MARKET BASED INSTRUMENTS AND SUSTAINABLE RESOURCE RECOVERY

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EXECUTIVE SUMMARY

To achieve a key component of sustainable development, there is a need to make the step-change to cyclical patterns of resource consumption and recovery. The missing link in making such a progressive change is the investment in resource recovery infrastructure to facilitate the recovery of materials at their highest resource value. This report reviews the use of Market Based Instruments (MBIs) as tools to direct recovered material flows to their highest resource value and drive sustainable resource recovery.

Market Based Instruments are increasing in popularity as tools to achieve environmental and sustainability outcomes. They seek to 'harness market forces' to reach desired goals by correcting market distortions or failures, caused by the existence of negative environmental externalities in the economy.

Intervention is required to correct these failings, either through a regulatory 'command-and-control' approach, or through setting the framework for a market based approach. A market based approach allows a voluntary response to the 'polluter pays principle' and provides flexibility for industry in two ways; firstly in choosing the nature of the response to meeting the MBI requirement and secondly in driving innovation to develop cheaper and more effective alternatives to achieve the same net result.

The market creation of tradeable permits and certificates has the potential to support sustainable resource recovery. This particular MBI creates a property right (essentially a tradeable certificate) for the recovery of resource value from materials that would otherwise be disposed of to landfill. To date most MBI schemes are designed within a framework of environmental economics. Environmental economics extends the neo-classical economic model by attributing a monetary cost to environmental externalities, while otherwise remaining 'values free' (that is leaving the market to operate without disruption).

The perspective of ecological economics, however, enables society to decide on a values driven goal, for example, the achievement of sustainable resource recovery, as opposed to 'only' driving toward the internalisation of externalities. It is proposed that societal values of restoring the environment, creating cyclical material flows and gaining a community operating licence should define the operating parameters of future market based instruments.

Case studies from Australia and overseas are explored to illustrate the potential for MBIs to achieve desired sustainability outcomes; in general and with specific reference to resource recovery. These case studies highlight lessons for developing and measuring the effectiveness of sustainable resource recovery MBIs.

Sustainable resource recovery requires consideration of the entire 'value chain' to identify points at which MBIs can direct material flows to their highest resource value. An assessment matrix for qualifying net present highest resource value is developed for this purpose. The justification for cyclical material flows comes from the 'industrial ecology' analogy of a system that can return resources for use back into the economy, involving a network of infrastructure with the ability to transform wrong time/place wastes into right time/place resources. This requires investment in reverse distribution and reprocessing infrastructure, and the consideration of impacts regarding local use as opposed to export global commodities markets.

A framework is developed for evaluating the effectiveness of sustainable resource recovery MBIs. It identifies several key indicators including waste generation, amounts recovered, commodity prices and market saturation, number of facilities trading in the programme, infrastructure development and engagement with the value chain. Highlighted against the potential indicators are the difficulties associated with measuring the comparative international performance.

A preliminary discussion on the potential workings of a sustainable Resource Recovery Certificate (RRC) scheme delivers the basis for stakeholder dialogue around the desirability, effectiveness, efficiency and design of such a scheme. The RRC trading scheme aims to encourage investment into resource recovery infrastructure that will result in otherwise wasted materials being recovered at their 'net present highest resource value', while achieving sustainability outcomes and contributing to achieving the targets set out in the NSW Waste Strategy. As such RRCs present as an innovative opportunity for government, industry and community to make a significant step toward sustainability.

GLOSSARY

Economic Instruments (EIs)	See Market Based Instruments.
Ecosystem Services	The range of services that are provided by the ecosystem (biosphere) including atmosphere and climate maintenance, water regulation and supply, biodiversity and genetic resources, soil formation and raw materials in addition to food production.
Environmental Acquis	The body of European Union law concerning the environment.
Environmental Externalities	The damage done to the environment by pollution that impacts on a range of third parties who were not involved with the activity that caused the environmental pollution in the first instance. The cost of these negative environmental impacts are also not paid for by the company or organisation that caused the impacts, but by the broader society at large.
Environmental Taxes	The imposition of a tax regime in order to internalise previously externalised costs of resource extraction, manufacture, distribution and waste generation.
Environmental Pollution	Refers to environmentally damaging emissions arising as a result of human activity by way of emissions to air (for example greenhouse gases, oxides of nitrogen and oxides of sulphur), water (for example sewage and agricultural run off) and land (for example waste to landfill and contaminated soils).
Ex-ante	A forward looking assessment of the likely impacts of new policies or proposals.
Excludability	Used to describe private property (and externalities) where the benefits (or costs) of an item or event can be excluded through the exercising of ownership rights from other individuals.
Ex-post facto	Latin for 'after the fact'. An ex-post facto assessment provides a historical analysis of a scheme. Contingent ex-post reviews of trading schemes are problematic in that they introduce uncertainty into the market place that the original limits, liabilities or generated credits of the scheme might be invalidated.
Externalities	In economic theory an externality refers to the instance where a decision causes impacts (positive or negative) on third parties who were not involved with the original decision. Costs associated with negative impacts (such as *environmental pollution*) are said to be externalised when they are not included in the price of a good or service. This can provide a cost advantage to companies who avoid paying for the damage that their activities cause.
Gaming	The application of game theory to decision making where 'rational' individuals face choices between acting out of self interest and acting for the common good, but where other participants' decisions in the 'game' are unknown, with a large potential for negative impact and create an incentive to act out of self-interest.
Industrial Ecology	Uses the model of natural systems to both assess the impacts of industry and technology on the environment, and to design industrial systems that reduce these impacts while improving interactions between elements of the industrial system and the surrounding environment.
Market Based Instruments (MBIs)	A collective grouping term for a series of tools that seek to harness market forces in the achievement of an environmental goal. Also known as Economic Instruments or Economic Incentives.
Natural Resource Use	Refers to the range of activities that use natural resources, both renewable (for example timber and fish) and non-renewable (for example metals and plastics).

Net Present Highest Resource Value (NPHRV)	The resource recovery option for any given material that maximises the positive and minimises the negative relative environmental, techno-economic and socio-political impacts.
Non-excludability	Used to describe the provision of public goods (and externalities) where the benefits (or costs) of an item or event can not be excluded from being shared with other individuals regardless of payment.
Offsets	Refer to situations where negative environmental impacts at one location (such as the emission of pollution) are offset by positive contributions at a different site (such as pollution reduction) in order to get an overall desirable balance.
Pigouvian Taxes	Refer to the range of Environmental Taxes that are placed on activities that cause unwanted and damaging externalities. Named after the economist A.C Pigou who developed the concept of externalities in the 1920s.
Property Rights	Set and define the rights of ownership and possession that are essential to the functioning of a market. It is recognised that part of the cause of environmental degradation arises from the 'public good' aspect of ecosystem services. The specification and privatisation of environmental property rights is thought by many to be a valid means of controlling pollution.
Public Goods	Refers to those goods and services which provide beneficial externalities that are unable to be sold for individual profit because they are available for everyone to share (*non-excludable)* and do not diminish with use (one person's use does not reduce the amount available to another). Examples include sunlight, air and public recreational space.
Requited Payments	Fees and charges are examples of requited payments to general government and are levied more or less directly proportional to the amount of services provided, for example load based licensing. See also unrequited payments.
Resource Recovery Certificates (RRCs)	A proposed trading certificate scheme to support sustainable resource recovery that is developed as an example in this study.
Unrequited Payments	Taxes are unrequited payments in the sense that the benefits provided by government to the taxpayer is not in direct proportion to the amount of tax paid. See also requited payments.

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TOTAL ENVIRONMENT CENTRE

1 INTRODUCTION

Australians generate some 28.4 million tonnes of waste each year, of which approximately two thirds ends up being disposed of in landfill, some 900 kilograms per person/year.[1] While many communities have embraced the challenge of sustainable resource recovery, there remains much work to be done, especially in making the step-change to cyclical patterns of resource consumption and recovery.

It has been argued that the missing link in making such a progressive step change is investment in resource recovery infrastructure. Infrastructure is needed to facilitate the flow of recovered materials to their point of highest resource value, along with a stable supply of 'waste' resources.

Market Based Instruments (MBIs) are a means to mobilise market activities (for example, trading mechanisms and price signals) to achieve sustainability objectives. Recent initiatives in Australia include Renewable Energy Certificates and the NSW Greenhouse Gas Abatement Scheme.

Waste management MBI activities have, to date, concentrated around landfill levies and the debate on container deposit legislation. These activities, however, do not act to promote the development of an 'industrial ecology' network of infrastructure that would sustainably recover resources from materials that would otherwise be disposed of to landfill. Thus there is a need to investigate potential MBI programmes that could effect the desired step-change outcome in resource recovery.

Total Environment Centre has been actively campaigning on these issues through their work on the Great Waste Debate and Extended Producer Responsibility and also through their development of the Green Capital Forum, an ongoing dialogue between business, government and NGO sectors on issues related to sustainability.

The Pratt Foundation has provided funding for Total Environment Centre, in association with Warnken Industrial and Social Ecology Pty Ltd, to investigate the potential for an MBI programme to promote sustainable resource recovery.

This document presents the background discussions to the development of a Market Based Instrument to support Sustainable Resource Recovery, in addition to providing an overview of the potential workings of such a sustainable resource recovery MBI – the Resource Recovery Certificate.

1.1 Overview of Report

This report is structured into six main sections. Following this introduction, Section 2 provides a review of theory behind market based instruments (MBIs), including the rationale for their use within the context of environmental economics, the benefits and limitations of a market based approach, the main categories of MBIs and the prerequisites for an effective and efficient MBI.

Section 3 then highlights a distinction between ecological and environmental economics, before presenting a range of case studies from around the world and Australia on the generic application of MBIs to a variety of environmental issues. Section 4 examines some of the MBIs that are used specifically with regard to resource recovery and the diversion of materials from landfill.

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[1] Australian Environment Industry Directory – 2004 Edition, Waste Management and Environment and Environment Business Australia.

Having completed the review of MBIs and their application, Section 5 sets the scene for a discussion on the ingredients within a sustainable resource recovery system, drawing on an analysis of the value chain of municipal solid waste to investigate highest resource value, industrial ecosystem thinking, reverse distribution networks and to consider the implication of domestic utilisation of recovered resources as opposed to exporting to global markets.

Section 6 then explores issues associated with benchmarking the sustainability of resource recovery MBIs and provides an evaluation framework in order to develop suitable indicators while giving consideration to comparative international experience. Using the insights derived from the previous section, the report concludes with Section 7 presenting an overview of the workings of a potential certificate trading scheme built around a Sustainable Resource Recovery Certificate.

This structure of the report is presented in Figure 1 below.

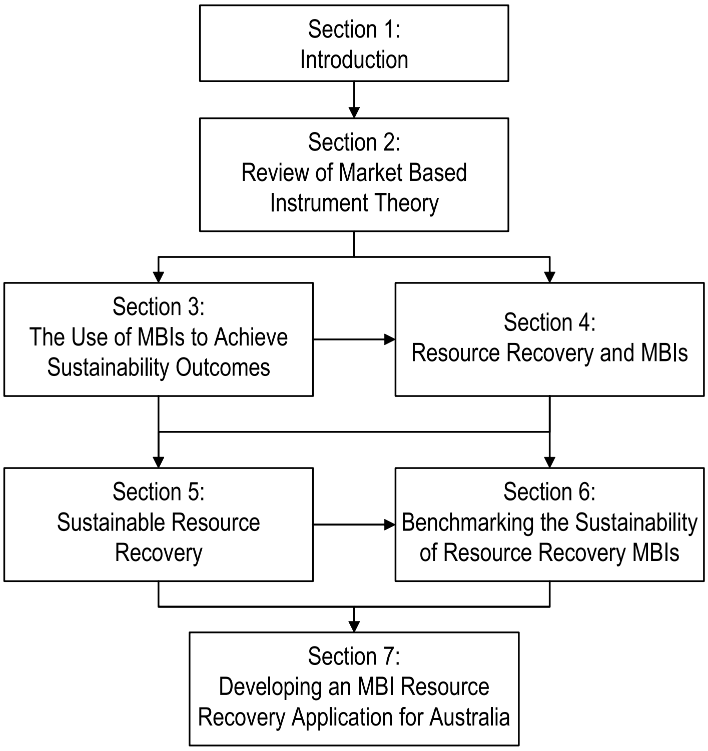

Figure 1 – Structure of report

2 REVIEW OF MARKET BASED INSTRUMENT THEORY

There are many environmental challenges being faced by countries worldwide, for example averting damage to the ozone layer, air quality, water supply and biodiversity, in addition to greenhouse gas reduction and waste management (OECD 2001a). Market Based Instruments (MBIs) also known as economic instruments or economic incentives (EIs) are gaining increasing popularity as a tool to achieve desired environmental outcomes.

2.1 Rationale for the Use of Market Based Instruments

It is often asserted that problems such as environmental pollution, over-use of natural resources and disruption to ecosystem services are primarily caused by distortions and failures within the competitive marketplace. Such market failures include monopolistic power, incomplete information, externalities and public goods.[2]

As a result of this market failure, a feedback loop is established with no warning signal, which reinforces market shortcomings. This rewards actions within the market causing environmental degradation and results in steadily worsening conditions, requiring government intervention in order to control the environmental damage. This cycle is presented in Figure 2 below.

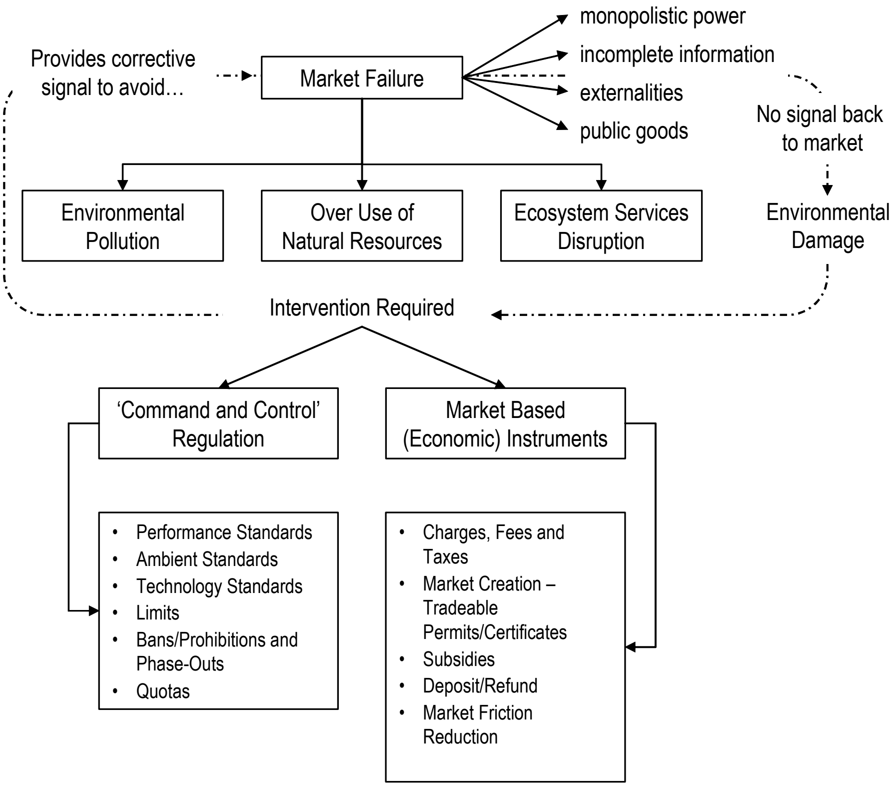

Figure 2 – The need for market based instruments within an environmental economics model

There are two main models of government intervention to correct for market failure, 'command and control' regulation and market based instruments. Command and control style regulation uses measures such as limits, quotas and bans or phase-outs in addition to performance, technology and ambient air or water standards, in order to achieve desired environmental outcomes.

[2] *Public goods are those goods or services that are unable to be sold for individual profit, for example, the services provided by natural systems (air, water and sunlight) and services provided by the government (defence and public recreational space).*

Market based instruments seek to harness market forces to assist in meeting the desired environmental goal. These types of instruments can be grouped into charges, fees and taxes, market creation (tradeable permits/certificates), subsidies, deposit/refunds and market friction reduction. Inevitably a market based instrument will require some level of 'command-and-control' regulation in order to function, for example implementing quotas that serve to create a 'cap' for trading certificates, or allocating a level of liability to an industry sector. However, the main difference is the greater level of freedom the 'market' has with MBIs to choose the nature and extent of response. Further details of the case for market based instruments are presented in the sections below.

2.1.1 Environmental Damage

The theoretical premise of any market-based or economic instrument is to correct for the environmental damage caused by the existence of negative environmental externalities in unregulated economies (OECD 2001a). Damage is evidenced by direct environmental pollution, through the un-valuing and depletion of resources and also through not valuing the services that ecosystems provide. It is in the rectification of these problem areas that Market Based Instruments are increasingly being used:

- Environmental pollution refers to the damaging emissions arising as a result of human activity by way of emissions to air (for example greenhouse gases, oxides of nitrogen and oxides of sulphur), water (for example sewage and agricultural run off) and land (for example waste to landfill and contaminated soils). The current approach with environmental pollution is to treat the symptoms, that is, to find measures that stop, reduce or limit the increase of environmental pollution, as opposed to addressing the underlying cause of the pollution (for example energy intensive methods of production, inappropriate choice of raw materials and aging or poorly designed infrastructure).
- Natural resource use includes the range of activities that use natural resources, both renewable (for example timber and fish) and non-renewable (for example metals and plastics). An ideal approach with natural resources is to prevent environmental degradation, for example by setting responsible criteria for use.
- Ecosystem services are the range of services that are provided by the ecosystem (biosphere) including atmosphere and climate maintenance, water regulation and supply, biodiversity and genetic resources, soil formation and raw materials in addition to food production. Damage occurs to ecosystems when stewardship is not practised. The preferred approach is to restore ecosystems to vigorous health, that is moving beyond the treatment of symptoms and even prevention to a proactive and restorative approach (although in some cases it is noted the stressors for action can be in part reactionary).

According to modern economic theory, the damage described above essentially arises as a result of an underlying market failure.

2.1.2 Underlying Market Failure

The theoretical competitive market is shaped by the interaction between forces of supply and demand, influencing what goods should be produced, the amount of unit production per good and the method of production. Marketable goods that fall within this mechanism have the common characteristics of being able to be measured in terms of physical quantity and also of being able to be valued in monetary units. One of the main problems with this model is that environmental goods are difficult to measure and to value in monetary units. For example a lake is not just the volume of water, nor the fish that can be caught from the lake, rather it is a complex ecosystem involving living and non-living interdependent elements (Thampapillai 2002).

Other problems with the market mechanism contributing to market failure include the presence of monopolistic power, incomplete information, externalities and public goods (ABARE 2001).

Monopolistic Power

One of the assumptions of a perfectly competitive market is that of 'atomistic competition', that is the situation where there are enough buyers and sellers of a good or service so that no one buyer or seller can determine the price of that good or service. Monopolistic power arises where a company is the sole provider of a good or service and thus has no competition. No competition means that the company can raise its prices higher than what would have been set by a competitive market. This results in an overall drop in welfare (Pindyck and Rubinfeld 1989). Monopolistic power also has the potential to accelerate environmental damage if the only company producing the good or service is doing so in an environmentally damaging manner.

Incomplete Information

Incomplete or 'asymmetric' information is a distortion of the 'perfect knowledge' assumption of the competitive market whereby buyers and sellers are in possession of all market knowledge. This potential to abuse incomplete information is the driver behind strict labelling laws (Pindyck and Rubinfeld 1989).

Incomplete information contained within false advertising related to environmental claims led the Australian Competition and Consumer Commission to issue a guide covering environmental claims in marketing in 1992. Their concern being that some claims might breach the prohibition against deceptive and misleading conduct under the Trade Practices Act 1974.

The flip side to misleading information, is information that is omitted or inaccessible to the general marketplace at both a company and product level. In Australia this concern is driving initiatives like the Corporate Law Economic Reform Program, in addition to mounting stakeholder pressure to adopt practices such as the Global Reporting Initiative. At a consumer and product level the 'Good Environmental Choice' and the 'Certified Organic' labels, for example, are trying to overcome incomplete information. Generally, however, there is no information available to consumers about the environmental impact that their purchases are causing.

Presence of Externalities

Externalities are those costs or benefits related to the provision of a good or service that are not reflected in market prices, hence are 'external' to the market (Pindyk and Rubinfeld 1989). When negative externalities such as the costs of pollution or resource depletion are not factored into market prices, 'inefficiencies' arise from the over-production or consumption of goods or services that continue to pollute and deplete, thus imposing social costs (OECD 2001a).

Negative externalities are exacerbated by the positive feedback loop that exists in our current economic system arising from the financial rewards that companies receive who are able to externalise their costs. In many respects the greater the level of externalisation a company can achieve, the greater their short term competitive advantage. For example, a company with no costs for discharging untreated pollution into the environment will have lower capital and operational costs that a similar company with strict licence conditions on allowable emissions.

There will always be a tension between the drive of a company to externalise costs, and the level of socially acceptable pollution, the cost of which is born by society.[3]

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[3] *The theory of externalities is credited to the English economist Arthur Pigou, and the range of taxes applied to prevent negative environmental externalities is referred to as 'Pigouvian Taxes'. Pigou noted in his book 'The Economics of Welfare' that 'the essence of the matter is that one person A, in the course of rendering some service, for which payment is made to a second person B, incidentally also renders services or disservices to other persons (not producers of like services), of such a sort that payment cannot be exacted from the benefited parties or compensation enforced on behalf of the injured parties' (Pigou 1920).*

Presence of Public Goods

Public goods refers to those goods and services that are 'freely' available for consumption by the public and that, once 'consumed' are still available for consumption by others. One example is street lighting. Once the street lighting has been produced it cannot be excluded from consumption and, having been 'consumed' by one member of the public, is still available to others (Hamilton 1997).

Another example of public goods includes those 'free' ecosystem services, such as the provision of clean air, clean water and stabilisation of the overall climate. Because these services have no private ownership and are not given a direct monetary value, they are not brought to account in traditional economic models. The ownership issue arises because the consumption of ecosystem services is non-excludable. For example, one cannot exclude a person from breathing clean air on the basis of what they have, or have not paid for[4] (Murtough *et al* 2002).

The potential for environmental degradation of public goods was noted by Garret Hardin in his article 'The Tragedy of the Commons' (1968) based on a scenario put forward by a 19th century amateur mathematician William Lloyd[5] involving publicly accessible grazing land (the commons). In this scenario it is within each individual herder's self interest to maximise the size of their individual herds, even though this leads to an overgrazing and degradation of the commons. Hardin focuses on the inevitability of self interest (rational economic behaviour) causing environmental damage to public goods.

The establishment of property rights is often highlighted as a solution in overcoming the tragedy of the commons and in achieving improved environmental and sustainability outcomes. The theory is that since property rights establish ownership, owners are more likely to protect their assets than users who have no long term stake in the resource productivity of the asset. Furthermore, owners are likely to invest in improving the quality of the assets, especially when this is perceived to yield a higher return and owners are also able to take action against vendors or sub contractors if resource extraction leads to the damage of the resource (UNEP 2004a).

However, while the theory of financially rewarding those who improve ecosystem services and charging those who destroy or damage ecosystem services is attractive, there are significant difficulties in understanding these processes and interactions, which makes its difficult to define and enforce ownership of ecosystem services (Murtough *et al* 2002).

2.1.3 Need for Intervention

In order to correct failures within the market place there is a need for intervention. This intervention may be in the form of direct action by Government, or from proactive industry leadership. Government intervention seeks to take actions necessary to restore the function of the market. For example, ensuring adequate competition within an industry sector and preventing predatory pricing, by enforcing standards of product and company disclosure, by making it more expensive for companies to pollute than to control their emissions and by defining property rights for public goods in order to facilitate their stewardship.

There are a range of instruments that can be used to achieve these goals. These instruments can be characterised as either a regulatory 'command and control' approach or a market based approach that involves an attempt to harness the power of the 'free' market to achieve the desired environmental outcome.

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[4] *In many respects the provision of kerbside waste and recycling collection services have the properties of public goods, especially for renters who do not pay rates (services are funded by local government through rate payers). The issue of access and public goods also impacts domestic waste services, in that where people live often dictates the range of 'public goods' that are accessible. Given that the range of collection services and their effectiveness varies from one local government area to the other, residential location may limit access to collection services and as such reduce the effectiveness of resource recovery.*

[5] *Lloyd's article was entitled 'Two Lectures on the Checks to Population' published in 1833 by Oxford Press and was included in part in 'Population, Evolution and Birth Control' (Hardin, G. ed. (1964), Freeman, San Francisco).*

The case for government intervention needs to establish the effectiveness of intervention, such as the degree of certainty in achieving a stated goal, and the efficiency of intervention, that is, achieving the stated purpose of intervention at the lower cost (ABARE 2001).

2.1.4 Command and Control – Regulation

Government has tended to respond to community demands for improved environmental outcomes through the establishment of increased regulation. Indeed the driver for these changes can be argued to be from community pressure in combination with increasing scarcity of environmental goods and services (Whitten *et al* 2003).

The principal argument used against direct regulatory mechanisms in achieving environmental policy is not that such mechanisms are necessarily ineffective, but rather that they may achieve their objectives at a higher economic cost than market based mechanisms (Bari 2002). For example, the command and control approach sets uniform standards by either prescribing the technology (methods and in some cases equipment) or the performance levels (allowing some solution flexibility) that industry must adopt. This creates the potential for high compliance costs arising from the prescribed use of cost ineffective technology, which can also provide a limiting effect on the development of innovative solutions to pollution.

Balanced against potential high costs is the counter-issue revolving around 'low hanging fruit' in that while it may be less expensive to access the 'easy' gains, there may come a time when regulation is required to move to the next level of performance. It is noted that just because things are expensive, it does not necessarily follow that they should not be done.

However, other limitations of a regulatory approach include providing a disincentive to adopting new technology, as is the case when businesses are penalised for adopting new cleaner technology by having their emissions limits reduced[6] (Stavins 2002). Additionally, command and control approaches are characterised by allowing pollution below regulatory threshold to occur for free, as opposed to incorporating a cost for any level of pollution, for their high level of public sector involvement and oversight and for providing no incentive to exceed regulatory targets (UNEP 2004a). For these reasons alternative market based approaches are finding increased popularity and support.

2.1.5 Use of Market Based (Economic) Instruments

Market-based instruments are an attempt to 'encourage behaviour through market signals rather than through explicit directives regarding pollution control levels or methods' (Stavins 2002). MBIs are an attempt to 'harness market forces' to achieve an environmental outcome. This is achieved by realigning the rights and responsibilities of industry in order to provide them with both the incentive and power to operate in a more environmentally responsible manner by increasing the cost of environmentally damaging inputs and rewarding more sustainable practices (UNEP 2004a).

Market based instruments attempt to adhere to the 'polluter pays principle'. defined in the 1972 OECD Guiding Principles on the International Economic Aspects of Environmental Policies, as:

> 'The principle to be used for allocating costs of pollution prevention and control measures to encourage rational use of scarce environmental resources and to avoid distortions in international trade and investment is the so-called "Polluter Pays Principle". This principle means that the polluter should bear the expenses of carrying out the above mentioned measures decided by public authorities to ensure that the environment is in an acceptable state.

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[6] *For example a company may install new gas emission technology, resulting in reduced pollution levels. However, if this is accompanied by stricter operational conditions in the form of reduced emission limits, the 'tighter' regulations may prevent on-site expansion or involve greater day-to-day management with additional reporting requirements, effectively resulting in a 'penalty' for improving operational performance.*

> In other words, the costs of these measures should be reflected in the cost of goods and services which cause pollution in production and/or consumption. Such measures should not be accompanied by subsidies that would create significant distortions in international trade and investment.'

Market based instruments allow a voluntary response to the polluter pays principle and provides flexibility for industry in two ways, firstly in choosing the nature of the response to meeting the MBI requirement and secondly in developing cheaper alternatives to achieve the same net result (Whitten *et al* 2003). The strength of MBIs thus arises not through the equalisation of performance levels amongst industry, but from the equalisation of the marginal costs of pollution abatement Stavins (2002). The assumption is that the least cost abatement measures will be chosen and that the level and allocation of pollution reducing effort will be efficient across companies (OECD 2001a).

It is generally recognised that an MBI programme will be complementary to direct regulatory initiatives. In fact there is often the need to have strong regulation to establish the framework and enforce operational aspects of an MBI scheme (UNEP 2004a). Voluntary initiatives from industry sectors can also achieve the results desired from either a regulatory or MBI programme. This occurs when sector-wide commitment is obtained to meet targets without the need for a government mandate, relying instead on self-regulation and reporting. However even with voluntary MBI initiatives some form of external regulation may be desired to address limitations such as the free rider issue. Other limitations in addition to the benefits of a market based approach are presented in the sections below.

2.2 Benefits and Limitations of a Market Based Approach

2.2.1 Potential Benefits of a Market Based Approach

The theoretical advantage of an economic instrument over a command and control regulation arises from static and dynamic efficiencies, the possibility of achieving a 'double dividend' and in self enforcement and greater transparency of stakeholders.

Static Efficiency

Static efficiency refers to the equalisation of marginal abatement costs (efficient pattern of abatement). Companies with relatively lower costs of pollution abatement will tend to reduce more pollution and thus will save on the payment of taxes or generate tradable permits, making the marginal cost of abatement cheaper than the environmental tax or the market trading price of the permit (OECD 2001a).

Companies with higher costs of pollution abatement will conversely pay tax on their emissions or purchase permits, making the marginal cost of abatement higher than the environmental tax or the market trading price of the permit. The result is said to be the achievement of environmental pollution abatement at the minimum cost and the equalisation of marginal abatement costs across companies (OECD 2001a).

For example, consider the scenario in Figure 3 overleaf where a group of companies is under an obligation to achieve 'A' units of improvement. This could be in terms of pollution abatement, purchase of renewable energy, greenhouse gas emissions, landfill diversion and so forth.

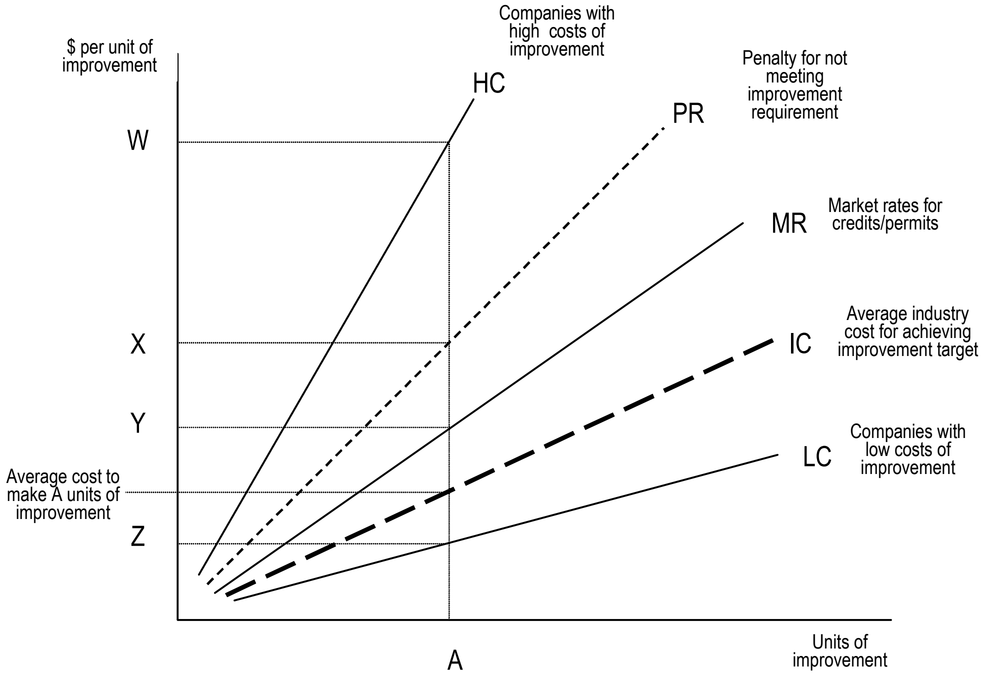

Figure 3 – MBIs – Least cost method of achieving environmental improvement

The penalty rate (PR) for not achieving the desired environmental outcome of 'A' units of improvement is set at $X. Companies with a low cost (LC) of achieving the desired improvement ($Z) will naturally take this option. Because of their low costs, these companies will also be able to achieve additional units of improvement and gain a credit (or not have to use a permit).

For companies with high costs (HC) of achieving the desired environmental improvement ($W), there exists the option of paying the penalty $X or purchasing the required credits or permits at a lower market rate (MR) of $Y. Logically, companies with high costs of abatement will purchase tradeable credits or permits where these costs are lower than the penalty rate (MR < PR).

The net result is that the group of companies are able to achieve the desired environmental outcome at an average industry cost that is between the market rate for credits/permits and the lowest cost of achieving the environmental improvement (LC < IC < MR), or in other words, more environmental protection at less cost.

Dynamic Efficiency

Dynamic efficiency is the ongoing incentive to reduce the costs of pollution abatement, over and above meeting an arbitrary performance level. The intention of a market based approach is that the more pollution that is reduced, the greater the saving in taxes or the greater the generation of tradable permits (OECD 2001a). This acts as a driver for the development of innovative technologies and methodologies to achieve the desired environmental outcome in a more cost effective manner.

Double Dividend

The double dividend of environmentally related taxes refers to the realisation of both an improved environmental outcome and a reduction in other taxes such as labour taxes. The hope being that the latter benefit will provide the impetus for greater employment, investment and a more efficient economy. However there is debate as to whether or not this double dividend is possible in theoretical or practical terms. For instance it is noted that environmental taxes can increase the costs of goods and services and thus reduce real wages leading to a reduction in employment and a subsequent reduction in tax revenue, which would then require increased taxes to cover the shortfall (OECD 2001a).

Another way of viewing the double dividend is to look at the potential for MBIs to improve environmental quality and at the same time stimulate economic activity. The achievability of either of these examples of a double dividend has yet to be proved. However it is noted that MBIs have earning or cost recovery potential for government departments to finance environmental initiatives (UNEP 2004a).

Self Enforcement and Transparency

Market Based Instruments tend to support the self enforcement of the MBI system. For instance where industries are selling tradable rights that they have generated, they will be motivated to ensure that liable parties are meeting their obligations under the scheme. Additionally, MBIs have the potential to result in increased transparency across stakeholders. The trading mechanism is by necessity transparent and information on trades is likely to be more accessible than complex and often commercial in confidence reports generated under command and control regulations (UNEP 2004a).

2.2.2 Limitations of a Market Based Approach

Some of the difficulties and limitations with using market based instruments include (UNEP 2004a):

- difficulties in determining policy baselines from which to measure MBI performance
- institutional weaknesses - if industry discovers it can continue to operate without buying credits or paying environmental taxes, then any market-based instruments will be rendered worthless, the free rider problem[7]
- legal gaps - there needs to be a legal authority and efficacy, that is, the necessary property rights and enforcement of contracts
- fiscal norms and perverse subsidies - it may be the case that the objective of the market based instrument is in direct contradiction of existing subsidies and financial baseline payments (and even may contradict other MBI initiatives)
- strong opposing political factions - well organised and funded special interest groups may disrupt the process of implementation of market-based instruments perceived to disadvantage their financial interests
- structure of the instrument - if structured improperly MBIs can actually accelerate resource depletion or environmental degradation
- community perception – there is the potential for MBIs to be perceived as comprising the ability to pay to pollute
- novel external circumstances – some circumstances such as emergency conditions requiring immediate rectification, initiatives involving excessive monitoring costs or an implementation path with no ability to make transitional payments and subsidies are unlikely to be improved by MBIs.

Another potential problem occurs when an MBI involves an environmental tax which is regressive, that is, when it has a greater impact on low income households than on the rest of the population. However, compensatory measures (redistribution of revenues raised) such as tax rate relief or subsidies could in fact reduce the environmental effectiveness of the economic instrument so that there is no price signal to change behaviour. Conversely, there is the issue of environmental tax effectiveness in that the more effective the environmental tax is in achieving its desired outcome, the quicker the tax base will erode (OECD 2001a).

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[7] *The problem with free riders is illustrated by a tradable credit system where participation is not mandatory. Those companies that purchase or generate credits will be at a competitive disadvantage from those 'free riders' who have not participated in the scheme.*

Another often cited obstacle to the implementation of environmental taxes has been the perceived reduction in international competitiveness. To date OECD experience has not borne out this fear, however, this may be as a result of exemptions to environmentally related taxes for energy intensive industries. OECD (2001a) concludes that these objections undermine the application of the polluter pays principle and fly in the face of research that sectoral competitiveness is based largely on capital investment and competency.

One remaining limitation of MBIs based on environmental taxes (or subsidies) is that they are predicated on the assumption that government is able to set an appropriate level of tax or subsidy to effectively raise overall social welfare (Murtough *et al* 2002).

Other issues arise from poorly defined environmental goals that are not conducive to the development of effective market-based instruments. For example with solid waste management, although there are stated concerns with resource conservation (waste avoidance and some forms of recycling) and industrial emissions (cleaner production) the policy metric has been volume of waste disposed to landfill and the MBI mechanisms selected to date have been levies, landfill taxes and subsidies. Furthermore, because of some of the mixed results from MBI schemes, there is often a debate as to whether the benefits justify the costs of establishment (Whitten *et al* 2003).

The cost issue again raises the 'low hanging fruit' syndrome identified earlier. It is recognised that there will be establishment costs at the start of an MBI scheme, especially instances where high complexity is involved (consider for example the NSW Greenhouse Gas Abatement scheme, which is discussed further in Section 3.4). Complexity of operation and difficulty in establishing an optimal cost/benefit balance with the lowest transaction costs should not, however, be used as an excuse for not engaging in the process of developing an MBI programme.

2.3 Types of Market Based Instrument

There are a wide variety of market based instrumentalities, also referred to as Economic Instruments in the European context and as Economic Incentives in the North American setting. There are also a large number of classification systems for grouping the various instruments. Here five main categories are identified and are presented in Table 1 below.

Table 1 – Main groupings of market based instruments (derived from UNEP 2004a, NCEE (2001), Bari (2002) and Whitten *et al.* (2003).

Category of Market Based Instrument	*Overview*
Charges, Fees and Taxes	Attempts to bring about a desired policy goal through the application of a charge, fee or tax in such a manner so as to change the actions of companies and individuals. Examples are usually based on the 'polluter pays principle' and include charges or levies for waste disposal, fees for pollution emission and environmental taxes.
Market Creation by Tradeable Permits and Certificates	Seek to assign property rights to items of value that previously had no direct monetised value. This is done in order to create markets for the damage control/reversal of environmental pollution, for the stewardship of natural resources and for the restoration of ecosystem services through tradeable permits and certificates. This approach allows flexibility for companies in taking action to achieve the desired level of environmental improvement and (in theory) provides industrial sectors a least cost approach to achieving environmental goals.

Category of Market Based Instrument	*Overview*
Subsidies	Refers to the use of subsides such as tax concessions, low or no interest loans and exemptions from fees and charges to improve the financial viability of organisations undertaking desired actions intended to bring about an environmental improvement. Also refers to the elimination of perverse subsidies. Perverse subsidies are those mechanisms that are in place that actively accelerate environmental deterioration, for example subsidies to fossil fuel based energy sources.
Deposit/Refund	Applies the principle of 'Extend Producer Responsibility' to products by including a refundable deposit in the purchase price of the product. A well known example is container deposit legislation (CDL). Also refers to other deposits that are required as performance bonds or financial assurances that environmental protection will occur, usually applied in the mining and minerals sector.
Market Friction Reduction	Addresses forms of market distortion through non-financial means. For example overcoming a lack of perfect information through a variety of information provision schemes such as Ecolabelling. Also includes legal reform associated with the assignment of liability and the right to sue.

These market based instruments are discussed in further detail below and a further listing of the variety of instruments available is included as Appendix 1.

2.3.1 Charges, Fees and Taxes

Charges, fees and taxes attempt to bring about a desired policy goal through the application of a charge, fee or tax in such a manner so as to change the actions of companies and individuals. Environmentally related taxes are defined as 'any compulsory unrequited payment to general government levied on tax bases and deemed to be of environmental relevance'.[8] In general, environmentally related taxes support the 'polluter pays principle' in which the costs of pollution are factored into the costs of manufacture and production. One issue to resolve is whether to tax the consumer or the producer. A consumption tax sends a direct price signal to the consumer whereas a production tax targets pollution abatement at the source (OECD 2001a).

'Green' tax reform has three main objectives (OECD 2001a):

- Restructuring of existing environmentally related taxes, that is the refinement of existing measures to fully internalise environmental and social costs, as opposed to only a partial internalisation.
- Introduction of new environmentally related taxes either on products or emissions that are currently exempted from taxation.
- Reduction of environmentally harmful tax expenditures. Harmful tax expenditure occurs when a government financially supports environmentally damaging activities, even when the support is in the form of foregone tax revenue (tax concessions). In fact, any non-internalisation of a social or environmental externality can be classified as a subsidy in that the future liability is not borne by the polluter, but by society as a whole.

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[8] It is noted that taxes are unrequited in the sense that the benefits provided by government to the taxpayer is not in direct proportion to the amount of tax paid. Fees and charges are examples of requited payments to general government in that they are levied more or less directly proportional to the amount of services provided, for example load based licensing.

Pollution charge systems impose a fee on the amount of pollution that a company or individual source generates. An example of this is the 'pay as you throw' form of waste collection where residents are charged on the basis of the volume of waste generated (Stavin 2002). Another example is the load based licensing scheme in New South Wales where companies are charged on the basis of the pollution they generate (NSW EPA 2001).

2.3.2 Market Creation - Tradeable Permits and Certificates

Market Creation aims to assign property rights to items of value that previously had no direct monetised value. This is done in order to create markets for the damage control/reversal of environmental pollution, for the stewardship of natural resources and for the restoration of ecosystem services through tradeable permits and certificates.

With regard to the control of pollution, an allowable level of pollution is decided upon and is distributed in the form of permits to businesses within an industry or a region.[9] Where a business emits less than their permitted amount, a tradeable surplus is created. The most notable American example of tradeable permits is the sulphur dioxide allowance trading programme for acid rain control (Stavin 2002). With a tradable permit scheme the quantity of pollution can be set, but not the price. This is contrasted with pollution taxes that set the price but not the quantity of the pollution (OECD 2001a).

Property rights based MBIs can be designed to achieve the desired environmental goods or service (or suitable proxy) but provide uncertainty to industry with regard to compliance costs. Examples include cap and trade schemes, tradable permits, rights or quotas, or offset schemes. For instance capping of emissions contributing to water related environmental damage such as caps placed on salinity in the Murray-Darling Basin and in the Hunter River, and on nutrients from wastewater treatment plants in the Hawkesbury-Nepean region.

Renewable energy certificates are an example of a positive rights based instrument (as opposed to a negative screen to stop activity from occurring) (Whitten *et al* 2003).

Barriers to the creation of a new market for environmental outcomes can arise where there is asymmetric information (information is skewed in that it is unknown what level of financial reward is required to trigger a desired activity) and/or a lack of buyers and sellers (possibility of collusion in setting the price of the new property right). The role of government is to define the property rights associated with the new market, establish the process for exchanging property rights and specify the procedures used to enforce the rules of the system, especially the case with the setting of a cap or limit (Murtough *et al* 2002).

2.3.3 Subsidies

Subsides such as tax concessions, low or no interest loans and exemptions from fees and charges to improve the financial viability of organisations undertaking desired actions intended to bring about an environmental improvement.

Other important initiatives involve the elimination of perverse subsidies. Perverse subsidies are those mechanisms that are in place that actively accelerate environmental deterioration. Stavin (2002) quotes a 1997 US EPA study that concluded that eliminating federal subsidies promoting the use of fossil fuels would have a significant reduction in carbon dioxide emissions.

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[9] *Where these permits are allocated by the Government it is referred to as 'grandfathering'. Other options for allocation include auctioning.*

2.3.4 Deposit/Refund

Deposit refund systems apply the principle of 'Extend Producer Responsibility' to products by including a deposit in the purchase price of the product (usually beverage containers but the principle can also be applied to chemical drums, paint tins and other recognisable containers), which is redeemable when the container is returned either to point-of-sale or to a collection depot. A well known example is container deposit legislation (CDL) such as the 5 ¢ deposit on beverage containers in South Australia.

Also included are other deposits required as performance bonds or financial assurances that environmental protection will occur. These are usually applied in the mining and minerals sector or other areas where long term impacts (and hence liabilities) are likely to be sustained.

2.3.5 Market Friction Reduction

Market friction reduction addresses forms of market distortion through non-financial means. MBIs designed to reduce market friction are less common and aim to achieve an environmental outcome through market stimulation such as reducing transaction costs and improving information flows. These efforts are longer term in nature and are uncertain in environmental outcome and industry cost. Examples include disclosing information through vehicles such as ecolabelling, information and technology transfer and research programmes to facilitate market exchanges (Whitten *et al* 2003).

Other initiatives include legal reform associated with the assignment of liability and the right to sue. For example liability rules to force businesses to consider outside implications of their actions and reporting requirements for companies (Stavin 2002).

2.4 Prerequisites for the Implementation of an Effective and Efficient Market Based Instrument

When designing a market based instrument it is important to understand the policy context including all of the existing economic, political, and institutional arrangements. Three major environmental policy objectives are identified (UNEP 2004a):

- modify, slow, or stop resource extraction
- reduce or eliminate problematic emissions
- make production and consumption patterns more sustainable.

These objectives suggest that an ideal resource recovery MBI would be able to influence the three levels of resource use, emission reduction and sustainable consumption.

Within these policy objectives there is the question as to how effective and efficient the MBI will be in achieving the desired outcome. Effectiveness refers to the ability of the MBI in achieving the stated policy objective, whereas efficiency refers to the costs associated with reaching those stated objectives. Hence an effective and efficient MBI is will provide the means of achieving the desired environmental outcomes at the least cost.

2.4.1 Four Phase Approach to the Development of Market Based Instruments

A four phase approach is identified by the United Nations environment programme in order to develop an effective and efficient market based instrument (UNEP 2004a):

Phase One - Structuring Existing Information

During Phase One the goal of the MBI is established, in addition to the baseline conditions, referring to institutional baselines (stakeholder analysis) and the mandate and level of power that the MBI is able to attract. Also to be considered is the long-term viability of the MBI.

Phase Two - Developing Policy Proposals on the Basis of Phase One

In Phase Two proposals for an MBI are developed, giving recognition to policy trade-offs such as environmental effectiveness, policy windows of opportunity, ease of introduction and acceptability to key parties. A realistic appraisal of policy limitations is made so as to match policy plans to institutional capabilities, ensure predictability and longevity and to understand the inherent constraint of the MBI.

Phase Three - Stakeholder Consultation for Feedback on Initial Policy Options

During Phase Three a range of consultation techniques including evaluation templates (if appropriate) are used to provide feedback on issues and input on alternatives.

Phase Four - Implementation Including Monitoring and Enforcement

Phase Four involves choosing policy instrument, introducing concurrent measures to mitigate severe impacts, securing inter-organisational cooperation and the marketing and promotion of the policy instrument. Additionally, provision for monitoring and enforcement is made, especially with regard to environmental effectiveness (effectiveness of achieving desired sustainability outcomes), economic efficiency (are costs of abatement or credit/permit generation rising or falling), administration and compliance costs, revenues and other wider economic and social impacts.

2.4.2 Implementation Lessons for Market Based Instruments

Several reports have made the following observations around lessons learned regarding the design and implementation of MBI schemes (Stavins 2002, Whitten *et al* 2003 and ABARE 2001):

- ensure flexible compliance alternatives in terms of technology choice and timing in combination with simple, transparent formulae that are difficult to contest or manipulate
- use absolute, as opposed to relative, baselines for reduction programmes to minimise the potential for 'paper trades'[10]
- use a flexible method of permit allocation to avoid excess costs
- have a capacity building programme to assist companies make the transition to identification of opportunities under the MBI scheme as opposed to minimising of costs under command and control regulations
- ensure an effective regulatory design that will be stable and constant with appropriate sanctions or penalties when the promised action is not delivered
- determine the rights and responsibilities of the MBI, that is who pays and who benefits. With regard to sustainability issues a clear and demonstrable link is required between the rights specified and the sustainability outcomes desired
- use incentive schemes such as subsidies where the benefits arising from the mitigation of environmental pollution are diffuse as these are likely to be more effective than taxes, charges, tradable permits and regulation.

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[10] *A paper trade describes the scenario where a company continues business as usual but claims an undeserved credit under a new MBI scheme using numbers that exist only on paper.*

3 THE USE OF MBIS TO ACHIEVE SUSTAINABILITY OUTCOMES

Market Based Instruments are promoted as a mechanism to harness market forces to achieve desired environmental outcomes. A distinction, albeit slight, needs to be made between environmental as opposed to sustainability outcomes. To highlight this distinction the differences between environmental economics and ecological economics is examined. Then a number of case studies from overseas and Australia illustrating the use of MBIs in achieving environmental and sustainability outcomes are presented.

3.1 Ecological Economics and Sustainability Outcomes

3.1.1 Differentiating Between Environmental Economics and Ecological Economics

Conventional economic theory concentrates on the financial interactions between producers and consumers (also referred to as firms and households), especially with regard to income (wages and interest), labour and capital, goods and services and prices for purchases (expenditures). Under this model the economy is seen as separate from the environment and the services of the environment such as provision of resources, receival of wastes and provision of amenities are not valued in monetary terms. This disconnect between economic activity and the environment gives rise to negative externalities such as pollution (Thampapillai 2002).

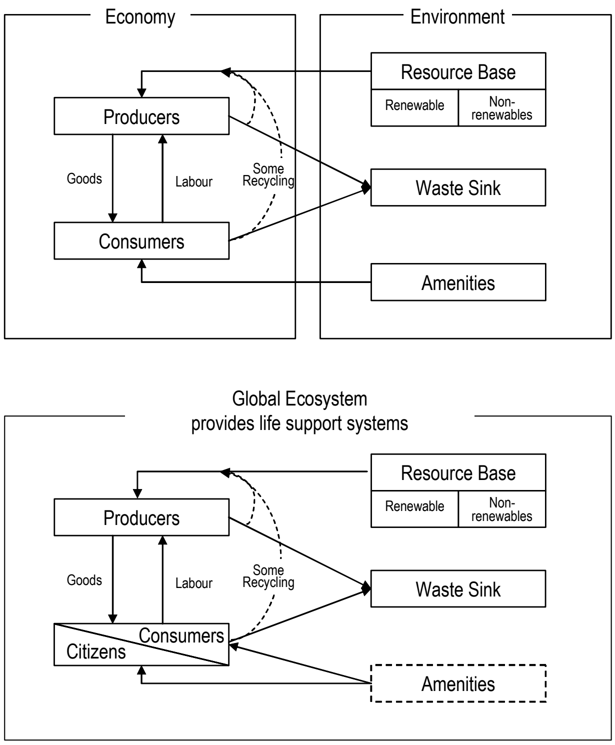

Figure 4 – Economic model (top left) as contrasted with environmental economics model (top two boxes) and ecological economics (bottom box) (adapted from Hamilton 1997).

Environmental economics (see Figure 4 above) continues to treat the economy as separate to the environment and accepts that the world is made up of self interested consumers, but attempts to limit environmental damage by valuing the environment in monetary terms. This is achieved by introducing measures that force producers to internalise the costs of resource depletion, externalities related to use of the environment as a waste sink and the loss of amenity from environmental systems (Hamilton 1997).

Ecological economics goes one step further and removes the dichotomy of economy and environment altogether, recognising that the economy is an interdependent part of the global ecosystem. The dual role of people as consumers and citizens is also highlighted. People as consumers will continue to use amenities provided by the environment and so will be willing to pay for them. People as citizens, however, transcend self interest and willingness to pay in order to make decisions on what is right (Hamilton 1997).

It is noted that MBIs have been applied to achieving a reduction in environmental pollution (internalising the cost of environmentally damaging activities), in managing natural resources (internalising the resource value of natural resources) and in protecting ecosystem services (creating an economic value for the provision of services such as biodiversity, clean air and water) Under an ecological economics framework it is also valid for society to decide on a values driven goal, for example the achievement of sustainable resource recovery. This concept and its application to resource recovery is explored further in the section below.

3.1.2 Ecological Economics and Sustainable Resource Recovery

It is important to recognise that a market based instrument for sustainable resource recovery, while deriving much of its theory from environmental economics, will have its origins within a model of ecological economics. That is to recognise it is the societal values of restoring the environment, creating cyclical material flows, gaining a community operating licence and other populist issues (for example opposing the creation of a new landfill) that will define the operating parameters of the market.

These values are often competing and in conflict with the market drive to externalise costs associated with resource extraction, manufacture, distribution and consumption. Hence, as is shown in Figure 5 below, government intervention is required to maintain the operating parameters defined by societal values.

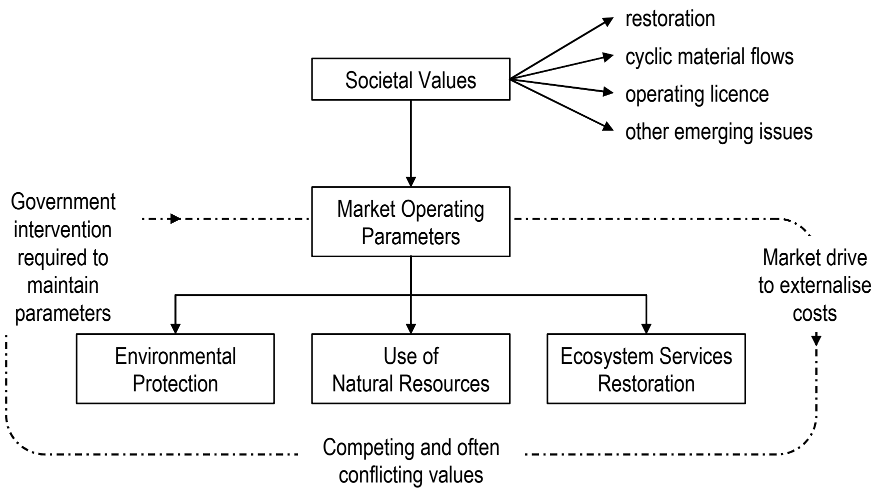

Figure 5 – Ecological economics model of the case for government intervention in maintaining market operating parameters

Both the ecological and environmental economics models agree that government intervention is required and that the intervention will be a mixture of command and control and market based approaches. The distinction is only of importance when it comes to selecting a MBI to promote sustainable resource recovery.

The environmental economics model will attempt to find an optimal trade off between the environment and the economy, of which one option will be cyclical material flows. The ecological approach, however, has cyclical material flows embedded as a given societal value. It will thus attempt to design a MBI that achieves an optimal least cost approach to achieving desired cyclical material flows.

To illustrate this issue consider the avoidance of waste disposal to landfill. Under an environmental economics approach, the least cost method of achieving this goal would be preferable, even if this meant mass burn incineration. From an ecological economics perspective, however, the challenge would be to find least cost alternatives to maximise material recycling on the basis of societal preferences for recycling and against mass burn incineration.

In order to investigate the potential for MBIs to achieve desired sustainability outcomes, a number of international and national case studies on the use of MBIs have been prepared. These are presented from a general perspective in the following sections. Case studies for MBIs that involve resource recovery initiatives are presented in Section 4.

3.2 Case Studies from the United States of America

The following case studies from the US are taken from 'The United States Experience with Economic Incentives for Protecting the Environment' prepared by National Center for Environmental Economics (NCEE 2001).

3.2.1 Southern California Regional Clean Air Incentives Market (RECLAIM).

Southern California's Regional Clean Air Incentives Market (RECLAIM) was set up by Southern California's South Coast Air Quality Management District (SCAQMD) with assistance from the US EPA. RECLAIM was established for the Los Angeles air-shed, one of the most polluted air-sheds in the US in terms of ozone precursors and other pollutants and deals primarily with sulphur oxides (SO_x) and nitrogen oxides (NO_x).

RECLAIM is a cap-and-trade programme (market creation by tradeable permits and certificates) for SO_x and NO_x. Reactive organic gases (ROGs) were also originally included, however, this part of the programme was discontinued because of problems measuring emissions of highly evaporative ROGs, the variable types of ROGs and different legislative regimes for different ROGs.

Liable parties were determined by creating a threshold pollution level of SO_x and NO_x to target the larger polluters. RECLAIM Trading Credits (RTCs) were allocated on the basis of a historical baseline for the start and then according to a declining annual amount set in order to reach a 2003 target level. This level then remained constant until the end of the programme in 2010. RTCs can be traded for current or future years, but can only be discharged against their issued 'vintage', with penalties for any emission liabilities that have not been offset with RTCs of the correct vintage.

RTCs are denominated in pounds of emission and are also weighted according to geography. Thus in some parts of LA a greater number of RTCs are required to offset NO_x emissions than in others. RECLAIM is generally hailed as a success in reducing SO_x and NO_x emissions, with the cost of participating in the trading programme well below the marginal compliance costs of proposed regulations.

3.2.2 US EPA Acid Rain Trading Program

The United States Government introduced the Acid Rain Program as part of Title IV of the Clean Air Act Amendments of 1990 in an attempt to reduce wet and dry depositions of sulphur dioxide (SO_2) from power stations by 50%. The Acid Rain Program is also a cap-and-trade programme (market creation by tradeable permits and certificates) with an overall cap of 8.95 million imperial tons of SO_2, to be achieved in two phases. Phase 1 began in 1995 and Phase 2 began in 2000.

Emissions trading of SO_2 allowances was accepted as the means of achieving compliance. Each allowance represented one imperial ton of SO_2 and had no expiry period, meaning that allowances could be banked for future use. Any power station (or other liable entity) that did not hold enough allowances to cover their emissions was fined US $2,000 per imperial ton in 1995 dollars (that is, the penalty amount was indexed for inflation). Continuous emission monitoring equipment was used to verify actual emissions with data sent to a central registry via the internet. The initial allocation of allowances was 'grandfathered' (determined) by the US EPA. New emission sources entering the market had to either purchase allowances through the SO_2 market, or through an auction of a small amount of new allowances offered by the EPA.

Acid rain allowance trading prices averaged around US $150 per imperial ton between 1995 and 2000, with transaction costs of less than US $2 per allowance. There was 100% compliance with Phase 1 targets, thought to be motivated primarily by the high penalty for non-compliance. The programme was estimated by the US EPA in 1995 to cost $1.2 billion annually in Phase 1 and $2.2 billion annually in Phase 2, while annual health benefits arising from the reduction in sulphates were estimated at $10.6 billion in Phase 1 and $40 billion in Phase 2.

3.2.3 Emergency Planning and Community Right to Know Act

The Emergency Planning and Community Right-To-Know Act (EPCRA) was enacted in 1986 as Title III of the United States' Superfund Amendments and Reauthorisation Act. It requires the disclosure of information to the US Environment Protection Agency (EPA) on the amounts of toxic chemicals released into the environment and transferred to treatment, storage, and disposal facilities, while maintaining a reasonable balance between community's right-to-know and the costs involved in collecting the information. The EPA makes the information received publicly available as the Toxics Release Inventory (TRI).

The emergency-planning component of EPCRA means that facilities must disclose the existence of hazardous chemical storage to a local emergency response body, in addition to giving immediate notification of any accidental releases. A further requirement is the preparation of a response plan to any accidental releases.

This form of market based instrument is a market friction reduction tool in that it attempts to provide more complete knowledge to consumers of products and investors regarding the actions of various companies who use hazardous chemicals. It allows consumers to boycott products from certain companies, campaigners to target 'laggards' more effectively and also alerts investors to the potential that companies with relatively high emissions might face mounting environmental costs in the future.

3.3 Case Studies from the European Union

3.3.1 Tax on Danish Pesticide Use

The intention of the tax on Danish pesticide use was to reduce pesticide use through optimisation at the farm level. It resulted from concerns about the level and spread of pesticides showing up in ground water. Initially in 1986 a 3% tax on the wholesale price of pesticides was introduced. This was increased in 1996 and again in 1998 to the point where pesticides are taxed on average at 37% of the retail price[11] (ECOTEC 2001).

[11] *This average comprises insecticides taxed at 54%; fungicides, herbicides and growth regulators at 33% and with microbiological agents at 3% of the wholesale price (ECOTEC 2001)*

Concerns with the implementation of the scheme include the stockpiling of pesticides by farmers before the introduction of the tax and the purchase of pesticides from EU neighbours without the same taxation regime for pesticides. Other issues arose because there was no differentiation between different classes of insecticide, herbicide and growth regulator and microbiological agents in terms of toxicity or other environmental impact.

This means that a new class of pesticide, with lower environmental impact but higher unit cost than others on the market, would be more expensive. A result seemingly at odds with the purpose of reducing the environmental impact of the tax (although it should be noted that there was a comprehensive review of the 213 active ingredients in pesticides resulting in only 78 being approved for ongoing manufacture and use - ECOTEC 2001).

Revenue raised by the tax goes into consolidated revenue for the Danish government, although there is a rebate to farmers that is paid as a reduction in land value tax and a mechanism to channel funds into research and development activities for the agricultural sector. It is interesting to note that the majority of the market for Danish manufacturers of pesticides is export trade, so the reduction in Danish use of pesticides has not had a detrimental impact on the industry. This result, however, could be viewed as contradicting the intent of the tax, namely a reduction in pesticide use (ECOTEC 2001).

The maximum impact of the tax was forecast to raise production costs by 4%, however for most crops the increase was only 1% and was unlikely to be passed directly on to consumers. Analysis determined that it was difficult to conclude that the tax was having a direct effect of reduction on pesticide use, primarily because pesticide use was falling at the time that the tax was introduced (ECOTEC 2001).

3.3.2 The European Union Greenhouse Gas Emission Trading Scheme (EU ETS)

The European Union Greenhouse Gas Emission Trading Scheme (EU ETS) is set to start in January 2005[12] and is based on European Council Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, which entered into force on 25 October 2003.

The aim is to assist EU Members achieve their Kyoto Protocol obligations at a lower cost by allowing the trading of carbon allowances amongst participating companies. A National Allocation Plan determined the amount of CO_2 allowances that each member state has to issue amongst liable parties (one CO_2 allowance equals the right to emit one tonne of CO_2 equivalent). The intention was that allowances to the power sector would be limited, creating scarcity to assist in the establishment of the market and to make real advances in reducing greenhouse gases (EC-EDG 2004). This makes EU ETS a cap-and-trade programme (market creation by tradeable permits and certificates).

There are approximately 12,000 liable companies spread among the 25 members of the European Union. These include companies such as power stations, oil refineries, coke ovens, iron and steel plants, and factories making cement, glass, lime, brick, ceramics, pulp and paper. The costs of meeting the desired greenhouse gas targets have been put at between €2.9 to €3.7 billion, with estimates of the costs of Kyoto compliance without a trading scheme set at €6.8 billion (EC-EDG 2004).

Article 16 of Council Directive 2003/87/EC set the penalty for not meeting targeted reductions or purchasing the requisite amount of allowances at €100 per tonne of carbon dioxide equivalent of excess emissions. During the period 2005 to 2008 a lower rate of €40 per non-delivered allowance has been set to facilitate a smoother transition period for industry.

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[12] *This decision to start the trading scheme was made independent of Kyoto coming into force.*

However, the payment of a penalty does not offset an organisation's liabilities, meaning that an amount of allowances equal to the excess that incurred a penalty will need to be surrendered in the following calendar year. Each Member State will be responsible for keeping track of and enforcing the penalty regime (EC-EDG 2004).

3.4 Case Studies from Australia

There have been an increasing number of Australian studies on MBIs that address the Australian context in terms of existing and potential programmes. Some of the major schemes of interest are presented below.

3.4.1 Hunter River Salinity Trading Scheme

The Hunter River catchment area is the largest coastal catchment area in Australia. The salt content of the Hunter River was of concern to primary producers, primarily as a result of salty water discharges from coal mines (water in coal pits has a high salt content that leached out of rocks and soils) and from power stations (water used for cooling evaporates and natural salt is concentrated in the remaining water) (NSW EPA 2003).

The scheme's basic premise is to control salty water discharges from mines and power stations so as to occur only during times of high water flow and low salt levels. A cap and trade system (market creation by tradeable permits and certificates) is used to achieve this result (NSW EPA 2003).

No discharges of salty water are allowed during periods of low water flow. During times of high flow, salty water discharges are controlled by a credit system linked to ambient salt level concentrations within certain 'blocks' of the river. During times of flood, there are no limits on salty water discharges, as long as the salt concentration does not go above the target level of 900 EC[13] measured at Singleton (NSW EPA 2003).

A total of 1,000 discharge credits were initially issued, each credit worth 0.1% of the total allowable discharge. The total allowable discharge varies on a daily basis, depending on the state of water flow. For example, if 100 tonnes could be handled by a block of the river, and a company had 100 Credits (10% of what was issued), that company could discharge salty water with an equivalent of 10 tonnes of salt in it. Any surplus credits that were not needed are available to trade. Any salty water discharges that are made in excess of discharge credits held are treated as a breach of licence conditions and fined accordingly (NSW EPA 2003).

The initial allocation of credits was grandfathered on the basis of a formula incorporating economic, environmental and social factors. Every two years 200 credits expire and a replacement number of credits with a life span of 10 years are publicly auctioned (NSW EPA 2003). The first such auction held in 2004 returned an average price paid of $507 per credit (DEC 2004a).

3.4.2 NSW Greenhouse Gas Abatement Scheme

The New South Wales Greenhouse Gas Abatement Scheme sets a target reduction in per capita greenhouse gas emissions arising from the consumption of electricity. Beginning in 2003 and remaining in force until 2012, the Scheme allocates a proportional liability on electricity retailers, certain electricity generators and other large wholesale purchasers of electricity. The Scheme also allows other large or significant users of electricity to opt in as elective benchmark participants (NSW GGSA, 2004).

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[13] EC stands for Electrical Conductivity and is used to provide a unit of measurement for the salinity of a liquid. The more salty the liquid, the more it conducts electricity. Electrical Conductivity is measured in micro-siemens/centimetre.

The baseline greenhouse gas emission for 2003 was 8.65 tonnes per capita of carbon dioxide equivalent (tCO_2-e). The target to be reached is 7.27 tCO_2-e by 2007, a level that is to be maintained until 2012 and beyond. Liable benchmark participants must reduce their greenhouse gas emissions to the target benchmark by surrendering abatement certificates. Any greenhouse shortfall will attract a penalty of $10.50 per tCO_2-e (NSW GGSA, 2004). This makes the Abatement Scheme a cap-and-trade programme (market creation by tradeable permits and certificates).

NSW Greenhouse Abatement Certificates (NGACs) are tradable certificates with a value of one tCO_2-e reduction and can be generated through certified abatement certificate providers who undertake any of the following (NSW GGSA, 2004):

- low-emission generation of electricity such as from renewable energy[14]
- demand side management activities that result in reduced consumption of electricity
- the sequestration of carbon from the atmosphere into forests.

It is also possible for large users to create a non-tradable certificate, the LUAC (Large User Abatement Certificate). One LUAC is also equal to one tCO_2-e reduction, however can only be used to offset the large user's abatement liability. LUACs can be created by undertaking any of the following (NSW GGSA, 2004):

- use on-site fuels more efficiently
- switch to lower emission fuels
- reduce greenhouse gas emissions from on-site industrial processes
- reduce greenhouse gas emissions from on-site fugitive releases.

In the first year of operation participants in the scheme surrendered 1,167,392 certificates and no penalties were issued. Also during the first year of operation some 6.7 million abatement certificates were registered, well above the requirement. These certificates are bankable and are available to offset against future benchmark liabilities (IPART 2004). Indicative prices for the trade of NGACs are between $5 and $7 per certificate (Australian Financial Markets Association in Ernst and Young 2004).

3.4.3 Mandatory Renewable Energy Target

The Mandatory Renewable Energy Target (MRET) is a target set by the Australian Government to achieve 9,500 gigawatt hours (GWh) of extra renewable electricity per year by 2010 and then to maintain that level of renewable electricity generation until 2020. MRET sets a positive target in creating a market for tradable certificates and was established under the Renewable Energy (Electricity) Act of 2000, which had three key aims:

- encourage the additional generation of electricity from renewable sources
- reduce emissions of greenhouse gases
- ensure that renewable energy sources are ecologically sustainable.

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[14] The scheme allows for any RECs surrendered for sales of electricity in NSW to be used to offset against the Greenhouse Gas Abatement Scheme. However, any activity that results in the creation of a REC can not be used to create a NGAC.

Liable parties under MRET include electricity retailers and other wholesale purchasers of electricity.[15] These retailers and purchasers are allocated a proportional liability for meeting their share of the target additional renewable electricity generation for that year, on the basis of the proportion of the total liable electricity that they purchase.

Liable parties meet their obligations under MRET through the surrender of Renewable Energy Certificates (RECs), tradeable certificates which are created through the generation of electricity from renewable sources. One REC is equivalent to the generation of one MWh of renewable electricity (ORER 2004).

Any liable party who does not meet their share of the target in any one year, has to pay a non-compliance penalty of $40 per MWh of shortfall.[16] This penalty is not tax deductible, making it an effective charge of $57/MWh (allowing for the corporate tax rate of 30%). A leeway of up to 10% is allowed in the meeting of targets, however if the shortfall is outside the 10% leeway, the whole shortfall is penalised. Provision is also made for the redemption of penalties if the shortfall is made up within the following three years (ORER 2004). Between February 2002 and March 2004 the spot price for RECs has been between $34 and $40 per certificate (NGES undated in Smith 2004).

MRET applies only to the generation of electricity from renewable sources. It does not apply to the use of renewable energy resources for process heat or to the use of renewable fuels (for example biodiesel) for transport purposes. One exception to this is the case of solar water heaters which can generate RECs on the basis of displaced non-renewable electricity no longer used for hot water (ORER 2004).

Eligibility for the generation of Renewable Energy Certificates is administered by the Office of the Renewable Energy Regulator. Allowable renewable energy sources include (ORER 2004):

- hydro
- wind
- solar
- bagasse co-generation
- black liquor
- wood waste
- energy crops
- crop waste
- food and agricultural wet waste
- landfill gas
- municipal solid waste combustion
- sewage gas
- geothermal-aquifer
- tidal
- photovoltaic and photovoltaic renewable stand alone power supply systems
- wind and wind hybrid renewable stand alone power supply systems
- micro hydro renewable stand alone power supply systems
- solar hot water
- co-firing
- wave
- ocean,
- fuel cells
- hot dry rocks.

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[15] *A wholesale purchase of electricity is a purchase directly from the National Energy Market (NEM) or a power generator.*

[16] *1,000 megawatt hours (MWh) is equal to 1 gigawatt hour (GWh). As an indicative guide, one domestic dwelling uses in the order of 7-8 MWh of electricity each year.*

4 RESOURCE RECOVERY AND MBIS

Following on from the preceding presentation of the application of general MBI programmes, a more specific discussion of MBIs and how they have been applied to resource recovery application is presented below.

4.1 United Kingdom Landfill Cap-and-Trade Programme

The Untied Kingdom is under an obligation to reduce the landfilling of biodegradable municipal waste (BMW) under Article 5(2) of the EU Landfill Directive. In order to meet their obligations under the EU Landfill Directive, the UK has designed a Landfill Allowance Trading Scheme (market creation by tradeable permits and certificates). This scheme sets an allocation of tradable landfill allowances amongst waste disposal authorities in United Kingdom (England, Ireland, Scotland and Wales).[17] Allowances convey the right to dispose of a stated amount of biodegradable municipal waste (BMW) within a given scheme year (DEFRA 2004a).

Taking advantage of an extension of compliance timeframes, the targets and dates for the UK are (DEFRA 2004a):

- by 2010 to reduce the amount of BMW going to landfill to 75% of that produced in 1995
- by 2013 to reduce the amount of BMW going to landfill to 50% of that produced in 1995
- by 2020 to reduce the amount of BMW going to landfill to 35% of that produced in 1995.

A trajectory with interim targets has also been produced to ensure that the requisite progress is made towards the target years. It is only waste disposal authorities (WDAs) that can participate and trade in the scheme that is set to start 1 April 2005. Under the scheme, landfill allowances can be (DEFRA 2004a):

- traded with other authorities at market prices yet to be discovered and also for non-monetary items for example, using the allowances to fund the provision of services from other counties
- banked and saved for the future, however banked savings cannot be used in a target year. For instance, any banked allowances need to be 'used' before 2009 (last scheme year before the target year of 2010) or they will expire
- borrowed by using future allowances to discharge current obligations, however only 5% of the next year's allowance can be borrowed to meet a target requirement.

The intention is that each waste disposal authority (WDA) will have flexibility to use allowances in most effective way. It is anticipated that WDAs with the cheapest access to BMW diversion will divert the most BMW from landfill and will trade their landfill allowances to WDAs with more expensive costs of diversion. Ceiling and floor prices for landfill allowances have not been set by government, although there is provision for this step in the enabling legislation. However the penalty for not meeting the target reduction in the amount of biodegradable municipal solid waste sent to landfill has been set at £200 per tonne, approximately four times the current price of landfill (DEFRA 2004a). This penalty will effectively act as a ceiling price on landfill allowances.

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[17] *For more information on the legislative framework see the Waste and Emissions Trading Act (2003), available at http://www.hmso.gov.uk/acts/acts2003/20030033.htm, and The Landfill (Scheme Year and Maximum Landfill Amount) Regulations 2004 www.legislation.hmso.gov.uk/si/si2004/20041936.htm.*

Two potential short term market failures have been identified (DEFRA 2004a):

- oversupply of allowances caused by a majority of WDAs exceeding their required diversion targets before the prescribed date resulting in a depreciation of the value of landfill allowances
- undersupply of allowances caused by a majority of WDAs not meeting their required diversion targets and causing the price of allowances to increase.

This market based instrument has been initiated in the UK amongst other slightly related MBIs including a landfill tax that is currently at £15 per tonne for biologically active wastes (BMW) and £2 per tonne for inactive waste. The landfill tax for active waste will increase at a minimum rate of £3 per tonne from 2005-06, until it reaches £35 per tonne (DEFRA 2004a). Also in the UK MBI mix for resource recovery are Producer Responsibility Obligations, which are discussed in the next section.

4.2 United Kingdom Producer Responsibility Obligations

The Producer Responsibility Obligations (Packaging Waste) Regulations 1997 were introduced in the UK in response to the EC Directive on Packaging and Packaging Waste. This initiative places obligations on packaging supply chain businesses who *handle* (as opposed to generate as waste) in excess of 50 tonnes of packaging materials, or who have a turnover in excess of £2 million to recover ever increasing amounts of packaging materials (DEFRA 2003a).

The main packaging materials include paper, plastic, aluminium, glass, steel, wood and other packaging materials such as jute, hessian, ceramics and cork. The Producer Responsibility Obligations allocate a certain liability to recover packaging materials on a weight basis for supply chain elements as follows (DEFRA 2003b):

- manufacturing raw materials for packaging – 6% responsibility
- converting materials into packaging – 9% responsibility
- filling packaging – 37% responsibility
- selling packaging to the final user – 48% responsibility
- importing packaging or packaging materials into the UK - up to 100% for packaging activities undertaken before import into the UK.

Essentially an obligation is placed on a business according to the amount of packaging material they handle, their position within the supply chain according to the pre-determined categories noted above and the national recovery target for pacakaging materials for the year for specific materials. Or in other words, [Tonnage of packaging handled] x [percentage activity obligation] x [UK recovery target] = [recovery obligation]. The recovery obligation can only be discharged through PRNs (Packaging Waste Recovery Notes) and Packaging Waste Export Recovery Notes (PERNs) (DEFRA 2003b).

PRNs and PERNs are generated by accredited reprocessors when packaging is recovered for recycling. These PRNs and PERNs can be bought and sold are differentiated on the basis of material type and in some cases, recovery function. The categories of PRNs, their target percentage reductions by 2008 and their trading prices are as follows (LetsRecycle.com 2004):

- paper, 70% recovery by 2008, paper PRNs at £7 to £9
- glass, 71% recovery by 2008, glass PRNs at £16 to £18

- aluminium, 35.5% recovery by 2008, aluminium PRNs at £22 to £30
- steel, 61.5% recovery by 2008, steel PRNs at £16 to £18
- plastic, 23.5% recovery by 2008, plastic PRNs at £11 to £13
- wood, 21% recovery by 2008, wood PRNs at £6 to £7

Penalties for not surrendering the requisite number of PRNs or PERNs are treated as a criminal offence with fines ranging up to £5,000 for local infringements and on a case by case basis for larger infringements (DEFRA 2003b). With regard to enforcement, it has been reported that some plastics packaging recyclers defrauded the scheme, claiming approximately 35,000 tonnes of recycling notes in 2003 when in fact no recycling had occurred. This followed on from a similar issue in 2002 involving the fraudulent claim that some 76,000 tonnes of wood packaging had been recycled, highlighting the problems with implementing the packaging waste trading scheme (DEFRA 2004b).

4.3 Advance Disposal Fees and Container Deposit Legislation

Advance disposal fees (ADFs) refer to charges that are placed on a product or material to fund end-of-life management costs associated with reprocessing or disposal (also referred to as levy-benefit schemes). The objective of an ADF is to internalise these end-of-life costs into product prices, which are then paid by consumers (Chakrabarti and Sarkhel 2003). This would prevent the current situation of recycling and waste being subsidised by a single section of the community, namely home owners through rates paid to local government for the provision of waste and recycling services.

The ADF can be applied in a differential fashion to materials and/or products to provide incentives for 'environmentally friendly' materials such as those made with recycled content, renewable resources and recyclable materials. The funds available to finance recovery activities can also be applied in a differential fashion. For example, a higher benefit payment could be made for direct recycling of materials such as plastic bottles to plastic bottles, with lower amounts paid for indirect reyucling (plastic bottle into mixed plastic park bench) or energy recovery (plastic bottle into process engineered fuel).

Selective application of fees (or taxes and levies) can also be applied to nuisance products, those materials within the waste stream whose disposal causes environmental pollution. Examples include lead acid batteries and used motor oil. Correcting for market failure suggests that these products should be charged so as to internalise the environmental and social costs of disposal. In the United States such taxes, levies and fees have been raised for beverage containers, fertilisers, furniture, motor oil, pesticides, refrigerators, solvents, and tires (NCEE 2001).

There are two approaches to nuisance product charges. The first is to increase the price of the product to the stage where its purchase is undesirable. The second is to raise money and to use part (or in some cases, all) of these funds to support resource recovery activities.

One Australian example of this style of approach, which also includes a differential payment, is the Product Stewardship for Used Oil Program. A charge of 5.449 cents is levied on every litre of oil that is sold in Australia. The funds raised from this levy go to pay stewardship benefits, a per litre payment on a sliding scale of recovery alternatives. The most desired recovery alternatives, such as recycling into new lubrication products, received the highest payment of 50 ¢ per litre, whereas the least desirable options receive a low or no levy benefit (DEH 2004).

An international example of an advance disposal fee system is the German 'grünes punkt' (green dot) operated by the non-profit organisation Duales System Deutschland. The green dot was set up as a collective industry initiative in order to meet obligations imposed by the German Packaging Ordinance 1991. Participating companies by a licence fee based on the weight and type of material used in the packaging of their product. This fee is then used to fund the collection and reprocessing of packaging materials (DSD undated).

Container deposit-refund systems differ from advance disposal fees in that they provide a mechanism for the *collection and return* of containers, as opposed to reprocessing and recycling. Container deposit legislation (CDL) generally receives strong support from local government and environment groups, but strong opposition from beverage, packaging and retail industries. Proponents point to high recovery rates that include away-from-home consumption, redistribution of costs to consumers (as opposed to rate payers) and a reduction in littered beverage containers. Opponents highlight the costs of implementation, negative impact on existing measures such as the National Packaging Covenant and potential negative impact on kerbside recycling services (ISF 2001).

The experience in the United States around 'bottle bills' (CDL) is similar with the debate around cost, recovery rates and overall benefits of a CDL approach. The Californian Redemption System is often put forward as an example of a modified container deposit scheme that achieves 'significant recovery at relatively low costs' (Beck 2002). Recent negative international experience includes the controversy surrounding the German system of mandatory deposits on some one-way beverage containers (IEMA 2004).

4.4 Differential Pricing for Kerbside Services

Differential pricing for kerbside waste management services refers to the practice of charging on the basis of the amount of waste generated, as opposed to a flat fee approach. Also known as 'pay as you throw', unit-pricing and variable pricing, this form of 'polluter pays' (charges, fees and taxes) market based instrument sends a direct price signal to residents based on consumption. Most residents are unaware of the costs of their waste management services resulting in a disconnect with the impacts of their waste generation. A direct and variable fee based on the amount of waste generated provides a direct incentive to reduce the amount of waste that residents generate[18] (OECD 2004).

Various forms of differential pricing schemes have been implemented in over 4,000 local authorities across the United States. Programmes range from volume, volume and frequency, weight and weight and frequency charging regimes. Success stories point to a decrease in the amount of waste disposed of to landfill, an increase in the amount of materials recovered for recycling and an increased level of customer satisfaction (80% rising to 90% in San Jose, cited in US EPA 2004).

The other aspect to differential pricing for kerbside services is the transfer of the charge away from rate payers and onto residents. More than one quarter of Australian households are either private (21%) or public (5%) rentals ABS (1999). As tenants do not pay rates on the property they rent and are not charged separately for waste services, they are effectively receiving a 'free' service. This serves to widen the disconnect between the costs involved with recycling and waste management, and the amount of waste generated.

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[18] *Although it is noted that this does not factor in away-from-home consumption. Some studies (for example ISF 2001) have suggested that away-from-home consumption may account for 50% of packaged products like beverage containers.*

4.5 NSW Section 88 Contributions

Landfill taxes, charges and levies are used for a number of purposes including to:

- internalise the negative external costs associated with landfill
- act as a disincentive for the disposal of waste to landfill
- encourage the uptake of recycling activities
- raise funds to be used for resource recovery activities
- raise funds to ensure an appropriate closure of the waste facility
- raise funds for government consolidated revenue.

Section 29 of the NSW Waste Disposal Act 1970 allowed the then Metropolitan Waste Disposal Authority to place a levy on materials disposed of to landfill in NSW. However, this mechanism was never used to discourage waste generation, with the levy amount remaining at 56 cents per tonne until 1991 (Denlay 1995). The levy was then increased to $2 per tonne a the start of 1991, $2.80 in 1992, $4.20 in 1993 and then to $7.20 half way through 1995 (NSW Waste Disposal Act Regulations), which was also at the time of change from a Liberal to a Labor state government.

With the introduction of the Waste Minimisation and Management Act 1995 (WMMA), the levy (now referred to as Section 72 contribution) rose to $10 per tonne for the Sydney Metropolitan Area (SMA) and $4 per tonne for the Hunter, Central Coast and Illawarra regions (extended regulated area – ERA) from November 1996 to June 1997, and then to $15 per tonne for the SMA and $8 per tonne for the ERA from June 1997. This was shortly increased in 1998 to $17 per tonne in the Sydney Region and $10 per tonne in the extended regulatory region (the Hunter, Central Coast and Illawarra).[19]

The waste disposal levy was again increased in July 2002 to $18.20 for the SMA and $9.60 for the ERA[20] with both levies set to increase to $25 per tonne (plus an adjustment for the consumer price index) by 2010 for the waste disposed of to landfill in the SMA and by 2013 for the ERA.

The NSW Government had also established a Waste Planning and Management Fund under the 1995 Waste Minimisation and Management Act (WMMA) in order to support waste minimisation projects. Revenue for this fund was derived from a portion of the waste disposal levy, a charge on every tonne of waste disposed of to landfill.

Although there was a NSW Labor Party policy set in 1995 of establishing a ‘direct link’ between the waste management levy and waste minimisation initiatives through hypothecation (NSW ALP 1995), it was not until the end of the 1990’s that a decision was made to hypothecate 55% of the funds raised by the waste disposal levy in to the Waste Planning and Management Fund, starting from 1 July 2000 (NSW EPA 2000).

This payment of waste disposal levy amounts into the Waste Fund was halted in the 2003/2004 financial year, with some $60 M of unspent funds (NSW Treasury 2004b). This means that some $89 M of waste disposal levies in 2003/2004 and $102 M in 2004/2005 will be paid directly into consolidated revenue, depriving the Waste Fund of a ‘hypothecated amount’ in excess of $100 M.

As such it can be argued that the increased waste levy in NSW has become a method for raising revenue for the government, with a secondary purpose of acting as a disincentive for landfill, with no ‘leadership’ commitment to investing in waste minimisation outcomes.

[19] This increase was introduced under the Waste Minimisation and Management Amendment (Contributions) Regulation 1998.
[20] This increase was introduced under an amendment to Protection of the Environment Operations (Waste) Regulation 1996 and referred to Section 88 of the Protection of the Environment Operations Act 1997.

4.6 Previous Australian Investigations

Two recent projects on the use of market based instruments and resource recovery/waste management were identified, a study entitled 'The potential of Market Based Instruments to better manage Australia's waste streams' by consultants McLennan Magasanik Associates Pty Ltd and BDA Group for Department of Environment and Heritage (MMA and BDA 2003) and the 'Sustainable Resource Certificate Project' (Chapman 2003), a joint project proposal developed between The Market Place Company Pty Ltd, Global Renewables Limited and CSIRO Land and Water.

The first study (MMA and BDA 2003) looked at two possible objectives, reducing upstream impacts associated with the disposal of solid waste using the volume of waste disposal as a proxy measure, and reducing the environmental impacts surrounding the disposal of waste materials to landfill. After a review of possible market mechanisms, four instruments were identified as warranting further investigation. These were:

- tradeable landfill quota schemes
- competitive tender processes in combination with subsidy or grant programmes
- recycling certificate schemes
- landfill emission fees.

Although a 'best' instrument was not clearly identified, one conclusion was the need to understand community expectations when prioritising resources for recovery and conservation, and then to develop market mechanisms accordingly. Another recommendation was to engage with stakeholders in the development and design of a market based instrument for waste management related issues.

The proposed Sustainable Resource Recovery Project (Chapman 2003) was based around the development of a certificate trading scheme that generates certificates representing total tonnages of waste diverted from landfill or incineration. A stated goal of the programme was to promote the development of organic processing from solid wastes with the intent of improving the condition of Australian soils. Also present was a bias against any form of energy recovery from waste materials, which may serve to limit resource recovery options. It is not known whether this project has progressed past its initial scoping stage.

5 SUSTAINABLE RESOURCE RECOVERY

This section provides a broad overview of the sustainability issues within resource recovery. It begins with the drive to recover highest resource value (best use of materials) from wasted materials, supported by the conceptual model of industrial ecosystem thinking in combination with the operational elements of reverse distribution networks and consideration of domestic utilisation versus export of materials.

The intent of this section is to map out the complexities within resource recovery that could impact on the successful implementation of a MBI aimed at increasing sustainability. The value chain of the Municipal Solid Waste (MSW) stream is also assessed as a means of exploring roles and responsibilities in achieving sustainability and of identifying likely points where a MBI scheme could be introduced. The characteristics of MSW evidenced by the value chain suggest that a form of positive rights based MBI, similar to the Mandatory Renewable Energy Target would be suited to achieving desired outcomes.

5.1 Value Chain of Waste Generation

Supply chain analysis traditionally concentrates on the flow of resources required to make products and their ultimate distribution to the consumer. The supply chain is contrasted with the more holistic concept of 'value chain', which incorporates additional elements related to design decisions and information flows, in addition to resource recovery and other end-of-life issues (marked as the dashed rectangles in Figure 6 overleaf). Not shown in the diagram of the Municipal Solid Waste value chain overleaf are the providers of capital for project and product development, the setting and enforcement of regulations and advertising standards for consumer protection.

An assessment of the complexities within the waste generation value chain is useful to identify points of influence where sustainability outcomes can be influenced. Ideally an MBI would influence the entirety of the value chain. Starting at the end of the value chain and working in reverse, a need for infrastructure to provide resource recovery operations is identified. There are a range of generic recovery options and Section 5.2 presents a discussion on the recovery of highest resource value from the waste materials, while Section 5.3 investigates the use of industrial ecosystem thinking to design the networks of infrastructure that are required. This presents the first challenge for a sustainable resource recovery MBI, namely to facilitate the development of infrastructure that recovers the highest resource value from materials that would otherwise be disposed of to landfill.

When considering the end-of-life management choice that a consumer faces, it is recognised that under our current systems of household recycling and waste collection there is no direct link with the amount of materials collected and the cost of the collections service. This suggests a need for a form of differential pricing for municipal collection services where households that generate more/recycle less waste will have to pay a higher price for their 'pollution'.

Considering ideal outcomes for other elements within the value chain, it is important to send signals that minimise packaging at point of sale and retail sales and distribution. There is also a role for market advertising to accept its responsibility in educating consumers to make decisions on the basis of sustainability considerations.

From a logistics and distribution perspective a price signal needs to reach wholesale distribution to drive optimisation with minimal packaging. The same price signal would ideally be strong enough to direct the research, design and development of products with maximal stock life, minimal impact throughout life of product and design for the product's end-of-life fate, that is, ready uptake through resource recovery channels.

It would also be hoped that a focus on solid waste impacts would have a ripple effect for 'product manufacture' and 'further manufacture and assembly' operations to embrace cleaner production and look to use renewable energy and recovered water. And finally at the top of the value chain, some influence would be desirable to move the resource extraction section of the value chain away from non-renewable and non-replenishable materials.

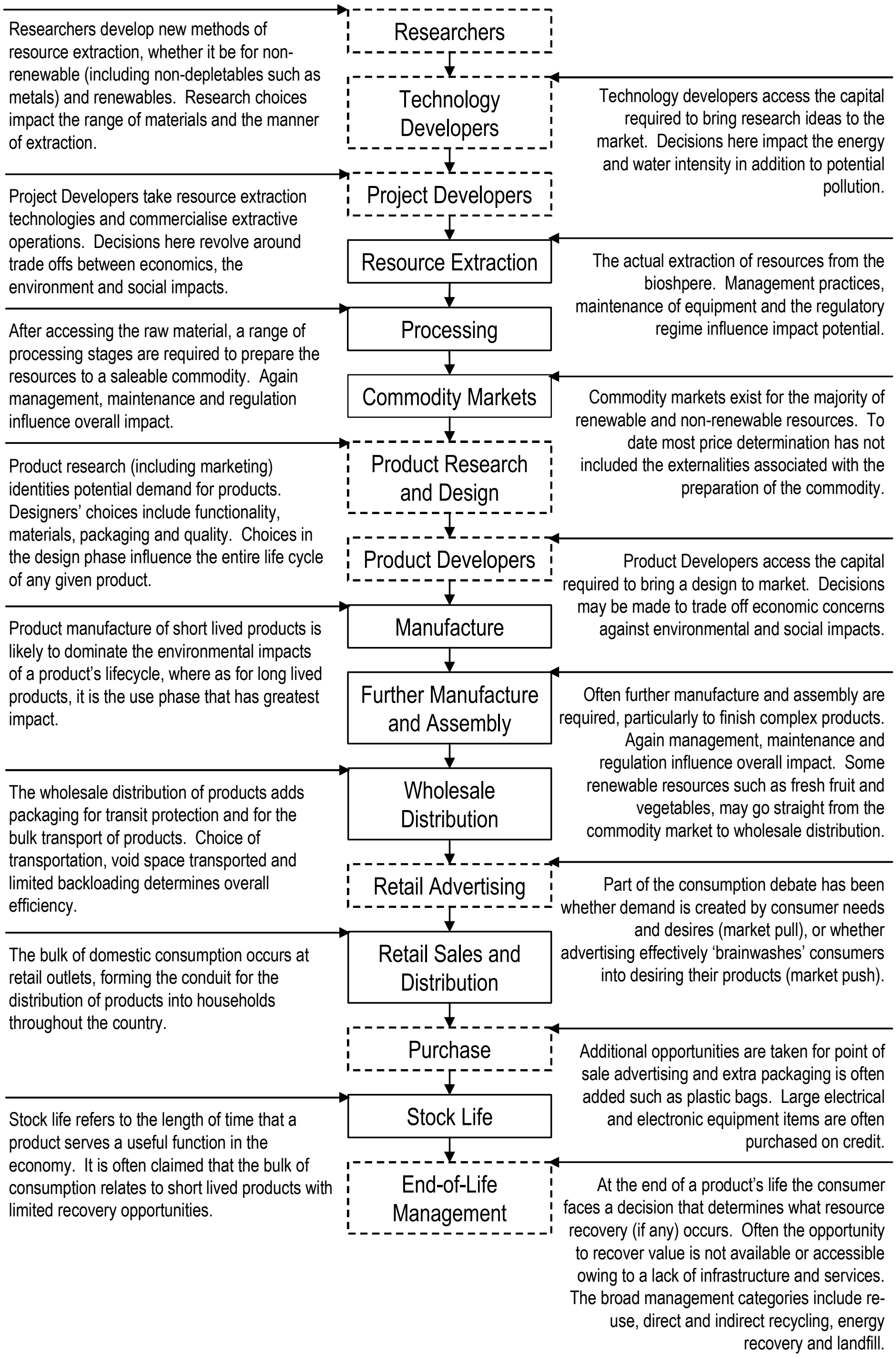

Figure 6 – Value chain analysis for municipal solid waste

The practical reality, however, is that it would be very difficult for the one MBI to create a positive influence that improves the sustainability of the entire value chain. Also it is recognised that a range of other initiatives target specific elements within the value chain are on the horizon. For example, some of the anticipated extended producer responsibility (EPR) schemes for 'iconic' waste products such mobile phones, television, computers and white goods.

As such an MBI to support sustainable resource recovery should target those diffuse and generic material types that end up in the residual waste stream and are unable to be dealt with through other forms of targeted intervention. This includes material types such as paper, glass, plastic, wood, metal and organics.

5.2 Highest Resource Value

5.2.1 Overview of Concept

One issue that arises in developing opportunities for sustainable resource recovery is that the diversion of waste from landfill is not sufficient to establish it as a sustainable recovery option. There are any number of recovery options for a given material, which begs the question as to which option will maximise the highest resource value of the material? This is similar to asking what is the best use of a recovered resource.

In some instances the answer is intuitively clear. An example is recycled solid hardwood floor boards. It is obvious that it would be a better use to turn those floorboards into a dining room table than to chip up the timber for fuel or landscape mulch. What is not so clear is balancing the issues with regard to composting and energy recovery for woody waste materials.

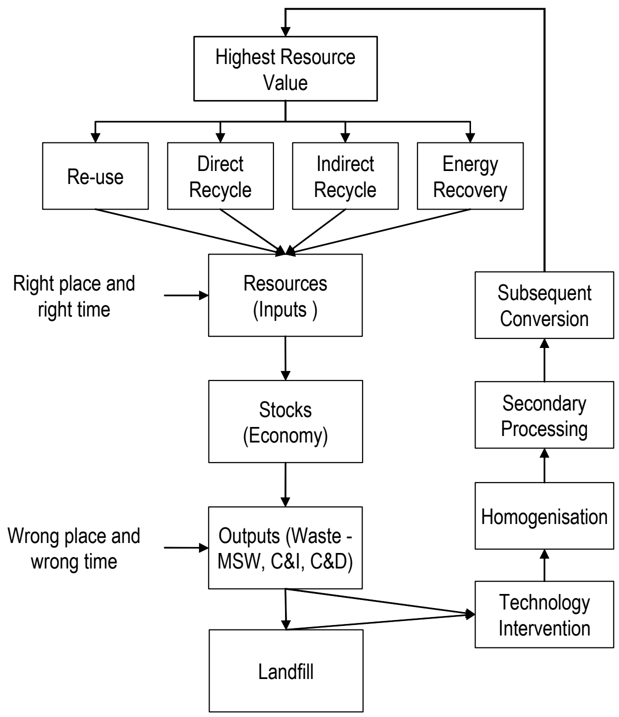

Figure 7 – System of resource recovery that is determined by highest resource value (adapted from Warnken 2004)

In an ideal world, resource recovery options such as re-use, direct recycling, indirect recycling and energy recovery would be chosen so as to maximise highest resource value as shown in Figure 7. This drive has been gaining some traction in the waste industry where it has been recognised that more sustainable outcomes can be obtained by recovering materials that would otherwise be used to ‘fill land’. This is especially the case for those materials that are have poor ‘land filling’ characteristics in that they are putrescible, bulky and do not easily compact (Warnken 2004).

The difficulty is in differentiating between options with competing benefits. Net present highest resource value is introduced here as a qualitative approach to screening recovery options.

5.2.2 Net Present Highest Resource Value

Each different recovery option has a variety of economic, environmental and social impacts that need to be addressed. Net present highest resource value (NPHRV) presents a conceptualisation of the desired outcome as follows (Warnken 2004):

- net – captures both positive and negative impacts of the pathway
- present – captures 'in the current circumstances'
- highest – point of differentiation and in combination with 'present' suggests the role of continuous improvement towards ideal performance
- resource – moving away from the mind set of waste management toward a focus on the inherent raw materials and associated product manufacture
- value – the combination of environmental, techno-economic and socio-political values.

Putting the elements of the concept together, the drive to recover the net present highest resource value of a material seeks to develop resource recovery operations that maximise the positive and minimise the negative relative environmental, techno-economic and socio-political impacts for any given material. A first order assessment matrix is presented in the table below to demonstrate how the concept of NPHRV would work.

Table 2 – Assessment matrix to determine first order Net Present Highest Resource Value

Assessment Criteria	*Comments*
What are the recovery options for the material in question?	This should include a listing of all of the 'possible' options to ensure that as wide a net as possible has been cast to investigate opportunities.
How many of these are commercial at the present time?	Moving from the possible to the probable, what options currently exist as commercial operations?
What kind of recovery opportunity is it?	Re-use – another trip through the economy for the product as is Direct recycle – another trip through the economy for the material Indirect recycle – possibly the last use before dispersion back to the environment, for example compost Energy recovery – irrecoverable loss of material structure to capture energy content.
What is the planned and accessible end-of-life use for the recovered material?	Re-use, direct recycle, indirect recycle or energy recovery.
What is the economic case for the commercial recovery options?	An assessment of the business case for each recovery option as a traditional cost and benefit analysis, including a comment on market maturity and stability.
What is the environmental case for the commercial recovery options?	An overview of the environmental impacts (both positive and negative) including potential emissions to land. Also including offset benefits such as reduced need for virgin materials, increased quality of soil and decreased fossil fuel use.
What is the social case for the commercial recovery options?	An overview of the social impacts (both positive and negative) including local amenity, jobs, preferences (as identified through stakeholder involvement) and issues in gaining a community operating licence.
What are the prevailing local conditions?	An overview of pertinent factors that could influence the resource recovery choice, for example, drought, brown outs, available land, level of industrial activity and/or urban encroachment and distance to markets.

5.3 Industrial Ecosystem Thinking

In a consumer driven economy there has always been a need to remove products from the economy at the end of their 'useful' life in order to create the 'consumption space' into which more products can be sold. These products have been arbitrarily designated as waste because of being in the wrong time and place, thereby having a negative value to the owner.

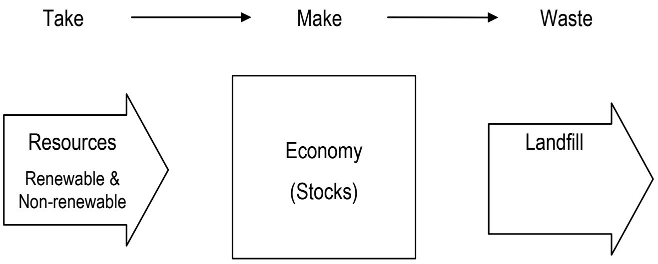

Figure 8 – Linear unsustainable resource flows

Historically landfill has been the only accessible end-of-life management option for products in the municipal solid waste stream. This has resulted in a linear 'one-way' flow of renewable and non-renewable resources from extraction through to waste in landfill as shown in Figure 8 above.

Growing concerns with the long term sustainability of such an approach have caused a re-examination. Based on the premise that natural systems are essentially cyclical in nature and that natural systems present as the optimal model for sustainability, efforts have been made to create cyclical patterns of resource recovery. These alternative approaches look to transform wastes into right time and place resources (see Figure 9). It is noted that this represents a *value* decision under an ecological economics model in that the desired sustainability goal is to achieve a cyclical flow of materials even if this is not currently the most efficient economic solution.

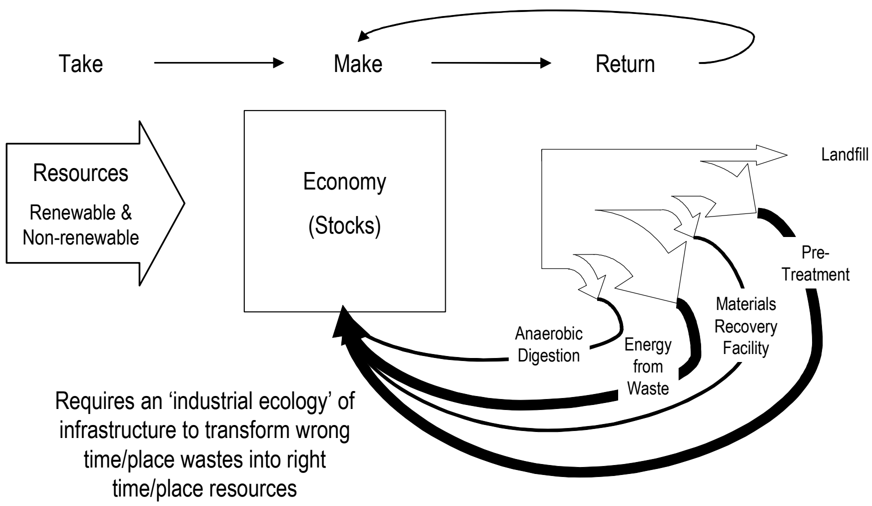

Figure 9 – Cyclical sustainable resource flows

The analogy is the creation of an 'industrial ecology' that is able to 'digest' the waste and return resources for use back into the economy. Such an industrial ecosystem would involve a network of infrastructure with the ability to transform wrong time/place wastes into right time/place resources. For example, a network of technologies for Municipal Solid Waste could involve materials recovery facilities, anaerobic digestion, pre-treatment and energy recovery facilities to return to the economy recycled products such as plastics, metals and glass, compost and energy as recovered resources.

An industrial ecosystem approach could also be used to provide the cross brand and cross product collection, aggregation and processing requirements necessary to implement Extended Producer Responsibility schemes in an efficient and effective manner.

For sustainable resource recovery to occur there is a need for capital investment into the infrastructure required to develop this kind industrial ecosystem. Again using nature as model and taking biodiversity as the indicator of ecosystem health, it is desirable that there would be a number of different types of recovery operations to ensure the viability of the overall system. This would create a number of pathways that a waste material could follow, rather than travelling straight to landfill.

At present a number of institutional barriers prevent this investment, with security of feedstock and 'bank-ability' of the project being primary ones. It is suggested that a key function of the MBI is the need to overcome these barriers to investment in sustainable resource recovery infrastructure.

5.4 Reverse Distribution Networks

Most economic activity, planning and business development is on the forward distribution network. However, following from the discussion on industrial ecosystem thinking, it is desirable to have the transportation and logistics networks to return products and materials to the reprocessing infrastructure, that is, the reverse distribution network.

Existing kerbside may be appropriate for some materials, for example, increased dry recyclable collections to a Materials Recovery Facility (MRF) or household waste to a 'pre-treatment' facility. There may also be additional requirements for a wider spread of drop-off, collection and aggregation points than what is currently available through transfer stations in order to minimise inefficient transport.

Requirements also exist for efficient transportation of reprocessed materials post collection and aggregation. This can be facilitated through increased backloading opportunities and the use of intermodal containers which can be transported by road, rail and sea. In an ideal world the trucks that were used to drop off new products at shops and warehouses would be used to transport recovered materials back to the manufacturer.

A return to retail approach has the potential for inefficiency, especially if every retailer has to manage different brand and different product EPR schemes. The alternative is reverse multi product, multi brand channels of distribution, which may need the establishment of drop off points and aggregation centres. (Although it is noted in this context that reverse vending machines can offer a measure of convenience.)

Whatever the chosen mechanism, reverse distribution networks are an essential component within an overall sustainable resource recovery system.

5.5 Domestic Utilisation vs. Export of Materials.

Australia is recognised as having limited internal market for many commodities when compared with some of the European, American and Asian markets. This is problematic when looking for sinks (markets) for recovered resources. If there is a limited market in Australia, companies will look overseas to gain access to a viable market.

Another issue arises not from the demand side of the market, but from the costs of processing. Some countries with cheaper labour costs are able to recycle materials at a lower economic cost than Australia. However it is also noted that this issue is controversial in terms of lower standards of occupational health and safety in combination with lower quality of life as perhaps being the foundation of cheaper processing costs.

Irrespective of the moral argument, there are economic drivers pushing some resource recovery operations towards the export of recovered materials, with varying degrees of processing having been undertaken. This can range, for example, from unprocessed and mixed paper to processed high density polyethylene (HDPE). One concern revolves around the requisite level of sorting required to distinguish between the export of recovered resources as opposed to the export of straight waste, the thinking being that unsorted materials with high levels of contamination more resemble a waste rather than a resource.

From a sustainability and public interest perspective, one could argue that it is a better outcome for materials recovered in Australia to be used in Australia, replacing virgin material use in the Australian economy and avoiding the environmental impacts associated with increased transport. Furthermore if the reason that overseas countries can process recovered materials more cheaply that Australia is due to externalised responsibilities related to environmental damage and occupational health and safety, then significant weight is added to the case to process locally.

However a push to restrict the export of recovered resources could be viewed as establishing a barrier to trade. For example Canada was not allowed to ban the export of PCB waste to the United States for reprocessing under the North American Free Trade Agreement. These type of concerns have prompted the Council of the Organisation of Economic Cooperation and Development (2004) to put forward the following decision concerning the control of transboundary movements of wastes destined for recovery operations:

> (a) The wastes shall be destined for recovery operations within a recovery facility which will recover the wastes in an environmentally sound manner according to national laws, regulations and practices to which the facility is subject.
>
> (b) All persons involved in any contracts or arrangements for transboundary movements of wastes destined for recovery operations should have the appropriate legal status, in accordance with domestic legislation and regulations.
>
> (c) The transboundary movements shall be carried out under the terms of applicable international transport agreements.
>
> (d) Any transit of wastes through a non-member country shall be subject to international law and to all applicable national laws and regulations.

In the same ruling the OECD Council put forward a two tier control procedure based on reporting, notification and material tracking in order to govern the transport of waste to recovery operations outside their country of origin. The control procedures were based on material type as classified under the Basel Convention,[21] in addition to other materials, including waste electronic equipment, glass and ceramic wastes, PVC, some slags and ash products, heavy metal containing wastes, hydraulic fluids, treated timber, sewage sludge and bio-filter media.

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[21] The Basel Convention is an international treaty that seeks to control the movement of hazardous waste across international boundaries. A central component of the Convention is the minimisation of hazardous waste production in order to protect human health and the environment. See www.basel.int for more information.

6 BENCHMARKING THE SUSTAINABILITY OF RESOURCE RECOVERY MBIS

This section presents a discussion on possible metrics for measuring the performance of an MBI scheme on the basis of previously identified national and overseas MBI programmes, in addition to the discussion on the sustainable resource recovery. Consideration has also been given to the practicality of benchmarking new MBI schemes with the purpose of increasing sustainable resource recovery in light of the international experience.

6.1 Evaluation of Market Based Instrument

An assessment framework has been derived from the large body of literature that is in the public domain regarding Market Based Instrument programmes and is presented in Table 3 below. Sources include relevant studies undertaken either by or for the following organisations:

- Organisation of Economic Cooperation and Development (OECD)
- United Nations Environment Programme (UNEP)
- United States Environment Protection Agency (US EPA)
- European Union (EU)
- Australian Department of Environment Heritage (DEH).

Table 3 – Assessment framework for Market Based Instruments

Evaluation Criteria	*Form of Assessment*
What is the environmental improvement (sustainability outcome) being sought and who is the principal player in terms of liable action?	Comparison of statement of purpose with probable outcomes
How effective will the proposed MBI be in realising the desired sustainability outcome?	Qualitative *ex ante* discussion
How will the proposed MBI foster innovation in bringing about the desired sustainability outcome?	Qualitative *ex ante* discussion
What is the environmental effectiveness of the sustainability goal?	Qualitative *ex ante* comparative analysis
What are the baseline conditions that the MBI is starting with (current or past performance)?	Quantitative *ex post* analysis of baseline data
What is the likely economic impact of the MBI in terms of potential market distortions, cost savings and opportunity generation?	*Ex ante* economic modelling
What is the long term viability of the MBI and can sufficient certainty be given to industry to influence decisions (predictability and longevity)?	Qualitative *ex ante* discussion
How susceptible to 'free riders' is the proposed MBI?	*Ex ante* economic modelling
What price signals will be sent back to value chain members such as designers, manufacturers and consumers as a result of the proposed MBI?	*Ex ante* economic modelling

Evaluation Criteria	*Form of Assessment*
Is the proposed MBI compatible with the provisions of common law, the Trade Practices Act and environmental regulations?	Review of current legislative framework
What administration and compliance costs are associated with the implementation of the MBI?	*Ex ante* economic modelling
How will revenues raised from the MBI be used?	*Ex ante* economic modelling in combination with policy statements
What are the likely social impacts arising from the implementation of the MBI?	Qualitative *ex ante* comparative analysis
How politically palatable is the proposed MBI?	Qualitative discussion on current political situation
What level of stakeholder support exists for the proposed MBI?	Qualitative and quantitative stakeholder involvement
What wider economic and social impacts might arise from the proposed MBI in terms of competition, employment, growth and local amenity?	Qualitative *ex ante* comparative analysis

The preceding evaluation criteria are useful in preparing an MBI prior to implementation, even with their reliance on qualitative discussions of various issues. Some quantitative assessment, though, is required in order to prepare baseline data for the operation of the scheme. Also important is economic modelling of the likely operation and impacts of the scheme. When preparing these models, the likely effectiveness of the MBI scheme in achieving primary objectives can also be evaluated. The following section presents potential key indicators useful for both a preliminary assessment of effectiveness and also for benchmarking a sustainable resource recovery MBI post implementation. These indicators have been based on key themes that emerge from the above evaluation criteria.

6.2 Suitable Indicators for Resource Recovery MBIs

The issue of benchmarking the performance of a Sustainable Resource Recovery MBI is a challenging one. Most resource recovery MBIs have not been set up for the purpose of promoting *sustainable* resource recovery (as defined in Section 5), focussing instead on issues related to the diversion of landfill, or minimising some other specific environmental impact. Sustainability, by definition, encompasses these and other issues. In order to select a set of indicators to be able to track progress on performance, it is necessary to consider what can practicably be measured in combination with pertinent evaluation issues and the purpose of the MBI. The following indicators have been derived from the evaluation discussion above and the sustainability reporting issues discussed in Section 5.

6.2.1 Waste Generation and Resource Recovery

Waste generation is equal to the amount of waste disposed of to landfill plus the amount of materials recovered and is usually measured in tonnes per annum. It is only when waste generation rates start to fall against increases in gross domestic product that a decoupling will be achieved between waste and economic activity.

Also important to measure are the amounts of materials directly recovered through the MBI programme, both in terms of absolute tonnes and as a percentage compared to baseline data. Additional information required to gross tonnages includes a breakdown of materials recovered according to Highest Resource Value categories, for example the amounts:

- recovered and available for subsequent recycling
- recovered for single use prior to beneficial dispersion to environment
- recovered for single use – energy recovery
- recovered for single use prior to disposal at landfill.

6.2.2 Markets for Recovered Resources

This indicator provides an overview of the market situation for recovered resources. For example:

- amounts of recovered resources from the MBI programme that were exported as a percentage of total recovered material exports
- commodity market prices for recovered resources with a comparison with virgin prices (where appropriate)
- an indication of the level of market saturation in order to identify where future growth could occur.

6.2.3 Infrastructure Network for Recovery

One of the goals of sustainable resource recovery is an industrial ecosystem of infrastructure for recovering and adding value to waste materials. This could be measured by:

- number of facilities trading in the MBI programme
- number of new facilities established for resource recovery compared to base line data
- processing capacity as measured against tonnes of total materials available

6.2.4 Engagement with Value Chain

It was identified in Section 5 that an ideal MBI would positively influence behaviour all the way up the entire value chain. One aspect of potential engagement that was noted was the design of products to facilitate resource recovery. Measuring this could be achieved through a 'design for recovery' symbol whereby designers ensure that the product can be recovered through existing infrastructure.[22] The indicator would then be number of products certified for the symbol as a percentage of the estimated products on the market.

6.2.5 Ease of Administration and Operation

It will be important to achieve an MBI programme that is easy to administer and operate. One method of measuring this is to calculate the total cost of programme administration and report this on a per unit of recovered resource basis.

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[22] *This would be more than a statement saying 'this product is recyclable' and would involve a process of certification that the collection and processing infrastructure was in place for the product to be recycled. This would discourage combination packaging where mixtures of material types prevents resource recovery.*

6.2.6 Summary of Potential Indicators for Sustainable Resource Recovery MBIs

A summary of the potential indicators for sustainable resource recovery MBIs is presented in Table 4 below.

Table 4 – Proposed Indicators for Market Based Instruments

Benchmark	*Measurement*
Waste generation (amounts landfilled plus amounts recovered)	Tonnes per annum
Tonnes of material recovered directly through the MBI programme	Tonnes per annum and also as a percentage increase over baseline amounts
Highest Resource Value assessment of recovered amounts	Tonnes per annum going to the various recovery categories
Export markets for recovered materials	Percentage of materials exported
Commodity prices of recovered resources plus comparison	$ per tonne
Market saturation level	Percentage of market demand left unsatisfied with existing amounts recovered
Facilities trading in the MBI programme	Number count
New facilities established for resource recovery compared to base line data	Number count
Processing capacity of new resource recovery infrastructure	Tonnes of annual capacity as measured against tonnes of total materials available
Engagement with value chain	Count of 'design for recovery' symbol

6.3 Comparative International Performance

OECD in their 2004 report 'Addressing the Economics of Waste' note that the cost of managing waste at either a local or national level is difficult to evaluate. The complexity in cost evaluation is part of the reason that local governments avoid the extra complexity involved with incorporating environmental externalities into the prices for waste management. This in turn creates barriers for alternative waste technologies as they are competing against current practices that are effectively subsidised by not having to pay a 'full' internalised cost.

OECD note that Market Based Instruments are increasingly being applied to the area of waste management as an attempt to internalise the externalities associated with waste by passing on costs to economic agents, in particular to consumers. Examples of the MBIs being used for waste management include (2004):

- taxes or charges on purchase (deposit refund systems), which are used to finance disposal or resource recovery of end-of-life products
- charges for the collection of household waste, either by weight or at a flat rate such as per household (as opposed to home owner/rate payer)
- taxes on landfill or incineration, an adjustable level allows for the direction of waste flows towards more environmentally desirable methods.

However the OECD conclude that with regard to MBIs for waste management 'there is very little information on which to base an assessment of the economic efficiency of the various instruments and types of approach'. This is problematic when it comes to setting comparative measures as goals for the Australian context.

It is likely that the most appropriate form of comparison will be on the basis of per capita Municipal Solid Waste (MSW) generation rates and per capita MSW recycling rates. An example of Australia's performance with regard to per capita waste generation and recycling rates is presented in Table 5 below.

Table 5 – Comparative Australian recycling rates and per capita waste generation and recycling (adapted from Nolan ITU 2002 and OECD 2002)

Country	*Recycling Rate*	*MSW kg per capita*
Holland	39%	620
Norway	37%	620
Austria	34%	510
USA	33%	730
Switzerland	31%	660
Denmark	29%	660
Sweden	26%	470
Canada	24%	350
Germany	23%	590
Australia	20%	690
Israel	13%	730
UK	8%	580
France	6%	530
Greece	5%	440
Italy	3%	510
Spain	3%	650

7 DEVELOPING AN MBI FOR SUSTAINABLE RESOURCE RECOVERY IN AUSTRALIA (STARTING WITH NEW SOUTH WALES)

This section puts forward a preliminary discussion on the workings of Sustainable Resource Recovery Certificates (RRCs), a tradable certificate scheme intended to support sustainable resource recovery outcomes. The intention here is to identify how a certificate trading scheme could work and then to use that model as the basis for stakeholder dialogue around the desirability, effectiveness and efficiency of such a scheme.

Initially the discussion of the MBI will be based on New South Wales only. Once a working model has been developed, it will be fine-tuned with other States and Territories so as to maximise the opportunity to implement a scheme that could be expanded nationwide.

7.1 Purpose of the Proposed Sustainable Resource Recovery Certificates (RRCs)

The purpose of a Sustainable Resource Recovery Certificate (RRC)[23] trading scheme is to encourage investment into resource recovery infrastructure that will result in otherwise wasted materials being recovered at their 'net present highest resource value'. It is anticipated that the increased amount of materials diverted from landfill could make a key contribution to achieving the NSW Government's diversion targets for 2014.

The RRC programme is not intended to replace any upcoming Extended Producer Responsibility (EPR) schemes, but rather to complement a range of EPR initiatives by targeting the more diffuse and difficult to manage material streams.

One initial application of RRCs could be with the Municipal Solid Waste (MSW) stream. It is recognised that the Commercial and Industrial waste stream also suffers from low recovery rates (33% as compared with the 35% for MSW based on NSW waste generation amounts in DEC 2004b), and is a larger contributor to overall waste generation (4,195,000 tonnes per annum compared with 3,325,500 tpa for MSW based on NSW waste generation amounts in DEC 2004b). However, given the inherent difficulties in establishing a new trading programme, it is thought that MSW could provide a simpler testing ground for the scheme, with the potential for C&I materials to be included at a later date (see also Section 7.2.1 and 7.2.6).

Alternatively, it may be more advantageous to focus on certain product or material types, for example packaging waste, paper/cardboard or plastics. In this case there would be no need to differentiate the source of the products or materials as they could be from any of the waste streams. Additionally the trading scheme could operate within a closely defined material or product market, with the ability to influence positive environmental outcomes through changed behaviours across a wide range of impact points. Ultimately the decision will be made on the basis of RRC programme objectives and MSW is used here with the intent of engaging with the debate, as opposed to arguing a final position. Further details of the purpose of RRCs are presented overleaf.

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[23] *RRC is a working title for discussion purposes.*

7.1.1 Investment in Resource Recovery Infrastructure

The current lack of investment into new innovative technologies for resource recovery is seen as a significant barrier to achieving sustainable outcomes. RRCs are intended to underwrite investments into such infrastructure, for example extra material recovery facilities or plastic sorting technologies, by overcoming a lack of long term contracted resource security. It is anticipated that such a system will foster innovation by facilitating projects based on their ability to deliver sustainable outcomes, as opposed to satisfying local government procurement processes. Furthermore the investment will go into an industrial sector that is keen to expand its resource base and is likely to work proactively and cooperatively in the development of the programme. The resulting network of infrastructure then becomes the framework for an industrial ecosystem that can service New South Wales, promoting cyclical flows of resources and energy.

7.1.2 Achievement of Net Present Highest Resource Value Outcomes

It is recognised that not all recovery options provide the same level of benefit according to environmental, social and economic criteria (triple bottom line). RRCs will attempt to set up a programme that maximises resource value while minimising environmental impacts, that maximises the useful service life of materials, that uses recovered resources locally and that targets materials that are currently lost to landfill. Thus an evaluation of resource flows and required infrastructure to achieve NPHRV for different materials should precede RRC implementation.

7.1.3 Achievement of Government Waste Strategy Targets

One of the targets of the NSW Waste Strategy is, for example, to increase the recovery of materials from Municipal Solid Waste (MSW) to 66% of MSW generated (Resource NSW 2003). In order to achieve this target, significant investment will need to be made in resource recovery infrastructure. With Resource NSW (now Department of Environment and Conservation) having no power to direct local government actions,[24] an MBI approach such as RRCs presents a mechanism to achieve this (and other) waste strategy targets.

7.1.4 EPR to Manage 'Icon' Waste Products

The focus of RRCs is likely to be on diffuse waste types, such as mixed MSW, paper, cardboard, wood, glass, metal and plastic. These are materials where a 'traditional' Extended Producer Responsibility (EPR) programme could be problematic. RRCs are not intended to replace EPR initiatives, indeed EPR is anticipated to provide schemes addressing 'icon' product types such as computers, televisions, mobile phones, batteries and whitegoods. Possible dovetailing between the two could be the opportunity for RRC accredited facilities to access funds from EPR schemes for specific materials that are recovered as part of their collection activities.

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[24] *Although this could change, even if Department of Environment and Conservation had the ability to direct local government actions, a MBI scheme would help by improving economic viability of resource recovery infrastructure.*

TOTAL ENVIRONMENT CENTRE

7.2 Potential Operation of Resource Recovery Certificates (RRCs)[25]

7.2.1 Liable Party

When considering which sector could present as a candidate to 'hold' the liability to underpin the trading scheme, it is important to choose a group that is readily identifiable and able to impact directly on the stated purposes of the scheme. Additionally it is important to select a group with sufficient numbers to operate a market and to avoid collusion and rorting. One possibility is for local government to be the liable party.

Local governments collect and or manage some 3,325,500 tonnes of materials each year in NSW, 1,115,500 tonnes of which are recycled and 2,170,000 tonnes of which are disposed of to landfill (based on NSW waste generation amounts in DEC 2004b). As the managers of the entirety of the Municipal Solid Waste stream, local government presents as the collective entity that controls the fate of slightly more than one quarter of waste generated in NSW. They also have good data on collection and are unlikely to resort to illegal dumping in response to an MBI programme.

However, there are also several difficulties local government would create for an MBI programme, for example:

- lack of experience in market based activities with a strictly commercial basis
- need for special legal protection in order to manage certain aspects of risk associated with an increased liability loading
- potential conflict with other local government activities, objectives and budgets, and the potential for RRCs to detract from these activities
- lack of start up funds needed to meet the requirements of a RRC scheme.

It may be the case that liability would be better placed with the waste collector or waste processor, perhaps as part of tender conditions for any bid to local government for the provision of waste services. Another option would be for liability to be held against large commercial and industrial waste generators (this is discussed further in section 7.2.9).

7.2.2 Allocation of Liability

The initial allocation of liability could be on the basis of a staged reduction of materials disposed of to landfill in line with targets set in NSW Waste Strategy. It is suggested that an MBI initiative could provide the impetus for meeting half[26] of the Waste Strategy targets.

One possible allocation, for example, would involve adjusting the current waste strategy target (Resource NSW 2003) from 66% to 70%, the target date to 2015 for ease of calculations, and assuming a baseline performance of 30% diversion. A progression of targets that makes allowance for a ramping up period and starting in 2006 would then be 38% by 2008 (extra 8% of recovery), 50% by 2011 (extra 20% of recovery), 60% by 2013 (extra 30% of recovery) and 70% by 2015 (extra 40% of recovery).

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[25] *It is noted again that this is presented for discussion purposes only.*
[26] *Note that a 50% allocation of the waste strategy targets has been chosen arbitrarily as a discussion starting point.*

Each local government area (or equivalent liable party) would thus be required to meet half of these targets by remitting RRCs to the value of 4% of waste generated by 2008, 10% of waste generated by 2011, 15% of waste generated by 2013 and 20% of waste generated by 2015. This proportion of RRC liability would then remain constant for ten years until 2025 as is illustrated in Figure 10 below. The important point here is that the allocation of RRC liability is over and above current baseline performance and rules out any potential 'double dipping'.

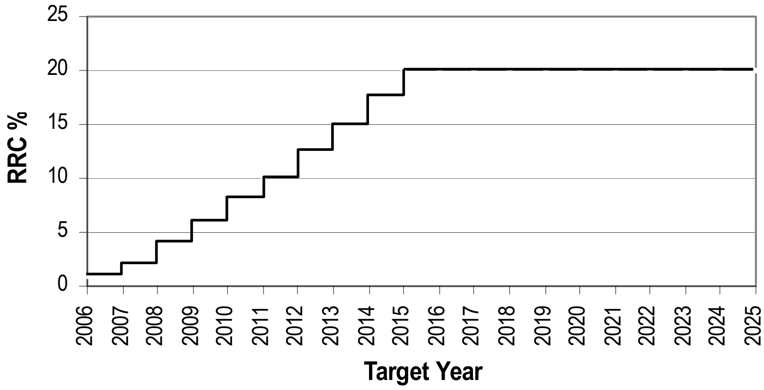

Figure 10 – Potential implementation of RRC liability on waste generation

7.2.3 Currency

The suggested currency of the Sustainable Resource Recovery MBI would be the Resource Recovery Certificate, the RRC.

On the liability side of the ledger, one RRC would be the equivalent of one tonne of MSW generated, meaning that one RRC would be required to offset against each tonne of liable waste for any given target year. The creation of RRCs is discussed below.

7.2.4 Eligibility and Allocation of Weightings

One issue to resolve is the eligibility of what materials create RRCs and the weighting factors applied per tonne of recovery amounts. It is recognised that having a per tonne equivalency across all material types may not be equitable. For example the sustainability benefits resulting from recovering one tonne of lead acid batteries from MSW will be greater than recovering one tonne of mixed paper.

A number of approaches could be used. For example, the approach of relative toxicity (as used in load based licensing) where a variety of weighting impacts would be assigned to emissions to air and water on the basis of their potential for environmental harm. A similar scheme could be used to allocate weightings to recovered materials on the basis of their potential for environmental harm if disposed of to landfill. Conversely, a more direct approach could be taken to target those low - value high-volume materials for which there is no market 'pull', as priority materials for RRCs.

Another possibility would be to weight certificate allocations on the basis of the environmental benefit of resource recovery. Some authors (for example Nolan ITU 2004) have constructed a valuation method to estimate the benefits associated with firstly avoiding the landfill and secondly for recovering resource value. A variety of impacts are taken into account associated with avoided leachate and landfill gas generation in addition to local amenity. To this are added the benefits associated with the recovered resource, for example, displacement of virgin resources and the impacts associated with that resource extraction, in addition to other benefits such as improved soil condition or reduced greenhouse gas potential.

There are also other Life Cycle Assessment (LCA) approaches that are similar to the above but focus on using LCA methodology to estimate the impacts associated with landfill and the benefits associated with recovery in order to estimate a net benefit for the activity. For example, the use of LCA to estimate the greenhouse impacts arising from the landfilling of certain waste materials.

Still another option would be to use the weighting system developed for the German green dot scheme DSD undated). Whatever the final system used, it must be chosen carefully to ensure that those eligible materials deliver an additional benefit over current baseline performance in line the goal of sustainable resource recovery.

7.2.5 Additionality

RRCs would be created though the recovery of resources by new or expanded capacity infrastructure over and above a local government's (or other liable party's) current recycling performance. At the start of the scheme local governments would be audited to determine their baseline recovery percentage, based on the average percentage of materials recovered over say the past three years previous to the scheme start year. This baseline percentage would then be set for the duration of the scheme (this is to enable the forecasting of liability). RRCs would only be able to be created on additional performance past this level. The allocation of RRC liability would then be calculated as:

$$\text{RRC liability} = \frac{\text{Total Waste Generated}}{(2\text{ yrs before target yr})} \times \text{RCC liability \% for target year}$$

$$\begin{matrix}\text{Non RCC - able}\\ \text{Recovery Amount}\end{matrix} = \frac{\text{Total Waste Generated}}{(2\text{ yrs before target yr})} \times \text{BaselineRecovery \%}$$

For example, City Council has an average rate of recycling of 30% for the calendar years 2002-2004. During 2006 (two years before the 2008 target year rate of 4%), City Council generates 100,000 tonnes of waste (recycled plus disposed). The RRC liability for 2008 would then be 4% * 100,000 tonnes = 4,000 RRCs.

During the year 2008, however, City Council would need to recover 30% * 100,000 = 30,000 tonnes of material before any valid RRCs could be created. Also the 4,000 RRCs would need to come from a new or expanded capacity resource recovery facility that was accredited to create RRCs.

It is noted that there may be a need for some adjustment mechanisms so that early leaders who have a recovery rate much higher than the average are not disadvantaged.

7.2.6 Trading and Discharge of Liability

The potential operation of the scheme is presented in Figure 11 overleaf. Local governments or other liable parties would have the choice of sending their waste materials to landfill or to an accredited resource recovery facility that has increased capacity or is a new facility. Amounts of materials recovered over and above the baseline recovery amount would be eligible to create RRCs. It is likely that there would be deals where a portion of the RRCs created are directly transferred back to the liable party as part of the service deal, with an appropriate cost factored into the negotiated gate fee.

The resource recovery facility then has RRCs that can be traded and so does the liable party if they acquire any surplus to their needs, if not they will be purchasers of RRCs. The requisite amount of RRCs would then surrendered to the RRCs Administrator. This body also undertakes the auditing of the local government (or other party) liability data, the RRC generation and the operation of the trading exchange.

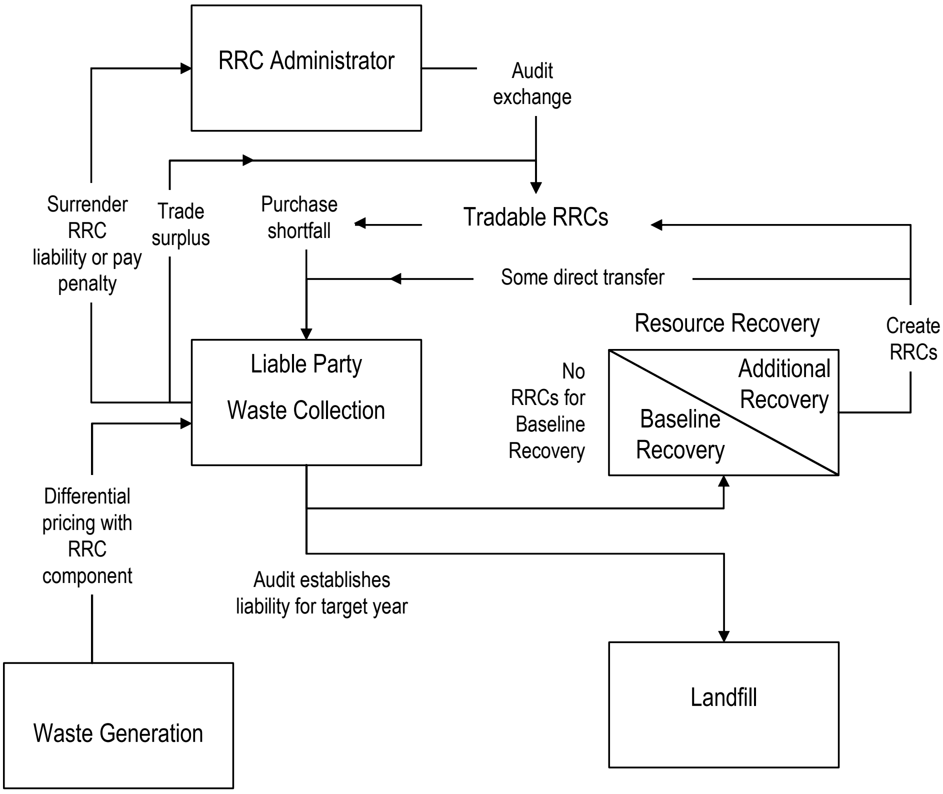

Figure 11 – Potential Operation of the RRC scheme

7.2.7 Penalty

In order to drive the market mechanism there will need to be a penalty for not complying with RRCs obligations, in order to fast track infrastructure development. As a starting point for discussion purposes, a penalty of $100 per tonne of undischarged liability is suggested.

7.2.8 Funding of Scheme

The establishment of the scheme in addition to the operations of the scheme and the ongoing auditing requirements and the like, could be funded through the NSW Waste Fund. This would lower compliance costs for all participants.

7.2.9 Applicability to the C&I Waste Stream

The opportunity with the C&I waste stream would be to designate liable waste generators as those companies generating in excess of say 1,000 tonnes of material per year or to have a waste stream of significant importance. These liable parties would then have a similar schedule of targets for RRCs that would need to be surrendered on the basis of additional materials recovered through new or expanded capacity infrastructure.

It is anticipated that collection contracts would be structure in such a way that the waste collector managed the RRC liability and included this as a service charge. There may be a longer lead time with this type of scheme as not many companies would have accurate data on waste generation to provide a three year baseline average. The alternate approach would be to arbitrarily set the required recovery rates.

One possibility would be to set the RRC liability on the basis of waste disposed of to landfill two years previously (a two year gap needed for planning purposes). A potential barrier to such a scheme is the likely increase in illegal dumping.

7.3 Issues to be Resolved

Based on the discussion in this report, and on the proposed trading scheme outlined above, there are a number of issues that need to be resolved through stakeholder involvement if an effective and efficient MBI for sustainable resource recovery is to be implemented in New South Wales and Australia. The issues highlighted below will form the basis of discussions as part of stakeholder workshop, which will be used to develop an action agenda to develop and implement the concept. Items to consider include:

- agreement of statement of purpose amongst stakeholders, that is agreement as to what is trying to be achieved (for example a common vision of sustainable resource recovery), irrespective of the final mechanism

- potential for an alternative regulatory approach (such as a ban on certain material types to landfill) achieve the same desired outcome

- selection of mechanism; a 'positive' rights based instrument has been suggested here, but there are also others such as a competitive auction for capital grants funded from an increased landfill levy or advanced disposal fees on generic material types

- allocation of liability on other parties other than local government, for example landfills, waste transporters, retail outlets and large waste generators

- definition of 'currency' and alternatives to the RRC

- target waste streams and target materials, including alternatives to Municipal Solid Waste such as certain fractions of MSW, commercial and industrial or construction and demolition waste streams, or other product and material types

- weighting allocations using a product and outcome based approach such as the type of material recovered or the type of product recovered, in combination with the end material use post-recycling

- potential impacts of the MBI, including economic issues such as costs to business, prices to consumers and offshore exports. environmental aspects such as greater or less resource efficiency and increased illegal landfill, and social concerns such as changes to amenity and jobs

- system leakages, including potential disruption by free riders, imported products, non-house owners (renters) and gaming

- state based versus a national approach – maintain the focus on New South Wales or move to a national approach first, with potential for increased costs of delay?

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9 APPENDICES

9.1 Additional Resource Recovery MBIs

Initiative	*Type of MBI*	*Overview*
German Ordinance for the Avoidance of Packaging Waste	Charges, Fees and Taxes	Introduced in 1991, the German Ordinance for the Avoidance of Packaging Waste established an obligation for manufacturers to re-use some packaging components or pay a fee to have it recycled. This legislation was the impetus for the formation of the Green Dot certification of recyclability programme.
User Pays Kerbside Garbage Collection	Charges, Fees and Taxes	In 1994 the Sidney Township of Ontario, Canada introduced a 'pay as you throw' scheme for municipal solid waste. 52 garbage bags were distributed, with additional bags available for a cost of $1.50 (Canadian). A reduction in waste disposed of to landfill was reported, in addition to an increase in recycling. This is similar to a Korean system whereby official garbage bags must be purchased from the Government for a fee and a Seattle system that operates on the size and amount of rubbish bins put out for collection.
Michigan's Solid Waste Alternatives Program	Subsidies	The intention of SWAP was to develop solutions for reducing the amount of waste disposed of to landfill. US $150 million was made available for projects related to waste reduction.
Plastic Bag Tax	Charges, Fees and Taxes	The aim of plastic bag taxes are to reduce the use of plastic bags, increase the recycling of plastic bags and decrease the incidence of plastic bags in the waste stream. Countries to implement taxes include Italy in 1989 and more recently Ireland in 2002. Part of the revenue raised by the Irish tax will be distributed as grants to local authorities for environmental improvement projects.
Ecolabelling	Market Friction Reduction	Voluntary environmental performance certification and labelling of products or services on the basis of life cycle considerations. The intention being that consumers will be better informed on the environmental impacts of their consumption patterns and will choose low impact products. Examples include the German Blue Angel, Nordic Swan Eco-label, European Union Eco-label, Canadian Environment Choice Program, Korean Eco-label , Green Mark of Taiwan, Green Seal of the United States, Green Label of Thailand, Eco-label of Hungary, Environmental Choice New Zealand and the EcoMark of Japan, in addition to the recently formed Good Environmental Choice label in Australia.
UK Landfill Cap and Trade Programme	Market Creation - Tradeable Permits and Certificates	A programme to meet the EU Landfill Directive target of 65% diversion of biological municipal waste (BMW) by 2020 by permitting local government to dispose of BMW to landfill only when they have a landfill allowance. Allocations of allowances are grandfathered to local government who are then in a position to trade in order to meet the target.
UK Producer Responsibility Obligations (Packaging Waste)	Market Creation - Tradeable Permits and Certificates	Introduced in the UK in response to the EC Directive on Packaging and Packaging Waste and places obligations on certain packaging supply chain businesses to recover ever increasing amounts of packaging materials.
Landfill Taxes and Levies	Charges, Fees and Taxes	Used to internalise the negative externalities, act as a disincentive for the disposal of waste to landfill, to encourage the uptake of recycling activities, raise funds to be used for resource recovery activities or to ensure an appropriate closure of the waste facility and also to raise funds for government consolidated revenue.

Initiative	*Type of MBI*	*Overview*
Container Deposit Legislation	Deposits/Refunds	A scheme to facilitate the collection of primarily beverage containers for recycling and to reduce the impact of litter by placing a deposit on the container that is redeemable when the container is returned.
Nuisance Product Taxes, Levies and Fees	Charges, Fees and Taxes	A tax or levy is charge on problematic product items in the waste stream, for example tyres, used motor oil, PVC and lead acid batteries, in order finance a recovery system - also known as advance disposal fees.
Performance Bonds	Deposits/Refunds	A deposit in the form of a performance bond is raised in order to ensure that adequate closure and clean-up occurs at landfill and other waste management sites.
Subsidised Recycling Services	Subsidies	The financial support of desired activities such as recycling. Examples include free or low cost garden organics collection and drop-off services, in addition to reduced cost or free drop off of recyclables at transfer stations.
Preferential Procurement of Recycled Product	Market Friction Reduction	A means of encouraging the development of 'green' products through the allocation of a commercial advantage as a preferred supplier on the basis of the environmental performance of the product and /or company.