numbers and to increase the capacities of 16 water treatment plants. For the Rijnland water board, the following are the historical and predicted charges:

Year	Charge per P.E.
1972	9.40
1980	36.00
1985	57.00
1988	62.00
1990	66.00
1991	72.00
1993(p)	80.00

4.3.2 Collection mechanism

A charge notice is sent to all charged subjects. The mechanism varies between water board regions. Sometimes the charge for households is, for practical purposes, included in the invoice of the household's energy bill.

Some differences exist between the various water authorities with respect to households in rented houses; sometimes the house owner pays, sometimes the renter and sometimes the costs are shared. Such differences are, however, reflected in the house rents.

If the industrial polluter can prove that the discharges are less than the calculated or estimated number of p.e.'s, the polluter can object to the amount of the charge and the case will be investigated. This means that the polluter requests a monitoring of the enterprise which will be done for a two week period during the year. There are in The Netherlands a wide variety of private agencies (registered by the water board) which perform many of these monitoring tasks.

The charge collection efficiency is high, the system costs approx. 1 to 4% of the total charge revenue, this includes monitoring costs (Janssen, 1990).

Water boards themselves also pay a charge to the Rijkswaterstaat if they discharge into waters under the auspices of the State. The revenue from the State Waters charge is reserved for subsidies for treatment or cleaner-technology measures in industry (hence some of these charge payments are returned to the water boards as subsidies, however this is expected to finish in the near future). Under this scheme investment in mechanical treatment is eligible for up to 60% subsidy, whereas biological treatment is eligible for up to 90% subsidy. Additionally, investments in cleaner process technology may receive as much as a 50% subsidy.

4.4 Monitoring and Enforcement

The amount of effluent discharged by firms needs to be regularly monitored according to a schedule given by the water boards to the firms. The water board sets the frequency of monitoring and also specifies how, and where it needs to be done. The samples need to be analysed following a specific set of rules which are published by the Dutch Normalisation Institute. Records need to be sent to the water boards and the measurements of the waste water content is not to vary from the licence by more than 5 percent. The water boards have officers in the field who regularly control the monitoring and enforce it.

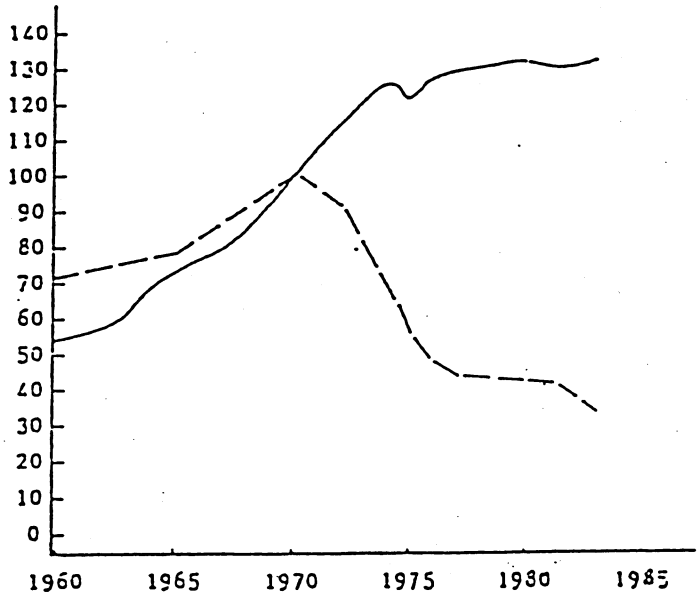
4.5 The Overall Impact of the Water Pollution Charge System

To judge the success of the Dutch charge scheme: three possible criteria could be suggested:

- a) what has been the treatment effect, i.e. what has the reduction been in the total pollution load through public treatment facilities?;
- b) what has been the structural effect, i.e. what has been the reduction in pollution load from industry?;
- c) what has been the overall acceptability of the programme?

Taking the first two together, Fig A2.1 shows what has happened between 1970 and 1985 (and considered together with the figures in Table A2.4, it is obvious that the trends have continued).

Figure A2.1 Index figures on the amount of industrial production (solid line) and oxygen-consuming industrial pollution in industrial water (dotted line)



Source: (Bressers, 1988; p.503)

What the figure shows is that the steeply rising pollution of the 1960s has been halted and even reversed. Between 1970 and 1985, waste water pollutants emitted by industrial sources, measured in terms of oxygen demand, decreased by more than 70 percent. The remaining 30 percent is partially cleaned by diversion to public treatment plants. The graph shows a clear decoupling of pollution from industrial growth. The volume of production has not declined, not even in the period of recession, 1975-80. It is clear therefore that pollution per unit of production has decreased more sharply than total pollution, and that the level of pollution reduction attained leads to an underestimation of the effectiveness of the water quality policy.

To look at this in slightly more detail, Table A2.4 shows the total amount of waste water produced before treatment (Janssen, 1991).

Table A2.4 Discharges on surface water (million p.e.)

	1969	1975	1980	1985	1990
Households	12.5	13.3	14.3	14.5	14.8
Industry	33.0	19.7	13.7	11.3	8.8
Total	45.5	33.0	28.0	25.8	23.6

Source: Janssen, 1991, p.19

While the total load of organic polluted waste water has been reduced from 48 to 23 million p.e., the reduction has been accomplished solely by the Dutch industry. The response of the Dutch industry in the first years was larger than anticipated which resulted in an overcapacity of the collective water purification plants. Moreover, as the number of total p.e. decreased, the charge had to be raised so as to yield the same total revenue.

If we combine the above figures with the effect of public treatment of waste water, we get the effect on the environment as shown in Table A2.5.

Table A2.5 Pollution levels over time in million p.e. (heavy metals and P not included)

	1969	1975	1980	1985	1990
Total emissions	45.5	33.3	28.0	25.8	23.6
Reduction in collective purification plants	5.5	8.7	12.6	14.5	17.4
Remaining pollution	40.0	24.3	15.4	11.3	6.2

Source: Janssen, 1991, p.20

As can be seen from Table A2.5, the total effect from both structural changes in industry and improved public treatment has been very substantial.

4.5.1 The effect of the charge on the reduction in total pollution

To what extent can these results be attributed to the effluent tax? The tax wasn't the only enforcement procedure present, there were also the mandatory permit requirement of best available and practical technology, and the ongoing economic pressure to modernize facilities. However the decentralised

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implementation of the programme offered a unique opportunity for statistical analysis used by Bressers (1988) and Shuurman (1988).

Because the different water boards undertook different levels of clean-up with different costs, there were differences in the level of the tax among the various administrative units. Their enforcement methods, however, were similar, because of collectively developed strategic approaches and central training of personnel involved in implementation. Bressers (1988) was able to test how differences in clean-up effectiveness among Water Board areas correlated with different tax levels. The association was very strong ($r=.86$). It improved (to $r=.92$) when Bressers left out of the analysis two special cases where the commercial fortunes of single companies, for reasons unrelated to the Act, determined the course of emission levels.

Bressers tested many other possible explanations for the reduction in pollution. Some of these were:

- a. Permits. The permits, issued for both large discharges into the sewerage system and discharges directly into surface water, had only a weak (not significant) negative relationship with relative abatement success in the areas involved.
- b. Inspection and courts. Here a weighted number of discharge inspectors and infringements was used as an explanatory variable. Again only a weak negative correlation was found.
- c. Technology, advice and informal negotiations. Companies had been contacted by water board personnel to inform them about developing new, clean production techniques or abatement technologies, to give advice on existing techniques or to prepare, jointly, so-called abatement plans. Some positive correlation was found, but since only very few water boards had drawn up any abatement plans, this correlation was based on only a small number of observation.

None of the above mentioned alternative variables could explain the strong match between emission reduction and tax level. Schuurman (1988) came to the similar conclusion that the taxes have been the main force in emission reduction by firms, with some differentiation based on sectoral background and local circumstances.

Interviews with water board personnel confirmed the results obtained by Bressers (1988) in that they considered the effluent charge to have made by far the greatest contribution to the abatement of pollution of industrial waste water with organic oxygen-consuming substances. However it should also be noted

that the impression of water board personnel was that their non-antagonistic attitude to firms, combined with their technical knowledge had a lot to do with the results obtained. It was a consultative approach (i.e. informal negotiation) backed up with policy instruments which had an influence strong enough to make abatement seem worthwhile to the companies to begin with, and that achieved ready participation.

4.6 Why was the Charge System Successful and Effective?

According to Huppés and Kagan (1989) some of the answers to the above question can be found in the following:

- a. The Dutch had in place the water boards, which were respected local agencies with a long tradition of effective water basin management. These water boards were neither traditional public utilities, nor private entities; they were in between, but are becoming more institutionalised.
- b. The way the charges were formally justified - not as a device to produce the socially optimal amount of pollution, as economic analysts would put it, but as an equitable way of financing the construction of sewers and treatment facilities. If the polluter-pays-principle has to be introduced (and this was generally accepted by all) then all should pay, i.e. households and all enterprise.
- c. The package, implied by the Act, was sold as a financing one (basically we will do for you what you don't do yourself), and the amount of the charge was based on revenues required. Also subsidies were available if you wanted to do things yourself. These subsidies are not in conflict with the p.p.p as the subsidies are paid from the revenues of the charge. However, the authors of the Act, also both expected and intended that the charges would have a regulatory effect. This is clear from the high standards set for purification by public plants, which required high costs and hence high fees. Also the fact that discharges not cleaned publicly but emitted directly would be taxed, underlined the regulatory intention.
- e. Implementation was practical in that households and small enterprises were charged on the basis of a fixed charge of 3 p.e. or one based on a table of enterprise representative pollution units. This allowed the water boards to concentrate on the main polluters, the larger industries.
- f. Widespread political and public agreement existed on the need for cleaner water.

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- g. Opposition from households to the 3 p.e. flat fee, was dealt with by introducing a reduced fee for one person households.
- h. Another potential source of opposition, the farmers, did not materialise. Farmers constitute a very potent political constituency. Although agricultural run-off, laden with fertiliser and manure, can be a significant source of water pollution, farmer were exempted from the permit system and effluent charge (except in the case of major point emissions, such as pumping manure directly into ditches or canals). Farmers were charged the flat fee of 3 p.e. This development reflects the important role that the farmer-dominated water boards played in planning the law and the crucial role they are playing in its implementation. Although plans are under way to improve this aspect, and to bring phosphates, pesticides and other toxic materials in the calculations, this is not guaranteed to succeed everywhere due to the large political power of the agricultural lobby.
- i. Monitoring was relatively straightforward.
- j. The empirical relationship between taxed emissions or inputs, on the one hand, and environmental harm, on the other, was relatively clear and simple. Although COD is not a perfect indicator, there is a more or less linear relationship between increases in oxygen demand and degradation of water quality. For that reason, taxing oxygen demand not only facilitates monitoring, but is intellectually acceptable to industry, giving regulated entities guidance as to the economics of investment in control technologies and other emissions reducing processes.
- k. The water boards were local institutions with a representation of industry, state and households on the board. Industry does not have a majority. The overall regulatory framework is a 'responsive regulatory mix' which is in contrast to the more traditional bureaucratic regulatory strategy (Sou Anderson, 1991). This seems to have contributed much to the acceptability of the scheme and the effectiveness of the water boards.

4.7 Lessons from the Dutch Case Study

The Dutch experience confirms, that green taxes do not operate in a vacuum, but that their implementation under certain institutional structures and in combination with regulation may bring out and enhance the dynamics claimed for economic instruments.

This is so for many other applications of economic instruments and applies for example also to the tradable air pollution rights systems in the U.S.A. In other European countries, similar combined systems of regulations plus charges have

been adopted (since the 1970's), e.g. France, Germany, Italy and Denmark (more will be said about these later on).

The Dutch success with the water effluent charge, however, is only relative, as The Netherlands is still coping with major surface water-pollution problems concerning manure and nutrients. In the manure case, charges have also been applied, but the lack of success of this programme has some telling lessons for the applications of economic instruments. Before looking at some of those lessons, what in summary are some of the key elements for the success of the Dutch programme? They are:

1. An effluent charge combined with a permit system which took into account variations in clean-up costs and environmental effects.
2. A strict adherence to the polluter-pays-principle. All expenditures were paid from the charges. No general tax revenues were used to fund the building of public treatment facilities (such as in the US system).
3. The smallness of the country and its corporatist political structure which made it easier to approach pollution control as a technical (rather than a political) problem.
4. The existence of institutions like the water boards, which were respected local agencies with a long tradition of effective water basin management.
5. The 'equity' with which it appeared the charge was applied to households, public treatment facilities and industries, and the exemption of farmers from permit requirements and effluent charges. The apparent equal treatment dampened any implication of being "anti-business", while the exemption of farmers assured the cooperation of the chief implementing organisations, the water boards.

The significance of some of these reasons becomes even more apparent when similar pollution tax systems are studied (in the Netherlands or in other countries) which have not achieved the same success as the Dutch system.

For example in The Netherlands, a pollution tax was introduced to deal with the manure problem. This is a relatively new programme but general consensus (and initial indication) is that it will not be successful. The reasons given by Huppés and Kagan, 1989, are divided in two sets, the first one political, the second one technical.

Appendix 2

The reasons relating to politics and administration are:

1. its legitimacy is weakened by unequal application: the taxes on polluting inputs - animals and fodder - bear heavily on highly intensive pig and poultry farms, virtually exempting most dairy farmers;
2. the taxes have no direct and clearly visible relation to emissions;
3. the direct regulations on manure use, by exempting artificial fertiliser, another main source of water pollution, seem to impose unequal and unjustifiable burdens on only some polluting enterprises or activities;
4. the implementation is by the central government's Department of Agriculture. Already when farmers, the agency's primary constituency, protested about the reporting and record keeping requirements, the Department bent to their wishes, undercutting the enforceability of the environmental regulations. Conversely, in administering the industrial pollution regulations, the water boards bore direct financial responsibility for operating waste water cleaning facilities and for their own polluting emissions to waters under responsibility of other agencies.

The technical reasons are:

1. emissions from industrial installations are easily monitored, because the number of points are relatively small and the techniques well developed (including automatic metering). In contrast, environmentally harmful emissions from manure and chemical fertilisers spread on farms are virtually impossible to monitor and hence to tax. This required redirection of regulation to the control of potentially polluting inputs (amount of manure spread, fodder bought, and animals per hectare). Especially the manure factor was hard to monitor, and this led to inaccurate monitoring, and also to questions of discrimination, all of which weakened the legitimacy of the programme.
2. the empirical relationship between taxed inputs and environmental harm was not clear and simple. There is no clear and simple relationship between the spreading of manure and environmental harm, except in extreme cases, such as direct dumping into surface waters. The problem is aggravated when the tax is pushed one step further back in the production process and is levied not on the spreading of manure but on activities correlated with manure production, that is, the purchase of fodder and the number of animals in intensive animal husbandry.

4.7.1 Comparison with other systems

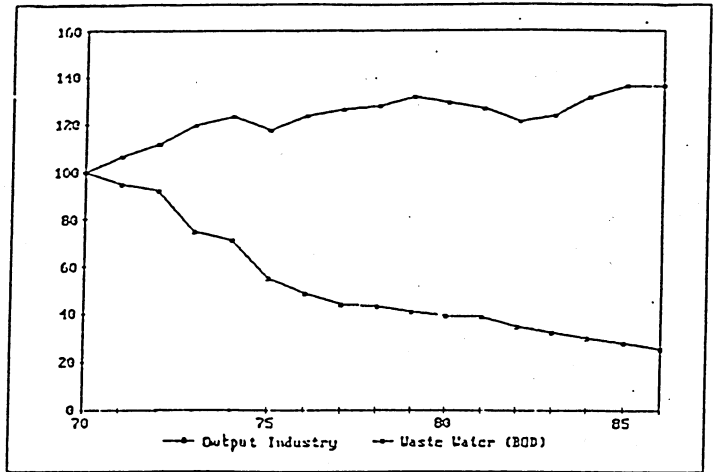
Comparison of the Dutch water pollution programme with other programmes again helps to amplify some of the reasons given above for the success of the Dutch programme. A comparison between the Dutch and Danish water pollution programmes (both of which are very similar) showed that while the Dutch were successful in de-coupling organic pollution and production, the Danes failed completely in this regard (Sou Anderson, 1991), see Figures A2.2 and A2.3³.

The major reasons given for this failure by Anderson are the fact that the Environmental Protection Agency, which controlled the programme from the national level, was controlled by industry, that subsidies were given beyond the charges recovered and that discharges directly to 'state' water bodies, were never subject to a charge. Overall, Sou Anderson attributes the difference between the two systems to the differences in the regulatory structure in the two countries. While the Dutch one is a responsive structure, the Danish one was a bureaucratic one, leading to conflicts, appeals, and long delays (Sou Anderson, 1991).

An analysis applied to U.S. pollution control policies, led to similar conclusions (Howe, 1990).

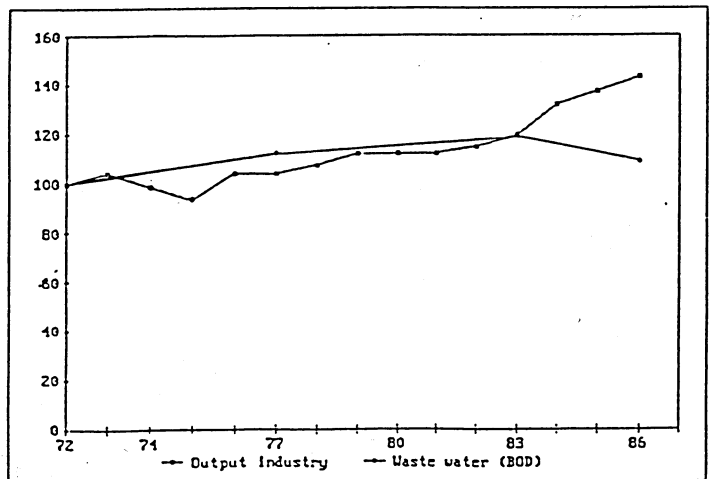
³ For comparison purposes, the graph of the Dutch experience has been reproduced on a comparable scale to the Danish experience.

Figure A2.2 Index of industrial output and waste water in the Dutch industry (1970=100)



Source: Skou Anderson, 1991, p. 25

Figure A2.3 Index of industrial output and waste water in the Danish industry (1972=100)



Source: Skou Anderson, 1991; p. 25

APPENDIX 3. DEPOSIT-REFUND SCHEME APPROACHES

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1.0 OVERVIEW

Deposit-refund systems were originally introduced voluntarily for merely economic reasons. These systems are widely applied with respect to beverage bottles. For environmental reasons, new systems have been introduced for aluminium cans, car hulks, plastic drink bottles, waste oil, waste materials, etc. The following table shows the use of deposit/refund schemes in the Nordic Countries.

A3.1 Overview of the use of deposit/refund applications in Nordic Countries

CATEGORY/ PRODUCT	COUNTRY Denmark	Norway	Sweden	Finland
Batteries	No	Yes NOK 3/each	Yes alkaline SEK 23/kg m-oxide SEK 23/kg n-cadmium SEK 15/kg lead bat SEK 32/bat	No
Deposit system for beverage containers	Industrially regulated deposits on beverage containers that are recycled.	Industrially regulated (private) deposits on beverage containers that are recycled.	Industrially regulated deposits on beverage containers that are recycled.	Returnable bottles. FIM 0.50/bottle
Beverage containers: wine,spirits beer soft drinks, water milk	Bottles/plastics: 50-224 øre each Metal cans: 80 øre each Cardboard Packages: 38-180 øre each Packages liquid dairy products: 10 øre each Disposable Items: 1/3 of value of product Packages for chemicals substances and products: 1/6 of value of the product	Beverage containers: beer, m.n. water: NOK 3.50 each soft drinks: NOK 0.50 each wines, spirits: NOK 0.50 each	Beverage conts: returnable bottles: 8 øre each disposable conts: 10-25 øre each	Disposable bev. conts: beer: FIM 1-1.50/tr soft drinks: FIM 2/tr plastic: FIM 2/tr metal/glass: FIM 3/tr
Lubricating oil	No	Yes NOK 0.50/litre	No	Yes FIM 2.20/tonne
Charge and deposit system for scrapped cars	No	Yes: scrapping charge NOK 700/veh. scrapping premium NOK 1000/veh.	Yes: veh. scrapping charge: SEK 300/veh veh. scrapping premium: SEK 500/veh	No
Waste	Yes DKK 130/tonne of waste	Yes: Waste mgt charge Sewage mgt charge	No	No
Sand and gravel (raw material)	Yes	No	No	No

Source: (Nordic Council of Ministers, 1991;46)

The first environmental charges introduced in the Nordic area in the 1970s were on beverage containers, prompted by problems of litter accumulation in the countryside. In Denmark, Norway and Finland, charges on beverage containers are at present considerably higher than in Sweden, and they fall only on disposable containers. The charge rate varies between DKK 0.1 and 4.50 per litre of beverage, depending on the type of beverage container, the volume and the type of material. One effect of the high charges on disposable containers in these countries is that returnable bottles have retained a large market share.

Denmark is the only Nordic country with a charge on milk containers. Cartons are exempt from the charge in Sweden, but not in Denmark, Norway or Finland. In practice, however, the Finnish charge does not fall on cartons since only soft drinks and beer are included in the charge system. The Swedish government has appointed a commission on packaging, and in its interim report of autumn 1990 the commission proposed a large rise in the tax on beverage containers. The question of charges on packaging other than beverage containers is being investigated further.

The same ambition of reducing litter in the countryside that underlay the instruments concerning beverage containers has also led, in Norway and Sweden, to the introduction of a deposit and charge system for car wrecks.

2.0 DEPOSIT REFUND SCHEME FOR ALUMINIUM CANS (SWEDEN)

2.1 Introduction

A deposit refund scheme for aluminum cans was introduced in 1984 in Sweden. The programme is organised by the Ministry for the Environment but implemented by a private firm (Returpack) established by the breweries and packaging industry. The task facing the firm was to achieve the objectives set by the Government which are:

- 85% return and recycling by 1991 and
- 90% return and recycling by 1993.

Approximately 800 million cans are sold each year in Sweden. The deposit rate is:

1984 - 1987: SEK 0.25; 1987 - 1992: SEK 0.50

The income of Returpack consists of the deposit money, an administrative contribution from the can makers and a return on the cans. The costs are the refund money, handling fees to breweries and retailers, transport and

administration costs. See the figure on the next page for the schematic representation of money and materials flows for the deposit-refund system.

Efficiency No comparison with other instruments have been made.

Acceptance This has been very high. The environmental movement was initially against the programme, but after they were convinced (through studies) that the recycling of aluminium from an energy point of view is no worse than other forms of packaging, they now support it.

Education This has been very intensive and Returpack spent SEK 8.6 million on information.

Results The return percentage in 1984 was 63%, in 1991 it was 82.5%.

Problems The can crush machines in the retail shops throw out, with the help of a magnet, any non-aluminium cans. Cans of other material are not accepted. The machine gives the client a ticket, and crushes the can. Next the cans are delivered to the recycling centre. The cost of the can crushing machines are a concern to small shops.

The percentage of steel cans has declined but it still remains a problem. There is also a need to standardise the size of the cans.

Outlook The system is working well. It is expected that the return percentage will reach 90%. This however will mean that the returns to Returpack will decline (in 1991 they suffered a loss). Proposals are in the air to increase the administrative contribution.

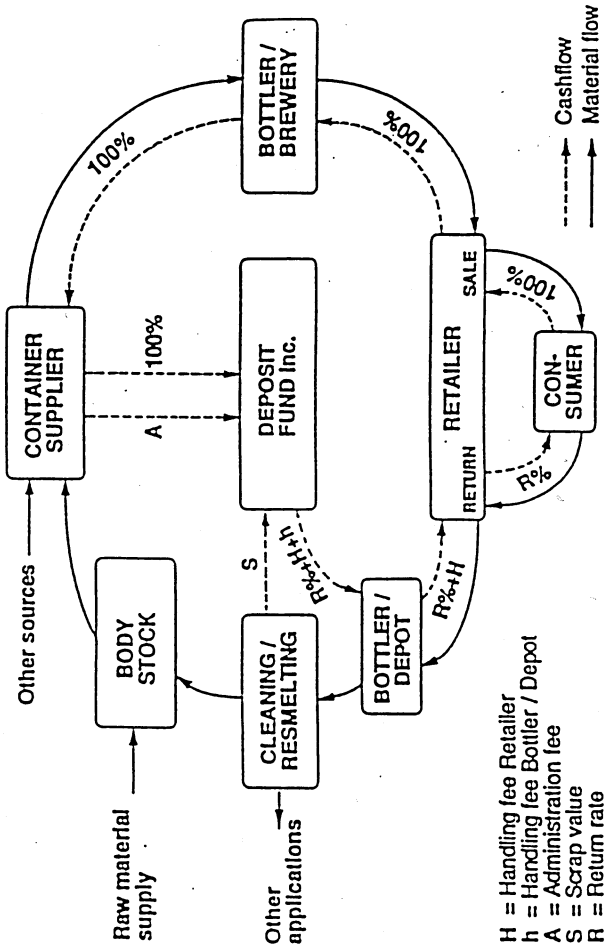
2.2 Conclusion for Sweden

1. The Swedish deposit/refund system for aluminium cans (approx NZ \$0.13 per can) appears to have been very successful (with a return rate of more than 80%). Steel cans are hardly used in Sweden and hence cause few problems. The crushing machines are not good at distinguishing different materials and hence if many steel cans are in currency, this may cause a real problem.

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2. The Swedish system is implemented by a private concern and rests on voluntary participation of all concerned. The Government has only set the percentage rates that need to be achieved. In such a system a 'handling fee' for beverage producers and the shops is of great importance as they have to accept not only their own cans but also those of their competitors.
3. The Swedish system was self-financing until last year, due to the fact that not all cans were returned. Therefore, part of the deposit money could be used for handling fees, transport and administration costs. The break even point lies at approximately 75% return percentage. Above this level money needs to be added from outside the system.
4. In Sweden there is hardly any importation of cans. In other countries this could, with a relatively high deposit level, be quite different and cause new problems.

Figure A3.1 Money and materials flow for the Swedish deposit-refund system for aluminium cans



(Source: IVM, 1992: p.43)

(Source: IVM, 1992: p.43)

3.0 DEPOSIT REFUND SCHEME FOR BATTERIES AS PROPOSED FOR THE NETHERLANDS

3.1 Introduction

The aim of the Dutch Government is to achieve 100% collection (separated) by the year 2000. A consulting firm Tebodin has analysed the possibility of doing so, using a deposit-refund or a delivery payment system.

The market consists of built-in batteries; industrial batteries and consumer (separate) batteries. Nearly all batteries are imported. The report concentrated mainly on the last category as not enough information was available on the first two.

The environmental problem associated with batteries is the lead, mercury, silver, nickel, and cadmium found in them. In 1991, 60% of all batteries sold was collected and 12% was reused. The aim is that by the year 2000, 100% is collected and the maximum possible amount is reused.

Deposit/refund: a charge is added to the retail price and this charge is refunded when the battery is handed in again. It is expected that this system will be operated by industry. There are 40,000 places where the batteries can be handed in.

Delivery premium: no charge is added to the retail price (at least not directly) and the consumer receives a payment when the battery is handed in. This system is to be operated by the Government, and money is to come from a waste disposal levy. There are 2,000 collection depots where batteries can be handed in.

The deposit money proposed is shown in the table A3.2 below. This is based on experience and research overseas (predominantly Sweden and the USA) as well as a survey in The Netherlands itself.

Table A3.2 Proposed levels of deposit money and delivery premiums

fl/piece	Deposit charge		Delivery premium	
	till '94	'95-2000	till '94	'95-2000
differentiated				
Ni-Cd	0.10	0.25	0.20	0.30
other	0.15	0.30	0.25	0.35
undifferentiated	0.15	0.30	0.25	0.35

where 1 fl = approx NZ\$0.90

Source: (Tebodin, 1991:49)

The lower deposit money is expected to achieve approx. 75% return, while the higher levy is expected to achieve 100%. The delivery premium is higher because there are fewer collection points for the delivery premium system than for the deposit refund system and hence the costs to individuals of returning the batteries will be higher.

In the table A3.3 the effectiveness of some deposit schemes elsewhere is shown. The table shows that the percentage rate of return appears to be independent of the level of the deposit. Other factors, therefore influence the return rate.

Table A3.3 The effectiveness of deposit money

PRODUCT	PLACE		SY ST EM	CHARGE/ per piece	RETURN %
Batteries	Sweden		DR	0.1	>100
Pesticide packaging	Maine		DP	10-20	80-90
Car accessories	Florida	tires	DP	2	80-90
	Florida	car batt.	DP	2	80-90
	Norway	wreck	DR	25	85
	Oregon	tires	DP	0.2	80-90
	Sweden	wreck	DR	160	80-90
Beverage containers					
	California	glass	DR	0.02	48
	California	glass	DR	0.02	5
	California	plastic	DR	0.02	67
	Germany	can	DR	0.55	99
	Denmark	glass	DR	0.25	99
	Finland	glass	DR	0.15-0.5	90-95
	Iowa	can/glass/paper etc.	DR	0.10	90
	N.York	can/glass	DR	0.10	60
	Norway	glass	DR	0.25-0.5	98
	Sweden	can	DR	0.08	25
	Sweden	can	DR	0.15	50
	Sweden	glass/ crate	DR	0.15	99
Other					
	Florida	paper	DP	0.2/t	low

Where: DR = deposit / refund system
 DP = delivery premium system

Source: (Tebodin, 1991:67)

For the system (DR) to work well there needs to be a structure that balances the incomings and outgoings for producers and for the shops.

3.2 Conclusion for The Netherlands

The purpose of DR and DP is to create a self contained system. From a legal point of view there are no major reasons why such a system couldn't be implemented.

No system will be self contained because of imports of batteries and because of a certain percentage of non-response by the users. It is possible to raise the response rate by raising the premiums.

The disadvantage of DR is that it has little impact on the built-in batteries, while DP can also deal with these batteries. The disadvantage of DP is the preparedness of consumers to travel to collection depots (of which there a lot fewer than shops) or wait for the Chemo car (a periodic curb pick up service).

For the consumers the refund at the point of sale is a clearer connection between batteries and the environment than the premium. The effect of tariff differentiation between rechargeable and non-rechargeable only shows an effect, due to the low price elasticity of demand, at very high deposit rates. There are currently not strong enough environmental reasons to justify the tariff differentiation.

The total cost of the two systems are very similar.

Another disadvantage of DR is the complex financing system, which requires quite a bit of administration.

Both systems are not easy to introduce. Although consumers are willing to accept the deposit charge or premium, the scheme receives opposition from the producers and retailers. The DP is very acceptable to local authorities. The implementation of the DR is very much dependent on the financing system to deal with the unequal net return problems, a problem DP has not got.

4.0 OVERALL CONCLUSIONS

The two case studies presented represent only a very small example of the possible applications of the deposit/refund instrument. Many countries are considering further applications. One of the most recent areas of interest is the area of toxic waste. To quote Macauley and Palmer (1992),

Appendix 3

"To remove the incentive for illegal disposal and thus reduce the social costs of such disposal, a deposit-refund system might be imposed on all parties that accept spent solvent for recycling and disposal. Such a system would encourage recyclers of chlorinated solvents to use the most socially efficient method of disposal by raising the costs of illegal disposal and rewarding appropriate disposal practices" (page 8).

APPENDIX 4 TRANSFERABLE RIGHTS

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1.0 INTRODUCTION

Many countries acknowledge the utility of so-called economic instruments in achieving the goals of environmental management. Almost 25 years have passed since Dales (1968) first proposed the use of transferable property rights in environmental management. This section reviews experience with transferable rights using 5 case studies. Three case studies - fisheries quota management, radio spectrum, ozone depleting substances - relate directly to the New Zealand experience. Two case studies - transferable development rights and transferable water allocation rights - use examples from overseas.

Environmental economists have examined the use of transferable rights as an economic instrument in many policy settings. Theoretical studies show the potential for transferable rights to achieve the objectives of environmental policy efficiently. An allocation of rights, call it X, is (allocatively) efficient if it is not possible to find another allocation Y such that those benefiting from a change $X \rightarrow Y$ could not fully compensate those losing as a consequence of change. Property rights must be well specified and transferable to achieve allocative efficiency. Allocative efficiency also requires all relevant values to be encompassed in the property rights so that market prices can reflect these values, and individuals will face the opportunity costs of their decisions. The case studies will illustrate the practical significance of the "valuation requirement". Transferability ensures that prices equal opportunity costs (at the margin) across alternative uses.

All systems of environmental governance involve property rights. Hurwicz (1973) evaluated forms of organisation in terms of: the optimality (efficiency) of outcome, whether the mechanism could operate in a decentralised fashion, and finally, the extent to which the outcome(s) satisfied social goals. Montgomery (1972) and others have shown the efficiency characteristics of transferable rights. The general result derived from economic theory is that it is not possible to claim that transferable rights will deliver efficient outcomes, at best transferable rights will deliver environmental objectives at least cost.

More recently, Howe *et al.* (1986) proposed six criteria for use in evaluating the performance of alternative mechanisms.

- (a) *Flexibility*: does the allocation mechanism have the flexibility to adapt to changes in demography, economic conditions, technology and natural supply?
- (b) *Security of tenure*: influences the level of investment in natural resource using systems because certainty of tenure

is a dominant factor in determining the user's ability to enjoy a return on investment.

- (c) *Predictability*: does the mechanism deliver surprises which make anticipation and strategic planning by users difficult?
- (d) *Opportunity costs*: are users confronted with real (and explicit) opportunity costs?
- (e) *Equity*: does the mechanism impose uncompensated costs on third parties?
- (f) *Broad public values*: does the allocative mechanism reflect the values attached to the resource?

When implementing a transferable rights mechanism, a number of practical issues must be addressed, including:

- (a) Geographic extent of the market: this will vary according to the natural resource and characteristics of the economy.
- (b) Coverage of users: which uses are required to have rights? Some uses can be excluded from requiring a right because of the high transaction costs of monitoring and enforcement. Complete coverage is not necessary for efficiency.
- (c) Initial distribution: the government, through its management agency, controls the initial distribution. Transferable rights are frequently introduced after attempts at management through regulation.

2.0 FISHERIES QUOTA MANAGEMENT SYSTEM

New Zealand has led the world in introducing tradeable property rights into fisheries management. However, this innovation has come about slowly and only after considerable experimentation with other regulatory mechanisms. Fisheries Act 1908 established the first legislative framework for fisheries policy in New Zealand. It provided the statutory basis for policies based on principles of conservation and scientific management of fishing activity. The Act was frequently amended over the years, indicating policy shifts that oscillated from open entry to limited entry and effort controls. The Territorial Sea and Exclusive Zone Act 1977 extended jurisdiction over New Zealand's fisheries resources. New Zealand's EEZ was declared on 1 April 1978 and encompasses an area of 1.4 million square miles. Vessels fishing the EEZ had to comply with New Zealand fishing law. The Act gives control over conservation and management of resources, but no claim to ownership.

2.1 State of the Fishery 1981-82

From March 1973 to March 1982, the national weighted average port price of fish increased on average 23% per annum. Total fish landings by the domestic fleet increased over the period 1978 to 1982. Significant commercial species (e.g. snapper, trevally) were under considerable pressure and harvest levels fell. Reductions in annual harvest levels of many commercially important species were necessary to allow for recovery and the adjustment required to meet the long-term sustainable yield. Failure to do this would lead to the economic collapse of a large part of the inshore fishing sector. At the same time there were dramatic increases in two major deep water trawl species, orange roughy and hoki.

In the inshore fishery a small number of vessels landed most of the catch. In 1981, the top 50 boats accounted for 45% of the total landings while the bottom 3,500 boats accounted for only 20% of the total. A moratorium on new entrants was imposed in late 1982 to protect the stocks and in 1983/4 a number of part-time fishers had their licences revoked.

Over-capitalisation in the catching sector was estimated at \$28 million in 1982, nearly all of which was concentrated in the regions of the east coast of the North Island. This was about 19% of the total capital invested in the full-time domestic fleet under 30 metres. The net impact of reduction of effort, considering alternative uses of capital, was estimated at \$16-22 million. Onshore over-capitalisation was put at \$4-5 million. The net benefit of maintaining effort at permanently reduced levels was estimated as an annual surplus of \$6.8 million in 1982 dollars.

2.2 Fisheries Act 1983

The Fisheries Act 1983 introduced significant changes to the institutions for managing fishery resources in New Zealand. A system of individual transferable quota (ITQ), operating within the constraints of a total allowable catch (TAC), became the primary management tool. New Zealand based its definition of TAC on that contained in United Nations Conference of the Law of the Sea (Article 61). In the Territorial Sea and Exclusive Economic Zone Act 1977 and the Fisheries Act 1983, TAC is based on the concept of maximum sustained yield (MSY) qualified by any economic, social, recreational or ecological factor. The Bilateral Fisheries Agreements with other sovereign states acknowledges the Crown's right to set and adjust TAC within the EEZ.

MAFFish is responsible for fisheries research, management and policy. The Ministry is required to conserve and manage the fisheries of New Zealand so as to maximize the national benefit. Non-commercial interests are included in

the policies aimed at achieving this goal. Fishery management plans are designed to allocate and manage the fishery resources having regard to the need for providing for optimal yields and maintaining the quality of the yield. The quota management system (QMS) - which includes the TAC-ITQ system and its enforcement - is an integral component of the Ministry's approach to fisheries management. A principal research objective of the Ministry is to develop better stock assessments so as to provide more accurate estimates of TAC. Although an annual resource rental is collected by MAFFish, management and research activities are financed out of the consolidated fund. The Minister of Fisheries recently announced a policy of full cost recovery.

2.3 The QMS

The Crown has retained important property rights in order to manage the TAC-ITQ system. Two distinct stages are apparent in the evolution of the QMS. In the first phase 1983-90, the TAC was set as a tonnage - that is, as a quantity available for commercial harvest - after consideration of Maori and other non-commercial interests. Catch as a percentage of species quota was quite variable, most species are not harvested up to their quota limit. An aggregation limit of 35% was placed on total quota holdings.

Concern over a need to harvest on a sustainable basis led to a reduction in TAC for many species. Legislation provided for TAC adjustments. At any time after the ITQ has been allocated, the Minister could, after consultation with industry, reduce the TAC provided:

- (a) the stock for a quota management area has fallen significantly below that considered sustainable, and
- (b) other controls would not be sufficient to maintain fishing at (approximately) the current TAC.

Reduction of the TAC could be achieved by:

- (a) reducing ITQ on a proportionate basis, in which case compensation (at market value) shall be payable by the Crown,
- (b) the Director-General of MAFFish may purchase, or lease, ITQ on behalf of the Crown, or
- (c) retain any quota.

The 1983 Act did not specify conditions under which TAC could be increased other than a requirement that the TAC should produce a maximum sustainable yield. Where the TAC was increased, the Minister was required to distribute the increased quotas on a proportionate basis free of charge to those fishers with provisional maximum ITQ. If aggregate quota was less than the TAC then the

increase could be allocated to the Crown as ITQ, offered on a proportionate basis to existing ITQ holders or allocated by competitive tender.

The second phase, beginning in 1990, was marked by an amendment to the Act changing the ITQ property right from a tonnage to a percentage of a TAC declared in a QMS fishery. This was a significant change in the definition of a tradeable right. Prior to 1990, the Crown was obliged to buy back quota in order to reduce the TAC for a species being harvested at a rate greater than what was considered to be sustainable. This structure of entitlements placed a considerable share of the risk of management on the Crown. By redefining the right to a percentage of a TAC declared in a QMS fishery the burden of risk has been shifted from the Crown on to the industry. Percentage ITQs provide for a more flexible arrangement, one it would seem that is better suited to the inherent variability of fish stocks. Compensation for this readjustment is available and will be financed by resource rentals.

2.3.1 Resource Rentals

Resource rent policy must accomplish three things:

- (a) allow price to be determined,
- (b) collect revenue from the value generated by rent-creating management activities, and
- (c) distribute rent.

Three mechanisms are required: one to value a service, a second to collect revenue, and a third to distribute the revenue. These mechanisms should be capable of adaptation and change.

As a valuation mechanism, the ITQ system establishes the value of quota *ex ante*. The system is inherently flexible and provides an opportunity for changes in consumer preferences, technology and relative scarcity to be incorporated into price determination. Transferable quota is therefore a very practical mechanism for encouraging individual firms to reveal, and act upon, information on the value they attach to a right to harvest fish. However the market valuation mechanism is contingent upon agency decisions. The task of establishing economic rents *ex post* within the fishery is complex.

A major element in government policy is the charging of resource rentals to capture the economic surplus created by the QMS. The Minister can vary resource rentals each year by Order in Council. For most species the maximum increase is 20% in any one year; adjustments beyond 20% can be made through legislation. The Minister is to take the following factors into account when considering rental adjustments:

- (a) the value of the ITQ,

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- (b) the impact on net commercial returns,
- (c) relevant changes to TAC, and
- (d) industry submissions.

Resource rentals were to be paid into a revolving fund established under the Public Finance Act 1977 which is administered in the Treasury. The Ministry was to operate the Fisheries Fund, undertaking activities which relate to the management of, and research into, New Zealand fisheries. The fund was never established and rentals are, in the meantime, being paid into the Consolidated Fund. It is not clear how residual balances in the fund are to be managed.

The 1990 amendment to the Act provides for resource rentals that would have been paid over the next four years to be made available for compensation to individuals whose ITQ was reduced. The sums involved are substantial, in the order of \$70 million over the 1991/92 and 1992/93 fiscal years. This development is likely to take the QMS into a contracting environment involving the Crown and industry.

2.4 Initial Allocation of ITQs

In 1983, the QMS was introduced as a framework for increasing economic rent in the fishery within the constraints of sustainability. Rebuilding fish stocks required catches to be drastically reduced in some fisheries, placing adjustment costs on fishers as they reallocated capital and labour to less stressed fisheries or into other areas of the economy. Because of costs arising from government intervention, and because the support of the industry for ITQs was required, government provided adjustment assistance. The idea was to compensate those fishers who had rights to catch unlimited quantities of fish for voluntarily accepting limitations on their catch.

ITQs for 7 key species were allocated in the deepwater trawl fishery on the basis of investment in caching and onshore capital and onshore throughput in March 1982. Although the initial allocations were made for a period of 10 years, government made the quotas valid in perpetuity in 1985, at the same time ITQ were introduced into the inshore fishery.

For the inshore fishery the allocation policy was based on historical catch, modified by the results of a buy-back policy and any administrative adjustments necessary to match effort with the available resource. Fishers were asked to tender the amount of money they would be willing-to-accept in return for reducing their historical catch by some specified amount. Tenders were then accepted so as to minimize the total economic cost of reductions as revealed

by the tender bids. Given the need to reduce catches to the desired TACs it was necessary to ensure that the scheme had sufficient flexibility to respond to either an insufficient number of tenders or expectations of fishers being unreasonably high in their tender bids. Provision was made for more than one tender round. Successful tenders were paid at a price per tonne for each species, based on the highest successful tender in each region. The bidding structure encouraged fishers to reveal their "true" valuation of the ITQ.

2.5 Enforcement

Reliable monitoring and effective enforcement is essential for a fisheries management regime based on transferable rights. Monitoring and enforcement of ITQs is done by standard auditing techniques involving random checking procedures. Fishing firms supply quota management reports to local MAF officers which include their catch, quota holdings and transfers, and the balance of quota that remains. Fishing firms are required to:

- (a) sell fish to wholesalers/processors, with a limited range of exceptions to cover such cases as wharf sales, retail shops with their own vessels, and
- (b) landing fish at recognized ports or landing spots.

The costs of the QMS are becoming more apparent as MAFFish increases its monitoring and enforcement activities. For the year ending June 1993 the Crown has budgeted \$10.2 million for fisheries enforcement. MAFFish is actively enforcing the law and can point to success in the courts. No information is available on whether the monitoring and enforcement activities are efficient.

2.6 Treaty of Waitangi

Transition from a policy of licensing to transferable quota had important implications for Maori, particularly part-time fishers in coastal communities. Fishing quota provided a focus for claims under the Treaty of Waitangi Act. Tradeable quota provided government with a means of correcting previous grievances.

2.7 Conclusions

By creating QMS, the Crown established a valuable property right. Commercial interest in this property right has been affected, positively and negatively, by management and research activities.

Effectiveness

The QMS policy has been effective in limiting harvest levels to administratively determined TACs. The fundamental, and continuing, problem has been one of setting the sustainable TAC. This has led to a redefinition of the right from a tonnage to a percentage. Tradeable quota has also provided for the settlement of Treaty claims.

Efficiency

Limited evidence suggests that the New Zealand fishery has been turned around and is now producing a positive economic rent. The search for dynamic efficiency continues with redefinitions to the ITQ and investment in fisheries science. Efficiency has improved, at both the harvesting and management level. Markets for rights exist. Numerous commercial arrangements - e.g. leases, share harvesting - have evolved around this inherently flexible instrument. No evidence is available on impact of reasonably high levels of quota aggregation on economic efficiency. The fishing industry has grown to become a major contributor to export earnings.

Equity

The QMS policy established rights on the basis of historical catch, although many part timers were excluded from the initial benchmark. The buy back scheme, was necessary to reduce harvest down to sustainable levels. The mechanism was equitable to the extent that a fisher's willingness to accept compensation accurately measures the full cost to the individual for exiting the industry.

Public finance

The MAFFish is effectively monitoring and enforcing the QMS policy. It would appear that the system is not self-financing. Moreover, it seems that incentive compatible financial mechanisms have yet to be developed. A recent announcement by the Minister would appear to signal government's desire to introduce a contracting environment coupled with cost-recovery mechanisms.

3.0 RADIO SPECTRUM

Radio frequency is a critical input into the production function of telecommunication firms. Prior to 1989 allocation of the radio spectrum in New Zealand was controlled by a centralised bureaucracy. Radio frequency management was a function of the New Zealand Post office, a state monopoly. The Radio Frequency Service decided spectrum use, the geographic scope of individual spectrum licences, permitted levels of interference and the spectrum to be reserved for future use. Telecommunication services were also supplied by the same state monopoly. In 1989 the Radio Communications Act replaced the existing nonmarket allocative mechanism with a market mechanism for deciding who gets the initial allocation of newly created spectrum rights. The Act also provides for transferable radio spectrum rights. The public record of ownership and trades, held within the Ministry of Commerce, is similar to the land transfer system underpinning the property market. By creating tradeable property rights in the radio spectrum resource the Act also reduced the barriers to entry into the telecommunications market.

3.1 The Spectrum Resource

The electromagnetic (radio) spectrum refers to the complete range of electromagnetic radiation from the longest waves (10^5 metres) to the shortest gamma radiation (10^{-13} metres). Radio communication involves the transmission and reception of electromagnetic energy, it does not require a supporting medium. Radio wave propagation can be influenced *inter alia* by atmospheric conditions, topography and buildings. Frequency, measured in hertz, or cycles per second, is one of a number of controllable parameters.

Unlike many natural resources the radio spectrum cannot be physically depleted, provided use is not contemporaneous. Once used, the spectrum is available for immediate future use. Technological advancement enhances its capacity for use. The radio spectrum does however have certain characteristics in common with other natural resources. First, like land and fishery resources, the spectrum is not homogeneous in its productivity. Second, like common pool resources, simultaneous use of spectrum frequencies produces external effects that reduce the economic welfare of other users.

De Vany *et al.* (1969) describe radio communication in terms of three dimensions: time (T) during which transmission occurs, the geographical area (A) over which the radio waves are spread and the spectrum (S) used in the transmission. Communication operators using the same TAS package will interfere with each other's service. Problems associated with frequency spill

overs can be avoided by technical design and are a common feature of government regulations world wide.

Economic considerations exist at the firm-level of radio communications. Consumer demand for communication services between two locations can be satisfied using numerous combinations of alternative inputs. With rapid growth in radio communication the radio spectrum has become a scarce resource. Of significance is the contemporaneous externality associated with multiple users of the spectrum. In other words, there is insufficient spectrum available to satisfy demand in all cases and some users would be willing to pay a price to obtain additional TAS rights.

3.2 Rights in Radio Spectrum

Spectrum rights create economic relationships between transmitters and receivers. In order to minimise contemporaneous externalities the entitlement structure must clearly specify the reciprocal rights and duties of right holders, particularly the limits to which a right holder can interfere with the signal quality of other transmitters and the degree of protection afforded the right holder from unwanted inference from other transmitters. Therefore the value of spectrum rights depends *inter alia* on the quality of communications possible between the transmitter and receiver(s).

To some extent New Zealand adopted the approach of De Vany *et al.* (1969) by defining spectrum rights around the TAS dimensions. The Radio Communications Act 1989 created a hierarchy of two quite distinct rights, management rights and licences. Although both rights are transferable, licence rights are subordinate and less flexible because they are constrained by limits imposed by the management right holder.

3.2.1. Management rights

Management rights are created when the Secretary of Commerce applies to the Registrar of Radio Frequencies for the recording of a management right in relation to a frequency. Management rights exist for 20 years. When the management right is initially created, the Crown (through the Secretary of Commerce) is the manager of the frequency. The entire range of, or part thereof, frequencies held under a management right can be transferred. Transfers are recorded by the Registrar. Management rights can be subdivided or aggregated, holders have the right to create licence rights.

In addition to specifying a range of frequencies a management right defines reciprocal interference limits. First, the management right holder can not spill

more radio energy into other bands than the adjacent frequencies emission limits (AFEL) specified. A radio engineer certifies that the specified AFEL is technically compatible with existing licences and will not interfere navigation services and radio services essential to public safety. Second, the management right specifies a protection limit (PL) which protects the right holder from radio emissions from users of other frequencies. The minimum protection limit on a management right is -50dBW (10 microwatts) equivalent isotropically radiated power. The Registrar can not legally register a management right to a frequency if AFELs exceed the PL specified in the management right.

3.2.2 Licence rights

Licences rights are subordinate to management rights. A licence, which is necessary for the transmission of radio waves, can be obtained in two ways. Either management right holders issue a licence to themselves or to others. Licence rights describe the licence holder, details of the transmitter, frequency, power, bandwidth, unwanted emission limits, and area of coverage. As a subordinate right, AFELs and PLs specified in management rights apply as constraints to licence rights. The management right holder can define licence rights in any way provided other management rights are not violated. Licence rights are transferable, they can be of variable duration but cannot exceed 20 years.

3.3 Incumbent and Noncommercial Licence Holders

Individuals granted a licence prior to 1 July 1989 had the right to be granted a licence under the new Radio Communications Act. The entitlements of incumbent licensees were unaltered and their allocation was recorded on the frequency's management rights with an expiry date identical to that of the management right. Incumbent licensees exercising their entitlement were, however, confronted with a fee schedule based on service (e.g. AM Sound Broadcasting) and power. The Act made special provision for noncommercial broadcasters. Their use of the spectrum is confined to existing use rights and their licence is nontransferable.

3.4 Auction Process

Any person or organisation may bid in the auction process. Bidders may make only one sealed bid for a particular lot, although a tenderer may bid for more than one lot in any tender. A refundable 25% deposit is made on the amount bid. Zero bids are acceptable. The winning bid is the highest tender offered. A second-bid auction was used in the first 3 tenders. If there was only one bid under the second-bid auction, the next highest bid defaults to zero and therefore nothing is paid by the successful tenderer. Ties are decided randomly.

Bidders can also indicate an order of preference for acquiring lots. If a bidder wins more lots than the number they have stated as being sought then lots are allocated in order of the preferences stated up to the number of lots sought. Remaining lots are then allocated by an iterative process to the next highest bidder, where that bidder has not won the number of lots sought, or having already gained the number of lots sought, would gain a higher preference for one or more lots.

In 1991 one significant change was made to the tendering rules. A first-bid auction was used in the fourth tender. Under the revised rules the winner for each lot remained the bidder who bid the highest amount but, in contrast to the second-bid rules, the winning bidder paid the amount tendered. Where there are two or more highest bids the winner is determined by random selection. The tendering rules remained the same in all other respects.

The literature on auction theory emphasises the importance of the information environment within which competition occurs. Detailed information on the rules of tender, lot descriptions and any restrictions on the lots offered is produced by the Ministry of Commerce. Successful bidders are notified approximately 1 week after the tender closing date. Furthermore, the list of bids, provisionally accepted bids and the final results are available to all bidders and the general public.

The following steps are involved in the auction process for the initial distribution of management and licence rights (Mueller, 1991).

1. The initiative to tender a frequency band can originate within the Ministry of Commerce or from an approach by an interested party. The Ministry calls for an expression of interest in order to assess likely demand and accumulate industry comment on technical issues.

2. The RFS formulates an engineering plan which defines the rights in terms of the maximum power of emissions permitted, unwanted emission limits, geographical scope, transmission sites, and so on.
3. Cabinet approval for the tender is obtained and the management or licence rights are created by application to the Registrar of Radio Frequencies.
4. A call for tenders is issued in The New Zealand Gazette. The rights attached to each Lot are described. The Gazette notice specifies the tendering method and the rules governing selection of the winning tenderer. A contract created by the acceptance of a bid is subject to Part V of the Commerce Act 1986, which clears merger and takeover proposals.
5. The management or licence rights are transferred to the successful tenderers. All transfers are recorded in the Register of Radio Frequencies.

Three hundred and twenty nine management and licence rights were sold in four tenders. Each tender round is summarised in Table A4.1. The first three by sealed second bid (English) auctions and the fourth by sealed first bid (Dutch) auction. Second bid auctions award the licence to the highest bidder, at the price bid by the second highest bidder. The price paid is determined solely by competitors bids, not on any action of the bidder. A consequence of this is that the bidder with the highest valuation will always win, and the equilibrium allocation is efficient. First bid auctions provide no equivalent assurance that the outcome will be efficient. Where the bidders have observably different characteristics, the outcome will be inefficient with some positive probability (Milgrom, 1989). Second bid auctions also have the advantage that they produce higher on average revenue than first bid auctions.

3.5 Post Tender Trades

A market in radio spectrum rights is developing. All transfers are recorded by the Registrar of Radio Frequencies. About 60 *bona fide* trades in licence rights have been recorded.

3.6 Treaty of Waitangi

In 1990 the Waitangi Tribunal asked the Crown to postpone the 3rd tender. Although policy reserved some frequency for Maori they considered the amount inadequate for their representation in the population. Cabinet did not accede to the request and therefore the New Zealand Maori Council sought an interim order to prevent sale. Such an order was granted. On appeal to the Court of Appeal the Minister acknowledged that the case was reasonable.

Table A4.1 Radio spectrum tender round summary

	1	2	3	4
Date	12/2/90	18/5/90	17/9/90	5/11/91
Auction	Second-bid	Second-bid	Second-bid	First-bid
SERVICE				
UHF	70 L	12 L	0	29 L
VIDEO	0	0	12 M	0
AMPS A	0	2 M	0	0
TACS A	0	2 M	0	0
TACS B	0	2 M	0	0
AM	0	0	35 L	9 L
FM	0	0	128 L	38 L
TOTAL	70	18	165	76

Note: L refers to licence and M to management right.

3.7 Conclusions

The Radio Communications Act 1989 created a system of rights for the radio spectrum. The auction procedure has enabled users to compete for rights to parts of the radio spectrum. Licence rights are subordinate to management rights, both are tradeable. Conclusions with respect to the criteria used in this report follow.

Effectiveness

Both management and licence rights are transferable, although licence rights are subordinate and less flexible. The registration system, modelled on the Torrens system, is very effective; as is the management agency. The system has a impressive computer-based record system that can provide up to date information to the public.

Efficiency

Tradeable spectrum rights offer flexibility and a choice to firms in the communications industry. Tradeoffs can be struck between investing in spectrum rights and/or spectrum economising technology. It is a field characterised by rapid technological change and intense competition. Efficiency gains are limited by the dominant use of licence rights.

Equity

Policy protected the interests of incumbent spectrum users. Maori were, after litigation, able to convince government that an allocation of spectrum was necessary for the protection and enhancement of their culture.

Public finance

There is no information available on whether the system is self-financing.

4.0 OZONE DEPLETING SUBSTANCES

The ozone layer is a global atmospheric resource that limits the amount of ultraviolet solar radiation reaching the earth's surface. Depletion of the ozone layer can increase the incidence of skin cancer, reduce the viability of natural ecosystems and reduce agricultural production.

New Zealand's economic wealth depends, to a large degree, on food exports. Large-scale refrigeration is an essential input into the value adding process. In 1986, 2,300 tonnes of chlorofluorocarbons (CFCs) were used, about 0.23% of global consumption (Ministry for the Environment, 1991). This is about 0.7kg per person. In addition, 140 tonnes of halons were used, about 0.65% of the global total. By 1991, New Zealand had reduced the importation of ozone depleting substances to less than 40% of the 1986 level. This case study illustrates how transferability can be incorporated into a policy aimed at phasing out New Zealand's use of ozone depleting substances.

4.1 Timetable

The Ozone Layer Protection Act 1990 aims to phase out the use of ozone depleting substances, in all but essential uses, by the year 2000. The Act gives effect to New Zealand's obligations under the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer.

4.2 Ozone Depleting Substances

Ozone depleting substances are defined as controlled substances in the Act and any other substance that has an ozone depletion potential (described below) of 0.01 or greater. Substances controlled by the Act include CFC's, Halons, Methyl Chloroform and Carbon Tetrachloride.

4.3 Depletion Coefficients

The Act specifies a schedule of ozone depleting potential (ODP) coefficients, shown in Table A4.2, that attaches to each group of controlled substances. These coefficients are derived from a calculation of the steady-state ozone reduction for each unit mass of gas emitted into the atmosphere relative to a unit of CFC-11. The mass of a substance multiplied by its ODP yields ODP tonnage. Base consumption levels are expressed in ODP tonnes of bulk controlled substance.

Table A4.2 Ozone depleting potential parameters

Substance	Ozone depleting potential
CFC-11	1.0
CFC-12	1.0
CFC-113	0.8
CFC-114	1.0
CFC-115	0.6
Halon-1211	3.0
Halon-1301	10.0
Halon-2402	NA

Source: Ozone Protection Act 1990

4.4 Reduction Rates

The use of propellants for aerosols was prohibited in 1990. The import or manufacture of dry cleaning equipment using controlled substances was banned in 1990. The sale of aerosol spray containing controlled substances was banned from 1992. Reduction rates apply to base year ODP tonnages. Table A4.3 shows the reduction timetables for CFCs by industry group.

Table A4.3 CFC reduction timetables by industry group

Year	Refrigeration & air conditioning (%)	Manufacture of group A plastic foams (%)	Solvents in dry cleaning (%)	Solvents in industry other than dry cleaning (%)
1990-1	0	10	20	20
1991-2	0	10	20	20
1992-3	20	55	20	20
1993-4	20	55	20	20
1994-5	20	55	20	20
1995-6	90	100	20	100
1996-7	90		20	
1997-8	90		20	
1998-9	100		100	

Source: Ozone Protection Act 1990

Zero reduction rates were initially set for Methyl Chloroform (MC) and Carbon Tetrachloride (CT). Table A4.4 shows the phase out schedules were added by Order in Council in 1991.

Table A4.4 Reduction timetable for MC and CT for all industry groups

Year	Methyl Chloroform (%)	Carbon Tetrachloride (%)
1992-3	10	0
1993-4	10	0
1994-5	40	85
1995-6	40	85
1996-7	40	85
1997-8	75	85
1998-9	75	85
1999-0	75	85
2000-1	100	100

Source: Ozone protection Act 1990, Order in Council 1991

Exemptions may be granted for fire extinguishers and aerosols necessary for human health. About 50% of the exemptions granted through June 1990 were for pharmaceutical aerosols considered necessary for human health. The remaining exemptions were for halon fire extinguishers used in the airline, car racing and fishing industry.

4.5 Import Permits

Because New Zealand does not manufacture any of the controlled substances the policy is aimed at reducing importation. The importation of bulk controlled substances requires a permit. The application must specify the quantity of the substance so that the ODP tonnage can be calculated (Table A4.5). The application for an import permit must also specify the total ODP tonnage the applicant claims to be entitled to import during the year. On receipt of an application for an import permit, the Minister for the Commerce determines the applicant's base consumption level. Those with a base consumption level are entitled to an import permit.

Table A4.5 New Zealand's imports of controlled substances

Year	Total CFCs	Total Halons	Methyl Chloroform	Carbon Tetrachloride
1986	2300	142	na	na
1987	na	na	na	na
1988	971	364	na	na
1989	1233	264	982	na
1990	633	210	774	1
1991	772	1	516	0.23

Note: Data are in metric tonnes

Source: Ministry for the Environment (pers. comm.)

The ODP tonnage of bulk controlled substances that an individual may import (i.e. individual quota) in any one year is calculated by multiplying the individual's base consumption level by the relevant reduction timetable shown in Table A4.3. The ODP tonnage of bulk controlled substances that an individual may import in any year may be allocated to one or more bulk controlled substances as the individual may elect.

4.6 Transfer

The Act provides for transfer of the base consumption level and import permit. An individual may transfer all or part of the base consumption level. The transferor simply notifies the Minister of the date, ODP tonnage and the reduction timetables that apply. This bundle of rights goes with the transfer. The transfer of import permits is also straightforward.

4.7 Reduction and Reallocation of Quota

The Minister can cancel an import permit if the individual has not applied for, or transferred, a permit within a 2-year period. If an individual does not fully use, or transfer the balance of, their quota within a 2-year period then the Minister may reduce the individual's base consumption level. Unused quota may be reallocated thereby increasing the base consumption level for some.

4.8 Enforcement and Penalties

The Ministry of Commerce and customs officers are responsible for enforcing the Act. Individuals committing a major offence (e.g. importing or manufacturing any controlled substance) can be fined a maximum \$50,000; the maximum fine for a body corporate is \$150,000. Lesser offences (e.g. making a false statement to obtain a permit) are half the above levels.

Nine seizures of items containing controlled substances that were imported without the required consent were made by the Customs department during the 1990/91 year. Most of the items seized were halon-charged fire extinguishers fitted in privately imported aircraft or motor vehicles.

4.9 Reviews

The Minister for the Environment is required to undertake reviews, at least every 2 years, to determine whether the reduction timetables are appropriate given the technology available. The Ministers of Commerce and the Environment must also report to the House of Representatives on the operation of the Act.

4.10 Conclusions

New Zealand's emission of ozone depleting substances contributes to global depletion of the earth's protective shield. It is significant that New Zealand imports all its requirements. This feature of the economy offers an easily identifiable policy target. Statute makes an import permit necessary for all controlled substances. This mechanism enables New Zealand to meet its obligations under the Montreal Protocol. The permits are specified in ODP tonnes allowing importers to take advantage of the potential to substitute different controlled substances but remain within their permitted limit. Furthermore, the import permits are tradeable. Trades have been recorded. Conclusions with respect to the criteria used in this report follow.

Effectiveness

The policy has been effective in reducing the importation of ozone depleting substances. However it does not follow that New Zealand's emissions of ozone depleting substances has fallen commensurate with import reductions. Although reduced emissions is highly likely, information exists on imports - i.e. inputs to production - not emissions.

Efficiency

Ozone using industry must apply for a permit to import. The effect of this instrument, and making it tradeable, is to create a valuable right. Trades have been recorded. The instrument offers a degree of flexibility because users can also consider alternative controlled substances in addition to buying a permit in the market. These characteristics suggest that the approach has least cost-minimising attributes. However, given the absence of a damage function it is not possible to comment on whether the policy is allocatively efficient. There is no information on the impact of the policy on New Zealand industry targeting the rapidly expanding markets of South East Asia.

Equity

The policy established permits on the basis of past use. Although a practical approach it does raise the problem of restricting entry into industry that relies on the use of controlled substances. A degree of equity is imparted by tradeability.

Public Finance

Government agencies appear to be effectively monitoring and enforcing the policy. Reports are available on policy performance. Illegal imports are policed. It is not known whether the policy is self financing, presumably cost recovery is applied to the permits. Whether the charge covers the full cost of policy is not known.

5. TRANSFERABLE WATER ALLOCATION RIGHTS

Water is a commodity that is pervasively involved in human economic activities. In New Zealand large quantities of water are available, but only a small fraction is useable by humans. Allocation problems arise when water is not found in the proper quantity and quality at the appropriate place and time. Water is usually categorized among the renewable resources although certain sources of groundwater are nonrenewable.

The literature distinguishes between two major classes of use:

- (a) Out-of-stream use: crop irrigation, municipal, industrial use. The water is taken from in situ, diverted or pumped to a point of use. Consumptive use means its removal from the hydrological cycle. At some later point, it is returned to the hydrological cycle.
- (b) In-stream use: requires no diversions from the ground or surface water. These uses include: hydroelectric power generation, wildlife habitat, waste dilution, navigation.

The following characteristics of water resources call for special consideration when it comes to transferable rights.

- (a) Mobility: water tends to flow, evaporate and seep. Consequently exclusive property rights may be difficult to establish and enforce.
- (b) Economies of large scale: scale economies are evident in large storage and distribution systems (e.g. municipal storage dams).
- (c) Variability in supply: space, time and quality.
- (d) Assimilative capacity: often has the attribute of non-rivalry in consumption.
- (e) Sequential use: it is rare for the services associated with a river to be consumed by one user. There is a real possibility for multiple use and externalities.
- (f) Complementarity of outputs: a reservoir can be used for flood control, irrigation, power generation, municipal needs and recreation.
- (g) Cultural and social values: these goals may oppose the result dictated by pure willingness-to-pay.

5.1 Allocating and Pricing Water

Internationally, water is allocated by numerous mechanisms. To date, New Zealand has used agency-determined allocations, centred around water

management plans that are open to public scrutiny. Applicants for a water right have to establish beneficial use and the agency weighs these benefits up against the benefits foregone in other uses. In other parts of the world, notably in regions of the United States and some states in Australia, allocations are determined on the basis of voluntary contracting occurring within a set of rules designed to protect third-party interests. Extensive markets have developed and they appear to have been successful in transferring water from low to high valued use (Howe, *et al.*, 1986; Saliba and Bush, 1987; Dudley, N.J. 1992; Cummings and Vahram, 1992).

Externalities associated with transfers of water rights are likely to be pervasive. These can arise from changes in consumption at a given site and as a result of transferring a right from one user to another. Most countries have acknowledged these interdependencies by establishing agencies responsible for protecting the rights of third-parties. In Australia and the United States, where water markets operate, there is usually a *supra* institutional structure prescribing the limits of the market. For example, minimum flow regimes establish the quantity of water available for allocation. Community interest is sought and considered during the management planning process or in the courts *via* the public trust doctrine.

5.1.1 Water markets

In principle, a system based on transferable rights is flexible, it can adapt to scarcity and has the potential to out-perform alternative allocation mechanisms provided tenure is secure, owners face the opportunity costs of holding onto their water rights, and compensation between willing buyer and willing seller occurs. In practice, careful attention must be given to changing the specification and distribution of property rights in water. Any attenuation or uncertainty in a water right may not prevent the formation of a market but it may reduce the value of the right and increase transaction costs.

Voluntary exchange can lead to uncompensated externalities. Experience has demonstrated that markets do understate the public values attached to the resource. But this observation is not sufficient to dismiss market mechanisms. Rather, it suggests that market mechanisms can improve water allocation amongst competing uses provided care is taken with respect to the externalities associated with use and transfer.

Howe *et al.* (1986) identify three administrative problems in water markets. First, third-party effects must be taken into account when deciding upon a transfer. Economic efficiency requires this. Moreover, it is not equitable for third-party effects to go uncompensated. The administrative mechanism guiding

transfer must be able to identify and incorporate these effects. In the Western US systems of state law provide safeguards for potentially damaged third parties. Those proposing to transfer must advertise the proposed transfer, potentially affected parties have recourse to the courts or planning tribunals that can modify the agreement or provide compensation. In New Mexico, the state engineer's office proposes modifications which the affected parties usually accept.

Second, the extent of the market may make identification of willing buyers and willing sellers difficult. The costs of searching for a buyer/seller has not been reported in the literature. If there is a demand for this service then it seems that numerous organisations could supply it. A regional water agency could operate an information system based on user-pays or the service could be contracted out to brokers.

Third, the allocative mechanism must account for the complete range of values attached to water. Sufficient rights to protect instream values could be acquired by environmental organisations. Whether this should be done by a community-based organisation or a department acting as an agent of the state has not been analysed in detail. One significant challenge remaining in the area of practical institutional design has to do with so-called non-market values and the closure of the transferable rights mechanism with respect to these values.

5.2 Instream Use

In New Zealand the changing emphasis toward preserving instream flows has created tension between environmental groups and traditional users. Regional and national water management agencies have established minimum flow regimes using a range of mechanisms including conservation orders and river classification standards. Protecting instream values does not entail water consumption but it can affect the economic value of existing water rights.

5.3 Water Management Agency

The operational role for water management agencies has not been analysed in detail. In most situations where transferable rights are used, the agency monitors the impact of transfer on the interests of third parties. If two users consider only their private interests then their private interests will not necessarily result in efficient transfer. The possibility of purchase and sale of return flows takes into account the full utilisation of water in its present use and the full anticipated use at the new diversion. In this case buyers and sellers weigh up the full productive use of water in its present and anticipated use so

that trade brings about an efficient transfer. Agencies need the technical ability to detect violations and a legal ability to deal with violators.

5.4 Markets in the United States

Recent attempts have been made to study existing market activity and evaluate outcomes. Saliba (1987) found numerous water markets existing in the Southwestern states of the US. She concluded that they appear to be relatively efficient in allocating rights among consumptive users, such as agriculture, cities and industry. Moreover, the outcome of the transfers and third-party effects among consumptive users were reflected in market prices. However criteria for transfer approval procedures require some modification because they were not adequately accounting for instream values and water quality. Saliba's research highlights the need for policy that considers the balance between the additional transactions costs imposed on market participants and the benefits foregone as a result of inhibiting trade, the need to protect third-party damages and public interests foregone as a result of trade. The design of a regulatory structure which avoids "too much" regulation and "too little" regulation, somehow balancing the two extremes, remains a central issue.

Comprehensive data on the private, administrative and third-party costs of market versus non-market allocative mechanisms are not available. More limited data on market transactions have allowed analysts to see if trading activity is behaving in a manner consistent with efficient market performance. Saliba (1987) examined 5 markets with respect to the following criteria.

- (a) Transfer patterns: transfers within agriculture occurred from low valued to higher valued crops. These changes were largely in response to commodity prices and inputs costs. Water transfers also occurred out of agriculture to municipal and industrial use.
- (b) Similar market prices: data on municipal demand for water and returns to water in South Arizona agriculture were found to be similar between 2 sectors.
- (c) Third-party impacts: Western state law stipulates that third-party water users with a water right may not be injured as a result of water transfers. As Howe et al. (1986) note, this law is asymmetric because it does not recognise third-party benefits resulting from transfer. In Arizona, the water right holder has to initiate legal action to protect this right. Approval procedures that seek to protect third-party impacts are a major cost and may preclude transfer.
- (d) Instream flow and water quality: State agencies in Colorado,

Nebraska, Montana and Idaho can buy water rights to maintain instream flows. Arizona, South Dakota, and Washington allow a private party to hold a water right for wildlife habitat or aesthetic purposes. Transfers can affect water quality and court action has prevented transfers due to water quality considerations. Saliba (1987) notes that water quality impacts are not routinely considered in the transfer approval procedures and the burden of initiative rests with those who may be detrimentally affected.

Some states in the US apply the "no damage" principle to govern transfers of water rights. By only allowing transfers that will not injuriously affect other vested interests, parties to an exchange are forced to internalise all the costs that would otherwise accrue to parties downstream. This principle is equivalent to requiring that only the fraction of a water right actually consumed may be transferred in location. If all water rights are consumptive, this rule of transferability guarantees that third parties will not be damaged. Although instream water rights do not involve consumptive use they can interfere with the ability of the "no damage" rule to prevent damages to third parties. The impact of instream water rights on transferability depends on their site-specific location. Impact is greatest when the water course is fully appropriated and a large number of individuals holding water rights below the instream water right wish to transfer them above or within the reach of the instream right.

In the US the public trust doctrine has been applied to instream flows. In 1983, as a result of *National Audubon Society v. Superior Court of Alpine County, California*, restrictions were placed on diversions from Mono Lake on the grounds that the state had a public trust relationship to the environment and wildlife of the lake (Anderson and Leal, 1991). The establishment of public rights, through the doctrine of public trust, was soon to follow in Montana. In these two states, and other western states where the prior appropriation doctrine is used, the public trust doctrine is being used to create public rights that are superior to private rights.

5.5 New Directions in Australia

The Australian water economy is characterised by a sharply rising marginal cost for water supply, intense competition for increasingly scarce water supplies, ageing infrastructure and externality problems. Pressure for more efficient use is directed mainly at irrigation. In Australia, the agricultural sector accounts for 82% of total water use, irrigated agriculture uses about 72% of total sector use. Therefore modest increases in the efficiency of use in irrigated agriculture has

the potential to produce large quantities of water available for use elsewhere, in agriculture and other sectors.

Water rights in Australia, like New Zealand prior to the Resource Management Act 1991, were appurtenant to land. The only way in which water entitlements could be transferred from one area or one purpose to another was to purchase the land to which a water right was attached. This system was seen as imposing constraints on efficient water use. Transferable water entitlements are seen as an important step toward greater efficiency and flexibility in water use.

Pigram *et al.* (1992) report on a review and evaluation of the implementation of transferable water entitlements in Queensland, New South Wales, Victoria and South Australia. From the outset it is important to note that this review focuses on irrigation water use, although the issue of satisfying sustainability constraints and instream requirements is addressed and reference is also made to the possibility of intersectoral transferability.

Pigram *et al.* (1992) note three prerequisites for transferable water entitlements to function effectively.

- (a) Water must be owned independently from the land.
- (b) The volume of water that an individual has available for transfer, and any special conditions applying to the right, must be clearly specified in law. The actual volume available for transfer at any time will clearly depend on supply. Therefore volumetric entitlements should be specified in stochastic terms.
- (c) Security of tenure is an essential prerequisite for a privately negotiated transfer price.

Australian water doctrine is a temporal, non-priority permit system which emphasises state control of water resource development and use. Water ownership rests in the public domain and individuals receive the right to use water by obtaining a licence from the state water agency. Water rights vary from 1-15 years, volume restrictions can be applied during supply shortages and state agencies have the power to terminate a licence if the conditions in the licence are violated. Introducing transferable entitlements into this regime has highlighted the importance of tenure security. Results from a research program at the Centre for Water Policy Research indicate that policy analysts will need to give greater consideration to the issue of what property rights to water should be established and to the broader issue of ownership. Insecurity and uncertainty will impair the effective and efficient operation of the allocative mechanism.

When discussing the introduction of transferable water entitlements, irrigators raise the following concerns.

- (a) Reduced reliability because of the activation of " sleeper" licences. These licences represent unused irrigation water. Introducing transferability means that the management agency will be confronted with the activation of rights which had not been previously used. Some states have imposed a reduction factor (see Table 4.2) on transfers to cope with this problem. The impact of this approach on efficiency is not clear.
- (b) The fear of negative economic consequences from transferring water arises when transfers are proposed between geographical regions. In the U.S. this phenomenon is referred to as area-of-origin impact. For example, the transfer of water from a rural to an urban area could lead to falling land values, a lower rateable base, lower local government revenue, deteriorating infrastructure, and so on.
- (c) Financial institutions would also be concerned if the value of their security was diminished as a result of water transfer.

The opinions of water management agencies is summarised in Table A4.6. Salinity considerations and the possibility of increasing the load on existing systems were considered important. Reduced reliability and negative area-of-origin impacts were not considered important to most agencies.

Transferable water entitlements have been introduced in several states of Australia. The markets are quite limited because of restrictions on transfer and the attenuation of rights regarding the entitlements and security of supply. Table A4.7 summarises some of the key features of transferable water entitlements in Australia. Irrigators strongly support transferability in the drier areas of New South Wales and Southern Queensland where the reliability of supply is much lower. Redistribution of water rights between users has occurred and the transfers are seen as an important mechanism for the irrigation industry. Although concerns expressed over permanent transfers of water rights are unfounded, most agencies are approaching the introduction of permanent transferability with considerable caution. The Australian policy initiative is gaining acceptance. Widespread endorsement must await further refinements to water resource allocation policy (Pigram *et al.*, 1992).

Table A4.6 Agency rankings of potential problems with transferable water entitlements

Potential problems	VI	I	NI
Increased load on delivery/drainage channels	2	1	1
Increased soil salinity in receiving area	3	2	-
Increased water salinity in receiving area	3	1	-
Reduced reliability in area-of-origin	1	-	3
Reduced irrigated crop production in area-of-origin	-	1	3
Reduced real estate values of farms transferring	-	2	2
Discounting of securities on loans	-	2	2
Market dominance	-	2	2

Source: Pigram, *et al.* 1992

5.6 Conclusions

Tradeable water rights have been used for a number of years in water-short regions of the world. Conclusions with respect to the criteria used in this report follow.

Effectiveness

The case studies show tradeable water rights to be effective in allocating water among consumptive users. There is little evidence of tradeable rights being used to protect and allocate water for instream uses.

Efficiency

Evidence suggests that tradeable rights will encourage efficient use within and between classes of consumptive users. Full allocative efficiency requires an equalisation of all values - use and nonuse - at the margin.

Equity

Third-party impacts and broader community values are incorporated *via* an agency and/or the courts. Whether this is the most effective and/or efficient way of proceeding is unknown. Attention should be given to whether or not the arrangement places the burden of proof on the community to challenge transfers effected in the market.

Public finance

Limited data suggest that agency costs are not explicitly, or fully, incorporated into water policies using tradeable rights. Cost recovery is only part of the issue. The role of water agencies has yet to be analysed in detail.

Table A4.7 Features of transferable water entitlements in Australia

	New South Wales	South Australia	Queensland	Victoria	Tasmania
When & scope	1983 State-wide	1982 Local	1987 Local	1987 Local	1989 Local
Duration	Varies	Permanent or temporary	Varies	One-year	One-year trial
Transfers between sectors	Depends on duration	Irrigators & others	Irrigators	Irrigators	Irrigators
Spatial restriction	Within same river Between rivers	Within same river Aquifer zoned	Within same supply system	Within same supply system	Within same supply system
Volumetric restriction	Minister on case by case	Clawback 10% if to irrigator 70% if to other sector	10% of nominal allocation None in some areas	None subject to stock & domestic allocation	No limitation
Protection of third parties	Agency sanction No \$ compens'n	Agency sanction No \$ compens'n	Not explicit	Agency sanction No \$ compens'n	Agency sanction Must benefit scheme
Special conditions	Security of supply	Delivery drainage of channel Salinity	Mortgagee written consent	Delivery drainage of channel Salinity Written consent of vested int.	No private transfers
Agency fee	\$75 for annual \$250 for permanent	\$9.50 ML ⁻¹	Scale per transfer: 1st-\$100 2nd-\$150 3rd-\$200	\$70 per transfer	No charge
Price	Negotiated buyer & seller	Negotiated Register kept	Negotiated Register kept	Negotiated	No market price

Source: Pigram, et al. 1992

6.0 TRANSFERABLE DEVELOPMENT RIGHTS

Transferable development rights (TDR) have been advocated by planners since the early 1960s. The basic idea is to make unused air space a transferable commodity. For example, the development right could be defined as the difference between a building's actual height and the permitted height. Therefore, a three storey building within an area zoned for buildings up to 10 storeys has an "unused entitlement" of 7 storeys. TDR effectively sever these rights from the land and make them transferable to other sites. The transferred rights can then be added on to the transferee site in excess of the limit set by planning regulations at the transferee site. The building owner accepts a restriction - e.g. control on demolition - in return for actual compensation.

Boast (1984) uses the Planning Tribunal's decision in *New Zealand Historic Places Trust v Wellington City Council (1979) 6 NZPTA 538* to illustrate the potential of TDR. The Historic Places trust had appealed to the Tribunal to delete a building from its register of historic buildings. The 19th-century building was located in a part of central Wellington zoned for high-rise development. In the absence of compensation to the building owner, the Tribunal considered the restriction too harsh and upheld the Wellington City Council's decision. Under a TDR system, the owner can sell the unused air space.

In general TDR are a land use tool that seeks to accommodate pressures for growth and development while preserving important natural resources. It is an instrument for balancing the demand for environmental preservation against the demand for urban growth. New York was the first city to adopt a TDR ordinance in 1968. TDR programs operate to rearrange density within a planning area for the preservation of some valued resource in the community. This may be historic preservation as in the Central Wellington, urban land transfers as in Florida, air rights as in New York city, or preservation of agricultural land, forests or unique habitats. To work, TDR require the existence of pressure for growth.

6.1 Design of TDR

The title to a parcel of land includes a bundle of rights, such as the right to air space and the right to develop the land's potential. Under TDR, the development potential of land is separated from the basic land value and transferred to another parcel of land. By transferring the development right from areas to be preserved to areas of high density growth the following objectives may be accomplished:

- (a) Town and cities may be able to preserve large areas at little cost to the community. The alternative of outright purchase

is costly. The option of zoning at low density levels may not be politically acceptable. Issuing development rights and allowing their sale provides compensation to those forgoing development.

- (b) Enables the designation of broad areas as preservation areas which may include natural resources such as forest land and watersheds important for water supply.

Any TDR ordinance must define the transferee and transferor lots and the relationships that are to exist between them. For example; can the lots be held under different ownership? Do the lots have to be adjacent? What are the limits of the excess over existing heights or floor area ratios permissible for transferee sites. A TDR policy comprises three elements:

- (a) The tract of land on which the rights are issued. Design of an effective preservation restriction on the transferor site.
- (b) Definition of the rights, including duration and the units available for transfer. Floor area and floor ratio are widely used although "dollar's worth" and cubic feet are other possibilities. Area of buildable floor area is the simplest and probably the best unit of transfer (Shales, 1974).
- (c) Areas selected to receive the rights. Intercity transfers would appear to be desirable -the states of New Jersey and Connecticut permit this, but it is rare owing to the parochial political reasons.

Obviously, TDR will not work if there is no market for the development rights. In particular, TDR requires a climate of growth to work. It is precisely under conditions of growth that TDR policies are required. Local authorities can influence the market when it defines bulk and density limits. If these parameters are set at exceedingly high levels then the prospect for a market to develop is reduced. Similarly, if the geographic scope for transfers to occur within is narrow then the historic place could be dwarfed by tall buildings - if it is too large then the market will be thin and the demands for urban infrastructure will increase.

6.2 TDR in Operation

No detailed data are available and the evidence summarised below is quite general.

6.2.1 United States

The world's first TDR ordinance was adopted in New York in 1968. Owners of listed historic buildings and areas of open space could transfer the unused development right to other lots in the same ownership provided that the transferee lot is within a certain distance from the transferor lot. Additional restrictions existed for the amount by which the transferred floor space may exceed height limits for any one transferee site. The New York system has been adopted in a number of other municipalities, including San Francisco. Costonis (1974) proposed a refinement to the basic TDR model by incorporating a "TDR bank" administered by the City. Known as the Chicago Plan, surplus TDR (obtained by purchase or from buildings owned by the City) were accumulated by the bank who could then sell TDR to owners of plots in designated high-rise areas for a profit. The Plan was not put into operation in Chicago; although Honolulu has implemented a version of the Plan. Part of the reluctance to implement the Plan arises from a lack of funds to buy up unused development rights and local authority conservatism (Boast, 1984).

Local authority implementation of TDR in the U.S. shows the impact of political and fiscal constraints on the extent to which TDR policies are embraced. The Costonis proposal for a "bank" administered by the city of Chicago has analogies with the "banking" role of agencies in the management of other natural resources *viz* fisheries and water. Incorporating a "bank" or agency in the policy has the effect of closing the model with respect to management, creating incentives for the agency to incorporate the economic impact of their decisions into their decision making. For example, a self funding "bank" of TDR would have to consider the revenue impact of adjustments to its portfolio of TDR.

Shales (1974) has examined the incidence of costs and benefits of a TDR policy. The cost to a municipality is slight in situations where a market exists for TDR at prices in excess of their cost to the transfer agency. Owners and occupants of transferor properties and their neighbours were found not to suffer economic cost, and in some cases have benefited. Developers and occupants of transferee sites were found to pay no more than would have been required without TDR.

6.2.2 New Zealand

Although the extent to which planning law can restrict the activities of land owners without compensation lacks the Constitutional dimensions evident in the U.S., planners in New Zealand are confronted with the same underlying issues. Common law in the U.S. does offer planners an idea of the limits to which the landowners rights can be controlled. The Supreme Court has drawn the line at

"reasonable return" - that is, planning restrictions may be compensable if they frustrate a landowner's legitimate expectations on investment. Boast (1984) sees this as a problem with devising TDR ordinances in New Zealand because the courts will need to establish whether use of TDR options provides adequate compensation. However, it would appear that the "cost-benefit" test in the Resource Management Act will go some way toward the establishment of a criterion - such as reasonable return.

The use of TDR to achieve preservation objectives was recognised, but not implemented, by Auckland City Council planners in 1974. Christchurch City adopted a TDR ordinance that enabled transfers to occur where the owner of the protected building also happened to own land elsewhere in the city; in other words the transferor and transferee lots are required to be in the same ownership. The Christchurch ordinance does not provide for transfer between independent buyers and sellers -there is no opportunity for a market to develop.

In 1982 the Auckland Regional Planning Scheme made a clear recommendation that local authorities consider adopting TDR as a means of providing compensation for amenity controls (Boast, 1984).

Pressure in Central Wellington's retail and office buildings market resulted in the destruction of many old buildings. In response Wellington City Council initiated new planning initiatives for the preservation of historic or noteworthy buildings. Transferable development rights were introduced into the Wellington District Scheme in 1983 by way of a variation (McKay, 1987). The ordinances aimed to achieve the retaining of historic buildings and encourage the strengthening of earthquake risk buildings. For these sites, the basic plot ratio was increased from 4.5 to 5.5. If the actual plot ratio of an existing building was less than 5.5 then the development right (i.e. the difference) was transferable.

The first transfer, of some 1,200 m², was finalised in 1984. Soon to follow was the notable transfer of some 7,000 m² from the St John's Presbyterian Church on Willis Street. The income generated from the transfer is intended for maintenance and upkeep of the church. However, a scheme change has prevented the transfer of development rights from undistinguished buildings and transfers between different zones within Wellington City.

6.3 Lessons From TDR Programs

A number of practical insights have emerged from the application of TDR programs implemented in the U.S. (Pizor, 1978). Most programs are established on a city or sub-city basis e.g., density transfers in Chicago, New

York or Wellington cover small areas. Most transfers have involved residential areas. Most TDR schemes have been permissive and not mandatory.

- (a) TDR are complex at the level of implementation.
- (b) Although TDR have the capacity to preserve large land areas, they must be located within an overall planning program. Moreover, there needs to be a degree of rigidity in the zoning process because, in a flexible environment, developers can seek (less expensive) zoning adjustments, instead of paying for TDR.
- (c) Successful TDR programs are based on sound physical plans and financial analysis of housing, land and development markets.
- (d) TDR is not a no-growth alternative. Indeed it is very much designed to encourage a rearrangement of existing development densities.
- (e) Provided the market is large enough it is unlikely that development right owners could thwart a program. Scarcity will drive up the price and increase the opportunity cost of holding on to a development right.
- (f) The number of landowners in both the preservation and transfer area must be sufficiently large to ensure that a market can be created. Moreover the area to be preserved should be sufficient to achieve the goals of the program. Large areas are required to achieve farmland preservation, whereas small amounts of land are required to accomplish the preservation of historic sites. If the cost of a development right is too high builders will be unable to use them. The market must be sufficiently strong to accommodate types and densities proposed by a transfer.
- (g) When implementing a TDR program it is important to think through related and additional considerations for the transfer district; carrying capacity, relation to existing developments and the characteristics of the community.

6.4 Conclusions

Transferable development rights have been promoted by planners for many years; few authorities have fully embraced the concept. They have application to historic buildings, landscapes, rural land, and unique ecosystems. Conclusions with respect to criteria used in this report follow.

- Effectiveness** Empirical data on the effectiveness of TDR in achieving policies such as the preservation of historic buildings is limited. The New Zealand case study shows that preservation goals can be achieved.
- Efficiency** Efficiency gains have been limited by the piecemeal approach adopted. TDR have not been comprehensively used.
- Equity** TDR are equitable to the extent that owners of assets are compensated.
- Public Finance** Some claim that TDR are fiscally neutral within a jurisdiction. Process can be self-funding as long as an adequate market exists.

APPENDIX 5. SUBSIDIES, GRANTS, COMPLIANCE SCHEMES, OFFSETS ETC.

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1.0 SUBSIDIES AND GRANTS

Many countries have a substantial practice of applying subsidies as instruments in realising their environmental policy objectives. It is difficult to pick out one or two case studies. In what follows subsidy schemes (and levels) are discussed for a couple of countries. The examples concentrate on payments made, as compensatory payments, for conservation and environmental purposes. This is very popular in the EEC at the moment and forms the justification for many farm subsidy programmes.

1.1 The UK

Under a programme of Countryside Stewardship positive incentives are provided to achieve environmental improvement for public benefit. The scheme is open to farmers (including tenant farmers), estate owners, voluntary bodies and local authorities. The scheme targets specific landscapes such as:

- Chalk and limestone grasslands
- Lowland heath
- Waterside landscapes
- Coastal areas
- Uplands
- Historic landscapes
- Old meadows and pastures.

The incentives come in three forms, annual payments, capital payments and payments available only for work that is essential to achieve good environmental management. Some examples are given in the table below.

Appendix 5

Annual Payments		£/ha
Lowland heath	-Base payment -For measures to improve the quality of the heath -Re-creation of lowland heath on improved land	20/ha 30/ha 250/ha
Waterside landscapes	-Conservation of existing waterside grasslands -Creation or restoration of waterside landscape	70/ha 225/ha
etc.		
Capital Payments		
Scrub management	Scattered scrub under 25% scrub between 25-75% scrub more than 75%	100/ha 250/ha 500/ha
Clearance of eyesores		120
Hedge planting		1.75/m
etc.		
Work essential to achieve good management	Fencing:post and wire sheep fencing	0.80/m 1.20/m

Source: (Countryside stewardship, 1992)

1.2 Germany

Encouragement to change to a low intensity (extensive) farming system. Goat and sheep farmers who farm,

- at least 3ha inside the 'good' quality land (not specified),
- and who graze this land only with sheep and goats between April and September;
- and don't have more than 6.6 sheep/goat per ha,

will get 180 DM/ha or 13,000 per farm.

Domestic buildings subsidies. Mainly subsidies for steps that will lead to a reduction of emissions - especially effluents up to 35% of the total costs (max 28,000DM). If the investment takes place in such regions where waterways are under national protection, and additional 25% (max 20,000) will be paid towards the total cost or a low interest mortgage up to 143,000DM/ per annum.

Allowances for actions to protect the biotopes, and landscapes. Protection of species, limitations on utilisation to protect nature and to build a network between biotopes. Compensation is paid for the limitations imposed on the use of the land (150-1400DM/ha)

Assistance for continuing education in farming and forestry.

Assistance for the care and maintenance of 'green land' (the rate depends on the slope).

Financial compensation to protect wetlands (200-800DM/ha/year)

Grants for the environmentally friendly storage of fertiliser.

Grants for the conversion from traditional to biological farming (up 350Dm/ha/year)

Grants to compensate for limited use of riparian strips.

Grants for farmers not to fully plant to the borders of their fields (leaving a grass strip to form an ecotope between grassland and field). If they do this they receive grants from 100-200Dm/year.

1.3 The Netherlands (Policies for nature and landscape conservation)

In The Netherlands the policy for conserving nature and landscape in agriculture is largely prescriptive. The Government identified the areas that had high natural science or landscape value. It is in those areas that the relation between agriculture and nature and landscape is most intense and a conflict of interest first appeared. To control these conflicts of interest the Dutch government developed a policy programme based on the Policy Document on Agriculture and Nature Conservation. In this document the government presented three instruments aimed at reducing the tension between nature and landscape. These instruments are:

- management agreements;
- maintenance agreements;
- creation of nature reserves.

1.3.1 Management agreements

Management agreements are private contracts between individual farmers and the Dutch government made according to civil law, by which the farmers voluntarily agree to use agricultural land in such a way that the value of nature

and landscape is sufficiently taken into account. The agreement runs for six years and the contract cannot be cancelled unilaterally by the government. The agreed management conditions refer to the intensity of land use and the manner of land use itself.

In return for carrying out or eschewing particular activities, the farmers receive certain transfers from the government to compensate negative income effects. The regulation identifies eight management goals, each with a limited number of packages of management practices. The compensation paid to farmers for adopting a management package is based on:

- decline in returns;
- extra man-hours;
- difference in operating costs;

and depends on the soil types. By the end of 1990, management agreements had been concluded for about 16,300 ha. These agreements involved 2,600 farmers.

1.3.2 Nature reserves

The second instrument is the creation of nature reserves. This means that if, in an area worthy of nature and landscape conservation, this conservation cannot be combined with agriculture in the long run, the government can decide to purchase such areas. This government-purchased agricultural land is cultivable and controlled by the State Forest Service or by private conservation societies.

By the end of 1990 approximately 10,000 ha had been purchased.

1.3.3 Maintenance agreements

By using this instrument, the government is able to conclude agreements with farmers whereby the latter agree to maintain one or more scenic features, such as pollarded willows or hedge banks, in a certain way in return for financial compensation. In practice, maintenance agreements come down to separation of functions at farm level, because no special conditions are imposed on agriculture. The farmer is remunerated only for services rendered on scenic features that belong both literally and figuratively to the fringe of his farming.

At the end of 1989 some 4,300 agreements in 66 regions were operational.

1.3.4 The EC less favoured areas directive

This directive is aimed at the "continuation of farming, thereby maintaining a minimum population level or conserving the countryside". Farmers receive a direct income payment for staying on in certain less favoured areas. The policy document on Agriculture and Nature Conservation identified 'less favoured areas'. Therefore in The Netherlands this EC regulation has been coupled to the system of 'management regulations'. In practice, this means that regions designated as management areas are periodically announced to the European Commission as less favoured areas. By the end of 1989, management areas in The Netherlands with a total area of 48,217ha had been placed on the common list of the European Commission. By the mid 1990s, less favoured areas agreements had been concluded with 1500 dutch farmers for 10,700ha. The maximum annual payment for the farmers under the EC programme is 180 guilders per ha, rising to 260/ha in peat areas.

1.3.5 Budgetary consequences

The budgetary costs consist of three categories:

- administrative costs
- subsidy costs
- cost of providing facilities.

The administrative costs are of the order of 6 million guilders. The expenses arising from management and maintenance agreements fall into the category of subsidy costs. In 1989 (see table below) these costs amounted to about 17.2 million guilders. The following table (A5.1) gives the break down of these costs.

A5.1 Government expenses (budgeted and actual) relating to the policy outlined in the Policy Document on Agriculture and Nature Conservation (million Dutch guilders; 1978-1991)

Year	Management agreement Budgeted	Purchase of nature reserves		Maintenance agreement		"LFA" agreements
		Actual	Budgeted	Actual	Actual		Actual
1978	13.7	0.1	-	7.2	0.7	-
1979	10.9	0.1	24.9	31.2	0.7	0.0
198	5.1	0.2	24.9	27.8	0.7	0.1
1981	7.7	0.5	36.4	26.8	0.7	0.1
1982	9.4	1.2	23.5	18.3	0.9	0.3
1983	9.2	1.7	17.5	29.3	1.0	0.5
1984	9.3	2.2	22.5	25.7	1.5	0.6
1985	9.4	4.0	31.7	32.8	2.5	0.6
1986	11.0	4.5	30.0	26.0	3.4	0.7
1987	12.5	6.6	26.2	18.7	4.0	1.0
1988	9.6	8.7	20.1	-17.6	4.0	1.2
1989	11.6	11.1	17.5	23.4	4.2	1.9
1990	15.6	-	19.0	-	4.2	-
1991	21.0	-	24.7	-	-	-

Source: (Slangen, 1991, 342)

As far as the management agreements are concerned, it is striking that in the past the actual expenses were much lower than the budget estimates. This suggests that management agreements did not achieve the results that the government expected. In 1989 the compensation paid to farmers for a management agreement averaged 845 guilders per hectare.

By purchasing land and creating nature reserves the government is taking the 'production' of nature and landscape into its own hands. Therefore the costs this incurs can be regarded as costs of government-provided facilities. These costs consist of the purchase money to buy land and the costs of management and maintenance. The purchase cost has been running at 20-30 million guilders a year.

For 1989 the total cost of these three categories was 57.8 million guilders (i.e the programme cost of this policy). Once all land targeted for this programme is under the policy the annual cost will be 85 million guilders, the total purchase cost will need to be 2.6 billion guilders.

1.3.6 Conclusions

The Dutch programme is a very expensive programme. Participation of farmers has not been as great as expected. This is caused by the limited choice by farmers as to which land to include and the bureaucratic nature of the subsidy payments. In terms of effectiveness in achieving goals, this is of course difficult to measure since the goal is conservation.

The combination of statutory regulation and subsidies are not seen by farmers as encouragements to achieve a meaningful integration of agriculture, nature and landscape. To achieve this, the subsidy system will have to be redesigned. Farmers should no longer be paid for not doing certain jobs, for this is not very stimulating; instead they should be encouraged by being remunerated for carrying out certain tasks.

The Dutch government has decided to designate 200,000 ha as management and reserve areas. These 200,000 ha will require a sum of about 2.6 billion guilders for land purchase and a sum of 218 million guilders annually for management agreements and to meet the cost of managing and maintaining the nature reserve. These sums might seriously restrict the feasibility of the policies of land management in the future.

2.0 COMPLIANCE SCHEMES, OFFSETS, NON-COMPLIANCE FEES AND PERFORMANCE BONDS

2.1 USA (Compliance schemes)

Sodbuster programme: denies farm programme benefits to producers who plant commodities on highly erodible grassland or forestland unless they obtain an approved conservation plan and fully apply that plan before planting a commodity.

Swampbuster programme: denies farm programme benefits to anyone who converts wetlands to crop production.

Conservation Reserve Program: is a long-term land retirement programme designed to help farm owners and operators conserve soil and water resources. Participants agree to retire land for a period of time (generally 10 years). In return, they receive annual rental payments and up to half the cost of establishing a soil-conserving cover crop. The CRP was originally aimed at highly erodible land. In the 1990 Farm Bill, the CRP was extended to emphasise water quality by including "such lands that contribute to degradation of water quality or would pose an on-site or off-site environmental threat to water quality if permitted to remain in agricultural production."

Water Quality Incentive Program: provides financial assistance for farmers in "environmentally sensitive" areas to voluntarily adopt water-quality-enhancing best management practices (BMPs). This programme is to be targeted to areas where nonpoint source problems from agriculture are known to occur, such as those watersheds identified under the Water Quality Act.

In light of research conducted it appears that the economic incentives may still not be sufficient to entice a change in behaviour. Also the future attractiveness of government programmes is uncertain. Budgetary concerns may result in a reduction in programme benefits. That, coupled with increased demand for U.S. farm commodities in Eastern Europe and the Third World, could greatly reduce the attractiveness of programmes and, thereby, the incentives for compliance (Ribaud, 1992).

In terms of **efficiency** there is much concern about the cost per ton of eroded soil avoided. Especially as the CRP programme is mainly aimed at soil erosion control. The measure used is to retire land for payment. Alternative ways would be to reduce erosion through better management techniques (strip cropping, minimum tillage, contouring and terracing). Sinner (1990) concludes that "on much of the land being enrolled in the CRP, we are spending far more than necessary to control soil erosion. Still, USDA continues to enrol acreage in the CRP to meet the statutory minimum of 40 million acres. If the government decides to continue funding soil conservation, the focus should be shifted away from land retirement" (Sinner, 1990: 11).

2.2 Offsets

Offsets can work at local, national and international levels. One US power generating company, for example, has recently undertaken to offset all further increases in CO₂ emissions by reclaiming Latin American rain forests. Two more local examples are briefly discussed below. The second example is not so much an offset as an example of compensating someone for some environmentally enhancing work. This is very much in line with EEC thinking

on Beneficiary Compensates principle, in which the beneficiaries, in the agricultural example the general population, compensates the farmer for the measures that enhance the environment. i.e. the subsidies and grants discussed above.

2.2.1 Germany (source: Young, 1992, 167)

In Hessen, the government is concerned about the impact of building and industrial development on the integrity and quality of the German landscape. To prevent further deterioration, developers are given an economic incentive to offset any environmental damage that they cause or, alternatively, to pay for the government to offset that damage. Often it is more cost-effective for developers to offset the damage themselves than pay the government to offset it for them.

When a development proposal is received it is assessed for its likely effect on:

- habitat potential for flora and fauna;
- the scenic quality of a landscape;
- recreation potential; and
- ecosystem functioning from a nutrient cycling water cycling and air quality viewpoint.

Subject to compliance with building code requirements, approval is then given on the condition that the developer pays a 'redress contribution' to enable the lost environmental functions and qualities listed above to be replaced.

The size of the offset payment or environmental redress contribution, as it is known, is determined via a system of non-linear formulas and the market cost of offsetting the damage. Substitution within a category is permitted but, on the assumption that loss in one category cannot be offset via improvement in another category, substitution between categories is not permitted.

As a result of this legislation, developers are revising proposals so that storm water is kept in on-site dams, trees are replaced, top soil is retained, lawns replace pavement, public access is given to as much of the site as possible and flora and fauna habitats are maintained.

2.2.2 USA

Two and a half miles off the beaches of Santa Barbara County, Calif., oil and gas seep from fissures on the ocean floor. The consequence of this seepage is a thick gooey carpet of tar that washes up daily on the beaches.

To tap these natural polluters, the Atlantic Richfield Co. (ARCO) ordered up two pyramidal traps. Placed over an area with a large concentration of seeps, they will sit on the sea floor like upside-down funnels, collecting gas and oil. The project is expected to yield 50bbl. of oil and 600.000 cu.ft of gas a day, which will not be enough to offset the \$8 million investment made by ARCO and its partners. The capping operation, however, will produce other benefits.

Geologists believe the seeps are bubbling as many as eight tons of hydrocarbons a day to the surface and releasing them into the atmosphere, causing much of Santa Barbara's air pollution. Under a deal struck with state and local governments, the oil companies will get an air pollution credit: for every two tons of hydrocarbons they eliminate, they will be allowed one ton of sulphur- and nitrogen oxide emissions from future drilling in the Santa Barbara Channel. The pact should clear the way for developing a nearby well that could produce as many as 4,100 bbl. of oil a day. Says ARCO's offshore operations chief, "We just couldn't do it without the trade-off."

3.0 CONCLUSIONS

The contribution of subsidies to economic efficiency are hard to assess. Granting subsidies, as compensations in case of economic hardship, might be more socially desirable in the long run than forcing standards upon firms which lead to shutdowns. On the other hand, "windfall profits" have been reported to occur (Opschoor and Vos, 1989;117). In several other cases it has been shown that subsidies create inefficiency.

Subsidy systems also have a low compatibility with the 'polluter-pays principle', but nevertheless are widely applied and an important tool for environmental policy.

Non-compliance fees often have not been very successful because the fee level was too low. As to its economic efficiency, the level of non-compliance fee, in principle, equals the profit surplus gained by violation of environmental regulations. The polluter is left with a private benefit-cost decision only, namely the balance between the profits gained by violation and the fee to be expected (Opschoor and Vos, 1989; 119).

In the US, polluters might expect to be charged for all the social costs caused by non-complying activities. This will raise the incentive effect.

The administrative efficiency of non-compliance fees is low. These fees normally are enforced through court cases.

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