

Social Research Working Paper

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**An Annotated
Bibliography of
Market Based Policy
Instruments**

M Higson and G Kaine

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1. Introduction

In this annotated bibliography we review the recent literature on the use of economic instruments to manage natural resources. Terms like economic instruments and market based instruments are used to refer to a variety of policy instruments such as taxes, charges, subsidies and trading schemes that depend on the use of price signals to influence access to natural resources. Such instruments are increasingly being considered by governments as a means of balancing the competing environmental, economic and social needs of communities.

The review is intended to provide a brief overview and guide to some of the current literature in this rapidly developing area of natural resource policy. In the review we focus on the different types of economic instruments available, their strengths and weaknesses and the issues that should be considered in choosing among them.

2. Annotated Bibliography

Bardsley, P. (2003)

Missing environmental markets and the design of “Market-Based Instruments”

6th AARES Annual National Symposium on Market-Based Tools for Environmental Management

In this paper the author investigates some of the broad issues associated with the use of market based instruments given their rise in popularity in natural resource management policy. The author argues that information asymmetries or hidden information lie at the root of missing or imperfect markets therefore policy needs to be designed around information constraints with an in-depth case-by-case study of each policy problem.

The Bush Tender habitat procurement auctions are used as an example to highlight the role of market based instruments in environmental policy. These auctions were trialed by the Victorian government to manage and preserve areas of remnant habitat.

- œ Management of these areas was difficult as the resources were on private land. This created inadequate incentives for private landholders to protect the habitat. Without markets to trade in biodiversity services there was no way for private landholders to realise the economic gains from providing biodiversity services.
- œ The solution to this problem focused on the supply side of the market with the government demanding the goods on behalf of the public.
- œ Scientists and economists developed a methodology to value biodiversity services which overcame difficulties in valuing the services provided.
- œ There was asymmetrical information costs involved as there were incentives for landholders to overstate private costs. To address this discriminating price, closed bid auctions worked well as they introduced competition and honest bidding.
- œ Technology and careful contract design were important when monitoring whether or not agreed upon services were actually being carried out. Digital cameras were included in the landholder’s contract with a schedule of photo points and dates to address this issue.

Bowers, J. (2003)

Instrument choice for sustainable development: an application to the forestry sector

Forest Policy and Economics, *article in press*.

Bowers views the selection of policy instruments as a principal-agent problem:

“The principal, the state, wishes to induce the agent, the forestry industry, to manage and exploit the forests in conformity with its requirements for sustainable development. The agent’s interests diverge from those of the principal and in the absence of the use of instruments by the principal, would not choose sustainable forestry”, (p1).

- œ Within the principal-agent framework three reasons for policy failure are highlighted: moral hazard, first mover failure and adverse selection. All stem from information asymmetries and the costs of sharing or uncovering information.
- œ It is recommended that “where policy failure results in irreversible effects, the Polluter Pays Principle (PPP) should not be applied”, as it is “incompatible with the design of policy instruments to minimise the risk of failure”, (p1, 11). Bowers based this argument on the finding that positive feedback loops in instruments minimise policy failure while instruments based on the PPP do not offer such loops as they penalise participants for non-compliance. Efficient instrument choice in these circumstances “requires that the agent be rewarded for contributions to achieving the policy objective”, (p1).
- œ The author cautions against applying typical market behaviour and valuation assumptions when designing new markets for environmental goods and services:
- œ *“Market behaviour is not innate and consumers entering markets for goods with which they are unfamiliar need to learn what values are appropriate ...Only once consumers have understood the market will they possess a [Willingness To Pay] WTP”, (p4).*

Cape, J. (1997)

The integration of environmental and economic considerations in the development of policies in relation to water allocation

Environment Australia: Environmental Economics Research Paper, 6.

Cape investigates water allocation policy and irrigated agriculture. Irrigated agriculture uses the majority of freshwater resources and contributes significantly to the economy. Policy discussions are set in Australia with a discussion of current and future policy options for water allocation including economic instruments such as non-compliance fees, investment subsidies, tradable water rights and tradable discharge permits.

- œ Cape stresses throughout the paper that water allocation policy needs to focus on increasing the efficiency of irrigation and urban water supply systems to reduce losses from the system and to increase water available for use in the environment. It was emphasised that there needs to be an adequate supply of water for the environment but also that the productive capability of irrigation is maintained.
- œ Future policy options highlighted included proportional non-compliance fees, more effluent charges based on drainage water and investment subsidies.
- œ Overall policy recommendations included the need for increased stakeholder consultation in policy development and for policy options to better reflect “the physical capacity of irrigation supply systems to deliver water in such a way that irrigators are in a position to respond to policy”, (p90).

Chaudhri, V. (2003)

Market based instruments and NRM: back to basics

6th AARES Annual National Symposium on Market-Based Tools for Environmental Management

Chaudhri discusses ways to achieve appropriate and effective land-use change on privately held land. There is also a lot of discussion about frameworks for market based instrument implementation where it is emphasised that there needs to be a portfolio approach to policy implementation.

- œ The author opens with consideration of the origin of environmental problems and the complexity of natural resource management. Key points raised were that:
 - Many environmental resources are inadequately valued in market systems while other resources have multiple outcomes, some of which may be valued in the market while others are not.
 - “Markets are generally efficient in allocating resources to ‘exploitation activities’ but may be ineffective with respect to investment in environmental conservation”, (p3).

- œ The author states that current environmental management policies suffer from three specific problems
 - Insufficient information to make reasonable choices – there is often an implicit assumption that standard benefits arise from interventions across the landscape which ignores the heterogeneity on both sides of the market.
 - Previous policies have failed to take into account the incentives of individual agents and the way that policy influences behaviour.
 - Lack of ex-post measures and accountability processes has limited policy learning and evolution.

- œ Chaudri believes care needs to be taken not to overstate the ability to define property rights and trade them as the costs of setting up a trading scheme are not necessarily recouped by future trading. Further, it is possible that the perceived gain of exploiting heterogeneity may be outweighed by perceived cost of constructing the market.

Davis, D., & Gartside, D. (2001)

Challenges for economic policy in sustainable management of marine natural resources

Ecological Economics, 36(2), p223-236.

The authors of this article focus on different approaches to achieving sustainable management of marine resources. Economic instruments, property rights, economic rent, and sustainability are identified as four areas of economic policy relevant to the management and development of these resources; economic instruments are argued to be particularly relevant to the sustainable management of scarce marine resources.

- œ Economic instruments are attractive as they send a clear signal in the market to consumers about the cost of producing a particular product and to producers about the relative valuations that consumers place on resources. Such signals and incentives are useful to co-ordinate consumption and production behaviour, directing resources to their most valued uses.
- œ Further, economic instruments allow for adaptive choice and the decentralisation of decision making to those whose behaviour is to be modified. However, this comes at the cost of relying on markets to allocate scarce resources whose inefficient exploitation can have serious, and possibly irreversible, consequences.
- œ Market failure occurs when prices do not adequately reflect the true value of the good in question and can increase the potential environmental impacts from exploitation of natural resources.
- œ Any policy solution requires a net benefit to society from the change, i.e., the new system should not impose more costs on society than the problem being solved.
- œ Markets can distort values when they are based on poor resource information.
- œ Economic instruments are underpinned by technical or biological considerations.

European Environmental Agency (1996)

Environmental taxes: implementation and environmental effectiveness

Environmental Issues Series, No. 1

This paper contains an in depth discussion about environmental taxes, their purpose and implementation within the European community. Particular attention is paid to barriers to the implementation of environmental taxes and potential solutions to overcome them.

- œ The purpose of environmental taxes is to “correct false price signals in the market-place by incorporating the costs of pollution and other environmental costs into prices”, (p3).
- œ The main barriers to implementation of environmental taxes are their negative impact on competitiveness, employment and low-income groups.
- œ The author suggests that these issues can be overcome through careful design, use within a package of policies and green tax reforms, gradual implementation and extensive consultation.
- œ It is argued that there is the potential for greater use of environmental taxes, particularly to tackle the diffuse or mobile sources of pollution that are an increasing concern.
- œ There are a number of different types of environmental taxes (cost covering, incentive, and fiscal); in practice a mixture may be used.
- œ The paper outlines a checklist of factors required for the successful implementation of an environmental tax.

Falconer, K. (1998)

Managing diffuse environmental contamination from agricultural pesticides: an economic perspective on issues and policy options, with particular reference to Europe

Agriculture, Ecosystems and Environment. 69, p37-54.

In this article Falconer reviews pesticide contamination control issues and the policy tools available to reduce pesticide use to achieve environmental improvements. In particular, various market mechanisms are discussed including taxes, subsidies, insurance schemes and tradable permits. Other policy options outlined include voluntarism, advice and education, and regulatory approaches.

Policy Design Issues

- œ Falconer states that the immeasurability and diffuse nature of non-point source contamination from agricultural pesticides makes emissions-based regulations or incentives inappropriate.
- œ Further, as pesticides may take a number of routes into the environment, implementing separate controls for each would be impractical.
- œ Generally there exists a lack of incentives for farmers to internalise the externalities arising from their activities. This has been accentuated by a history of command and control pesticide policies.

Taxation & Subsidies

- œ “Ambient concentration taxes are unlikely to be very useful in practice as concentration levels are very transient”, (p44). Further, as a result of “The high costs of targeting policy instruments on pesticide emissions or ambient environmental concentrations” policy discussions are generally focused on inputs, (p44).
- œ Input taxes create a substitution effect based on relative price changes, though inputs are imperfectly correlated to discharges. Falconer states that if a farmer is risk averse a tax may need to be set very high to trigger a reduction in pesticide use. A lack of information about pesticide alternatives or difficulties in implementing

solutions may also increase the level of tax required to encourage behaviour change.

- œ There are different ways to apply a tax yet each way can create perverse incentives. For example, if taxes are based on usage levels this may encourage heavier but fewer applications of pesticides while setting taxes as a percentage of product prices may encourage stockpiling of goods before the tax is introduced.
- œ Subsidies for environmentally friendly practices have a different property right configuration than taxes and are often criticised for 'propping up' inefficient farms; to address this it is suggested that subsidies for capital works are paid over a number of years.

Insurance Schemes

- œ Farmers may use more chemicals to guard against general uncertainty. To reduce this extra pesticide use as well as the risk faced by farmers there may be "a role for low-cost insurance programmes". However, Falconer warns that this tool is only cost effective if the premiums are less than the price of standard pesticide applications. Damage assessment is likely to be complicated and Falconer warns that implementation is likely to be difficult.

Tradable Permits

- œ Practical problems have led to the limited application of tradable permits in the agricultural sector. However, "if total usage was restricted, transferable permits should provide strong incentives for farmers to use inputs efficiently from their own perspectives and simultaneously meet social objectives", (p47).
- œ Reducing the number of total permits over time would allow farmers to adapt while offering continuous incentives to reduce pesticide usage.
- œ Although a tradable permit system requires many producers the markets may be 'thin' given the large number of chemical products.

See Appendix One for the following extracts - Table 1: Summary of potential controls for pesticide policy and Table 2: Summary of policy tools and performance according to a number of evaluation criteria.

**Federal Ministry for the Environment, Nature Conservation and Nuclear Safety,
(2003)**

The ecological tax reform: introduction, continuation and further development to an ecological financial reform

Retrieved 15/03/04 from: <http://www.eco-tax.info/4fakten/index.html>

Germany introduced an Ecological Tax Reform in 1999 to encourage energy saving, efficient energy use and promote renewable energies. The Ecological Tax Reform also aims to dismantle existing subsidies that are ecologically harmful and for which the economic benefits are uncertain.

Reform has occurred in three stages which are described in some detail; the tax burden on the labour sector has decreased and shifted to focus on environmental consumption activities. Energy taxes were increased and pension contributions were decreased. As such, Germany's federal environmental agency argues that the Ecological Tax Reform has been close to revenue neutral and has reduced unemployment.

Greenspan Bell, R. (2003)

Choosing environmental policy instruments in the real world

OECD Global Forum on sustainable development: Emissions trading

In this paper the practical application of environmental policy instruments with an emphasis on market based instruments is discussed. The article draws attention to the choice of instrument for developing or transitioning economies.

- œ Greenspan Bell criticises advocates of market based instrument use in environmental management, stating that often such tools are designed without first examining the problem. She states that the policymakers then try to “bend institutions to support the already identified cure”, (p4).
- œ Further, she argues the instruments do not match the environmental problem or fit the society, culture and economy within which they operate. The author believes that this is aggravated by a lack of real experience which sees instruments based more on theory than application.
- œ It is suggested that market based instruments such as taxes and emission trading should only be used in the most developed countries. Stressing that transitional or developing countries lack sufficient services, institutions, legal systems and culture to support such advanced mechanisms.
- œ The author argues that market based instruments are the most difficult and complex form of environmental policy and that a lack of institutional capacity needs to be corrected before implementing such schemes. Smaller steps and alternative approaches to environmental improvement are suggested to be used while long run institutional change occurs.

Guerin, K. (2003)

Property rights and environmental policy: A New Zealand perspective

New Zealand Treasury Working Paper: 03/02

In this detailed paper Guerin attempts to lay a “foundation for applying a property rights perspective to environmental policy issues facing New Zealand”, (pi).

- Core principles behind effective rights regimes are summarised.
- The application of regimes to environmental issues internationally is reviewed.
- Current natural resource regimes in New Zealand are described.

œ Market based instruments can be criticised as regressive; their effective use requires “detailed knowledge, good governance arrangements, competitive markets, and adequate administrative capacity”, (p16).

Fisheries

œ New Zealand’s development of an individual transferable quota (ITQ) for fish stocks created defined transferable fishing rights as a means to counter the ‘tragedy of the commons’ “where competition for a scarce common resource resulted in depletion as no one had a secure property right in future use”, (p24).

œ “ITQs [were] introduced for inshore fishing and expanded for deepwater fishing in 1986. Quota entitlements were based on catch history...there are maximum and minimum quota holdings for each species, and limits on foreign involvement. ITQs became proportional rather than fixed in 1990”, (p28).

œ A Total Allowable Catch (TAC) which is “designed to maintain the biomass of the fishery” is set capping all catches, (p28). “After allowing for recreational and customary harvests, a Total Allowable Commercial Catch (TACC) [is set and] allocated to ITQ holders. Each ITQ represents a set proportion of the TACC, not an absolute amount, and reductions in the TACC for sustainability reasons are not compensated”, (p28). Effectively, the recreation and customary sectors “have a superior property right as they are given priority access to available fish stocks”, (p28).

- œ Guerin argues that “Under an ITQ system the incentive to use quota efficiently is maximised and quota owners have stronger incentives to enhance the fishery because they know they will have their share of future catches. Such a system has, however, social and community implications because quota tends to become more concentrated and the number of vessels to decline over time under efficiency pressures”, (p25).

- œ Guerin also states that “The QMS has significant long-term environmental and commercial benefits from maintaining aquatic biodiversity [sic]. New Zealand is now also able to offer more consistent long-term supplies of fish products than other supply sources, and in some cases obtain a market premium for the sustainable nature of its fisheries”, (p28).

- œ It is likely that the QMS is going to be extended to include new species; 20% of any new quota species must be allocated to Maori.

- œ The QMS has proved to be far more efficient than previous effort controls such as gear or season restrictions.

Hahn, R. (2000)

The impact of economics on environmental policy

Journal of Environmental Economics and Management. 39, p375-399.

Hahn investigates the role of economics in environmental policy design focusing on the increased use of incentive-based mechanisms and analytical decision making tools such as benefit-cost analysis. The discussion is primarily based within the United States where economic instruments have been applied at federal, state and regional levels.

- œ The political process surrounding natural resource policy making has a large impact and the ability to “block outcomes that would result in higher levels of economic welfare”, (p392). Within the political process it is unlikely that economic efficiency would be the key objective.
- œ Objectives and policies can be manipulated by the influence of lobby groups on bureaucratic decision makers.
- œ It is important to recognise the impact that such political issues have on the form and content of policy design.

Industry Commission (1997)

Role of economic instruments in managing the environment

Staff research paper, Industry Commission, Melbourne

This document, like the Rae (1997) article that reviews it, provides a good introduction to the use of economic instruments in environmental management, reasons for government intervention and the role of various stakeholders. It provides a useful description of the economic instruments in place in Australia at the time although this information is superseded by more recent documents such as The National Action Plan on Salinity and Water Quality (2002).

- œ The paper highlights areas in need of further research such as performance indicators and data about specific environmental problems. The paper stresses the need for better information relevant to the design and implementation of economic instruments.

- œ A number of factors were highlighted as limiting the use of economic instruments; these included conceptual, information and valuation, resource and cross-border problems. Resource problems were based on the difficulty in finding sufficient diversity in skills and expertise. Cross-border problems represented issues such as the difficulty in trading water across states that had different legislation.

James, D. (1997)

Economics instruments and wastewater management

Environment Australia: Environmental Economics Research Paper, 6.

James investigates the use of economic instruments within wastewater management in Australia. He argues that wastewater is not necessarily just an environmental problem as it has the potential to be a valuable resource that provides economic benefit. Economic instruments for use in wastewater management are discussed as well as areas where further work needs to occur.

œ James recommends that wastewater is managed within the context of total water cycle management. The details of wastewater treatment and its benefits are outlined including its role within total water cycle management.

œ The paper contains a section defining economic instruments, arguments as to why this type of policy tool is useful for wastewater management, and the limitations of economic instruments with regard to managing wastewater.

œ The limitations relate to practical issues around the design and implementation of economic instruments. Such as the complex and uncertain nature of identifying and valuing damage costs. Other limitations are that economic instruments do not necessarily lead to least cost solutions.

œ Economic instruments relevant to wastewater management include:

- Full cost pricing of primary water supplies
- Tradable water entitlements for abstractions (river, reservoirs)
- Full cost recovery pricing for water supply treatment
- Appropriation of revenue for sale of treated effluent
- Full cost recovery pricing for sewage collection and treatment
- Effluent fees for discharges
- Tradable permits for discharges
- Performance bonds
- Transparent subsidies

- œ The paper provides an in depth look at Australia's wastewater policy's past, present and future. James sees the need for Australia to develop information systems to support improved policies, establish criteria for the use of economic instruments, undergo institutional strengthening, increase community involvement and for more inter-governmental co-operation to occur.

Johnstone, N. (2003)

Efficient and effective use of tradable permits in combination with other policy instruments

OECD Global forum on sustainable development: Emissions trading

In this report the conditions under which it is preferable to use multiple policy instruments instead of a single instrument to manage natural resources are discussed. Johnstone explores which combination of instruments are effective and efficient complements, particularly focusing on the link between tradable permits and other policy instruments. This article is particularly relevant given the frequent recommendations in the economic and policy literature to use a mix of policy instruments when tackling environmental problems.

- œ In contrast to much of the current literature an earlier report by Johnstone found that, in some cases, the use of a mix of policy instruments instead of a single instrument can reduce economic efficiency, increase administration costs and reduce environmental effectiveness.
- œ Johnstone stresses that it is the conditions surrounding the use of policy instruments that determines whether a combination or single instrument is best.
- œ Johnstone highlights four incentives to use a combination of policy instruments to target an environmental problem:
 - Reduction of abatement cost uncertainty
 - Overcoming technological market failures
 - Increase behavioural responsiveness
 - Address local environmental impacts

Reduction of abatement cost uncertainty

- œ Tradable permits provide environmental certainty about the total level of emissions or harm, assuming perfect monitoring and complete enforcement. However, abatement costs are not fixed under a tradable permit system.

- œ A combination of policy instruments can 'bound' uncertainty "in a way which increases the economic efficiency of the environment policy regime", (p5). For example, a tax can put an upper bound on permit prices when abatement costs are higher than expected. A trade-off occurs as the 'bounding' of permit price uncertainty creates more uncertain emission levels.

Overcoming technological market failure

- œ Tradable permit systems have incentive effects as a result of the change in relative permit prices and the increase in the opportunity costs of emitting a particular pollutant. Firms and households react by reducing their demand, in the long run this should lead to the development and diffusion of environmentally less damaging technologies.
- œ It is possible that both environmental and technological market failure exists. This may require the joint application of two environmental policy instruments. This can also help to even out the trade off between the "potential benefits of increasing the rate of environmentally preferable technology change with the costs of misdirecting the trajectory of such change", (p8).

Increase behavioural responsiveness

- œ Information failures exist in the market which may make it necessary to "complement a tradable permit system with measures that are targeted at potential consumers" to increase "responsiveness on the demand side", (p8). Such measures include project demonstrations, information campaigns, eco-labels or certification schemes.

Conditions for complementarity

- œ Johnstone states that for an additional policy instrument to increase the efficiency and effectiveness alongside a tradable permit system the 'complementary' instrument must:
 - Meet a legitimate policy objective which can not be met more efficiently through the tradable permit system itself;
 - Be the best instrument available to the regulatory authority to meet that policy objective;
 - Preserve the benefits of the tradable permit system to the greatest extent possible;
 - Be administratively feasible at reasonable cost.

Kane, S.

The role of economic instruments in environmental management

Retrieved: 23/01/04 from <http://divcom.otago.ac.nz/epmrc/2-17.html>

In this brief article the author looks at the use of economic instruments in environmental management contrasting the use of these policies in New Zealand against implementation levels in other OECD countries.

- œ The introduction defines economic instruments, their advantages and disadvantages as well as outlining which OECD member countries have implemented this type of policy mechanism.
- œ The focus of the rest of the paper is on a 1997 study into New Zealand economic instrument use for environmental management. This study was motivated by a 1995 investigation by the OECD that found, of all member countries, New Zealand had some of the lowest levels of economic instrument use.
- œ The limited use of economic instruments in New Zealand is thought to be partly a result of the uncertain legislative environment that arose from the introduction of the Resource Management Act 1991. “Although the Act set the platform for the implementation of such instruments, it provided no guidance as to when or where such instruments should be used”, (p1).
- œ It was also found that the use of economic instruments was extremely limited with the only scheme applied on a national scale (petrol taxes) being implemented primarily to raise revenue for road development and maintenance rather than environmental protection.
- œ Suggested reasons for this lack of interest include a reliance on regulation and public opposition to the introduction of new instruments. Further, given the need for “high demand or pressure on resources in order to create a viable market”, perhaps New Zealand’s natural resources aren’t perceived to be under enough pressure yet, (p3).
- œ The report identified areas with potential for the implementation of economic instruments, these included vehicle charging and water resource management.

Ministry for the Environment, Kearney, M., & Sinner, J. (1997)

Transferable water permits: Two case studies of the issues

MAF Policy Technical Paper, 97/12

This paper incorporates two case studies based on New Zealand's attempts to implement tradable permit systems for water management in the Manawatu and Tasman regions. The first case study identified the barriers to establishing transferable water permits through the regional plan process; a summary of this case is included below. The aim in the second case study was to uncover community perceptions about the use of transferable water permits.

Both studies were conducted in 1997; both studies found that:

- œ Community members tended to find it difficult to understand both the concepts and the application of a tradable permit scheme. This stemmed from policymakers promoting how the scheme was to be implemented rather than first explaining the theory (that they were very familiar with) behind it.
- œ Consequently the authors argued there was a need for a thorough consultation process, ensuring that community stakeholders understood the disadvantages of the previous system and how these would be overcome with a tradable permit system.

Case Study 1: Oroua Catchment Plan, Manawatu Region

- œ Only agricultural irrigators are able to transfer permits. This is to protect farmers from their fears of a 'buy out' of permits by large interests. Separate negotiations for water abstraction limits occur for non-agricultural abstracters, such as the town water supply.
- œ "Transfers can only occur once the river reaches the first threshold point, based on 30 percent of the mean monthly flow of the river. At this point, irrigators holding new permits must suspend abstractions, and existing permit holders must apportion their take within a specified total water budget...to give permit holders more flexibility permit transfers are also allowed as long as the total take is not exceeded", (p9).
- œ Existing permit holders must suspend abstractions when the river reaches a second minimum flow threshold point.

- œ “The two-tier permit system gives preference to existing permit holders without precluding new permit holders. It also gives existing permit holders more certainty by allowing them to continue abstracting until the ... minimum low flow is reached”, (p9).

- œ The system became operative in 1995; during the first two years the river flows did not drop below the first threshold point therefore no restrictions were put in place and no transfers occurred.

New Zealand Climate Change Office (2004)

Climate change policy in brief

Retrieved 15/03/04 from: <http://www.climatechange.govt.nz/resources/info-sheets/policy-in-brief.pdf>

This web page contains a brief overview of New Zealand's climate change policies including price based charges and non-priced programs.

- œ A greenhouse gas charge, a price-based economic instrument, is to be applied to carbon dioxide and fossil methane from 2007 onwards. However, there is to be no charge levied on agricultural greenhouse gas emissions until after 2012 as it is felt that currently there are limited means to reduce emissions from agriculture without seriously reducing output and competitiveness.
- œ Negotiated Greenhouse Agreements are a risk reduction mechanism that firms can apply for if they feel that charges will significantly reduce competitiveness. "In return for relief from all or part of the emissions charge" firms or industry agree "to achieve international best practice in managing emissions", (p2).
- œ The national government is to take responsibility for New Zealand's forest sinks including meeting deforestation liabilities and managing sink credits.
- œ Emissions are to be dealt with through national policies rather than regional authorities.
- œ Policy for fluorinated gas reduction is to include voluntary approaches and regulation designed to phase out their use.

OECD, Directorate for Food, Agriculture and Fisheries. (2003)

Agri-environmental policy measures: Overview of developments

Joint working party on Agriculture and the Environment, JT00153105

The objective of this report was to highlight developments in the use of agri-environmental policy measures in OECD countries. It looked at similarities and differences in approaches used in different countries.

- œ Agri-environmental policy measures were classified into three groups; economic instruments, command and control, advisory and institutional measures.
- œ Economic instruments were defined as affecting the “costs and benefits of alternative actions open to farmers, with the intended effect of influencing behaviour in a way that improves environmental outcomes”, (p10). The main types of economic instruments reviewed were those involving a monetary transfer, (payments and charges or taxes) or the creation of new markets, (tradable permits or rights).
- œ Although economic instruments have been gaining popularity “their application in agriculture continues to be fairly rare”, (p16). The transaction costs involved in the initial set up of economic instruments can be large and continued monitoring of such systems can be expensive, particularly because of the predominance of non-point source pollution.

Payment Programmes

- œ Payment programmes involved payments to farmers or landholders to address environmental problems or promote the provision of environmental amenities. The main types of programmes related to payment for changing farming practices, resource retirement or investing in fixed farm assets.

Environmental tax or charges

- œ A major obstacle to the use of environmental taxes in the agriculture sector is the practical problem of measurement particularly given the non-point source nature of most agricultural pollution. Some countries attempt to overcome this with levies based on estimates of off-farm emissions of nutrients above set limits. The

Netherlands have implemented a minerals accounting system which requires farmers to provide an assessment of the inputs and outputs that lead to the 'surplus' of phosphorous and nitrogen produced on their farms.

- œ To manage non-point pollution other countries place a tax on inputs such as pesticides or commercial fertilisers which have been identified as having a negative environmental impact.

OECD Environment Programme. (2001)

Implementing domestic tradable permits: Recent developments and future challenges

Executive Summary, Retrieved from <http://www.oecd.org/dataoecd/18/44/1948734.pdf>

This publication is based on the proceedings from an OECD workshop held in Paris, in September 2001, which reviewed the development in the use of tradable permits and evaluated *ex post* their progress. The authors note that tradable permits can be a cost effective and flexible policy instrument to address pollution control and natural resource management; tradable permits are able to address a wide range of environmental issues.

- œ Six criteria were identified as important for ex post evaluation, these included:
 1. Environmental effectiveness;
 2. Dissemination of prices (marginal abatement costs) through the market;
 3. Ability and willingness of participants to use the opportunity to trade or transfer allowances or credits;
 4. Magnitude of transaction and administration costs;
 5. Extent to which market power is a problem;
 6. Adaptability and sustainability of the tradable permits program under changing conditions.

- œ It is emphasised that the role and use of tradable permits needs to be complementary within a mix of policies instead of being used in isolation.

- œ A number of examples are given of tradable permit schemes in operation; these include greenhouse gas trading, tradable renewable energy certificates, solid waste management and tradable permits for water quality and abstraction.

- œ Key lessons identified from existing tradable permit programmes for water management include that:
 - Water rights trading can be facilitated when separated from land ownership.
 - Temporary or seasonal water right trades often occur more frequently than permanent trades.
 - Water cannot simply be defined as a private good and its treatment as a tradable commodity can meet social resistance.
 - Trading schemes need to be adapted to existing local institutional frameworks for water management.

OECD Environment Programme. (2001)

Environmentally related taxes in OECD countries: Issues and strategies

Executive Summary, Retrieved from <http://www.oecd.org/dataoecd/13/10/2385291.pdf>

This executive summary is from an OECD publication that investigates the use of environmental taxes and discusses the trends in, advantages of, and barriers to, their use.

- œ It was found that “revenue from environmentally related taxes averages roughly 2 per cent of GDP in OECD Member Countries”, (p1). The majority of revenue is generated from transport fuels (64%) and motor vehicles (26%).
- œ “Green Tax Reforms” are increasingly being implemented by a number of countries. Reforms can include the:
 - Restructuring of existing taxes to reflect the polluting characteristics of different products or activities
 - Introducing new taxes, for example on water use, pollution or waste.
 - Removal of environmentally harmful tax exemptions and subsidies
- œ “...while some sectors may face a net loss in competitiveness due to an environmentally motivated tax reform, other (often more environmentally benign sectors) could generally improve their competitiveness”, (p3).
- œ However concern is raised in the report over the possibility of large administration costs and the impact of taxes on low-income households. Some environmental taxes can have greater impacts on low-income households or can increase regional income disparities more than others. When investigating any distribution effects it is stated that it is important to ensure the investigation includes the secondary impacts of any compensation payments, any reductions in other taxes, induced employment effects or the distribution of environmental benefits resulting from the tax.
- œ It is important that any existing exemptions or rebates and subsidies that are likely to limit the effectiveness of environmental policy or be environmentally damaging be phased out.

Parminter, T. (2003)

Policy strategies for natural resource management

MAF Technical Paper, 2003/1

Parminter discusses policy instruments for natural resource management, in particular for use in agricultural environments “where changes in landowner environmental practices are required”, (p i). Different policy instruments are outlined as well as criteria to aid in their selection and a case study is presented to illustrate the instrument selection process. The evaluation criteria are used in the case study to select a mix of policy instruments to address water quality in Lake Taupo. Policy tools described in the paper include voluntary initiatives and enhanced property rights, education and negotiation, regulations, taxes and charges, subsidies, and tradable permits.

Taxes and Charges

- œ In general, environmental taxes and charges are seen to be simple to design, self-funding and placing responsibility on the agricultural user with a penalty for undesirable behaviour.
- œ The downside of these instruments is that they are often viewed unfavourably by farmers as they involve extra costs. Further, as it is often difficult to measure and attach a tax to actual discharges, taxes are often applied to inputs or other outputs instead.
- œ Information requirements can pose another obstacle. Precise estimations of external costs are needed to set the tax at optimal levels.

Tradable Permits

- œ The theoretical foundation of tradable permits is outlined. Parminter notes that “transferability ensures that the market can reallocate sources until the marginal costs of control are equal among all permit holders”, (p9). The incentive for trading occurs when farmers have different marginal costs.
- œ The author states that in the agricultural setting a tradable permit system is best employed where there is “efficient monitoring in place to provide information on each farmer’s amount of discharge and the total discharge in specific areas”, (p10).

- œ Initial allocation of permits is an important issue as it affects producer costs and the potential for the issuing body to raise revenues, creating property rights issues between the issuing body and producers. Alternative allocation mechanisms are outlined, these include:
 - Gifting where permits are allocated “to individual farmers through the use of monitoring information based on their historical discharge levels (p11).
 - In an auction buyers pay for the value of the resource with the highest value securing the most right. The body selling the permits gains the resource rents in the process.

- œ Permits can be for a limited or permanent term; permits for different terms allow farmers to buy the permit that best reflects their risk profile. Limited term permits provide more administrative flexibility to change discharge levels

Subsidies

- œ Parminter suggests that the government rewards “improvements in land practices that provide improvement in discharges and water quality” rather than “subsidising specific land use measures”, (p12).

- œ The main weakness of subsidies is the large financial costs of providing the subsidy; they may also create inefficient outcomes as farmers focus on collecting subsidies rather than the natural resource problem at the heart of the payment.

- œ Parminter believes that subsidies should only be used as a last resort when all other tools have proved inappropriate

Policy Selection

The following are the six assessment criteria to use when selecting policy instruments:

1. Feasibility of attaining the policy goal
2. Achieving economic efficiency or alternatively providing the least costs alternative
3. Equity of the outcome
4. Political acceptability and constituency satisfaction
5. Improving community capacity for taking action
6. Social cohesion and consistency

See Appendix Two for the following extract – Table 1: Definitions of the Six Policy Instruments.

Rae, J. (1997).

Economic instruments for environmental protection

Environment Australia: Environmental Economics Research Paper No. 6

This paper provides a good introduction to the use of economic instruments in natural resource management, highlighting the results of a research project into the role of economic instruments for environmental management in Australia, (see above Industry Commission, 1997).

- œ The rationale for government intervention in environmental protection is presented, focussing on the market's failure to reach optimal use and protection of the environment. Reasons for this include externalities, environmental ignorance, public good features and inappropriate signals.

- œ Intervention is separated into three classes of measures: regulation, suasive and economic instruments. Five types of economic instruments are discussed: charges and taxes, subsidies and tax concessions, performance bonds, deposit refund systems and property rights and market creation.

- œ The article goes on to outline the various economic instruments used in Australia at the time and issues that economic instruments could be applied to.

See Appendix Three for the following extract – Table 1: Main characteristics of selected economic instruments.

Randall, A. (2003)

Market-based Instruments – International patterns of adoption, remaining challenges and emerging approaches

6th AARES Annual National Symposium on Market-Based Tools for Environmental Management

This paper discusses 'flexible instruments' and their progress in world-wide adoption. Flexible instruments include market based instruments such as pollution trading, pollution charges and market reforms as well as negotiated or voluntary agreements, industry standards and eco-labelling.

- œ Pollution charging includes effluent and user fees, deposit-refund programs as well as tax differentiation favouring environmentally-friendly practices.
- œ Pollution trading includes cap and trade programs that distribute a strictly limited amount of pollution permits that may be traded to meet ambient environment quality targets. Distribution can be through gifting or by auction where the government typically appropriates the value of the permits.
- œ Pollution reduction credits work in a similar way to cap and trade programs; they allocate the capped level of emissions among firms who earn credits for reducing pollution below the allowable cap. Firms enter the market and buy credits so that new pollution is offset by reductions in other firms.
- œ Market reforms include market creation, liability rules, product labelling, reporting requirements and the removal of subsidies on environmentally damaging activities. They can reduce barriers impeding environmental markets and the internalisation of externalities
- œ Effluent trading among point sources is popular as it minimises compliance costs. The effect is even stronger for non-point sources that have been typically sheltered in the past from the polluter pays principal. However, Randall reports that only six actual trades have occurred among the 40 water quality trading schemes operating in the United States, (p7).

- œ Given it is difficult to measure non-point source pollution, in many schemes involving trading between point and non-point sources the non-point source usually promises to implement Best Management Practices in exchange for disposing of a credit to a point source. Randall believes that trading programs based on such promises “are inherently problematic” due to the difficulties in establishing reliable relationships between Best Management Practices and emissions and the lack of monitoring of abatement performance of Best Management Practices on farms, (p8).

Key lessons highlighted from the study are that:

- œ Trading programs work best when aggregate pollution standards are specified and absolute baselines not relative ones are used.

- œ Monitoring and enforcement are important with the need for continuous monitoring and strong penalties.

Schilizzi, S. (2003)

Should equity concerns impose limits on the use of market-based instruments?

6th AARES Annual National Symposium on Market-Based Tools for Environmental Management

Schilizzi investigates the ethical implications of market based instruments using distributional equity as a criterion to measure and compare policy performance.

- œ Schilizzi highlights that despite market based instruments reported efficiency gains over command-and-control approaches efficiency is only one measure of policy performance.
- œ Market based instruments typically involve rights to public rather than private goods which the author states raises equity issues related to resource access and the allocation of the flow of benefits generated. Equity is highlighted as an important concern as an efficient but “unfair” policy may not be implemented.
- œ The author believes that equity concerns should impose limits on the use of market based instruments but that this shouldn’t be any different from the limits posed by efficiency concerns, other policy instruments, or equity concerns over markets in general.
 - Under a normative approach the limits would be endogenous stemming from the decision-makers own sense of equity.
 - Under a positivist approach limits would vary according to whether they are implemented in a liberal or coercive manner. Liberal limits will be in the form of the probability of acceptance or adoption of the instrument. While under coercive limits potential efficiency gains can be offset by political risks.

Scrimgeour, F., & Piddington, K. (2002)

Environmental taxation in New Zealand: What place does it have?

IPS Policy Paper: 12/2002

In discussing environmental taxation and its role in New Zealand, the authors aim to provide a base for “further work in New Zealand examining specific opportunities for environmental and resource-use taxation”, (p1). The theoretical foundation of resource-use taxation is outlined covering the need to internalise the social costs of environmental degradation with full cost pricing of costs “incurred by society during production and consumption of a good or service”, (p2).

- œ Four types of environmental tax are presented, each differing in the way they are levied.
 - Effluent and emission taxes are directly related to the quantity or quality of pollutants discharged.
 - Product and input taxes are used to address indirect products creating environmental externalities in manufacturing, consumption or disposal.
 - Environmental subsidies are payments to reduce pollution.
 - Investment tax incentives can include tax credits for environmental protection investments.

- œ Environmental tax reform involves shifting the tax burden from factors of production to pollution and natural resource use. This can involve revenue recycling where the introduction of a new tax combines with a tax reduction in other areas to leave total revenue unchanged or revenue neutral, though the effects vary for different players in the economy.

- œ A number of complications exist for evaluating the impact of environmental taxes. There can be methodological difficulties in identifying the effects of taxes, limited data may be available. Time can also be a restricting factor as it may take many years for a tax to become effective.

Intra-generational equity issues

- œ Environmental tax can be regressive, impacting a “higher proportion of the income of low-income groups than that of the higher income groups”, (p5). “This usually occurs when the tax is applied to a product or input rather than to emissions or environmental damage”, (p5).

- œ When considering the distributional effects of a tax the authors state that concern “should be for the final incidence (the households that ultimately bear the burden of the tax) rather than the formal incidence (who makes the tax payments)”, (p5).

- œ The question is raised that although an environmental tax may be regressive is it more or less regressive than the alternative?

- œ A number of checklists are given including: criteria to address in new policy development; generally accepted policy principles; successful implementation criteria

Sharp, B. (2002)

Institutions and decision making for sustainable development

New Zealand Treasury Working Paper: 02/20

The author of this paper focuses on policies to achieve sustainable development such as tradable permit systems, pricing access to natural resources and subsidies. In addition, a framework for considering the quality of institutional structures in achieving sustainable development is presented. The paper also includes an investigation into New Zealand's environmental policies.

- œ Various types of uncertainty create an obstacle to the effective operation of policy instruments. Uncertainty can reduce the accuracy, effectiveness and efficiency of instruments, distorting the impact of instruments which may result in an efficiency loss.

Subsidies

- œ Reducing subsidies can reduce environmental damage as subsidies alter the relative prices faced by consumer and producers. Although subsidies may increase production they accelerate resource use and depletion.
- œ Subsidies for positive environmental action may be effective in the short run but over the longer run they “dampen innovation and increase demand on government revenue”, (p16).

New Zealand

- œ In New Zealand there exists a “clear preference for CAC [command-and-control mechanisms] in situations where statute provides a legal framework for market based instruments”, (pi). “The use of market based instruments is severely constrained by legislation and the CAC culture that exists in regional government”, (p57). It is recommended that public policy be “based on the rational use of market incentives”, (p59).
- œ Despite provisions in the RMA “for the transfer of water permits, to take and use water,...the Act precludes the use of tradable instruments in point sources of air and water pollution”, (p57).

- œ It is identified that there is uncertainty in New Zealand as to who has the rights to implement market based instruments. The author alleges that a significant skill gap in the design and implementation of economic instruments exists at lower levels of government.

Barriers to implementing market based instruments

- œ Positive returns to the environment are not valued in monetary terms therefore it is likely that under-investment will occur in environmental assets and over-investment in environmentally damaging activities.

- œ Weak governance and legal structures such as a lack of adequate property rights, established authority or enforcement of incentives.

- œ The lack of capacity to build competitive markets, limited financial and administrative capacity and the institutional inability to provide flexibility of response or choice.

Siebert, E., Young, D., & Young, M. (2000)

Market-based opportunities to improve environmental flows: a scoping paper

Environment Australia

The authors' purpose in this "paper is to promote discussion relating to the trading and banking of environmental water allocations in the context of the Australian water industry", (p1). It documents a change in Australian water management towards the recognition of the need for water to be allocated to the environment as well as to consumptive uses; whereby the environment is seen as a "legitimate user of water", (p2). The paper discusses water allocations to the environment and the definition of environment rights as well as ways to increase environmental allocations such as water trading and banking.

- œ A key issue when determining the size of environmental water allocations is "whether the environment has a right that is prior to consumptive uses", (p2). Either the "environment has a prior right to be satisfied before water allocation decisions or [the] environment has a competitive right that allows trade-off among economic, social and environmental objectives", (p2).
- œ If it is determined that the environment has a prior right to water allocation then this is "made without payment of compensation to other water users as they only hold a right to that not needed for environmental purposes", (p2).
- œ The authors' believe that in theory it is possible to have a model with a mix of defined prior and competitive rights, stating that this is type of model might work well in a market situation and is an area that needs further investigation.
- œ Ways to implement prior rights to provide more water for the environment includes investing in infrastructure rehabilitation, voluntary community water use reductions and taxing water trades. The latter option would involve taking a portion of the water to be traded and returning it to the environment.

- œ Water trading is discussed in terms of trading for consumptive uses as well as trading in environmental flows. The latter would involve rights to environmental allocations being “assigned in the form of a license or title to a Government or independent body responsible for managing those rights. The resource managers would then be able to buy and sell allocations”, (p5).

- œ Banking is also discussed, it is seen as a way for landholders to secure water supply and insure against drought. It is stated that banking has the potential to provide incentives for irrigators to “deposit part of their [water] allocation in the bank during years when water is plentiful, watch their allocation grow over time and then withdraw it when water is scarce”, (p4).

Smith, S. (2003)

What have we learned from the Hunter River Salinity Trading Scheme?

6th AARES Annual National Symposium on Market-Based Tools for Environmental Management

This paper outlines the Hunter River Salinity Trading Scheme that controls discharges of saline water from coal mines and electricity generators into the Hunter River.

- œ After analysing water flows and salinity levels it was found that during high water flows there was an initial flow or spike of very salty water. After each spike passed a period of hours or days of very low salinity. During this time the impact of introducing saline water discharges would be minimised.
- œ The river was separated into 'sections' based on the different volumes of water flows. Monitoring points along the river allowed operators to assess whether the river was in low, high or flood flow, which determined the level of discharges.
- œ The water in the river was further divided into 'blocks' that were continually monitored to record flow level and ambient salinity. This enabled the calculation of how much salt could be added to the particular block of water.
- œ Credits were available to be bought and sold according to the individuals operating conditions.
- œ Initially credits were allocated by gifting to existing license holders. Credits were issued with different life spans, 200 credits expired in two year intervals beginning 30 June 2004. Every two years 200 new credits are created to replace those expired, each has a 10 year life span. New credits are sold by public auction, revealing the market price of credits. The value of the credits decreased if too many were traded into one river sector.
- œ After the trial phase the scheme is now operating on full cost recovery, participants pay an annual contribution for services provided alongside the scheme, such as river monitoring. Total scheme costs are split between discharge license holders and credit holders.

Key Lessons:

- œ The need to clearly define the environmental goal or output of the scheme.
- œ The need for a regulatory framework to underpin the scheme.
- œ The importance of extensive consultation and involvement of stakeholders.
- œ Twenty-four hour access to the trading programme to allow fast and efficient trading while also allowing participants to recognise discharge opportunities at any time.
- œ An extended pilot proved necessary, enabling scheme improvement and finalisation
- œ That it is necessary to gradually remove gifting credit entitlements to encourage participation by new industries.

Stavins, R. (2000)

Experience with market-based environmental policy instruments

Resources for the Future: Discussion Paper 00-09

This paper contains an extensive review of market based instruments which are separated into four categories: pollution charges, tradable permits, market barrier reductions and government subsidy reductions. Market based instruments are broadly defined to capture many different instruments and programs. Definitions are given for each type of policy tool along side a description of various programs in operation internationally.

- œ The appendix includes many useful tables outlining particular market based instrument schemes operating in various countries; tables are constructed by specific policy mechanisms such as effluent fees, deposit-refund systems and tradable permit systems.
- œ The paper concludes with a section on the 'lessons' to be gained from the experience to date with market based instruments; these include design issues such as the need for flexibility and simplicity. Flexibility is discussed in terms of timing and technological options, using permit banking as an example of providing temporal flexibility. Simplicity refers to the clear definition of rules and the argument that "there should be no requirements for prior government approval of individual trades", (p30). Further recommendations include that baselines for tradable permit schemes should be absolute rather than relative. The continued importance of monitoring and enforcement is also emphasised.
- œ Stavins cautions that gifting permits to initially allocate the resource can make trading more costly than if they were initially auctioned as "auctioning yields revenues that can be used to finance reductions in pre-existing distortionary taxes", (p31).
- œ From the analysis of market based instrument schemes in operation it is noted that many organisations lack the internal capability to fully utilise market based instruments; they are still structured in a way that minimises the costs of compliance with command-and-control regulations.

Stoneham, G. (2003)

An overview of the ideas and information needed to develop and implement market based instruments

6th AARES Annual National Symposium on Market-Based Tools for Environmental Management

In this article Stoneham focuses on the design and application of market based instruments for environmental management where markets are missing and problems arise from asymmetric or “hidden” information. It is suggested that environmental markets need to be designed specifically for each policy issue. Game theory, experimental economics, field pilots and information technology are considered to assist in the design of artificial markets.

- œ A game theory based policy design framework views the policy design problem as a strategic game of interacting decision makers.
- œ Experimental economics involves individuals participating in laboratory experiments to test new policy settings and market designs. This tool is said to fill the gap between theory and design, with possible treatments including different incentives, conflicts across objectives, different mechanisms to resolve conflict.
- œ Field pilots are another way of demonstrating and testing policy mechanisms before they are implemented by government or environmental agencies. They are relatively more expensive than laboratory experiments and they tend to carry some political sensitivity. Field pilots can also take a lot longer to be approved, designed, implemented and evaluated relative to laboratory experiments.
- œ In addition to these techniques, “developments in information technology and surveillance can greatly improve the ability to implement theoretical propositions through more efficient contracts and monitoring strategies,” (p11).

Stoneham, G., Lansdell, N., & Strappazzon, L. (2003)

Where do market-based mechanisms fit in the policy mix? An economic analysis

6th AARES Annual National Symposium on Market-Based Tools for Environmental Management

The authors consider the optimal policy mix for environmental issues, investigating where market based instruments 'fit in' by developing a transaction cost framework to discuss and evaluate policy options. Ultimately they recognise that a mix of both regulation and market based instruments are likely to create the optimal solution. An example of this is a cap and trade permit system. The cap acts as a quantity restriction similar to a regulation while trading allows efficient distribution of the costs of maintaining the cap.

- œ The transaction cost theory is drawn heavily from a Williamson (1985) text where it is stated that "systems evolve to achieve a certain outcome at minimum cost", (p4). Transaction costs are defined as the "comparative costs of planning, adapting and monitoring task completion under alternative governance structures", (p7).
- œ In policy development and implementation the transactions costs of negotiating, monitoring and enforcement can be especially large if there are low levels of public acceptance.
- œ Demand-side transaction costs make information costly to obtain and transfer, hindering information flows between players in society. This means that often community members do not see all outcomes of a policy which can hamper attempts to gain public support and approval.
- œ Transaction costs are associated with different types of property right allocation; different allocation methods can significantly alter the magnitude of transaction costs.
- œ To achieve dynamic efficiency it is suggested that there is a need to look at multiple time periods to assess the efficiency of a mechanism as transaction costs may vary over time, possibly decreasing in the longer term.

A range of policy mechanism are outlined including regulation, auctions flat-rate taxes and subsidies, land purchase, offsets and eco-labels.

- œ The discussion about auctions relates to the provision of biodiversity services and raises similar issues as Bardsley (2003) above.
- œ Eco-labels signal product attributes that may be difficult for customers to verify in an attempt to counter asymmetric information problems.

Verbruggen, A. (2004)

Tradable green certificates in Flanders (Belgium)

Energy Policy. 32, p165-176.

Belgium is a federal state consisting of three separate regions: Flanders, Wallonia and Brussels. Responsibility for energy covers both federal and regional authorities.

- œ The green certificate market in Flanders introduced in early 2002 is a quota based system to ensure that a predefined amount of renewable energy sourced electricity is introduced into the electricity market. The certificates are traded as separate financial assets; the green certificate market operates like a financial one
- œ Producers earn tradable green certificates in proportion to renewable energy produced. Suppliers of electricity who sell to end-users have a government enforced quota of renewable energy that they must meet. They have the option of producing renewable energy themselves or buying a specified number of certificates from renewable energy producers.

3. References

- Bardsley, P. (2003). "Missing environmental markets and the design of market based instruments." 6th AARES Annual National Symposium on Market Based Tools for Environmental Management. Canberra, Australia (2 & 3 September, 2003).
- Bowers, J. (2003). "Instrument choice for sustainable development: an application to the forestry sector." Forest Policy and Economics. (*article in press*)
- Cape, J. (1997). "The integration of environmental and economic considerations in the development of policies in relation to water allocation". Environmental Australia: Environmental Economics Research Paper, 6. Retrieved 12/03/04 From: <http://www.deh.gov.au/pcepd/economics/round1/pubs/roundtable.pdf>
- Chaudri, V. (2003). "Market based instruments and NRM: Back to basics." 6th AARES Annual National Symposium on Market Based Tools for Environmental Management. Canberra, Australia (2 & 3 September, 2003).
- Davis, D., & Gartside, D. (2001). "Challenges for economic policy in sustainable management of marine natural resources." Ecological Economics, 36(2): 223-236.
- European Environment Agency. (1996). "Environmental taxes: implementation and environmental effectiveness". Environmental Issues Series No.1. Retrieved 15/03/04 from: <http://reports.eea.eu.int/92-9167-000-61en/gt.pdf>
- Falconer, K. (1998). "Managing diffuse environmental contamination from agricultural pesticides: An economic perspective on issues and policy options, with particular reference to Europe." Agriculture, Ecosystems and Environment, 69(37-54).
- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. (2003). "The ecological tax reform: introduction, continuation and further development to an ecological financial reform". Retrieved 15/03/04 from: <http://www.eco-tax.info/4fakten/index.html>
- Greenspan Bell, R. (2003). "Choosing environmental policy instruments in the real world." OECD Global forum on sustainable development: Emissions trading OECD Headquarters, Paris (17-18 March, 2003).
- Guerin, K. (2003). "Property rights and environmental policy: A New Zealand perspective." New Zealand Treasury Working Paper: 03/02.
- Hahn, R. (2000). "The impact of economics on environmental policy." Journal of Environmental Economics and Management 39(3): 375-399.
- Industry Commission. (1997). "Role of economic instruments in managing the environment." Staff research paper, Industry Commission: Melbourne.

- James, D. (1997). "Economic instruments and wastewater management". Environment Australia: Environmental Economics Research Paper, 6. Retrieved 12/03/04 from: <http://www.deh.gov.au/pcepd/economics/round1/pubs/roundtable.pdf>
- Johnstone, N. (2003). "Efficient and effective use of tradeable permits in combination with other policy instruments." OECD Global forum on sustainable development: Emissions trading. OECD Headquarters, Paris (17-18 March, 2003).
- Kane, S. (2004). "The role of economic instruments in environmental management." Retrieved 23/01/04 from: <http://divcom.otago.ac.nz/epmrc/2-17.html>.
- Ministry for the Environment, Kearney, M., & Sinner, J. (1997). "Transferable water permits: Two case studies of the issues." MAF Technical Paper No: 97/12.
- New Zealand Climate Change Office. (2004). "Climate change policy in brief." Retrieved 15/03/04 from: <http://www.climatechange.govt.nz/resources/info-sheets/policy-in-brief.pdf>
- OECD (2002). "Implementing domestic tradeable permits: Recent developments and future challenges." (*executive summary*). Retrieved from: <http://www.oecd.org/dataoecd/18/44/1948734.pdf>
- OECD (2001). "Environmentally related taxes in OECD countries: Issues and strategies." (*executive summary*). Retrieved from: <http://www.oecd.org/dataoecd/13/10/2385291.pdf>
- OECD, Directorate for Food, Agriculture and Fisheries (2003). "Agri-environmental policy measures: Overview of developments." Joint working party on agriculture and the environment.
- Parminter, T. (2003). "Policy strategies for natural resource management." MAF Technical Paper No: 2003/1.
- Rae, J. (1997). "Economic instruments for environmental protection." Environment Australia: Environmental Economics Research Paper No. 6.
- Randall, A. (2003). "Market based instruments: International patterns of adoption, remaining challenges and emerging approaches." 6th AARES Annual National Symposium on Market Based Tools for Environmental Management. Canberra, Australia (2 & 3 September, 2003).
- Schilizzi, S. (2003). "Should equity concerns impose limits on the use of market based instruments?" 6th AARES Annual National Symposium on Market Based Tools for Environmental Management. Canberra, Australia (2 & 3 September, 2003).
- Scrimgeour, F., & Piddington, K. (2002). "Environmental taxation in New Zealand: What place does it have?" IPS Policy Paper: 12/2002.

- Sharp, B. (2002). "Institutions and decision making for sustainable development." New Zealand Treasury Working Paper: 02/20.
- Siebert, E., Young, D., & Young, M. (2000). "Market-based opportunities to improve environmental flows: A scoping paper. Report to Environment Australia. Retrieved 19/05/04 from: <http://www.deh.gov.au/water/policy/envflows.html>
- Smith, S. (2003). "What have we learned from the Hunter River Salinity Trading?" 6th AARES Annual National Symposium: Market Based Tools for Environmental Management. Canberra, Australia (2 & 3 September, 2003).
- Stavins, R. (2000). "Experience with market-based environmental policy instruments". Resources for the Future: Discussion Paper 00-09.
- Stoneham, G. (2003). "An overview of the ideas and information needed to develop and implement market based instruments." 6th AARES Annual National Symposium: Market Based Tools for Environmental Management. Canberra, Australia (2 & 3 September, 2003).
- Stoneham, G., Lansdell, N., & Strappazzon, L (2003). "Where to market based instruments fit in the policy mix: An economic analysis." 6th AARES Annual National Symposium: Market Based Tools for Environmental Management. Canberra, Australia (2 & 3 September, 2003).
- Verbruggen, A. (2004). "Tradable green certificates in Flanders (Belgium)." Energy Policy 32: 165-176.

4. Appendices

Appendix One

Table 1: Summary of potential controls for pesticide policy

Falconer, K. (1998).

Table 1
Summary of potential controls for pesticide policy

Control instrument	Target	Control techniques	Compliance measures
Advice	Environmentally more-sound pesticide usage; farmers using and acting on improved information	Improved advice and extension services; more crop protection research	None (voluntary measures by farmers)
Compulsory training	More socially desirable levels and types of pesticide usage (e.g. mode of application, timing)	Improve knowledge and understanding of farmers of necessity for treatments; increase decision rationality	Prohibit use or purchase of pesticides or spraying equipment without a certificate of competence
Performance standards	Soil loss/pesticide run-off or leaching	Limits on pesticide losses	Environmental simulation or field measurements
Design standards	Pesticide application	Sprayer specifications, buffer strips along water courses, field margins etc.	Farm inspections, spot-checks
Input use restrictions	Mode of use/timing/frequency of application/maximum dosage/restrictions on use, prohibitions in certain conditions or generally	Statutory labelling of formulations	Spot-checks, farm records, fines for non-compliance; self-regulation
Permits	Inputs, emissions, treated area, crop area	Limits on farm input use/emissions/ crop area	Farm records and inspections; coupons for pesticide input purchases, handed in at point of sale
Taxes	Input use, emissions, treated area, numbers of applications	Increase price of materials or applications, perhaps through a percentage levy or charge per unit, to encourage reduced pesticide usage	Distributor and/or farmer records
Subsidies to change practices	Increased use of reduced dose/ non-chemical pest controls	Compensate farmers for financial losses resulting from changed practices	Farm inspections
Transferable permits	As above	Limits on total (for example, catchment) input use, emissions, crop area...	As above
Crop insurance	Reduced pesticide usage	Reduced prophylactic treatments	None (voluntary)

Table 2: Summary of policy tools and performance according to a number of evaluation criteria.

Falconer, K (1998).

Table 2
Summary of policy tools and performance according to a number of evaluation criteria

Instrument	Efficiency	Effectiveness	Maintainability	PPP	Economic consequences for farmers	Ability to differentiate policies
Extension, training and education	±	±	+	+	±	+
Pesticide admission regulation	±	+	±	±	±	-
Usage regulations (design standards)	-	+	-	+	±	+
Prescriptions for hazardous substances	+	+	-	+	±	+
Waste disposal regulation	±	+	-	+	±	+
Farm pesticide usage limits (e.g. annual input quotas)	-	+	-	+	±	+
Pesticide input taxes	+	+	±	+	-	-
Subsidies for environmentally sound practices	-	±	-	-	+	+
Compensation for environmental results	±	+	-	-	+	+
Transferable usage permits	+	+	±	±	±	+
Yield risk insurance (subsidies for experimenting farmers)	±	±	-	+	+	+

Key: + =high, positive; ± = moderate, neutral; - =low, negative.

Efficiency: incentives for optimal usage.

Effectiveness: ability to reach and maintain environmental quality objectives.

Maintainability: low enforcement and monitoring requirements/feasibility of control at reasonable economic cost.

PPP: 'Polluter pays' principle upheld.

Economic consequences for farmers: negative if financial outlays required; positive if financial in-flows likely.

Appendix Two

Table 1: Definitions of the Six Policy Instruments

Parminter, T. (2003)

Instruments	Voluntary initiatives property rights	Education and negotiation	Regulation	Environmental taxes/charges	Tradable permits	Subsidies
Definitions	Relies on market forces, altruism, and comprehensive property rights to determine the optimal level of control.	Raises awareness about externalities – who is bearing the costs, who is benefiting, and how these differences might be resolved.	Establishes a set of rules to limit polluting activities and their discharges to socially desired levels.	Charges polluters the marginal social cost.	Limits total emissions and trading provides an efficient means of allocation.	Provides financial assistance for investments that reduce pollution.
Economic Efficiency	Can be difficult to define the property rights, lack of control over results. Risk of negative externalities remaining	Requires well-established property rights and transaction costs, lack of control over results.	Difficult to set the legal limit at precisely the right point.	Trial-and-error processes	Efficiency is sustainable over time but has a thin market.	Some funds may be misused or diverted.
Least Cost	May involve large initial costs to establish sufficient groups, set comprehensive legislation or property rights	Affected parties find the efficient pollution level rather than the control authorities	Information asymmetry; inefficient emission standard	When appropriate charge rate is established, cost-minimising allocation will be self-established	Cost-minimising allocation is self-establishing	High cost for control authorities
Acceptability	May not be favoured by the public since it can be difficult to identify and deal with the polluting parties Voluntary groups may strengthen community relationships	May be supported by the public because it is nonconfrontational, and is generally favoured by polluters	Publicly and politically acceptable but generally unfavourable toward polluters	Firms dislike taxes	Regulators may feel less control over the situation and firms often think rules are cheaper. Opportunistic behaviour may upset some citizens	Politically unfavourable
Examples	Landcare groups taking action themselves to plant riparian areas on their own properties.	Auckland Regional Council "Dirty Diesel" campaign resulting in cleaner diesel fuel for Auckland.	Regional Councils' rules concerning the discharge of farm dairy effluent.	The proposed carbon charges for meeting NZ Kyoto obligations.	EPA sulfur dioxide emission control in the USA.	The cleanup of contaminated industrial sites in some jurisdictions.

Appendix Three

Rae, J. (1997).

Table 1 Main characteristics of selected economic instruments

Type and definition	Advantages	Difficulties/disadvantages	Relevance
Emissions and effluent charges or taxes charges based on the quantity and quality of pollutants discharged	— low transaction costs for firms or individuals	— setting the charge at the right level — monitoring requirement	discharges from point sources
Product charges levies on products which are harmful to the environment when used or disposed of	— reduces the use of products that are harmful to the environment	— setting the charge at the right level — monitoring requirements	where it is not feasible to monitor pollution from individual sources
Clean up or restoration levies a levy to raise funds for environmental clean up	— levy funds are linked to environmental purposes	— determining the relevant group to levy	to fund clean up costs caused by past (but not ongoing) activities
Subsidies payment by government to those undertaking environmentally friendly activities	— encourages action to overcome environmental problems	— externalities are not internalised by polluter — may reward poor environmental performers — may pay those who would undertake action even without a subsidy	where other economic instruments do not work or are too 'expensive'
Performance bonds financial security lodged with government against environmental damage	— minimises the risks and potential costs of polluters defaulting on liability — encourages restoration and clean up where necessary	— setting a realistic level of security	where it is necessary to minimise the risk that environmental damage will not be rectified
Legislated deposit refund systems a refundable deposit which is paid on products which can cause pollution if discarded	— reduces the volume of waste and/or the release of toxic substances into the environment	— transaction costs may be high — significance of benefits (relative to changes in costs) not always clear	most effective if applied to products which have an existing distribution system, eg household milk containers
Tradeable permits a transferable right to discharge a prescribed level of pollutants or use a certain amount of a resource	— allocation of resources to the highest valued use — reduced information needs for regulators — more certainty regarding pollution or resource use levels	— establishing an efficient market — setting overall level and initial allocation of permits — transaction costs	where environmental impact is independent of pollution source, eg for air pollution within a defined area
Environmental liability making polluters legally liable for environmental damage	— potential polluters are forced to either adopt environmentally friendly practices or pay potential damage (through higher premiums)	— choosing the level of increase in premiums, etc. that will cover liability and risk — enforcement of liability	where environmental outcomes are linked to the availability of finance, insurance, etc.