Resource Stewardship and Waste Minimisation
Towards a Sustainable New Zealand

Lesley Stone - Editor
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# Contents

**Acknowledgements** ......................................................................................................................... v  
**CAE** .................................................................................................................................................. vi

## Part 1: The Context for Resource Stewardship and Waste Minimisation in New Zealand

1 Introduction .................................................................................................................................. 3  
2 The Political Context .................................................................................................................... 7  
3 Change Mechanisms ................................................................................................................. 13  
4 Learning from Experience .......................................................................................................... 23

## Part 2: Industry Sector Reports

5 The Dairy Sector ........................................................................................................................ 33  
6 The Meat Sector ........................................................................................................................ 51  
7 The Forestry Sector ................................................................................................................... 75  
8 The Built Environment Sector .................................................................................................... 99  
9 The Tourism Sector ................................................................................................................. 131  
10 The Retail Sector ............................................................................................................. ......... 153  
11 The Plastics Sector .................................................................................................................. 173

## Part 3: Resource Stewardship: Improving the Contribution of Waste Minimisation

12 Revisiting the Context .............................................................................................................. 205  
13 Sector Group Responses ....................................................................................................... . 207  
14 Towards Resource Stewardship .............................................................................................. 225

## Appendices: Instruments, Tools and Change Agents

1 Regulatory, Economic and Voluntary Instruments and Tools with Examples of their use in a Range of Countries ........................................................................................ 237  
2 Brief Descriptions of a Range of NGOs that Work with Business on Resource Stewardship or Waste Minisatio-related Activities ............................................................... 243  

Index ............................................................................................................................................. 249
Acknowledgements

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CAE at a Glance

- is a not-for-profit organisation, established in 1987
- has a well-established, proven record of achievement
- is based at the University of Canterbury campus
- is concerned with issues of national and international importance
- is helping to develop new solutions through advancing engineering knowledge and practice
- is helping inform and educate New Zealand communities about technology matters.

Our Mission

To advance New Zealand’s economic growth and social progress through broadening national understanding of emerging technologies and facilitating early adoption of advanced technology solutions.

How we Operate

CAE was built on a vision to raise this country’s technical knowledge for the benefit of New Zealanders. CAE operates as a Charitable Trust under a Trust Deed registered by the University of Canterbury. The success to date of CAE is a result of the determination of the University of Canterbury and CAE’s former and current Trustees to actively promote and encourage the uptake of advanced engineering and technology. In doing so, CAE plays a strong integrating role within New Zealand’s engineering and technology sectors, undertaking major projects that seek to build this country’s technological capabilities in areas of national importance. Collaboration and the dissemination of knowledge are the cornerstone to achieving that goal. CAE’s organisational strength lies in its ability to facilitate expert groups and provide the knowledge transfer capability to build upon the findings of specific project activity.

Historically, CAE activities have involved strong participation and financial support by industry and the engineering profession. Much of its work has been directed at projects that go beyond conventional engineering practice so as to create new perspectives on emerging technology trends to New Zealand. Its strategy is to be seen as a neutral, far-sighted commentator on technology and engineering-related matters.

CAE’s Contributions

By progressing knowledge and technological understanding, CAE is uniquely positioned to facilitate an expanding role for the engineering profession and to bring about a real change in the technological capability of New Zealand. The organisation offers well-established project management skills and a wide network of academic, research, professional and business links, both national and international. As a knowledge broker, CAE gathers, interprets and disseminates knowledge and information through the publication of books, the conduct of seminars and conferences, and via its website.

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Part 1:

The Context for Resource Stewardship and Waste Minimisation in New Zealand
1.1 Background

In 1992, the Centre for Advanced Engineering (CAE) published *Our Waste: Our Responsibility* (CAE, 1992). This book, which became a much-used resource for waste practitioners in New Zealand, resulted from a major CAE project that involved over 120 people and included several international experts.

The book was very much a product of its time. Three of its four main parts covered the then primary areas of debate: what to do with hazardous waste, how to progress from dumps to engineered landfills, and how to prevent contamination of water supplies. The remaining part covered many new and emerging concepts that viewed wastes as resources and focused on the need to prevent, reduce, re-use and recycle them in that order of priority. The term that was used to describe the approaches within this hierarchy was ‘waste minimisation’.

This new publication arises out of a need to update the waste minimisation section (Part 2) of *Our Waste: Our Responsibility*, and is based on the CAE Resource Stewardship: Waste Minimisation (RS:WM) project, which was set up specifically for this purpose. It follows the earlier release, in April 2000, of *Management of Hazardous Waste* and *Landfill Guidelines*, Parts 3 and 4 respectively of the original book, and becomes a companion volume in the CAE series, now subtitled: *Towards a Sustainable New Zealand*. The project has been substantially funded by a grant from the Sustainable Management Fund with further contributions from local and regional councils. The sponsors are acknowledged in the front of this book.

The goal of the CAE RS:WM project is to advance environmental sustainability in NZ by sharing knowledge, experience and tools to improve waste minimisation practices and raise the level of resource stewardship. A strong motivation is the need to ensure that waste management practitioners have access to the latest information. Fulfilling this need is a fundamental part of the journey towards sustainability.

The need for information is also consistent with *The New Zealand Waste Strategy* (MfE/LGNZ, 2002). This document, prepared by the Ministry for the Environment (MfE) and released in March 2002, with its inclusive approach to both wastes and waste management options, has signalled that there is now widespread recognition of the need for a comprehensive, integrated approach to material and resource efficiency at every stage of production and consumption.

Over ten years have now passed since *Our Waste: Our Responsibility* was published by CAE and, to many people, waste minimisation has tended to become synonymous with the lower end of the hierarchy: i.e., re-use and recycling. Much has been achieved in New Zealand by the many groups that have focused on these activities, and it is important for this work to continue, but it is not enough.

Significant benefits lie in encouraging people (and organisations) to consider the comparative advantages of avoiding and minimising the generation of waste in the first place. This is considered a significant issue for New Zealand. The ability to use resources in the most efficient and sustainable manner lies at the very root of the problem, and provides a large part of the solution.

Quite apart from the fundamental underlying issues of sustainability, there is also the important
Resource Stewardship and Waste Minimisation

fact that New Zealand trades heavily on its ‘clean and green’ image and cannot afford to place this image at risk. It is clear that, if the perception should change, it may do untold damage to the economy.

In the past decade since Our Waste: Our Responsibility was published there has been a growing appetite for change in the way the environment is managed, and this has largely been driven by:

- a change in the political context with respect to wastes of all kinds and waste minimisation;
- an increase in the use of instruments and tools to promote waste minimisation;
- an increase in activities of relevance to waste minimisation, particularly amongst non-governmental organisations (NGOs);
- research into the effectiveness of waste minimisation programmes; and more recently,
- pressure derived from the Kyoto Protocol concerning processes that emit gaseous waste.

These drivers are important because they reflect the context within which any further progress will occur. Context is important because it affects the receptiveness of society to change, and it influences the effectiveness of change programmes (e.g. Eero, Grendstad and Wollebak, 2001). Later chapters will discuss each of these drivers and their relevance to further progress.

Waste minimisation activities are an important part of New Zealand’s journey towards sustainability. This book is about whether, how, and to what extent, these activities are really contributing towards this journey.

The book has been divided into three parts.

- Part One provides a background to waste minimisation in New Zealand; particularly how it relates to resource stewardship and an overview of the drivers mentioned above. These include: political context, instruments and tools, the role of non-government organisations, and the results of research into the effectiveness of waste minimisation programmes.
- Part Two provides an insight into the current status of waste minimisation and resource stewardship in New Zealand within seven industry sectors that form a major part of the New Zealand economy: dairy, meat, forestry, building, tourism, retail and plastics.
- Part Three provides a summary and discussion of the key findings, followed by conclusions and recommendations.

1.2 Why Resource Stewardship?

The term ‘resource stewardship’ has been used here because it is a fundamentally important facet of the drive towards the goal of a more sustainable future. Clearly, the processes that use resources and create waste have an important part to play in this journey. This section outlines how the term encapsulates the ultimate purpose of waste minimisation, and how it relates to other concepts and approaches.

Resource stewardship reflects recognition of the need to assume greater responsibility for resources. This requirement is implicit in the concept of sustainable development, i.e. the need for society to develop in a way that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCSD, 1987).

Resource stewardship is enshrined in the Resource Management Act 1991 (RMA), the principal purpose of which is to promote the sustainable management of natural and physical resources (s5). It is also implicit in the ‘sustainability principles’ of the Energy Efficiency and Conservation Act 2000 (EEC Act) (s6).

Resource stewardship is also consistent with the Maori concepts of kaitiaki and kaitiakitanga. The
NZ Waste Strategy defines *kaitiaki* as “guardians or stewards of resources who promote the integrity of the resource” and *kaitiakitanga* as “guardianship over the land and its resources”. In the RMA, *kaitiakitanga* is similarly defined as “the exercise of guardianship” which, “in relation to a resource, includes the ethic of stewardship based on the nature of the resource itself” (s2). The Maori view is very relevant. There is much that society, in general, can learn from these concepts and, in doing so, gain a better understanding of how people and nature are irrevocably intertwined.

Many times in the past decade, a new concept or approach has been promoted as the ‘one true way’ to achieve sustainability. This often has had more to do with the limited availability of funding for sustainability-related initiatives in New Zealand and the competition that it engenders, than the inherent superiority of any one concept or approach. Its effect, often, is to confuse many of those who would normally be in the target audience for sustainability initiatives, to shut down communication, to minimise the availability of resources, and to limit the learning that can occur when experiences are shared.

Care is thus required to avoid resource stewardship being seen as the next in a long line of concepts that have been applied to waste management over the past 10 - 20 years (e.g. see Figure 1.1). Within this context, resource stewardship could be touted as the new high point in a progression from ‘end-of-pipe’ types of approaches that focus on dealing with wastes once they are generated (e.g. re-directed disposal, treatment, remediation), to ‘up-the-pipe’ types of approaches that focus on dealing with the sources of waste (e.g. cleaner production, pollution prevention). Such a framework, however, would not be helpful.

The diagram in Figure 1.1 implies that initiatives lower down the list are inferior. This is unfair and unhelpful. There are many examples in New Zealand where people have worked hard to reduce the effects of wastes on the environment, and to reduce wastage by having resources removed from the waste stream and re-used or recycled. All of these are important roles that contribute in one way or another towards a more sustainable society.

![Diagram of waste management concepts and approaches](image)

*Figure 1.1: Resource stewardship presented as the latest in a succession of waste-related concepts and approaches*

Bringing the term ‘resource stewardship’ into the waste management lexicon requires, for many people, a shift in the way they think about waste. It is unlike the other concepts that are identified in Figure 1.1, because it is heavily value-laden. Efforts to change from ‘end-of-pipe’ to ‘up-the-pipe’ approaches, represent a progression from total disregard or lack of responsibility for wastes and their effects, to acceptance of responsibility. In this respect, resource stewardship should not be viewed as the next in a long line of concepts or approaches (as presented in Figure 1.1), but rather the rationale behind and the ultimate aim of all the approaches (as presented in Figure 1.2).
As such, resource stewardship can provide an *integrating* mechanism for the waste management industry. The progression shown in Figure 1.1 occurred as a result of a sequence of people standing up and arguing for a switch to an alternative approach: from dumps to landfills, from landfills to recycling, from recycling to reduction at source, etc. One outcome of this was the ‘waste management hierarchy’, which has found its way into much of the rhetoric of the past decade (and even into law\(^2\)).

The waste hierarchy was essentially based on the need to bring about a change in values. However, it tended to create something of an ‘us-and-them’ culture wherein the achievements in the ‘upper’ levels had more status than those in the ‘lower’ levels. An obvious example can be found in external recycling initiatives. They are ‘lower’ in the hierarchy, but they are often very successful in terms of public participation. They can also result (relatively easily) in what is essentially a huge switch in values: from one where wastes are simply dumped to one where they are viewed as resources worth conserving. The hierarchical approach not only de-values these types of initiatives, but de-values the often considerable passion that those who work towards them have for the environment.

The ultimate aim is to place greater focus on resource stewardship, which requires a shift in values from irresponsibility to responsibility, and to evaluate ANY initiatives in terms of the contribution they are making towards that shift, rather than their level within the hierarchy.

### 1.3 References


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\(^2\) The Local Government Act 1974 was amended in 1996 to include a requirement for local authorities to develop waste management plans that incorporate the waste management hierarchy.
2.1 Introduction

A major change that has occurred in the past decade is that waste minimisation has moved from being little more than something to provide a measure of satisfaction to environmental sensibilities, to now being recognised at the highest levels as an important part of waste management in New Zealand. Three recent initiatives are indicative of this changing political context.

- the New Zealand Waste Strategy (MfE);
- the Lifeafterwaste Programme (WasteMINZ); and
- the Energy Efficiency and Conservation Strategy (EECA).

These three initiatives each vary in content and detail. Yet, they each share commonalities in that they were all developed within the context of sustainability; they are all cognisant of the Treaty of Waitangi; and they all recognise the need for resource stewardship. In particular, the Waste Strategy and the Energy Efficiency and Conservation (EEC) Strategy both extend responsibility for the environment within government beyond MfE to include local government and the Ministry of Energy. The EEC Strategy is, arguably, more robust than the Waste Strategy because it is supported by legislation, but this depends on how much weight the documents, and the institutions that are responsible for their implementation, carry.

2.2 The New Zealand Waste Strategy

The New Zealand Waste Strategy was published in March 2002 and resulted from a collaborative effort between the Ministry for the Environment (MfE) and Local Government New Zealand (LGNZ). Included in its development was an advisory group made up of a range of professionals working within the waste management field (the Working Group on Waste Minimisation and Management), a review by local government officers, and an extensive public consultation phase. It has three core goals:

- lowering the social costs and risks of waste;
- reducing the damage to the environment from waste generation and disposal; and
- increasing economic benefit by more efficient use of materials (resources).

Most importantly, the Waste Strategy recognises that reducing waste cannot succeed without systems that manage wastes from the point of generation through to disposal. Hence, a more effective, integrated approach to material and resource efficiency is needed at every stage of production and consumption.

The long-term challenge identified in the Waste Strategy is to break the present link between the amount of waste produced and the rate of economic growth. This requires a change of direction that includes closing the loop on resource use and waste generation. Figure 2.1 below (from the Waste Strategy) illustrates the difference between the current ‘linear’ approach to resource use, and an envisaged ‘cyclical’ approach. While it could be argued that the ‘cyclical’ approach as represented in the figure is still ‘end-of-pipe’, it does recognise that waste should no longer be accepted as a normal part of doing business.
The Strategy identifies six core principles that will guide both central and local government. These are widely used in other developed countries and are consistent with OECD principles for strategic waste prevention.

- **Global citizenship** – New Zealand’s responsibility to protect the environment extends beyond its borders.
- **Kaitiakitanga/Stewardship** – Everyone has a responsibility for looking after the environment, and for the impact of products and wastes they make, use and discard.
- **Extended producer responsibility** – Producers have a responsibility for their products throughout the product’s life-cycle, from production through to final disposal.
- **Full-cost pricing** – The environmental effects of production, distribution, consumption and disposal of goods and services should be consistently costed.
- **Life-cycle principle** – Products and substances should be designed, produced and managed so all environmental effects are accounted for and minimised during generation, use, recovery and disposal.
- **Precautionary principle** – Where decision-makers have limited information or understanding of the possible effects of an activity, and there are significant risks or uncertainties, a precautionary approach should be taken.

Section 3 of the Waste Strategy is important because it sets out criteria for prioritising actions that will achieve the Strategy’s vision and goals. Five core policies in the Strategy form a basis for action.

1. There is a need for a sound legislative basis for waste minimisation that clarifies the function of key players and recognises the Crown’s responsibility under the Treaty of Waitangi.
2. Further development and application of pricing policies that reflect the full cost of waste disposal are crucial and form a cornerstone of the strategy.
3. The protection of environmental and public health demands high standards. A priority in the strategy is the implementation and monitoring of environmental standards.
4. Effective waste minimisation is hampered by a lack of good information. The strategy recognises the role of central government in setting up national information systems and facilitating public information and education programmes.
5. More efficient use of materials (resources) will have the biggest long-term impact on waste reduction.
The New Zealand Waste Strategy is important because it presents a new vision for minimising waste in accordance with the government’s commitment to reducing the waste stream and local government’s desire for more effective and efficient waste management and minimisation. It also provides a vision for the future management of wastes in New Zealand and sets out a practical programme of both medium and long-term actions. The Strategy’s underlying argument for resource stewardship is compelling and it should be considered essential reading for all those involved in the management of waste.

2.3 The Lifeafterwaste Programme

Lifeafterwaste is a Waste Management Institute of New Zealand (WasteMINZ) initiative designed to help people change the way they think about waste. The programme is important because it was developed as part of a consultative process that involved a broad cross-section of the waste management sector. This sector, from which WasteMINZ draws its membership, represents many interests including central and local government, industry, waste management companies and professionals, NGOs and educational institutions.

The interests of WasteMINZ members cover the full spectrum of waste-related activities including disposal, remediation, treatment, recovery, recycling, re-use, reduction and prevention, and all of these interests were represented in some way in the consultation process that the organisation undertook to develop the Lifeafterwaste programme.

The Lifeafterwaste programme is consistent with the New Zealand Waste Strategy and is very forward looking. It is designed to make people think about waste other than as something to be discarded, a notion that is encapsulated in its vision:

To achieve lifeafterwaste we New Zealanders need to change the way we act ... With individual commitment and action we can make the change from waste disposal to waste avoidance, we can be a resource efficient nation and we can clean up our environment ... Let’s make the commitment to close the loop on waste...

The Lifeafterwaste programme includes a set of Change Principles that form the basis for change actions. These are summarised below.

- An opportunity exists to make New Zealand truly ‘clean and green’, before that image becomes tarnished and reflects reality.
- All change must take place within the framework of sustainable development.
- New Zealand needs to become resource efficient. The focus must be on linking waste avoidance, material reuse and recycling with the upstream benefits of resource conservation and efficiency, pollution prevention and sustainable development.
- Waste and the environment need to be managed in an holistic way and include all wastes such as sewage, stormwater, gaseous emissions, agricultural runoff, and the inefficient use or misuse of resources such as water, air, energy and land.
- A single set of actions is needed that can be clearly understood.
- Everyone needs to be committed and must feel that the initiative has honesty and integrity.
- There needs to be a single set of targets that are ‘realistic and attainable’ so progress and success can be measured.

The Change Actions based on these principles address the need for:

- personal acceptance of responsibility;
- education and ‘know how’;
- recognition of the ‘special’ nature of the New Zealand environment;
• dispelling inaccurate perceptions, particularly as they relate to sources and solutions;
• recognition of the economic value of resource efficiency and the role of consumers; and
• leadership from within all sectors.

These give rise to a number of Sector Challenges, identified as:
• integration of the efforts of all contributing sectors in making the connection between waste, resource use and environmental degradation;
• collaboration, integration and consistency among local authorities;
• mechanisms to ensure that costs accurately reflect environmental (and social) outcomes; and
• the development of infrastructure, as well as secure markets.

The Lifeafterwaste programme is very relevant to the way that current thinking on sustainability is changing. It was produced following extensive consultation by an organisation (WasteMINZ) whose disparate members are known to have had many disagreements in the past on waste issues and is, quite possibly, one of the most integrative and forward-looking statements on waste management that has been published in New Zealand.

2.4 The Energy Efficiency and Conservation Strategy

This strategy was developed by the Energy Efficiency and Conservation Authority (EECA) in response to a requirement under the Energy Efficiency and Conservation Act 2001 (EEC Act). It was developed during a 15-month process that included: a set of ‘vision pieces’ produced by key ‘energy commentators’; stakeholder workshops; hui, and ‘numerous one-on-one meetings’. In addition, a draft strategy was aired in presentations around the country and public submissions were called for and taken into consideration.

The EEC Act requires the strategy to “give effect to the Government’s policy on the promotion in New Zealand of energy efficiency, energy conservation, and the use of renewable sources of energy”.

The EEC Act also established the Energy Efficiency and Conservation Authority. EECA is a ‘perpetual’ Crown entity charged with the role of meeting the EEC Act’s purpose. Its functions include: encouraging, promoting and supporting energy efficiency, energy conservation and the use of renewable sources of energy. EECA’s essential purpose is to:

• provide advice to the Minister of Energy;
• assist the Minister to prepare and administer the EEC Strategy;
• raise public awareness;
• promote relevant practices and technologies;
• arrange for relevant research, assessments, demonstrations and studies;
• monitor and review progress; and
• publish relevant information, research, and other material.

EECA also has the power to provide grants, awards or loans, develop regulations for energy efficiency in, and labelling of, products and services.

Organisations such as councils, major companies, community trusts, professional bodies and government departments are key partners in the EEC Strategy, and in EECA’s business. These partnerships put practical programmes into action to deliver energy efficiency results. As well as promoting the wise use of energy, EECA also promotes the use of renewable sources of energy, which are vital in achieving sustainable energy (Dahlberg, pers. com., 2002).

The EEC Strategy was developed within the context of a vision of a ‘sustainable energy
economy’, that includes energy efficiency, energy conservation and the use of renewable energy systems. It includes various ‘policy directions’, goals, ‘high-level’ targets, as well as a set of policy ‘measures’ and sector-specific programmes.

The policy directions set the direction for the strategy and are described as “continuing improvement in our energy efficiency” and a “progressive transition to renewable sources of energy”. The goals are to:

- reduce the emissions of CO₂;
- reduce the local environmental impacts of energy production and use;
- improve the country’s economic performance and the value it derives from energy;
- promote the development of industry through the use of energy efficiency and conservation;
- improve the resilience of the New Zealand economy to future disruptions or price rises; and
- improve community health and welfare by enhancing energy efficiency and availability.

These policies are reflected in two high-level targets to be achieved by 2012:

- to improve the efficiency of energy use across the whole economy by at least 20%; and
- to increase the supply of renewable energy by 25-55PJ.

A number of policy measures have been set in place to help achieve these targets and these are supported by various sector-specific programmes covering central and local government, energy supply, industry (including agriculture), buildings and appliances; and transport.

The Energy Efficiency and Conservation Strategy is important because energy is a resource. It has long been recognised by some within the waste management sector that resource stewardship and waste minimisation need to be applied to energy as well as material resources.

2.5 References

3.1 Introduction

The term ‘tools’ can be used in different ways when referring to waste minimisation. The mechanisms or devices that are used to promote resource stewardship and waste minimisation on a societal level (e.g. laws, taxes, voluntary agreements) are sometimes referred to as ‘tools’ but are also known as ‘instruments’. The ‘step-by-step’ types of guides, manuals, management systems, etc., that are developed and used to assist individual householders, businesses or other organisations to undertake waste minimisation, are more commonly known as ‘tools’.

The ‘Lifeafterwaste’ programme, New Zealand Waste Strategy and Energy Efficiency and Conservation Strategy, described in Chapter 2, are effective instruments for encouraging waste minimisation to occur at all levels, and they incorporate references to some of the other instruments that are available (e.g. policies, targets and educational programmes).

Although a start has been made in New Zealand, a much wider range of instruments is available and in use in other countries. Generally, these fall into three categories: regulatory, economic and voluntary. Examples of the types of instruments and tools in these three categories are provided in the ‘Toolbox’ included in Appendix 1. The majority of countries use a range of tools and instruments to encourage waste minimisation. This is because no one instrument (or tool) is likely to work in isolation. Also, the changes that are required of society can be significant. For example, a change from ‘out-of-sight, out-of-mind’ types of values, where wastes are considered to be someone else’s problem, to ‘there is no such thing as waste’, where unwanted materials are recognised as valuable resources that need to be conserved, requires acceptance of responsibility by the individual.

While many programmes focus on behavioural change, it is important to recognise the role of values in informing behaviour. Behavioural change can only be regarded as sustainable in the long-term if values are changed (e.g., see Stern et. al., 1995; Schein, 1992; Argyris, 1999).

Values, however, can be extremely difficult to change because they have developed within a social context that continually enforces and reinforces them. Stern, et. al. (1995) in their model of ‘environmental behaviour’ suggest that, in order to change values, it is necessary to change the institutional structure and constraints within society. Institutional structure is about the way in which formal aspects of society (e.g. laws, policies, economic systems, religious doctrines, educational curricula) act together to reinforce certain values. Different instruments tend to target different parts of this institutional context, so it is not surprising that more than one instrument is needed to try to bring about the value changes necessary to institute behavioural change. Since institutional structures and constraints are different for different social groupings (e.g. different countries, communities or sector groups), it follows that the instruments are more likely to be effective if they are chosen strategically for each specific social context.

3.2 An International Example

In the USA, for example, the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), together with the Pollution Prevention Act of 1990 (PPA), were used to establish the US Environmental Protection Agency (USEPA)’s ‘Toxics Release Inventory’ (TRI). The legisla-
tion was enacted within the context of public concern about and demands for information on chemical releases to the environment beyond the factory fence (USEPA, 2002). This concern stemmed from a series of high profile incidents involving toxic, persistent and/or bio-accumulative hazardous substances (e.g. Seveso, Bhopal) and the discovery of contaminated sites all across the US, the most notorious of which was found at Love Canal in New York State. The EPCRA, the TRI and the PPA were designed to act together to rectify some of the institutional inadequacies that resulted in these types of incidents.

The EPCRA, among other things, requires industrial facilities to report on the annual releases of a range of 650 hazardous wastes (over a particular threshold level) and requires the USEPA and States to collect this information and make it available to the public via the inventory. The PPA requires the inclusion within the inventory of further information on the waste management and reduction at source activities of the industries. The TRI works in conjunction with general and industry-specific voluntary programmes that are designed to assist individual businesses to reduce their wastes at source. It is also complemented by public campaigns run by non-governmental organisations (NGOs), e.g. Environmental Defense and the Unison Institute. These campaigns encourage the public to become aware of and put pressure on the corporations within their neighbourhoods that are releasing TRI substances. They do so with the use of tools such as Environmental Defense’s ‘Chemical Scorecard’ (www.scorecard.org) and the Unison Institute’s ‘RTKNet’ (www.rtknet.org). These public campaigns are clearly recognised as an important part of the whole project and are openly promoted by the USEPA.

The USEPA has found this particular combination of regulatory and voluntary instruments/tools to be extraordinarily effective in reducing hazardous waste. The ‘33/50 Program’, for example, was a trial programme that actively engaged reporting businesses and worked closely with them to assist them to set targets, and develop and implement programmes to reduce at source 17 priority pollutants. The programme achieved reductions of over 407 millions tonnes (60%) in the 8 year period during which the results were monitored (USEPA, 1999).

3.3 Instruments and Tools in New Zealand

New Zealand uses few legal and economic instruments to encourage the uptake of waste minimisation or other activities related to resource stewardship. The Resource Management Act 1991 (RMA), provides overarching legislation relevant to resource stewardship. Though it requires sustainable management of natural and physical resources (s.5), it is simply not specific enough to encourage waste minimisation. Under the RMA, wastes are only dealt with as ‘end of pipe’ sources of effects, not as resources that need to be conserved and stewarded. Any methods can be used to deal with wastes, as long as environmental effects are avoided, remedied or mitigated. While it could be argued that avoidance of effects may lead to waste minimisation, it is important to emphasise that it is effects, not wastes that are required to be avoided, and that there is still a choice of remedying or mitigating the effects they cause. While this may be seen as a deficiency in the RMA, it is also a matter of how the Act is used rather than, necessarily, any fault in the legislation. Not producing waste will always be more sustainable than having to rely on mitigation of the effects.

The only economic instruments that have so far been used within New Zealand and that are relevant for waste minimisation, are included within by-laws that are specific to particular regions, cities and districts. Practical examples include: stickers that are bought and placed on bags for collecting household solid waste (e.g. North Shore City Council) and pre-paid bags used for the same purpose (e.g. Opotiki); a tax on wastes disposed of in landfills (e.g. Christchurch City Council), and permit costs that control discharges of industrial waste into sewers (e.g. those administered by Watercare Services in parts of the Auckland Region). A carbon tax has been identified as an appropriate option for enabling New Zealand to meet its obligations under the Kyoto Protocol, but this is unlikely to be in place before 2007, and cer-
tainly not before the Protocol comes into force (Reuters, 2002).

**Regulatory instruments**

Prior to 1996, New Zealand’s most specific legislation with regards to waste was Part XXXI (s.538 - 544) of the Local Government Act 1974, which covered local authorities responsibilities with respect to “refuse collection and disposal”. The Local Government Amendment Act 1996 (No. 4) replaced this with a new Part XXXI that required local authorities to “promote effective and efficient waste management” within their districts, particularly with regard to environmental and economic costs and benefits, and public health (s.538). The new Part XXXI also required local authorities to develop (in consultation with members of the public), adopt and implement a waste management plan that includes the collection, as well as reduction, reuse, recycling, recovery, treatment, or disposal of waste (s.539).

The Act defines these terms as follows, and requires that they be incorporated into the plans in the following order of priority (italics added):

*Reduction* means lessening waste generation.

*Reuse* means the further using of products in their existing form for their original purpose or a similar purpose.

*Recycling* means the reprocessing of waste materials to produce new products.

*Recovery* means extraction of materials or energy from waste for further use or processing and includes, but is not limited to, making materials into compost.

*Treatment* means, in relation to waste, subjecting the waste to any physical, biological, or chemical process to change the volume or character of that waste so that it may be disposed of with no or reduced significant adverse effect on the environment.

*Disposal* means final deposit of waste on land set apart for the purpose.

The Local Government Act also provides for local authorities to make by-laws (s.542); provide grants to assist in the reduction, reuse, recycling, recovery, treatment, or disposal of waste (s.543); and allocate costs in a way that will “effectively and appropriately promote the objectives of the plan”, including the ability to establish economic incentives and disincentives (s.544).

The Local Government Act 2002 includes a requirement for a waste management plan that is consistent with the requirements laid out in s.539 of the Local Government Act 1974 (and presumably its latter replacement, the 1996 amendment), and for the plan to be adopted by 30 June 2005 (if such a plan is not already in place) (s.286).

Interestingly, the majority of local government plans tend to focus mostly on solid waste while neglecting other wastes. This may be due to the long-standing focus on ‘refuse’ as per the dictates of the Local Government Act 1974, and the failure to appreciate that this focus is absent from the replacement Part XXXI. The New Zealand Waste Strategy clearly attempts to extend the scope of waste management activities beyond ‘refuse’ to include solid, liquid and gaseous wastes. However, the Strategy does not specifically include ozone depleting or greenhouse gas forming wastes, nor does it include non-point source wastes and waste energy.

The omission of ozone depleting and greenhouse gases, which the Strategy notes are subject to existing programmes, may reflect the different institutional context (provided by the Montreal and Kyoto Protocols, and the regulatory instruments that apply them nationally). However, it is hoped that the programmes that cover these types of substances are integrated with those that arise from the Strategy, so that they complement and reinforce one another. Non-point sources
of pollution are addressed by separate work programmes. Examples are the emissions from cars, which may present difficulties because of their mobile nature, and nutrient run-off from farms. They could easily be integrated under a ‘resource stewardship’ banner.

Waste energy is covered by the Energy Efficiency and Conservation Act 2000 (EEC Act), the purpose of which is to promote energy efficiency, energy conservation, and the use of renewable sources of energy in New Zealand.

It is clear that the enactment of legislation such as the EEC Act provides the opportunity to enhance the extent to which different types of instruments are able to be used by government, both at a central as well as a local level. In this regard, the regulatory requirements at the present time with respect to energy wastage are far more detailed and specific than those for the majority of other wastes.

**Voluntary Instruments**

As far as minimising non-energy wastes is concerned, government programmes in New Zealand have tended to focus more on voluntary, rather than regulatory and economic types of instruments. These have included: demonstration projects such as the multi-sector Target Zero project (Brown, 2000), single sector hospitality, construction and demolition, printing, and health projects, as well as general and specific guides or manuals such as the Cleaner Production Guidelines (MfE, 1994).

The demonstration projects usually aim to show how particular concepts and methods apply to specific activities. They mostly involve assisting participating businesses and/or other organisations to undertake a step-by-step process that includes quantifying wastes, and identifying, assessing and implementing options for improvement. One of the more common processes used for businesses is summarised in Fig. 3.1 and was originally derived from the USEPA's Waste Minimization Opportunity Assessment Manual (USEPA, 1988), which in turn had its origins in the quality management movement.

![Common stages in the waste minimisation processes applied to businesses.](image)

The change process includes making a commitment to the project, planning and organisation, an assessment or audit phase, the identification, evaluation and implementation of options for improvement, monitoring and review. This basic process is echoed in many of the guides and manuals that have been produced since, including MfE’s early Cleaner Production Guidelines (MfE, 1994), and the more recent “Industry Guide to Zero Waste”, published by the New Zealand Business Council for Sustainable Development (NZBCSD, 2002).
While all of the derivatives have been altered in some way to reflect particular nuances, the processes are still basically mechanistic, and do not take into account the socio-political dynamics within organisations, and the environment within which they exist.

Guides and manuals are frequently used in conjunction with, or supplemented by, case studies designed to demonstrate the economic and environmental (and infrequently, social) benefits of the approach in question. Ever since terms such as ‘pollution prevention’, ‘reduction at source’, ‘waste minimisation’, ‘cleaner production’, etc., came into use, case studies have been used to encourage uptake. They are useful because social change usually involves some degree of uncertainty. Case studies can act to reduce uncertainty by showing how a new concept would work, and what are its costs and benefits (Cameron, 2002).

There are now many more waste minimisation or related case studies to draw from than there were when the CAE’s original ‘Our Waste: Our Responsibility’ was published in 1992. The most common amongst these are the types of cases that report on the results of applying a particular concept within an individual organisation, usually a business. Prior to the first CAE book, most of these types of cases were drawn from experiences within businesses in other countries1. The 16 cases presented in ‘Our Waste: Our Responsibility’ were the first New Zealand cases to be documented. They differed from the international examples that had previously been used because they focused on New Zealand-specific sectors and interests. The report has been followed by a number of programmes and publications that include case studies (e.g. MfE, 1994; NZBCSD, 2002).

New Zealand’s most comprehensive, searchable on-line database of business case studies was developed by the Auckland Regional Council and was subsequently moved to the BusinessCare website (www.businesscare.org.nz/material/casestudies). The database contains a wide range of cases that are arranged according to sector and topic. The sectors are categorised according to Australia/NZ Standard Industry Codes (SICs), including: agriculture, forestry and fisheries; automotive trades; building services; communication and media; food and beverages; health services; local government; manufacturing; retail; tourism; accommodation, cafes and restaurants; transport and storage, and personal and other services. The topics include: accounting, reporting and auditing; cleaner production; energy; environmental management systems and tools; global environmental initiatives; packaging; transport, and waste. For each case, a summary, business profile, project type and the reasons for the project are provided, as well as details on the processes used and the benefits. (www.businesscare.org.nz/material/casestudies). Other examples of websites that include case studies are those of Christchurch City Council (www.ccc.govt.nz/sustainablechristchurch/successstories), and the NZBCSD (www.nzbcsd.org.nz/casestudies.asp).

Less commonly reported are the programmes or activities run by local councils or non-governmental organisations that are not limited to individual businesses. The report produced as part of Phase I of CAE’s Resource Stewardship: Waste Minimisation project identified 85 such discrete waste minimisation activities or initiatives2 (Stone, 2002a). Since identification of these initiatives relied on the return of questionnaires, it is likely that there are even more waste minimisation initiatives than those listed in the report. The majority of the initiatives identified involve a number of businesses or other organisations, and/or whole communities, so there are now likely to be hundreds of case studies that could potentially be used to demonstrate waste minimisation in action. A summary of what was learnt from research into the effectiveness of the sample of the waste minimisation initiatives studied for Phase I of the CAE project is presented in Chapter 4, and its relevance is further discussed in Part Three.

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1 UNEP’s Cleaner Production Information Clearinghouse – www.emcentre.com/unepweb; USEPA’s Pollution Prevention Information Clearinghouse - www.epa.gov/opptintr/library/ppicarchive

2 For the purposes of the CAE report, a waste minimisation ‘initiative’ was defined as “an organised programme/activity that puts (or attempts to put) waste minimisation policies into action AND has a specific time schedule and budget” (Stone, 2002a: 9).
The chapters that follow in Part Two include case studies, but they are presented in a way that is designed to provide insight into some of the learning processes that occur during implementation, rather than the detailed methods, costs and benefits that have to date been the focus of case material.

3.4 Non-governmental Organisations as Change Agents

Another noteworthy change that has occurred within the past decade is that, in addition to government agencies, there are now many other organisations involved in promoting waste minimisation or related concepts and approaches. When *Our Waste, Our Responsibility* was being written, there were only a limited number of organisations actively promoting waste minimisation. These included MfE, one or two councils, and some of the broader-based environmental groups such as Greenpeace New Zealand, Friends of the Earth New Zealand, Maruia Society and Royal New Zealand Forest and Bird.

The growth in non-governmental organisations (NGOs) that directly or indirectly promote waste minimisation and related concepts has been phenomenal over the past decade. Some of these were established specifically for the purpose and operate nationally (e.g. The Waste Exchange, New Zealand Recovered Materials Enterprise Trust and Zero Waste New Zealand Trust) while others are more locally focused (Waste Not Auckland Trust and WasteBusters Trust Canterbury). NGOs also include sector-specific industry representative bodies, the majority of which were not specifically established for environmental reasons, but that now include waste prevention and/or minimisation-related activities in the programmes they provide for their members (e.g. Packaging Council of New Zealand and Plastics New Zealand Inc.).

The greatest variety can be found in the non-sector-specific NGOs that were established for broader sustainability and/or environmental reasons, but also include waste-related activities and/or programmes. Some are strongly member-driven and project-focused (e.g. New Zealand Business Council for Sustainable Development and the Sustainable Business Network), while others focus more on training (e.g. BusinessCare National Trust). Some focus on advocating the use of and demonstrating specific concepts and/or approaches (e.g. Anew New Zealand Trust, Redesigning Resources and The Natural Step Environment Foundation Aotearoa New Zealand), while others have adopted a broader advocacy role (e.g. Environmental Defense Society). Some focus on consultancy work (e.g. Waste Not Auckland Charitable Trust), while others are more like ‘grassroots’ organisations and focus on community participation in resource recovery/recycling (e.g. Nelson Environment Centre, Canterbury Environment Centre and Kaitaia’s Community Business and Environment Centre).

Apart from the basic categories identified above, it can sometimes be quite difficult to distinguish between organisations. While they do have distinguishing characteristics, they are not necessarily always obvious from the outside. Because of the plethora of organisations now working in related areas, and the relatively small funding base in New Zealand, there is the potential for competition between some of them. Many of them act as advocates, not only for sustainability, waste prevention and/or minimisation principles, but also for their own particular approach, and have developed resource materials (including case studies) to help them to advance these ‘brands’. Within this context, it can be difficult for potential ‘users’, such as businesses and local authorities, to identify the organisations that will best provide for their needs. To provide assistance in this regard, outline descriptions of the various organisations operating in New Zealand are provided in Appendix 2. These descriptions are based on material provided by representatives from the organisations themselves. They also include representatives’ perceptions of benefits and limitations of each organisation.

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3 The term sustainability is used here in a way that is synonymous with the World Commission on Environment and Development’s definition of sustainable development, i.e., development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987: 43).
The primary areas of focus for each organisation are summarised in Table 3.1, particularly as they relate to waste minimisation and/or resource stewardship. It is important to note that the table does not mean to imply that all of the NGOs focus on resource recovery, resource conservation or resource stewardship, nor that they even use the three terms to describe their activities. The table was derived by considering only those parts of their activities that do relate to waste minimisation or resource stewardship in a direct way. The table was derived using information that is publicly available regarding the programmes, and as such it may be subject to interpretative constraints. It is also important to note that in keeping with the non-hierarchical approach discussed in Chapter 1, the order here is alphabetical and no hierarchy is intended.

The most striking feature of Table 3.1 is that the majority of NGOs listed do not explicitly include resource stewardship as one of the goals of their activities. This could, of course, be because the term itself is not in common usage and because resource stewardship could be considered to be implicit in the concept of sustainable development, as defined by the World Commission on Environment and Development (WCSD, 1987) and from which most sustainability-related...
concepts are drawn. However, it is important to note that while resource stewardship may result from programmes that have sustainability-related imperatives, this will not necessarily be the case. A programme is more likely to deliver resource stewardship if it is explicitly identified as one of the goals of the programme in question, and if the programme is designed to achieve that goal. In addition, recent studies on the effectiveness of waste minimisation programmes (Stone, 2002a, 2002b) appear to confirm that, for resource stewardship to be achieved, it not only needs to be set as a goal and contribute to the design of programmes, but it also needs to be used as a basis for evaluating and improving programmes.

In addition to providing a summary of their activities (see Appendix 2), NGO representatives were also asked to provide insight into the benefits and limitations of their activities. Despite the perception amongst many NGOs that they are unique, there were some striking similarities. Commonly perceived benefits included: provision of resources and advice; networking; ‘on-the-ground’ follow-up for programme participants; presentation of a range of concepts, and independence. Common limitations were the availability of resources and the limitations of the service offered. The latter was more common amongst NGOs that do not have a particular sector whom they represent and who are strongly membership driven. The similarities benefits and limitations between majority of NGOs do seem to suggest that it could be worthwhile to rationalise and integrate NGO activities in this area.

Those who have been working towards resource stewardship or waste minimisation over the past decade will have noticed how NGOs have changed. There is a considerable difference between the NGOs that promoted waste prevention and minimisation when the first CAE report ‘Our Waste: Our Responsibility’ was published and those that are doing so now. The environmental NGOs of a decade ago tended to be issue specific, campaigning organisations that responded to specific environmental problems and took direct-action (e.g. Greenpeace New Zealand). They were membership-based and so did not have the resource constraints that are now identified by some of the NGOs, but they were equally not membership-constrained because their membership was broad and community-based, not sector specific.

Another important distinction is that early NGOs were often ‘pressure’ groups. Since their zenith in the late eighties, early nineties, these organisations have largely dropped from the picture, as least as far as resource stewardship/waste minimisation is concerned, and have been replaced by NGOs that tend to be ‘softer’ towards business. The latter focus on working with, and assisting, businesses to adopt practices that are more sustainable. This is not in itself a problem. Indeed there will, until sustainability is achieved, always be a strong need for this type of work, though the reality is that the NGOs that are currently operating in this field are working with a relatively small number of businesses. At most, their collective membership can be counted in a few hundreds in a country that has over 280,000 enterprises (StatsNZ, 2002). Although progress has been made, this suggests that the substantial reliance on voluntary uptake of sustainability concepts and approaches has not always been very effective in the past decade.

3.5 References


### 3.6 Acknowledgements

Thanks are due to María José Baldoni for assisting in the gathering of summary information on New Zealand NGOs, and also to the NGO representatives, particularly those who so generously provided valuable insights into the benefits and limitations of their organisations.
4.1 Introduction

The previous chapters in Part One serve to introduce another important change that has occurred within the last decade. Many, many people have now been involved in the implementation of activities of relevance to waste minimisation, and their experiences will have influenced their understanding of how implementation works. The knowledge that is gained from experience is a valuable asset, but all too often it remains with one person or within a particular group. Objective evaluations of waste minimisation activities remain few and far between.

This chapter summarises the results of two New Zealand studies that aimed to provide a better understanding of the factors that contribute to the success or failure of waste minimisation and other related initiatives. The first was an assessment of past and present waste minimisation activities initiated in New Zealand by local councils, NGOs or businesses, targeting communities or businesses (Stone, 2002a), and was undertaken by CAE as a preliminary exercise leading to the Resource Stewardship: Waste Minimisation project. The second was an evaluation of the effectiveness of a multi-sectoral demonstration project that primarily targeted businesses (Stone, 2002b). Together, the results of these studies provide valuable insights into the lessons that can be learnt from waste minimisation programmes and used to improve the potential for success.

This chapter also provides an introduction to the sector-specific chapters that follow.

4.2 Assessing Waste Minimisation Activities in New Zealand

The first phase of CAE’s RS:WM Project (Stone, 2002a) attempted to draw out some of this learning by interviewing representatives from a sample of 17 waste minimisation initiatives or activities. While the purpose of the research was to improve the evaluation of waste minimisation initiatives, it included questions designed to provide insight into the factors that contribute to the success and/or failure of such initiatives.

The detailed results of the research are available under separate cover from CAE (www.caenz.com) and will not be repeated here. However, it does seem useful by way of introduction to the chapters that follow, to summarise what the research teaches us about the implementation of resource stewardship and waste minimisation. The research identified three areas of learning that have the potential to improve the effectiveness of these types of programmes and made recommendations on the development of programmes, the necessary support mechanisms, and their contribution to sustainability.

Development of programmes:

- Goals need to be integrated across programmes and regions.
- Success needs to be carefully defined.
- Targets need to be carefully considered and set.
- Monitoring programmes need to be designed in a way that is appropriate for the goals.
- Success needs to be evaluated.
- The results need to be used to improve outcomes.

1 University of Auckland
Provision of support for programmes/initiatives

• Particular efforts need to be made to maintain and enhance commitment, motivation and enthusiasm.
• Champions need to be acknowledged and developed.
• Important relationships (e.g. between NGOs, local authorities and target audiences) need to be developed and enhanced, as does competence.

Making progress towards sustainability

• Costs and benefits need to be evaluated in economic, environmental and social terms.
• That economic viability needs to be de-coupled from success.
• That a life cycle approach is necessary, but does not need to be a dominant feature of all programmes.
• That it is important to ensure that the programme does result in progress ‘up the waste management hierarchy’.

Comments in previous chapters emphasise that it is not necessarily important for all initiatives/programmes to ensure progress ‘up’ the hierarchy. It may be more useful, in the interests of inclusiveness and integration, to recognise that all waste minimisation activities need to contribute to resource stewardship irrespective of their ‘level’ within the waste hierarchy.

The CAE Phase 1 report noted that:

“...ultimately, the most important criterion against which to measure the effectiveness of waste minimisation initiatives is the extent to which they lead their target audiences to accept responsibility for the wastes they generate and, as a result, make changes to what they buy and how they use their resources” (Stone, 2002a).

However, it is also important to note that the report also emphasised that:

“...this is probably the most difficult criterion to measure and it appears from the research to be outside the scope of the majority of the initiatives studied. Certainly none of them appear to have been measured in these terms. The results suggest that it would be a mistake at this point to recommend that all waste minimisation initiatives be measured according to these terms. The results suggest that it would be more useful to recommend that initiatives should focus on (and their success be measured according to) the areas that are compatible with the interests and capabilities of those involved” (Stone, 2002a).

Another important outcome of the research was recognition of the importance of social factors in the change process. The CAE report pointed out that:

“...waste minimisation is essentially about social change, but very little research has been done on the effectiveness of waste minimisation activities in achieving this” (Stone, 2002a).

Another key recommendation was that it is not necessarily possible to transfer waste minimisation programmes/initiatives to other regions or industry types. For real change to occur, programmes must be developed so that they reflect differing needs, areas of interest and sources of motivation. It is interesting to note that this recommendation suggests that broad-based campaigns such as a recent national campaign are highly unlikely to have any real effect on values. This research suggests that money may be better spent on developing capacity and support at a local level, rather than trying to apply a ‘one-size-fits-all’ approach nationally (for more discussion on this, see Stone, 2002c).
4.3 Improving Business Programmes

The findings from the CAE assessment of waste minimisation activities complement the results of earlier research into the effectiveness of sustainability programmes for business. This research was conducted in fulfillment of a PhD thesis in Environmental Science at the University of Auckland (see Stone, 2002b). The research was unique in that it was the first to undertake an in-depth analysis of the dynamics of change within organisations attempting to put ‘cleaner production’ (CP) or ‘pollution prevention’ (PP) into practice. The research was conducted by evaluating the effectiveness of a CP/PP demonstration project. While others have conducted evaluations of these types of projects (e.g. Chandak, 1994; Hillary, 1999), this research was different because organisation theory, specifically as it relates to change and learning, was used as the basis for developing a new model for improving the effectiveness of sustainability programmes for business.

While the prescriptive nature of CP and PP distinguishes them from more generic environmental management systems (EM), the programme components are similar. Fig. 3.1 shows common phases in a generic CP/PP/EM change model. The results of the evaluation could potentially be applied to improve other business initiatives that use similar components.

The research evaluated New Zealand’s Target Zero (TZ) programme, a two-year, multi-company project designed to demonstrate the value and applicability of CP in New Zealand. TZ was considered suitable for evaluation because it used a relatively standard methodology that has been applied in CP and PP demonstration projects around the world for the past decade. It was the largest and most well-resourced project of its kind in New Zealand and was therefore comparable, in terms of scale and support, with similar projects in other countries.

The project involved 23 organisations (mostly businesses) in two regions in New Zealand. It also involved, in supporting roles, the New Zealand Ministry for the Environment (the primary funding agency), the Electricity Corporation of New Zealand (project management), local councils, power retailers, consultants (as facilitators) and students (as assistants).

The evaluation was conducted in three parts. Part I used a ‘traditional’ approach to evaluation research (e.g. Ellis, 1996) that required participants to report, at the end of the project, on its success, benefits and value, as well as ways in which it could have been improved. Part II used a ‘quasi-experimental’ methodology that required participants to provide insight into the existence of various indicators of EM, CP/PP, organisational culture and personal attitudes before, during and after the project. The results from the demonstration group were compared with those from a randomly selected ‘control’ group. Representatives from organisations in this group were surveyed at the same times as those in the demonstration group. Part III used a mixture of ‘objectives-based’, ‘expert-opinion’ and ‘goal-free’ approaches to provide in-depth insight into the dynamics of change within the organisations. The information was provided in the form of monthly progress reports that were written by consultants acting as facilitators for each of the demonstration organisations.

In general, the results of Part I of the evaluation suggested that the project was successful. Participants believed that their organisations had benefited from increased awareness of waste-related issues, as well as the resultant environmental improvements and financial savings. They attributed this success to the external support that had been provided.

Indeed, in superficial terms, the project could be considered to have been successful. Over $
million in savings per annum were identified as a result of reductions in the use and loss of raw materials, water and energy (Brown, 2000). However, the results of Part II provided a very different picture. They suggested that the project was successful in its ability to bring about changes in CP indicators (e.g. the conducting of a CP assessment/audit and the identification of options for preventing or reducing wastes). However, there were no significant changes at systemic, management or cultural levels.

The results of Part III provided insight into a wide range of organisational factors that had contributed to this failure. They were categorised according to the five key areas of organisational theory as summarised by Pugh (1997), i.e. structure, organisational environment, management and decision-making, people and organisational change and learning.

Together the results emphasised the importance of social factors in the implementation of CP/PP projects. They suggested two primary and three secondary areas for improving the effectiveness of these types of programmes. The two primary areas were commitment and continuous improvement. They were identified as primary areas for improvement because of their primacy in the literature and the critical roles they have to play in sustainability programmes. The three secondary areas were: the leadership and support provided by management; communication with and involvement of staff, and compatibility and design of the project. They were identified as secondary areas because, while important, they are still subservient to commitment and continuous improvement.

The model was developed from this work using the following steps:

• The way in which each primary and secondary area for improvement is covered (or not) in standardised approaches to CP/PP/EM, was studied;
• This coverage was compared with the way in which these areas are covered in organisation theory in general, and organisation change models, in particular; and
• Elements of standardised approaches to CP/PP/EM, as well as organisation change models, that were thought to have the potential to improve sustainability programmes for business, were identified and combined.

The model is presented in Fig. 1.4. It has been designed to improve the ability of sustainability programmes to deliver commitment and continuous improvement, as well as leadership, support, communication and involvement, in a way that is compatible with the culture and needs of individual organisations. It draws on relevant elements of a range of change management approaches and models, specifically: Lewin’s (1952) ‘force field’ model; Lippett et al.’s ‘planning model’ (see Kolb and Frohman, 1970); Schein’s (1969) ‘group problem solving’ model and his approach to ‘organisation culture’ (1992); the ‘action research’ approach (see Eden and Huxham, 1996); Worley et al.’s (1996) ‘strategic change’ model; Argyris and Schön’s (1974) ‘reflective learning’ model, and Whiteley’s (1995) ‘core values’ approach.

The model is characterised by:

• a diagnostic phase (to enable the programme to be customised so that it responds to the needs and culture of the organisation in question);
• visioning (to engage and involve all staff);
• iterative use of the vision (to motivate, inspire and drive continuous improvement);
• participatory design of the programme (to enhance commitment); and
• inclusion of senior managers at key stages in the process (to maximise involvement, leadership, commitment, progress and support).

The model also includes six distinctive types of activities that are designed to be carried out by staff with different roles, responsibilities and abilities. These are:
Learning from Experience

• development of a vision for the organisation that includes sustainability;
• assessment of status in relation to that vision;
• short, focused audits using CP/PP tools;
• actions based on the results of the audits;
• evaluation of the effectiveness of the actions in relation to the vision; and
• communication of the results.

Allocation of responsibilities is designed to maximise the potential for bringing about iterative and critically reflective processes within the organisation.

An important feature of the model is that the sequence of components after the diagnostic phase (see Figure 4.1) is not meant to be fixed. The sequence needs to be based on strategic imperatives for bringing about change and learning in each particular business.

The barriers that businesses face in pursuit of sustainability are considerable (e.g., see Chandak, 1994; Hillary, 1999). It would be naive to think that the model outlined above could work in isolation to overcome these barriers. It is important to emphasise that these results are not only of relevance to programmes that are based on the CP/PP or EM model. They are potentially of relevance to all change programmes that follow a similar audit-based approach or that attempt to put into place standardised methodologies.

The research that led to its development, and the model itself, do provide an example of a critically reflective approach to a particular part of the sustainability puzzle. In concurrence with that approach, it will now need to be developed and tested, so that practitioners can reflect on its validity and the learning process can continue. Chapter 14 provides more insight into this critically reflective approach.

4.4 The CAE Resource Stewardship: Waste Minimisation Project

So far, Part One has provided an overview of:

• what resource stewardship is and how it relates to other concepts;
• the political context within which waste minimisation and, hence, resource stewardship
• the regulatory, economic and voluntary instruments and tools that are available for promoting such practices;
• the activities of NGOs; and
• the lessons that can be learned from experience, particularly through formal programme evaluation.

The seven chapters that follow in Part Two are based on the results of work carried out as part of the CAE RS:WM project by industry task groups. The scope of this work, as outlined below, is intended to provide an insight into the current status of waste minimisation and resource stewardship within seven industry sectors: dairy (Chapter 5), meat (Chapter 6), forestry (Chapter 7), built environment (Chapter 8), tourism (Chapter 9), retail (Chapter 10) and plastics (Chapter 11).

The chapters were written by sector group representatives with input from each particular sector, according to a common format. Their purpose is to provide a snapshot of achievements to date in the sector, and to use them, together with key issues that have been raised in the introduction, to make recommendations for improving the contribution of waste minimisation activities to resource stewardship. Each sector group report was required to include the following sections:

The **Introduction to the sector** includes a profile of the sector within New Zealand, including: international and national significance; size (e.g., no. of activity units, jobs provided); contributions to economy (% of GDP, exports vs. domestic); geographic distribution, and any other important characteristics that help to define the sector (e.g., as a flagship for New Zealand).

The section on **Resource use and waste minimisation within the sector** includes a description of specific types of activities undertaken within the sector and their distinguishing characteristics; the main types of resources (inputs\(^3\)) that are used by the different activities within the sector; and, the types of products and wastes that are generated (outputs\(^4\)). For the dairy, meat and forestry sectors the sequence of activities has been summarised in the format shown in Fig. 4.2.

\(^3\) Inputs include materials, water and energy.

\(^4\) Outputs include products or services, wastewater, solid wastes, gaseous emissions and energy losses.

\[\text{ACTIVITY A1} \quad \text{main inputs} \quad \text{main outputs} \]

\[\text{ACTIVITY A2} \quad \text{main inputs} \quad \text{main outputs} \]

\[\text{ACTIVITY A3} \quad \text{main inputs} \quad \text{main outputs} \]

\[\text{ACTIVITY A4} \quad \text{main inputs} \quad \text{main outputs} \]

\[\text{etc} \]

**Figure 4.2: Sequence of activities for the dairy, meat and forestry sectors.**

This format was used because an input/process/output approach is commonly used in waste minimisation programmes to provide insight into the types and quantities of resources that are being used and wastes that are being generated, as well as priority areas for improvement. The remaining sectors, because they include a wide range of more service-oriented activities, have
adapted this format in ways that provide similar insights, but that are unique to the sectors themselves. In addition, this section includes (wherever possible) estimates of total quantities of inputs and outputs for each of the activities in the sector. The processes and/or services are described, as well as any reduction, re-use, recycling and recovery that may occur before resources are finally discarded as wastes. Case studies are included to provide insight into the learning process that is occurring within each sector.

The next section on Resource stewardship within the sector, provides insight into the extent to which resource stewardship is (or isn’t) occurring within the sector. It also identifies any obstacles to, and opportunities for, enhancing the contribution that waste minimisation makes to resource stewardship within the sector.

The section on Governance of the sector identifies and briefly describes any relevant standards, guidelines and codes of practice that apply to the sector. It also includes an indication of the extent to which: 1) they are used, and 2) they contribute to resource use and stewardship within the sector.

The section on Drivers for change within the sector includes current influences on the sector (i.e. what currently drives and constrains it). This includes social, economic and environmental influences at local, regional, national and international levels (where relevant), as well as the key relationships within the sector and how sector or producer/provider responsibility is exercised. This section provides insight into how these drivers affect resource use and stewardship within the sector. It describes how existing and potential drivers could be harnessed to improve resource use and stewardship, and identifies any other drivers that have the potential to bring about change in the future.

Finally, Conclusions and recommendations draws key conclusions from the way resource stewardship and waste minimisation occur within the sector, and attempts to answer two questions: 1) What can be learned from current practices? and 2) How can the sector move towards resource stewardship and reducing the generation of wastes? It includes a set of recommendations on how the sector’s contribution to resource stewardship in New Zealand could be improved.

The CAE project and this publication have provided a unique opportunity to critically reflect on achievements to date and to learn from past experience. Part Three considers the information presented in the industry sector chapters within the context of waste generation in New Zealand, and includes recommendations on what needs to occur for New Zealand to make real progress towards resource stewardship. These recommendations are not presented as a set of prescriptive tools, but rather in response to the results of the project. Together, the chapters aim to enhance readers’ knowledge of resource stewardship and the role of waste minimisation. They aim to provide decision-makers and practitioners with insights that will help them to change their thinking from waste minimisation to resource stewardship.

The CAE project has involved a generous amount of voluntary effort on the part of many in the project team and CAE gratefully acknowledges and appreciates the effort that has been made. There have, of course, also been significant costs involved and the project would not have been possible without substantial assistance from the Sustainable Management Fund as well as financial contributions from many territorial and regional councils. The councils that contributed to the project are listed in the Acknowledgements at the front of this book.

4.5 References

Brown, G. 2000. “You too can profit from cleaner production and waste minimisation”, Brochure
reporting the results of the Target Zero project, produced by Ecosense Ltd., with funding from the New Zealand Ministry for the Environment, Wellington.


Part 2:

Industry Sector Reports
5.1 Introduction

Dairy farming started in New Zealand with the arrival of the first European settlers in the early 1800s (MAF, 2002a). In 1871 the first cooperative dairy company was formed and the first refrigerated shipment of butter to Britain was made in the 1880s (Anon, 2000; MAF, 2002a). In 1861 there were 193,000 dairy cattle in New Zealand and this grew to 3.1 million by 1921 and over 4.3 million today (Anon, 2000).

The New Zealand dairy industry, described in this chapter, covers both the farming and manufacturing sectors. New Zealand dairy farmers produce about 10,500 million litres of milk on over 15,900 farms (MAF, 2002b; Fonterra Cooperative Group, 2002). The numbers of dairy farms and dairy cows, by region, are shown in Table 5.1.

<table>
<thead>
<tr>
<th>Region</th>
<th>Total dairy farms</th>
<th>Total dairy cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northland</td>
<td>1,530</td>
<td>386,640</td>
</tr>
<tr>
<td>Auckland</td>
<td>762</td>
<td>131,967</td>
</tr>
<tr>
<td>Waikato</td>
<td>5,943</td>
<td>1,503,208</td>
</tr>
<tr>
<td>Bay of Plenty</td>
<td>1,023</td>
<td>346,255</td>
</tr>
<tr>
<td>Gisborne</td>
<td>30</td>
<td>5,765</td>
</tr>
<tr>
<td>Hawkes Bay</td>
<td>105</td>
<td>44,852</td>
</tr>
<tr>
<td>Taranaki</td>
<td>2,679</td>
<td>608,315</td>
</tr>
<tr>
<td>Manawatu-Wanganui</td>
<td>1,092</td>
<td>329,325</td>
</tr>
<tr>
<td>Wellington</td>
<td>351</td>
<td>97,284</td>
</tr>
<tr>
<td>TOTAL: North Island</td>
<td>13,515</td>
<td>3,453,611</td>
</tr>
<tr>
<td>Tasman/Nelson</td>
<td>240</td>
<td>74,216</td>
</tr>
<tr>
<td>Marlborough</td>
<td>87</td>
<td>33,018</td>
</tr>
<tr>
<td>West Coast</td>
<td>435</td>
<td>120,992</td>
</tr>
<tr>
<td>Canterbury</td>
<td>747</td>
<td>275,305</td>
</tr>
<tr>
<td>Otago</td>
<td>363</td>
<td>124,690</td>
</tr>
<tr>
<td>Southland</td>
<td>564</td>
<td>232,966</td>
</tr>
<tr>
<td>TOTAL: South Island</td>
<td>2,436</td>
<td>861,187</td>
</tr>
<tr>
<td>TOTAL: NEW ZEALAND</td>
<td>15,951</td>
<td>4,314,798</td>
</tr>
</tbody>
</table>

Table 5.1: Total dairy cattle by region as at June, 1999 (MAF, 2002b)

Over 75% of the dairy cows are located in North Island although production in the South Island has increased by 72% since 1994 (New Zealand Dairy Board, 2000), mainly in Canterbury and Southland. The main dairying regions are the Waikato, Taranaki, Northland, Bay of Plenty and the Manawatu in the North Island and Canterbury and Southland in the South Island (Table 5.1). A total of 1.9 million hectares is used for dairy farming representing 7.2% of the total land area of New Zealand (Anon, 2000).

About 350 million litres of liquid milk are consumed on the local market (Anon, 2000). The remainder of the milk is converted into a variety of milk products, the main ones being milk powders, cheese, casein, butter, anhydrous milk powder, and whey protein products. Manufac-
turing operations take place in seven butter, 11 powder and 10 cheese/casein processing plants located throughout the country. The total number of employees in the manufacturing and marketing part of the industry is approximately 21,000 and there are 29,710 full-time and 9090 part-time employees (including owners) on dairy farms (Anon, 2000).

Although New Zealand’s 2% of the world milk production is small, the country exports over 90% of its dairy output. Globally, only around 7% of total milk production is traded internationally, with 93% being consumed domestically within the country of origin (Anon, 2000; New Zealand Dairy Board, 2000).

The domestically traded milk and milk products sectors in other countries are generally not available to the New Zealand dairy industry unless high tariffs are paid. To maintain and increase this market share the industry must continue to assure the quality of product and production processes. This means high milk quality, animal health, animal welfare and environmental performance.

The value of the export dairy industry to the New Zealand economy is shown in Table 5.2. This represents about 23% of New Zealand’s export revenue.

Significant growth has occurred in the dairy industry with the value of the total dairy exports increasing by 35% between 1995 and 2000. Most of this growth has occurred in protein containing products rather than fat containing products (Table 5.2).

New Zealand exports dairy products to 140 different countries with the main areas being North America, Asia, Central America, Australia and the European community (Fonterra Cooperative Group, 2002).

5.2 Resource Use and Waste Minimisation within the Sector

A variety of products are manufactured at New Zealand dairy processing plants. The sequence of activities will vary from site to site and will also vary in response to the demand for different products.

In the farming sector the main inputs are sunlight, water, fertiliser and energy and the main output is milk. In the processing sector inputs are milk, or milk by-products (e.g. whey), water, energy, chemicals for both product manufacture and cleaning the plant, and packaging.

The main outputs are the various dairy products along with emissions to the environment.

These are shown schematically in the sections that follow, together with an explanation of the processes and the waste minimisation activities that are carried out.

The farming sector

Resource use within the farming sector can be summarised by the following diagram.

On the farms raw materials and natural resources are converted into animal protein and milk. The combination of sunlight, water and fertilisers results in pasture growth, which is harvested (consumed) by grazing dairy cows. The milk is harvested, usually twice daily, and transported to the dairy processing plants for further processing.
Wastes are produced as a by-product of animal metabolism. These waste materials are recycled back to the land as dung and urine where the nutrients are reused by the pasture. Because urine and dung is not distributed evenly to the pasture localised concentrations of these materials occur resulting in some loss of nutrients to either the atmosphere or to the groundwater (McLaren and Cameron, 1990).

Minimising the effects on the environment of these natural emissions has become a focus of the dairy industry.

Energy usage by the farming sector is generally confined to the use of farm equipment (e.g. farm vehicles) and in the farm dairy.

New Zealand is internationally recognised for its very high environmental standards and values and this fact plays a key part in the industry’s marketing strategy.

Environmental and Animal Welfare Guidelines have been established for dairy farmers to protect access to export markets and to address national issues of importance to the dairy industry and the wider public.

The question facing the industry was “How do farmers deal with the guidelines in a simple, easy manner without spending excessive amounts of time on paperwork?”. The result was the ‘Market Focused’ programme, outlined in Case Study 5.1.

### The manufacturing sector

Milk, which is produced on the farm, is transported to the processing plants for manufacture into various dairy products. Typically produced are butter, anhydrous milk fat (AMF), milk powders (skim and whole milk), cheese and casein products.

At sites where cheese and casein are manufactured the whey produced may be further processed. At any processing site only some of these products will be manufactured. For example a plant may manufacture butter and skim milk powder, or cheese. At some sites a component of the milk (e.g. cream) may be transported to another site for further processing.

Total inputs and outputs for the dairy processing sector are shown in Table 5.3. A total of 11,500 million litres of milk is converted into 1,713,000 tonnes of dairy product. The main resource inputs are energy (mainly for drying of product) and water (for cleaning operations) and these operations produce 13,800 million litres of wastewater annually.

Resource use, processes and waste minimisation in butter, anhydrous milkfat, milk powder, cheese, casein and caseinate production, and whey processing, are summarised in the sections below.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Skimmilk powder</td>
<td>425.7</td>
<td>545.8</td>
<td>486.2</td>
<td>481.7</td>
<td>509.5</td>
</tr>
<tr>
<td>Wholemilk powder</td>
<td>942.6</td>
<td>1,051.5</td>
<td>1,126.2</td>
<td>1,199.9</td>
<td>1,269.9</td>
</tr>
<tr>
<td>Cheese</td>
<td>617.4</td>
<td>838.5</td>
<td>892.5</td>
<td>983.4</td>
<td>987.4</td>
</tr>
<tr>
<td>Casein</td>
<td>557.1</td>
<td>569.4</td>
<td>651.7</td>
<td>763.0</td>
<td>802.6</td>
</tr>
<tr>
<td>Butter</td>
<td>703.7</td>
<td>752.4</td>
<td>787.3</td>
<td>677.0</td>
<td>736.5</td>
</tr>
<tr>
<td>AMF</td>
<td>155.6</td>
<td>163.1</td>
<td>233.1</td>
<td>303.9</td>
<td>259.8</td>
</tr>
<tr>
<td>Other</td>
<td>390.1</td>
<td>404.9</td>
<td>441.3</td>
<td>528.3</td>
<td>536.9</td>
</tr>
<tr>
<td>TOTAL</td>
<td>3,792.2</td>
<td>4,325.6</td>
<td>4,618.3</td>
<td>4,937.2</td>
<td>5,102.6</td>
</tr>
</tbody>
</table>

*Table 5.2: Total value of New Zealand dairy exports in June for the previous year (NZ$Million)*  
*(Anon, 2000)*
Case Study 5.1: Development of Market Focused - an on-farm environmental management system for farmers

An industry group composed of the Fonterra Research Centre (FRC), Dexcel, New Zealand Dairy Group, Kiwi Co-operative Dairies worked to produce an environmental and animal welfare management package to help farmers meet these new requirements as part of an integrated approach to on-farm quality assurance (QA).

Initially, a nationwide survey of New Zealand dairy farmers was conducted to assess current farmer practices and dairy farm compliance with the list of legal requirements currently in force. The results formed a baseline assessment of the dairy industry.

Information from dairy farmers already involved in QA, the on-farm survey results and existing QA providers were used to shape the system that the group has produced. The outcome has been Market Focused, an on-farm quality management system for dairy farmers.

The system was trialed in Waikato and Otago by 70 dairy farmers. It has two modules:

- Module one provides farmers with the tools needed to meet the new industry and dairy company requirements on environment and animal welfare issues.
- Module two allows the farmer to carry out a more critical and comprehensive approach to their own farm environment issues.

Market Focused leads the dairy farmer through six environmental and four animal welfare templates, with examples from other dairy farmers and industry’s best management practices printed on the back of each template. Spare sheets are available for farmers to manage other on-farm issues they have identified. A helpful ‘information source’ data sheet shows them where to find the latest information about on-farm management in more detail.

Results of the trials were very encouraging. Market Focused has been adopted as the environmental management system for the industry and it will be implemented on all dairy farms over a five-year period.

<table>
<thead>
<tr>
<th>Inputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk</td>
<td>11,500 million litres</td>
</tr>
<tr>
<td>Energy</td>
<td>18,400,000 GJ</td>
</tr>
<tr>
<td>Water</td>
<td>14,000 million litres</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk powders</td>
<td>821,000 tonnes</td>
</tr>
<tr>
<td>Cheese</td>
<td>290,000 tonnes</td>
</tr>
<tr>
<td>Casein/Caseinates</td>
<td>92,000 tonnes</td>
</tr>
<tr>
<td>Butter/AMF</td>
<td>395,000 tonnes</td>
</tr>
<tr>
<td>Lactose</td>
<td>620 tonnes</td>
</tr>
<tr>
<td>Whey Products</td>
<td>19,800 tonnes</td>
</tr>
<tr>
<td>Liquid milk</td>
<td>350 million litres</td>
</tr>
<tr>
<td>Other products</td>
<td>89,000 tonnes</td>
</tr>
<tr>
<td>Wastewater</td>
<td>13,800 million litres</td>
</tr>
</tbody>
</table>

Table 5.3: Inputs and outputs from the dairy sector  
(Fonterra Research Centre, unpublished data)
Butter production

Resource use for milkfat production can be summarised by the following diagram.

Butter manufacturing involves a number of stages. The whole milk is separated, and the cream is vacuum treated by heating, followed by flash cooling to remove entrapped gases and volatile substances. Vacreators and spinning cone columns are used for this purpose.

The cream passes to the crystallisation silo, where it is subjected to a temperature programme that creates the necessary crystalline structure for butter production. The cream is then pumped to a continuous buttermaking machine where it is churned causing the fat to coalesce into butter grains. Buttermilk, which contains the remaining fat from the process, is drained from the process, after which the butter is reworked to produce a continuous fat phase containing finely dispersed water. For salted butter, salt is usually added as a slurry during the working of the butter. Finally, the product is packed.

Buttermilk is a by-product of the buttermaking process and is recovered for further processing. High losses of fat to this stream constitute a waste of milkfat that would otherwise have been useable for manufacturing butter.

Vacreators or spinning cone columns generate condensates and tailwaters. Under normal operating conditions, these streams contain relatively low amounts of BOD/COD. However, if there are leaks in the process or if overloading causes a carry over, the levels of BOD/COD can rise, creating higher loads for wastewater treatment systems.

Losses to the wastewater arise from flushing product from the plant at the end of the production run and cleaning of the processing equipment. Hosing and washdown of equipment and floors generate additional wastewater from the plant.

Fat recovery systems utilise gravity separation or centrifugal separation. During gravity separation, water is periodically drained from the fat recovery silo before the milkfat is reintroduced to the cream treatment system. If the water being drained is not monitored and shut off appropriately, fat losses can be high.

Losses occur from the flushing of product and water from pipelines and equipment during start-up and shut-down. Correct operation of separator desludges, including the desludge frequency and the time the bowl remains open, is important for reducing desludge losses.

Typical losses for butter manufacture, based on representative New Zealand plants, are less than 0.12% of the incoming raw material and are shown in Table 5.4.

<table>
<thead>
<tr>
<th>Source of waste (butter)</th>
<th>% Milkfat loss from plant feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensate</td>
<td>0.005</td>
</tr>
<tr>
<td>Desludges</td>
<td>0.003</td>
</tr>
<tr>
<td>Wastewater</td>
<td>0.110</td>
</tr>
</tbody>
</table>

Table 5.4: Milkfat loss to butter waste streams from the feed to the plant
(Fonterra Research Centre, unpublished data)
Anhydrous milkfat (AMF) production

Resource use for anhydrous milk fat production is as shown for butter manufacture (see previous section).

AMF is produced in a series of separators, which concentrate the milkfat. Cream from a whole milk separator is used as the raw material. The cream is pasteurised and then passed to the cream concentrator (centrifugal separator) for initial concentration to about 75% milkfat. This is usually carried out at 60°C. Further separation in an oil concentrator increases the concentration of milkfat to about 99.5%. The buttermilk is re-routed to a buttermilk separator for recovery and recycling of fat.

In some instances, the milkfat is neutralised with sodium hydroxide to reduce the level of free fatty acids (FFAs) present in the oil. The saponified FFAs are removed with the water phase by passing through a polisher to remove added and residual water. The last step before packaging the product is a deodorization step, in which a vacuum is applied to remove undesirable volatiles and odours.

Three by-product or waste streams are removed from the process: skimmed buttermilk, polisher tailwater and tailwater from the deodoriser. All three streams usually contain very little fat, but systems need to be monitored and operated effectively.

All cleaning processes produce wastewater that contains milkfat. Leaks in unions, valves and pump seals and overflowing balance tanks may create waste.

Fat recovery systems can be employed to deal with product recovered from plant shut-downs and start-ups. So long as there is no contamination the fat can be reprocessed through the plant. There is a potential for losses to occur during draining of fat recovery systems.

Typical losses for AMF processing, based on representative New Zealand plants, are given in Table 5.5. Total losses of incoming material are less than 0.3%.

<table>
<thead>
<tr>
<th>Source of waste (AMF)</th>
<th>% Milkfat loss from plant feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polisher Water – Neutralised</td>
<td>0.15</td>
</tr>
<tr>
<td>Polisher Water – Un-neutralised</td>
<td>0.03</td>
</tr>
<tr>
<td>Separator Desludge</td>
<td>0.02</td>
</tr>
<tr>
<td>Wastewater</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Table 5.5: Milkfat loss to AMF waste streams from the feed to the plant (Fonterra Research Centre, unpublished data)

Milk powder manufacture

Resource use for milk powder production can be summarised as follows:

The first stage of milk powder production is concentration of the milk using evaporation. Milk is introduced at the top of the evaporator and flows as a thin film down the outside surface of
heated tubes or plates in the evaporator. The surfaces within the evaporator are heated by steam.

In most dairy plants, multiple-effect evaporation, in which a number of evaporators are operated in series, is used. The vapour generated from the milk evaporated in the first evaporator is used as the steam input in the next evaporator, and so on. Up to seven effects can be operated in series, but three to five are more common. Operating evaporators in this way provides for greater steam efficiency and therefore reduced energy consumption.

In order to attain further steam efficiency, the vapour exiting each evaporator can be recompressed to increase its energy before it is used as the heating medium in the next evaporator. Traditionally, thermal recompression, also referred to as thermal vapour recompression (TVR), has been the most common recompression system in use. It involves the mixing of high pressure steam with the vapour to compress the mixture to a higher pressure. A single evaporator with a thermocompressor is as efficient as a two-effect unit without a thermocompressor. Therefore thermal recompression is often used with multiple-effect evaporation systems.

Another form of vapour recompression is mechanical vapour recompression (MVR). The pressure increase of the vapour is accomplished by the mechanical energy that drives the compressor.

The advantage of the MVR evaporator is that all the vapour is recompressed, rather than just a portion of it, as is the case with TVR evaporators. This makes for a high degree of heat recovery. In addition, MVR systems are driven by electricity rather than steam, which means that operating costs are considerably lower. The operating costs of a three-effect MVR evaporator are approximately half those of a conventional seven-effect TVR plant.

A disadvantage of MVR systems is that it is not possible to attain high temperatures and thus a steam-heated ‘finisher’ is required.

Another option that has become available for pre-concentrating the liquid to be dried is reverse osmosis (RO). RO can remove some of the water from the milk mechanically without the application of heat. Electrical power is used to drive pumps, which causes liquid migration through a semi-permeable membrane.

Once the milk has been concentrated from 11% total solids up to 50%-60% total solids in an evaporator, it is dried in a spray drier or a roller drier to up to 95% total solids.

All drier systems discharge process air to the atmosphere. This air will contain small amounts of milk powder. Emission reducing equipment on drier systems include bag filters and wet scrubbers. Losses occur from raw material and product left in processing equipment at shutdown, and out of specification material produced during start-up. Emission reduction from milk powder plants is described further in Case Study 5.2.

Case study 5.3 describes how water use was minimised and reused at a manufacturing plant.

**Cheese manufacture**

Resource use for cheese, casein and caseinate production can be summarised as follows:
During the manufacture of cheese, whole milk is passed through a separator that removes part of the cream component. The milk is then pasteurised, and a bacterial culture and rennet is added. The enzyme activity of the rennet and bacterial action creates conditions that allow the milk to coagulate into curds and whey.

The curd is separated from the whey and, where necessary, salt is added to the curd. Whey resulting from the salt addition processes is known as salt whey.

The cheese blocks are packed to allow ripening to occur.

**Case Study 5.2: Reducing air emissions**

Milk powder driers that were fitted with cyclone powder collectors lost up to 1% of the skim milk powder to the atmosphere. The milk powder was subsequently deposited on the surrounding neighbourhood. The introduction of baghouses to recover particulates (fines) from the milk powder manufacturing process has been an industry initiative to address this problem and at the same time recover useful product. Following the introduction of baghouses, emissions of powder fines from the drier stacks have been completely eliminated. The powder fines are collected and sold for animal feed (calf milk replacement).

A recent innovation to the industry has been clean-in-place baghouses. These have now been installed at two new drier plants. The new baghouses can be cleaned regularly, allowing the fines collected to be reintegrated with the main product powder.

During the manufacture of cheese, whole milk is passed through a separator that removes part of the cream component. The milk is then pasteurised, and a bacterial culture and rennet is added. The enzyme activity of the rennet and bacterial action creates conditions that allow the milk to coagulate into curds and whey.

The curd is separated from the whey and, where necessary, salt is added to the curd. Whey resulting from the salt addition processes is known as salt whey.

The cheese blocks are packed to allow ripening to occur.

**Case Study 5.3: Reducing and reusing water**

The number of dairy manufacturing sites in New Zealand has been decreasing, while at the same time the quantity of milk processed on the remaining sites has been increasing. As a result larger amounts of processing and cleaning water are required. A flow-on consequence of high water use during the manufacturing process is high wastewater production.

Therefore, the large sites also produce large volumes of wastewater that require more land for irrigation treatment, or larger treatment plants if adverse effects on receiving waters are to be avoided. Hence the industry has focused on minimising the volume of water used in the manufacturing process and reusing water where possible.

Systems to recover and reuse the water used to rinse the manufacturing plants after chemical cleaning have been installed at many sites and cooling water is now routinely reused in a closed circuit with cooling towers used to remove excess heat from the water.

Milk consists of approximately 80% water, much of which is removed during the manufacture of milk powders and whey products. The Whareroa processing site has installed a plant to recover and treat milk condensate from the site’s powder plants. The treated condensate is used primarily as a demineralised water source for the cleaning of membrane plants. Reverse osmosis polishing plants have been installed at the Stirling and the Lichfield cheese and whey protein concentrate factories to treat permeate from the whey product plants to a standard suitable for cleaning the membrane plants. In all of these cases the recovered water is replacing water that would otherwise be drawn from a local water source and would then require treatment in a demineralisation plant to remove the minerals present in the water.

As a result of these measures water use within the industry has reduced from 2.8 m³ of water per m³ of milk processed in the 1970s to about 1.2 m³/m³ milk at present. With water treatment costs of $0.18/m³ and wastewater treatment costs of $0.37/m³, savings of $10 million per year at current production levels across the industry have been realised.
Whey is normally considered to be a by-product of the cheesemaking process, but losses of milkfat and cheese fines in the whey are losses of product that could be used for cheesemaking. To avoid transfer to the wastewater system, the fines in the whey are screened and dealt with as solid waste. The salt whey is normally kept separate from other whey sources to allow different treatment to occur.

Wastewater from flushing product from the equipment at the end of the processing run and from the clean-in-place (CIP) of equipment is a major source of losses from the process. Losses in the wastewater consist of milk, whey and cheese fines. The wastewater also includes contributions from leaking equipment (including equipment drain valves), spillages during normal operation and plant stoppages.

Curd losses can also be significant. They are usually swept up, collected as solid waste and made use of as stock food.

Typical losses for cheddar and brine-salted cheese, based on representative New Zealand plants, are given in Tables 5.6 and 5.7.

<table>
<thead>
<tr>
<th>Source of waste (Cheddar)</th>
<th>% Milkfat loss from plant feed</th>
<th>% Casein loss from plant feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet Whey</td>
<td>5.80</td>
<td>3.17</td>
</tr>
<tr>
<td>Salt Whey</td>
<td>1.27</td>
<td>0.18</td>
</tr>
<tr>
<td>Stock Food</td>
<td>0.11</td>
<td>0.12</td>
</tr>
<tr>
<td>Wastewater (including CIP)</td>
<td>0.50</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Table 5.6: Milkfat and casein losses to cheddar cheese waste streams from the feed to the plant (Fonterra research centre, unpublished data).

<table>
<thead>
<tr>
<th>Source of waste (brine salt cheese)</th>
<th>% Milkfat loss from plant feed</th>
<th>Protein loss from plant feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet Whey</td>
<td>7.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Stock Food</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Wastewater (including CIP)</td>
<td>0.50</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Table 5.7: Milkfat and casein losses to brine-salted cheese waste streams from the feed to the plant (Fonterra Research Centre, unpublished data)

The main loss of material that occurs in a cheese manufacturing plant is in the whey (equivalent to about 7% of the incoming raw material). The milkfat in whey is recovered and made into other products. Whey also contains mainly lactose and whey proteins that are not part of the final cheese product. At some larger sites it is possible to further process the whey into lactose and/or whey protein concentrate. These processes are described in the next section.

As with cheddar cheese manufacture the main loss of material that occurs in the whey (equivalent to about 7% of the incoming raw material).

Casein and caseinate manufacture

Resource use for casein and caseinate manufacture is as shown for cheese production (see previous section).

Casein is a major component of the proteins in milk. There are two main types of casein manufactured: rennet casein and acid casein.

In acid casein production, skim milk is pasteurised and then acidified, by either lactic-acid-
producing bacteria or a mineral acid, to the isoelectric point of casein (pH 4.6-4.7). This is the point where the hydrogen ion concentration neutralises the negatively charged casein micelles, resulting in coagulation of the casein complex. After setting of the coagulum in the silo, it is pumped to a low velocity cooker.

Rennet casein production also begins with pasteurised skim milk. Rennet, which contains the enzyme chymosin, is added to the skim milk. Either a hot set procedure or cold setting is used. In the hot set process, the milk is heated for a short period and then cooled to 30˚C. The rennet is added at this point. A gel forms after 30-45 minutes, at which point the gel is pumped from the silo to a low velocity cooker. In the cold set process, the rennet is added to the milk at 14˚C - 15˚C and left for three to three and a half hours to set. In this process, the milk does not coagulate until it is cooked.

The casein material is passed over a de-wheying screen and then decanted to remove as much water from the curd as possible before washing begins. The casein passes through a minimum of two washing stages. At each stage, the casein is washed counter-currently and then dewatered over a screen. The water is recycled between washes, with fresh water being used at the last stage only. The casein is passed through another decanter before being dried. The dry casein is milled and bagged.

Caseinates are compounds that contain light metals bonded to casein and are produced through a reaction of dilute alkali with wet acid casein curd or dry acid casein. Whey is a by-product from the process, but high losses of fines in the whey stream are a loss to the process.

Casein fines will remain in the wash water exiting the first wash. It is usual to use a decanter to recover the fines and return them to the process. CIP (from ‘clean in place’) water, containing curd, overflows from screens and balance tanks and leaking equipment are all sources of losses to the wastewater and must be treated as a loss to the process of making casein.

The use of fluid bed driers in modern plants has increased because of the advantages of low temperature and quick and uniform drying that these systems can provide. Dry-cleaning of driers, mills, screens and filters is more desirable than wet washing as it reduces the liquid waste streams that need to be treated by wastewater systems.

Avoiding overflows from dewatering screens and repairing any leakages will reduce losses from the plant. Using decanters for dewheying the curd reduces the volume of washwater required in the process. The recovery of casein fines can be improved by using clarifiers instead of decanters. Clarifiers are often used when the whey is used for producing whey protein concentrate (WPC) or other whey products.

Typical losses for rennet and acid casein manufacture, based on representative New Zealand plants, are given in Table 5.8.

<table>
<thead>
<tr>
<th>Source of waste (casein)</th>
<th>% Casein loss from plant feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proteolysis (Lactic Acid Casein)</td>
<td>2.5 - 3.8</td>
</tr>
<tr>
<td>Proteolysis (Rennet Casein)</td>
<td>5.3</td>
</tr>
<tr>
<td>Whey</td>
<td>0.4 - 1.0</td>
</tr>
<tr>
<td>Washwater</td>
<td>0.15 - 0.35</td>
</tr>
<tr>
<td>Stock Food</td>
<td>0.2 - 0.3</td>
</tr>
<tr>
<td>Wastewater</td>
<td>0.1 - 0.2</td>
</tr>
</tbody>
</table>

*Table 5.8: Casein losses to casein waste streams from the feed to the plant (Fonterra Research Centre, unpublished data)*
Casein and caseinate manufacture isolate and recover a specific group of proteins in the milk. Therefore, losses occur of non-casein material, particularly in the proteolysis part of the process, and in the whey and washwater.

**Whey processing**

Resource use for whey processing can be summarised as follows:

Whey is processed into a large number of products. Casein fines are usually removed from the whey and milkfat is recovered before further processing. Fines have an adverse effect on fat separation and are removed first. Various types of equipment, such as cyclones, centrifugal separators and rotating filters, are used. Fat is recovered next, in centrifugal separators.

**Whey Powder:** after separation and thermalisation, whey powder is produced by evaporating and drying the whey. The whey is usually concentrated in falling film evaporators. Modern systems use mechanical and thermal vapour compression technologies in this process to lower costs. Reverse osmosis (RO) has been used as a pre-concentration step before the evaporation process. The concentrate is cooled after evaporation. It is then dried, usually in a spray drier, and packed.

**WPC and Processing of UF Permeate:** WPC processing, ultrafiltration (UF) permeate processing and demineralisation all begin with whey pretreatment as described above, with fines and fat being removed from the whey. In the WPC process, the whey stream is processed through a UF plant. This concentrates the WPC to approximately 25% solids, and then the retentate is diafiltered to remove more lactose and ash, raising the protein concentration. Diafiltration washes out low molecular weight components — mainly lactose and minerals. These two processes in series produce a concentrate with a protein concentration as high as 85% in the resulting dried product. The retentate from the diafiltration stage is then evaporated and dried as the final two steps to obtain dried WPC products.

Permeate from the UF plant is often used for the production of lactose. The permeate is passed through an RO plant and the resulting retentate is further concentrated by evaporation. The lactose-rich stream can then be processed into lactose powder. The permeate from the RO plant can be further processed with RO polishers to obtain a source of demineralised water for reuse in the plant.

Demineralised whey powders are manufactured from demineralised whey. Demineralisation involves the removal of the inorganic compounds and a partial reduction of the organic ions. Partial demineralisation processes are carried out by nanofiltration, and high level demineralisation processes are carried out by electrodialysis or ion-exchange columns. Some plants use a combination of these unit processes.

Casein fines and fat are removed from the whey by mechanical separators, strainers and screens. These waste streams can be reintroduced to other processes as raw materials. Separator sludges need to be removed periodically and disposed of.

The UF permeate can be a major source of protein loss, especially if the membranes become damaged, through age or unsuitable handling.
In demineralised whey production various waste streams are produced. Ion exchange produces wastewater from initial flushes of the resin and regeneration of the resin. Nano-filtration produces a permeate that is relatively low in lactose but has high levels of potassium, sodium and chloride.

Material lost during plant start-up and shutdown procedures can be substantial. CIP procedures and spillages provide additional loads to the wastewater. Losses from evaporators are usually restricted to start-ups and shutdowns.

If there are operational problems during the drying process or if spillages occur out-of-specification material may be produced. These materials are often used as stock food. Stack losses are minimal under normal operation.

The retentate from the UF plant has a high concentration of whey proteins. During the flush at the end of the processing run, it is therefore important to flush as much retentate as possible through to the evaporators before it becomes too dilute to evaporate.

Any leaks in the retentate system and evaporators have the potential to result in high losses very quickly unless they are repaired promptly.

Reverse osmosis can be used after UF permeate processing to produce a relatively clean permeate stream containing a COD of 200–500 g/m³. RO polishers (reverse osmosis plants with a tighter membrane) can be used to reduce the COD to < 10 g/m³. The polisher permeate can be used as a source of demineralised water for membrane cleaning or CIP rinses.

Typical losses from WPC manufacture are shown in Table 5.9.

<table>
<thead>
<tr>
<th>Source of waste (WPC)</th>
<th>% Whey protein lost from plant feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whey Treatment Wastewater</td>
<td>0.5–1.0</td>
</tr>
<tr>
<td>UF and Diafiltration Permeate</td>
<td>8.0</td>
</tr>
<tr>
<td>Stock Food</td>
<td>0.8</td>
</tr>
<tr>
<td>Wastewater</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Table 5.9: Protein loss to WPC waste streams from the feed to the plant (Fonterra Research Centre, unpublished data).

The main losses that occur during WPC manufacture are in the membrane permeates. Although these losses are relatively high, the processing of whey recovers material that would otherwise be lost from other manufacturing operations (see previous sections). Therefore, the losses shown in Table 5.9 are low when compared to the original input of milk.

5.3 Using Waste Minimisation to bring about Resource Stewardship

The main drivers and opportunities for resource stewardship within the New Zealand dairy sector are associated with waste reduction, water use reduction and reuse, improved energy efficiency and chemical reduction. These processes bring direct benefit to the business by:

- increasing the recovery of material either as the primary product or as some other product (i.e. a financial return);
- reducing costs for water treatment and waste treatment; and
- reducing resource input costs (e.g. energy, chemicals etc)

The products produced by the New Zealand dairy industry are generally food products, mainly for overseas markets. Therefore, an important consideration is that the product quality must not be compromised by any of the activities associated with the manufacturing process. When more
Case Study 5.4: Whey utilisation

Whey is a by-product of cheese and casein manufacture. During cheese and casein manufacture, between 850 and 1100 litres of whey are generated for every 1000 litres of milk processed. Whey contains about half the Biological Oxygen Demand (BOD₅) of milk. Before 1970 the cheese and casein plants in New Zealand were relatively small by today’s standards, typically processing 300 - 400 m³/day of milk. The whey from these factories was usually fed to pigs, spread onto land or discharged into rivers or the ocean.

The volume of whey discharged into rivers was generally small in comparison to the size of the rivers and the environmental effects were low. It was also possible to spray irrigate whey onto selected land around the dairy factory without causing detrimental effects. In those days however, the term ‘sustainability’ was not as well recognised and it is unlikely that the practice as occurred then would be allowed today.

As processing plants have become larger the volumes of whey produced became too large for use by pig farmers or for disposal to land. Where whey was discharged to rivers, the high oxygen demand of the whey could potentially cause oxygen depletion in the rivers and the growth of sewage fungus.

To address these problems, research was undertaken into alternative uses for whey. The outcome of those initial studies was the use of whey as a feed source for dairy cattle and the managed use of whey as a fertiliser. It was determined that whey had a high fertiliser value and spreading it onto pasture or crops at controlled rates did not cause the problems seen when high application rates were used.

Concurrently, research was being undertaken into processing whey to increase the economic ‘yield’ from milk by developing new high-value nutritional products for humans. These initially included specialised whey powders, whey protein concentrates and lactose, and uses for the products ranged from additives to nutritional foods to confectionery.

Lactose has been produced from whey for many years and the more recent development of ultrafiltration membrane plants allowed the whey proteins to be recovered from the whey. Other unit processes introduced at about the same time, including ion exchange and electrodialysis, allowed even more manipulation of the mineral, lactose and whey proteins to produce products specifically for customer needs.

The research and development efforts have continued with the introduction of new technology and improvements in existing technologies to produce whey based products for the nutraceutical markets. These products include a range of whey protein isolates and whey fractions. Whey is processed into a range of highly profitable sophisticated products that include texturisers for meat, yoghurts and fresh cheeses, specialised proteins for sports and medical products, and hypoallergenic proteins for infant formulae. Now, almost no whey is wasted during processing.

Further fractionation of whey proteins is the latest development in whey processing technology and this has enabled the manufacture of a number of high-value whey protein fractions that have highly specific applications and distinct nutritional benefits.

The processing of whey has become a highly profitable business for the New Zealand dairy industry. Since whey was first manufactured, profits and revenue have risen steadily, with revenue reaching $182.3 million in the 99/00 season.
longer have the required functionality or food properties and may even be unsuitable as a human foodstuff. An alternative approach is to recover the material but to use it as a completely different product. An example of this would be where the recovered material is used to manufacture completely different products (e.g. as with whey processing products). Often a range of different product uses is available and materials may even be recovered for their fertiliser value or as a stockfood. When this approach is taken the recovered material must realise sufficient income to cover the costs of the recovery operations.

The dairy industry waste minimisation project was initiated in the 1970s when the industry began determining the yields for manufacturing dairy products and monitoring the wastewater production from the dairy factories. The initial drivers for the project were the increasing environmental pressures the manufacturing sites were coming under as small dairy companies amalgamated into larger manufacturing sites. From the initial studies it was realised that significant improvements could be obtained by reducing the loss of milk and milk products and reducing water use within the processing plants.

The main results of the early work were:

- A team was formed at the Fonterra Research Centre (FRC), to measure yields from the manufacturing processes. Best practice loss levels were determined for each manufacturing process.
- Loss monitoring techniques were developed to allow the manufacturing plants to accurately measure losses from the manufacturing process.
- The FRC series of open channel flowmeters and samplers were developed and manufactured to meet the industry’s needs.
- An increased awareness of the importance of reducing losses on the manufacturing sites.

All sites now measure daily losses from the manufacturing plants. The daily losses are compared against best practice losses from the plant and other similar plants. Where there are major variances a team from within the industry investigates the sources of the high losses and instigates changes in plant, process or management to reduce the losses in the plant. The FRC maintains a database of best manufacturing practice.

This has resulted in a reduction in the volume and organic content of wastewater, hence reducing the effect of the operations on the environment and the quantity of wastewater requiring treatment. Milkfat losses have decreased from 1.95% of that processed in the 1970s to 0.6% at present. At one cheese/whey protein/casein plant COD levels have dropped from 9400 to 4050 g/m³, fat from 665 to 240 g/m³ and organic nitrogen concentrations from 232 to 104 g/m³.

The FRC waste minimisation project has established good resource stewardship by minimising milk (product) losses from the manufacturing process and reducing resource use (e.g. water) within the processing operations. The project has operated within an economic context and has ensured that the competitiveness of the processes are maintained. Additional benefits have occurred, such as reduced treatment costs (through a reduction in waste volumes and the requirements for land and resources for the treatment of the wastes) and improved environmental outcomes. In the future the combination of reducing losses and maximising product recovery, and external pressures from the environmental regulatory communities and the community will ensure that this process continues.

5.4 Governance of the Sector

The farming sector of the dairy industry must meet local standards relating to air and water quality promulgated in regional and district plans by local government. Each region in New Zealand develops their own standards and publishes these in regional or district plans. These plans reflect the communities’ environmental targets.
To meet these standards the industry has developed the Dairy Industry Environmental and Animal Welfare Policies. These policies include issues relating to animal welfare (physical and health needs of animals, tail docking, inductions, bobby calf collection and casualty cattle) and the environmental (residues, human wastes, wetlands, farm dairy effluent, water quality and fertiliser usage). Environmental issues identified in the guidelines are:

- **Residues.** Preventing stock access to contaminated site, ensuring that correct withholding periods are used for all animal remedies and treatments, and prohibiting the application of industrial wastes that contain toxic contaminants to dairy farms or pasture that will be used on dairy farms.
- **Human Waste.** Prohibiting human waste application to dairy farms or to crops and pasture that will be fed to dairy cows.
- **Access to Wetlands:** Preservation of all existing significant wetlands, and control of stock access to such wetlands to avoid destruction of native flora and fauna.
- **Farm Dairy Effluent.** The disposal of farm dairy effluent is to be undertaken in a manner that does not present significant risks to human health or aquatic systems. The disposal of such effluent must meet the requirements of the Resource Management Act and regional plans.
- **Water Quality.** The industry’s goal is to maintain and enhance water quality in dairy catchments. Approaches to achieve this include preventing stock access to waterways and the planting of stream banks (riparian management).
- **Fertiliser Usage.** The goal is to minimise nutrient losses to groundwater and rivers. Nutrient budgeting is an approach to achieve this goal.

The processing sector is required to meet all national standards for food quality as well as any additional standards relating to individual overseas markets.

In the past, responsibility for meeting standards was largely up to individual processing companies, although the Fonterra Research Centre (formerly the New Zealand Dairy Research Institute) took a lead role in developing methodologies and standards for the industry. As amalgamations of the processing companies have occurred requirements for resource use and management have become standardised and coordination of both effort and approach is now possible. Standards are being progressively implemented by the company shareholder organisations with the assistance of technology transfer groups such as the Dexcel Consulting Officer Service.

The processing sector has also begun using ISO 14000 environmental management systems. ISO 14000 allows the processing plants to achieve environmental performance to a recognised international standard. This has benefits in assuring international customers that the products they are purchasing are manufactured with suitable regard to environmental issues. It is expected that all the major New Zealand manufacturing plants will be accredited to the ISO 14000 standard by 2005.

Of prime importance in implementing good resource stewardship is to have an effective awareness and education policy in place. This is more easily managed in the manufacturing part of the sector where company and site training programmes can be implemented. In the farming part of the dairy sector awareness programmes are more difficult to implement. Individual farmers are responsible for their own part of the business (the farm) and how they achieve their business outcomes. The large number of individual farmers makes achieving a common standard more difficult. Considerable effort is now going into developing good technology transfer/learning programmes for farmers and their farm workers.

### 5.5 Drivers for Change within the Sector
The initial drivers for change within the dairy sector were related to external pressures, especially from the regulatory authorities and the community and because the amalgamation of small dairy processing plants had increased the environmental effects at fewer sites. Imposed on these drivers were the need to ensure that the dairy sector remained competitive. These same pressures still exist today but additional features have become important.

The main drivers for waste minimisation and good resource management within the dairy industry today are:

- **The clean-green marketing strategy.** In various markets elements of New Zealand being clean and green is used to some degree. Ensuring that operations within New Zealand support these images is an important driver for good waste management practices being implemented. The long-term benefit is that New Zealand can remain in these markets and use the clean green image effectively.

- **Regulatory requirements.** The main environmental legislation in New Zealand is the Resource Management Act. This impacts directly on both the farming and manufacturing sector to ensure that emissions to air and water are minimised.

- **Community expectations.** The community requirements for environmental well-being are related to the regional council requirements through the resource consent procedures. Community expectations are often complex involving aspects of resource protection, waste minimisation, environmental protection and economic well being.

- **Customer requirements.** Customers are exerting pressures on the New Zealand dairy industry by inspecting farms and processing plants and ensuring that appropriate standards are met throughout the production chain. These pressures have concentrated mainly on the food safety area, but increasingly environmental issues are being considered.

Of paramount importance both to the dairy industry and to New Zealand as a whole is that the industry remains competitive. The dairy industry took a lead in this area by implementing the waste minimisation project. This area is still seen as important today and is effective because it attributes a cost to poor resource or environmental performance.

### 5.6 Conclusions and Recommendations

The New Zealand dairy industry has been a leader in resource stewardship in New Zealand. Each manufacturing plant undertakes routine loss monitoring and has processes in place to ensure that losses are minimised and non-conformances are dealt with effectively. Work is continuing in this area at both a research and implementation level through the investigation of new and improved systems for minimising water and chemical usage in the plants.

As new technologies become available they are evaluated to ensure that they meet the required environmental or resource minimisation requirements and also that they do not adversely affect either the manufacturing process or the final product.

More recently the farming sector has come under increased pressure to minimise effects on the environment. To achieve improved environmental performance in the farming sector the industry has developed a series of policies and guidelines. Although the final outcome of these policies is to ensure that environmental and product quality standards are met the result is improved management of the resources that go into the farming sector. One of the main areas is in improved fertiliser management.

The New Zealand dairy industry is in a position where it can utilise the existing and new structures that are being developed to improve resource management within the sector. Approximately 95% of the milk produced in New Zealand is supplied to a single company — Fonterra Co-operative Group. This structure allows a coordinated approach to be taken to resource stewardship. Common goals can be set with national coordination of loss monitoring.
and reduction methodologies.

5.7 References


6.1 Introduction

Since the first export meat shipment was prepared on the Totara estate near Oamaru and set sail for England on the refrigerated cargo ship Dunedin in 1882, the meat industry has grown to be an important part of New Zealand’s economy. Departing Port Chalmers on February 15 1882, the Dunedin arrived in England after a passage of 98 days to discharge 4,931 mutton, lamb and pork carcasses – only one of which was condemned (Wylde, 2000). Refrigeration technology transformed a struggling domestic industry into what would become New Zealand’s largest export industry until only late in the twentieth century when it was overtaken in export earnings by the dairy industry.

Figure 6.1 illustrates the importance of the export meat industry to the New Zealand economy. In 2001 the export earnings from meat and meat by-products (excluding wool) was $5,155 million, or 15.8% of New Zealand’s total export earnings (Statistics New Zealand, 2002). The meat export trade continues to be an important earner of overseas currency, second only to dairy exports.

![Figure 6.1: Value of NZ exports ($32,655 million for the year ending December, 2001) (Statistics NZ, 2002)](image)

On a global scale, although New Zealand’s meat production is a relatively small percentage of world production, its share of the world export market is very significant, especially for sheep meats. Table 6.1 shows that while contributing 7.2% of the world’s sheep meat production, New Zealand dominates world trade in sheep meats, accounting for 51.4% of world trade. The corresponding data for New Zealand’s share of world beef meat production and trade are 1.3%

<table>
<thead>
<tr>
<th>NZ production, % world</th>
<th>NZ exports, % world</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef &amp; veal</td>
<td>Lamb &amp; mutton</td>
</tr>
<tr>
<td>1.3</td>
<td>7.2</td>
</tr>
</tbody>
</table>

Table 6.1: NZ and world meat production and trade (The Economic Service, 2001)
and 8.6% respectively.

Figures 6.2 and 6.3 show the export of New Zealand sheep and beef meats is concentrated on two main markets — North America for beef and Europe for sheep meats.

The combined North American markets of the USA and Canada account for 70% of New Zealand’s beef export revenue, while Europe alone accounts for 67% of the sheep meat market.

New Zealand’s meat production industry comprises over 41,000 farms producing sheep, beef, venison, goats and pigs. Ninety-three percent of the sheep flock and 78% of the beef herd is produced by approximately 16,260 of these farms. The area of land utilised for meat production is approximately 10,530 thousand hectares, representing 3.9% of New Zealand’s total land area. (Statistics New Zealand, 2000)

There are approximately 82 red meat processing plants in New Zealand that are licensed either to process meat for export (51), pack meat for export (18) or process meat for the local market (13). Stock and processing plants are distributed throughout New Zealand (see Figure 6.6).

There are in addition 123 poultry meat producers. Three large poultry producers process 92% of New Zealand’s market at six processing sites. Fifteen small processors around the country process the remaining 8% (Cooper-Blanks, 1999). In 2001 the poultry industry processed 119,000 tonnes of poultry meat, 115,790 tonnes of which was from 69.3 million broiler chickens, the balance from turkey and game birds. Almost all poultry is consumed domestically (PIANZ, 2002).
The production of the major meat species is summarised in Figure 6.4.

The production of all meats (excluding deer and goat) illustrated in Figure 6.4 totalled 1,315,000 tonnes (bone-in basis) in 2001, of which sheep and beef meats comprised 87.6%.

New Zealand exports around 80% of the beef kill and 90% of the sheep kill. In 2001 the red meat industry slaughtered 26.3 million lambs, 5.44 million sheep, 2.21 million cattle, 148,000 goats and 474,000 deer (The Economic Service, 2001).

Figure 6.5 shows an overall decline in the total kill since 1980. However, what is notable is that although sheep stock numbers have dropped by 22% over the last decade, lamb meat production has increased over that period by 14% as a result of significantly improved lambing percentages, up from 100% in 1990 to 116% in 2001.

New Zealand’s ability to compete on the world market is in large part due to the use of pastoral farming. While in itself having an effect on land-use, there is increasing competition from dairy conversions of sheep and beef farms and an increase in forestry on formerly pastoral land.

Land use competition has had an impact on the meat sector. Over the eight year period to 2001, 1692 dairy conversions displaced 4 million beef and sheep stock units. Over a similar time frame, 340,000 hectares of farmland was converted to forestry, reducing pastoral area by 2.5% and displacing 1.5 million sheep and beef (The Economic Service, 2002). There is also increasing competition for agricultural land from the development of lifestyle blocks (MacKay, A., Pers. comm.).
The 16,260 commercial farms that account for 93% of the sheep and 78% of the beef production respectively provide paid employment for an estimated 24,400 people (including the owner). The remaining smallholdings (approximately 24,000) provide further employment opportunities.

Table 6.2 shows that the meat processing and associated by-product industries also provide significant employment.

<table>
<thead>
<tr>
<th>Processing activity</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep and beef farming</td>
<td>34,000</td>
</tr>
<tr>
<td>Meat processing</td>
<td>20,430</td>
</tr>
<tr>
<td>Poultry</td>
<td>1,840</td>
</tr>
<tr>
<td>Leather</td>
<td>1,820</td>
</tr>
<tr>
<td>Fellmongery</td>
<td>460</td>
</tr>
<tr>
<td>Oil and fat production</td>
<td>310</td>
</tr>
<tr>
<td>Shearing, top dressing and contract services</td>
<td>18,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>78,860</strong></td>
</tr>
</tbody>
</table>

*Table 6.2: Employment in the meat and associated by-product industries (Stats. NZ, 2001)*

In total, approximately 5% of the New Zealand (full time equivalent) work force are employed by the meat and associated industries. Including other support services such as farm supplies, transport and finance increases the level of employment to over 6%.

Figure 6.6 shows the geographic spread of farms and livestock production around New Zealand by regional council, as well as the main meat processing facilities.

6.2 Resource Use and Waste Minimisation within the Sector

Resources are used within the meat industry across three primary areas of activity — farming, transport and processing.

The main quantifiable inputs into the farming sector are land, energy and fertiliser, although the farming sector is heavily dependent on the natural resources of water and solar radiation. All but solar radiation is manageable to some extent by the farmer.

Fertiliser consumption is often quoted as an indicator of the economic well-being of the farming sector. On that basis, the latest figures available indicate that farming is in good heart, purchasing the highest recorded input of fertiliser since the early 1970s. In 2001 the beef and cattle farming sector purchased 2,899,800 tonnes of fertiliser, of which an estimated 65% is manufactured superphosphate, or fertilisers containing superphosphate. (The farm-input figures exclude the energy used for fertiliser manufacture). (The Economic Service, 2001).

Figure 6.7 shows the major inputs and outputs from the meat sector from farm production through to the processing plant.

The primary resource inputs into meat processing are stock, energy (principally electricity, gas and coal), water, packaging and labour. In terms of energy, the meat processing demand is comparable to the combined farm energy and livestock transport energy demand.

National on-farm electricity and fuel consumption figures have been estimated from MAF model farm data (MAF, 2001), which provides stock unit based costs for farm expenses. There appears to be an opportunity to improve the data collection in the agricultural sector, potentially expanding the scope of data presented in the context of the national farm model. Transport related fuel consumption data has been calculated from data estimated by a transport
operator and is indicative only.

Processing energy data has been derived from available meat industry survey data (EECA, 1996) extrapolated to the present day using a suitable improvement factor (Lovatt, Pers. comm., 2002). Water and wastewater data has been estimated primarily from limited research data and is indicative only.

The following sections trace the flow of stock from the farm to the processing plant and discuss the level of resource stewardship evident within four key areas:

- land use;
- stock management;
- transport; and
- meat processing.

Figure 6.6: Distribution of livestock, farms and processing plants
(MAF, 2001; Meat NZ, 2001)
A project with the objective of developing awareness and understanding of sustainable land use within a group of Wairarapa farmers (MAF, 2001a) makes the observation:

“There is a general perception that intensification of land use compromises sustainability. But, some extensive land use practices and management are also unsustainable. The challenge is that every farm is a unique set of soils, interacting with both land-use policies and land management practices. Every activity undertaken by farmers has implications for the soil. Yet few farmers have sufficient knowledge about the features and behaviour of the soils of their farm to tailor their land-use policies and practices to enable them to manage their land in a more sustainable and profitable way.”

New Zealand’s pastoral based production of beef and cattle has low energy intensity by virtue of the reliance on solar energy to generate pastoral feed. Low energy intensity in itself however does not guarantee long term sustainability.

Examples of threats to the sustainability of New Zealand’s pastoral based agriculture are (MAF, 2000):

- The loss of soil quality as a result of accelerated erosion, sediment run-off, soil compaction and pugging and nutrient imbalance.
  - A study in 1993 reported that 47%, or 8.6 million ha, of erosion susceptible land in New Zealand was being farmed. This means that 68% of (all) New Zealand farmland is on erodible land.
  - The primary causes of nutrient depletion are leaching, transferring animals and erosion.
  - Acidification of soils through cation removal and the addition of phosphate fertilisers.
  - Although soil pH can be modified by the application of lime, there is concern that pH monitoring and pH correction is not common practice.
- Impact on water quality as a result of farming systems contaminating surface and ground water with pathogens, sediment and nutrients (nitrate, phosphate). Land use change also affects the structure and health of aquatic ecosystems.
  - The removal of riparian vegetation leads to substantial modifications in stream environments, particularly where livestock enter streams, which can disrupt aquatic ecosystems, increase flow variability and flooding and increase nutrient loading of waterways (Sinner, 1992).
- Impact on air quality from drift from agri-chemicals used in weed and pest control and top-dressing. Greenhouse emissions from soils and livestock are also a focus issue.
A loss of biodiversity through the failure of private landowners to protect biodiversity in intensively utilised hill country and lowland farms.

There are a number of sustainable land management practices that help minimise or eliminate adverse environmental impacts resulting from land use. These include:

- maintenance of riparian strips to maintain aquatic environments and filter nutrients;
- monitoring and management of soil structure;
- inaccurate fertiliser application is estimated to cost NZ farmers and growers between $50 million and $100 million per year in lost revenue, as well as causing adverse environmental impact (MAF, 2001b); and
- appropriate land-use to minimise erosion.

Two initiatives with the objective of developing more sustainable farming practices are:

- The Green Project farm management system; and
- The Farm Environmental Award scheme (see Case Studies 6.1 and 6.2).

**Case Study 6.1: ‘Green Project’ farm management system**

One of the North Island meat companies, Richmond Ltd, has initiated and is leading a New Zealand industry project to develop a New Zealand standard for sustainable production on sheep, beef, deer and goat farms. The primary goal of the project is to develop a voluntary New Zealand Sustainability Specification for farmers based on triple-bottom-line (TBL) reporting.

The specification will:

- Be based on best practice farming with the goal of enhancing production, providing future proofing for the farming business and demonstrating that New Zealand farmers are in fact ‘clean and green’ by providing an internationally recognised QA system.
- Encompass the TBL (economic, environmental and social) aspects of production and address RMA regulatory requirements with the goal of avoiding the risk that sustainability specifications will be imposed on the farming sector by central government.
- Provide the opportunity to differentiate product for more discerning and higher paying markets.
- Provide an opportunity to talk ‘equivalence’ with New Zealand’s trading partners, rather than having to accept conditions of supply that do not reflect New Zealand’s farming systems.

Although there is a risk that a New Zealand Sustainability Specification could prompt overseas customers to request the specification as part of conventional QA programmes, New Zealand’s major competitors (e.g. Australia, EU etc) are also developing sustainability programmes with the full support of their government and associated industry agencies.

**General Principles**

- A supply capability based on sustainability principles must consider economic, environmental and social aspects of production.
- Conditions for supply are based on factual information with a scientific basis wherever practical; however, consumer views and perceptions on acceptable practice are considered and are adopted wherever proven to be important.
- Builds on-farm assurance for conventional supply, which includes animal welfare and food-safety requirements.
Stock

An important aspect of a successful farming sector is the continuing improvement of the animal stock. In recent years, improved management practices and breeding have improved lambing percentages by 16% nationally.

Opportunities for genetic modification within the meat sector have been noted. The meat
Case Study 6.2: Farm Environment Award

The Ballance Farm Environment Award was started in the Waikato in 1993 and in 2002 expanded to include the Wellington and Southland regions. The award is conducted annually by the Farm Environment Award Trust with support from the respective regional councils and a number of farming industry sponsors. The purpose of the award is to encourage sustainable agricultural practices and to demonstrate to farmers that profitability need not compromise and, in the best examples, can restore and enhance environmental values. There are several topics considered by judges when assessing the awards, including:

- achieving farm production targets;
- protecting and enhancing natural features;
- matching land types to land use;
- management of waterways;
- habitat enhancement;
- energy efficiency, considering alternatives to achieve total on-farm efficiency; and
- pasture and crop health.

The 2002 Wellington Supreme winners, Jim and Simon Campbell, won the Richmond and PPCS sponsored beef and sheep farm award and the Wrightson Habitat award. The Campbell’s run 1400 Romney ewes, 190 Angus/Hereford beef cows and 250 deer on Rameslie, a 525 ha farm near Mt Bruce in the Wairarapa. Examples of the initiatives implemented by the Campbell’s to enhance the farm environmental sustainability included soil management appropriate land-use and habitat enhancement.

Soil management

Development of winter farming policies to avoid soil damage:

- wintering cows for three months under pine tree plantations under feedlot type management; and
- closing 125 ha of rolling hill country during winter.

Fertiliser management:

- The use of reactive phosphate rock on parts of the farm because it lasts longer and is friendlier to the soil; and
- Use of lime to manage soil pH.

Habitat enhancement

All the naturally boggy wetland areas have gradually been fenced off and planted up, so the farm now has around 30 reasonable sized ponds, supporting not only a huge array of water birds, and other wildlife, but also providing shade and shelter for stock. Some steeper land has also been retired and planted up. The wetlands provide a habitat for a variety of waterfowl, including a breeding pair of the endangered whio, or blue duck. The whio are part of a nation-wide breeding scheme where any progeny are released in Taranaki.

Riparian management

The Campbell’s are progressively fencing off the two rivers flowing through the property, as
industry is voicing concern on the potential for limited access to genetic modification technology, with the Meat Industry Association being a founding member of the LifeSciences Network\(^1\) formed to provide input to the 2001 Royal Commission on Genetic Modification. The industry body favours “maximum flexibility with appropriate protection” seeing GM as representative of a “leading edge technology in the livestock and pastoral sectors” that was a prime component of the industry’s competitive positioning (MIA, 2001).

The implication of genetic modification for sustainable agriculture is an on-going debate, with strong views held by both proponents and opponents. The major conclusion of a Royal Commission on Genetic Modification was that “... New Zealand should keep its options open. It would be unwise to turn our back on the potential advantages on offer, but we should proceed carefully, minimising and managing risks. At the same time, continuation of the development of conventional farming, organics and integrated pest management should be facilitated.” Opponents argue however that for New Zealand to ‘keep its options open’ effectively means closing the door permanently on the GE free New Zealand option — an option from which there will be no turning back.

The contribution of the pastoral sector to the greenhouse gas inventory has also been the cause of concern, in particular nitrous oxide and methane.

**Transport**

The transport of livestock from farm to processing plant is primarily by road and consumes diesel fuel as the main resource. Transport of stock between farms prior to the works is also significant, estimated by one transport operator to be equivalent to as much as 40%-50% of the farm-to-works fuel.

The wide distribution of farms together with procurement demands from processing works (to maximise staff and plant utilisation) generates significant logistical difficulties and a potential conflict in terms of fleet efficiency. A focus on fulfilling work kill quotas alone can be at the expense of fuel cost and poor transport utilisation. One transport operator commented, for example, that the use of back-loading to improve utilisation was probably between only 15% and 20% nation-wide.

Although previously uncontrolled and distributed ‘en-route’, animal wastes produced in-transit now have to be contained and disposed of at approved facilities, either at the works receiving the stock or at transport company depots.

**Meat processing**

The New Zealand meat industry has undergone major restructuring over the last twenty years. There has been a move away from large ‘freezing works’ with a multitude of operations on one

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\(^1\) The LifeSciences Network is an incorporated society and states as one objectives its intent “to provide an active voice for the creation of a positive environment for responsible use of genetic modification with appropriate caution.”
site, to small plants that only undertake slaughter, dressing and boning, with by-product processing, such as rendering and fellmongering, either centralised to a company owned facility or contracted off-site. (Currently there are approximately 25 rendering plants in New Zealand, of which independent contractors operate six.)

The processing of meat has definable steps that are illustrated in Figure 6.8. These steps include the reception, washing and housing of stock prior to slaughter; the slaughter and subsequent dressing\(^2\) of the meat carcasses; the further processing of carcasses into consumer cuts and portions; the processing of edible (offal) and inedible by-products, including rendering; the chilling and freezing of product prior to shipment; and the treatment and disposal of residual wastes.

A common resource that links all these process operations is water. As the environmental manager of one meat company observed:

> "The principle waste that we deal with all the time is dirty water. [We] use large volumes of water in the processing, [we] probably overuse water, and it carries away a lot [of material] or becomes contaminated throughout the process. So that is our principle concern ... walk into the sheep yards and we wash the trucks, we wash the sheep, we wash the yards the sheep stand in, we wash every other part of the factory at least four times a day. And we use water to transport product and to clean product. Skins, guts."\(^3\)

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\(^2\) Dressing refers to the processing of a carcass into edible and inedible constituents.

\(^3\) Industry comment and information quoted throughout the chapter on the meat sector was gained from interviews with a selection of meat company managerial staff.
The potential environmental impact of meat processing is large. For example, the untreated wastewater discharged from processing all the stock slaughtered in 2001 was equivalent to the wastewater that would be generated in a year by a population of about 1 million people.

A breakdown of a typical meat processing operation is given in Fig. 6.8.

The process of restructuring has heralded the advent of more modern plants and technology, which together with improved operational practices, has seen an improvement in plant efficiency. For example, over the period of major restructuring between 1980 and 1995, the overall energy intensity (energy used to process a tonne of meat) was reduced by about 42% to 4.57 GJ/tonne (EECA, 1996). It is anticipated that a current review of energy use in the meat industry, due to be published late 2002, will show a continuing downward trend to about 4.10 GJ/tonne.

The introduction of new and more efficient technology also has a role in improving resource stewardship. The process of transferring a new technology into an industry sector requires the co-operation, support and a degree of risk taking from a number of players. The installation of a superheated steam dryer to dry meat and bone meal at Lowe Corporation’s Hawera site is a good example (see Case Study 6.3).

Rising energy costs have prompted companies to commission energy audits to identify new opportunities for reducing energy use, or review opportunities previously rejected. Concern over the impact of ratification of the Kyoto agreement is also providing some impetus to review energy use. New Zealand’s short-term hydro storage and vulnerability to drought, coupled with uncertainty regarding the gas resource, add impetus to maintaining the industries recent trends of reducing energy use.

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**Case Study 6.3: Superheated steam drying — introducing new technology**

Superheated steam (SHS) drying, also called airless drying, uses a SHS atmosphere to dry product as the SHS vapour displaces air from the system. The absence of oxygen reduces the possibility of product burning and product degradation, and dries product using less energy than conventional drying systems.

In conventional meat and bone meal dryers, whether indirect or directly fired, all of the water evaporated from the product is vented from the dryer. In contrast, a SHS dryer re-uses a proportion of the water vapour evaporated from the product as the heating medium by recirculating the vapour through a heat exchanger. The heat exchanger heats the vapour to a temperature well above that where it would normally condense, and the SHS is then recirculated to the dryer. Similar to conventional dryers, the excess vapour is condensed to produce hot water. The SHS dryer uses an indirect heat exchanger that reduces the volume of non-condensable vapour (mainly hot air) and consequently the size and cost of the condensers.

**Making it happen**

The installation of the SHS dryer at Hawera has highlighted the importance of some of the key elements necessary for successful technology transfer: industry sponsorship and vision, applied research, experienced commercial partners and an innovative ‘early adopter’ within industry.

In 1997 Meat New Zealand, the sponsor of the programme, commissioned AgResearch’s MIRINZ centre to investigate the potential and benefits of superheated steam drying...
technology in the meat industry. A pilot plant built by MIRINZ demonstrated the technology’s product quality and energy efficiency potential. In late 1998, Trevor Arnold from Lowe Corporation attended a MIRINZ project update and became interested in the potential for the SHS design to reduce the energy costs of drying meat and bone meal. Subsequent pilot plant trials of material from the Hawera plant demonstrated two benefits to Lowe Corp, in addition to energy savings, that convinced them to proceed with the new technology. The ability of the dried meal to meet the rigorous Japanese meat and bone meal time-temperature sterilisation requirements, and the high quality of gelatine recovered from the bone particles.

Commercialising the technology was not without obstacle. The first commercial partner decided not to proceed due to technical concerns. The project stalled. In 1999 Keith Engineering, now Pinches Consolidated Industries, began working with Lowe Corp, Meat NZ and AgResearch to solve some heat exchange and corrosion issues and turn the concept into a commercial reality.

In mid-2002, five years after project inception, Lowe Corp staff at the Hawera rendering plant began operating the first fully-functional superheated steam meat and bone meal dryer in the world.

**What it means**

To successfully transfer new technology requires a combination of timing, commitment and co-operation. All the stakeholders involved in the process have had a critical role to play:

- Meat NZ — Vision and seed finance.
- AgResearch/MIRINZ — Technical and research capability, industry contacts.
- Lowe Corporation — A willingness to innovate.
- Pinches — Practical engineering and commercial experience.

For Lowe Corporation, Trevor Arnold says that, “Although we initially got involved for the energy savings, ultimately it has been the ability to produce a high quality gelatine product that will pay for the investment. The energy savings are a bonus.” The application of superheated steam drying is not limited to meat and bone meal. The technology has potential in a wide range of areas including wood drying, cereal drying and the drying of waste sludge.

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| Pinches Consolidated Industries | Lowe Corporation |
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The meat-processing sector is also a high water user. While in some areas the abundant supply of water means water use minimisation has been a low priority, in many areas water consumption is more critical. Examples are areas where drought situations, or threatened groundwater sources, have forced significant improvement in water use efficiency.

A lot of the improvements in meat plant resource efficiency have been through engineering changes or technology improvements that do not depend on staff behavioural change. Some examples are listed in Table 6.3. Other examples include:

- The industry-wide introduction of accelerated conditioning and ageing of lamb carcasses reduced chiller holding time and energy use (and improving product quality).
• The installation of refrigeration heat recovery systems at several plants has reduced the fossil fuel demand for hot water heating.

• Advances in meat packaging technology that has resulted in polyethylene packaging being used more efficiently.

One plant realised a 20% reduction in water use, a 50% reduction in effluent BOD and a 67% reduction in effluent suspended solids by implementing a range of engineering solutions. The Engineering Manager has recognised however that many opportunities will only be realised by involving staff in the improvement process (see Case Study 6.4).

Minimising the impact of waste on the environment has meant that the principle activity for most companies is to collect, treat and contain waste through a range of steps – for example primary screening to primary treatment to secondary treatment and irrigation on to land. Waste minimisation, which has the added benefit of broader resource savings, is not yet an inherent part of business practice.

The enactment of the Resource Management Act in 1991 has focussed companies on reducing environmental impact, not on improving resource efficiency.

Meat companies have over the last 10 years significantly reduced the impact of their discharges on the environment, principally by investing in improved end-of-pipe treatment. The operations manager of one company commented that the installation of polishing wetlands at one of the company’s sites to treat secondary effluent was a result of the discharge conditions determined through the RMA consent process.

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**Case Study 6.4. Involving staff in the improvement process**

With the exception of the mid 1980s when meat by-products were supporting weak meat commodity prices, rendering departments have generally been neglected in terms of management support and investment. Although returning value on what would otherwise be an intolerable waste burden, rendering systems have not benefited from the level of investment of time and resources necessary to make the same efficiency gains that have been evident in meat processing. Many plants have taken the step of contracting rendering off-site to independent companies.

The Engineering Manager at one meat processing plant however has introduced a team-based approach where operators and engineering staff work together to identify opportunities for process improvement within the rendering department. He knew the rendering plant was not performing well and that by improving the operational performance, material that was currently contributing to the effluent load could be processed into valuable product.

After only six months, the collaborative approach had identified several ways of improving performance with the result that, without the need for any capital expenditure, company revenue was increased by $400,000. This was a result of a combination of a 7% increase in product yield, a reduction in effluent treatment costs and an improvement in tallow quality. The Engineering Manager has also observed a significant improvement in staff morale.

Despite the rendering team generating significant improvement in environmental and economic performance, and staff morale, at minimal cost, the Engineering Manager commented that the rest of the management team is, inexplicably, resistant to transferring this approach to different departments.

From the Engineering Manager’s perspective, staff are the company’s most valuable resource.
The treatment systems used by the meat industry are usually a combination of the following:

- **Primary screening**: Screening followed by sedimentation or dissolved air flotation.
  - solids can be rendered (depending on quality), composted or land-filled
- **Primary treatment**
  - physico-chemical treatment, or
  - anaerobic lagoons
- **Secondary treatment**: Aerobic lagoons
- **Discharge of secondary treated effluent**:
  - through irrigation onto pasture or forestry, or
  - through a constructed wetland.

What was once disposed of as waste is now in many cases put to beneficial reuse. Examples Richmond Ltd have initiated include:

- static pile composting of paunch grass from Hawkes Bay meat plants;
- vermiculture composting of paunch grass from Waikato meat plant; and
- the utilisation of methane produced from a covered anaerobic effluent lagoon in the Dargaville plant boiler.

The processing of an inherently heterogeneous raw material is necessarily a complex operation. No two animals are identical and the ranges of operations required to extract the maximum value are numerous.

Stock are received and housed until slaughter, at which point the carcass begins to be broken down into constituent parts. The primary separation is into edible meat and offal and inedible products.

The edible meat portion was traditionally exported as whole frozen carcasses that were broken down into retail portions by the receiving market. In recent years the focus has shifted to adding value within New Zealand, with a strong emphasis on further processing of retail cuts or boned product, and an increasing proportion of chilled, rather than frozen, product.

For example, in the 1986/87 season, 63% of lamb was exported in carcass form. In the 2000/01 season, only 8% were exported as carcasses, 76% as retail cuts and 16% as boneless product. In the 2000 season, 12% of lamb product was exported chilled (The Economic Service, 2002).

### Case Study 6.5. The ‘dropped meat’ programme

The preparation of retail cuts and boneless meat portions have added considerable value to New Zealand meat exports. Improving the yield of added value products has been a focus industry wide.

One meat processing company reported that by implementing a range of measures its boning and cutting room yields had improved by about 3%. In an industry where over 90% of red meat production is further processed, a 3% improvement in yield means large revenue gains. Improvements have been realised through improvements in operator technique, training and action, to stop product from dropping onto the floor.

One aspect of this improvement has been the reduction of meat dropped onto the floor. Dropped meat has to be downgraded to pet-food or rendered product and loses up to 80% of its value. Eliminating ‘dropped meat’ also means the avoidance of wasted production...
The meat industry has however made significant progress over the last 10 years in its evaluation of resource use. Steps recently taken by one company include:

- implementing a regular monitoring programme enabling a packaging mass balance to be completed so that yields and percent waste can be determined;
- including regular measurement of all identifiable waste opportunities since 2000; and
- running a weekly internal benchmarking programme updating all plant managers on a range of indicators including energy, transport and labour on a per carcass basis.

Table 6.3 gives examples of a range of waste minimisation options that have been implemented within meat processing facilities. The information presented in Table 6.3 has been drawn from a range of industry sources.

### 6.3 Using Waste Minimisation to bring about Resource Stewardship

Waste minimisation has continued to gain ground in the meat industry over the last decade and there are numerous examples that clearly demonstrate the role of waste minimisation in reducing resource use. There is ample evidence of the value of waste minimisation to the meat industry. However, waste minimisation, as pointed out by one industry manager, continues to occupy a ‘back seat’ and is still ‘depressingly uncommon’. For many companies, waste minimisation has been something incidental or thought of later. Certainly when the opportunities are identified and the financial benefit quantified there is support, but it is not yet integrated into business practice.

One company manager, when asked if results of a wide range of waste minimisation projects within his company have had any influence on senior management’s attitude to resource stewardship, responded with an emphatic “No. Hell no!”

In contrast, another company manager believed that waste minimisation has had a positive impact on senior management and that attitudes have shifted over recent years. He cited a number of initiatives within the company that indicate this shift, including improved boning yields, farm quality assurance programmes and increasing awareness of the importance of sustainable farming or good farming practice. He believed the introduction of kerb-side recycling has also had a role to play, raising the awareness amongst operational staff and management alike, of environmental issues.

Although many companies run profit improvement programmes, where different departments are required to identify opportunities to improve profit, these initiatives remain profit-driven and as yet do not include a sustainable management driver. In most cases, although significant resource as well as economic benefits result, the extent to which resource stewardship and sustainability are highlighted is dependent more on the individuals involved than the values and drivers of the company.

One company manager commented that despite having implemented a well-structured profit improvement programme, there was a need to upgrade the level and quality of on-going monitoring and reporting. One example cited was that despite the routine reporting of render-
<table>
<thead>
<tr>
<th>Process</th>
<th>Waste</th>
<th>Waste minimisation option</th>
</tr>
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<tbody>
<tr>
<td><strong>Stockyards</strong>&lt;br&gt;Reception and housing of stock prior to slaughter</td>
<td>Faecal</td>
<td>Minimise water use by:&lt;br&gt;− Rationalise stock washing requirements in consultation with MAF vet&lt;br&gt;− Use timed sprays in preference to manual hosing&lt;br&gt;− Use high pressure hoses when necessary&lt;br&gt;− Use rainwater or ('clean') recycled process water</td>
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<tr>
<td><strong>Slaughter board</strong>&lt;br&gt;− Blood collection</td>
<td>Effluent nitrogen loading&lt;br&gt;− Product loss&lt;br&gt;− Energy use</td>
<td>Optimise drain time to enhance blood yield&lt;br&gt;− Secure drain area to eliminate loos ease to drain&lt;br&gt;− Design draining area to maximise blood collection yield&lt;br&gt;− Eliminate water dilution to reduce losses and downstream processing energy demand&lt;br&gt;− Dry-clean blood collection area prior to wash-down&lt;br&gt;− Where practicable eliminate water fluming of offals, skins, hides, hocks and heads.&lt;br&gt;− Where fluming is necessary, reuse and/or recycle water for inedible products&lt;br&gt;− Use on-demand configuration hand and apron spray washes&lt;br&gt;− Use on-demand spray type sterilisers on constant temperature ring-main&lt;br&gt;− Rationalise water flow requirements at all water use points e.g. by installing flow restrictors&lt;br&gt;− Rationalise viscera table water use to satisfy hygiene requirements&lt;br&gt;− Improve slaughter and dressing quality to eliminate need for carcass wash</td>
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<tr>
<td>− Removal and separation of inedible/edible components</td>
<td>Water use&lt;br&gt;− Product loss (entainment)&lt;br&gt;− Water and energy (hot water) use</td>
<td>Where practicable eliminate water fluming of offals, skins, hides, hocks and heads.&lt;br&gt;− Where fluming is necessary, reuse and/or recycle water for inedible products&lt;br&gt;− Use on-demand configuration hand and apron spray washes&lt;br&gt;− Use on-demand spray type sterilisers on constant temperature ring-main&lt;br&gt;− Rationalise water flow requirements at all water use points e.g. by installing flow restrictors&lt;br&gt;− Rationalise viscera table water use to satisfy hygiene requirements&lt;br&gt;− Improve slaughter and dressing quality to eliminate need for carcass wash</td>
</tr>
<tr>
<td>− Steriliser, apron and hand washes, carcass sprays, viscera table sprays</td>
<td>− Effluent load&lt;br&gt;− Tallow quality</td>
<td>− Optimise drain time to enhance blood yield&lt;br&gt;− Secure drain area to eliminate loos ease to drain&lt;br&gt;− Design draining area to maximise blood collection yield&lt;br&gt;− Eliminate water dilution to reduce losses and downstream processing energy demand&lt;br&gt;− Dry-clean blood collection area prior to wash-down&lt;br&gt;− Where practicable eliminate water fluming of offals, skins, hides, hocks and heads.&lt;br&gt;− Where fluming is necessary, reuse and/or recycle water for inedible products&lt;br&gt;− Use on-demand configuration hand and apron spray washes&lt;br&gt;− Use on-demand spray type sterilisers on constant temperature ring-main&lt;br&gt;− Rationalise water flow requirements at all water use points e.g. by installing flow restrictors&lt;br&gt;− Rationalise viscera table water use to satisfy hygiene requirements&lt;br&gt;− Improve slaughter and dressing quality to eliminate need for carcass wash</td>
</tr>
<tr>
<td><strong>Paunch cleaning (beef)</strong>&lt;br&gt;− Removal of paunch content, prior to removal of omasum</td>
<td>Water use&lt;br&gt;− Effluent load&lt;br&gt;− Tallow quality</td>
<td>− Dry dumping of beef paunch contents for beneficial reuse e.g. composting, vermiculture&lt;br&gt;− Removing paunch from rendering raw material improves tallow quality&lt;br&gt;− Final spray rinse only</td>
</tr>
<tr>
<td><strong>Rendering</strong>&lt;br&gt;1 Screening &amp; gut-washing&lt;br&gt;− The use of water for fluming and washing product entrains fat and protein&lt;br&gt;− Screening of all waste streams is essential to reduce effluent loads and increase rendering yield</td>
<td>Fat &amp; protein effluent loading&lt;br&gt;− Low rendering yield</td>
<td>Ensure gut-wash water sprays are directed onto gut material&lt;br&gt;− Warm sprays to prevent fat build-up should be infrequent and solenoid activated.&lt;br&gt;− Ensure adequate screens are installed to collect raw material for rendering&lt;br&gt;− There is a variety of rendering systems installed in NZ. All require good monitoring and management of operating conditions to optimise performance.&lt;br&gt;− Minimising water entrainment in raw material and optimising heat recovery reduces energy costs on integrated sites.</td>
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<tr>
<td>2 Tallow &amp; meat meal production</td>
<td>Low yield&lt;br&gt;− Effluent loading&lt;br&gt;− Energy loss</td>
<td>Ensure gut-wash water sprays are directed onto gut material&lt;br&gt;− Warm sprays to prevent fat build-up should be infrequent and solenoid activated.&lt;br&gt;− Ensure adequate screens are installed to collect raw material for rendering&lt;br&gt;− There is a variety of rendering systems installed in NZ. All require good monitoring and management of operating conditions to optimise performance.&lt;br&gt;− Minimising water entrainment in raw material and optimising heat recovery reduces energy costs on integrated sites.</td>
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Table 6.3: Examples of waste minimisation in meat processing
ing yield data, poor performance was neither identified nor acted upon. The systems in place were not developed to the extent that staff could fully manage their own work or process environment.

The same manager also voiced the concern that even if systems were upgraded, there was no guarantee that the time and resources would be available to enable staff to be proactive and make positive changes. The support structures would need to be in place, otherwise staff would become frustrated and disillusioned.

Another obstacle cited was that the multi-process nature of meat processing sites often resulted in sites becoming internally fragmented. Because product and waste were transferred from department to department, staff could not appreciate the ‘big picture’ and had no interest in activity or impacts beyond their own department.

According to three of the meat company managers interviewed, to move waste minimisation forward requires a combination of better communication, a commitment to training and a conscious effort to integrate waste minimisation into already existing profit improvement programmes. Suggestions included:

• introduce brainstorming to encourage ‘different’ thinking. Initially between plant managers to encourage cross-fertilisation of ideas;
• re-focus profit-driven project teams on waste minimisation;
• raise awareness and regularly update plant managers of the methods and technologies that are available to reduce waste;
• introduce small teams and maintain consistent improvement; and
• training, training and more training.

If these experiences and comments were representative of the meat industry, they would indicate that cost reduction and resource stewardship are not yet adequately linked. The resources made available to staff to minimise waste are influenced strongly by what are the perceived priorities, or drivers, within the meat sector.

In the late 1990s the environment was mooted as the next significant market pressure to influence the New Zealand meat industry, following on from earlier demands for verifiable quality assurance systems. Several companies as a consequence were seriously evaluating the implications of becoming accredited to ISO 14001. The rapid and industry-wide adoption of ISO9001 systems has not, however, been repeated with ISO14001.

According to the environmental manager of one company, the major issues for the meat industry as identified by the customer are in priority order food safety, animal welfare, with the environment a ‘distant third’. Although the necessary resources are allocated as a high priority to ensure environmental consent requirements are met, for most companies the resources do not extend to the level necessary to integrate waste minimisation into work practice.

One company manager perceived a systems approach to management as the way to implement waste minimisation on a company-wide scale. The barrier to this approach for his company was a lack of resources. The staff familiar with a systems approach needed to be teamed with the staff who ‘make it happen’, but they do not have the opportunity to work together to develop those systems. A primary reason is that the systems staff always have other priority tasks such as the development of quality systems, or HACCP, and their resource is not available. The company manager, referring to how the lower priority assigned waste minimisation has limited its effectiveness, commented that:

“I think the primary cause for [waste minimisation] not being effective [in our company] is that we haven’t matched the resources that we have put into food safety programmes and quality

Page 68

Resource Stewardship and Waste Minimisation
management programmes [in] the environmental area at all. So the environment is taking third place and we are lacking a trained group of people that instinctively act and operate in that area. We tend to be production driven rather than minimising waste ... we have put more training effort into our people in the food safety and animal welfare aspects than we have in waste minimisation.”

6.4 Governance of the Sector

As a major export sector, legislation and associated standards governing procedures and practices within the industry have been developed or have evolved over time to satisfy overseas market requirements. The most notable example is the Animal Products Act 1999 (NZFSA, 2002). The Animal Products Act (APA) will at the conclusion of a transition period (1 Nov 1999 to 1 Nov 2002) effectively replace the Meat Act. The objective of the APA is to provide a regulatory basis for the management of the risk associated with the production and processing of animal products and to facilitate access into overseas markets. The APA requires all animals traded to be ‘fit for intended purpose’, and for them to conform to the New Zealand animal product standards that are contained in part 1 of the Animal Product Regulations 2000. A foundational component of the risk management system prescribed by the Act is the requirement for meat exporters to have a documented programme to identify and manage hazards. The risk management programme must be based on the principles of Hazard Analysis and Critical Control Point (HACCP). In addition there is provision for:

- regulated control schemes where hazards cannot be effectively managed by the business operator’s individual risk management programmes; and
- safeguards that ensure that overseas market access requirements are consistently met, and to manage risks to the integrity and reputation of New Zealand’s official assurances and systems.

A major impact of the APA on the meat industry’s ability to improve resource stewardship has been the acute urgency the Act has placed on the development of a verifiable risk management programme, and the pressure this has placed on staff and management resources. A lack of time and resources are frequently cited as reasons for a lack of progress in minimising waste.

A notable positive outcome of the implementation of the Act has been a focus on product integrity throughout the supply chain. In part, it could be argued that the Act has helped to focus meat processing companies on farm practice, which has resulted in initiatives such as the Green Project (see Case Study 6.1).

The Resource Management Act⁴ has also had, and continues to have, a major influence on the meat industry. The focus of this legislation is on minimising environmental effects and does not directly encourage responsible resource use. As a consequence, most meat companies have focused on meeting agreed resource consent conditions by improving the level of waste treatment, rather than the nature or quantities of resources used in the first place. Although waste minimisation can make a major contribution to reducing waste loads and the consequent capital investment, the RMA does not currently make this type of approach mandatory.

The third piece of legislation with the potential to influence resource stewardship is the Health and Safety in Employment Act, which contains principles that are applicable to resource stewardship. The reduction of workplace hazards encourages a systematic approach of identification, elimination, isolation, reduction and protection that parallels waste minimisation (clauses 7-10). The training, monitoring and reporting provisions are also compatible. One meat company representative commented in particular that the requirement within the legislation to involve employees in the development of health and safety procedures (clause 14) was synergistic with his efforts to encourage staff to reduce processing waste.

⁴ All New Zealand legislation can be viewed at http://rangi.knowledge-basket.co.nz/gpacts/actlists.html
6.5 Drivers for Change within the Sector

The meat industry, as a major exporter, is exposed to both national and international influences. As with any business, the priority attached to these influences determines the level of resource allocated.

The priority drivers currently within the processing sector are:

- food hygiene;
- animal welfare; and
- environment.

As previously indicated, with the exception of meeting the legislative requirements of the Resource Management Act, environmental issues do not attract the same level of resources as food hygiene or animal welfare. One company manager commented that:

“The primary drive within [the] company at the moment is to rewrite all of our food safety programmes into risk management plans under the Animal Products Act. And that’s one year’s work for one manager and people at each plant.”

Food hygiene and animal welfare are both directed by legislation through the Animal Products Act, but more especially by the major international customers.

One of the large UK supermarket chains has recently asked to inspect meat production practices on-farm principally from an animal welfare perspective. One meat company manager commented that their supermarket customers want to be assured that the animal from which the meat they are purchasing has been produced has been treated humanely and responsibly, both on the farm and at the processing plant.

Although not directly influencing resource stewardship yet, a focus on meat production is having the effect of requiring meat companies to consider their supply chain. Although the current focus appears limited to animal welfare, will customers in the future want to be reassured that farming, or perhaps processing, practices are responsible and sustainable?

Closely associated to food hygiene are the recent BSE and foot and mouth outbreaks in Britain. These outbreaks have emphasised the damage this type of outbreak can have on market access, which in New Zealand’s case would decimate the export meat trade. Consequently there has been an increased focus on tightening procedures and putting contingency plans in place to identify and isolate early any potential outbreaks.

BSE in particular may also have implications for downstream processing. As a consequence of the BSE outbreak in Britain, the EU has progressively tightened regulations regarding the feeding of meat and bone meal to farm animals. European Commission decision 2002/248/EC of 27 March 2002 effectively places a total ban on the feeding of animal proteins to any farmed animal (not only ruminants), that are bred for food:

“Member States shall prohibit the feeding of:
(a) proteins derived from animals to ruminants;
(b) processed animal proteins to farmed animals which are kept, fattened or bred for the production of food.”

This regulation, if implemented in New Zealand, would have the effect of devaluing rendered product, potentially reducing it to boiler or incinerator fuel.

Nationally, there is concern regarding the shortage of a skilled workforce, both tradesman and shop floor staff. Increasing automation and computer-based systems in modern meat processing plants require higher levels of numeracy and literacy, and the meat industry is constrained by a
lack of skilled labour. As one manager commented:

“Using sophisticated scanning technology at product load-out has highlighted for us the lack of numeracy and literacy amongst the labour force.”

A combination of rising energy prices and the potential for a carbon tax as a result of New Zealand ratifying the Kyoto Protocol has provided new impetus for the meat industry to reassess energy use. Both rising prices and a tax have the effect of changing the cost benefit of energy-related improvements, and companies are now revisiting projects previously rejected as not cost-effective as well as looking for new opportunities to reduce energy use. A company manager commented:

“Looking at opportunities you know with the ratification of the Kyoto agreement coming in — starting to worry like hell about that. And starting to revisit some projects which previously didn’t have very good paybacks. Their financial profile will change if the carbon tax comes in ... or something shifts.”

Another driver that is common to most industry and relevant to the meat industry relates to public relations and image — either a desire to avoid negative publicity or to attract positive publicity. One company manager stated that environmental initiatives within his company were not implemented out of a sense of environmental responsibility, but rather to avoid negative publicity and to stay out of the limelight. For this company, the desire to avoid negative PR is clearly the dominant driver. This company’s position, however, does not discount the fact the other companies may be looking to build some sense of environmental responsibility into their product brand. Examples include Richmond’s leading role in ‘Green Project’ (Case Study 6.1) and their support together with PPCS of the Environmental Farm Awards (Case Study 6.2).

6.6 Conclusions and Recommendations

There is no doubt that the meat processing industry has put significant investment into improving process efficiencies over the last decade. There is evidence also of a growing awareness and changes in farm management practices that reflect a shift toward resource stewardship (see Case Studies 6.1 and 6.2). The evidence equally suggests however that a commitment to resource stewardship is not mainstream practice, and that for the majority of meat-related businesses a waste minimisation approach remains a nice-to-do, rather than a must-do.

New Zealand has been a land of seemingly bountiful natural resources and there is significant attitudinal inertia to overcome before many New Zealand business appreciate the true value of these resources and accord them higher priority. Many of these resources, though of intrinsically high value, have been provided at a relatively low price. Water for example is used extensively in meat processing and in some locations is available for the cost of an extraction permit.

The increase of more intensive agricultural and horticultural production have resulted in water shortages in some parts of New Zealand, which have changed work practices, albeit temporarily in some cases until the crisis passed. Similarly, a lack of hydro storage has impacted electricity prices and caused meat companies to revisit energy efficiency options.

There has been a significant increase in the amount of added-value processing of export meat. A focus of profit improvement programmes in several companies on this aspect of meat processing has resulted in increases in production yields. In the absence of a strong financial driver or apparent resource shortage, there has not been the same degree of focus on other resources used within the industry. The processing industry is still described by company staff as production driven.

One company representative believed there were extensive opportunities to reduce resource use and make substantial cost savings by applying waste minimisation principles, by “… doing the
There is ample evidence that minimising waste and using resources wisely is good for the environment and the bottom line. Resource stewardship and sound economic performance are not mutually exclusive, but complementary.

Integrating waste minimisation into all aspects of meat processing would improve the meat sector’s contribution to resource stewardship while benefiting the industries economic performance and marketing image. While it is possible overseas market demands may help to drive sustainability into the industry, this is by no means a given and can not be depended upon. For example, the anticipated requirement for ISO14001 has not eventuated, and environmental pressures are perceived to have diminished.

A more proactive position for the meat industry would be to actively reduce waste and improve efficiency in all aspects of its business, which as well as providing economic benefit, would prepare the industry for any future market-driven demands from overseas customers. Some recommendations to assist the meat industry to move in this direction are outlined below.

Recent attention by overseas customers on animal welfare issues has resulted in meat companies becoming actively involved in on-farm, transport and processing plant-related stock management issues. Customer concerns have helped catalyse a number of initiatives looking at supply chain issues. The importance of sustainable farm practices is gaining prominence, with one example being the joint sponsorship by the PCCS and Richmond of the beef and sheep farm award in the 2002 Ballance Farm Environment Awards (see Case Study 6.1).

Another recent initiative is the Green Project, which has the objective of developing a minimum voluntary New Zealand standard for the sustainable production of sheep, beef, deer and goat (see Case Study 6.2). This jointly-funded project includes Richmond Ltd as the lead meat company. The Green Project is still under development.

Recommendation

- Continue the co-ordinated development of sustainable farming initiatives that includes key stakeholders such as the meat processing industry, Federated Farmers, local government and MAF.
- Move toward supply contracts that require compliance with the developed sustainable farming standard.

The meat industry draws on a broad range of suppliers and as an industry group it commands significant purchasing power. The extension of the supply chain concept to encompass wider purchasing requirements would benefit the level of awareness within the industry of environmental responsibility as well as reducing the industries environmental impact.

Recommendation

- Introduce environmental purchasing policies to lever off the sector’s purchasing power.

The meat processing companies have implemented a wide range of positive measures to reduce waste and improve resource efficiency. For the most part this has not been the result of a systematic approach to reducing waste, but rather a strong production and product yield focus on profit improvement. As a consequence, although the industry is less resource intensive than 10-15 years ago, there remains a significant opportunity to reduce waste.

Recommendation

- Integrate waste minimisation as a core principle within all profit improvement programmes.
- Develop company policy, monitoring systems and accountability (e.g. key performance indicators) that integrate profit improvement and resource stewardship across all company operations and processes.
6.7 References


6.8 Acknowledgements

Grateful thanks to the Economic Service, the meat industry representatives for their time and valuable input, the Wellington Regional Farm Environment Award personnel and Punawai farm for their assistance confirming on-farm data.
7

The Forestry Sector
Angela Duignan¹, Peter Hall¹,
Per Nielsen³ & John Gifford⁴

7.1 Introduction
Forests cover 30 percent of New Zealand’s land area, providing habitat for flora and fauna whilst conserving soil, improving water quality and creating recreational facilities. Plantation forestry in New Zealand began at the turn of the last century in response to a foreseen depletion of our native forests as people were using more timber than they were growing. Pinus radiata was introduced to New Zealand in the late 1920s and, since that time, continual improvement and research has produced a tree that can be harvested in short rotations of twenty-five to thirty years compared with 50 and sometimes 100 years overseas (NZFI, 2002).

Plantation forests cover 1.7 million hectares or 6% of New Zealand’s land area, the bulk of which are in Pinus radiata. New Zealand’s climate and soil ensures that tree growth is highly productive with yields of 400-500 m³ per hectare (NZFI, 2002). Whenever a stand of trees is harvested, stems are removed then the site is prepared for replanting the following year. This practice of sustainable yield forestry ensures New Zealand’s forests can provide fuel and fibre for domestic and overseas markets in the distant future. Radiata will continue to be the major plantation species for many years to come, however attention is increasingly focussed on the potential of other species such as Douglas Fir and Eucalyptus for specific sites and uses.

Wood product production involves over ten separate stages. These include planting, growing, harvesting, processing, secondary processing, marketing, and retail. Once the product is in use, the final product stages are recycling or reuse, disposal and finally combustion or decomposition. New Zealand has completed around 15-20 life cycle assessments (LCA) studies that relate to forestry and construction materials with a further 20 relevant studies identified from international literature, which are compiled in Gifford et. al. (1998).

The forestry industry can be divided into log production and wood processing sectors. An estimated 18.5 Mm³ of wood were harvested in the year ended March 2001, the majority from planted forests in the central North Island. Figure 7.1 illustrates the size of plantation forests by region with the Central North Island the largest area of 576,000 ha. Wood harvested from New Zealand’s forests are used to make a wide range of products for use in domestic, commercial and industrial applications. New Zealand’s forest industry supplies 1.1% of world and 8.8% of Asia pacific’s forest products trade from just 0.05% of the world’s forest products trade (NZFI, 2002). Table 7.1 summarises primary production of annual harvest and the volume of products exported. Logs, sawn timber and pulp are the main products with approximately one third of produce exported overseas. Timber as a building material has many natural benefits due to its strength, light weight, simple construction systems, durability, aesthetic quality, warmth, biodegradability, renewability, and low embodied energy.

Forestry accounts for 4% of GDP. Overall 70% of the forest products produced or 13 Mm³ are exported in raw and processed forms, earning New Zealand $3.6 billion and ranking forestry third in terms of commodity exports (FIC, 2001).

Large areas of marginal agricultural land were converted to forestry during a significant planting boom back in the 1970s. These trees are ready to be harvested and as a result, by 2010 the industry will potentially have 12.5 Mm³ of wood additional to its current processing and log export requirements, to export as logs or to process into added-value products. This ‘wave of

¹ Forest Research (since left); ² Forest Research; ³ Forest Research (corresponding author)
opportunity’ will not only increase the size of the industry by 1 million m³ pa over the next 15 years and therefore virtually double the resource, but will also make forestry the number one exporter in New Zealand and provide direct jobs for 60,000. The forest industry currently provides jobs for about 23,500 people directly and 100,000 indirectly. There will also be additional infrastructure improvements such as road and rail, energy supply and human capital development, particularly in new forest regions such as Northland and East Cape (MAF, 2002).

The forestry sector has major social, economic and environmental implications for this country. New Zealand forestry plays an important role in providing not only an abundant wood resource for building and other uses, but also in economic and regional development, recreational use, biofuels and sustaining forest and wildlife ecosystems.

The relatively young age class of plantations and an afforestation rate of 45,000 hectares per year makes New Zealand’s forest a carbon sink (NZCCP, 2001). This fact has considerable worth on the international market due to carbon trading under the auspices of the Kyoto Protocol.

<table>
<thead>
<tr>
<th>Process</th>
<th>Log &amp; Chip</th>
<th>Sawn Timber</th>
<th>Pulp &amp; Paper</th>
<th>Panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Plants</td>
<td>N/A</td>
<td>350</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Production</td>
<td>18 M m³</td>
<td>3.8 M m³</td>
<td>Pulp 1.6 Mt and Paper 0.87 Mt</td>
<td>Veneer 0.4 Mm³ 1 Mm³ fibre &amp; particle board</td>
</tr>
<tr>
<td>Export %</td>
<td>21</td>
<td>22</td>
<td>33</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 7.1: Forestry primary processing production including exports, MAF Stats, 2002

Figure 7.1: New Zealand’s plantation forest area in ha by region (NEFD, 2000)
New Zealand produces wood more efficiently and with less impact on the natural environment than almost anywhere else in the world. Forests have important roles to play in delivering sustainability, because they:

- soak up carbon dioxide, a potential cause of climate change;
- create habitats for many native birds and animals;
- create jobs and wealth across the regions;
- offer recreation and tourism opportunities; and
- provide timber and other wood products sourced from a renewable resource.

7.2 Resource Use and Waste Minimisation within the Sector

As mentioned earlier, the forestry sector involves harvesting, sawmilling, panel production, pulp and paper making, and re-manufacturing. The processes used for each are summarised below:

Harvesting is the conversion of stems in the forest to logs ready for transportation to mills or port. Stems are felled and converted into logs by removing branches and cutting to grade orders. Logs are loaded onto trucks at landing or skid sites or, if moved to a central site of significant size, a central processing yard (CPY). Harvesting techniques include manual or mechanised operations, either ground-based or by haulers if on steep terrain (these use a winch, cable and pulley system to transport logs off steep slopes) thus labour, machine and fuel requirements vary according to techniques and terrain.

Sawmills use mechanical saws to convert wood to lumber. The design and technology used in a softwood sawmill vary greatly, depending on age of plant, capacity, log grades and required products and therefore a range of conversion efficiencies exists in the industry. Most sawmills produce primarily structural lumber products but, with an increasing volume of high quality pruned logs available, there is a trend towards appearance-grade products.

Logs are debarked before sawing then transported along feed decks to the headrig where the first saw converts the log into flitches or large dimension timber (see Figure 7.2). The cant is rotated and sent through the headrig saw repeatedly to recover the maximum amount of wood. The three types of saw used in New Zealand are bandsaws, circular saws and chipper canters of which the bandsaw is most efficient. The secondary saw cuts the flitches to narrower widths while edgers remove the outer rounded part of boards where the bark was once attached. Lumber is then docked, to remove defects and achieve a specified size. Lumber is often cut to 20% oversize to allow for shrinkage when timber is kiln dried to improve strength and reduce potential damage by decay from fungi. Timber is finally graded into different quality classes to maximise the timber value and rejects are conveyed to the chipper. timber can be treated with anti-sapstain and/or preservatives to resist damage-causing insects or fungi. As timber is stacked a tally is kept of the number and length of pieces to calculate total volume in the packet and thus assist in mill efficiency calculations.

Panel manufacture can be segregated into two distinct processes:

- Veneer, plywood and laminated veneer lumber (LVL) is produced by peeling off layers of wood from logs to form sheets or strips. These are subsequently glued together to produce reconstituted board products. Plywood is manufactured by gluing together one or more
veneers with alternate layers arranged at right angles to each other. Plywood is generally produced in panels and used in the construction industry due to its ability to withstand large racking forces such as an earthquake. The LVL process produces high strength solid timber componentry.

- Reconstituted panel products (RPP) such as particleboard, medium density fibreboard (MDF), and triboard. Five panelboard companies produce RPP (MAF Statistics). Fibreboard includes hardboards, insulation boards and medium density fibreboards (MDF), classified according to particle size, density and production method. Fibreboard is produced from low-grade wood and residues reduced to wood fibre from chips that are softened with heat (see Figure 7.3). The chips are fed into the centre of a refiner that consists of a pair of large discs rotating against each other. Wood fibres escape through a narrow gap in the refiner and are blown into a dryer. Resin is added to the fibre before it enters the dryer and air turbulence ensures that the resin is well mixed. The fibre mattress is formed on a moving belt and is progressively pre-pressed to consolidate and remove any air pockets. Mats are pressed long enough for resin curing, before removal for sanding, trimming to size, grading and packaging. MDF is primarily used in the joinery and furniture industry.

**Pulp** is the product of the mechanical or chemical breakdown of wood (fibrous cellulose material), into component fibres. For mechanical pulp, separation is brought about by applica-
tion of mechanical energy, which requires a large energy input and results in much fibre breakage and formation of fine fragments. Mechanical pulp has higher yields than chemical pulp due to the high proportion of lignin that remains in the product, requiring 2 t of green wood per tonne of air-dried pulp compared with 4.5 t of green wood for chemical pulp (AUSNEWZP&P, 1993). Chemical pulp is where wood chips are cooked with chemicals to degrade and solubilise the lignin. Wood is broken down into fibre and lignin in cooking chemicals. The cooking chemicals are separated from the fibres by washing and the resultant liquor is then concentrated and burned in a specially designed furnace. This allows the cooking chemicals to be recovered for recycling and also results in the production of energy to assist in driving the mill. Chemical pulps are bleached using chlorine. Effluent is then typically biologically treated in aerated lagoons.

**Paper** is made from prepared pulp stock on a paper machine. When mixed with water the mass of fibres can be spread as thin layers of matted strands onto a moving wire mesh. Heavy press-section rollers, absorbent felts and heat remove water. The layer of fibres remaining is essentially paper, although in practice other materials may be added such as fillers (clay or calcium carbonate). There is a growing contribution from recycled paper and paper board in the process with over 300,000 tonnes collected for 2001.

**Re-manufacturing** industry takes approximately 15% of the sawn timber produced in New Zealand (NZPMA, 1995). The principal inputs are sawn timber (frequently kiln dried) and energy. Sawn timber is resized, moulded and cut to remove defects. Further processing (finger jointing, laminating) may also occur with sanding to follow. The industry is geographically diverse and produces a range of products from doorframes to furniture.

Forestry as a sector is keen to live up to its image as an environmentally friendly choice for the environment and for material use because of forest ecosystems, the carbon-neutral, biodegradable nature of wood, and high levels of recovery, reuse, recycling and renewable energy utilisation. Waste minimisation within the forestry sector is not perceived as a major problem for the industry as a whole. However, a strong focus on reducing costs and improving efficiency exists as a key driver to increase recovery. An illustration of this is the lack of waste data collected and analysed both at a company and industry level. Significant research exists, but this mostly concentrates on increasing mill recovery and assessing wastes available for resources. However, the forestry sector uses significant quantities of resources including fibre, chemicals, water and energy and there exists a wide scope to reduce waste and continually improve resource stewardship.

Volumes of various materials dumped to landfills are site specific and occur when other uses for the materials are unavailable. The decision to landfill depends on the capacity of the landfill, distance for transportation and cost of disposal including environmental remediation conditions, compared to the costs of sending to another process. The exact quantity of woody residues from wood processing that is dumped is unknown, but was estimated to be around 1 Mm³ (solid) for the year 2000.

In the case of in-forest residues from harvesting, these are not toxic, contain organic and inorganic nutrients, and are usually dealt with inside the confines of the forest owner’s land. The dumping of the residues is an economic decision. The material is low value, produced from a strategy designed to create the maximum value return to the forest owner. Unless there are changes to the economics (an increase in price for industrial fibre or demand for bio-energy fuels) there are unlikely to be major changes to current practices.

Wood processing residues are sent to landfills if a more suitable use cannot be found or methods to reduce waste are not available, when no alternative markets exist, or these markets are saturated. Another reason is contamination such as stones and earth from yard scrapings during handling. Sometimes the volumes of certain types of waste are too small to justify reusing or,
recycling so are dumped to save transportation costs. Where biomass boilers exist, they are usually set up to take specific types of feedstock only. This means that the size, moisture content and calorific value are predetermined and anything that does not meet these criteria would decrease efficiency or damage the plant. Product off-cuts, rejects or trims contain glues or chemical treatments, which make them unsuitable for reuse or combustion, may be dumped. Again reducing waste in first place, by ensuring quality consistency, increasing accuracy of dimension specifications and reducing contaminants, would reduce waste and improve resource stewardship. In addition, wastes such as boiler ash, metal wire, strappings and general rubbish accumulate from operations.

Continual monitoring to meet discharge consents occurs regularly for both air and water emissions. Gaseous emissions include heat, steam, gases such as carbon dioxide, dust, particulates, and chemicals such as hydrochloric acid from pulp bleaching. This process has been modified to make processes chlorine free, avoiding the potentially harmful by-products of treatment, including dioxin traces. The main use of water is fibreboard and pulp mills where water is used to transport fibre. Pulpmill waste water streams are also often discoloured. Much work has and continues to be done to clean up effluent from pulp mills (see Case Study 7.4). The other main source of waste to waterways is landfill leachate. This leachate is likely to contain tannins and be acidic. The impact of these is mitigated by capping the residue dumps (minimizing water infiltration) and locating the dumps away from water courses. In some cases leachate traps are used.

For the subject of resource stewardship and waste minimisation, primary processing (which includes sawmills, pulp and paper mills, and panel mills) and the two steps directly before and after this, harvesting and remanufacturing, were considered significant due to the quantity of resources involved. New Zealand processed 12.6 Mm$^3$ on-shore and whilst each process facility functions as a separate entity, they are also interdependent on each other for fibre. There are several major forestry companies that own plant throughout the entire value chain, but there are also numerous privately owned companies that run small plants from portable sawmills through to moulding manufacturers.

Each process requires a unique mixture of machinery, labour, fibre, energy, chemicals and water as essential inputs. In the same way the products and subsequent waste streams also vary in both quantity and quality. However, processes are interdependent on one another so one factory’s waste is another factory’s resource and therefore it is difficult to refer to all residues generated as waste without considering the high rate of reuse, recycling and renewable energy within the system. This said, between 0.84 and 1 Mm$^3$ of solid waste is estimated to be sent to landfill every year in addition to gaseous and chemical wastes, so there is much to be done to achieve the government’s stated goal of ‘Zero Waste’ (MfE, 2002). In addition, the further up the processing stream the fibre is used the more value it has in monetary terms and also the more efficient the process, less handling and processing inputs are required resulting in a better use of resources.

Figure 7.4 is a flow diagram of wood consumption and outputs by sector in the forest industry.

Fig 7.5 illustrates flow of wood from harvesting through to primary processing including exports, residue production and disposal to landfill. This diagram, which only represents the first stage of wood product production, gives an indication of how many different processes and stakeholders are involved in the forest industry.

Resource use and waste minimisation for harvesting, sawmills and pulp and paper are presented separately in the sections that follow.

**Harvesting**

The principal resources consumed by the forest harvesting industry are heavy machinery,
labour, and diesel, to produce logs of various grades (peelers, sawlogs, industrial). Residues are produced in-forest during felling when breakage and delimbing create an estimated 1.29 million m³/year of residues on the cutover. Of this 0.61 million m³/year is on steep terrain where recovery would be difficult and expensive so residues, including needles and branches of the tree crown, are left to decay in situ and thus nutrients are recycled back into the soil (Hall, 1998).

Most harvesting operations require that the majority of short sections of stem wood are harvested and quality control procedures are in place to monitor the recovery of this material. Once stems are extracted to roadside landings, superskids¹ or central processing yards (CPY) for cutting into logs (more residues estimated at 0.58 million m³/year) and loading onto trucks, sections of stem wood mostly short (< 1.0m), are produced (Hall 1998).

At the stem to log processing site defects are cut out of the stem to produce logs of higher grade and value. The volume of residues produced is typically between 3% and 6% of the harvested volume, which arises from the practice of cutting individual stems for maximum value recovery rather than maximum volume recovery. The defect sections are often dis-

¹ Super skids are where logs are hauled from several stands; CPY are where full length stems are transported, then debarked, scanned and cut into logs.

Logging Residues, Highlands, Rotorua, 2002, Duignan
In total 1.87 Mm$^3$/year, or approximately 10% of the harvest, remains in the forest and is currently considered to be uneconomic to extract (Hall, 1998). The key area of focus for future improved management is the landing residue, which in many cases are simply dumped or abandoned in situ. There is significant potential for this material to be better utilised.

The other main waste besides residues includes exhaust emissions from chainsaws and heavy, diesel-powered, harvesting and log transport equipment.
Sawmills

All sawmills produce residues including wood chips, shavings, slabs, sawdust and bark. For 2001, the amount of log input required to produce 1 m³ of rough sawn timber was 1.89 m³ or an efficiency of 53% for planted production forest, an increase of 4% from 1990. For natural forests in 2001 the conversion rate is lower at 52% due to the predominance of hardwoods (MAF Stats, 2002). The final destination of these residues depends on markets for fibre and fuel on their own site and at other processing plants. Many mills use sawdust and bark as fuel for boilers that produce predominantly heat and, at times, electricity to run the mill and this renewable energy offers significant savings on disposal and energy costs. In addition biofuel is carbon neutral if sourced from sustainably-managed forests as the carbon released on combustion as carbon dioxide was absorbed by the tree during growth (Matthews, 2001).

Table 7.2 shows the destination of residues from sawmills by volume and illustrates improvements in sawmill efficiency in the last decade. Where no market exists for residues they are dumped to landfills. However, there was a 22% decrease in the amount of residues sent to landfill despite a 60% increase in total volume of wood processed, as conversion increased and residue markets increased for pulp mills etc (MAF Stats, 2000).

MDF production

MDF was introduced to New Zealand in 1976. New Zealand produces 875,000 cubic metres annually, less than 20 per cent of which is sold locally (BIS Shrapnel 2001). Predominant domestic uses include furniture, cabinetry, joinery, doors and it is estimated that MDF users account for 20%-30 % of furniture manufacturers, 60%-70 % of joiners and 90%-99 % of cabinet makers. There are four main manufacturers of MDF and increasingly their fibre input is sourced from residues, rather than chipping logs, which contributes to making MDF a recycled product.

Pulp and paper

Pulp and paper manufacturing produces a range of outputs to air, land and water especially if a chemical pulp process is involved. Due to the large-scale nature of these plants and their high demand for heat and steam, most of the residual material is used for fuel or recycled back as raw materials. Recycling of water, fibre, chemicals and the calorific value of the spent cooking liquor from the Kraft Recovery process is a critical practice in pulp mills as the chemical process is economically dependent on the recovery of chemicals. Technical problems, however, such as silica content of the liquor, sometimes set a limit to the possibilities of closure of the mill

Case Study 7.1: Fibre Recovery Limited — Kaingaroa Forest

Kaingaroa is a large (149,000 hectare) mature forest in the central North Island. Harvesting practices have changed, from stem to log processing at individual landing scattered throughout the forest to central processing yards where up to 900,000 m³ per annum is processed. Consequently stem wood residues are produced in significant volumes (20,000 m³ per annum) at a single location. In situ dumping of the residues was not possible so a system was developed to create a range of products from the stem wood residues. The stem wood residues are segregated by length. The longer sections are debarked and chipped to create a feed stock suitable for pulp chip.

The shorter sections are fed into a large tub-grinder, screened for fines and oversize and the resulting product is suitable feedstock (flake) for particleboard plants. The fines and debarker waste can be mixed and sold as boiler fuel. Keys to this operation are the scale of the harvesting operations and the ability to transport some of the material in oversize trucks and local demand for all three products.

Alastair Deakin. Fletcher Challenge Forest
systems. Water is used by the industry in large quantities as a carrier to move the pulp around the mills. Much of this water is evaporated through drying processes and other recovery systems. Figure 7.6 shows a mass flow diagram for a kraft pulp and paper machine at a typical pulp and paper mill (Kinleith), and illustrates the complexity of the processes involved.

The process outlined above was developed through continual improvements to increase recovery and reduce waste (see Case Study 7.4 for a brief description of some of these changes).

**Remanufacturing**

Remanufacturing covers a broad range of operations including finger-jointing, moulding and

<table>
<thead>
<tr>
<th></th>
<th>1990 (000m³)</th>
<th>2000 (000m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total sawlogs (roundwood input)</td>
<td>5733</td>
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</tr>
<tr>
<td>Total sawn timber production</td>
<td>2828</td>
<td>5075</td>
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<tr>
<td>Efficiency</td>
<td>49%</td>
<td>54%</td>
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<td>Fuel</td>
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<td>129</td>
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<tr>
<td>Sold to pulp mills</td>
<td>29</td>
<td>302</td>
</tr>
<tr>
<td>Sold to panel mills</td>
<td>29</td>
<td>43</td>
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<tr>
<td>Other uses</td>
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<td>388</td>
</tr>
<tr>
<td>Waste</td>
<td>610</td>
<td>475</td>
</tr>
<tr>
<td>Total assumed residues (000 m³)</td>
<td>2 905</td>
<td>4 316</td>
</tr>
</tbody>
</table>

Table 7.2: Total wood production in the forestry sector, including exports (MAF Stats 2000)

Contact: Jeremy Smith, VL Smith Sawmill, Tel: 03 319 5447

Last year they upgraded their sawing equipment. This included moving from a circular saw to a bandsaw and introduced a new setting system. The circular saw is the familiar circular blade rotating around a central axis (arbor). The blade is thicker than some other saws and has a larger kerf, producing more waste (sawdust). A bandsaw is an endless steel band that is strained between two large wheels, the lower one pulls the blade down through the log as it is fed into the saw. Bandsaws have a narrower kerf and are more efficient. The log is fed to the saw on a log carriage that can position or rotate the log to present the desired face to saw. Exposing the first face is the step that determines maximum recoverable volume achievable from the log. The cutting pattern determines how or in what order cuts will be made on a log. Different patterns have been developed to suit different logs and enhance utilisation and value recovery. Each has various advantages and disadvantages in processing speeds and costs, grade targeting and product quality. The simple act of changing one saw reduced sawdust produced by 20% and therefore significantly increased recovery. The setting system increased accuracy to 0.1 ml from 2 to 3 ml with a payback period of a few months.

This case highlights the role of the numerous small stakeholders involved with the processing industry who cannot afford to keep up to date with and make capital changes on a regular basis. However simple, transformational changes can occur from wise investments.

Contact: Jeremy Smith, VL Smith Sawmill, Tel: 03 319 5447

**Case Study 7.2: VL Smith Sawmill**

VL Smith Sawmill is a family-run sawmill based in Canterbury that processes 10,000 tonnes of radiata log per year, the main output being timber production. Residues produced include sawdust and shavings that are burnt in a boiler, and bark that is sold for landscaping.

This case highlights the role of the numerous small stakeholders involved with the processing industry who cannot afford to keep up to date with and make capital changes on a regular basis. However simple, transformational changes can occur from wise investments.

Contact: Jeremy Smith, VL Smith Sawmill, Tel: 03 319 5447
Case Study 7.3: Production of MDF boards, Nelson Pine

Nelson Pine is one of the larger producers of MDF boards in New Zealand. During 2001, 510,000 tonnes of logs with an additional input of 130,000 tonnes of chip, sawdust and other material, were processed to produce 313,000 tonnes of MDF boards for kitchen units, furniture and construction purposes. During debarking and chipping 480,000 green tonnes of chips are produced plus 35,000 tonnes of residue (mainly bark). Total residues on site are 70,000 tonnes including sander dust, trims, and reject board. All residues are used as fuel for raising steam in the drying process.

The company continuously strives to achieve the best resource management, maximise recycling and reduce any waste of fiber material, which can be recycled into the MDF production process as well as reducing other waste streams such as water and glue consumption and ash disposal. In general the MDF production produces very little waste, mainly ash and water. However, different methods are continuously applied to reduce residue production, which consists of moving wood waste up the value chain and therefore increasing the amount of fibres going into MDF board production. The production of bark on-site has reduced in recent years due to increased use of mechanical harvesting, particularly mechanical deliming, before the logs arrive at the MDF plant.

Two examples could be mentioned as a way to increase the efficiency. One example is a technology, which was developed by Nelsonpine, as a fibre recovery process, where 1%-2% of fines are recovered from the chip wash and put back into the MDF production. Alternatively these fines would have been screened out prior to chip washing and used for fuel. If, by conservative estimate this saved 1.5% of the chip previously screened and burned, it represents a saving of about $500,000 per year in wood costs.

Another example is the installation of an effluent treatment plant, which produces sludge dry enough to burn. Previously the liquid effluent was given primary treatment in a settling basin where the suspended solids settled out. This basin was periodically dug out and the sludge trucked to land fill. This process was replaced with a Dispersed Air Flotation clarifier and a high compaction ratio slow rotating screw press. The solids from the screw press are sufficiently dry to burn in the furnaces. The screw press has proved to be a very effective and reliable piece of equipment.

This screw press also has the facility to steam heat the hollow shaft of the screw and increase further the dryness of the sludge improving its calorific value. Consideration is being given to using the blow down from the steam generator to provide the steam for this application.

The waste minimisation and recycling of fibres into the MDF production process is economically beneficial. Whilst measuring the economic benefits of new waste minimising developments is not always straightforward, their integration into modern MDF factories is a recognition of their economic benefit.

Contact: Philip Wilson, Nelson Pine,
Tel: 03 543 8871
furniture making. The final use of such products means the appearance of the wood is important and therefore clear lengths of timber are used between whorls of knots. The whole process results in residues such as off-cuts, shavings and sander-dust. Shavings can be used as fuel, feedstock for pulp or animal bedding, and some is dumped. Case Study 7.5 provides an example of how the trim and other residues are reused to make firewood logs in the winter months and to provide fuel for the sawmill boiler in summer. Again the incentive for this change was the introduction of dumping fees.

Another example of utilising residues as fuel is that of Blue Mountain Lumber (Case Study 7.6). This is a good example of large-scale residue handling occurring on-site, therefore avoiding transportation, which allows for cogeneration, the production of both heat and electricity to the mill and remanufacturing plant.

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**Figure 7.6: A summarised flow diagram for the Kinleith pulp and paper mill (CHH, 2002) — continued overpage.** Key: t/a: tonnes/annum; Ml/a: megalitres per annum; MW/a: megawatts per annum; adt/a: air dried tonnes per annum; TRS: total reduced sulphur; BOD: biological oxygen demand.
7.3 Using Waste Minimisation to bring about Resource Stewardship

A significant benefit of resource stewardship and increasing efficiency is the reduction of the number of freight trucks on the road. Residues for various plants can be sourced from over 100 kms in addition to logs and product movement. Trucks and the consequent social and environmental implications could be avoided if residues were minimised at source.

Transport of logs from forest to mills and ports is a significant resource use. There are a number of initiatives current in the forest industry, which aim to improve the efficiency of this operation. These include computer optimised truck scheduling (to reduce truck capacity requirements by eliminating waste queuing and travel). There are also initiatives to improve tracking of loads and logs by electronic tagging, which will improve inventory control and reduce stocks and costs. An allied initiative which will affect all road freight transport is the initiative driven by the Road Transport Association to increase the maximum length and weight limits on trucks. If successful this would increase the efficiency of road transport of logs and other forestry derived products.

With over 350 mills of various capacity, sawmills are a key focus of any drive to increase resource stewardship. The more modern the equipment the higher efficiency achieved through technological development and hence increased recovery. Balance books are the primary decider of further upgrades with each efficiency gain justified by cost outlay versus increase in return. Hence the higher the price for timber and associated wood products the greater the
Case Study 7.4: Kinleith Pulp and Paper Mill

Kinleith pulp and paper mill has an environmental policy with the aim of continuous improvement in management practices, equipment and resources. Policy includes all capital expenditure signed off by the environmental manager, operations conducted in ways that result in the more efficient use of natural resources their ‘Resource Efficiency Principle’ and waste will be minimised and, where possible, eliminated the ‘Waste Minimisation Principle’. All employees undergo environmental training, including waste minimisation. As well as policies and education the performance of the mill is measured daily using an Environmental Performance Indicator (EPI) based on the quality of air and effluent discharged from the mill. Levels are compared against compliance limits or targets that are reviewed annually.

Waste reduction has occurred at several stages of the mill process through new and improved technology. Examples include: plant modernisation in 1991 that reduced waste flows and organic loadings by 40%, reduced discharge colour by 60%, and reduced discharge of chlorinated compounds by more than 90%. In 1997 further plant modernisation resulted in the reduction of water usage and waste water volume of 25%-30%, reduction of organic material discharge of 25-30%, and reduction in discharge colour of 25%-30%. A specific, recent example is the installation of foul condensate stripper that has resulted in significant reductions in odour and wastewater discharges. Emissions to air were reduced through the following steps:

- Shut-down three recovery boilers and started-up a low-odour boiler (reduced TRS Emissions);
- Upgraded no. 3 lime kiln and tall oil plant (reduced TRS Emissions);
- Improved recovery boiler odour control (reduced TRS emissions); and
- Shut-down 2 and 3 primaries and started-up cogeneration plant (reduced particulate emissions, able to burn biofuel).

This commitment to continuous improvement has seen water usage and contaminant loads (waste) decrease dramatically over the years. To minimise solid waste to landfill a survey of all solid wastes generated and their destination was undertaken and the following initiatives were introduced:

- waste segregation occurs using different coloured bins for general waste, waste paper and boxes and scrap steel.
- all steel scrap is recycled;
- concrete from demolition is crushed for road metal;
- unglued ply trim from the plywood mill is hogged and burnt as are untreated packing crates and pallets;
- office paper waste is recycled;
- operation cleanup was introduced to minimise oil use on site and waste oil is collected; and

CHH Kinleith Mill, Tokoroa Barren
The Forestry Sector

Incentive to invest. Similarly a greater cost of disposal provides increased justification to reduce residues and associated transportation of wastes. Depending on the size and age of the plant, some mills upgrade during a total overhaul, spending millions of dollars, some invest money on an incremental basis, whilst for smaller mills, one-off capital expenditures occur. There was a large wave of capital replacement in older mills that occurred during the transition from native timber to radiata. Some mills run fortnightly recovery and production checks to ensure machines and staff are operating to plan.

The sawmilling industry has seen major improvements in processing technology to enhance recovery and reduce costs. Major gains in mill efficiency include replacing circular saws with bandsaws, use of scanners and electronic control systems along with saw improvements for secondary saws and edgers. Laser guides, log scanning and timber grade recovery software have all improved value recovery, mill throughput and simplified process control. Many other facets of the industry can identify similar process gains. Most sawmills are continuously striving to improve productivity and are looking for tools, that can help them. Over the years Forest Research has developed a number of tools to improve sawmill productivity, including:

- a saw tooth inspector to measure critical angles;
- fibre spills are reclaimed and lime is now used as a fertiliser instead of being dumped.

Future initiatives include the continual reduction of waste at source and burning of all recycle plant waste and glued plytrim (requiring a consent change that has been applied for). A recycling facility is being set up to handle all non putrescible waste from Kinleith and the Industrial Park so only material that cannot be reclaimed and/or recycled will be dumped to landfill after sorting and compacting. Alternative uses for clarifier sludge will be found (this may be burning or land spreading).

#8 Boiler ash will be spread onto forest landings along with logyard scrapings to add minerals back to the forest. In addition, Kinleith mill has formatted the Kinleith Consultative Group, which has a wide range of stakeholder representation and aims to increase knowledge about Kinleith’s environmental performance including aspects such as resource stewardship and waste minimisation.

Contact: Paul Dykstra, CHH Kinleith Mill, 07 886 3593

Case Study 7.5: Trayco Manufacturing

Trayco Manufacturing is a lumber re-manufacturing operation in Tauranga who source their dry lumber from sawmills in the Bay of plenty, with a significant proportion coming from the FCF sawmill in Kawerau. The operation produces fruit boxes for the local market and blocks of finger-jointed material for export to the USA. The operation produces about 25 to 30 tonnes of sawdust per day. In the past this material was dumped at a local landfill free of charge as it was used as clean cover by the landfill operator. When the landfill operation changed to a transfer station, charges of $600 per container were introduced. This was an incentive to utilise the sawdust for some other purpose. This material along with other material (hogged off-cuts and blocks) is compressed into firewood logs and sold for use in domestic fireplaces. Demand varies according to the time of year and during summer months sawdust is returned to the Kawerau mill to be used as boiler fuel.

At full production during winter the operation produces 80 to 90 tonnes per month (at 5% to 6% moisture content) of “HOTLOGS”. The constraint to further expansion of the use of wood processing residues to make fuel logs is obtaining guaranteed supply of the residues.

Contact: Graeme Wooley, Trayco Manufacturing, 07 578 465
• a band saw strain measuring system;
• log and top wheel movement measuring systems;
• data logging for size control (T-Size 2002);
• a glue line pressure sensing system; and
• sawblade temperature and displacement measuring systems.

Other upgrades include external and internal scaling of logs, improvements in resource handling to prevent contamination, spoiling and water saturation, new debarking equipment, improving sawing curf (blade thickness), computerised log input, minimum opening face scanners and computer analysis rather than manual. Preservation consumption through timber treatment has leveled out in the last few years due to use of techniques such as kiln drying, though recent proposed changes to the Building code may impact on this. Monitoring efficiency occurs through size checking lumber after sawn for consistency and keeping up with latest developments is in itself essential and involves networking, analysis and variation on conversion factors. National initiatives to provide greater uniformity for log input and sizing of finished sizes of product to meet export requirements will prevent the resource-intensive practice of trying to be all things to all people. Another non-technical improvement is transferring from throughput analysis to increase sawn timber fibre recovery.

New Zealand’s emphasis on one species has helped with tree breeding programmes. Improvements focused initially on genetically controlled improvements such as smaller branches, less spiral grain, greater density and strength. In the future, it is likely the ability to ‘manage’ selection of genetic qualities will enhance and speed up this process. Most sawmills are designed to take radiata, a softwood. The increase in different species, particularly hardwoods such as eucalypts, and indigenous timbers will result in lower conversion efficiencies due to increased wood strength and subsequent cracking.

The conversion factor is heavily affected by the quality of the raw material, which is generally

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**Case Study 7.6: Blue Mountain Lumber**

Blue Mountain Lumber is a large sawmill in central Southland (Tapanui). Its log input is in the order of 180,000 cubic metres of logs per annum. Associated with the sawmill are drying kilns and a re-manufacturing plant.

The sawmill produces waste in the form of sawdust, green shavings and bark, totaling 50,000 cubic metres, or 28% of the input volume. Much of this residue was being burned to create heat for the kiln drying of sawn timber. However some (green sawdust) was being landfilled. As the facility expanded and the existing heat plant aged, the possibility of expanding the heat plant to consume all of the residues from the site came about.

Along with the sawmill residues the adjacent re-manufacturing plant produces 5,520 cubic metres (solid) of dry shavings and 11,200 cubic metres of dry block wood per annum. This material is used as fuel for a co-generation system that produces electricity and heat for kiln drying. Hence the re-manufacturing residues provide energy (heat and power) for the production of its raw material (kiln dried sawn lumber) and power for the re-manufacturing plant itself.

A key to this operation is its scale, the combined residues of the sawmill and re-manufacturing plant total in excess of 66,000 cubic metres solid (or 311,000 GJ of energy). Not all of the residues can be consumed by the existing co-generation plant, and some is still dumped.

Contact: Paul Adams, Auld Allan Consultancy, 03 208 4284
considered to be quite variable within the industry. The presence of a range of defects (resin pockets, checking etc) in the raw material combined with high customer expectations is leading to high rates of discarded defect material. This decline in quality has lead to increased docking (off-cuts) of defects from the product, which also relates to the veneer and remanufacturing industry. Purchasing from proven quality sources has become a driver, with competition for logs from some sources increasing raw material prices. The ideal log is wide diameter and pruned; however, a significant volume of wood coming on line has small diameter and lots of knots.

Poor matching of materials to processes and products results in significant losses to the industry. This problem is becoming more acute as variation within the resource grows, with an increase of logs grown from small sites. The focus is therefore on providing the tools that will allow managers to identify in stems and logs on the skidsite, and in lumber at the sawmill, those properties that are going to be important to the performance of the end product. In this regard, non-destructive testing is becoming an important tool, application of modern scanning, image analysis, simulation, optimisation, and process control techniques, to increase the efficiency of these processes. Priority for the forest industry is moving from growth and yield to enhancing wood quality to ensure that logs produced are of high quality suitable for the purpose.

7.4 Governance of the Sector

The Forestry sector is governed on environmental and health issues through voluntary and legislative codes and practices from government, community and the industry itself. The all-encompassing Resource Management Act (RMA) applies to the forest industry and is the key environmental legislation that provides guidelines and standards across a range of activities from plant establishment to discharges to air, land and watercourses. Implementation occurs mostly by territorial authorities such as Rotorua District Council for land issues and regional councils such as Environment Bay of Plenty (EBOP) for water and air discharges. The RMA therefore covers specific issues such as water runoff, storm water discharge, suspended solids from bark, noise levels, testing and monitoring for pollutants such as copper chrome arsenic (CCA) and formaldehyde, and clean air from boilers, planers and kilns. An environmental management system (EMS) is usually required as part of the consent process.

To aid understanding of the sometimes complex requirements of the RMA a working paper on managing vegetation disturbance activities under the RMA, “The Way Forward: Forestry and the RMA” was developed by the Ministry for the Environment (MfE) in 1999. The paper provides an MfE view on the preferred approach to managing vegetation and soil disturbance activities under the RMA, and includes a set of model permitted activity conditions for these situations. A similar approach could be used to prepare best practice guides for wood processing activities as suggested by the wood processing strategy. Other environmental policies of relevance include MfE landfill guidelines, the New Zealand Waste Strategy, and the Environment 2010 Strategy. Some government policies are related to international treaties such as the Kyoto Protocol, and Agenda 21 based on sustainable development, which are being picked up by government and industry leaders (WBCSD). The Health and Safety Employment Act applies to all forestry employees and is enforced by Occupational Safety and Health (OSH), a division of the Department of Labour, as well as the 1994 Approved Code of Practice for the Safe Use of Timber Preservatives and Antisapstain Chemicals and formaldehyde standards in preparation.

There is an increasing role for the forestry industry in self governance through a range of best
practices and operations guidelines such as New Zealand Forest Code of Practice, and New Zealand Forest Accord. Forest Industries Training produce several operations guidelines including cable logging, ground-based logging, tree felling, land preparation, and forest roading manual. Industry groups such as the Pine Manufacturers Association (NZPMA) and the Timber Industry Federation (TIF) liaise closely with members to ensure quality standards are maintained. For example TIF recommend standards across the industry including grade sizes and pack sizes, to ensure mills are producing the same product to the same standard. There are significant gains from uniform practices such as using the same measurement units. For example, clearwood, best quality timber is exported to the US and specifications are therefore in feet whereas other measurements are in metres.

New Zealand is an active participant in the Montreal Process. The Montreal Process is the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests. It was formed in Geneva, Switzerland, in June 1994 to develop and implement internationally agreed criteria and indicators for the conservation and sustainable management of temperate and boreal forests. As a guarantee of environmental performance, many companies have also sought some form of forest certification, which demonstrates that their forest management operations do not cause irrevocable harm to our land, air, water and wildlife, and respects community interests and cultural heritage. Forest Stewardship Council certification applies to the majority of forestry companies in New Zealand. Principle 5, Criterion 3, states forest management should minimise waste associated with harvesting and on-site processing operations and avoid damage to other forest resources (FSC, 1998). Appendix 1 contains the full text of the FSC Principles and Criteria. There are also provisions for reducing the amount of chemicals applied and safe removal of waste oil and chemicals. Forest Certification is of particular importance for native logging practices such as Silver Beech harvesting on the West Coast.

In addition, the public at large continue to be involved in setting environmental standards through local community and Iwi consultation for RMA applications, and general expectations from neighbours and tourists on issues such as odour and visual waste. Industries such as the pulp and paper industry, which are often identified as major sources of pollution, are the target of a lot of public concern. Increasingly stakeholder pressure is concentrating on the environmental and social performance of companies.

7.5 Drivers for Change within the Sector

A key driver for change is the price of wood at an international commodity level. As a primary processing industry, forestry is dependent on fluctuating prices driven by off-shore demand and currency exchange rate. If these combine to push prices for logs, chip and pulp up, resource stewardship becomes more critical. To maintain competitiveness there is a continual drive to improve efficiency and quality performance, and to reduce waste and close systems. Very competitive markets are driving the improvements in efficiency, with relative log prices and costs perceived to increase whilst sawn timber price remains static, therefore owner operators are always looking at better ways of doing things. Another driver for change within the sector is the application of awareness of fibre recovery to other inputs such as chemicals and energy and achievement of waste minimization through improved conversion rates.

So, while the major driver of waste minimisation is economic, environmental considerations also play a role, such as those required under the RMA. The introduction of the New Zealand Waste Strategy (MfE, 2002) has put the onus on companies and authorities to reduce the volume of material sent to landfill. Putting a price on resources that reflect their true value is the fastest way to reduce waste. However, many companies are small- to medium-sized and have a limited ability to continually upgrade and modernise plant. This can result in very inefficient plants operating and the corresponding production of wastes. However, when knowledge of 'best
technologies’ is available, upgrades can often occur with impressive payback periods (see Case Study 7.2, above).

The Wood Processing Strategy (WPS) is a partnership between the forest industry and central and local government. WPS aims to accelerate the development of wood processing and get the best value from the regional expansion of wood by attracting new investment, processing at least 50% of the increased harvest in New Zealand, and maximising wealth creation, employment and infrastructure. (WPS, 2002). If there is a rush of new processing plants installed, it is important that these plants incorporate resource stewardship for environmental, social and economic benefits. To aid plants through the planning process, the WPS is proposing a definitive best practice standard or code of practice for wood processing industries to be established, which would include industry training and measuring the success of the code.

Such a best practice guide could incorporate consideration of issues such as:

- dust emissions (particularly from sawmill and MDF activities);
- noise issues (particularly in relation to possible double shift or 24 hour operations);
- fugitive emissions (particularly formaldehyde emissions from MDF and LVL operations);
- stack emissions;
- log handling issues, including yard stormwater controls;
- traffic issues;
- avoidance of site contamination (particularly for timber preservation activities);
- lighting and glare issues; and
- monitoring requirements and measurement methods.

With resource consent compliance, there is some indication that the wood processing industry could improve its practices. In the Bay of Plenty Region, for example, while wood processing industries accounted for one-quarter of the consents assessed, these industries accounted for 50% of those rated as having a ‘poor’ compliance record (Environment BOP, 2000). Site management issues were cited as primary reasons for non-compliance with resource consent requirements.

Increasing harvest and therefore residue volumes will increase the scale of supply and disposal issues. Expansion of wood processing at a district level may provide demand opportunities for wood residues as fuel in some regions (Northland, East Coast) where energy supply is currently limited for other energy sources (gas, coal and electricity). However, fragmentation of resource by region and owner is a constraint to progress with the utilisation of in-forest residues (and other woody residues). Gas is currently widely used in the wood processing industry; if the supply of gas becomes constrained (and the price rises) some users of gas may seek alternative and renewable fuel sources, such as forestry and wood processing residues. The Energy Efficiency and Conservation Act (EECA) and the subsequent EECA strategy aims to encourage and incentivise energy efficiency improvements in existing and new industry. The forestry sector is responsible for about 10% of the country’s energy demand, half of this is met through self-generation of bio-energy. The wood processing strategy in association with the Bio-energy Association of New Zealand (BANZ) aims to optimise the amount of bio-fuels used for processing and this will increase the value of wastes and reduce emissions from and dependence on non-renewable fossil fuels (BANZ, 2002).

Over the next decade the cost of disposing of waste to the environment and the cost for natural resources such as water will increase. Therefore more efficient use of raw materials and a decrease in the amount of waste generated through awareness of resource stewardship and waste minimisation programmes is a key to minimise environmental impact. Avoiding these
losses by adoption of cleaner production strategies improves both the financial and environmental performance of companies. Use of full cost accounting to highlight the cost of waste and its treatment is a good start.

As mentioned before, the key driver for reduction of waste or recovery is the price of logs. The higher the price the more likely it is that residue production will reduce by increasing conversion rates, and therefore the volume of high-worth product. This will eradicate unnecessary handling costs for disposal, and current low-value fibre, such as in-forest residues, will be recovered. This is illustrated through the ‘Wood Hierarchy’ where the value of fibre is related to consistency, quality and therefore applicability for use in high-grade product manufacture.

It is critical that increasing efficiencies do not create a situation whereby a boiler or process is resource constrained. The close link between residue reduction and feedstock requirements for processes such as fibre boards and bio-fuels is one that the industry is looking closely at and in future will require close co-ordination between stakeholders to ensure all requirements are met at least cost. The essential factor is the hierarchy of uses and cost drivers for each region, a brief example of which is illustrated in Table 7.3.

### 7.6 Conclusion and Recommendations

The old saying ‘treasure what you measure’ is a key factor for resource stewardship through waste minimisation in the forestry sector, where waste as an issue is not prioritised historically due to an ‘out-of-sight, out-of-mind’ mentality. Whilst the use of resources, capital, labour and fuel is being scrutinised on an ongoing basis, for economic reasons this has not gone as far as to assess waste on a national, or in most cases, a company scale. Once the type of wastes generated are accounted for at an organisational level then greater measures to increase resource stewardship, decrease the liability of waste, and increase value recovery can occur. Already there are several examples of industry taking the lead on resource stewardship, which can act as flagships for other companies. In some cases these improvements are neither costly nor complicated. However, the diversity of stakeholders and processes means that replication is not always straightforward.

Residue recovery, reuse and recycling of fibre, steam and chemicals have always been an essential component of the highly competitive forestry industry, but with approximately 1 million m³ of residue landfilled per annum, there is still room for improvement. Technology is not a major constraint as modern machinery and systems are available both here and overseas. However, implementation involves education, awareness and economic incentives. The wave of

<table>
<thead>
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<th>Value</th>
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<tr>
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</tr>
<tr>
<td></td>
<td></td>
<td>boilers</td>
</tr>
<tr>
<td>2</td>
<td>wood chips</td>
<td>pulp, panels, exported, pellets, landfill</td>
</tr>
<tr>
<td>3</td>
<td>shavings</td>
<td>burn for fuel for kiln or particleboard, landfill</td>
</tr>
<tr>
<td>4</td>
<td>sawdust</td>
<td>wood panels mdf, animal bedding, boiler, landfill</td>
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<td>6</td>
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</tr>
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<td>8</td>
<td>MSW</td>
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</tr>
<tr>
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<td>Boilers</td>
</tr>
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<td>10</td>
<td>Sander dust, fines</td>
<td>Boiler fuel, Landfill</td>
</tr>
<tr>
<td>11</td>
<td>Yard scrapings</td>
<td>Landfill, boiler</td>
</tr>
</tbody>
</table>

Table 7.3: Optimal Residue Recovery according to Economic Value (Duignan)
opportunity has the potential to transform not just the forestry sector but also energy, waste and the wider economy at large. It is therefore crucial that resource stewardship is given the precedence it deserves in planning strategies, such as the best practice guidelines currently being developed, based on financial, economic and social reasoning.

As described by Forestry Insights (Forestry Insight, 2002):

“New ideas and technologies, more efficient process management, a better trained and more sophisticated workforce and marketing of improvements are required if the forest products industry is to continue to reduce waste at source.”

7.7 Acknowledgements

Unless otherwise stated all statistical figures on forest industry production are from MAF Forestry Statistics 2001. The Forestry Insights web site demonstrates forestry processing techniques. Thanks are due to the Forest Research staff and all those from industry who contributed their time (see Chapter 7 Appendix for full list of contributors).

7.8 References


CHH, Kinleith Mill, 2002. Cleaner Production Pre-Assessment


www.maf.govt.nz/forestry/woodprocessing/index.htm#Composite%20Panels

Matthews, R and Robertson, K, 2001. “Answers to ten frequently asked questions about bioenergy, carbon sinks and their role in global climate change”, IEA Bioenergy, Task 38


## Appendix to Chapter 7

### Project Contributors

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<td>Timber Industry Federation</td>
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The Forestry Sector  Page 97
8.1 Profile of the Built Environment Sector

The built environment sector is wide-ranging and includes a variety of building and construction-related industries, organisations and institutions. For the purposes of this report, the built environment sector has been defined as ‘all the structures and services relating to the provision of buildings’. The capital value of this ‘built environment’ accounts for approximately 9.5% of New Zealand’s gross domestic product (GDP) (Page, 2002).

The structural provision component of the sector puts in place about NZ$9 billion of buildings per year, representing approximately 8.1% of total GDP. On the whole, the sector is characterised by the small average firm size. For house construction, the average size is only 1.9 full-time equivalents per firm, and for non-residential building it is a little higher at 8 full-time equivalents (Statistics New Zealand, 1998). The small scale of operations is also represented in the market share. New Zealand’s largest house building company builds about 2.3% of all new dwellings (including apartments), and the top 10 build only 9.5% of all new dwellings in a typical year (Page, 2002).

Employment in the building and construction industries was approximately 116,000 in December 2001 (Statistics New Zealand, 2001) representing 6.2% of all employment. The type of work undertaken is shown in Figure 8.1, and is based on building consent values (averaged for the five years ending March 2002). The categories are mostly self-explanatory; ‘Dwellings Repairs and Minor Work’ relates to work that does not require a building consent. The figure is an estimate based on household expenditure surveys and is therefore an approximate figure.

As shown, ‘New dwellings’ are the major share followed by ‘Non-residential buildings’. New dwellings are mainly detached houses, but multi-unit buildings (i.e. apartments, flats and terraced housing) are currently 16% of all new dwellings by count, up from 7% in the early 1990s. ‘Repairs and Minor Work’ is becoming more important as the housing stock ages. ‘Non-residential buildings’ includes a large variety of buildings (see Figure 8.2). The largest sector is ‘Industrial’ (factories, warehouses, farm buildings), followed by ‘Office and Administration’ buildings.

![Figure 8.1: All types of work undertaken by the building industry (Statistics New Zealand, 2002)](image1)

![Figure 8.2: Non-residential work undertaken by building industry (Statistics New Zealand, 2002)](image2)
This physical and economic profile of the built environment stock shows the share of the various types of buildings. Two of the more significant types — residential houses and office buildings will be examined in the following sections. Three key ‘themes’ where improved resource stewardship can be achieved in relation to this stock will be explored in some detail. The key themes are:

- urban sprawl;
- material waste; and
- energy use.

These themes have been selected based on their global importance (i.e. issues that impact beyond regional/national boundaries), their lifecycle impacts (i.e. issues associated with continuing impacts over the lifecycle of a building), and their potential for change (i.e. the ability of addressing the problem).

**Urban Sprawl**

Urban sprawl is defined as dispersed development outside compact urban centres into suburban and rural areas — or more simply, wasteful use of urban space. New Zealand’s urban space is almost 900,000 hectares, which is 3% of our total land area (MfE, 1997a). Urban space can generally be defined as those areas either built upon, such as buildings and infrastructure, or used for recreational and community purposes (Bachels, Newman and Kenworthy, 1998). Eighty-five percent of New Zealand’s population live in this ‘space’ — one of the highest rates of urbanism in the world (PCE, 1998).

While a 3% urban land area can hardly be called crowded, the question is are we using it wisely? Many would argue that we are not (RSNZ, 1998; Memon and Perkins, 2000). Our cities are continuing to expand at relatively low densities. Since 1969 the area of land classed as urban has trebled (MfE, 1997a). The fact that much of this outward development and associated infrastructure provision has been on resource rich land — floodplains, estuaries and coastline — means that urban sprawl is a critical resource stewardship issue. Not only is it important in terms of lost agricultural land, biodiversity and open space, but inner city decay and loss of community character means that urban sprawl has many economic and social implications as well.

**Material Waste**

Worldwide, the construction of buildings consumes approximately three billion tonnes of raw materials, or 40% of the total material flow into the global economy (Roodman and Lenssen, 1995). The huge quantities of construction and demolition (C&D) waste created in all high-consumption countries illustrates how remote the goal of sustainable construction is. Solid waste creation is one of the big pressures that the construction sector places on the environment. It lags far behind other industries in terms of resource efficiency (reduced material consumption, increased reuse, and recycling). For example, a new automobile contains 70% recycled content, but a new building usually contains less than 1% reclaimed materials (Kibert and Languell, 2000). A more efficient use of materials, including products with an increased recycled content, and the implementation of recycling processes are necessary if the construction sector aims to overcome its poor environmental track record.

In New Zealand C&D waste accounts for approximately 20% of all landfill waste (Street, 1997). However, it should be noted that not all C&D waste is landfilled. For example, in the Auckland Region, in addition to the 670,000 tonnes of waste disposed of in landfills in 1995 (of which approximately 198,000 tonnes, or 30%, is C&D waste), another 526,000 tonnes of C&D waste was disposed of in cleanfills (MfE, 1997b). This makes the total amount of C&D waste disposed of in Auckland for 1995 stand at 724,000 tonnes. This exceeded all other waste types.
**Energy Use**

Building-related energy use can be separated into three areas:

- construction energy — required to source and manufacture the building materials (usually called ‘embodied energy’);
- operational energy — required to provide occupant services, i.e. heating, ventilation, cooling, hot water and lighting-related; and
- maintenance energy — required for the buildings upkeep where functionality is the key concern.

The significance of each of the building stages for the two main types of building (in terms of energy use) examined over 50 years is shown in Table 8.1.

By far the largest contributor to energy use during a building’s lifetime is operational energy. However, it can be seen that construction and maintenance energy are also significant. ‘Operational’ energy accounts for around 22% of all energy usage in New Zealand (EECA, 2000).

An ‘average’ domestic building in New Zealand consumes about 36,000 MJ annually, with the domestic sector contributing about 60 PJ (or just under 10%) of all energy used in New Zealand (Ministry of Economic Development, 2002). An ‘average’ office building in New Zealand consumes about 400 MJ/m² annually, with the sector contributing about 3.6 PJ of all energy used in New Zealand (Camilleri and Jaques, 2001).

There are three principal determinants of energy usage in a building — building design, the appliances used, and the behaviour of its inhabitants. The way in which each influences energy use (and interacts with each other) is complex and not fully understood. What is known is that on an international basis, New Zealand ‘buildings’ are profligate users of energy, with a large potential for better resource management and stewardship. It is also recognised that this energy wastage must be addressed through a combination of voluntary market and legislative measures, if significant and lasting energy reductions are to be forthcoming. In addition to resource stewardship issues, improving our building-related energy efficiency has social (e.g. health and comfort), economic (e.g. more discretionary income and less reliance on global markets) and global (e.g. greenhouse gas production) implications.

### 8.2 Resource Use within the Sector

The built environment sector is a complex collection of products and services. The impacts extend beyond the local area of the building to the source of all products and services provided to a building over its lifetime. It also includes the final destination of the emissions and wastes created during the construction, its useful life and the removal of the structure. The main types of resources that are used by the sector are explored as follows.

**Urban Sprawl**

Resource use in relation to urban sprawl is not easily categorised or quantified. Not only is

<table>
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<th>Energy Proportions by stage and built-form</th>
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<td><strong>By Stage</strong></td>
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Table 8.1: Building energy proportion, by stage (Isaacs, Bennett, Sharman and Jaques, 1997)

1. Refurbishment energy (i.e. the energy associated with the replacement of a material or component mainly for aesthetic/fashion reasons) is not considered here, as no figures were available for the New Zealand case.
every new urban development project different, the urban systems and processes that influence the outcomes and effects of the development can vary between and across the system’s boundaries. Also, because ‘curbing urban sprawl’ sits within the bigger picture of urban sustainability, it is difficult to separate urban sprawl resource use from other urban-related resource use problems.

Figure 8.3 is a macro-level representation of the resource use pattern leading to urban sprawl. The resource ‘inputs’ are the physical structures that make up the urban space, e.g., infrastructure, buildings and modified open space. These inputs are then subject to an urban management and planning system that is usually associated with creating (or at least predisposing) urban sprawl. The result — an urban space that is characterised as sprawl (the resource ‘outputs’). The resulting outputs create a feedback loop, e.g. the need for more inputs such as roads and services, to support the sprawled development, which are then subject to the same planning system, and so the cycle continues.

New Zealand has a history of urban sprawl resulting from many decades of planning systems based on zoning, car-focussed transport, and disrespect for the environment — but this is not
always the pre-determined outcome. Local government, as key players in the management of land use (and thus the prevention of sprawl), have a range of governance mechanisms to ensure, support and encourage resource stewardship and waste minimisation. In this context, the desired outcome for urban space is reduced resource use, reduced waste and emissions, greater liveability, improved urban systems and processes — all combining to enhance the quality of the urban environment.

**Material Waste and Energy Use**

A building’s life cycle includes raw material extraction, product manufacturing, construction, maintenance, retrofitting, and waste management at the building’s retirement — in total this is commonly known as a ‘cradle to grave’ approach. There are no legal requirements or financial incentives established in New Zealand that would encourage or force the construction and demolition industry to avoid, reduce, reuse or recycle their wastes. Consequently, all built infrastructure has been described as ‘waste in transit’ (Guthrie and Wolveridge, 1998), that is to say, based on today’s linear resource flow economy, all materials in use by society will become waste at the end of their useful life span.

Figure 8.4 illustrates the inputs required for the creation of a building, the resources used during the building’s lifetime, the energy consumed when the building is finally disposed of, and the resulting emissions to air, water and land. The figure shows that the ‘standard industry practice’ for the reuse and recycling of building materials as inputs is only significant for the construction of new buildings.

The timeline on the left of Figure 8.4 is reflective of a ‘typical’ project set-up. The time between the initial concept and the start of construction takes several months, with the length of time for the structure to serve its useful purpose (or economic life) usually being 50 or more years.

For houses, energy demand by end-use is estimated to be made up of 38% water heating, 36% space heating, 7% refrigeration with the rest (at 26%) going to cooking, lighting and other (Massey University, 1992). Domestic energy sector demand, by fuel type, is electricity (71%), wood (14%), coal (7%), gas (7%) and other (1%). In summary, domestic buildings energy use is water and space heating dominated, with electricity being the most common fuel type.

For offices, energy-end use demand is divided into those buildings which are internally load dominated (ILD) i.e. for heating, ventilation and cooling, and those which are skin load dominated (SLD) i.e. the building structure. Whatever sub-category they are, it is thought to make little difference to the amount of their overall ‘per floor area’ energy consumption. Heating (at 38% for ILD buildings and 53% of SLD) and lighting (38% for both) make up by far the bulk of the energy requirements (CAE, 1996). The energy sources are mainly electricity and gas, at 60% and 15% of total energy, respectively (Ministry of Commerce, 1997).

It comes as no surprise that the last determinant of energy use — the occupant — generally places very little importance on the benefits of energy efficiency. The BRANZ Advisory Helpline (for both industry and the public) consistently fields calls from people who have only the vaguest impressions of what energy efficiency/insulation is all about, with whole building insulation being one of the most misunderstood parts of the design process (Bruce, 2002).

### 8.3 Standard Practice within the Building Sector

This Section examines what is currently occurring within the sector to illustrate the standard practice of dealing with waste. However, a principal characteristic of the sector is the wide variety of activities that are undertaken and the uniqueness of each project. In other words, each project is designed for specific circumstances, and thus has its own peculiar problems. As a result there is a spectrum of ‘standard’ practice within the sector.
Urban Sprawl

The standard practice of achieving resource stewardship to address wasteful land use is a complex managerial and planning issue. As a result there are a multitude of agencies, each with a number of tools available to them, for curbing urban sprawl. As mentioned, the principal agencies are local governments; the principal tools are the Local Government Act (LGA, 1974) and the Resource Management Act (RMA, 1991). The former provides the governance mandate for local governments; the latter sets the governance framework for the sustainable management of natural and physical resources. In addition, the land development industry must comply with secondary legislative requirements, such as NZS 4404 ‘Land Subdivision and Development Engineering’ (in preparation), the Building Act (1991), and so on.

These legal requirements sit alongside a whole host of non-statutory mechanisms including kaitiakitanga2, advocacy by Regional Councils, the Ministry for the Environment, the Department of Conservation, non-governmental organisations, community groups, and various private funding measures (PCE, 2001). See Table 8.2 for an overview.

Overall, these tools make up the framework for the management of urban space and if ‘properly used’ can prevent urban sprawl. Clearly, the use and ability of this framework in bringing about resource stewardship and waste minimisation bears mixed results throughout the country, and

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2 Guardianship over the land and its resources.
The Built Environment Sector

across and between jurisdictional boundaries. In addition, defining whether urban sprawl has occurred in an urban area, who or what is to blame, and how it can be remedied or prevented — or even whether urban sprawl is ‘bad’ — continues to be debated in the planning literature (Searle, 1998). It is not the purpose of this section to become involved in this debate, or critique the management framework3, but to highlight New Zealand’s settlement pattern as a result of it.

New Zealand’s current settlement pattern and demographic profile shows migration back to the urban centres paradoxically occurring at the same time as the suburban areas continue to expand (Gjerde, 2000). This can be seen in the growing number of medium-density, mixed-use communities that have been built or are under construction in the main urban centres, e.g. the Beaumont Quarter, Auckland, Tapu te Ranga Marae in Wellington, and Lancewood Courts in Beckenham, Christchurch. Demand is continuing for revitalised, higher density and/or mixed-use living (Ledbury and Frisbie, 2002). On the other hand, expansion can be seen all over the country, for example:

- Rodney District, a rural and coastal area north of Auckland, has growth rates of 81% compared to Auckland’s 31%;
- Wellington’s Kapiti Coast, another rural-coastal area, has grown 47% in contrast to the region’s 8%; and
- Similar areas like Waimakariri and Selwyn have grown 37% and 28% respectively, compared to Christchurch’s 12% (BRANZ, Fletcher Challenge and Forest Research, 2000).

From a resource stewardship and waste minimisation perspective, the key limiting factor is how the various land management agencies can positively contribute to good quality urban design within the existing land management framework.

**Material Waste**

Designers can affect waste creation throughout the lifecycle of a building. However, a recent study conducted by BRANZ found that there is very little importance placed by designers on waste minimisation, compared to other design criteria (Jaques, 1998). Starting with building component specification, a great deal of construction waste results from overestimating material needs. This includes having excess materials delivered to the site or mixing more material on site than the project requires at the time. Surplus materials made up 14 % of construction site

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3 An investigation of the land management framework can be found in ‘Managing Change in Paradise, Sustainable Development in Peri-urban Areas’ PCE, 2001.
waste in a study of construction sites in Auckland (Patterson, 1995).

Not only are there problems with surplus materials, damaged materials account for a significant portion of construction waste. The biggest concern with damaged materials is that the company pays for material, delivery, handling and disposal without receiving any benefits. Goods are often damaged when they are delivered in excess or when they arrive before they are needed, thus requiring additional handling or makeshift storage.

Another standard practice is the non-transfer of surplus materials from a completed operation in one building to the next or from one part of a larger building to another where similar materials are to be used. This largely applies to such materials as partly used bags of plaster, sheets, cut sheets of plasterboard and hardboard, partly used cans of paint and adhesives as well as nails and screws. Waste is also particularly common with bulk or loose materials, such as aggregates, which, if allowed to spread during mixing operations results in sand and aggregate being trampled into the soil and rendered useless (Broughton, 1965).

Waste composition varies within the C&D waste stream, depending on the kind of work carried out. Waste arising from renovation projects is different to that of new construction projects, because timber, windows, doors and sheet material make up a larger than average component of the waste stream. Renovation projects can involve the removal of parts of a structure, demolition projects aim at leaving a clear site and are generally the point within a structure’s life cycle when the single largest amount of waste materials is produced. Each kind of project represents unique opportunities for material recovery.

The differences in the waste streams are reflective of the differing types of building work — construction, renovation/fit-out and demolition. Each determines different approaches to ‘standard practice’. The wastes generated at construction sites are more likely to be recycled than demolition wastes due to the relative ease in separating the materials and compiling similar materials. Materials resulting from renovation work are usually generated in too small amounts to warrant multiple bins on site and thereby make material recovery more complicated. Demolition waste is inherently more contaminated and is often commingled from the start, making it much harder to separate at the source. It also tends to include a wider range of materials.

Despite these problems, waste minimisation is particularly relevant as nearly all construction and demolition waste can be recycled or reused. However, it lags far behind other industries in resource efficiency. One of the reasons for this lack of success is that there is still limited awareness of waste minimisation or its benefits by New Zealand’s construction industry. Many businesses consider the cost of disposing of waste simply as a cost of doing business. Material waste is seen neither as a problem or an opportunity, with the cost of disposal simply passed on to clients.

In fact, many businesses link waste minimisation with an environmental movement that will result in cost with no financial benefit (Boyle, 1998). There is no legislation in New Zealand that focuses purely on waste prevention. The focus of the Resource Management Act on effects on the environment moves the issue from the production of waste to the effects of the waste produced. There is no requirement for companies to reduce their material waste or to even implement waste reduction measures. Furthermore, the lack of interest by consumers in New Zealand in environmentally-friendly products and services discourages businesses from undertaking environmental programmes. Despite this somewhat pessimistic picture, the number of examples of best practice emerging is encouraging.

**Energy Use**

Standard practice is determined by the key supporting documents relating to the energy efficiency requirements of the New Zealand Building Code (NZBC) Clause H1: Energy Efficiency.
These are NZS 4218 (Standards New Zealand, 1996a) for small buildings, NZS 4243 (Standards New Zealand, 1996b) for the thermal envelope of large buildings, and NZS 4305 (Standards New Zealand, 1996c) for the hot water system use. These are part of a package of standards, guidelines and calculation methods available to the designer to assess the energy efficiency of their building. A summary of this package is given in Table 8.3.

It should be noted that all the legislative requirements described in Table 8.3 target new buildings only — even though by far the largest gains in energy efficiency is to be made in retrofitting or the extensive refurbishment of the bulk of the existing building stock. In terms of the design process for both houses and office buildings, designers have little motivation for increasing the insulation requirements above the minimum code requirements. Many building officials and building certifiers don’t know how to apply the code so energy efficiency is largely ignored (Bruce, 2002). The design process is largely first-cost focused. This inevitably results in a building that is less comfortable and uses more energy than it needs to.

In New Zealand, extensive use of standard house plans is made, with little attention given to even the basic, low/no-cost energy efficiency aspects such as orientation, location, internal planning, and window aspects (otherwise termed as ‘passive solar design’). Most homebuyers lack information, motivation and funding to achieve good energy efficiency (EECA, 2000a). In many cases, energy usage is driven by poor levels of insulation, damp conditions and limited availability of useful sunlight. The relative energy efficiency of household appliances varies considerably, depending on the age and country of origin of the individual appliance (EECA, 2000a). There is little uptake of solar water heater units, or high efficiency or direct gas and water space heating.

There is a lack of integration in the design process for office buildings, with building specialists (service engineers, product suppliers and contractors) rarely being consulted at the conceptual stage of the building. It has been shown that the initial design (incorporating the schematic design and design development) has by far the greatest potential energy savings of any stage in the design process (CAE, 1996). In more recently built offices, there has been a trend for installing fully air-conditioned services, even though New Zealand’s climate is temperate and full air conditioning is not widely needed. This is at least in part because of the current perception that those that are air-conditioned are higher quality and attract a higher price premium (Saville-Smith, 1998). Also, often buildings are operated in less than ideal manner, which results in energy inefficiencies. The reason for incorrect commissioning is thought to be because of pressures to complete the construction contract, resulting in the HVAC services never operating as designed (EECA, 2000a). Standard practice ensures that little post-occupancy evaluation will be carried out, so that little knowledge is derived from the way occupants operate and maintain them.

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1. The NZBC is performance based with the ‘associated’ standards being acceptable solutions (but not the only means of compliance)

Table 8.3: Tools available for good energy efficient design
8.4 Best Practice within the Sector

This section describes the main tools available for practitioners to pursue best practice within the sector. In this context, best practice is defined as those initiatives undertaken which are ‘leading edge’ in terms of resource stewardship.

Urban Sprawl

The push for quality and the need for more efficient use of land has led to a flurry of alternative urban design guides, websites and/or strategies developed by various organisations in response. While they form part of the land management framework outlined previously, these design guides represent current good or best practice in urban land management. Some examples include:

- “Developers’ Design Guide” (Waitakere City Council, 1998); guidelines for residential subdivision and medium density housing.
- “The Residential Design Guide” (Auckland City Council, 2001); guidelines for developments in residential zones in strategic growth management areas.
- “Good Solutions Guide” (North Shore City Council, 2001); guidelines for intensive residential developments.
- “Quality Planning” (www.qualityplanning.org.nz); a website to promote best practice by sharing knowledge about policy and plan development under the Resource Management Act.
- “Design Opportunities” (Christchurch City Council, 2001); the design perspective behind the planning of central Christchurch to influence redevelopment.
- “New Housing in Living 4 Zones”, “New Housing in Living 3 Zones” and “Large Buildings in Lower Density Living Zones” (Christchurch City Council, 2001; 1999; 1999 respectively); design guides for houses in central and suburban Christchurch.
- “People, Places, Spaces: a Design Guide for Urban New Zealand” (Ministry for the Environment, 2002); guidelines that provide a broad overview of urban design processes and principles.
- “Subdivision for People and the Environment” (Standards New Zealand, 2001); guidelines and design information to assist environmentally sensitive land development.
- “Development Design Guide” (Social Housing Strategy, HNZC, in press); guidelines for social housing in New Zealand.

As can be seen by the majority of titles and the brief description of contents, the guides are focussed on design — based on the premise that the most influence can be achieved at the design stage of any proposed urban development (whether a new site or retrofit of an existing site). Indeed, many infer that efficient use of resources in terms of land development is absolutely reliant on their incorporation into an integrated design process. Underpinning them all are similar resource stewardship principles. These can be grouped as follows (BRANZ et al, 2000):

- proximity to existing/future development and infrastructure
- mix and balance of uses;
- site optimisation and compactness;
- community context and site design;
- accessibility and mobility choices;
- environmental quality;
- diversity; and
- process collaboration and predictability of decisions.
While the main obstacle for these guides is their voluntary nature, they do provide opportunities for practitioners to showcase best practice and to position themselves favourably in the ‘urban design’ market — one which is slowly waking up to the benefits of good design. In fact, one could argue that by undertaking urban design and land management that incorporates resource stewardship principles, elements of waste minimisation — in an urban sprawl context — will automatically be achieved (SNZ, 2001).

**Material Waste**

A number of local, regional and national programmes, aimed at demonstrating best practice in the handling (avoidance, reduction, reuse and recycling) of the large volumes of solid waste created by the building sector are underway in New Zealand. All of them have been initiated and are funded and maintained by territorial authorities and industry groups. These initiatives share the goal of improving the construction industry’s environmental performance, but none of them could be described as a ‘one-stop-shop’ for building-related environmental issues. The agendas of the programmes described below are fragmented, and while they duplicate each other’s core objectives, they differ in the more sophisticated issues addressed. A combination of all the information and tools provided through these programmes would result in a comprehensive resource for the building sector.

**REBRI**

REBRI stands for Resource Efficiency in the Building and Related Industries. It is a voluntary programme designed to increase the environmental performance of the New Zealand building industry. REBRI addresses the problem of C&D waste from three directions. The first one is building awareness amongst the general public (mainly through the web site www.rebri.org.nz). The second is to work closely with the construction industry through case studies and support. The third is market development; identifying material recyclers as well as trialling recycled materials as new construction materials.

**Construction Waste Minimisation Project**

The Christchurch City Council has been proactive in the C&D waste reduction area for a number of years. It has undertaken a two-staged construction waste minimisation project. Stage one investigated and trialled source separation of construction wastes on four construction sites. The second stage of the project examined waste prevention initiatives through targeted contract clauses at project inception.

**Better Building Code and Sustainable Home Guidelines**

The Waitakere City Council has produced the Better Building Code and the Sustainable Home Guidelines. The Better Building Code is an environmental guideline for council buildings, but is equally applicable to all public and commercial buildings. The reference book provides standard clauses to include in tendering and briefing documents for the design and construction of public buildings. Clauses can be mixed and matched depending on the project’s priorities. The Sustainable Home Guidelines is another initiative from Waitakere City Council. It provides a practical guidance for new and existing buildings. Issues addressed include energy, water, materials, safety and waste.

**Easy Guide to Eco-Building**

This booklet is a collaborative effort of Auckland Regional Council, Hamilton City Council and BRANZ Ltd. It shows how to carry out construction projects with consideration for the environment, while increasing building performance and comfort. It suggests issues to consider and practical things to do, from the start of the design to the end of the building’s lifetime.

While the effectiveness of these programmes is hard to measure, it is generally felt that they are...
successful. The main obstacles are the:

- small financial incentives;
- voluntary nature; and
- initiative and additional planning required.

The level of success achieved is directly related to the advocacy that each individual programme has received. Programmes that are supported by strong champions do well. Programmes that perform well while supported by territorial authorities or industry organisations struggle to survive once this support is reduced or withdrawn. This illustrates that such programmes cannot be expected to be self-reliant in the near future, but require long-term or permanent support. The benefits provided by these programmes for communities, businesses and the environment easily warrant the commitment required.

**Energy Use**

Although the NZBC dictates to a large degree what the energy efficiency of new buildings should be, the recent passing of the Energy Efficiency and Conservation Act (2000) has huge potential for improving how the nation sees building-related energy use. One of the implications of the act is the National Energy Efficiency and Conservation Strategy (EECA, 2001a). One of the objects of this Strategy is to push for 'best practice energy-use' in both new and existing residential and non-residential buildings. The Strategy proposes a comprehensive package, which goes a long way to address many of the current building-related energy concerns.

The new Energy Efficiency Strategy (EECA, 2001a) will also have a significant effect on the energy use in buildings, by dealing with energy performance labelling and minimum energy performance standards for a variety of appliances. For example, these regulations will ensure that inefficient water heaters are no longer supplied (starting from February 2003), although the sale of inefficient second-hand water heaters will not be affected.

Key examples of New Zealand-specific energy efficiency documents include:

- **“Action Plan for Buildings and Appliances”,** (EECA, 2001b). The most ambitious and comprehensive initiative taken to reduce building-related energy use, it includes research, information and education, support and legislation programmes. One of the first offshoots of this is the 'Code of Good Practice for Energy Efficiency of Houses' (Standards New Zealand, in press); which provides guidance on how to greatly improve the energy efficiency requirements well beyond NZBC requirements. It introduces recommendations for designers, builders and homeowners and provides expected increased levels of comfort.

- EECA web site (www.eeca.govt.nz), which has a comprehensive, searchable resource for practical energy advice, consultants, downloadable publications, tips and general energy efficiency information.


- **“Heat Loss Reduction in Houses”** (BRANZ, 1995), and ‘Improving Thermal Insulation’ (BRANZ, 2002). These bulletins provide practical guidance on how to reduce heat losses from new and existing buildings.

- **“Designing Comfortable Homes”** (Cement and Concrete Association of New Zealand and EECA, 2001); passive solar guidelines giving details of glass, mass and insulation requirements.

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4 To avoid duplication, some of the relevant design guides were omitted in this section as they have already been covered in the previous sub-sections on urban sprawl and material waste.
Developing substantially self-heating houses and incorporating energy efficient water heating systems and appliances could reduce home energy use by 40% to 50% of current levels, while providing increased levels of comfort. A similarly aggressive programme for existing homes could reduce energy use levels by approximately 20% in more recent homes, increasing to about 60% in older villas (EECA, 2000a). For office buildings, energy savings from retrofits can cut end use energy requirements by 15% to 25% for heating and 25% to 40% for lighting. If energy efficiencies are incorporated into a new building or a major retrofit, the potential energy saving can approach 75% (CAE, 1996). These programmes also have other co-benefits, such as employment opportunities and social benefits (e.g. improved health and comfort), as well as being better able to cope with climate change (Camilleri and Jaques, 2001).

The obstacles for the uptake of more energy efficient buildings are well documented (CAE, 1996; Saville-Smith, 1998; and EECA, 2000a), and include:

For domestic buildings:
- high initial capital cost;
- other priorities (too busy and/or regard making changes as inconvenient);
- consider there will be a reduction in home comfort as a result;
- consider they are already efficient and nothing more can be done;
- other household members frustrate their efforts to be more efficient; and
- limited understanding and availability of ‘energy efficient technologies’.

For office buildings:
- little incentive as energy efficiency doesn’t lead to lower capital costs;
- no simple measure of building performance by which energy efficiency could be measured;
- little professional encouragement or recognition from the design fraternity for energy efficient design; and
- the tenancy-landlord problem, where the landlord does not directly benefit from reductions in energy costs (paid by the tenant) resulting from energy efficiency improvements.

These obstacles present several opportunities, which the wider building-related industry is addressing. To change the public’s and building fraternities present (low) perception of building-related energy efficiency initiatives there must be three operators working in unison:

- AWARENESS — through education (whether through seminars, workshops, flyers or demonstration projects). The appeal to ‘health’ and ‘comfort’ issues should be made in conjunction with energy efficiency.
- TOOLS — for assisting design and retrofitting/refurbishment, so that a more accurate indication of how building performance will change as a result.
- MOTIVATION — where the awareness and tools result in some action being taken there must be appropriate back up legislation.

8.5 Case Studies of Best Practice within the Building Sector

The following case studies investigate possibilities for the reduction and diversion of waste for addressing resource stewardship and waste minimisation within the built environment sector in New Zealand.

Urban Sprawl

Good quality urban design is the key to curbing urban sprawl. Recent attempts at ‘packing more people into less space’ has led to poor developments and a public backlash at the whole
concept of higher density, mixed-use living (Ledbury and Frisbie, 2002). If urban managers want sprawl to stop, public buy-in is essential. To do so requires developments that create communities — not just buildings, or even worse, the ‘slums of the future’. Beaumont Quarter, Auckland is one such development with ‘community’ as its fundamental concept.

Case Study 8.1: Urban Sprawl

Beaumont Quarter

Beaumont Quarter is a high-quality, medium-density development on an existing site in Auckland City that aims to be a benchmark for consolidated living. The re-development, by Melview Developments, is a $100 million scheme on a 2.4 ha heritage site adjacent to Victoria Park. The concept plan, which took a year to complete, has 230 housing units as well as some office facilities and shops within the original buildings at the front of the site. The development is due to be completed by the end of 2003 and will end up with around 30 different housing types including semi-basement car parking.

Examples of the different housing types include two- and three-storey terrace houses, split-level homes with roof terraces, hilltop houses, work-from-home terrace houses, modern one-bedroom apartments, and loft apartments. Interspersed are linked pedestrian walkways, trees, and grassed areas. Retention of the existing historic buildings, the provision of car-parking via a semi-basement car park rather than individual garages, landscaping for privacy and an emphasis on pedestrians, are all examples of resource stewardship. Located in the CBD with multiple services and recreational facilities nearby, this development makes a ‘rewarding urban lifestyle a reality’ with reduced environmental impact.

These good urban design principles have been applied in many other residential developments recently, but what is important in the context of this section is the fact that it is redevelopment of an existing site within the city centre, not development of a new suburb or sub urban area — and thus is not wasting urban space.

[Information about this development has been adapted from ‘New Zealand Environment, Issue 2, 8 February 2002’. For more information contact Melview Developments, ph. (09) 379 9666, or see www.beaumontquarter.co.nz]

Tapu Te Ranga Marae

Another redevelopment of an existing site is the Tapu Te Ranga Marae in Island Bay, Wellington. The Marae’s founder, Bruce Stewart, has a philosophy of caring for both people and the environment. Since 1974, he has had a vision to develop the land to establish a community, which has the commitment and capacity to:

- sustain the Marae as a place which meets the needs of the whanau;
- further Maori aspirations for their well-being;
- contribute towards the expression of Maoritanga;
- develop the arts, particularly Maori art;
- facilitate mutual understanding between Maori and Pakeha;
- offer opportunities for people to acquire work-based life skills;
- restore an area of coastal rainforest as part of Wellington’s native bird corridors; and
- offer environmental education as an integral aspect of the community life.

As a result, the concept plan is a mixed-use development including papakainga (village)
Material Waste

The following two case studies investigate possibilities for the reduction and diversion of construction and demolition wastes at two different stages of a building’s life. The first case study experiences deconstruction as an alternative to the destruction and disposal of whole buildings at the end of the structure’s useful life. The second case study examines source separation as an alternative to the disposal of wastes generated during the construction phase of a building. Both case studies have been highly successful in reducing the amount of waste disposed of in landfills or cleanfills.

Case Study 8.2: Material Waste

Blows Building, Auckland

Deconstruction is an alternative to the demolition of buildings. It is often described as ‘construction in reverse’ as it takes a building apart, salvaging material that can be reused or recycled, rather than breaking it into pieces small enough to fit on a truck and disposing of everything in a landfill or cleanfill. Recovered materials and building elements are sold on the spot, transported to a warehouse or picked up by material recyclers. Additionally, deconstruction provides benefits in the recognition and handling of hazardous building materials. Such materials are more likely to be identified and removed for proper treatment and disposal if a building is taken apart, than during traditional heavy machinery dominated demolition.

Ward Demolition was given the contract to demolish the Blows Building, on the corner of Fort Street and Emily Place in downtown Auckland. This historic building was constructed in the early 1900s and consisted of high value building components, such as brick, kauri tongue and groove floors, kauri beams and a corrugated steel roof. The interior of the
building was fitted out with plasterboard, hardwood planks, and similar materials.

To salvage as many of the valuable materials as possible, demolition by hand, followed by careful machinery application was chosen. To do this kind of demolition successfully, time is of the utmost importance. During the first stage the interior of the building was removed. This provided the main source of waste going to landfill, as there were no recycling outlets for gypsum wallboard. Stage two involved salvaging the roof, joists and floorboards, followed by controlled dismantling of the walls to salvage the bricks. The salvaged materials were:

- Timber – 150m³ of kauri, ranging from 6” x 1” tongue and groove flooring to 12” x 10” beams, and 10” x 3” joists. Some timber was sold directly, and the rest re-sawn and sold as floorboards.
- Bricks – 875 pallets of 400 bricks each were cleaned and chipped for resale.
- Rubble, broken bricks – Crushed and sold as aggregate
- Steel roofing – Good quality steel was sold for reuse, the rest was crushed and sold to a metal recycler.

The described demolition, which aimed to salvage as much material as possible, took six weeks and cost the developer NZ$35,000. A rapid demolition of the same building using heavy machinery with no attempt to salvage would only have taken two to three weeks, but would have cost up to NZ$180,000. Savings on the demolition costs were NZ$153,000 or more than 85%. Ninety-five percent of the demolition materials or about 270 truckloads were salvaged. The job generated more employment than a non-salvage demolition job would have generated. The reduced disposal costs, and the profit from materials sold, easily covered the labour costs.

The economic benefits were due to Ward Demolition’s ability to sell salvaged materials, the reduced need for heavy machinery and significantly reduced tipping fees — 95% of all the materials were diverted from landfill.

[Information about this project has been adapted from a case study undertaken by the Auckland Regional Council as part of ‘Project C&D’. For more information contact the REBRI co-ordinator via www.rebri.org.nz.]

**AUT Sports & Recreation Centre, Akoranga Campus**

Source separation is the collection of wastes on the construction site where they are produced. Materials are collected in separate bins, cages or piles depending on their material type and level of contamination. Source separation creates material streams that can be directly forwarded to users or reproprocessors. It thereby avoids the disposal of large quantities of waste to landfill and uses them as a replacement for materials, which would otherwise have to be extracted from the diminishing stock of non-renewable resources. The scraps and wastes generated at construction sites are more likely to be recyclable than demolition wastes due to the relative ease in separating materials and the lower degree of contamination.

Hawkins Construction was contracted by Auckland University of Technology (AUT) to construct a new sports and recreation centre at their Akoranga Campus on Auckland’s North Shore. The construction site within the Akoranga Campus was an empty lot, so no demolition was necessary. Construction of a new sports and recreation centre started in early April 2000. The total construction time was nine months.

The materials to be separated on site were chosen on the basis of quantity, recyclability (outlets), and the value of scrap or recycled material. Subcontractors were introduced on their arrival to the site of the aims and requirements of the trial. An area on site was assigned as the separation centre and all bins were marked and colour-coded according to their content.
Regular site visits were made to monitor the performance of the waste separation, and to identify when the next stages of construction would begin, to assure that additional bins would be on site when required. Waste generation during the first three months did not warrant more than a single bin on site. As soon as waste generation increased and significant amounts of recyclable waste materials were generated, multiple bins were installed at a central location on site to form a waste separation centre. More bins were added as new materials entered the waste stream. This approach kept the number of bins to a minimum, which reduced the space required on site as well as the likelihood of contamination.

Total Waste Services provided financial incentives for certain types of separated wastes, such as steel and timber. Separation of materials on site made it possible to recycle about half of the total waste, which significantly reduced the amount of materials disposed of in landfills from this construction project. The management costs, arising from the set-up and operation of the source separation, were minimal and easily compensated by the 20% saving in disposal costs that were achieved by diverting 53% of all construction wastes by weight (46% by volume) from landfills.

Source separation is a viable option for construction wastes. The main factors are availability of space on site, support from the site management, availability of users and processors of separated materials and the co-operation of the waste contractor. Source separation offers the extremely rare combination of no risk, and the potential to achieve significant financial savings.

[For more information on the project, contact Sven Hanne on (021) 437 636 or at mailbox@svenhanne.com.]

**Energy Use**

Two highly resource-effective buildings are now considered. The first (an office building example) is more focused on the single issue of best practice in terms of just energy efficiency features, the second (a residential house) takes a more holistic approach to resource efficiency, addressing a raft of resource-related issues.

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**Case Study 8.3: Energy Use**

**Canterbury University Maths Complex**

This building emphasises the benefits of a well thought-out design integration — that is logical placement of services and integrated energy efficiency design considerations from the projects inception. University of Canterbury’s Mathematics, Statistics and Computer Science (MSCS) building makes use of leading-edge energy efficient techniques. Completed in 1998 in Christchurch, the MSCS building has a floor area of 11,551 m² and comprises three, seven-storey academic towers on the north-east side and a four-storey teaching wing on the south-west side. The towers incorporates staff offices, meeting, teaching, and seminar spaces.

The building makes good use of many design features to heat, ventilate and light the building naturally, all without compromising occupant comfort. Specific energy efficient design features include:

- using a naturally occurring aquifer under the site for cooling;
- having a northerly aspect;
- fixed and adjustable exterior and adjustable interior solar shading devices;
- a large number of window or louvre opening options;
• an atrium which brings natural light into the core of the building while doubling as a ventilation chimney;
• the use of carefully positioned thermal mass to maintain even indoor temperatures; and
• the use of insulated precast concrete panels which doubles as a thermal storage medium.

All these provisions contributed to keeping the direct energy requirements down to a low 143 kWh/m², which is within the new NEECS target value of 150 kWh/m² (this compares to an average office building of around 400 kWh/m²). As part of energy efficiency strategies, the lighting is designed to a very economical 9 W/m² of floor area — half of the energy intensity specified by the New Zealand standard, and means that the effects of waste heat from the lighting are reduced. The building has achieved this through a combination of passive means (using natural air flows) as well as mechanically assisted air conditioning. In addition to this, the building is recognised as being structurally efficient — for example, the ceiling in the teaching block also serves as a thermal sink and provides space for services such as sprinklers and ventilation.

A post occupancy survey was carried out three years after completion and the occupants rated it highly in terms of the provision of lighting, comfort, temperature, air quality and noise. The key to the success of this design was the careful planning and integration of design specialists from the project’s inception. This resulted in a high-quality building which not only has lower operation costs but also a lower capital cost compared to a typical building of its size. As a result, the university has been prompted to include energy consumption benchmarks into briefs for new buildings.

Many of the concepts and features associated with this building are applicable to office buildings. Passive solar design features, integrated service design and post occupancy evaluation checks are all techniques with well documented benefits to make buildings more effective amenity providers.

[Information about this development has been adapted from Energy Wise News, Issues #59 (1998) and #75 (2002). For more information on the post occupancy evaluation, contact Dr George Baird at George.Baird@vuw.ac.nz ]

Waitakere’s Eco-Friendly Home

The second example considers some of the latest energy efficient technologies wrapped within an ‘environmentally friendly’ framework. Not only energy related resources are considered, but also material resources, water resources, air quality, health, and economic considerations. This 156 m² detached house, completed in 1998, is a single-storey dwelling located in the suburb of Kelston, in Waitakere City. The design incorporates indoor-outdoor features in which three building wings surround a U-shaped courtyard. The aim was to build an eco-friendly home, which was sensitive to nature, and healthy and sympathetic to the lifestyle of its occupants. For this building, energy efficiency is one of a palette of resource issues examined as part of the overall environmental assessment.

The energy efficiency features can be divided into whole house initiatives and those related to major appliances. Many passive solar aspects were included for the whole house. The floors, walls and ceilings all have insulation far beyond the code requirements, with a fifth of the total window area double-glazed. The warmer living spaces are located on the northern aspect and good use is made of carefully-sized overhangs to reduce summertime overheating. A portion of the total floor area is designed as a heat sink (by means of a sun-exposed concrete and tile combination) and good use is made of cross-ventilation for summertime cooling. Many of the major appliances are also energy efficient. Heat-pump technology is used for both space and water heating, reducing energy consumption by a
8.6 Governance of the Sector

This Section provides an overview of the governance of the built environment sector and where applicable, the extent to which it contributes to resource stewardship. Governance is defined as the mix of legislative, non-statutory, public and private ‘managerial structures’ which contribute to leadership within each of the key themes.

Urban Sprawl

In an earlier section, the management framework for the control of urban areas was outlined. The key pieces of legislation in this package were highlighted, namely the Local Government Act 1974 and the Resource Management Act 1991. Secondary legislative governance is provided by other legal documents such as NZS 4404 (in preparation), the Land Transfer Act 1952, the Building Act 1991 and the Building Code Handbook 1992. The recently released SNZ Handbook ‘Subdivision for People and the Environment’ (Standards New Zealand, 2001), while not yet statutory, provides governance in that it aims to provide certainty for urban managers wanting to progress resource stewardship in an urban context.

This emerging legislative basis and the increasing production of urban design guidance by local authorities (as outlined above), is occurring in tandem with a ‘policy push’ by the Ministry for the Environment towards more sustainable urban design and an increasing interest in urban issues in general. This means that there is likely to be greater emphasis placed on inter-departmental co-ordination over policies related to urban development, and more central government guidance in relation to alternative design solutions.

Guidance is also being provided at the regional and local level in Auckland and Christchurch with the strategic documents “Auckland Regional Growth Forum” (Auckland Regional Council, 1999) and “Future Path” (www.futurepath.org.nz) respectively. Each strategic document is based on a 50-year vision. These over-arching documents provide long-term guidance/governance for quality urban development. They aim to provide strategic direction for our urban space in such a way as to influence the land management framework to improve quality of life.

In summary, governance in an urban sprawl context is being provided at central, regional and
local levels via legislative and non-legislative mechanisms — some of which have been highlighted in this Section.

**Material Waste**

Current legislation regulating the generation and management of wastes is exclusively reactive, dealing with waste materials once these are created (end-of-pipe solutions), rather than proactive, targeting waste generators and promoting cleaner production techniques. There is no law in place in New Zealand with waste minimisation specifically in mind. But the need for such a piece of legislation is increasing. So far it has been proactive territorial authorities that have struggled to implement tougher regulations regarding the production of waste with the existing set of legislative instruments. With the arrival of the New Zealand Waste Strategy, this challenge has reached another order of magnitude.

The New Zealand Waste Strategy (www.mfe.govt.nz) launched in March 2002 aims to change the emphasis from the current end-of-pipe approach, which focuses on waste disposal, to a preventive management concept, which focuses on a more efficient use of materials, waste prevention and resource recovery. The Waste Strategy promotes cleaner production and outlines specific, practical targets for various waste streams. But it is a strategy, not a piece of legislation and therefore it does not have the power to enforce compliance. The Ministry for the Environment has indicated that a failure of the market to respond to the strategy and alter their operations to support the strategy goals would lead to making the strategy mandatory, but no specific timeframe, or measures have been named. As a result of this lack of direct governance, all applicable existing legislation is under scrutiny to identify acts and laws that can be employed to manage the ever-increasing waste problem.

As with urban sprawl, there are a number of laws that relate to waste management within the construction industry. The main sources of regulations for promoting waste minimisation would be regional or district plan rules under the Resource Management Act (RMA, 1991), by conditions attached to resource consents granted under it, and bylaws under the Local Government Act (LGA, 1974) and the Health Act (1956). The New Zealand Building Act (1991) limits the power of territorial authorities and thereby acts as a barrier to the enforcement of waste minimisation initiatives in the construction sector.

An outline of the major pieces of existing legislation affecting the generation and handling of waste can be found in Appendix 1. While it is possible for territorial authorities to initiate avoidance and recovery of construction and demolition wastes using existing legislation, it is so complicated that few authorities are likely to succeed in implementing this mechanism.

The Waste Strategy recognises that New Zealand lacks a central agency, as well as the comprehensive legislation dedicated to the management and minimisation of wastes that other OECD countries have. These issues will be addressed in the current review of the Local Government Act. In the meantime local authorities will have to try to reduce the vast amounts of C&D waste with a mix of laws and bylaws that were never designed for the task. While this may be easier to implement and face less opposition from the industry, it lacks the practicability and the symbolic function a purpose built piece of legislation would have.

**Energy use**

Key building-related energy efficiency/conservation requirements are the NZBC and its associated standards (NZS 4218 (1996a), NZS 4243 (1996b) and NZS 4214 (1996d)), and the upcoming Energy Efficiency Regulations 2002 (which govern the sale of energy efficient items). The main drivers for having energy efficiency performance standards at all are seen to be fulfilling central government energy policy having national positive interest — being good for all in terms of health, independence from non-renewables, etc (Isaacs, 1999). However, in future upgrades, the basis for the changes is more likely to be influenced by the Energy Efficiency and
Conservation Act 2000 and the resulting National Energy Efficiency and Conservation Strategy (NEECS) (EECA, 2001a). In the future this could become more important because of New Zealand’s environmental obligations — i.e. the Kyoto Protocol.

The NEECS programmes will, in all likelihood, have significant and far-reaching impacts on the way New Zealanders think about and use building-related energy. It provides practical voluntary and mandatory measures and instruments, drawing upon the assistance of a wide range of organisations — including research, community groups, TLA’s, central government agencies, and Standards New Zealand. The buildings’ ‘Action Plan’ targets all three determinants of building energy use — building envelope, appliances and the occupants — thereby having the best chance of success.

To some degree, energy efficiency will also be influenced by non-mandatory measures — a host of which have recently come out of the umbrella of ‘good urban design’. The three instigators of these guidelines — central government, local government and Standards New Zealand have all been very active in promoting the benefits of energy efficient design features (whether directly or indirectly). The major examples were discussed earlier.

It is recognised that for a durable programme to operate successfully, there must be a good strategic mix of both market and mandatory measures. Saville-Smith (1998) suggests that the construction industry could be more responsive to energy efficiency without regulatory intervention, through promotion, provision of information to consumers and the development of affordable products. To some degree, this has been addressed by the building industry, through a variety of initiatives, including the “Gib Living Solutions Home Owners Guide” (Winstone Wallboards, 2000) and the New Zealand Cement and Concrete Association’s “Designing Comfortable Homes” (NZCCA, 2001). These target issues of comfort rather than the long-term economic/environmental or other benefits.

It is difficult to determine the influence of any these documents on actual design considerations given that very little, if any, monitoring has been carried out. It is also difficult to gauge how much they contribute to resource use and stewardship within the building sector. However, it is expected that these initiatives will be greatly aided by the growing environmental concerns and awareness of environmental issues in general — largely thanks to the Kyoto Protocol.

8.7 Drivers for Change

This Section describes the main driving factors, influences and mechanisms behind the emergence of resource stewardship principles within the building sector.

Urban Sprawl

Despite the current management framework in place to avoid wasteful use of land, there is increasing pressure from councils for more guidance. Hence, the shift of focus from regulation to strategy — seen by the development of long-term strategies for urban areas (as discussed earlier). This mix of governance mechanisms should encourage a more integrated approach, as they bring local governments, communities, infrastructure providers and the private sector together — or at least provide a common goal to work towards.

While the drivers for this change can also be viewed as barriers to progress, the change of focus towards improved resource stewardship can typically be grouped as (BRANZ et al, 2000):

- Land price and availability — characterised by zoning that does not facilitate higher density residential development, high development costs of brownfield sites, and buyer demand for larger, detached sites.

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5 Energy efficiency is used here as a proxy for climate change, as it is essentially a subset of it.
• Transport — characterised by relatively ineffective public transport systems, road congestion, and a public who are ‘married’ to their cars.

• Infrastructure cost and capacity — infrastructure costs for low-density greenfield developments are high.

• Environmental pollution — urban sprawl has given rise to significant environmental and health impacts, e.g. declining air and water quality, vehicle emission pollution, and other health problems due to reduced leisure time and exercise.

• Demographics — an aging population combined with changes in family structures has impacts on housing choice and demand.

• Lifestyle — quality of life is very important. People want easy access to their place of employment, home and leisure pursuits.

All of these features are driving the push for improved stewardship of urban areas. The governance mix of the urban management sector, the legislative and non-statutory framework, and the shift of focus towards strategic planning and guidance, all point to the same outcome — prevention of uncontrolled human settlement development. Taking a resource stewardship approach means that it is possible to have growth without sprawl! The results:

• management of growth;
• security of community; sense of place and space;
• quality of life;
• preservation of the natural environment;
• better use of resources, both natural and supplied; and
• better building and infrastructure design.

As these results become realised, they create a positive feedback loop, and thus strengthen the driving forces further.

**Material Waste**

The previous section illustrated the current lack of regulatory guidance on waste minimisation and recycling, but there are indirect pressures, based on statutory requirements in other areas as well as from non-governmental sources, towards a change in the current management of C&D waste. Similar to current legislation (as described above), these pressures are focused on the end of the pipe — land disposal (landfills and cleanfills), with the exception of the New Zealand Waste Strategy (Ministry for the Environment, 2002a) which aims to introduce cleaner production into New Zealand industries. The pressure resulting from land disposal operations and the New Zealand Waste Strategy can be separated into three groups — although in some cases the lines are blurred:

**Social**

• hard to site new landfills due to opposition from NIMBY and local communities; and
• decreasing acceptance of the generation of waste.

**Environmental**

• existing landfill sites had to close due to conflicts with the RMA;
• currently illegally operating cleanfills will be monitored or closed due to the RMA and the New Zealand Waste Strategy (Ministry for the Environment, 2002a); and
• cleanfills will be monitored more closely, therefore more materials need to be taken to the

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6 Not In My Back Yard – local residents who oppose the siting of landfills, incinerators, etc close to their homes.

**Economic**

- rising cost of waste disposal:
  - full cost pricing according to Ministry for the Environment’s Landfill Full Cost Accounting Guide (2002c);
  - expensive process of siting new landfills due to opposition from NIMBY & local communities; and
  - closer monitoring of cleanfills will require more materials to be sent to landfills initiated by Ministry for the Environment’s Cleanfill Guidelines (2002b).

While all these pressures discourage the continuation of current waste generation and disposal practices, purely financial calculations of disposal costs do not capture the plentiful less-quantifiable benefits, which accrue to construction companies as a result of improved environmental performance. These include improved public image and goodwill, and improved staff morale. Both of the latter foster loyalty and lengthen relationships. The opportunity costs of not addressing waste are anything but negligible. In the near future companies will be recognised for activities (or lack thereof) that create environmental and social value for their stakeholders, in addition to economic value.

As a result of a case study, one Auckland based waste service company has found that supporting source separation (logistically as well as financially) has been perceived well by their customers and given them access to building sites of larger construction companies who originally dealt exclusively with a preferred waste management contractor. Many site managers, foremen, builders and site workers have commented to them that they prefer to send their waste materials to recycling or reuse rather than to the landfill. During trials it has turned out that waste materials collected in separate containers are more likely to be reused on site, than those collected as mixed waste. This reduces the amount of waste as well as the cost of materials per project.

**Energy Use**

To a large extent, the main ‘driver’ of building energy efficiency is the statutory requirements under the New Zealand Building Code (NZBC, 1991). The New Zealand Building Act (NZBA, 1991) requires the provision for necessary controls relating to building work having particular regard for the need to facilitate the efficient use of energy (in the case of new buildings) during the buildings lifetime. The Building Act is enacted through the NZBC, which sets minimum standards for new buildings. These minimum standards depend on variables such as the building’s type, location and size. Domestic and office buildings have a requirement to achieve an ‘adequate’ degree of energy efficiency when energy is used for modifying temperature or humidity or both, providing hot water and (for larger commercial building only) providing artificial lighting. The term ‘adequate’ is important, as the required energy efficiency measures in the code were never intended to achieve ‘good’ (i.e. energy efficient) design (Isaacs, 1995). However, there is a misconception by both the public and the building industry that Code requirements represent ‘good’ rather than ‘minimum’ practice.

New Zealand’s building-related energy-use picture becomes even bleaker when considering the entire building stock. It is estimated that 70% of housing stock was built before it was subject to any mandatory energy efficiency requirements (EECA, 2000a). Nearly half of the houses in the stock (i.e. 600,000) were under-insulated. It is estimated nearly 100% of commercial buildings were built before they were subject to mandatory building code energy efficiency requirements, with virtually the entire stock probably not able to meet the new energy efficiency standard for large buildings (EECA, 2000a). This all makes for a very energy-inefficient building stock.
The ‘bottom line’ is that most architects do not perceive energy efficient design as important enough to place it high on the list of factors they consider most important to define good architecture. Thus, they don’t incorporate energy efficiency features to a notable extent in their works. Other ‘economically themed’ drivers affect the energy efficiency initiatives in the marketplace. However, these are more secondary in nature. These include the cost of various types of energy (mostly electricity), which is, on an international scale, very inexpensive. Power crises (such as in Auckland in 2000) are only a short-term driver, as its perceived importance and therefore influence is fleeting.

In terms of social-related initiatives, there are a variety of resources available including: Internet sites (such as www.eeca.govt.nz, www.ecan.govt.nz), general guidelines (such as ‘People, Places, Spaces’ (Ministry for the Environment, 2002), ‘Passive Solar Design in New Zealand Homes’ (EECA, 2000b), detailed technical information such as ‘Design for the Sun’ (EECA, 1994) and BRANZ Technical Bulletins), and design-specific tools (such as BRANZ’s ‘ALF3’ (Stoecklein and Bassett, 2000)), demonstration homes (in Auckland and Wellington), and services (such as the recently launched PV Association and private contractors), and education (such as the Universities and Polytechnics architecture, design and engineering courses). Just how influential any one of these resources are in changing peoples attitudes and modifying behaviour is unknown.

The NEECS (EECA, 2001a) can be seen in as an environmental initiative — and should be very influential in changing peoples attitudes to better resource management in terms of the built environment. Core initiatives include:

- The forthcoming ‘Better’ and ‘Best’ design standards for non-residential buildings in place by 2005. This will set an easily defined target, and benchmark all buildings.
- The piloting of the integrated design team in 2002/2003 which will culminate in energy efficient designers for commercial buildings and the best performing building award in 2004 onwards
- A new standard for the operation and commissioning of energy efficient commercial buildings by 2004.
- The development of a national Home and (non-residential) Buildings Energy Rating Scheme (HERS and BERS, respectively), which may result in mandatory HERS consumer information for house sales by 2006.

The Kyoto Protocol, which has been ratified by New Zealand, will also have some influence on energy use in buildings. Consumers will have to pay a noticeable extra on their power bill, even if the proposed small tax (at $25/t carbon) is introduced. Consumers may respond by either conserving more or becoming more energy efficient.

In addition to national initiatives, some local authorities have also been proactive in the promotion of energy efficiency (whether by a environmental stewardship or economic and social). An example of this is Christchurch City Council’s energy efficient showhome and web resources available for both new and existing residential and office buildings (www.ccc.govt.nz). These initiatives are likely to result in a greater awareness of energy efficiency issues, and create market incentives and demand for effective products and services.

8.8 Conclusions and Recommendations

This section draws conclusions and makes recommendations on how to progress further in terms of improved resource stewardship, by examining the lessons to be learned from existing ‘standard’ and ‘best’ practice.

Urban Sprawl

It is clear from the preceding Sections that good tools for improving urban land use are avail-
able from a variety of sources, and that use of these is reflected in the move towards good urban planning. However, while positive examples of good urban design and planning are emerging, they are still few and far between and continue to be hindered by legislative constraints. The difficulty in preventing urban sprawl is that the constraints and barriers that are described as hindering consolidated planning, can equally be described as drivers and opportunities. For example zoning and rule-based planning is routinely criticised, but if written in a more proactive way, could require more design led planning processes to be employed. This means that improving resource stewardship in a land use context is both conceptually and logistically challenging. Overall, the lessons learned from standard and best practice can be summarised as follows:

- good tools are available from a variety of sources;
- there is a move towards good urban planning;
- there are good examples emerging, but few in number;
- drivers/constraints and opportunities/barriers to preventing urban sprawl can be the same;
- the RMA does not address urban design issues specifically; and
- not everyone thinks urban sprawl is a resource use problem.

By identifying these lessons, what further needs to be done to improve resource stewardship within the land management paradigm to minimise wasteful use of urban space?

We suggest two recommendations with regard to urban sprawl:

- Create an organisational structure to focus attention on urban issues, e.g. an ‘Urban Land Institute’ or ‘Ministry of Urban Affairs’.
- Create partnerships. Partnerships must be created amongst developers, architects, planners, the construction and building products industry, professional organisations, regulatory authorities, and the community. This is seen as necessary to champion resource stewardship principles and ensure consistent, ongoing implementation of them.

Material Waste

It has been illustrated that the waste stream described as C&D waste is highly heterogeneous with its constituents depending on the stage within a structure’s life cycle and the type of work undertaken. Correspondingly, the options and challenges for resource stewardship vary. In general, based on the types, quality and volumes of materials consumed and the amount of waste produced, the construction sector has a high potential for recycling and reintroduction of recycled materials. Currently no advantage is taken of this potential.

The discussion of the generation and management of solid wastes within the building sector illustrates that current standard practice is based on cheap and easy disposal of waste materials at landfills and cleanfills. Construction professionals as well as their customers are generally not interested in waste reduction but accept its generation as part of the construction process. Additionally, the small size of an average construction firm and the conservative nature of the industry obstruct the distribution of information on better and best practice, and acts as an encumbrance to change. While recycling is well perceived amongst construction professionals when involved in trials, only short-term changes are made. The small additional effort required, prevents firms from continuing with recycling programmes on their own. Furthermore, materials collected for recycling are usually not re-introduced into the construction process but down-cycled into materials of lesser quality than their origins, and therefore not valued as a resource.

It has been shown that a substantial body of knowledge on better and best practice is available

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7 Since the time of writing this chapter (May 2002), Hon. Marian Hobbs has been appointed as the Minister responsible for Urban Affairs.
to industry professionals as well as to the general public. While none of these guides are comprehensive, they represent a good amount of information and support, which is available at little or no cost. The guides are based on case studies carried out in different parts of New Zealand and have been successful in reducing and diverting waste volumes going to landfills and cleanfills. Most industry trials have focused on end-of-pipe solutions rather than avoiding wastes through design changes, although design guides illustrating how to incorporate waste reduction during the design stages are available. The main obstacle for all these programmes appears to be their voluntary nature.

At the time of writing, there was no legislation in place in New Zealand aimed at the reduction of waste produced. While current legislation may technically enable local government to require waste reduction or recycling on construction sites, it is unpractical to implement and questionable whether such conditions would withstand challenging in the Environment Court.

The Ministry for the Environment has provided guidance with the introduction of the New Zealand Waste Strategy. In addition to aiming for a general reduction of waste volumes, it targets individual sectors on the basis of their waste volumes and their hazard to the environment. Construction and demolition waste is one of these targeted groups because of the excessive waste volumes it produces. While the introduction of this strategy has not altered the legal vacuum, it has put waste reduction in the spotlight.

To achieve the goals set by the strategy, a comprehensive national programme, based on industry education, incentives and a statutory framework, will be required. Statutory requirements could include diversion, recycling and recycled content quotas. Additionally, the disposal of construction and demolition waste needs to be monitored and controlled more closely and the disposal of all waste must be charged on a full cost basis. Simple measures have the potential to reduce C&D waste by 50%, overseas examples show that more sophisticated measures can exceed 90% diversion.

**Energy Use**

Building-related energy use and efficiency has a very low profile, both in the design fraternity and the public domain. Associated with this is the fact that New Zealand’s domestic and office building stock operates inefficiently, with a large proportion having little thermal insulation installed. It is known that there is ample opportunity to greatly reduce energy demand — whether through retrofitting or within new building design.

The reasons for its low profile are many and they are well documented. To raise this profile and promote long-term change, three ‘operators’ must work in unison — awareness, tools and motivation. These should be presented as a mixture of voluntary and legislative measures, embracing both the ‘carrot’ and the ‘stick’ approaches.

To a large extent, this ideal — based on these three operators — is embraced by the newly released NEECS “Action Plan for Buildings and Appliances”. The NEECS has three overarching objectives:

- upgrade the energy efficiency rating of existing homes and commercial buildings;
- achieve best practice design in new buildings; and
- improve appliance energy efficiency to best practice.

For the first time, the New Zealand building industry is about to have specific tools (in the form of The Code of Good Practice for new residential and commercial buildings) to easily measure their performance. Designs will be able to be benchmarked in a quantitative manner for not only energy use/savings but its associated comfort benefits. This will give market differentiation for developers with likely positive feedback from potential building owners. This ‘market transformation’ activity based on the ‘carrot approach’ will, in all likelihood have sustained long-
reaching consequences. In terms of the existing stock (which has the greatest potential for improvement), the NEECS also provides a variety of programmes to improve their energy efficiency, addressing both the physical and management (commissioning) aspects.

These NEECS programmes for new and existing buildings will undoubtedly have flow-on effects. For example, as new home owners become aware of the choice between having a minimally Code insulated house or a more comfortable option, expectations of higher quality will need to be met. As the market becomes better informed, pressure is put on exceeding the minimum expectation required by mandatory standards.

8.9 References


Homes, Wellington.


Page, Ian, 2002. BRANZ Building Economist, Personal communication.


Appendix to Chapter 8: Key New Zealand construction waste-related legislation

**The Resource Management Act 1991 (RMA)**

The RMA has a single, overarching purpose: to promote the sustainable management of natural and physical resources. Although there is no reference to the concept of cleaner production in the RMA, the cleaner production approach does not conflict with the purpose of the act, and it can significantly contribute to achieving this purpose (Dalloz, 1997). However, since the RMA focuses on effects, the major concern with regard to resource consents lies in the discharge of wastes into the environment. Businesses negotiate with waste service companies to accept their wastes, and are then not liable for the pollution from their waste – it is the responsibility of the company treating and disposing of the waste materials. In many cases the waste-producing company has limited knowledge of the wastes they produce and dispose of, their only concern is the cost of disposal, and this cost is often minimal. As a result, companies do not deem cleaner production programmes essential. Overseas there is a growing trend towards using regulations at the building permit or consent stage to influence the waste generated by construction and demolition projects. In New Zealand, the implementation of waste management plans, detailing how waste will be reduced, could be imposed as a condition attached to resource consents. A performance bond could be required to ensure their implementation. The purpose of waste management plans would have to be specified in district plans in accordance with the RMA.

**The Local Government Act 1974 (LGA) and Local Government Bylaws**

The Local Government Act (LGA) defines, in very general terms, the purpose and functions of local governments (i.e. regional councils, city councils and district councils). The Act only allows local government to undertake activities listed in the Act and it usually goes further by prescribing how those activities must be undertaken. The LGA imposes on territorial authorities the duty to “make provision for the collection and reduction, reuse, recycling, recovery, treatment, or disposal of waste in the district”. While this mentions the steps of the waste management hierarchy, no order of preference is assigned to the individual processes, thereby putting avoidance on the same level with disposal. The LGA also provides territorial authorities with the power to make bylaws with regard to waste management. These can prohibit the deposit of waste, or of specific classes of waste, or imposition costs to create incentives for waste minimisation.

**The Health Act 1956**

This act provides local authorities with the option to make bylaws to “improve, promote or protect” public health and prevent or abate “nuisances”. Nuisances can be created by “accumulations” of wastes or deposits likely to be injurious to health and by the burning of waste material and other refuse from any business activity, so that it can harm public health. These regulations could be used to regulate certain aspects of construction and demolition work, such as the disposal and burning of waste on building sites, and the handling, application and storage of hazardous substances during building works. However, under this act, territorial authorities would not be able to make bylaws regulating building products and imposing the design of healthy buildings. The Health Act has been amended by the Building Act so as to limit the powers of territorial authorities to make bylaws regarding building design.

**The Building Act 1991**

The Building Act is concerned with the control of building design and construction, and focuses mainly on the protection of human safety, health, property and amenity during the construction and the use of buildings. The issues of resource-efficient design and waste minimisation on construction sites are not addressed; the overall environmental impact of building materials and
techniques are not considered. Section 7(2) of the Building Act in fact limits the power of territorial authorities to impose requirements additional or more stringent than the Building Code under the RMA, unless this is justified by a particular planning or resource management issue.
9.1 Introduction
According to the World Tourism Organisation (WTO, 2002; TNZ, 2000) between 1950 and 1999 the number of international visitor arrivals world-wide grew from 25 million to 664 million (an average annual growth rate of 7%). The majority (62%) of people travelled for holiday, leisure and/or recreation. The number of international visitor arrivals world-wide is forecast to grow to 1,046 million visitors in 2010. The tourism sector is seen by many countries as a source of economic development, with increasing levels of competition in a global marketplace.

New Zealand’s global market share is estimated to be between 0.25% and 0.45% of all international visitors. The New Zealand market share in our top four markets varies from 0.35% to 17.88% (TNZ, 2001).

Research recently undertaken by Tourism New Zealand (reflecting the year 2000) suggests that between 1995 and 1999 New Zealand’s market share declined in seven of its top nine origin markets. It was estimated that if New Zealand’s 1995 market share position had been held, a further 295,000 international visitors would have visited New Zealand in 2000. This would have added a further $1.12 billion in foreign exchange (TNZ, 2001).

Total international visitor arrivals have grown over the last decade. During the 1990s, international visitor arrivals grew by 85%. International visitor arrivals for 2000 were 1.8 million, an increase of 11% from the previous year. Domestic tourism also grew by 40% over this time. In 1999 it is estimated that domestic tourists outnumbered international tourists by approximately 10:1 (TNZ, 2001).

The measurement of tourism’s contribution to the New Zealand economy is complex due to tourism’s inter-sectoral nature. Statistics New Zealand (Statistics New Zealand 2001) uses a Tourism Satellite Account (TSA) to measure New Zealand tourism activity with the most recent available analysis based on 2000 data. The TSA estimated tourism expenditure (international and domestic) to be $13.2 billion, or 9.7% of GDP (when both direct and indirect contributions are taken into account). The 2000 TSA confirmed tourism to be one of New Zealand’s largest export earners, generating 16% of exports. This was greater than any other single export sector in New Zealand (Tourism Satellite Account 1998 - 2000).

The targets set by Tourism New Zealand (TNZ - the Government Marketing body) for visitor arrivals and visitor expenditure for the year ended June 2000 have been achieved. The targets were: international arrivals of 1.7 million, and visitor expenditure of $4.2 billion excluding international airfares (TNZ, 2001).

<table>
<thead>
<tr>
<th>International Arrivals by Market</th>
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<tbody>
<tr>
<td>Australia</td>
<td>573,870</td>
</tr>
<tr>
<td>UK</td>
<td>200,260</td>
</tr>
<tr>
<td>USA</td>
<td>195,790</td>
</tr>
<tr>
<td>Japan</td>
<td>151,360</td>
</tr>
</tbody>
</table>

*Table 9.1: Sources of NZ’s tourism market (TNZ, 2001)*

1 Previously Tourism Association of New Zealand
Significant differences exist between international and domestic visitor spending patterns due to differing regional preferences. Auckland and Otago are the only regions where international spend exceeds domestic visitor spend.

The tourism industry provides a wide variety of products and services ranging from adventure tourism, to culture and heritage, transport, accommodation, retail, and hospitality. Table 9.2 provides an overview of the composition of the industry in 2001 (excluding airlines) (TIANZ 2001).

Tourism involves a small number of publicly listed companies and it is estimated between 13,500 and 18,000 SMEs, approximately 80% of which employ less than 5 people. The tourism sector in New Zealand accounted for the direct employment of 86,000 full time equivalent (FTE) persons and indirect employment of a further 63,000 FTE persons in 1997. This is equivalent to tourism supporting one in every ten jobs in New Zealand (Tourism Satellite Account 1998 - 2000).

Characteristics of the two main visitor groups are summarised in the two sections that follow.

9.2 International Visitors

In 1999, international visitors numbered 1.8 million (* Tourism Satellite Account, 1998 - 2000 see above) in 2000 and domestic overnight trips for the year have been estimated at 17.2 million. The domestic overnight visitor expenditure however accounted for only 44% of all tourist expenditure (TNZ, 2001).

TNZ estimated international visitor spend to be $4.7 billion in 2000. This is calculated by multiplying International Visitor Survey (IVS) data by departures. This spend increases to $5.4 billion when it is multiplied by international arrivals which are approximately 201,019 greater than departures. As all forecast data is based on international visitor arrivals this higher spend estimate has been used as the basis for forecast comparisons (TNZ, 2001).

Table 9.3 provides a summary of the reasons international visitors travel to New Zealand. Holiday/leisure visitors comprise the majority of visitor arrivals, overnight stays, and total spend.

Table 9.4 provides a summary of the expenditure of international visitors to New Zealand. It is estimated that Japan has the highest spend per visit and contributed the highest proportion of visitor expenditure to New Zealand tourism for the year 2000 (16% of total international visitor expenditure).

<table>
<thead>
<tr>
<th>Products and Services in the Tourism Industry</th>
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<tbody>
<tr>
<td>34%</td>
</tr>
<tr>
<td>16%</td>
</tr>
<tr>
<td>13%</td>
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<tr>
<td>11%</td>
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<tr>
<td>7%</td>
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<tr>
<td>5%</td>
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<tr>
<td>4%</td>
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<td>4%</td>
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<td>3%</td>
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</table>

Table 9.2: Products and services in the NZ tourism industry (TIANZ, 2001)
In analysing these figures it is important to note that Australia has a relatively low spend per visit, but visitors from Australia come in large numbers making up 32% of all international arrivals and generating a lot of repeat business. Seventy percent of those who came to New Zealand in 2000 had been here before. The overall pattern of international visits is seasonal due to the underlying influence of the ‘holiday’ visitor summer peaks and winter troughs.

9.3 Domestic Tourism

In 2000, New Zealanders made an estimated 16.3 million domestic overnight trips, spending 49.9 million nights away from home at an average of 3.0 nights per trip. The overall decrease in the number of trips made in 2000 (compared to 1999), did not occur evenly across the country, with more trips made to South Island main destinations (+1.4%) and fewer to North Island destinations (-2.3%). Waikato, Auckland, Canterbury and Bay of Plenty remain the most commonly visited regions. In total, 72.7 percent of trips had a main destination in the North Island (67.8% of nights) and 27.3 percent of trips were to South Island main destinations (32.2% of nights) (TRC, 2000).

As was the case in 1999, the origin of overnight trips correlates closely to regional populations, with the greatest number of trips originating from Auckland, Wellington, Canterbury and Waikato. On average New Zealanders made 5.7 overnight trips each in 2000, with North Islanders making fewer trips than in 1999 (-2.2%), and South Islanders making more (+1.2%). Residents of Waikato (7.2 trips per capita), Marlborough (7.2) and Bay of Plenty (6.9) were the most frequent travellers while residents of Auckland (4.9) were the least frequent travellers (TRC, 2000).

Although the number of trips declined from 1999, trips made for holiday/leisure reasons (42.4% of all trips) increased by 3.2 percent and trips made for ‘other’ reasons (8.6% of all trips) also

<table>
<thead>
<tr>
<th>International Visitors: Reason for Visit</th>
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<tbody>
<tr>
<td>Visitor arrivals (%)</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Visitor nights (%)</td>
</tr>
<tr>
<td>Visitor spend (%)</td>
</tr>
</tbody>
</table>

*Table 9.3: Reasons international visitors give for travelling to NZ (TNZ, 2001)*

<table>
<thead>
<tr>
<th>Market</th>
<th>Percent of total international visitor expenditure (%)</th>
<th>Spend per visit ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>16.3%</td>
<td>$5,867</td>
</tr>
<tr>
<td>Australia</td>
<td>16.2%</td>
<td>$1,535</td>
</tr>
<tr>
<td>United States</td>
<td>12.7%</td>
<td>$3,512</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>12.3%</td>
<td>$3,344</td>
</tr>
<tr>
<td>South Korea</td>
<td>4.8%</td>
<td>$3,931</td>
</tr>
<tr>
<td>Germany</td>
<td>3.5%</td>
<td>$3,694</td>
</tr>
<tr>
<td>Taiwan</td>
<td>2.2%</td>
<td>$2,943</td>
</tr>
<tr>
<td>Canada</td>
<td>2.1%</td>
<td>$3,393</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1.1%</td>
<td>$4,675</td>
</tr>
<tr>
<td>Other</td>
<td>28.8%</td>
<td>$3,317</td>
</tr>
<tr>
<td>All markets</td>
<td>100.0%</td>
<td>$3,039</td>
</tr>
</tbody>
</table>

*Table 9.4: Expenditure in NZ by international visitors from various markets (in the year to December, 2000) (TNZ, 2001).*
increased (+26.5%). Conversely, the number of trips made to visit friends and relatives (VFR, 35.1% of all trips) declined (-6.8%), as did the number of business trips (13.9% of all trips, down 12.1%) (TRC, 2000).

Holiday/leisure travel accounted for close to half of all person nights (48.3%), VFR just over a third (34.6%), and business travel 10.4 percent of all nights. It is estimated that in 2000 New Zealanders spent $4.05 billion on overnight domestic travel at an average of $81 per night. This is a slight drop in total expenditure since 1999 (-0.6%), but an increase in average expenditure ($77 in 1999). The regions receiving the largest shares of this expenditure were Auckland (17.2%), Canterbury (14.4%), Waikato (12.0%) and Wellington (11.2%). Overall 67.2 percent of expenditure occurred in the North Island and 32.8 percent in the South Island (TRC, 2000).

Mean expenditure per night was highest in Wellington ($108 per night), Auckland ($103 per night) and Canterbury ($94 per night). Mean expenditure was $80 per night in the North Island and $83 per night in the South Island. The greatest proportion of travellers’ average daily expenditure was spent on transportation (26.4%), food (25.3%) and accommodation (18.5%). Other shopping (10.6%), alcohol (9.3%), recreation (6.2%), gifts and souvenirs (3.1%) and gambling/casino (0.7%), made up the remainder of expenditure (TRC, 2000).

As in 1999, the majority of nights on overnight trips were spent in the homes of friends or relatives (51.3%), with hotels and motels (21.0%), camping grounds (10.3%), holiday homes/baches (7.9%) and ‘other’ types of accommodation (9.6%) accounting for the remaining nights away. The overall drop in the number of nights spent away was reflected across all accommodation types. In particular hotels, motels and ‘other’ forms of accommodation suffered the largest drops in the number of nights spent, while private homes, holiday homes and camping grounds experienced smaller decreases (TRC, 2000).

January and February were the most popular months for overnight trips. Trip numbers were lowest over May/June, but peaked again in September/October. Holiday/leisure trips were particularly affected by seasonal fluctuations, as were VFR trips, albeit to a lesser extent. Business trips peaked mid-year, but overall, followed a more stable pattern throughout the year (TRC, 2000).

In addition, it is estimated that New Zealanders made 36.8 million domestic day trips in 2000 – an average of approximately 13 day trips each, per year. This is a 16.9 percent decrease in the number of trips since 1999. A key possible reason for this was the rapid increase in petrol prices over 2000. As in 1999, Auckland (18.5%), Waikato (15.9%) and Canterbury (13.2%) were the most popular destinations for day trips. Overall, 75.5 percent of day trips had North Island main destinations, and 24.5 percent had South Island main destinations. The overall drop in the number of day trips taken was higher for South Island destinations (-19.4%) than for North Island destinations (-16.0%) (TRC, 2000).

Aucklanders made the largest number of day trips (22.5%), followed by travellers from Waikato (14.4%) and from Canterbury (13.4%). Travellers from Waikato remained the most prolific day travellers making an average of 19.4 trips per year, per capita. Travellers from Northland (18.8), and the Bay of Plenty (17.3) were also relatively frequent day travellers. Residents of Marlborough (7.6) and Auckland (9.5) were the least frequent day travellers (TRC, 2000).

The main reason for undertaking a day trip in 2000 was holiday/leisure related (43.3%). One in four trips was taken to visit friends or relatives (24.2%) and just under one in five for business
The remaining trips were taken for ‘other’ reasons (14.3%). The numbers of trips of all types declined, in particular VFR trips (-22.0%). Trips taken for ‘other’ reasons declined least (-0.5% ) (TRC, 2000).

It is estimated that New Zealanders spent a total of $2.2 billion on day trips in 2000 at an average of $61 per trip. This represents a drop in expenditure per trip and as a result, a 21.6 percent decrease in total expenditure from 1999. The majority of this expenditure occurred in Auckland (18.6%), Waikato (15.6%) and Canterbury (13.0%). Average expenditure per trip was highest for trips to Otago ($68 per trip), Wellington ($68) and West coast ($66) and lowest for trips to Taranaki ($55) and Marlborough ($56) (TRC, 2000).

Transport comprised the largest component of day trip expenditure (34.4%) followed by food (25.8%), and other shopping (24.7%). The remaining expenditure items were recreation (5.1%), alcohol (4.7%), gifts/souvenirs (4.0%) and gambling/casino (1.3%). The private vehicle was by far the most common mode of transport for day trips (91.8% of sectors travelled). Air travel was a distant second (1.8%) followed by commercial bus/ferry and bus/coach (1.7%) (TRC, 2000).

As with overnight trips, January and February were the most popular months for day trips. Trip numbers then dipped to a low in May/June, before rising in September/October and dropping to the lowest levels in November/December. Holiday/leisure trips were particularly affected by seasonal fluctuations. VFR trips were most common over January to April, but followed a steady pattern for the remainder of the year. Like overnight trips, Business day trips also peaked mid-year (TRC, 2000).

Auckland received the greatest proportion (17.7%) of total domestic expenditure (spent on day and overnight travel), followed by Canterbury (13.9%) and Waikato (13.3%). Overall, total direct expenditure dropped 9.2% between 1999 and 2000. Only Gisborne and Hawkes Bay registered a significant relative increase in total expenditure, while Northland and Marlborough suffered the largest relative losses. In total, 69.9 percent of all domestic expenditure occurred in the North Island and 30.1 percent in the South Island (TRC, 2000).

Overall, 64.5 percent of all domestic expenditure occurred on overnight trips (up from 58.9% in 1999), and 35.5 percent on day trips. Regions in the South Island received a higher proportion of domestic travel income from overnight trips (70.5% on average), than regions in the North Island (61.9%) (TRC, 2000).

The profiles of domestic travellers are interesting. Studies conducted by Massey University and Ministry for the Environment (Massey University, 2001; MfE, 2001) suggested that New Zealanders are increasingly concerned about issues such as waste minimisation, clean air and clean water. Those who had made an overnight trip in the previous month were more likely to be younger (15-34), with likelihood decreasing with older age. They were also more likely to have a higher than average household income, be male, and live in Marlborough, Waikato, Bay of Plenty or Otago.

Those making day trips were more likely to be aged under 70 years, earning a moderate to high household income and be male. Overall however the likelihood of making a day trip is less clearly influenced by factors such as age and income than for overnight trips (TRC, 2000).

Those who had made an overseas trip in the previous year were more likely to be in the 45-69 year old age bracket, have a high household income and live in Auckland, Wellington or Christchurch. The most common reasons given for not taking a domestic trip recently were having no reason to travel (29.9%) and having no time to travel because of work (28.7%), or family commitments (7.5%). Cost was mentioned by a higher proportion than in 1999 (13.5% compared with 10.5% in 1999), suggesting the increased cost of travelling in 2000 was a factor in the drop in the number of trips taken (overnight and day) (TRC, 2000).
9.4 Resource Use and Waste Minimisation within the Sector

Consideration of resource use and waste minimisation within the sector can contribute to the tourism industry’s vision and mission. However, the multifaceted nature of the tourism sector and the fact that it provides a service, not tangible products such as the dairy, meat and forestry sectors, makes resource use difficult to apportion and quantify. Fig. 9.1 shows the components of tourism as identified for marketing purposes.

Each component uses resources, some within and some outside the country, and the type and quantity depends on the activities themselves and the services they provide. In addition, the visitors themselves undertake a wide range of activities, which in some ways are specific to their tourism experiences, but in others mirror those of the general population. The wide range of tourism experiences means that it would be an extremely complex exercise to identify, let alone quantify, the resources used by visitors.

Some work has been done, in relation to other programmes within the industry to quantify resource use. The most obvious of these is energy use. Research by Lincoln University and Landcare Research note that the direct energy consumption in 1997/98 by the tourism sector was 27.53 PJ1 (cf. TRC, 2000). This energy use resulted in 1,438,000 tonnes of CO₂ emissions. Given national totals of 440.64 PJ of energy and 28 million tonnes CO₂ in 1997/98, the tourism sector accounts directly for 6.2% of direct energy use and 5.1 % of CO₂ emissions.

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1 Measured in tonnes of oil equivalent
Domestic tourism is responsible for 74% of tourism’s direct energy use and associated CO₂ emissions. This is mainly explained by the much larger tourist volume of more than 16 million trips per year compared with international tourist arrivals of about 1.7 million per year. When measuring the direct and indirect pressure on the environment in the form of energy use and CO₂ emissions, tourism ranks 19th out of 26 sectors, whereby the 26th consumes most energy and produces the largest amount of CO₂. ‘Households’ (134 PJ), ‘Basic Metal Products’ (54 PJ), and ‘Transport and Storage’ (44 PJ) are the largest energy consumers and CO₂ producers.

While the sector is complex, tourism operators are at the workface of the sector and their approach resource use and waste minimisation will impact directly or indirectly on the resources the visitors use among the tourism operators.

The case studies below are based on the responses given by a range of New Zealand Tourist Operators to a number of questions relating to waste reduction, energy consumption and/or water consumption within their operation.

9.5 Resource Stewardship within the Sector

Potential visitors view destination or brand New Zealand in six key realms or axes that have been summarised as “energising”, “sociability”, “connection”, “relaxation”, “learning” and “status”. They are explained in Table 9.5.

Tourism New Zealand’s current branding makes use of these realms. The ‘100% Pure New Zealand’ brand is used to build on those realms by integrating the brand into statements such as ‘100% Pure Fun’, ‘100% Pure Relaxation’, etc.

Potential and actual visitors see New Zealand’s key appeal being its natural environment - putting New Zealand strongly in the natural rather than the social realm. While New Zealand is well-positioned to meet needs at both ends of the natural realm (energising and relaxing), it is the desire of Tourism NZ to focus on the more aspirational energising need. This is because focusing on relaxation reinforces some current perceptions of New Zealand as a relatively quiet and uninteresting destination.

It is interesting to note that the market sees the brand a little differently. The report by Otago University (Higham, Carr and Gale, 2001) noted that around 16% of respondents did not believe the clean green perception that this brand might imply. Just under 30% of New Zealanders, 18% of Canadians and 17% of German visitors did not believe that the brand’s environmental

![Figure 9.2: Tourism Industry direct CO₂ emissions from different fuel sources](image)

*(Let's Talk Tourism*, 2002)
perception was realistic. Specific issues raised included lack of recycling, litter, human waste, logging, use of sprays, and little use of alternative energy. This finding also highlights the potential impact other industries may have with regard to delivering a tourism product that incorporates a high perception of ‘clean and green’.

In 1995, TNZ (then the New Zealand Tourism Board) commissioned Colmar Brunton to research product development opportunities in the fast growing North Asian and South East Asian markets (TNZ and Colmar Brunton, 1995). In 1997, TNZ commissioned a similar study for the North American and Central European markets (TNZ and Colmar Brunton, 1997). The

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<th>Realm or axis</th>
<th>Explanation</th>
<th>Typical perception</th>
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<tr>
<td>Energising</td>
<td>New Zealand’s distance and rugged natural beauty have strong appeal, and the country can fit the need for new and interesting outdoor destinations. However, some travellers perceive New Zealand as currently too quiet and pastoral.</td>
<td>“I would go there because of the nature, just to see what it is like to get lost in the wilderness down there.”</td>
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<td>Sociability</td>
<td>Overall, New Zealand is not an ideal fit for travellers with sociability needs, as the New Zealand experience is seen as lacking the necessary social liveliness these travellers seek. Backpackers are a notable exception, as a social interaction through the backpacker network allows young people to meet and socialise with backpackers throughout the country.</td>
<td>“You don’t really think of New Zealand as having a night life or many people - more quiet and relaxing.”</td>
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<tr>
<td>Connection</td>
<td>New Zealand is seen as providing the relaxed, easy-going environment these travellers seek. However, as they enjoy group activities, they may feel there are not enough activities in the cities for a group of friends, a couple or a family.</td>
<td>“She’s looking for something where the whole family can relax. They would be safe in New Zealand with the children but she wouldn’t be sure if the kids would have enough to do. Also it’s a long way to take a family and they want to do things as a family.”</td>
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<tr>
<td>Relaxation</td>
<td>New Zealand is an ideal fit for these travellers as it is seen as providing a relaxed, scenic natural environment perfect for really kicking back and enjoying nature.</td>
<td>“It’s a feeling of calm and serenity. He hasn’t got a care in the world. Finally time to stop rushing and to smell the roses…to kick back and enjoy his surroundings.”</td>
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<tr>
<td>Learning</td>
<td>New Zealand is seen as lacking a strong and different indigenous culture. Its dominantly European culture is not sufficiently exotic, mysterious or authentic for the tastes of these more independent and adventurous travellers.</td>
<td>“The native culture there is pretty much gone…it’s all just touristy stuff, so you don’t really see much different.”</td>
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<tr>
<td>Status</td>
<td>New Zealand’s unique and premium aspects can appeal to this need for “one of a kind” or premium experiences. The exceptional natural environment coupled with factors such as off-season skiing and premium fishing, golfing and accommodation can appeal to these very discriminating travellers.</td>
<td>“I have always wanted to go skiing there in the summer time. I thought it was going to be wild to go skiing in August and July. Just really just to say to people, ‘What did you do for the summer?’ I’d say, ‘I went skiing.’ They’d say, ‘Water skiing?’ I’d say, ‘No, snow skiing.’”</td>
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Table 9.5: The six realms or axes of NZ tourism and the perceptions that typify them. (Tourism New Zealand, 2000)
Case Study 9.1: The Kaikoura Winery, Kaikoura

The Kaikoura Winery is situated on State Highway 1, just south of the Kaikoura township. It has been in operation for approximately three years and is currently working through Green Globe 21 Benchmarking. The winery offers wine tasting in the bar, has a high-quality Deli Bar, an extensive gift/souvenir area and guided tours through the underground wine cellars. The winery currently grows the grapes in Marlborough, but does have young plantations on the winery grounds. Kaikoura Winery is a Green Globe 21 Benchmarked operation.

Solid Waste

The Kaikoura Winery manager and staff find the only problem with solid waste reduction/minimisation is time and space. Otherwise they find waste reduction very manageable and are conscious of resource stewardship. The winery is currently working towards becoming a local flagship ‘zero waste company’. The largest current solid waste is glass bottles, followed by cardboard, office paper then plastic. All bottles go to the local recycling centre where they are crushed and used for field drains. The cardboard and recyclable plastic are baled by the recycling centre for the Christchurch recycled materials markets and most office paper is shredded and used for mulch. All organic food scraps go to a pig farm. The remaining solid waste is landfilled as were the above materials prior to the establishment of the recycling centre. Recycling practices have been improved since installing separate recycling bins both inside and out and there is regular staff training on waste reduction.

An obvious economic as well as environmental improvement of waste reduction is the cost savings (both on the bottom line as well as the environment) by simply not landfilling. The staff enjoys talking to the customers and takes pride in the fact that as an operation they are being as ‘green’ as they can be at this stage. Future improvements include all corks being given away or sold for cork boards or to be used as props for the Kaikoura Recycled Arts Show. The Deli Bar’s use of plastic cutlery will be replaced with stainless steel reusable cutlery. Giftware stock made from New Zealand recyclable materials is purchased and minimal packaging from stockists encouraged.

For the winery, the main lesson to be learnt from this process is that as an operation we can do a lot more in terms of waste reduction without putting too much effort in, once the systems are in place, and it’s not nearly as hard as you would think. It’s a case of changing habits and rather than relying on recycling, the winery is learning to think about what is purchased first, e.g packaging around gifts, recycled toilet paper and tissues.

Fresh Water Resources

The same questions were applied to the management of fresh water resources. The main problem in Kaikoura is the water shortage during the summer months and the consequential water restrictions enforced. To overcome water restrictions and to help encourage water conservation the winery has a number of initiatives in place, including:

- rain water caught for vineyard/winery use;
- toilet flush levels set on economy;
- taps regularly checked for leaks;
- water recycled for plant watering;
- utilising winery solid wastes for mulch; and
- use of biodegradable and phosphate free cleaning materials.

The winery also only irrigates vine plants minimally by using a trickle feed irrigation system.
The purpose of this research was to understand expectations of tourists in these target markets, and strategies to increase their numbers. The findings of the research pertinent to this paper are summarised below.

- Asian tourists were mainly attracted to New Zealand for the “real nature experience” it provides. The research indicated that they were attracted to an experience that was both tranquil and relaxing as well as “stunning and expansive”. For older people, especially couples, the emphasis appeared to be on tranquillity and relaxation, whereas with younger visitors the emphasis was more on personal challenges and “extending boundaries”. The research also found that Asian tourists were very keen on experiencing a “real Kiwi lifestyle” that could be best expressed through a pastoral theme.

- For European and North American tourists the total image of New Zealand as a holiday destination and expectations of their experience motivate them to travel here.

- North Americans tend to travel here to take “a vacation and a time out”. They have very high expectations of the scenery and landscape. While Canadians seek “a colourful, contrasting world” and a “fresh experience”, visitors from the USA tend to seek “a unique and spectacular experience”.

- Tourists from the Netherlands and Germany tend to be environmental enthusiasts. While Dutch tourists are enthusiastic about nature they are not precious about it. Their emphasis is on “understanding and appreciating the nature as well as the people”. Visitors from Germany, however, are very staunch with regards to their expectations of the scenery and landscape that has been promised to them. They perceive the environment in Germany to be “damaged” and feel that New Zealanders should respect and appreciate the environment they have. Nature and landscape is the primary motivation for travelling in this case.

- Visitors from the UK are motivated by a sense of cultural familiarity as well as the perception of New Zealand as a “Garden of Eden”, with a relaxed lifestyle, lush and flourishing forests and fresh fruits and vegetables, which are often not available in the UK. Their expectations are that of an “untouched paradise that is refreshing and abundant” (TNZ and Colmar Brunton, 1995, 1997).

From 1999 through to 2000, market perceptions were tracked by CM Research New Zealand (TNZ and CM Research, 1999). Markets in North Asia, South East Asia, USA, UK and Central Europe were examined. One of the purposes of this research was to monitor New Zealand’s image in the target markets and assess how perceptions change over time. The research showed that in all these markets, New Zealand was strongly associated with beautiful scenery, being refreshing and revitalising, an outdoor lifestyle, adventure, and time ‘away from it all’.

Part of the new vision of the strategy is that NZ environmental and culture be preserved and sustained in the spirit of kaitiakitanga and guardianship. The new mission includes protecting our environment and the new objectives involve securing and preserving a long term future.

In developing the New Zealand Tourism Strategy to 2010, input was sought from a wide cross section of the tourism sector through one-on-one interviews, individual and group submissions, facilitated workshops, cluster-based focus groups, and strategy sessions at the Tourism Industry Association’s ‘Tourism @ Work 2001 Roadshows’.

Kaikoura Wine Company, State Highway 1, Kaikoura
Manager Neroli Gold, 03 319 7966.
Case Study 9.2: Adventure South, Christchurch

Adventure South is a Christchurch-based operation specialising in nation-wide guided cycling, hiking and ‘mid-life adventure’ active tours of New Zealand. Adventure South is a Green Globe 21 Benchmarked operation.

Solid Waste
The Director of Adventure South has delivered the clear message relating to the importance of solid waste reduction, reuse and recycling very effectively resulting in absolute buy-in by all staff and guides. A comprehensive recycling process is in place, and on all trips plastics, cans, paper, glass bottles and a large proportion of compostable materials are either dropped off at various recycling centres around the trips, or if this not possible are brought back to the main office depot for recycling.

Items remaining that are often difficult to recycle during the trips include yoghurt containers, plastic food containers, tin foil, tissues and general food wrappings. These items are then landfilled. However, as an organisation Adventure South is diligent in its purchasing of such items prior to trips.

In the past year, Adventure South have taken some significant steps (as listed below) to ensure a waste minimisation scheme is firmly in place. These include establishing an Environmental policy incorporating the waste minimisation policies from Green Globe. Involved in this are the setting of objectives and action plans, and putting these in place.

- Both depot and office waste during the past season has been regularly audited involving guides and staff.
- Shopping bags made up to reduce plastic bag usage
- Compost bin set up at depot – the remaining waste going to staff member’s chickens.
- Also compost bin set up at Queenstown base.
- Recycling bins set up for regular sorting and dispatching. All trips also have these bins.
- Communication with suppliers to assist in providing drop off points for waste along the trip route as well as understanding their initiatives and contributions in their communities.
- Regular communication with staff.

Adventure South is committed to improving and learning about its environmental responsibility, to understand its impact and to find ways to improve the negative and acknowledge the positive. Adventure South disseminates this message to its suppliers, staff and other operators in the tourism industry.

Water and Energy
Minimal water is used on trips and tours, with all water usage recorded. Buses carry a 25 litre container, which when filled up on a trip stopover is then recorded. Adventure South endeavour to waste as little water as possible, and educated their clients to think and act the same way.

Bus cleaning is the biggest problem faced in water consumption. However again, minimal water is used, and often recorded and measured to improve upon e.g by investigating the usage of high pressure spray cleaning.

The biggest form of energy consumption is office power e.g the use of computers, lights, heaters, radios, etc. Energy consumption has been measured, and strategies are being
This input identified a range of challenges that the sector must meet to remain competitive in the global marketplace and to ensure that tourism remains sustainable. There is a high degree of consensus about the challenges presented. The challenges identified include:

- ensuring that tourism does not deplete the natural resource on which it depends;
- making the most of our branding and marketing, recognising and championing our positive points of difference;
- understanding better what visitors will be seeking from New Zealand and what motivates them to travel;
- making New Zealand tourism product more distinctive and aligned to visitors’ needs and wants;
- taking a more strategic approach to pricing and positioning to support increased yield and better returns for operators and investors;
- finding ways for all parts of the tourism sector to be more efficient and to work more effectively together;
- capturing the opportunities offered by technology; and
- developing the quality of New Zealand product and becoming internationally known for this.

To address the identified challenges and ‘future proof’ the sector, the New Zealand Tourism Strategy focused on: continued sustainable growth; integrating marketing and destination management; managing and increasing yield; increased participation and partnerships, and aligning and rationalising structures (Office of Tourism and sport, 2001) The long-term future of the sector is linked to growing tourism in a way that protects our natural, cultural, built and social heritages. Closer links will be established between these heritages and growth, in order to safeguard the sustainability of growth.

A coherent and balanced approach will be taken to yield optimisation. Increasing visitor numbers is important, but this must be linked to effective pricing, yield and destination management strategies. There will be more effective partnerships established between: public and private sectors; central and regional/local government agencies; regional tourism operators (RTOs) and other agencies/operators, including Maori tourism organisations, and the industry and Maori in general. There will be more participation of Maori, local communities and individual New Zealanders in shaping and delivering tourism. Current structures will be aligned with and support the future development of tourism in New Zealand. This will involve some ‘rationalisation’ of current participants as the sector is over serviced and under served by the current multiplicity of organisations.

Sustainability is critical to ensure the benefits accruing from the sector’s growth are not short-lived. To achieve sustainable growth a unified vision and mission and a set of supporting objectives have been developed to guide the sector over the next ten years. The following is the Vision for Tourism in New Zealand that has been developed to provide a picture of the desired future:

“In 2010: Visitors and their host communities understand and embrace the spirit of...
manaakitanga (hospitality) while, New Zealanders' environment and culture is conserved and sustained in the spirit of kaitiakitanga (guardianship) and, tourism is a vibrant and significant contributor to the economic development of New Zealand.”

(New Zealand Tourism Strategy 2010).

The vision reflects the future for tourism in New Zealand and consists of:

- the people involved in the sector, including those who visit and travel within New Zealand;
- those who are employed in the sector, and the communities that host visitors;
- the place in terms of promoting destination New Zealand and its regions in a way that ensures the effective management of destination elements and sustainability issues;
- the prosperity of both the sector and its individual businesses based on informed, investment, business profitability and the economic and social well-being of communities; and
- New Zealand as a whole.

The Vision informs the Mission, which is to:

- welcome visitors;
- protect our environment; and
- celebrate our culture.

(New Zealand Tourism Strategy 2010).

This mission statement was developed for participants in the tourism sector and aims to guide and inspire the actions of the tourism sector. Participants should be confident that by aligning
9.6 Governance of the Sector

The Tourism Industry in New Zealand is governed by a mix of public and private sector stakeholders. The Tourism Industry Association New Zealand (TIA) is a membership-based and funded organisation representing the interests of over 3,500 businesses from throughout the tourism industry. TIA has four main areas of activity:

- industry advocacy, including government relations and media and industry relations updates;
- business networking, providing forums for business and professional development (e.g. Conference and TRENZ) and vehicles to identify issues that impact on business and industry performance (e.g. Reference Groups);

Case Study 9.4: Dolphin Encounter, West End, Kaikoura

Dolphin Encounter is a well-established locally owned business with a commitment to a strategy of environmental sustainability and improving operator efficiency. They are currently at the Green Globe 21 Benchmarking stage.

**Dolphin Encounter**

Reducing, reusing and recycling waste for Dolphin Encounter is an important and integral part of its environmental sustainability commitment. Dolphin Encounter is fortunate that to a certain extent this is made relatively easy, in the Zero Waste District it operates from, and the excellent recycling service offered by Innovative Waste, Kaikoura.

The whole organisation is very focused on reuse and recycling and tries hard to reduce the volume of waste to landfill. This is their single and most effective plan of action in managing their waste.

They are looking at reduction in packaging by choosing bulk products in preference to smaller amounts of the same products.

Dolphin Encounter believes that this is a very important aspect of Green Globe 21 and will be the outcome that many businesses will find motivating and inspiring. Economic effect of include paying less dumping fees by recycling and buying in bulk, which saves money and reduces packaging. Environmental benefits include extending the life of the landfill, and an increased awareness of what waste does to our environment in a negative sense.

Social benefits include acknowledging that a small change in habits can have a significant impact on the negative environmental impacts, that each of us can make a difference, and instilling in everyone (staff, customers, community) that taking responsibility is the key to making that happen.

**Problem faced with waste reduction/minimisation**

Dolphin Encounter believe that as you look in depth at each of the benchmarking criteria (Green Globe 21) specific to your business it brings an understanding of the impact on resources that your business activity creates. It makes you take on a sense of ownership.

Dolphin Encounter
58 West End, Kaikoura,
03 319 6777

their policies or business strategies to the mission they will benefit from the mission’s promises. This will in turn build prosperity as outlined in the vision for the sector.
• industry development programmes that involve developing, coordinating or sourcing programmes for the industry that can contribute to improvements in business performance/results; and

• membership services, including membership deals, newsletters and issues.

Membership bodies also exist for other specific sectors within the tourism industry, e.g. the Bus and Coach Association, and the Motel Association. Most of these groups are affiliated to TIA.

Tourism New Zealand is a Crown entity and is responsible for the international marketing of Destination New Zealand. This is done through developing, implementing and promoting strategies to market New Zealand’s tourism industry. Tourism New Zealand was established in November 1991 and has recently promoted the following mission: “To motivate the world to come now, do more and come back.” The organisation’s vision is to make New Zealand the ultimate destination and ensure the world knows it. The board receives and annual appropriation from Government of $55 million to fund its operations.

The Ministry of Tourism commenced operation on April 1st 2002, taking responsibility for the policy functions previously performed by the Office of Tourism and Sport within the Ministry of Commerce and the sports policy functions previously performed by the Policy Group in the Department of Internal Affairs. The Ministry is focused on advancing the cause of tourism and related issues within Government. The following are the primary roles of the Ministry in relation to tourism:

• Provide policy advice on tourism and related issues.

• Promote understanding of tourism issues within Government.

• Identify and seek to provide for the information needs of the tourism sector.

• Administer the various relevant Acts for which the Ministry is responsible (New Zealand Tourism Strategy 2010) [ditto].

The Office is responsible to the Secretary of Internal Affairs on State Sector Act and Public Finance Act issues and to Vote Ministers (Tourism) for the delivery of the outputs specified in the Purchase Agreement. The 2000/02 appropriation for policy advice was $2.5 million (Ministry of Tourism website, www.tourism.govt.nz)

Local government are represented in the governance section of tourism in a variety of forms and models. In general there are two main groupings: Regional Tourism Organisations (RTOs) and District Tourism Organisations (DTOs). There are currently 25 RTOs. All of these operate under different structures (e.g. Trust, work within a Territorial Local Authority, stand alone company). Primary sources of funding for RTO’s totalled around $25 million in 2000 with 57% of this coming from local government. The remaining amounts were largely generated by sales from Visitor Centres and joint initiatives with industry. The key roles of RTO’s are based around Destination Marketing, providing business advice, economic development initiatives and maintaining conventions bureaus. There are at least 30 DTOs. Little research has been completed on this grouping but the majority are assumed to be funded by local government. Their key roles are Destination Marketing and providing business advice (NZ Tourism Strategy 2010).

One of the key issues in tourism is the governance of who or what environmental management process is most applicable to the tourism industry. There are a plethora of environmental management processes or philosophies in the marketplace. They include: Triple Bottom Line, The Natural Step, Business for Social Responsibility, Enviromark, ISO 14000.

When these are added to the 110 (November 2000) international environmental schemes with some tourism bias, there is a clear governance issue in terms of a process and approach that best meets the needs of tourism businesses. While businesses are free to choose whichever process is most appropriate, there is, at least within tourism a link between the strategy and the industry-
preferred process, e.g. Green Globe 21.

9.7 Drivers for Change within the Sector

Sustainable tourism development demands strategies that embrace many environmental and economic, as well as social aspects. This section discusses the drivers for change on the environmental aspects of sustainability as it relates to tourism in NZ.

Four goals have been identified in the NZ Tourism Strategy process within this area.

- To recognise the value of the natural environment and actively protect, support and promote its sustainability.
- To ensure Maori participate and are partners in the tourism sector and that the Maori and culture and identity is protected.
- To proactively foster the recognition, understanding and appreciation of New Zealand’s built, historic, cultural and Maori heritage.
- To have New Zealanders and their communities understand and actively support tourism (New Zealand Tourism Strategy 2010).

The natural environment is clearly fundamental to the New Zealand brand and many tourism products. New Zealand promotes a clean, green brand image and visitors assume that New Zealand is vigilant at environmental management. This is not always the case, as illustrated by a 1997 OECD survey that ranked New Zealand last when it came to the number of companies producing environmental reports. In addition, New Zealand may struggle to meet the 1997 Kyoto protocol, which requires developed nations to reduce carbon dioxide emissions by 5.2% of their 1990 levels between 2008 and 2012 (Ministry for the Environment, 1999).

In other instances New Zealand demonstrates a much greater commitment to environmental management. These include Green Globe 21, the Seoul Declaration and the APEC/PATA Code. Green Globe 21 is an international environmental accreditation programme for travel and tourism companies, and New Zealand leads the world in implementing it. The activities carried out in the case studies were conducted as part of the Green Globe 21 programme. The Seoul Declaration resulted from the APEC Tourism Working Group meeting in Seoul in 2000. One of its outcomes is a ‘Tourism Charter’, which sets out four policy goals, one of which is “to sustainably manage tourism outcomes and impacts”. New Zealand chaired the working group that developed this recommendation (Tourism Industry Association, 2000).

At the Pacific Asia Travel Association (PATA) meeting in April 2001, PATA and APEC adopted the Code for Sustainable Tourism. The code, which New Zealand developed with PATA, encourages APEC member economies to:

- conserve the natural environment, ecosystems and biodiversity;
- respect and support local traditions, cultures and communities;
- maintain environmental management systems;
- conserve energy and reduce waste and pollutants;
- encourage a tourism commitment to environment and culture;
- educate and inform others about local environment and culture; and
- co-operate with others to sustain environments and cultures (Ministry of Tourism, 2000).

Environmental conservation is not currently seen as the responsibility of all those that operate in the sector. The sector must improve the management of environmental elements if the benefits of growing visitor numbers are to continue to outweigh the costs that this growth imposes on accessibility and use of these environments.
The planning and development of sustainable tourism involves a range of elements, and how these are co-ordinated is outlined below.

At present tourism planning and development is seen to be fragmented, complex and inefficient. It is undertaken by many agencies often independent to the tourism sector and it is especially hard for operators new to the sector to understand. Its inefficiencies are partly related to the number of organisations involved. The working relationships between current RTOs and local governments are not as effective as they need to be to ensure tourism and attractive elements of New Zealand, remain sustainable in the longer-term.

The friendliness of the New Zealand people is one of our differentiators, but not all welcome tourism activity. While some people will continue to resist tourism, increasing the awareness of the benefits of tourism (for instance the economic returns it delivers, how it impacts the environment) should eventually lessen the resistance. Support for tourism at the community level will be critical to ensuring that the required infrastructure to support tourism is in place, and that destination management and destination marketing are linked so that the benefits of tourism outweigh the costs at a community level.

The NZ Tourism Strategy 2010 addresses the need for all New Zealand environmental factors to be protected and promoted. Maori participation in all facets of this strategy is essential. It requires all sector participants to commit to conserving the natural environment to achieve sustainability and to maintain the quality of the visitor experience. The aim is to have all operators and organisations recognising the value of the natural environment and actively protecting, supporting and promoting its sustainability as part of what they do. All sector participants must embrace the values of manaakitanga and kaitiakitanga.

Environmental sustainability and enhancement of the quality of the tourism product are interrelated. The Strategy’s key recommendations involved the Ministry for the Environment (MFE), the Ministry of Tourism, TIANZ and the Department of Conservation (DoC). By 2010 MFE, the Ministry of Tourism and TIA, are to develop and promote, on behalf of private sector operators, resource use efficiency initiatives and environmental management systems that will achieve agreed international benchmarks (including carbon neutrality). DoC is to monitor visitor impacts on the protected environment and promptly intervene to manage these impacts using tools such as booking systems and one-way routes. The Department has also recommended that DoC invests in maintaining existing, and developing new recreational services and facilities on conservation lands to support increased visitor growth without damaging the environment.

Other recommendations were: for operators to continue to implement Green Globe or similar systems; to implement the Seoul Declaration and the APEC/PATA Code; to investigate options for carbon neutrality and resource use efficiency; to develop a tourism environmental statement, and to investigate the options for monitoring and minimising conflicts between tourism and the environment.

Tourism planning and development must be streamlined and made more effective if New Zealand is to succeed in accommodating the projected growth in visitor numbers sustainably over time. Tourism planning and development is an important strand across many of these areas.

The key recommendation of the Tourism Strategy 2010 was to adopt a whole of sector model to
reduce complexity and improve efficiency in tourism planning and development by 2004. This will be led by LGNZ with local operators, investors, local government, Maori, New RTOs, New TNZ and central government agencies. This will require relationships and processes to be put in place to support better planning and development efforts.

Further recommendations are outlined below.

- Identify and monitor the cumulative effects of tourism activities on the environment and develop options for their management. This will be undertaken by TLAs, Regional Councils and the Ministry for the Environment.
- Develop and implement district and tourism planning processes that uphold community values and involve communities in identifying local assets and defining acceptable limits of change for these. This will be undertaken by TLAs and New RTOs.
- Develop frameworks for identifying outcomes and assessing the impact of tourism.
- Increase participation in planning and develop process by Maori.
- Work with Maori to manage the protection of Maori rights of ownership and non-depletion by tourism of Maori historic and cultural heritage.

As part of this co-ordination this strategy recommends that new RTOs’ roles incorporate elements of destination management as well as destination marketing.

The risk of potential damage to New Zealand’s reputation for being ‘clean and green’ was highlighted in an MFE report “Valuing New Zealand’s Clean Green Image?” (MfE, 2000). In summary the study found that the extent of change in purchasing behaviour varied by country. “… Under worsened environmental perceptions, tourists in New Zealand would reduce their stay by: 48% (Australia), 79% (Japan), 77.5% (UK), 70% (US) (see Table 9.6). The annual loss to

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<tr>
<th>Australia</th>
<th>United States</th>
<th>United Kingdom</th>
<th>Japan</th>
<th>Korea</th>
<th>Total Annual Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Expenditure (NZ$M)</td>
<td>907</td>
<td>807</td>
<td>693</td>
<td>703</td>
<td>108</td>
</tr>
<tr>
<td>Current Average Length of Stay (days)</td>
<td>18.44</td>
<td>39.08</td>
<td>37.18</td>
<td>34.98</td>
<td>42.16</td>
</tr>
<tr>
<td>Average Length of Stay under Worsened Perceptions (days)</td>
<td>8.9</td>
<td>7.72</td>
<td>13.56</td>
<td>10.14</td>
<td>12</td>
</tr>
<tr>
<td>( \rho_i = \frac{\text{Future Average Stay}}{\text{Current Average Stay}} )</td>
<td>0.4826</td>
<td>0.1975</td>
<td>0.3647</td>
<td>0.2899</td>
<td>0.2846</td>
</tr>
<tr>
<td>Loss in Expenditure ( = \Delta_i = \text{Total Spent} \times (\rho_i - 1) ) (NZ$M)</td>
<td>-469</td>
<td>-648</td>
<td>-440</td>
<td>-499</td>
<td>-77.3</td>
</tr>
<tr>
<td>Measure 1 = Total Loss in Expenditure * 0.36553 (NZ$M)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure 2 = Total Loss in Expenditure * 0.43965 (NZ$M)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure 3 = Total Loss in Expenditure * 0.24859 (NZ$M)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9.6: Valuation Results for Tourism Sector (MfE, 2000 – is this reference correct?)
New Zealand from the five markets covered would be between $530 million and $938 million, depending on whether lost wages and GST are taken into account (MfE, 2000).

The first benefit measure (added value) yields a loss of NZ$780 million to New Zealand, while the second (added value plus GST) yields a larger loss of NZ$938 million. The third measure deducts the labour component and yields a loss of NZ$530 million (MfE, 2000).

The valuation for the tourism sector only analyses the effects on our top five markets (which jointly accounted for almost 85 percent of all visitor arrivals in the year 2001 (TNZ, 2002). The effects of the other markets (such as Singapore, Taiwan and Germany) have been excluded. Had they been included, the loss figures would have been greater.

The loss figures are then representative of the losses we would expect from our top five tourism markets. It is also worth noting that this loss can be regarded as a upper bound estimates in that the ‘before and after’ images used in the survey serve as a ‘shock’ (equivalent to the recent Foot and Mouth Disease and Scrapies scares) as opposed to a gradual change in perceptions. An assumption is also made that the perceptions of everyone in the population are altered.

As part of the report one of the questions asked visitors how important the respondent’s perceptions of New Zealand’s environment was in their decision to undertake a trip here (MfE, 2000). Their response was measured on a scale of 1 to 5. The box plots in Fig. 9.3 summarise their responses. Australia was the only market with a median of below 3. This is quite interesting given that Australia had the lowest percentage decrease in number of days stayed. The ‘perception’ scores for Australia are also more widely spread than those of the other markets.

Also note that for the Asian markets (Japan and Korea) the only low scores (1 and 2) are in fact outliers2.

The report concludes that New Zealand’s clean green image does have a value (MfE, 2000). Environmental image is a substantial driver of the value New Zealand can derive for goods and

![Box plots showing the responses of visitors to the perceived importance of New Zealand's environment.](image)

*Figure 9.3: Importance of perceptions in choosing NZ as a destination. (Key: 1 = Not important at all; 2 = Not very important; 3 = Neither / nor; 4 = Important; 5 = Very important) (MfE, 2000)*

2 Outliers are denoted on the boxplot via the isolated lines.
services in the international market place. New Zealand is relatively clean and green. This is mainly attributable to our low population density resulting in relatively benign environmental pressures. However, there are environmental problems that are sufficient to raise questions about the sustainability of the value of New Zealand’s exports attributable to its environmental image. There is a risk that New Zealand will lose the value created by the current environmental reputation if we are not vigilant in dealing with the problems that could threaten the image.

9.8 Conclusions and Recommendations

New Zealand cannot afford to move down a path where tourism, or other industries, are impacting on our clean green image as evidenced in the following model. If New Zealand tourism, and in fact the wider Destination New Zealand, is to avoid the possibility of environmental issues driving a downturn in tourism arrivals and expenditure then further work, as outlined below, needs to occur.

If the sector is to achieve the goals set out in this strategy, it will need to change significantly over the next 10 years. It is envisaged that by 2010 the majority of our visitors will be holidaying or visiting friends and relatives. Increasingly they will be free and independent travellers who are technology savvy and seek to use technology enabled distribution channels. The sector will have developed effective CRM strategies and through targeted marketing will grow our market share.

Maori will participate fully in all facets of tourism and will play a key role in differentiating the New Zealand tourism experience. Product authenticity will be protected and all operators will embrace the values of manaakitanga and kaitiakitanga. The New Zealand experience (‘the way we make you feel’) will stand out as a unique global offering. ‘Destination New Zealand’ will be seen as a leading global tourism destination. Tourism destinations and products will have been developed in a way that protects our environment, culture and built heritage. All sector participants will work towards securing and conserving our long-term future. New Zealand will have achieved its carbon neutrality targets and will lead the world in Green Globe and other environmental management strategies. A strong global brand will be established and will be marketed internationally through both physical and virtual distribution channels. Marketing strategies will be developed and implemented jointly with private sector tourism operators and agencies (e.g. Trade NZ, Dairy Board) that market New Zealand off-shore. Our destination marketing and destination management will be closely aligned to ensure that we deliver on our promise to visitors. High spending visitor markets will be targeted. Products will be developed to improve yield, reduce seasonality issues and increase regional spread. Growth in visitor numbers from key volume markets like Australia, USA, the United Kingdom and Japan will be a priority.

The organisations servicing the sector will have reduced in number and will more closely meet the needs of operators and our customers. In addition, the sector will have invested significantly in technology and band-width issues for remote communities will have been addressed. The sector will be viewed internationally as leading the way in terms of embracing technology to improve business practices and decision making amongst the many SMEs operating in the sector, meet the needs of visitors, and redefine how distribution channels work within the tourism sector. Improved research and development will underpin decision-making and will be relevant to, and widely used by, operators and policy makers.

The profitability of the sector will have improved through a combination of factors including: increased visitor numbers; improved management of seasonality, and application of pricing and yield management strategies. Communities will understand the benefits of tourism and will be welcoming hosts. Projections are that there will be at least another 100,000 new jobs created in the economy as a consequence of increased visitor expenditure. Tourism will be seen as an exciting and dynamic sector to participate in and will be a highly desirable career choice.
Based on the issues raised in this report, the recommendations and action plans resulting from the New Zealand Tourism Strategy, and the knowledge gained from the introduction of Green Globe 21 into New Zealand, the following recommendations are made:

- The tourism sector should continue to implement Green Globe 21 as an international, benchmarked process, based on continuous performance and independent accreditation, as the ultimate environmental standard for businesses to aspire to.
- The tourism sector should integrate the Green Globe 21 process into the national tourism accreditation scheme (Qualmark). All tourism businesses as a key component of their accreditation should at least have and implement an Environmental Plan based on the Green Globe 21 framework.
- The tourism sector should focus not only on Green Globe 21 companies, but also the development of Green Globe 21 communities as a further way of integrating resource stewardship across communities and of positioning tourism as a positive contributor to environmental change.
- The tourism sector should continue to develop ‘toolkits’ and processes that enable tourism operators to efficiently and economically aspire to reach the above recommendations.
- The tourism sector should continue to work with regulatory and non-regulatory authorities in order to develop further drivers which will integrate current process with the Green Globe 21 process.

9.9 References

Websites


Articles

Massey University, 2001. New Zealanders’ Perception of our Environment, Massey University, Palmerston North, New Zealand.


TNZ and Colmar Brunton, 1995. Product Development Opportunities for Asian Markets, Tourism...
New Zealand, Wellington.


Tourism Industry, June 20002, “Kyoto - What does it mean for tourism?”, *Tourism Industry Association Newsletter*. 
10.1 Introduction

Retailing in New Zealand had its origins with immigrant shopkeepers who sold highly specialised goods and services to colonial settlers. Some of these early stores developed into national chain-stores, although few still remain from those early days (Bateman, 2000).

The Drapery and General Importing Company, more readily identifiable as DIC, started life in Dunedin. From a single store established in 1884, a national chain developed that endured for 100 years (Bateman, 2000).

On the assumption that in a democratic society enacted legislation ultimately reflects the wishes and needs of society, the legislation applying to retail trading traces an interesting cycle of societal expectation.

Prior to 1891 there was no legislation to control shopping hours or hours of work, (apart from Sunday trading which was prohibited under the 1790 UK Sunday Observance Act), nor was there specific legislation to protect the consumer. As a pioneer nation with a small rural population, the demand for goods and services was in general confined to the necessities, consumers were knowledgeable about most products, and could recognise the good from the bad (Dept. Stats., 1990).

From 1892 until the 1950s legislation continued to evolve, maintaining strict controls on shop trading hours that were commensurate with New Zealander’s expectation of ‘the weekend’ and the rights of the employee. Since the 1950s however, there has been a progressive liberalisation of shop trading laws so that shop hours and days of trading are now effectively unlimited.

In terms of goods sold, World War II brought new demands for a greater range of goods, primarily from the US serviceman stationed in New Zealand, stimulating a change in the style and type of retailing in New Zealand. The 1960s heralded the first supermarkets and the first shopping malls.

The latter half of the twentieth century has seen a shift in the availability of consumer goods so that what were once luxuries are now mainstream consumables. A global transport system servicing a global market has had a major impact on world trade volumes and the consequent availability of goods. World merchandise exports were US$6.19 trillion in 2000, more than hundred times the value of US$58 million in 1948. On a per capita basis, this is equivalent to an increase from US$23 to US$1094 in 2001 dollars (WTO, 2001).

The New Zealand Government has also taken steps that have increased the access, range and availability of consumer goods by progressively removing controls on imported goods and significantly reducing tariff barriers during the latter part of the twentieth century.

All New Zealanders have contact with the retail sector, whether out of need, indulgence or for

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1 Eco$ense Ltd
therapy. For a high proportion of New Zealanders, the retail sector is the closest they will come to the manufacturing and processing industries that provide the retail goods. Retail is the primary interface between the consumer and industry (NZRA, 2002a).

In the year ending December 2001, New Zealanders spent a total of NZ$46,282 million on retail goods. By way of comparison, during the same period NZ$50,688 million was spent on residential housing (REINZ, 2002).

The contribution of the retail sector to New Zealand’s GDP in 2001 was NZ$7,929 million, or 7.3% (Statistics NZ, 2002a). Figure 10.1 shows where New Zealanders spend their retail dollar.

Although the retail sector is extremely diverse, catering for the needs and wants of a consuming public across a wide range of markets, there is a clear concentration of spending in two main areas. As shown in Figure 10.1, over half (57%) of the retail dollar is spent buying or servicing vehicles, or on food (retail and prepared food-outlets).

Retail outlets on average employ the equivalent of 5.1 full-time staff. In 2001, there were a total of 49,259 retail outlets in New Zealand that provided employment equivalent to 249,420 full-time staff, or 17.5% of New Zealand’s full-time equivalent workforce. The actual number of people employed is more than this, estimated to be 325,000 (Statistics NZ, 2001), as there is a significant amount of part-time work available within the retail sector.

About 42,000 of the retail outlets are owner operated, while the remaining 7000 are managed by an estimated 150 national chains.

The retail industry depends on low profit margins and a high turnover for its financial viability. The average operating surplus before tax for the whole retail sector (including restaurants, cafes and hotels) was 4.1% of gross revenue in 2001. In comparison, the average operating surplus before tax was 7.1% of total income for the manufacturing sector, 25.2% for dairy farming and 6.1% for dairy processing (Statistics NZ, 2002b).

The goods sold by the retail sector are as diverse as the needs and wants of the market and consumer goods are sourced from a wide range of suppliers. The major overseas markets

![Figure 10.1: Where New Zealanders spend their retail dollar (2001). (Stats. NZ, 2002a)]
supplying New Zealand are Australia, the USA, Japan and China which together account for 56% of all imports.

In 2001 the total expenditure on merchandise imports into New Zealand was NZ$31,700 million (Statistics NZ, 2002c). Consumer goods imports (including cars, but excluding fuel) totalled NZ$10,316 million, and has more than doubled in value over the last decade. Figure 10.2 shows the main source markets of New Zealand’s retail goods. Figure 10.3 shows the distribution of retail enterprises and the associated employment throughout New Zealand.

10.2 Resource Use and Waste Minimisation within the Sector

One of the challenges facing twenty-first century economies is the need to de-couple resource use and waste from economic prosperity. In today’s society, an increase in wealth and standard of living inevitably means an increase in the sales of consumer goods, an increase in the consumption of resources, and more waste. According to an OECD report (OECD, 2002) waste generation continues to increase in direct proportion to economic growth. Between 1980 and the mid-1990s, gross domestic product and municipal waste generation both increased by 40%.

Although the retail sector consumes resources and generates waste as a result of its own operations, as the interface between manufacturers and consumers it represents only the ‘tip of the iceberg’. Goods for sale represent all the embedded resources and waste, from extraction to manufacture and transport, that has been used or has resulted from their manufacture. A logical out-take is that the consumer ultimately has a lot of power to influence resource stewardship, all the way down the supply chain, by utilising informed discretion in the purchase of goods. The abdication by us as consumers of the power to use informed discretion when purchasing goods means that in every sense, including the environment we live in, we get what we pay for — 
caveat emptor.

A retail outlet is at the delivery end of a long supply chain, and as a company, unless vertically integrated or very large, has very little influence on the supply chain. In general, New Zealand retailers rely on their suppliers for support and information, and exert minimal influence back down the supply chain (Heard K, pers. comm.). Some notable exceptions, including some of the national chain stores, are discussed in the next section.

![Figure 10.2: Where New Zealand’s imported goods come from. (Stats. NZ, 2002c)](image-url)
There is very little information available on resource use and waste that is specific to the retail sector. Recent data indicates 80% of consumer purchases are thrown away after only one use (MfE & LGNZ, 2002). While the contents of the household rubbish bag are the penultimate destination for a large amount of retail related resources, it only provides a part of the answer. There is no reliable data on the quantities of resources and waste directly attributable to retail operations.

Packaging Council data indicates that in the year 2000, 582,405 tonnes of packaging was consumed in New Zealand (PCNZ, 2001). Again, only a proportion of this packaging will be attributable to New Zealand retailers, as exporters will also consume a significant amount.

Energy is also a significant input, used primarily for lighting and HVAC (heating, ventilation and air conditioning) and for food premises, cooking and refrigeration. No reliable data is available.

FTE: Full-time equivalent persons engaged equals the sum of the full-time employees and working proprietors, plus half the part-time employees and working proprietors.

Geographical Units: Defined as enterprises with greater than $30,000 annual GST expenses or sales, or enterprises in a GST exempt industry.

Figure 10.3: Distribution of retail businesses and employment in New Zealand (Stats, NZ, 2001)
Figure 10.4 illustrates a typical retail supply chain from manufacture through to disposal.

For many of the products retailed in New Zealand, the manufacturer depicted in Figure 10.4 is located offshore. The dependence of the New Zealand market on imported goods to meet consumer demand means there is a significant dislocation of the supply chain, with, in many cases, the retailer having minimal knowledge of the origin of the goods. The level of influence a New Zealand retailer has on aspects of manufacture of imported products is minimal, and recycling and reuse loops are inevitably outside the manufacture-to-retail chain and exist only to serve a commodity market in recycled materials.

Resource stewardship is not well established in the retail sector. Activity has in general been limited to the more innovative retailers, together with a few council managed programmes. More recently, in 2002, the New Zealand Retailers Association initiated a programme to evaluate the options for an industry co-ordinated approach to promote and implement measures to better manage resources and minimise waste. At the time of writing, this initiative was still in the developmental stage (AEBN, 2002).

Despite the poor penetration of waste minimisation into the sector as a whole, there is a range of initiatives within the sector that clearly demonstrate the potential for improving resource stewardship. Initiatives include solid waste recycling, reducing supplier packaging, energy waste reduction, product take-back and product procurement.

It is useful to distinguish between resource stewardship directly within the control of the retail

![Figure 10.4: An abbreviated retail supply-chain](image-url)
sector and resource stewardship that the sector can only influence:

- the retail sector has direct control over resources used in the course of retail operations, that is primarily energy and packaging and organic waste disposal; but
- indirectly the retail industry sells goods that represent a much larger proportion of resources in terms of embedded extraction, manufacture and transport.

The following sections look at how resource efficiency can be applied to retail operations in terms of local transport, packaging and energy and also to the goods themselves.

**The Retail Goods**

There are a number of small owner-operated retail outlets in New Zealand that have a strong environmental focus, retailing goods ranging from natural-ingredient-based household cleaners, skin and health care products, organic food and non-hybrid seeds, to recycled computers and renewable energy technology. Although ‘green’ retail businesses represent only a small portion of the New Zealand retail sector, they occupy a well-supported and established niche in the market. Examples of commitment to resource stewardship with respect to the nature and source of the products sold is not, however, widespread within the sector.

Attention to resource stewardship in relation to the types of goods sold results from a strong personal commitment or belief by executive management and a sense of corporate responsibility, or legislation.

The Body Shop was started in 1976 by Anita Roddick, selling about 25 home-made beauty care products from a small shop in Brighton, England. The Body Shop brand is well-established globally and is readily associated with environmental and social responsibility. The Body Shop pursues sustainable business in terms of the nature, manufacture and disposal (packaging take-back) of its products (The Body Shop, 2002).

Nationally, the awareness that tropical hardwood harvesting can have serious long-term environmental impacts has resulted in several New Zealand retailers reviewing their timber, or timber furniture, procurement policies. Many retailers selling hardwood furniture, although not necessarily able to produce certified verification, will assure customers that the wood source is sustainable. Alternatively, some retailers deal exclusively in furniture manufactured from recycled timber.

By 2004 The Warehouse intends to source all outdoor furniture from manufacturers who are members of the Tropical Forest Trust (TFL, 2003). Membership of the Tropical Forest Trust indicates manufacturers are actively working toward Forest Stewardship Council certification (FSC, 2001, TFT, 2003).

Carter’s, one of New Zealand’s large building product suppliers, have developed a specific policy with regard to timber procurement (see Case Study 10.1). The policy signals a clear willingness by Carter’s to source timber from sustainable sources, but equally clearly acknowledges the role of the consumer with regard to the implementation of the policy. Carter’s timber procurement policy will be implemented voluntarily at a rate not dependent on any legislative requirement, but rather dependent on consumer pressure.

In contrast, the Energy Efficiency and Conservation Act is one of the first examples of New Zealand legislation designed to reduce waste associated with consumer goods. The Energy Efficiency and Conservation Act 2001, through the Energy Efficiency Regulations (2002), has introduced minimum energy performance standards and labelling for specified goods.

Energy labelling requires an accredited star rating and an annual energy consumption to be clearly visible on selected consumer products:

- refrigerators and freezers;
The Minimum Energy Performance Standards (MEPS) regime establishes minimum energy performance criteria that must be met if a product is to be sold in New Zealand. The objective of the MEPS scheme is to exclude products that do not meet the minimum standard from the New Zealand market. The MEPS scheme applies to the following products:

- domestic refrigerators and freezers (from July 2002);
- three-phase cage induction motors (from July 2002);
- packaged air conditioners (from July 2002);
- fluorescent lamps (from July 2002);
- fluorescent lamp ballasts (from Feb 2003); and
- domestic electric storage water heaters (from Feb 2003).

The Retail Process

Examples of the retail supply chain that are in the direct control of the retail merchant are transport, packaging and energy.

Transport

The comments of managers within two large supermarket chains both indicated that they work to maximise the utilisation of their respective transport fleets by back loading wherever practicable.

“When we send a truck out to a store, it could go out full and come back empty — so there is a resource that is being consumed without any return ... so what we are doing is we are telling the suppliers whom we deal with who might be in the area [of our store delivery] that we will come and pick our product up. Well, they normally send it to us anyway, they are just using [a freight company], so there is a commercial advantage for us to [pick the goods up] as well as them.”

“It’s in the early stages, because we’ve needed a lot of time to encourage our suppliers to see the benefits, but today we are back loading the trucks wherever we can so that we are minimising the amount of fuel that is used.”

Both of these supermarket chains are implementing policies to improve the utilisation of their transport fleet to reduce cost and fuel use per item. The level of logistical planning and schedul-
ing required is likely to limit this degree of co-ordination to bigger chain stores, most particularly those with some form of distribution centre.

Packaging

Discarded packaging is the waste most readily associated with the retail sector, although not necessarily the most costly in financial terms for the sector. Many retailers have the opportunity to recycle waste packaging through either council or commercially-operated collection schemes. Similarly, an increasing amount of post-consumer waste can be recycled through kerbside recycling schemes. It is estimated that more than 60% of New Zealand’s population have access to recycling (PCNZ, 2001).

A national packaging mass balance undertaken in 2000 indicated 49% of all packaging materials are recycled (PCNZ, 2001).

Some of the larger retailers, by virtue of their size, have the opportunity of working with their suppliers to reduce unnecessary packaging. The strategic business manager of one supermarket chain comments:

“We believe where we are able to have a reasonable amount of influence is on packaging. How we can influence our suppliers [is specifying] the types of packaging the product comes in. And we are starting to have some wins from time to time. We get [some] product that is merchandised by the pallet. Now it is coming in a form whereby we can split the pallet down on the floor, cut the plastic wrap that it comes in, it is pretty heavy wrap, and we don’t have any card board to recycle [and] we don’t have any cardboard to cut to display the stuff.

And it is continually looking with all the people we deal with. I guess asking the question ‘How can we work smarter?’ And then in order to understand how we can work smarter we have to know the components of that supply chain, which is why we have to process map and why we have to understand all the components the cost of each step.

One of the big pip-fruit suppliers [supply us] with their returnable containers and their retail ready bins that the product comes in. So there are a number of things like those initiatives that are going on around the place.”

The Warehouse chain has also implemented a number of initiatives to reduce packaging waste. Although the initial focus was on recycling as the primary method of diverting waste from landfill, the Warehouse has looked at how waste can be eliminated by suppliers.

The Warehouse chose to begin their ‘journey toward sustainability’ by focusing on a zero waste to landfill programme that relied principally on recycling. Although providing a useful point of departure, Richard Morley-Hall\(^2\) believes the recycling focus may have inhibited their rate of progress. “We should have introduced the waste minimisation concept into other areas of the business a lot sooner than we did. A focus on recycling alone has resulted in a lot of our staff thinking that waste minimisation is only about zero waste to landfill. In fact, it is a lot, lot bigger than that!”

Examples of initiatives by The Warehouse that have started to broaden the scope from solid waste minimisation to a wider consideration of resource stewardship include (TWL, 2001):

- developing a packaging guide to facilitate working with suppliers to minimise packaging;
- commitment to supplying furniture made from sustainable timber certified by the Forest Stewardship Council (or similar);
- commitment to supporting New Zealand suppliers attaining certification to the internet-based Enviro-Mark NZ environmental management system standard; and

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2 Richard Morley-Hall was Environmental Manager for The Warehouse at the time of writing, but left The Warehouse in September 2003 to take up a position with the Christchurch branch of the Sustainable Business Network.
The Retail Sector

• evaluating options for reducing greenhouse gas emissions through energy efficiency.

Energy

In common with other sectors, energy savings offer the retail sector significantly more attractive financial opportunities than solid waste. This is principally due to the relatively low cost of solid waste disposal in New Zealand, and the revision of electricity contracts that have for many companies resulted in price increases of 60%.

The strategic manager of one supermarket chain commented that “The biggest cost reduction that we have through waste management is actually in energy — electricity.”

The retail sector’s primary use of energy is for lighting and space heating, and refrigeration in food retailing. Case study 10.3 describes energy saving initiatives implemented by a small independent retailer as a part of a showroom fit-out.

Case Study 10.2: Reducing and recycling

The Warehouse Group has 75 red sheds and 32 Warehouse Stationery stores in New Zealand. As a major retailer of consumer products, packaging dominates its waste volume.

By July 2002, all Warehouse Stores had recycling in place. Now that the recycling scheme is well established, The Warehouse is increasing the focus on reducing waste at source.

The Warehouse has already had some success reducing waste at source.

• Shoes imported from China come packed with stiffening and tissue paper inside the shoes. These two items of packaging accounted for 30% of The Warehouse’s paper waste. There was a perception amongst some Warehouse staff that suppliers would not be interested in making any changes for a relatively small player like the Warehouse, and there was a six-month delay before one of the buyers agreed to at least ask one of the suppliers.

The response was immediate and very positive. By talking to the Chinese supplier, the shoe stiffening and tissue packaging was eliminated and was not imported into New Zealand. Although the reduction in waste was important, the main financial saving resulted from eliminating the staff time required for unwrapping and disposing of the excess packaging. The Warehouse is now working with all their shoe suppliers to eliminate the in-shoe packaging.

• Another initiative that required working with the supplier was the substitution of the polystyrene chips with paper. CDs distributed from an Auckland supplier were packed with polystyrene chips that had a considerable nuisance value for Warehouse staff; the chips stuck to clothing, spilled over the floor and when put in the skip, blew around the yard. The distributor was more than happy to change to paper packaging, which was cost neutral for him and provided both environmental benefits and reduced hassle for all concerned.

• Apparel packaging use in the store has been reduced by hanging clothing on reusable hangers. Reducing shipment packaging provided another challenge. Between the winter seasons of 2003 and 2003, plastic outer carton strapping was reduced by 88.4% and garment wrapper bags by 77%. In addition, requesting suppliers to change the type of plastic packaging improved the recyclability from 35% to 92.3% over the same period. Between them these initiatives eliminated the need for 14.25 tonnes of plastic that would otherwise have been disposed of in a landfill.

For more information, contact: Trevor Johnston, The Warehouse, Phone 09 489 8900, email: trevor.johnston@thewarehouse.co.nz

• evaluating options for reducing greenhouse gas emissions through energy efficiency.

• another initiative that required working with the supplier was the substitution of the polystyrene chips with paper. Cds distributed from an Auckland supplier were packaged with polystyrene chips that had a considerable nuisance value for Warehouse staff; the chips stuck to clothing, spilled over the floor and when put in the skip, blew around the yard. The distributor was more than happy to change to paper packaging, which was cost neutral for him and provided both environmental benefits and reduced hassle for all concerned.
Resource Stewardship and Waste Minimisation

The Green Retail M2M (measure-to-manage) project that involved the Edward Gibbon store was part of a programme managed by the Christchurch City Council that was based on the principle that ‘if you don’t measure it, you can’t manage it’. The Green Retail programme was aimed at smaller retail premises and focused on regularly measuring electrical energy usage, allowing comparisons to be made between stores as well as recommendations for improving energy efficiency.

Where resources permit, more detailed monitoring and reporting systems can result in significant energy savings. Case Study 10.4 describes how implementing an energy monitoring system has helped The Warehouse halve its average energy use.

Integrating Resource Stewardship

With the improved access to recycling operations, a significant number of retailers are in 2002 sending a smaller proportion of their solid waste to the landfill than they were a decade ago. But for many retailers, that is where waste minimisation begins and ends.

One of the major supermarket chains has, over a period of years, integrated waste minimisation into work planning and operations. One of the key tools they use is process mapping (see Case Study 10.5).

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**Case Study 10.3: Efficient lighting and timing**

Edward Gibbon Plumbing Plus in Christchurch retails bathroom supplies. Just prior to commencing a showroom refit, the manager was made aware of more efficient lighting options than those already specified for the refit.

The manager had originally requested metal halide lamps because he had been impressed with their effect in another showroom. The lighting designer had complied with the manager’s request and designed the lighting scheme accordingly.

The shops concurrent participation in a Christchurch City Council sponsored ‘Green Retail’ programme during the design period provided an opportunity for the lighting scheme to be reviewed. Liaison by council Target Zero staff with the lighting designer and the store manager resulted in the lighting design being redesigned to include more energy efficient lighting options.

As a result they have installed energy efficient lights with electronic controls or ballast in the showroom. By installing T5 fluorescent lamp technology they have saved $2,000 per annum with a payback of 2 years, compared to the metal halide down lights that were originally designated.

The light output is better even though the wattage of each lamp is much lower than the metal halide lamps. The new T5 lamps have resulted in a reduction in operating costs, lower maintenance and reduced environmental pollution. The T5 lamps are made from less glass and mercury and last longer than ordinary tubes. The other bonus is the electronic ballast used reduces heat loss from the lamps, reducing the air-conditioning load.

One of the key factors that contributed to the success of the project was timing. The project would have been unlikely to proceed without the involvement of the Target Zero team with the site during the refit process. The lighting designer, although aware of more energy efficient options, had not made their client aware of the options, but had rather responded according to the client’s request.

For more information, contact: Target Zero, Christchurch City Council
Phone 03 941 8830, e-mail: targetzero@ccc.govt.nz
Examples of where waste minimisation has been integrated into work practices within the supermarket’s operation were:

- implementing a seven-bag policy where checkout operators put a minimum of 7 items per plastic bag, has reduced plastic bag consumption by about 18%; and
- store lighting reduces automatically by 50% when the doors close for trading and the night crews begin work.

Another factor that has a major influence on how progressive a company is with respect to resource stewardship is the company’s core values. For one supermarket chain these are:

- ‘Have a passion for winning’;
- ‘Demonstrate respect for others’;

Case Study 10.5: Process mapping

“The big picture of waste minimisation is very broad and wide sweeping and we have addressed the fact by building a number of programmes into our process mapping that we do on an ongoing basis. We are very heavily into process mapping.

We do process mapping with everything, and that goes right through even to understanding the value chain with activity-based costing aimed at getting products to market through the supply chain and so forth, so that we understand the costs that are involved in steps of the process as well as the process itself. The reason for needing to do that is that the food retail industry is to some degree a transient industry with a lot of people passing through it.

For that reason we have to be highly process driven and understand how each of the processes works and all the costs involved in those processes. From the minimisation of waste from energy perspective, the recycling of energy from our refrigeration outputs to each store and that type of thing is crucial; the way that the electrical systems work with lighting to minimise electricity usage in lights and so forth. The big refrigerants that were in use long before the latest legislation was passed, in terms of what it required and environmentally friendly refrigerants, we had already changed our refrigeration to that some years before.”

Strategic Business Development & Marketing Manager, Supermarket chain
‘Be fair, honest and consistent’;
‘Embrace creativity and innovation’;
‘Celebrate life and achievement’; and
‘Learn from everything we do’.

Interestingly, although there was no specific reference to ‘the environment’ in the supermarket chain’s value statements, the strategic business manager commented that the values were integrated into the staff work ethos to the extent that looking after the environment was an accepted and integral part of business.

10.3 Using Waste Minimisation to bring about Resource Stewardship

Resource stewardship is not well established within the New Zealand retail sector. Although solid waste recycling is now much more accessible in 2002 than it was 10 years ago, only a small fraction of the 49,000 plus outlets have ventured beyond recycling to investigate more substantive issues.

The economic well-being of the retail sector is dependent on the spending power of the consuming public, and is in good health when consumer spending is high. The inherent contradiction, from the perspective of resource stewardship, is the presiding view that economic prosperity in the retail sector will only increase as a result of selling more goods.

The retailer is the final link in the supply chain to the consumer. New Zealand retail businesses are comparatively small, and with the exception of some of the larger chain stores, have limited ability to influence the supply chain.

With fewer than 38,000 of a total 49,259 (Statistics NZ, 2001a) outlets (including accommodation and food outlets) employing less than 5 people, the resources available to implement waste minimisation is limited when maintaining a business in a sector where the average before tax profit is only 4.4% of turnover.

The Christchurch City and Waitakere City councils have both run programmes to assist retailers minimise waste, and in each case have worked with groups of retailers as well as with individual businesses.

Observations drawn from their collective experience help identify the issues of implementing waste minimisation within the retail sector. The issues identified included a lack of time and resources, the low value of solid waste of savings, a high staff turnover, a lack of consumer pressure and a reluctance to do more than recycling.

“Retailers are very busy, time is of the essence and capital is in short supply.”

“The potential savings, particularly from solid waste reduction, are small.”

“There is a high staff turnover, including store managers, particularly in chain stores.”

“There is no consumer pressure in New Zealand — we are not asking the questions.”

“It is very difficult to move retailers beyond the easy fixes, like recycling, to the more important issues like what they are selling and why.”

Shopping malls provide a unique opportunity to work with a cluster of retailers, but not without potentially serious pitfalls. The two most serious barriers encountered were the level of commitment from mall management, and how service charges were allocated.

Regarding management commitment, a cleaner production advisor working at Waitakere City Council (Bielby, B. pers. comm) commented that:
“Although we started the programme in partnership and with the full support of the mall management to develop environmental initiatives, a change in ownership and subsequently management personnel meant that, with the exception of some recycling, a lot of the initiatives ceased or were not followed through. The new management had no idea of the previous environmental programmes and it essentially became a case of having to start from scratch again.”

A report summarising a Christchurch City Council programme (Speidel, 1999) highlighted an issue with service charging that provided no financial incentive to reduce waste:

“The retailers are charged for fresh water, liquid waste and solid waste (but not energy) in relation to the shop area. Large shops pay more, regardless of their water usage or their generation of liquid and solid waste. Therefore, there is hardly any financial incentive for the retailers to minimise water consumption or waste. Mall Management does not intend to change this system, [as they believe] a change would affect retailers with high waste production negatively, and they might break away from the mall.”

The Christchurch programme (Speidel, 1999) also had an issue with long term commitment.

“When the mall management realised that waste minimisation is a long-term issue that can be time consuming and complex, the idea of marketing the project [to promote the mall as an Eco-mall] was given up and [their] commitment to the project declined substantially.”

On a more positive note, a mall in West Auckland is revamping its environmental programme due to pressure from many of the large retailers located in the mall. Previously the programme had been abandoned, after being initiated by management, due to a lack of interest from many of the retailers. (Bielby, B, pers. comm.).

There are potential advantages for an intervention programme operated in the context of a mall. Experience to date has also highlighted potential pitfalls. The pros and cons are summarised in Table 10.1.

There are occasions where waste minimisation options are constrained by ‘competing’ demands. Case Study 10.6 highlights the pre-eminence of food hygiene in food retailing and describes how one company developed a solution to minimise waste and satisfy food hygiene requirements. Unfortunately it also highlights the fragility of New Zealand’s small recycling market where the initiative ultimately failed because the recycler went out of business.

10.4 Governance of the Sector

Although there are close to 40 separate items of legislation that affect the retail sector, there are none, with the exception of the recently enacted Energy Efficiency Regulations and the Resource Management Act, that have any direct impact on resource stewardship. The New Zealand Retailers Association has recently reviewed the legislation applicable to the retail sector with the objective of encouraging government to reduce compliance costs and improve ease of use (NZRA, 2002b). A discussion of a selection of applicable legislation follows.

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
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<tbody>
<tr>
<td>Convenient cluster of retailers</td>
<td>Bundled water, trade and solid waste charges allocated per m² provides no incentive to minimise waste</td>
</tr>
<tr>
<td>Potential for central co-ordination by mall management</td>
<td>Lack of mall management commitment a major barrier</td>
</tr>
<tr>
<td>Common resource, waste and utility management</td>
<td></td>
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<tr>
<td>Opportunity to build on existing relationships between retailers and mall management</td>
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Table 10.1: Promoting resource stewardship in retail malls — pros and cons
Legislation can be grouped into four main categories: consumer rights, taxation, employment and environmental issues.

**Consumer rights**

Legislation addressing consumer rights includes the Commerce Act, the Fair Trading Act, the Consumer Guarantees Act, the Lay-by Sales Act, the Sales of Goods Act, the Second Hand Dealers Act, the Pawnbrokers Act and the Auctioneers Act.

Although there is no conscious intent to encourage resource stewardship within the consumer rights legislation, the Consumer Guarantees Act does provide safeguards that can have an impact on resource use. The requirement that goods sold be ‘fit for purpose’ and of ‘acceptable quality’ provides an incentive for both the retailers and suppliers to provide goods that avoid product returns. The efficacy of the legislation however relies on consumer knowledge of their rights and willingness to complain.

The Commerce Act, via the Commerce Commission, can also impact resource stewardship by ensuring there is a competitive market in circumstances where a lack of competition results in inefficient practices. The existence of a competitive market does not guarantee resource stewardship as highlighted in 2002 by the ‘leaky building syndrome’, where cost cutting also cut quality.

**Taxation**

Legislation addressing taxation includes the Goods and Services Act and General Taxation legislation. The existing taxation legislation currently has no impact on resource stewardship, although the proposed carbon tax and landfill levy could in the future.

**Employment**


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**Case Study 10.6: Bags to buckets**

Packaging groceries in plastic bags is a standard option in all New Zealand supermarkets. Plastic bags are an attractive packaging option because of their strength and low bulk. Options for reducing plastic bag consumption include reusing (at the next visit) or recycling into another product.

For one supermarket chain, encouraging the reuse of their plastic bags was not an option because of food hygiene concerns. For example, packing fresh items in a plastic bag that had previously been used to carry a leaking fresh chicken portion could have serious health implications. Allowing the reuse of plastic bags means the supermarket no longer has any control of the quality or condition of the packaging, which was considered an unacceptable risk both for the public and for the company.

Although reuse would ordinarily be considered ahead of recycling in the waste minimisation hierarchy, in this case food hygiene regulations and practical concerns precluded the reuse option.

An alternative option was to provide a facility for customers to recycle their used plastic bags. The returned bags were recycled into plastic buckets that were used as containers for fruit and vegetable produce and provided at no charge to the customer. The scheme operated at a net cost to the company. Unfortunately, the recycling option had to be publicly withdrawn when the recycling company ceased trading.
This area of legislation impacts most directly on the social aspects of sustainability, including issues of wages, hours of work, holidays and work place safety. However, the progressive liberalisation of shop trading hours has increased the opportunity and access to consumer goods.

Trading hours have moved away from the traditional 5-day week, 9 am to 5 pm with late night Friday, to a situation where shops can potentially trade up to 362.5 days per year, 24 hours per day, providing an acceptable agreement is negotiated with employees. These factors are believed to have had a positive impact on retail sales (Hellberg, B, pers. comm) and consequently increased the consumption of goods and resources.

**Environment**

The two statutes directly addressing environmental issues are the Resource Management Act and the Energy Efficiency and Conservation Act.

The purpose of the Energy Efficiency and Conservation Act, 2000 is “to promote, in New Zealand, energy efficiency, energy conservation, and the use of renewable sources of energy.” The Act makes provision within its Regulations for mandatory Minimum Energy Performance standards and energy labelling with the intent of improving the energy efficiency of New Zealand’s stocks of electrical appliances and equipment as they are updated. These regulations also make provision for a maximum fine of up to $10,000 for non-compliance.

The principal impact of the Resource Management Act (RMA) on the retail sector is with regard to the application for consents for new retail stores. The RMA considers environmental impact as the primary issue and tends to focus on the mitigation of discharges and outputs rather than the level of resource use within a business activity. Although improving resource stewardship will have downstream benefits in terms of environmental impact, a preventative approach is not mandated by the RMA.

Although there have been no sector-wide guidelines developed to assist improve resource stewardship, there are initiatives within individual companies that promote resource stewardship. The Warehouse have developed a Packaging Guide (TWL, 2002) for its suppliers that is based on TWL policy that packaging shall, “Conform to our environmental principles of reducing unnecessary packaging, facilitating the re-use or recycling of packaging materials and restricting or eliminating particular types of packaging materials.”

### 10.5 Drivers for change within the sector

Legislative drivers for change in the retail sector are minimal, although the Energy Efficiency Regulations 2002 are impacting the energy efficiency of a range of electrical goods sold in New Zealand.

New Zealand exporting companies (see for example the chapters on the Meat and Dairy sectors) are responding to market signals regarding sustainable production from overseas retail customers such as Sainsbury and Tesco. Businesses supplying to the New Zealand market are also sensitive to customer demands. But the difference between the two markets is the apparent lack of awareness or concern of New Zealand customers regarding sustainability and the consequent lack of any significant pressure for businesses to be more environmentally responsible.

The supply chain manager of one supermarket chain highlighted the potential influence of customer pressure on business practice and the potential the customer has to drive change:

“When we react [to] what our customer wants. They can drive change. If the customers turned around and said to us we are not happy with the impact of plastic bags on the environment and want you to get rid of them, we would.”
[But] what happens to the plastic bag? Why do we use a plastic bag? We tried to get rid of plastic bags and our customers said ‘No! Give us back our plastic bags!’

“I think the next generation might say, ‘Look, if this is the impact [of] using plastic bags, we don’t want it.’ The customers’ wants will change.”

A building supplies retailer provided a similar example. *Pinus radiata* framing timber has traditionally been boron treated to provide resistance to borer insects. Studies have found that borer does not attack kiln-dried timber, and consequently boron treatment of kiln-dried framing timber was phased out. In response to customer demand however, a proportion of framing timber is still boron treated, in spite of its greater environmental impact.

Richard Morley-Hall commented that, “All of the current activity in New Zealand on sustainability is almost exclusively dependent on a corporate sense of social responsibility. Although the consumer is by far the single biggest catalyst for change, there is very little customer pressure in New Zealand.”

The consumer, although a potentially extremely powerful force for change, is inundated with information that supports the status quo, the consumer society — information about the environment pales in comparison. The global advertising spend in 2001 has been estimated to be US$325 billion (Zenith, 2001).

Another factor impacting on the retail sector is the effect that liberalising shop trading hours has had on the growth of shopping malls. The convenience of shopping under one roof as a family on a weekend has expanded the access to retail goods. This growth in shopping malls has been particularly notable in Auckland and Christchurch (Hellberg B, pers. comm.)

### 10.6 Conclusions and Recommendations

The retail sector is potentially in a very influential position at the top of the supply chain and in direct contact with the consuming market. The goods retailed represent resources and wastes much greater than those immediately visible, with considerable scope for improving resource stewardship.


- Approximately 93% of the materials consumed never end up in saleable products at all but are discarded during the production process.
- Approximately 80% of what we produce is discarded after a single use.

That means that consumers use only 1.4 percent of the materials used for production more than once (i.e. 20% of the 7% of materials that end up in saleable goods).

For all the potential influence of the retail sector, it is misleading to attribute responsibility to the sector in isolation. The retail sector is but a part of a supply chain within an economic system that thrives on increasing productive capacity to meet increasing consumer demand. The retail sector is dependent on maintaining a high turnover of goods for its financial viability, which for the majority of New Zealand retailers means selling more goods is good for business.

There is anecdotal evidence suggesting that the improved accessibility of recycling has resulted in more retail stores diverting packaging and organic waste from landfills. In the majority of cases however, recycling of solid waste is the beginning and end of resource stewardship. A few retail outlets are developing initiatives to reduce energy consumption.

Although the existing incentives for minimising waste are primarily financial, the rewards are not substantial.

- For solid wastes in particular the financial rewards are not large and is perhaps why retail
has progressed little beyond implementing recycling options.

- Although offering more financial savings, energy saving initiatives generally require more expertise and capital investment that can be an obstacle to progress.

Although providing guidelines and information to retailers on aspects of waste minimisation will help those retailers who want to but don’t know how, widespread implementation will only occur if and when retailers are sufficiently motivated. Motivation can be provided either internally, by integrating values that place a high priority on resource stewardship, or externally through mandatory standards or legislative requirements. Values-based change is preferable.

**Recommendations**

- Encourage the development of values by the retail sector that balance economic prosperity with resource stewardship. Both central and local government and retail sector associations should play a role.

- Introduce and promote voluntary tools to encourage resource stewardship. For example, schemes that promote, to the consumer, retailers that are actively reducing resource use and waste.

- Develop financial instruments that encourage resource stewardship. For example, developing a revolving loan to finance energy investment that is repaid from savings.

As encouraging as the increased level of recycling, or even energy saving may be, it does little to address the consumption of resources that is integral to an economy dependent on growing a consuming market. There are relatively few examples in New Zealand of retail outlets that have looked at the resources used in the production of their retail goods. These examples have been limited primarily to vertically integrated businesses that control manufacture and retail (e.g. The Body Shop), larger retail chains who have can exert some influence on suppliers (e.g. The Warehouse) or niche players, particularly in the natural products market.

Those retailers in New Zealand actively pursuing resource stewardship through their supply chains are most often motivated by a sense of corporate responsibility.

The key to the stewardship of the resources represented by the retail sector lies not with the sector itself, but with consumers. An environmentally aware and proactive consumer market could exert an enormous positive influence on the amount of resources consumed. However, as Clarke (2002) pointed out at a New Zealand Association of Environmental Education conference in Hamilton:

“... I do believe that it is a mistake to hope that a society that is prepared to sacrifice just about anything in the name of convenience is prepared to challenge its own values and assumptions when there’s a sale on.”

With the exception of the few innovators, retailers are not going to swim against the tide of consumerism, and pressure their suppliers to provide them with resource efficient goods unless there is significant consumer demand to change.

Short of applying mass-market techniques to reverse the brainwashing achieved through of billions of dollars per annum of consumer advertising, how can consumerism be challenged to improve resource stewardship? The options for challenging consumerism can be either persuasive or compulsive.

The persuasive options include education, mentoring, voluntary methods and agreements, marketing and advertising. Mentoring in particular is an essential strategy if the multitudes of small retailers are to be reached successfully.

A successful persuasive strategy is unlikely to be dependent on only one approach but would contain a combination of techniques. The following recommendations provide some examples.
**Recommendations**

- Expand central government support and promotion of environmental labelling schemes.
- Identify and form a working group of innovative retailers to help develop a strategy to disseminate resource stewardship amongst New Zealand retailers.
- Encourage innovative retailers to participate as anchor companies in shopping precinct or mall-focused resource stewardship promotion and implementation programmes.
- Encourage the innovators to mentor other retailers.
- Develop projects with larger retailers to drive resource stewardship down the supply chain.

Compulsive, or legislative, options should ideally only be supporting what is already being done voluntarily by, for example, ‘levelling the playing field’. An existing example is the minimum energy performance standards and the energy-labelling scheme introduced within the Energy Efficiency Regulations, and restrictions on imported Japanese cars.

**Recommendations**

- Progressively introduce mandatory labelling of consumer goods to support voluntary initiatives such as Environmental Choice and similar.
- Extend minimum performance standards (on goods for sale in New Zealand) to other consumer goods, to discourage the importing of resource intensive goods.

A strategy to improve resource stewardship in the retail sector needs to address two key objectives:

- Changing business values to incorporate resource stewardship
- Raising consumer awareness of the environmental and social impacts of buying patterns to develop a more discerning consumer market.

10.7 **References**


10.8 Acknowledgements

Grateful thanks to Barry Hellberg of the NZRA, the cleaner production staff at Waitakere City Council, the Resource Efficiency staff at Christchurch City Council, the AEBN and the retail representatives who contributed comment and case studies.
11.1 Introduction

There are over 400 plastic product manufacturers and raw material suppliers in New Zealand, who collectively employ some 8,000 employees (Statistics NZ, 2002). They produce products for a wide range of applications, including packaging, construction, agriculture, and houseware. Industry revenues now exceed $1.8 billion per year and directly contribute over 1.7% to New Zealand’s GDP (Statistics NZ, 2002).

Direct export of finished plastic products is a particularly vibrant part of the sector, with revenue increasing from $80m in 1990, to approximately $347m at present (Statistics NZ, 2002). In addition, it has been estimated that up to half as much again is exported ‘indirectly’, i.e. as packaging or components for other export industries, in particular for meat, dairy and horticultural produce (PNZ, 2002).

Some 236,755 tonnes of plastic were used by the New Zealand plastics industry in 2001, 75% of this being consumed locally (PNZ, 2002). Increasing volumes of raw material imports are projected, as consumers both here and overseas demand better product protection, longer shelf life, recyclable packaging, lightweight materials and increased functionality and utility. By the year 2030 over 300,000 tonnes of raw plastic material will be imported if current trends continue (PNZ, 2002).

Plastic is increasingly the most efficient and effective material choice for many products. Recent studies in Western Europe, for example, demonstrate that while plastic packaging accounts for only 17% of all materials used in packaging, it packs almost 50% of products (APME, 2002). Plastic continues to substitute for items previously made from paper, cardboard, tin, wood and steel. In New Zealand, the packaging sector of the plastics industry faces mounting pressure to make reductions in raw material usage, while at the same time their customers and consumers increasingly specify or choose their products. There are many drivers for these choices, most based on consumer preference. To date the two strongest for the industry have been cost and source reduction. Source reduction satisfies the first requirement of waste minimisation and the drive by businesses to reduce production costs. In an increasingly competitive market, plastic companies have been very focused on increasing their operational efficiency and have actively adopted practices that reflect eco-efficiency as a result.

The New Zealand plastics industry faces mounting pressure as plastics are increasingly substituted as the material of choice, the volume of production increases, and international pressure to reduce waste and recycle grows. Plastic, which often uses less raw material than other materials, is a victim of its own achievement. By successfully displacing other materials in a wide range of products and packaging, plastic has also replaced these in the waste stream.

Plastic is something that people feel very strongly about and it often tends to be examined in a very emotive non-factual manner. The connotations of cheap, nasty plastic are still commonly held by the public. But these same people often act differently in the supermarket, demanding the benefits of product protection, and shelf life, responding to branding and the clear messages and information that the packaging provides. Consequently, environmental issues related to plastic waste tend to be examined in an uninformed manner. Public policy makers need to respond to calls for less-plastic-in-our-landfills and more recycling with a strong fact-based approach to ensure that the waste minimisation measures being proposed, are sustainable.
Making products with less material is the most effective and responsible action a manufacturer can take to minimise impacts on the environment. The wide success of plastics, however, masks the benefits being derived from source reduction. Source reduction is not easily measured. It is common for public policy makers to accept this and move on to other waste minimisation priorities lower down the hierarchy. The Ministry for the Environment, for example, tracks plastic packaging usage against recycling volumes as a measure of the sector’s environmental performance. For the plastics sector this a limited view that could result in political rather than sustainable decision-making criteria. Central and local government risk promoting waste minimisation solutions that may undercut benefits that could be achieved by aggressive source reduction and sustainable product design.

Unfortunately the durability of plastic waste increases its visibility and results in the scale of plastic waste being overestimated. Due to the negative image of plastic the plastics industry has often been forced into a defensive role — feeling the need to promote, protect and defend its current position and its future growth as a sector. The plastics sector has seen environmental initiatives and legislation as a threat to economic growth that continues to increase compliance costs and affect profitability. This has led to environmental initiatives by the plastics sector to minimise that risk.

Increasing emphasis is now being placed on Extended Producer Responsibility at an international level by governments and environmental pressure groups. This challenges industry to look beyond the areas of internal operational efficiency that have been the focus over the last decade. Environmental challenges now facing the industry increasingly focus on the full lifecycle of the products and services offered. Public concern is typically with the waste resulting from the use of plastic products, not from the waste generated during manufacture. This places an increased importance on stakeholder consultation and the transparent adoption of sustainable design principles by manufacturers.

These trends are a reflection of four distinct phases reported in the progression of sustainable business (Gehrke, 2000):

- **Compliance phase** — 1970s regulatory standards.
- **Anticipatory phase** — 1980s companies.
- **Eco-efficiency phase** — 1990s industry sought to reduce input and waste costs.
- **Sustainable Development phase** — 2000s integration with sustainable product design.

Many industry participants remain skeptical of public policy initiatives and are unlikely to participate fully in waste minimisation initiatives until a fresh approach to managing plastic waste has begun. This requires an understanding at the national policy level that there is no single answer. Given current technology and economics, 100% recycling of plastic products in New Zealand is not technically viable or financially achievable. It needs to be recognised that products made from plastics have benefits to society that must be taken into account while assessing waste minimisation issues. It must also be recognised that while some plastics can and should be recycled, others should not.

A survey on Small Business Environmental Information Sources conducted in America found that small businesses prefer to receive information about the environment and environmental regulations from vendors, associates, and industry associations (PPRC, 2003). The survey measured business type, areas of needed assistance, opinion of current information received, and actual versus preferred information sources. Overall, it found small businesses tend to avoid information sources that are associated with regulatory agencies or outside their sphere of close personal associates.

Plastics New Zealand and the plastics sector have recognised the need to take a leadership role in resource stewardship but are unable to make effective progress without the support and
participation of government, other business sectors and the public. The New Zealand Plastics Sustainability Initiative developed by Plastics New Zealand Inc. was launched by the Prime Minister, Helen Clark, on behalf of the New Zealand plastics industry in February 2003. The initiative sets out a five-year agenda for action that the industry believes is necessary to overcome some of these issues and to engage all levels of the New Zealand community in taking responsibility for plastic waste. Identifying opportunities for partnerships is a central focus of the Initiative. The New Zealand Packaging Accord, currently being renegotiated, provides a valuable opportunity to develop relationships at this level.

The following information examines the impact of the New Zealand plastics industry on solid waste generation in New Zealand and how the sector is working to reduce the environmental impacts of this. Plastic products are used within all sectors of New Zealand. Decisions made by the New Zealand plastics industry therefore impact directly on the waste minimisation efforts of government, councils, businesses and households. The focus of the information which follows is therefore not just plastic waste created during manufacture but, more importantly, on the larger volume of waste created at the end of a plastic product’s useful life.

It should be noted that this assessment in the main refers only to plastic products manufactured within New Zealand and not those imported as finished goods or packaging. This is an important caveat as imported plastic products are a major contributor to the plastics waste stream. Unfortunately public policy considerations invariably make local manufacturers responsible for the whole problem when they are unable to directly influence the decision-making of importers in any effective manner. Central government needs to help reconcile this issue with the sector under the New Zealand Packaging Accord and other policy mechanisms.

11.2 Resource Use and Waste Minimisation within the Sector

The New Zealand plastics industry does not manufacture plastic raw materials. Imported mainly in granular form from Northern America, Australia and Asia, plastics are derived from petrochemical byproducts and are therefore a non-renewable resource. The basic structure of plastics is long chains of carbon and hydrogen molecules. The huge variability in the possible structure of plastic gives it versatility in application, but also complexity in terms of waste minimisation. Figure 11.1 shows the tonnage of plastic raw material imports from 1990 to 2001. Imports remained relatively static from 1994 to 2000, with a more rapid increase in 2001. Given current trends, it is anticipated that over 300,000 tonnes of raw plastic material will be imported in 2030.

![Fig. 11.1: Plastic raw material imports 1990 – 2002 (PNZ, 2002)](image-url)
The processes of plastic product manufacture used in New Zealand in very basic terms involve melting and shaping the material. The manufacturing process, though technically demanding with exacting product specifications, is relatively clean and simple in comparison to others. Basic resource use includes:

- plastic (236,755 tonnes in 2001 (PNZ, 2002));
- water;
- energy for plant and transport;
- chemical additives used to exact colour, mechanical, flexibility, impact, hardness, heat, environmental/chemical resistance and durability requirements;
- lubricants, inks and solvents for machinery and printing;
- packaging; and
- office and café supplies.

Plastics New Zealand Incorporated (PNZ) gathers annual statistics on New Zealand plastics production and recycling. Fig. 11.2 shows the volume of the six main types of plastic imported as raw material. Appendix 1 details the properties and products that each of these plastics can be used and recycled in.

Low Density Polyethylene (LDPE), which is commonly used for pipe and film applications, is the largest area of production in New Zealand with continuing rapid growth. Another major growth area in the last decade has been Polypropylene (PP). This is mainly used for rigid packaging and is anticipated to be the next viable material for kerbside collection.

Figure 11.3 illustrates source reduction in the New Zealand plastics sector. The relationship between New Zealand plastic 'outputs' (as measured by industry turnover) can be benchmarked against raw material imports, and the measure gives an overall index of the productivity of the New Zealand plastics industry. For each dollar of output, New Zealand

![Figure 11.2: NZ plastic raw material imports 1994 – 2001 (PNZ, 2002)](image)
manufacturers are using less and less material as measured by tonnes of resin imported. In fact, by this measure, more than 50,000 tonnes of material has been saved in the eight years from 1994 to 2001. This is a crude measure, as it takes no account of changing product design requirements for added features, nor the utility benefits from materials selection. It does, however, start to show the size of the value of continuing source reduction, and why policy makers should acknowledge industry for these efforts.

The complex nature of the plastic sector, with its differing material types and markets, is shown in Tables 11.1 and 11.2, which indicate the percentage of production and tonnage in each area. This information is extremely useful, for example, in determining and assessing the viability of recycling schemes. These statistics reveal there are only 279 tonnes of rigid PVC packaging produced in New Zealand and therefore any kerbside recycling collection proposed is unlikely to be viable. In a recent survey by Plastics New Zealand some councils noted their intention to collect rigid PVC containers in their kerbside collection in the absence of this information. Better dissemination of this data is therefore an issue for the sector to address in ensuring that national recycling efforts are strategically focussed and co-ordinated.

The entrance of plastic products into the waste stream is determined by the duration of their use. For example 82% of PVC is used in construction products and while this is the third biggest tonnage produced, these products are typically specified for applications with a use of up to 50 years duration.

Table 11.3 shows the main sectors of plastic production, the volumes of plastic used and the approximated time frame in which these products will enter the waste stream. This information can be used to predict and determine future waste minimisation work required by the sector.

In-house recycling of plastic by manufacturers, where offcuts are reground and reused in the same or similar products, ensured 9,439 tonnes of plastics were reused in 2001. Because of this, plastic waste from manufacture in New Zealand is only 1% of material used (PNZ, 2002). The cost of raw materials is a strong economic driver to reduce waste and maximise reuse of materials where possible.

The Ministry for the Environment (MfE), councils, and to a large extent the New Zealand public, base the environmental performance of plastic on waste. The judgements made at these

<table>
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<th>Resin</th>
<th>Rigid: Non Food</th>
<th>Rigid: Food</th>
<th>Flexible: Non Food</th>
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<td>100</td>
<td></td>
</tr>
<tr>
<td>PP</td>
<td>9</td>
<td>23</td>
<td>4</td>
<td>13</td>
<td>1</td>
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<td>14</td>
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<tr>
<td>PS</td>
<td>6</td>
<td>79</td>
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<td></td>
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<td></td>
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<td></td>
<td>14</td>
<td>1</td>
<td>100</td>
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<tr>
<td>EPS</td>
<td>7</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>63</td>
<td></td>
<td></td>
<td>8</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>9</td>
<td>47</td>
<td>2</td>
<td>3</td>
<td>21</td>
<td>10</td>
<td>1</td>
<td>5</td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Table 11.1: NZ produced plastics 2001: % Domestic end use by sector (PNZ: 2002)
Resource Stewardship and Waste Minimisation

levels are based on what is visible in the waste stream and are typically made in isolation from any consideration of the full life-cycle impacts of the product. The highly technical nature of such assessments and the complex nature of plastics with all its many variables and applications is a barrier to realising the true environmental impact. Plastic makes up 7% of New Zealand’s waste stream by weight (MfE, 2002). Because plastics are lighter than many other materials, they contribute a larger proportion by volume of up to 20%. Approximately 190,000 tonnes of plastic waste is disposed of to New Zealand landfills each year (PEAG, 1997). The New Zealand Packaging Council has estimated that at least 50% of plastic packaging sent to New Zealand landfills is imported (PacNZ, 2002).

Perhaps the most important gap in information currently is the level of plastic imported as product and packaging. There are no accurate statistics available on the total weight or volume of plastics consumed and likely to enter the waste stream. Massey University has conducted research on the packaging sector that gives some clarification of this aspect of imports; details can be obtained through the New Zealand Packaging Council. More recent landfill surveys are identifying plastics that are recycled separately. This is where PET (1) and HDPE (2) plastics are defined as a subset of plastics to determine the success of kerbside recycling, rather than as one broad plastics category as currently specified under the New Zealand Waste List. The annual mass balance survey completed by Plastics New Zealand in combination with the estimated life span of differing plastic products provides a mechanism for anticipating future plastic waste volumes.

<table>
<thead>
<tr>
<th>Resin</th>
<th>Rigid: Non Food</th>
<th>Rigid: Food</th>
<th>Flexible: Non Food</th>
<th>Flexible: Food</th>
<th>Packaging</th>
<th>Construction</th>
<th>Agriculture</th>
<th>Housewares</th>
<th>Other Prod.</th>
<th>Recycled</th>
<th>Waste</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET</td>
<td>201</td>
<td>15790</td>
<td>22</td>
<td>311</td>
<td>1</td>
<td>114</td>
<td>132</td>
<td>117</td>
<td>16690</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDPE</td>
<td>5784</td>
<td>14501</td>
<td>3030</td>
<td>413</td>
<td>114</td>
<td>2598</td>
<td>10300</td>
<td>223</td>
<td>1002</td>
<td>386</td>
<td>65</td>
<td>38506</td>
</tr>
<tr>
<td>PVC</td>
<td>167</td>
<td>112</td>
<td>26332</td>
<td>3331</td>
<td>180</td>
<td>915</td>
<td>85</td>
<td>100</td>
<td>31794</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LDPE</td>
<td>1518</td>
<td>1594</td>
<td>903</td>
<td>23974</td>
<td>903</td>
<td>1837</td>
<td>7730</td>
<td>22</td>
<td>253</td>
<td>1938</td>
<td>1603</td>
<td>57722</td>
</tr>
<tr>
<td>PP</td>
<td>1493</td>
<td>4938</td>
<td>468</td>
<td>2681</td>
<td>241</td>
<td>357</td>
<td>1269</td>
<td>2469</td>
<td>1535</td>
<td>189</td>
<td>399</td>
<td>16094</td>
</tr>
<tr>
<td>PS</td>
<td>422</td>
<td>6185</td>
<td>3</td>
<td>722</td>
<td>990</td>
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<td>3</td>
<td>8328</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPS</td>
<td>275</td>
<td>425</td>
<td>94</td>
<td>3416</td>
<td>51</td>
<td>396</td>
<td>144</td>
<td>4802</td>
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<td></td>
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<tr>
<td>Other</td>
<td>38</td>
<td>96</td>
<td>389</td>
<td>762</td>
<td>2</td>
<td>121</td>
<td>54</td>
<td>653</td>
<td>191</td>
<td>71</td>
<td>369</td>
<td>2754</td>
</tr>
<tr>
<td>Total</td>
<td>10769</td>
<td>48057</td>
<td>19739</td>
<td>15498</td>
<td>1022</td>
<td>42290</td>
<td>22966</td>
<td>5042</td>
<td>5808</td>
<td>2233</td>
<td>27372</td>
<td>1 76780</td>
</tr>
</tbody>
</table>

*Figures are abridged for simplification, therefore totals differ

Table 11.2: NZ produced plastics 2001: Tonnage for domestic end use* (PNZ: 2002)

<table>
<thead>
<tr>
<th>12 months (tonnes)</th>
<th>1-5 years (tonnes)</th>
<th>50 years (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rigid Packaging</td>
<td>53539</td>
<td></td>
</tr>
<tr>
<td>Flexible Packaging</td>
<td>32953</td>
<td></td>
</tr>
<tr>
<td>Other Packaging</td>
<td>1357</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td>34661</td>
</tr>
<tr>
<td>Agriculture</td>
<td></td>
<td>22735</td>
</tr>
<tr>
<td>Housewares</td>
<td></td>
<td>4270</td>
</tr>
<tr>
<td>Other Products</td>
<td>5396</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>93245</td>
<td>27005</td>
</tr>
<tr>
<td>Approx Waste per annum</td>
<td>93245</td>
<td>5401</td>
</tr>
<tr>
<td>Approx total waste to landfill from NZ manufactured product</td>
<td>99339</td>
<td></td>
</tr>
<tr>
<td>Plastic raw material waste from production</td>
<td>2772</td>
<td></td>
</tr>
<tr>
<td>Total plastics waste generated by NZ plastics industry</td>
<td>102111</td>
<td></td>
</tr>
</tbody>
</table>

Table 11.3: Estimate of the lifespans for various types of plastics (PNZ: 2002)
Concern about disposal of plastics to landfill is based on the fact that it degrades very slowly. A more fundamental issue is that plastics disposal represents the waste of a valuable, non-renewable petrochemical resource. There are four options available at the end of a plastic product’s life: mechanical recycling, chemical recycling, energy recovery and landfill. In New Zealand landfill is the prevalent destination for plastic products, with 18% of plastic packaging now being diverted through private and public recycling operations. Survey figures show that recycling has more than doubled in the last five years. The material collected by New Zealand territorial authorities and recycling companies is used for mechanical recycling. The process involves:

- material collection (kerbside, drop off, commercial bin collection);
- transport;
- sorting; and
- either baling for export or regrinding or flaking then washing and drying or re-extruding to form pellets or granules for reuse.

Figure 11.4 illustrates the volume of recycling in New Zealand from 1997 to 2000. Unfortunately a record of individual plastic types was not kept until 2000. However, the figures show that the level of plastics recycling has risen dramatically.

There are three main streams of plastic recycling in New Zealand:

- kerbside PET (1) and HDPE (2) collections of post consumer waste;
- commercial collection of commercial films (shrink and shroud wrap); and
- in-house plastics recycling by manufacturers (figures not included in Figure 11.4).

In 2000 New Zealanders recycled 26,702 tonnes of plastic (PNZ, 2002). Collection of post consumer PET and HDPE is currently at around 25%-30% recovery so there is room for improvement (PNZ, 2002). At 18% (see Table 11.5), our plastic packaging recycling rate is comparable with most European countries which range from 7% to 22% — Germany being the one exception where 31% recovery has been achieved under a mandated take-back scheme (APME, 2002). Europe is seen as a leader in this area with prescriptive mandates and targets under European Union directives.

The New Zealand Plastics industry has recently set recycling targets for plastic packaging under the New Zealand Waste Strategy as part of the New Zealand Packaging Accord. Packaging was not originally targeted as part of the waste strategy, but has since come under strong public

<table>
<thead>
<tr>
<th>Material</th>
<th>Consumption per person</th>
<th>% collected for recycling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic*</td>
<td>31kg</td>
<td>18%</td>
</tr>
<tr>
<td>Glass</td>
<td>32kg</td>
<td>42%</td>
</tr>
<tr>
<td>Paper</td>
<td>81kg</td>
<td>66%</td>
</tr>
<tr>
<td>Steel</td>
<td>7kg</td>
<td>38%</td>
</tr>
<tr>
<td>Aluminum</td>
<td>2kg</td>
<td>50%</td>
</tr>
</tbody>
</table>

*The above figures include imported and New Zealand manufactured plastics.

Table 11.4: New Zealand packaging consumption 2000 (MfE, 2002).
pressure. As a result MfE have now grouped packaging, under the special waste target of the strategy, as one of eight sectors to introduce extended producer responsibility pilot programmes for the collection and reuse, recycling, or appropriate treatment and disposal of at least eight categories of special wastes.

As part of the formulation of the sector’s Sustainability Initiative, recycling targets were considered, but it was eventually decided that there was not enough information on what material was available and what capacity the recycling sector had to cope with this increased volume. Mass balance figures do not provide a full breakdown of end products as many are composites, co-extruded, laminated or welded, which impacts the ability to recycle. A goal was therefore established to determine what the sustainable level of plastic recycling is for New Zealand. This will require further research and assessment.

Table 11.4 shows a comparison of packaging consumption and recovery in New Zealand for the different mediums as reported on by the Ministry for the Environment. Unfortunately, as discussed above, this method of analysis portrays the industry in a narrow way and it is easy to draw a negative conclusion about the plastics sector from the comparison of these figures. This is due to a huge number of factors including the number of differing plastics, its source reduction capability, the value of raw materials and the number of collectors, recyclers and manufacturers.

The New Zealand plastics industry is committed to the diversion of plastics waste from landfill but emphasises that all waste management solutions should provide the optimum balance of environmental impact and economic cost, from raw material extraction, through to disposal of final residual waste. On this basis, it is important to establish the reasons for plastic recycling:

- energy conservation;
- resource efficiency;
- lack of landfill space; and
- possible leachate from plastic additives in landfill.

These criteria should provide the basis for considering the feasibility of a recycling scheme and in identifying the types of plastic recycled from an environmental perspective. It is well accepted that plastic recycling is a marginal industry economically. A critical measurement of all such proposals needs to be examination of the cost and energy consumed through recycling process and energy saved in reuse of material versus energy wasted in landfill and cost of landfill.

A recent Association of Plastics Manufacturers in Europe (APME) report concluded that too great an emphasis on recycling as a recovery option for plastics packaging waste could drive Europe to ever increasing waste management costs with limited environmental gain (2002). The study illustrates that increasing recycling above approximately 15%, in combination with municipal solid waste incineration, has no major impact in terms of eco-efficiency. By exploring a number of different waste management scenarios, the study demonstrates that there is a cut-off point above which increasing plastics packaging recycling does not provide further environmental gain. One important factor is the impact that increased recycling rates have on the total energy balance — the extra energy required to separate plastics packaging waste for recycling is not offset by the saving in resources from substitution of new materials.

There is no hierarchy of recovery techniques that can be applied universally when making waste management decisions about plastic. Instead the focus for waste management should be on diverting plastics from landfill via a range of recovery options, dependent on specific local conditions. Key insights from the European research conducted for APME were:

- 100% landfill has the highest environmental impact, but currently represents the lowest cost
option at the other extreme;

- 50% recycling of plastics packaging waste has the lowest environmental impact but by far the highest cost burden; and

- 15% mechanical recycling combined with energy recovery offers the greatest reduction in environmental impact at a reduced cost compared with the current average situation (APME, 2002).

Overseas more emphasis has been placed on energy recovery, particularly within Europe and Asia, where high volumes of plastic waste in highly populated countries with small landmasses which struggle to deal with the increasing volume of waste. The European Directive for Waste (91/156/EEC, 18th March 1991) is an important guiding document for Europe. Article 3, section (b):

> encourages members states to...

(i) recover waste by means of recycling, re-use or reclamation or any other process with a view to extracting secondary raw materials or

(ii) use of waste as a source of energy.

Because plastics have a high intrinsic energy content, recognition that plastic waste can be an energy source is important. Incineration is the main method utilised for energy recovery from plastic waste. Incineration has historically been highly polluting, however more recent technology have vastly reduced emissions. To date current technology has remained too expensive to establish energy recovery plants within New Zealand due to the low volume of suitable material available here. There is also a high level of resistance within environmental groups such Greenpeace NZ and the Zero Waste New Zealand Trust, that could prove another major barrier to such technology being established here with the public consultation process under the Resource Management Act 1991.

The New Zealand plastics industry has to date been strongly focused on promoting the environmental efficiency and effectiveness of plastic, light-weighting and down-gauging, in-house recycling and to recycling. Box 11.1 provides a list of examples of current technical innovations. Some parts of the industry do however remain unwilling to take the perceived commercial risk of other environmentally positive decisions due to cost barriers which may threaten customer

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**Box 11.1: Key examples of current technical innovation in the Plastics industry**

- New polyethylene types which allow further down gauging to produce thinner films with similar properties.

- Improved polymerisation catalysts for polypropylene, enabling films and mouldings to be more rigid, allowing lighter packages and improved balance of properties.

- New polymers and polymer combinations that allow better barrier properties and enhanced protection of food products using minimal material.

- Improved process controls, enabling better consistency, and reduced film gauge and container weights.

- Increased electronic control and precision in equipment increasing consistency and reducing rejection rates.

- The change to flexible packs and pouches from rigid containers, significantly reducing weight and resource use.

- The removal of the need for secondary packaging, e.g. stand-up-pouches instead of bags in boxes.

(APME, 2002)
loyalty or because of the level of capital investment required.

Current environmental pressures and trends indicate that these measures are no longer sufficient and call for increased plastic recycling volumes. There is an increasing level of frustration apparent within local authorities as they attempt to reach Zero Waste targets and wish to start or expand community recycling for plastic products. Councils consistently report difficulty in identifying markets for plastic material and in determining the appropriate sort of plastic to collect.

The differing focuses of manufacturers, councils and recyclers and the resulting dissemination of information and education provided between them, has been identified by the industry as a major weakness in facilitating waste minimisation for the sector. The need to set mutually beneficial targets and goals as part of a cooperative strategy between manufacturers, customers, councils and recyclers has been identified as a major opportunity for the future of the sector.

The following sections outline the work being done on issues affecting solid plastics waste at a company, organisational and governmental level.

11.3 Resource Stewardship within the Sector

“The best way to reduce any environmental impact is not to recycle more, but to produce and dispose of less”

William Rathje

There are many barriers to reducing waste from plastics products. First amongst these is the growth of the sector. The success of the industry ultimately means more waste. From an environmental perspective, the key benefits of plastic are its lightness and durability. These same characteristics are the biggest hurdles to overcome when establishing recycling schemes, reducing litter and minimising waste to landfill.

Plastic manufacturing companies working to reduce their own waste are gaining an increased level of resource stewardship awareness. There are growing numbers of examples of new and existing products being redesigned in response to difficulties manufacturers have in recycling their own production waste. Once a product has been established successfully on the retail market it is extraordinarily difficult to change or remove it given the overriding focus of business to succeed financially. Without strong customer support for the changes required these are unlikely to progress. To avoid these situations, environmentally informed decision-making is required at the product design stage. Outlined below are the key issues and opportunities involved in enhancing waste minimisation and resource stewardship for the sector.

New Zealand Plastics Sustainability Initiative

Historically the focus of Plastics New Zealand Inc. (PNZ) has been the protection and promotion of the plastics industry. Recent feedback from territorial authorities and environmental groups shows that the information presented on plastics on this basis is not helping them solve the issues they face. Some have perceived the information provided as whitewash or as a public relations exercise and are very skeptical of the intent of the industry. A survey of councils and other research, carried out by PNZ in 2002, indicates that there is a major lack of information and cooperation between stakeholders involved in plastic production and recycling. Comment is frequently made that recyclers, councils, NGO’s, retailers, the public and industry are not working together. Uncertainty, lack of information and strategic direction amongst these groups has resulted in uninformed decisions being made. PVC label contamination, stockpiled plastics wastes, recyclers exporting and manufacturers importing recovered material are all symptoms of this problem.

Plastics New Zealand facilitated a full day workshop on 10 September 2002, with twenty
Case Study 11.2: Business School Partnerships — Sealed Air Corporation and Fraser High School

In August 2001 a team of 10 employees from Cryovac Sealed Air Corporation’s Hamilton site set a goal of reducing their waste to landfill by 80% within a year. Cryovac have been working closely with the Waikato Environmental Business Network, Environment Waikato, and Hamilton’s Fraser High School as part of the Gateways Programme. The students from Fraser High School did a research project in 2001 to find out the actual value of waste produced on the Hamilton Sealed Air site, including the cafe and administration area, and made recommendations about what to do next. The project involved measuring waste production, waste reprocessing and waste to landfill.

Sealed Air Corporation is a global manufacturer of materials and systems for protection, presentation, and fresh food packaging in the industrial, food, and consumer markets, with four New Zealand branches in Auckland, Hamilton, Rotorua and Wellington. Sealed Air has an Environment, Health and Safety policy that commits to continual improvement. Each employee is expected to promote these goals in their tasks, and to work towards safety and environmental excellence as an integral part of their programme. This corporate philosophy has strong management support that has translated into the dedication of staff time and resources to wasteiminisation in New Zealand.

As a result of this project, the Hamilton Sealed Air Corporation site and Fraser High School students have focussed on reducing, reusing and recycling plastics production waste, blue strapping, shrink wrap, photocopy / printer cartridges, cafe waste, paper and cardboard, adhesives, solvents, and stormwater system / identification / separation. Refuse costs over the first six months of 2002 dropped dramatically from $60,000 to $20,000. The team feels so strongly about the project that they are storing some types of waste plastic until they actually find a new use. The next step for Sealed Air is working on those problem wastes that they have not yet found a use for. Through the Gateway programme Hamilton’s Fraser High School again worked with Sealed Air in 2002 to find alternative uses for the remaining problem wastes.

The waste minimisation project has already successfully reduced waste and saved money, but more importantly it has raised awareness of the inability to recycle or reuse several of Sealed Air’s major product lines. This inability to deal with some of their own waste, while not quickly solvable, has opened the team’s eyes. This philosophy is being increasingly echoed within other Sealed Air branches and cooperation on product development at an international level provides future opportunities for the company. The major successes of this project have been:

- involving and educating the local community;
- a developing staff passion for waste reduction;
- growing awareness of material choices and product design; and
- re-evaluation of current products due to their lack of ability to be recycled.

Contact: John Hall
Cryovac Sealed Air Corporation
07 850 0100
www.sealedair.com
Case Study 11.3: PVC Plastic Sleeves

In 2001 Recycling Operators of New Zealand (RONZ) members raised concerns about the impacts and issues associated with a noticeable increase in the use of PVC plastic sleeve labels. The sleeves are shrink wrapped on to bottles to provide label over the entire product surface and are predominantly made from PVC. PVC is a well-known contaminant in the PET and HDPE recycling streams. In New Zealand sleeved products are mainly used for flavored dairy milk drink bottles normally in the 300 to 500 ml serving sizes, but these are increasingly entering the energy drink and juice markets. A formal complaint was laid with the New Zealand Packaging Council.

Most bottle labeling is imported to New Zealand. PVC labels form the bulk of the sleeve market and are the cheapest. Alternatives are not considered as technically effective with differing temperatures, shrink performance and colouration impacts. Stopping the use of PVC labels would have ramifications in terms of costs, time and equipment. The sleeves also are affecting the Australian PET recycling market and have been raised as an issue there with the Australian Council of Recyclers (ACOR).

ACOR emphasised the importance of getting everyone on-side before going ahead with research to come up with an economic alternative. ‘Buy in’ from label makers and market share for any initiative being necessary. With all major bottle manufacturers involved there can be sufficient market push to get solutions actioned. ACOR stated it would be at least 12-18 months before an acceptable alternative was defined.

Dissemination of information to the relevant industries about the issue was seen as critical and media was identified as the best way of doing this through newsletters and articles in trade publications. The Australian Packaging Covenant has funded the Recycling Guide for Beverage and Food Manufacturers Marketing in PET Containers. A copy of this has been distributed to all New Zealand PET manufacturers as well as a similar guide for HDPE products.

The New Zealand Code of Practice for Packaging of Goods provided a formal avenue through which a complaint could be made and followed up on. In this case, as an international issue involving multi-national companies a resolution is being sought at that level. A resolution is highly dependent on the commitment of the parties involved. In this case, a major multi-national company using the recovered material is directly affected by the contamination and therefore has a strong interest in reaching a solution. As a voluntary code of practice the complaint process lacks enforceability and a timeframe for resolution.

Given the information being provided by territorial authorities in New Zealand where kerbside collections are available, a member of the public would assume that, as one of these sleeved bottles is either PET(1) or HDPE (2), the bottle is able to be recycled. The general public is not typically aware at this stage that there is a problem with recycling this type of bottle. This means the process is not fully transparent and that manufacturers and fillers are not being held fully accountable for their decisions.

The complaints process does however give manufacturers the opportunity to resolve the issue without jeopardising or confusing the public on the message of recycling 1 and 2 plastics, and is being taken extremely seriously by the companies involved. Information on PVC sleeves is available from Plastics New Zealand, RONZ, or the Packaging Council.

Contact: John Webber, Packaging Council of New Zealand
09 262 4044
info@packaging.org.nz
The Plastics New Zealand Sustainability Initiative focuses on design, labelling, communication, education, and partnerships as the mechanisms to improve environmental performance, minimise waste and increase recycling. Vital to its success will be expansion of the initiative to involve other sectors with the support of those directly involved in purchasing decisions, educating the public and recycling. The New Zealand Packaging Accord presents a valuable opportunity to initiate this in relation to packaging, via the major New Zealand brandowners and retailers. Other opportunities for construction, agricultural and homeware streams also need to be developed and fostered by the industry.

**Efficiency – Waste Tracking/Costing**

The ever-present drive to improve efficiency has dramatically improved levels of industry resource stewardship. Total Quality Management and similar systems institutionalised within New Zealand industry over the 1980s and 1990s have resulted in the establishment of systems and measures that have improved resource efficiency dramatically. These management systems instigated some time ago within most company structures are still in place with staff working to reduce error rates and faults. Effective operational managers are constantly measuring and reviewing these issues. There is a noticeable trend emerging within the industry to quantitatively measure and cost production waste as a performance indicator. Marley New Zealand, Fisher & Paykel Healthcare, Huhtamaki Ltd and Chequer Packaging Ltd are among some of the larger plastic companies instigating this practice.

Financial incentives to reduce material use are strong. Improving technologies and tight markets continue to push manufacturers to light weight, reducing the amount of raw material required per product. This has also resulted in continued efforts to recycle as much plastics waste as possible. ‘In-house recycling’ is now standard practice in the plastics industry with 9,439 tonnes of plastics material being reused in 2001. The production of a milk bottle, for example, produces flaps of surplus plastic at the base and top that account for 40% of the overall material use in production. Recycling of this material back into the product results in huge energy and resource savings. Many machines are now equipped to gather and return production off-cuts straight to a grinder to be chipped for reuse. This area of recycling is not shown in plastic recycling statistics but demonstrates a significant contribution by the industry towards waste minimisation.

Mixed or contaminated plastic waste proves more difficult to deal with and represents most of the residual 1% of plastics production waste achieved by the sector. An effort has been made recently by Plastics New Zealand to promote the recycling of the purge material used to clean machine barrels between differing batches. An industry challenge was also issued by Plastics New Zealand for companies to reduce their waste by 50% by May 2003 at the 2002 Plastics New Zealand conference. Two companies exceeded this target, and there is a strong commitment within the industry to reduce waste even further. The impending rise in landfill charges under the New Zealand Waste Strategy has been used to further raise this commitment. Given the continued efforts of plastic manufacturers in this area towards best practice the main waste minimisation challenge now facing the plastics industry in New Zealand is the reduction of waste at the end of their products’ useful lives.

**Industry Education and Environmentally Sustainable Design**

A lack of knowledge of what constitutes the best environmental solution provides a barrier to resource stewardship. Councils and environmental groups have both noted the lack of responsiveness and understanding to questions and concerns about plastic identification codes and recycling by plastic manufacturers. This lack of knowledge reflects poorly on the industry and reflects a lack of capacity to consider environmental issues in the design process where the parties are not sufficiently informed to make decisions or offer clear justification for design decisions from this perspective. While environmental factors in terms of durability, performance

The Plastics Sector

Page 185
Case Study 11.4: Farm Plastic Waste

The Ministry for the Environment released a consultation document entitled the Dioxin Action Plan in 2001. This document proposed several policy measures aimed at reducing the emission of dioxins to air. Among the proposed measures was the introduction of a National Environmental Standard that would result in a ban on uncontrolled outdoor burning of plastic materials. The document pinpoints farm plastic waste as a source of dioxin emissions. Particular sources identified are agri-chemical containers and silage wrap. However as both of these are typically polyethylene, this would be dependent on chlorine being present in the contents of the containers.

In reaction to this document the rural sector asked the Ministry for the Environment what alternatives were going to be provided if they were now going to be unable to burn their waste. A resulting workshop on farm plastic waste held on 12 February 2002 identified that, even in regions where burning had already been banned by regional councils, this practice was still commonplace. Most regional councils current rules permit on-farm land filling, including triple-rinsed agrichemical containers where waste has been produced on the property.

Education and provision of alternative methods of disposal were identified as the obvious solutions to these problems. Key issues for plastic recyclers in examining options for farm plastic waste included: small volume/low weight; cost of collection; collection system; return to buyer; no regional council funding; adaptable overseas programmes; reuse - refilling of containers; triple-rinsed water returned to spray tank; agrichemical containers need to be clean (some of the acid herbicides may be an issue); and size of container for reuse.

The 1997 landfill census conducted by MfE did not look at rural sector waste, but estimated it at 10% of waste. In rural New Zealand there are 77,000 land-based businesses, and 45,000 rural residential properties. Some of these have access to municipal waste streams. Feedback from rural sector groups at the workshop could be summarised as a feeling of frustration over the lack of options for plastic wastes other than burning or burying.

A willingness from growers to pay levies on their agrichemical containers to fund a collection and recycling scheme was also raised. Both Canada and Australia have systems in place. Pressure is being placed on New Zealand growers to document and audit best practice of waste management measures. As silage and agrichemical plastic have the same basic logistics of collection, it was concluded both needed to be looked at.

The need to take an integrated approach to the issues of agrichemicals, farm plastics and other associated on-farm plastics was central to the formulation of the Sustainable Management Fund (SMF) grant application. Another major objective of the working party formed is that the results of the project could be integrated into existing projects and processes.

The key outcomes of this workshop were the creation of a working group and the amalgamation of two existing applications for funding from the SMF. Information on the project’s current status can be obtained from the Ministry for the Environment or NZAET.

While the final outcome of the project is uncertain the project has been positive as it has raised awareness and provided an opportunity for sharing perspectives from a broad array of sector groups from manufacturers, suppliers, customers and councils.

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and appearance are usually considered, it is equally possible that additives used to achieve these ends may negate any environmental benefits achieved by the comparative longevity of the item. While design decisions are being based on resource efficiency from the point of view of cost savings, this element of the design decision-making process needs to be expanded to examine other factors critical to waste minimisation and sustainability.

The Health and Safety Manager at a large plastics converter, which has a comparatively young engineering design team, says that the basic ability to design products for environmental sustainability or recyclability is lacking. Theoretical training in universities is not providing engineering and design graduates with the practical knowledge and skills needed to make environmentally-informed design decisions. Assessment of plastic industry unit standards and feedback on the environmental performance of the industry demonstrates that there is a gap between university and industry training. Course conveners from Massey and Auckland Universities have commented that:

- they are not able to lecture at the level of specific technical detail required for this due to the broad scope of their courses; and
- the field of sustainable design is so new that what makes a product ‘sustainable’ is not yet able to be clearly defined.

Feedback from the Plastics and Material Processing Industry Training Organisation (PAMPITO) has been that this is also not the appropriate level for delivering sustainable product design training. Plastics industry unit standards are currently focused at the operator or supervisory level and do not access those directly responsible for making design decisions. A commitment has however been given to incorporate more environmental information within existing unit standards as these are reviewed over the next two to three years.

Research by Plastics New Zealand shows that few companies have environmental or recyclability considerations built into their company procedures for product development or design. These aspects need to influence the selection of plastic materials, how they are put together, and how they are labeled. Management and design staff need to be aware, informed and able to undertake research where information is not immediately available. The Packaging Council Environmental Awards are one positive example of creating incentives for the industry to adopt sustainable design practices. Plastics companies Coca Cola Amatil and Vertex Pacific Ltd won the Supreme Award in 2001 and 2003 respectively.

Entries in these awards and surveys conducted by Plastics New Zealand with member companies make it evident that many of the larger plastic companies are adopting sustainable design practices with resulting increases in resource stewardship. This is often a result of strong international environmental policies or more informally as a result of market differentiation or specialisation. These practices are still however very fragmented when looking at the industry as a whole, especially within smaller companies. This reflects overseas research which has found small- and medium-sized enterprises to have lower environmental performance and initiative in comparison to their larger counterparts (New Business, 2003).

At a time when recyclers are competing for more material and green groups are demanding better access to recycling some plastic manufacturers and fillers are compromising this by placing unrecyclable products on the market. This is a contradiction that needs to be alleviated through better tertiary education and communication between environmental, educational and industry sectors.

The New Zealand Waste Management Strategy released in March 2002 adopts the principle of Extended Producer Responsibility. This is defined as putting “the onus on business to look for, and capitalize on, opportunities for resource conservation and pollution prevention throughout a product’s life-cycle, including disposal and the life-cycle principle where products and substances should be
designed so all environmental effects are accounted for and minimized during generation, use, recovery and disposal” (MfE, 2002). Based on the feedback received from the tertiary sector, industry now needs to establish advice and resources to achieve these objectives.

**Responsibility for Decision-making**

Interviews with plastic manufacturers indicate awareness of waste minimisation is starting to affect decisions made, but that this responsibility is frequently being deferred to their customers. The concern here is that these customers are often uninformed about the possible resource impacts of the decisions they make. The PVC sleeve contamination issue is a good example of market innovations succeeding where they are in direct conflict with accepted design criteria for recycling. Deferring decisions to other sectors that are less informed is a real concern and raises the importance of co-operating in the education and provision of environmental/sustainable design resources and information to the industries that the plastics sector serves. The broad scope of related industries and the ability to disseminate the correct information within these is another strong barrier to improving the design of plastic products.

**Supply Chain**

Plastic raw material supply companies commonly have strong formal environmental policies. Unfortunately these same companies do not always fully inform or advise clients on the correct labeling or recyclability of materials sold. These, often multi-national companies, have an implied social and environmental responsibility to provide technical advice and support to their clients and the communities where these products are eventually sold, used and disposed of. There appears to be a consistent theme developing where companies are now monitoring their own environmental performance within the company, but this is often done in isolation from the full life-cycle effects of the products and services they provide. A good example of this is the frequent queries from plastics manufacturers over the past year about what can they do with empty raw material bags which are not recyclable. As a result, a number of major New Zealand suppliers have changed to recyclable LDPE(4) material bags. As an industry group part of our waste minimisation strategy must be to examine supply level relationships and the possibility of formulating service level agreements.

**Risk management**

The manufacturing sector continues to see environmental initiatives and legislation as a threat to economic growth that will continue to increase future compliance costs and reduce profitability. Environmental initiatives have therefore frequently been made by the plastics companies to minimise risk, as opposed to maximising market opportunity. Actions now being taken by the plastics industry indicate that this mindset is shifting, with environmental philosophies emerging strongly among many of our leading plastic businesses.

**Sector development**

There is a strong opportunity for strategic projects to be forged between sector groups. Consultation and co-ordination is needed to ensure:

- economies of scale;
- buying power;
- certainty and reduced commercial risk; and
- greater transparency.

Plastics recycling has had a chequered history in New Zealand. Recyclers are often referred to as ‘cowboys’ by both manufacturers and other recyclers. The plastic recycling industry has often been typified by people who are passionate about recycling but who are unfortunately not always good business managers. Tight recycling markets and fluctuating prices have seen many
of these companies close. One positive result of this has been growing an increased level of professionalism among the operators that have sustained their businesses. Overcoming existing perceptions and increasing cooperation between the two groups has been a focus for both Plastics New Zealand and the Recycling Operators of New Zealand.

Comments from manufacturers not able to source enough recycled material contrast with recyclers who are exporting materials. This reveals a real lack of co-ordination between the two groups. There is a lack of capacity within New Zealand to reprocess material for reuse here, with only one commercial plastics washline in operation and technical limitations on the type of material able to be reprocessed without this facility.

From an environmental perspective reuse of these materials within local markets is a direct environmental gain, given the loss of energy involved in shipping materials overseas to China and Asia. It is also probable that the environmental performance of manufacturers within New Zealand is higher than those being achieved overseas. Most collectors bale material which is unable to be used directly by manufacturers. The lack of access to New Zealand re-processors for recovered material will be an issue that needs to be readdressed as collection volumes continue to increase.

Ideas for plastic recycling abound but linking these with a reliable source of material in sufficient volumes, and with adequate business acumen and entrepreneurial skill, is proving more difficult. The Recovered Material Foundation, which manages the Christchurch City kerbside collection, has as part of its brief the creation of additional employment. The focus of the organisation to date has been to investigate start-up opportunities. There are, however, sufficient plastics companies already successfully operating locally which have the capacity to use all the HDPE (2) material collected by the council. Facilitating and initiating contact between these two groups to establish possible markets is something that Plastics New Zealand and RMF have undertaken to investigate.

The marginal nature of recovered plastic material means that sales of material are very market driven. Consideration by councils of their aims for recycling and what defines an acceptable market for materials should form an important part of their contracts. Alan Goddard, Chair of WasteMINZ, has commented that councils are placing too much reliance on contractors’ advice and judgement on markets, their criteria for an acceptable market is economically driven and may not reflect accurately what the community is setting out to achieve by recycling. Further cooperative work is required by the Recycling Operators of New Zealand, Plastics New Zealand, Local Government New Zealand and WasteMINZ to provide better advice and information to Territorial Authorities to enable informed and sustainable decisions on plastic recycling.

**NGO’s and Government Departments**

The lack of co-ordination and resources among business/environmental groups within New Zealand is a further barrier to improved business waste minimisation practice. There are a plethora of such groups in New Zealand. While these groups are highly enthusiastic and are succeeding in the promotion of change, they seldom have any strong governmental mandate and are typically small and under resourced. Groups such as the Zero Waste Trust, Sustainable Retail, AEBN, BSR, NZBCSD, The Natural Step, WasteMINZ, RONZ, the New Zealand Packaging Council, BusinessCare, Landcare, the Ministry for the Environment, and cleaner production staff within councils where they exist, should consider further amalgamation, or at least better co-ordination of projects and pooling of resources.

As a national organisation Plastics New Zealand struggles to find local resources and support people for leading waste minimisation projects with individual companies. There is a wide breadth of support available through the groups referred to above, but very little depth. For example, the plastics sector has its biggest pool of industry within Manukau City. Unfortunately
Manukau City does not have any cleaner production staff and therefore no cleaner production coordinator under BusinessCare. The establishment of a central agency to co-ordinate the work of all these groups and to refer and answer business enquiries would be hugely beneficial for the business community. Business owners and managers look at environmental work as something to do where time and money permits. Having easy access to the right resources and support people in their local communities is therefore critical to ensuring ongoing commitment to waste minimisation work. Also critical is a better alignment of New Zealand Trade and Enterprise with the Ministry for the Environment. Technology and engineering innovations will be critical to development and redesigning of plastics products for better waste minimisation. Industry development, research support and coordination is needed at this level.

**Economic barriers**

Investment in capital, product research and development is essential to ongoing reductions in material usage and energy consumption. A lack of market incentives to carry out these developments is a barrier. Adjustments to depreciation and taxation may provide opportunities to improve the rate of plant replacement that would have a very positive impact on energy consumption by the sector. The industry is typical of most in New Zealand where engineers and technicians are skilled at keeping the older, simpler, but less efficient, machinery operating at lower cost than purchasing replacements.

One barrier referred to in reference to further reducing bottle weights was the ability for fillers to cope with these innovations. Some beverage companies, for instance, continue to operate with equipment designed to fill heavy glass bottles that will not cope with the lightest weight plastic bottles now technically possible. Waste minimisation in terms of energy consumption is also a critical issue. A number of plastics companies did extensive work on energy efficiency in the late 1990s; as a result the easy wins have already been made. Further efficiency gains require large capital investment. Economic incentives to speed this shift need to be examined by government.

**11.4 Governance of the Sector**

The plastics industry has the relative luxury of having no industry-specific legislation. It is however subject to the normal raft of standards, regulations and acts which dramatically impact on business compliance costs here in New Zealand. Like other sectors further legislation of waste minimisation based controls is seen as a further compliance cost that the sector wishes to avoid. The threat of legislation is therefore a driver for action. The following section outlines the current governance of the sector and some future implications of this.

**Legislation**

There is no specific legislation for plastics or packaging within New Zealand. Manufacturers and recyclers operate under national and international standards, Resource Management, Health and Safety, and Hazardous Substances legislation and regulations. Statistics New Zealand figures show $739 million worth of plastic goods, excluding packaging, are now imported per year (Statistics NZ, 2002). The New Zealand economy has been deregulated and there are few or no controls on imported plastic products or packaging. Consumers buy for cost savings, brands, looks and convenience. Short product life-cycles and fast-changing consumer choices typify our consumer society.

Environmental legislation in New Zealand is framed to minimise the impact of industry. For example, the purpose of the Resource Management Act 1991 under section 5 requires the: “... avoiding, remedying, or mitigating any adverse effects of activities on the environment”. The purpose of the Hazardous Substances and New Organisms Act 1996 under section 4 is: “... preventing or managing the adverse effects of hazardous substances and new organisms.”
The hierarchy of action for waste minimisation focuses first on source reduction. The focus of government under our current political climate, as evidenced by these pieces of legislation, is however not on decisions made in design and product development, but on managing the effects of these decisions. With no environmental focus on product design and development, councils are left to solve the waste issues of our communities in isolation. Problems are, as a result, discovered after the fact. A good example of this is PVC sleeving case study (see Case Study 11.2). PVC sleeves, a relatively new innovation, gathered rapid market growth and acceptance both here and overseas in spite of being a well-known contaminant of the PET and HDPE recycling streams. The current government focus on compliance is not representative of best waste minimisation practice. Any incentive to improve beyond compliance is on a purely voluntary basis. While this is a scenario preferred by industry there needs to be a provision of corresponding government leadership and resources that focus on leading and enabling industry to improve beyond compliance levels.

**The Packaging Accord and the New Zealand Packaging Code of Practice**

The 1996 Packaging Accord sought to minimise the environmental effects of packaging waste. Innovations such as light weighting have slowed the growth in this waste, however the total quantity of packaging waste has continued to increase. The Packaging Council of New Zealand represents the broader packaging sector groups of glass, paper, tin, aluminum and plastic. The Packaging Accord provides a general direction to minimise packaging waste.

The Packaging Council of New Zealand also produced a self-regulatory Code of Practice for the packaging of consumer goods. The key objectives of the code are:

- to ensure that new packaging materials or new forms of packaging are evaluated for their environmental impact prior to their introduction and if possible, modified to ensure minimal environmental impact;
- to allow companies to evaluate the environmental impact of existing packaging and if necessary, make alterations to any package to make it more environmentally appropriate; and
- to reflect the following waste management options: Reduction; Reuse, Recycling, Recovery and Disposal (Packaging Council, 2002).

The Code is self-regulating and does not have any enforceable mandate under which the Packaging Council administering can act. The Code provides a complaint procedure under which formal complaints may be made about plastic packaging where the code is breached. The Code was reviewed in consultation with the Ministry for the Environment in 2002.

The New Zealand Packaging Accord is currently being renegotiated. As part of a renewed agreement, action plans are required from all packaging sectors, including retailers and brand owners, recyclers, central and local government. Increased emphasis has been placed on retailers and brand owners for their influence on the supply chain and potential to impact changes through combined purchasing power. Also included for the first time are requirements for the sectors to monitor and report on environmental performance at a level broader than recycling. These requirements reflect an increasing awareness within the Ministry for the Environment of the need for a more holistic approach to assessing the environmental impact of industry.

**Standards and guidelines**

There are various technical guidelines on plastics, including product design and material compatibility. Full resources on standards and guidelines are available at www.plastics.org.nz.

The websites www.apme.org and www.4spe.com are two other excellent sources for best European and American plastic technologies and technical life-cycle assessments. The following
is an abbreviated list of current standards that impact on product design and labelling:


AS/NZS 14021, *Environmental Labels and Declarations*.

AS 2070, *Plastic Materials for Food Contact Use*.

NZS 5825, *Re closable Packages: Child Resistant packaging*.


### 11.5 Drivers for Change within the Sector

As with all business sectors there are various pressures pushing and pulling the decisions and actions of plastic business owners and managers. The plastics industry is one that enjoys the unfortunate privilege of being a sector people love to hate when talking about environmental issues. In any discussion on waste minimisation plastics invariably comes up as a major concern, although it only contributes 7% of the waste stream by weight.

Unfortunately, concern about plastic waste does not often translate into behaviour changes like purchasing decisions. For this reason the industry faces both strong and weak drivers for change. The following section outlines and discusses the main drivers.

**Markets**

Customer feedback to the plastics manufacturing sector is vital to the redesign of plastic products. Manufacturers base most of their decisions on the demands of the customer. If demands to ensure recyclability and reuse of recovered material are not supported by customers these will not succeed. A prime example of this is the purchasing practice of councils. Manufacturers cite several councils demanding coloured rubbish bags that prevent the use of recycled material. A black rubbish bag can be made from 100% recycled content and yet some councils will not purchase these. Provision of infrastructure by councils and government using recycled plastic is a major opportunity to ensure that materials are reused locally.

There are good examples of industry innovation being used to overcome market barriers. Several products have been developed where a layer of virgin material over recycled material is used to meet customer specifications. HDPE, for example, is commonly used in pipes. Marley New Zealand Ltd recently developed a pipe with a co-extruded coloured outer that means black recycled material can be used inside while the coloured outer layer of virgin material enables easy identification of the underground service provided.

Unfortunately market experience has also shown the failure of environmentally sound plastic products. The sad reality is that some of these failures have made manufacturers wary of trying new environmental product initiatives — therefore support through purchasing policies will be vital to ensure that manufacturers are giving these considerations weight in the decision-making process.
For example, the heaviest plastic component and most expensive part of roll-on deodorant bottles is the roller ball. The balls are typically made of a different material, are not removable and are therefore unable to be recycled. The ‘Mum’ deodorant refill produced by Premier Plastics alleviated this problem, reducing costs, material usage and enabling recycling, but proved unsuccessful on supermarket shelves (PNZ, 2002). Lack of market support for resource smart products creates a disincentive to taking innovative action.

Clients are basing their product and packaging decisions on price and this typically becomes the key determining factor in material selection for manufacturers. Raw material prices can result in plastics being selected that are not recycled being chosen ahead of those that are. For example, ABS and PS are frequently used for dairy products, instead of HDPE which is recycled through kerbside collections. Our manufacturers have expressed a willingness to change if their clients gave some form of guarantee that they would not defect to a cheaper competitor’s product in the original non-recyclable material. Currently there is no financial incentive for either party to take this action.

The need for customer support is an issue that is common to all sectors. A survey of the retail sector revealed the following comments and opinions (AEBN, 2002):

- Retailers are highly customer driven and would quickly respond to whatever their customers demanded;
- They stressed the importance of looking back up the supply chain to work with suppliers to address sustainability issues at source;
- As major companies with large buying power, they felt that NZ suppliers would listen to them and take action in response to retailer concerns; and
- One retailer stated that responding to issues as a sector meant they would have bigger impacts on the major suppliers.

As discussed above, the action plans now being required under the Packaging Accord will provide an opportunity to ensure the retail sector acts on the above comments. Sealed Air Auckland cite a case of a customer requesting that a plastic coated paper product be changed to one plastic material (LDPE) so that it could be recycled (PNZ, 2002). This product change, which was driven by the customer, not only enabled recycling but reduced raw material costs, and therefore provided both environmental and economic benefits to the manufacturer. Better promotion and awareness of waste minimisation issues within our industry and with our customers will increase the incidence of this sort of scenario. The need for better education and co-operation are elements that will be focused on under the industry’s Sustainability Initiative.

**Plastics New Zealand**

Plastics New Zealand Incorporated (PNZ) represents over 165 plastic product manufacturers and raw material suppliers with a membership base covering over 75% of the total industry. Plastics New Zealand is based on a representative committee structure and employs three full-time staff. The purpose of PNZ is to maximise the growth and success of plastics-based technology in New Zealand in an economically, socially and environmentally responsible manner. A list of initiatives that PNZ has initiated in the past couple of years is provided in Box 11.2. PNZ has employed a full time environmental affairs manager since 1993. The principal purpose of this role is to assist and encourage members to operate their businesses in an environmentally responsible manner by promoting relevant standards, by-laws, legislation and best practice relating to environmental issues. The principal role of the environmental affairs manager is to implement the industry Sustainability Initiative.

**Zero Waste**

The aim of Zero Waste New Zealand Trust is to eliminate rather than ‘manage’ waste. The
Trust’s website states that advocacy and policy development are major functions. This is actioned by promoting the vision of a ‘zero waste’ society where all materials are valued as resources. Zero Waste New Zealand Ltd list their function as:

- industrial designers designing products that can be reused, disassembled or recycled at the end of their lives;
- manufacturers creating products with minimal waste and reducing packaging to a minimum;
- retailers stocking products that are recyclable and repairable;
- secondary materials handlers providing a high-quality service that out-competes waste disposal services;
- local authorities providing the incentives and support infrastructure for recycling and resource recovery;
- central government creating policy that favours waste minimisation and recycling over disposal to landfill; and
- consumers making responsible buying decisions, buying products with minimal packaging and made from recycled materials and recycling at home and work (Zero Waste, 2002).

The Trust has placed strong emphasis on, and been highly successful in, gaining support for waste minimisation through zero waste. The successful uptake of the ‘zero waste’ philosophy by at least 50% of the territorial authorities in New Zealand is evidence of this (Zero Waste, 2002). This has created a situation where considerable pressure is placed on recovering and recycling plastics from the waste stream. While the Trust has not focused on industrial design and retail purchasing decisions it has definitely created pressure to influence these. The campaign by the Trust against plastic shopping bags is one recent example of this.

A key benefit of this movement has been in the increased level of community recycling and moves to examine future plastic recycling streams. Unfortunately these decisions are typically made in isolation from the producers of these products, feedback to manufacturers has been sporadic and largely based on public debate. Both Plastics New Zealand and Zero Waste have been working to find better ways to cooperate, even where it is not possible to reach agreement on specific issues.

As councils attempt to find solutions for plastics waste, pressure will continue to develop for manufacturers and importers to reconsider their material or design choices. Moves by the Trust to provide educational infrastructure for the New Zealand waste industry may also provide further opportunity to promote best practice in plastics waste management.

Public

There is public pressure to offer plastic recycling services through kerb side collections. Recycling is seen as the environmental solution to what the public perceive as a mountain of plastics waste. Queries from the public often reveal that they perceive the proportion of plastic waste as much higher than the reality of 7%. The general public does not often consider nor are they aware of the environmental life-cycles of the packaging or products, which they purchase, use, and dispose of. Paper or cardboard is seen as preferable due to the ease of recyclability and the perceived ‘naturalness’ of the material. The international plastics industry had invested significant money to research the lifecycle of plastics and the comparative energy use in the production of plastic materials and products. Provision of information and educational resources is seen by the plastics industry as a way of better informing the public and ensuring that debate on the environmental impacts of plastic is an informed one.

Media

The media have published a variety of reports on plastics and plastic recycling. Members of the
The Plastics Sector

public frequently ask the PNZ Environmental Affairs Manager “Doesn’t it [kerbside plastic] all just get dumped anyway?” This perception seems to have resulted from news media items on recycling that have focused almost entirely on unfortunate circumstances where collected materials have been sent to landfill. This had led to a belief that plastics recycling is a sham or not worth it because “it all gets dumped anyway”. Transparency of the industry with access to

Box 11.5: Plastics New Zealand has initiated or taken part in the following projects in 2001-2002

• Annual Mass Balance Survey of all New Zealand plastic production and recycling businesses.
• Issue of a 50% industry waste reduction challenge from the 2002 to 2003 at the PNZ conference held in May.
• Work with ERMA New Zealand to assist the transfer of plastic industry substances by grouping polymers into common types and providing evidence to confirm that they are non-hazardous.
• Initiation and facilitation of a workshop on rigid household plastic recycling for New Zealand plastic manufacturing and recycling sectors to discuss current concerns for the recycling industry relating to contamination, confusion over the use and application of the plastic resin identification code and the impact of more complex products entering the marketplace was discussed.
• A second workshop was held with representatives from the printing, labeling and marketing sectors where a programme was developed to ensure that these sectors are also aware of current contamination issues.
• A new version of the Plastics Identification code was launched in May and distributed to all manufacturers and territorial authorities.
• Ongoing industry site visits and meetings with PNZ company managers to determine existing levels of environmental performance and identify areas for improvement.
• Investigation of options to create or incorporate practical environmental content within the plastics industry training unit standards.
• Development of a Sustainable Development Strategy for Plastics New Zealand.
• Responding and providing resources to public queries on plastics recycling, the plastics identification code and effect of plastics on the environment.
• Issuing a two-monthly newsletter on current plastic industry environmental issues to an expanded group plastic manufacturers, recyclers, councils, government departments, environmental groups, and other interested parties to improve communication between all stakeholders.
• Telephone survey of all New Zealand councils to seek feedback on plastic waste, recycling schemes and their information requirements.
• A survey of 160 schools using the Plastics New Zealand technology education kit to get feedback to review the contents of the kit and Plastics New Zealand website www.plastics.org.nz.
• Representation of the Plastics industry on the Farm Plastics Waste Sustainable Management Fund project.
• Presentations and stands at various interest group events.
• Distribution of over 50,000 free Boatie Rubbish Bags to boat and yacht clubs.
• 100,000 HIPS water cups were provided to 2002 Auckland Round the Bays Fun Run, 75,900 collected and recycled into coat hangers.
accurate information on plastics and recycling for those educating and informing the public is therefore vital to any future increase in recycling levels.

PNZ has produced a series of informational brochures, and has redeveloped its website www.plastics.org.nz in response to this need. It has also produced a free education kit for secondary school students studying under the technology curriculum. Over 300 schools have used this kit over the last five years. The material provided has been aimed at providing teens with better information about plastic as a material for use in technology applications and to raise a better public awareness of the energy efficiency and the positive environmental benefits of plastic over its entire life-cycle.

**Local Government**

Councils must prepare an assessment of effects on the environment that examines alternatives under the Resource Management Act — this cost-benefit analysis is not often made when recycling contracts are being assessed. Waste contract decisions are typically made on a financial basis through the annual plan and tender processes employed by councils. Concern has been expressed that councils are accepting recommendations on plastics recycling from contractors without any thorough verification or assessment. Contractors are basing their tenders on plastic markets usually from a purely financial perspective that may not fully reflect the broader environmental and social intentions of a council. The occurrence of disparate advice being received by councils about the existence, or not, of markets for types of plastic from contractors, with a vested interest, needs to be alleviated by the provision of some neutral industry information. Plastics New Zealand, the Recycling Operators of New Zealand, Waste MINZ and Local Government New Zealand have an opportunity to help fulfil this need. The role and responsibilities of local government for recycling will be broadened under the New Zealand Waste Strategy with tendering and maintaining recycling contracts, promotion and education of recycling schemes, and monitoring of contract performance all needing to address this issue. The incidence of questions from local authorities to Plastics New Zealand has definitely increased of late and this reflects a growing awareness of the often complex issues surrounding plastics recycling which is really positive.

McDonough and Braungart state that “blindly adopting superficial environmental approaches without fully understanding their effects can be no better – and perhaps even worse – than doing nothing” (McDonough and Braungart, 2002). Considerable energy and resources are consumed by the recycling of plastics. Take for example PET, considered one of the success stories of the New Zealand plastics industry from an environmental perspective. This material is collected and transported from as far away as Dunedin to China and other Asian countries where it is reprocessed for fibre. The international anti-plastics lobby has attacked the plastics industry for ‘dumping’ plastics in third world countries where there is no guarantee of environmental performance or employment conditions. There is no record of an environmental life-cycle analysis in the New Zealand context that would take into account these factors. Councils continue to make the decision to recycle plastics based on partial information. The determination of end markets is usually left to contractors and traders who are focussed solely on cost recovery. An anomaly in the market means it is cheaper to ship New Zealand’s plastics waste to China than to Australia where reprocessing facilities are available. RONZ has recently initiated a study to gain better technical information on these PET markets.

HDPE, the other major post-consumer recycling stream, is a comparative success story with the majority of these materials being reused within New Zealand with minimal levels of reprocessing.

The lack of information and the complex technical nature of assessing the true costs and benefits of plastics recycling is a barrier to making best practice waste management decisions in New Zealand. Plastics New Zealand has undertaken to meet with recyclers, councils and waste
companies to define common strategic goals for plastics recycling in New Zealand in an attempt to provide councils with clear guidance.

**Recognition**
Both Plastics New Zealand and the New Zealand Packaging Council hold high profile biennial awards that have strong environmental criteria and continue to raise the profile of incorporating environmental factors into the design process. Vertex New Zealand won the 2002 Plastics Industry Environmental Award for their jerry can that contains 64% less plastic than a normal jerry can of equivalent capacity.

**International trends**
Twenty-five percent of New Zealand plastic production is exported (PNZ, 2002). Overseas trends towards waste minimisation therefore have a direct impact on our products as manufacturers here design to specifications. These same trends are closely monitored and reported on by environmental groups, by government assessing and determining policy, and by Plastics New Zealand to ensure that its members are informed. Europe typically has the strongest formal policies with current trends toward legislating Extended Producer Responsibility (EPR), for control on material use, identification and responsibility to take back products at the end of their lives.

Overseas models for ‘extended producer responsibility’ (EPR) in packaging include:

- packaging industry covenants (Netherlands, Australia);
- mandated beverage container deposits (some USA states, South Australia, Germany, Netherlands, Norway, UK);
- mandated take-back responsibility (Germany, Austria, France); and
- mandated recycled content (some USA states) (MfE, 2002).

The sector has established the need to further investigate extended producer responsibility, with Plastics New Zealand actively promoting this with companies on a business-to-business basis. Opportunities for Extended Producer Responsibility schemes at a macro level will be an important consideration in the assessment and further workshops are proposed under the sectors Sustainability Initiative targets.

**New Zealand Waste Strategy**
The New Zealand Waste Strategy released in March 2002 sets voluntary targets for access to recycling but does not specify the type of material that should be collected. There are no specific targets that relate to plastics. The Strategy does however pave the way for imposing true cost pricing on landfills. The low cost of landfill in New Zealand has long been a financial disincentive for recycling — particularly plastic recycling which has comparatively low financial returns.

Relevant waste minimisation and special waste targets for the sector to work towards are (MfE, 2002):

- by December 2005, at least 10 major businesses will be participating alongside central and local government in developing and promoting waste minimisation programmes within their sector;
- regional councils will ensure that industrial resource consent holders will have in place a recognised waste minimisation and management programme; and
- by 2005 businesses in at least eight different sectors will have introduced EPR pilot programmes for the collection and reuse, recycling, or appropriate treatment and disposal of at least eight categories of ‘special’ wastes. e.g. [packaging] waste oil, tyres, end-of-life vehicles,
packaging, computers, batteries.

**Threat of future legislation, waste levies and increased compliance costs.**

A key concern of the plastics industry is that of product substitution. Government initiatives such as the removal of trade barriers, climate change policy and further measures designed to internalise environmental costs have left the plastics industry exposed and vulnerable to imports from countries that can employ cheap labour and poor environmental performance. Any New Zealand initiative to design plastic products for waste minimisation must therefore be on a cost competitive basis with these cheaper imports and presents the industry with a double challenge — first selling these initiatives to their customers, and secondly ensuring that they are not displaced by imports.

### 11.6 Conclusions and Recommendations

Based on the above assessment the key barriers for the plastics sector in establishing the best available waste minimisation practices for the full life-cycle of products and services are:

- lack of incentives for business to achieve best waste minimisation practice;
- lack of market purchase support for sustainable product design;
- lack of practical sustainable engineering and technology design education at a tertiary and industry level;
- lack of government leadership and technical resources to support sustainable product design;
- too much focus on waste solutions, e.g. recycling;
- lack of inter-sector co-ordination and leadership at a national level on business sustainability issues; and
- lack of co-ordination between government departments, academia, and business sector projects and research.

The New Zealand plastics industry has developed its Sustainability Initiative as a tool towards overcoming these barriers. Most goals within the Initiative relate directly to resource stewardship and waste minimisation. Under the principle of Extended Producer Responsibility major challenges face the plastics sector with the large number of materials, sectors, participants and companies involved in the life-cycles of a vast array of products.

The plastics industry does have the opportunity to lead by example and to raise awareness. Trail blazing is however often frustrating, expensive and time consuming, as evidenced by the earlier failure of some of our products designed for waste minimisation. Plastics companies are in business to make money — waste minimisation solutions and resource stewardship must ultimately meet these ends. There is a reluctance within the industry to take an environmental leadership role because of existing negative perceptions about plastic, and the perceived risk that companies will be ‘cut down if they hold their heads up’.

This re-emphasises the need for stronger government leadership on waste minimisation and resource stewardship, from a holistic industry perspective encompassing the full product life-cycle from design to waste solutions. There has been much political reference to decoupling economic growth from growing waste volumes. Government input into supporting sustainable design solutions is now needed through political, technical and purchasing support. Recycling is an excellent mechanism for hooking into peoples’ emotions, and raising community enthusiasm, and involvement which the sector and government will continue to maximise.

The often singular focus of central and local government, environmental groups and the public
on plastic waste and recycling in their policies, programmes and actions is of real concern to the plastics industry. There needs to be more tangible support given by these groups to enable positive product and service designs by raising the awareness of the impact of purchasing decisions and more formally through supply programmes and purchasing policies.

The need to share information and co-operate between sectors, organisations, businesses and consumers both nationally and internationally is critical to the success of the Plastics New Zealand’s Sustainability Initiative. Lack of formal consultation and communication networks between non-governmental and governmental agencies means communication is fragmented and often haphazard. Sectors within the business community are at differing levels of understanding and capability in terms of waste minimisation. Approaches to the retail sector for example revealed that they are just starting in some cases to examine energy efficiency and waste reduction for their shops and few currently consider it their responsibility to define supply or purchasing policies on an environmental basis.

Also critical will be the improvement of engineering design-based waste minimisation education within the sector. Technology and engineering design courses are currently lacking the specific content required to ensure that environmental issues are weighted into the decision-making process. It is likely that this problem is common to most other manufacturing sectors and there is an opportunity to create a model that can be transferred to other sectors.

Fortunately the adoption of the Plastics Sustainability Initiative has coincided with many other positive changes. These include the creation of a Sustainable Industry group within the Ministry for the Environment, the renegotiation of the Packaging Accord, the creation of the Sustainable Business Network, provision of resources and facilitator working groups by Business Care, WasteMINZ, Zero Waste and RONZ, and a growing sense of co-operation between the many groups working in this arena.

PNZ in its role as the industry representative will continue to assist and encourage members to operate their businesses in an environmentally responsible manner by promoting relevant standards, by-laws, legislation and best practice relating to environmental issues under the framework of the industry Sustainability Initiative and the Packaging Accord.

11.7 References


PEAG, 1996. Minimising Packaging Waste: A National Strategy for Minimising the Volume of Packag-
ing Waste in New Zealand, Packaging Environmental Advisory Group, New Zealand.


# The Plastic Identification Code

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Type of Plastic</th>
<th>Properties</th>
<th>Common Uses</th>
<th>Recycled In</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="PET" /></td>
<td><strong>PET</strong> Polyethylene Terephthalate</td>
<td>Clear, tough, solvent resistant, barrier to gas and moisture, softens at 80°C</td>
<td>Soft drink and water bottles, salad domes, biscuit trays, salad dressing and peanut butter containers</td>
<td>Pillow and sleeping bag filling, clothing, soft drink bottles, carpet</td>
</tr>
<tr>
<td><img src="#" alt="PE-HD" /></td>
<td><strong>PE-HD</strong> High Density Polyethylene</td>
<td>Hard to semi-flexible, resistant to chemicals and moisture, waxy surface, opaque, softens at 75°C, easily coloured, processed and formed</td>
<td>Crinkly shopping bags, freezer bags, milk bottles, ice cream containers, juice bottles, shampoo, chemical and detergent bottles, buckets, rigid agricultural pipe, milk crates</td>
<td>Recycling bins, compost bins, buckets, detergent containers, posts, fencing, pipes</td>
</tr>
<tr>
<td><img src="#" alt="PVC" /></td>
<td><strong>PVC</strong> Unplasticised Polyvinyl Chloride PVC-U Plasticised Polyvinyl Chloride PVC-P</td>
<td>Strong, tough, can be clear, can be solvent welded, softens at 80°C</td>
<td>Cosmetic containers, electrical conduit, plumbing pipes and fittings, blister packs, wall cladding, roof sheeting, bottles</td>
<td>Flooring, film and sheets, cables, speed bumps, packaging, binders, mud flaps and mats</td>
</tr>
<tr>
<td><img src="#" alt="PE-LD" /></td>
<td><strong>PE-LD</strong> Low density Polyethylene</td>
<td>Soft, flexible, waxy surface, translucent, softens at 70°C, scratches easily</td>
<td>Glad wrap, garbage bags, squeeze bottles, black irrigation tube, black mulch film, garbage bins</td>
<td>Rubbish bin liners, pallet sheets</td>
</tr>
<tr>
<td><img src="#" alt="PP" /></td>
<td><strong>PP</strong> Polypropylene</td>
<td>Hard but still flexible, waxy surface, softens at 140°C, translucent, withstands solvents, versatile</td>
<td>Dip pottles and ice cream tubs, potato chip bags, straws, microwave dishes, kettles, garden furniture, lunch boxes, blue packing tape</td>
<td>Pegs, bins, pipes, pallet sheets, oil funnels, car battery cases, trays</td>
</tr>
<tr>
<td><img src="#" alt="PS" /></td>
<td><strong>PS</strong> Polystyrene</td>
<td>Clear, glassy, rigid, brittle, opaque, semi-tough, softens at 95°C, Affected by fats and solvents</td>
<td>CD cases, plastic cutlery, imitation 'crystal glassware', low cost brittle toys, video cases</td>
<td>Coat hangers, coasters, white ware components, stationery trays and accessories</td>
</tr>
<tr>
<td><img src="#" alt="PS-E" /></td>
<td><strong>PS-E</strong> Expanded Polystyrene</td>
<td>Foamed, light weight, energy absorbing, heat insulating</td>
<td>Foamed polystyrene hot drink cups, hamburger take-away clamshells, foamed meat trays, protective packaging for fragile items</td>
<td></td>
</tr>
<tr>
<td><img src="#" alt="" /></td>
<td><strong>OTHER</strong> Letters below indicate ISO code for plastic type e.g. SAN, ABS, PC, Nylon Properties dependent on plastic or combination of plastics</td>
<td>Includes all other resins and multi materials (e.g. laminates)</td>
<td>Car parts, appliance parts, computers, electronics, water cooler bottles, packaging</td>
<td>Car parts, concrete aggregate, plastic timber</td>
</tr>
</tbody>
</table>
The NZ Plastics sustainability Initiative

The NZ plastics sustainability initiative
Agenda for action by 2008

The New Zealand Plastics Industry promoting economically, socially & environmentally responsible Plastics

Industry Action
1. Develop and implement industry training to ensure that all plastic companies are provided with the capacity to adopt waste minimisation practices including; cleaner production, design, labelling, and recyclability.
2. Sharing waste minimisation ideas and innovations between members and making it easy for good ideas to be adopted.

Company Commitment
3. To design new products for recyclability and/or waste minimisation.
4. To label all rigid plastic products.
5. To label all printed plastic 1-6 films.
6. To educate and advise customers on product design and selection based on best sustainable development practice.

Joint Projects
7. We have a regular forum with our major customers and brand owners to develop and progress an environmental strategy for plastic product design, production and purchasing.
8. We have an annual forum with government, councils, recyclers and manufacturers to develop and progress a common strategy for plastic waste.

Targets
A. We have simple and effective programmes in place for improving environmental performance.
B. Where possible all our products are designed to minimise environmental impact.
C. Sustainable design forms an important part of the decision making process for manufacturers, raw material suppliers and recyclers.
D. Clear identification of plastics type on New Zealand produced products.
E. Our customers are making environmentally informed decisions when purchasing plastic products.
F. We have assessed New Zealand’s plastic waste stream and established which plastics should be collected for recycling.
G. We have set and met waste minimisation targets and a process for measuring improvement.
H. Our recovered plastics all have defined sustainable markets.
I. Importers, retailers and brand owners are requesting plastics identification on all products.
J. Our stakeholders; including territorial authorities, government, customers, and the public have a better understanding and contribute to industry sustainability initiatives.

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Part 3:

Resource Stewardship: Improving the contribution of Waste Minimisation
The purpose of Part Three is, firstly, to examine the outcomes from the industry task group work reported in Part Two within the context described in Part One. The important issues here are whether or not industry is making any serious attempts to reduce the production of waste, and how the efforts that are being made impact on the future of resource stewardship in New Zealand. Secondly, in a more general sense, the questions that have been raised during the course of the CAE RS:WM project need to be considered in light of the changes that are required for progress towards resource stewardship to happen. Part Three concludes with a number of recommendations for improving the contribution waste minimisation makes towards resource stewardship and, hence, sustainability.

Part One discussed the political environment within which waste minimisation, and its role in resource stewardship, are practiced in New Zealand, and how it has changed during the past decade. The WasteMINZ Lifefterwaste programme, the New Zealand Waste Strategy and the National Energy Efficiency and Conservation (NEEC) Strategy are notable amongst a raft of initiatives and provide evidence of a more strategic approach to the problems posed by wastes. They also signal new levels of consensus and co-operation within the diverse waste management industry, between central and local government, and within central government. However, questions remain regarding the level of integration among these initiatives, and the extent to which the New Zealand Waste Strategy will be adopted, given that it is not underpinned by legislation (unlike the NEEC Strategy).

Nevertheless, the Local Government Amendment Act (No. 4) 1996, the Energy Efficiency and Conservation Act 2000 (EEC Act) and the Local Government Act 2002 have, each in their own way, paved the way for a greater range of instruments including further regulations, economic incentives and disincentives, and the strategies themselves. Part One identified the need for careful selection, application and integration of these instruments in ways that are appropriate within the New Zealand context. An important question is whether or not the programmes that arise as a result of these different regulatory instruments need to be integrated, and if so, how.

Issues regarding the poor level of integration were also raised in Part One on the role played by NGOs. Over twenty NGOs were identified during the CAE RS:WM project that work in various ways with businesses and communities to promote a range of relevant concepts and approaches. Common benefits were the provision of resources, establishment of networks, shared learning, local mentors, the ability to respond to individual needs, and independence. While these benefits were identified for a wide range of NGOs, limitations appeared to be differentiated along the lines of group membership. NGOs that are representative of a particular sector, and strongly member-driven and funded, appeared to be limited in the services they are able to provide, while those that are not so clearly membership-driven and funded appear to be limited mainly in terms of resource availability. Two obvious questions that arise are whether so many NGOs are desirable and whether or not their work needs to become more integrated, or even rationalised. Related to this is the matter of whether or not there is some level at which resource sharing, co-ordination and integration may be useful.

Another noteworthy conclusion was that the majority of NGOs, particularly those that work with businesses, appear to be conciliatory in nature. Questions that can be asked are whether
this is necessarily a good thing, and whether the absence of strong pressure groups is perhaps resulting in complacency amongst non-participating businesses. More importantly, while NGOs vary in terms of focus, geographic spread, membership and the services they offer, they are similar in that they tend not to focus on resource stewardship as an outcome.

In revisiting Part One it is apparent that several important conclusions can be drawn from the discussion on experience and learning.

• Waste minimisation activities could be improved in terms of programme development, their support mechanisms, and their contribution towards the goal of sustainability.
• Programme goals need to be integrated, success needs to be clearly defined and monitored, and targets need to be carefully considered and set.
• Monitoring programmes need to be carefully designed and their results need to be used to continually improve outcomes.
• Support mechanisms need to be included that will maintain and enhance commitment, motivation and enthusiasm of those involved, particularly champions.
• Important relationships and competencies need be nurtured, developed and enhanced.
• Costs and benefits need to be evaluated in economic, environmental and social terms, and economic viability needs to be de-coupled from success.

It is important to recognise that not all programmes need to include the full range of activities that are necessary to achieve sustainability. Programmes need to be valued according to their merits and the core competencies and passions of staff and/or volunteers. However, they still need to be evaluated in terms of the specific contributions they make to achieving resource stewardship. One very relevant question that arose in Part One was how the non-technical competencies required to undertake these improvements will be developed. A further important question is how to integrate programmes within the de-regulated context under which New Zealand operates without a central authority or some sort of integrating agency to assist.

The main conclusion from the business programme evaluation was that such programmes may be limited in their ability to develop or enhance commitment and, therefore, on-going improvement. Contributing factors appear to be inadequacies in bringing about leadership, support, communication and widespread involvement within individual businesses. Another conclusion was that programmes that are customised according to the activities, needs and culture of individual businesses appear to have greater potential for increasing commitment and on-going improvement. A question that arises is how to balance the need to customise programmes with the need to maximise what can be done with a limited amount of resources.
13.1 Introduction

Part Two provided insights into the current status of waste minimisation and resource stewardship within seven industry sectors: dairy (Chapter 5), meat (Chapter 6), forestry (Chapter 7), built environment (Chapter 8), tourism (Chapter 9), retail (Chapter 10) and plastics (Chapter 11). The chapters were written by sector group representatives with input from each particular sector. Their purpose was to provide a snapshot of achievements to date in the sector, and to use them, together with key issues that have been raised, to make recommendations for improving the contribution of waste minimisation activities to resource stewardship.

13.2 Characteristics of the Sectors

The introduction to each sector chapter provided a profile of the sector within New Zealand, including: international and national significance; size; contributions to economy; geographic distribution, and any other important characteristics that help to define the sector. The main characteristics for each sector are summarised in Table 13.1. From Table 13.1 it can be seen that the sectors covered account for nearly half of New Zealand’s GDP, almost two thirds of its export earnings and well over a third of its fulltime employment. It’s interesting to note that while primary producers such as dairy, meat and forestry often receive a high profile in New Zealand because of their high export earnings, tourism, the built environment and retail together contribute more than 25% of New Zealand’s GDP. In addition to holding its own with regard to GDP, tourism is also a high ‘export’ earner due to the revenue generated from international visitors. When added to the income generated by local tourists (who outnumber international visitors by 10:1), it is possible to see that, of all the sectors studied, tourism makes the greatest contribution to GDP, followed by built environment. Retail is by far the largest employer followed by built environment and tourism.

This information is important for resource stewardship. On the surface, the dairy and meat sectors may appear to be very different to the tourism sector. However, they are inextricably linked in that they all derive benefit from trading on New Zealand’s ‘clean-green’ image. This image has been identified by the tourism industry as a critical component of the attraction that New Zealand holds for international and local visitors alike. The dairy and meat sectors rely heavily on New Zealand’s image to attract customers in international markets. Because both sectors are competing in markets with strong local production (only 7.2% of sheep meat and 2% of milk production world-wide is traded internationally), both sectors have recognised the importance of quality in maintaining and developing these international markets and New Zealand’s image provides a strong visual metaphor for quality. However, an important difference between these two primary producers and the tourism sector is that their markets will not necessarily ever visit New Zealand, while all of the country’s tourists will. Consumers of New Zealand beef, lamb and milk products are likely to rely heavily on the sectors’ own marketing material as a basis for verifying claims. However, international tourists will all be in a position to evaluate the situation themselves once they arrive here. Given that 70% of international visitors are repeat visitors, it is essential for the future health of the sector for their expectations regarding New Zealand’s image to be met.

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1 University of Auckland
2 Note that the ‘export’ revenue for tourism as presented in Table 13.1 excludes international air travel, which is usually paid for in the country of origin.
Since dairy and meat producing farms, and forestry, cover over half of New Zealand’s land mass, they contribute directly to a major part of the image New Zealand projects to its visitors. It would be interesting to know what proportion of the international consumers of New Zealand dairy and meat products buy New Zealand produce because they have visited the country (and indeed, what proportion of those who have visited the country choose not to do so, and why). Equally, the experiences international visitors have in the hands of the tourism sector may well reflect on the choices they make with regard to New Zealand products upon their return home. It seems reasonable, therefore, to emphasise the inextricable links between the tourism sector and the dairy, meat and forestry sectors.

There are strong links too between the tourism and retail sectors, although these are likely to be more important for international, rather than local tourists. Visitors with high expectations of New Zealand’s environmental quality (e.g. from Germany and The Netherlands) may respond negatively to the relatively low levels of environmentally compatible goods available in retail stores, for example. And this perception may, in the absence of obvious evidence to the contrary, be exacerbated by the burgeoning plastics sector and the perceptions that members of the public have regarding this sector’s contribution to solid waste. While these connections may not seem to be as direct as those that exist between tourism and the primary sectors, it is possible that a negative association thus experienced could also damage New Zealand’s reputation and negatively impact not only upon tourism, but also upon New Zealand product choice after returning home. Negative visitor experiences of the built environment (e.g. unsightly urban sprawl, combined with inadequate public transport and traffic congestion), may also have the potential to affect international visitors’ perceptions regarding New Zealand’s clean, green status and, eventually decisions to buy New Zealand products available on the international market.

What is important here (in the absence of any quantitative information on these linkages), is not so much the specific nature of these relationships and their relative worth, but rather the interconnectedness of New Zealand’s sectors. The relevance of this interconnectedness for resource stewardship will become more apparent in the following sections.

### 13.3 Sector Resource Use and Waste Minimisation

The section on resource use and waste minimisation within each sector chapter in Part Two included an overview of the main types of resources that are used within the sector, a description of the specific types of activities (or processes) undertaken within the sector, the main types of products and wastes that are generated, and their quantities. These are summarised in Table 13.2. One of the most striking features of Table 13.2 is what is not in it, rather than what is. The majority of sector chapters include relatively little information on the quantities of resources used and the products and wastes generated. While this is perhaps not surprising for the tourism sector (given the non-material nature of the services it provides, and the relatively recent attempts to reduce its wastes), it is surprising for sectors such as dairy, meat and forestry, where waste minimisation initiatives have supposedly been in place for many years. Where figures are available, they tend to be limited to the resources that contribute most directly to the products themselves (e.g. milk and milk products, cattle and meat, trees and wood products, plastic granules and products), as well as their direct derivatives (e.g. whey, wood residues).

One of the basic tenets of waste minimisation is that ‘you can’t manage what you don’t measure’. The almost complete absence of quantities for water and energy use and wastage, as well as discharges to air, suggests that the focus in these industries is still very much on increasing product yield, rather than on resource stewardship across a wider range of resources. A noteworthy exception is the quantification of CO₂ emissions for some sectors. The specific nature of this inclusion suggests that this is in response to New Zealand’s ratification of the Kyoto Protocol and the prospect of economic instruments, such as a carbon tax, to encourage the
Table 13.1: Summary of important characteristics of sector groups (note that figures quoted should only be seen as representative: dates, periods and methods of calculation vary)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Dairy</th>
<th>Meat</th>
<th>Forestry</th>
<th>Built environment</th>
<th>Tourism</th>
<th>Retail</th>
<th>Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total earnings pa</td>
<td>$9.5 billion</td>
<td>$3.4 billion</td>
<td>$4.3 billion</td>
<td>$10.3 billion</td>
<td>$13.2 billion</td>
<td>$7.9 billion</td>
<td>$1.8 billion</td>
</tr>
<tr>
<td>% of NZ's GDP</td>
<td>7%</td>
<td>3.2%</td>
<td>4%</td>
<td>9.5%</td>
<td>9.7%</td>
<td>7.3%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Total employees (full- &amp; part-time)</td>
<td>59,800</td>
<td>78,860</td>
<td>23,000</td>
<td>116,000</td>
<td>94,000</td>
<td>325,000</td>
<td>8,000</td>
</tr>
<tr>
<td>% of NZ's employment</td>
<td>3.2%</td>
<td>4.2%</td>
<td>1.2%</td>
<td>6.2%</td>
<td>5%</td>
<td>17.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Production units</td>
<td>15,900 farms</td>
<td>28 processing plants</td>
<td>41,000 farms</td>
<td>82 red meat, 123 poultry processing plants, 26 renderers</td>
<td>350 timber mills, 4 pulp &amp; paper mills, 11 panel manufacturers</td>
<td>21,700 carpenters, joiners &amp; builders (inc. contractors)</td>
<td>13,500-18,000 SMEs</td>
</tr>
<tr>
<td>Land coverage</td>
<td>1.9 million ha</td>
<td>10.5 million ha</td>
<td>1.7 million ha</td>
<td>900,000 ha</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>% of NZ's land area</td>
<td>7.2%</td>
<td>39% (check)</td>
<td>6%</td>
<td>3%</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Main resource</td>
<td>4.3 million dairy cattle</td>
<td>34.6 million livestock (lambs, sheep, cattle, goats, deer) processed pa</td>
<td>18.5 million m³ harvested pa</td>
<td>$9 billion worth of buildings pa</td>
<td>1.8 million international, 18 million domestic tourists pa</td>
<td>$46.2 billion worth of retail goods sold pa</td>
<td>236,756 tonnes of plastic used pa</td>
</tr>
<tr>
<td>Exports</td>
<td>&gt;90% exported</td>
<td>80% of beef, 90% of sheep kill exported</td>
<td>70% exported</td>
<td>na</td>
<td>9%*</td>
<td>na</td>
<td>25% exported</td>
</tr>
<tr>
<td>Export earnings</td>
<td>$7.6 billion pa</td>
<td>$5.2 billion pa</td>
<td>$3.6 billion pa</td>
<td>na</td>
<td>$4.7-$5.4 billion pa*</td>
<td>na</td>
<td>$335 million</td>
</tr>
<tr>
<td>% of NZ's export earnings</td>
<td>23.4%</td>
<td>15.8%</td>
<td>9%</td>
<td>na</td>
<td>16%*</td>
<td>na</td>
<td>1.3%</td>
</tr>
<tr>
<td>% of global production</td>
<td>2%</td>
<td>7.2% (sheep)</td>
<td>0.09%</td>
<td>na</td>
<td>0.02%*</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>% of global trade</td>
<td>28%</td>
<td>51.4% (sheep)</td>
<td>1.1%</td>
<td>na</td>
<td>0.25-0.45%*</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

Key features:
- Quality plays a major role in maintaining & increasing market share
- Rapid increase in growth (35% in 5 years to 2000)
- Rapid decrease in sector over past 8 years: 4 million beef/sheep units displaced by 1,992 dairy conversions; 340,000 ha (2.5%) sheep/beef farmland converted to forestry
- Poultry almost all locally consumed
- Environment a significant consideration in visitor choice
- 70% of international visitors have been before

Key: a = figures for 2001, b = figures for 2000, except exports 2001, c = plantation forests, d = international as a % of total tourists, e = international visitors, f = full-time equivalents, SMEs = small to medium-sized enterprises, na = not available or not applicable. See sector chapters for sources)
<table>
<thead>
<tr>
<th>Sector</th>
<th>Main resources used (estimated pa)</th>
<th>Main processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>Sunlight (na)</td>
<td>Dairy cattle farming</td>
</tr>
<tr>
<td></td>
<td>Fertiliser (na)</td>
<td>Milking</td>
</tr>
<tr>
<td></td>
<td>Stockfeed (na)</td>
<td>Transport</td>
</tr>
<tr>
<td></td>
<td>Milk (11.5 billion l)</td>
<td>Milk products processing</td>
</tr>
<tr>
<td></td>
<td>Energy (18.4 million GJ)</td>
<td>By-product processing (e.g. rendering, felting, tanning)</td>
</tr>
<tr>
<td></td>
<td>(breakdown na)</td>
<td>Planning, design</td>
</tr>
<tr>
<td></td>
<td>Water (14 billion litres)</td>
<td>Planning, booking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Travel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accommodation &amp; food</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visiting people, destinations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experiencing, participating in activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat</td>
<td>Sunlight (na)</td>
<td>Growing</td>
</tr>
<tr>
<td></td>
<td>Fertiliser (2.9 million tonnes)</td>
<td>Harvesting</td>
</tr>
<tr>
<td></td>
<td>Stockfeed (na)</td>
<td>Transport</td>
</tr>
<tr>
<td></td>
<td>Livestock (35.6 million animals)</td>
<td>Slaughtering, dressing, boning</td>
</tr>
<tr>
<td></td>
<td>Poultry (119,000 tonnes)</td>
<td>By-product processing (e.g. rendering, felting, tanning)</td>
</tr>
<tr>
<td></td>
<td>Fuel (1,034 TJ)</td>
<td>Planning, design</td>
</tr>
<tr>
<td></td>
<td>Electricity (2,915 TJ)</td>
<td>Planning, booking</td>
</tr>
<tr>
<td></td>
<td>Coal (1,476 TJ)</td>
<td>Travel</td>
</tr>
<tr>
<td></td>
<td>Gas (1,384 TJ)</td>
<td>Accommodation &amp; food</td>
</tr>
<tr>
<td></td>
<td>Water (14.9 million m³)</td>
<td>Visiting people, destinations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experiencing, participating in activities</td>
</tr>
<tr>
<td>Forestry</td>
<td>Sunlight (na)</td>
<td>Planning, design</td>
</tr>
<tr>
<td></td>
<td>Trees (18.1 million m³)</td>
<td>Planning, booking</td>
</tr>
<tr>
<td></td>
<td>Various (depending on secondary processes)</td>
<td>Travel</td>
</tr>
<tr>
<td></td>
<td>Land (na)</td>
<td>Accommodation &amp; food</td>
</tr>
<tr>
<td></td>
<td>Infra-structure (na)</td>
<td>Visiting people, destinations</td>
</tr>
<tr>
<td></td>
<td>Materials (wide range) (na)</td>
<td>Experiencing, participating in activities</td>
</tr>
<tr>
<td></td>
<td>Electricity (63.6 PJ)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water (na)</td>
<td></td>
</tr>
<tr>
<td>Built environment</td>
<td>Sunlight (na)</td>
<td>Planning, design</td>
</tr>
<tr>
<td></td>
<td>Land (na)</td>
<td>Planning, booking</td>
</tr>
<tr>
<td></td>
<td>Infra-structure (na)</td>
<td>Travel</td>
</tr>
<tr>
<td></td>
<td>Materials (wide range) (na)</td>
<td>Accommodation &amp; food</td>
</tr>
<tr>
<td></td>
<td>Electricity (63.6 PJ)</td>
<td>Visiting people, destinations</td>
</tr>
<tr>
<td></td>
<td>Water (na)</td>
<td>Experiencing, participating in activities</td>
</tr>
<tr>
<td>Tourism</td>
<td>Tourist destinations, experiences (na)</td>
<td>Planning, design</td>
</tr>
<tr>
<td></td>
<td>Tourists/visitors (19.8 million)</td>
<td>Planning, booking</td>
</tr>
<tr>
<td></td>
<td>Operators</td>
<td>Travel</td>
</tr>
<tr>
<td></td>
<td>Tourism offices &amp; agencies</td>
<td>Accommodation &amp; food</td>
</tr>
<tr>
<td></td>
<td>Water (na)</td>
<td>Visiting people, destinations</td>
</tr>
<tr>
<td></td>
<td>Materials, products (na)</td>
<td>Experiencing, participating in activities</td>
</tr>
<tr>
<td></td>
<td>Energy (27.53 PJ)</td>
<td></td>
</tr>
<tr>
<td>Retail</td>
<td>All products manufactured, experiences (na)</td>
<td>Planning, design</td>
</tr>
<tr>
<td></td>
<td>imported for sale in NZ</td>
<td>Planning, booking</td>
</tr>
<tr>
<td></td>
<td>Energy (incl. electricity &amp; fuel) (na)</td>
<td>Travel</td>
</tr>
<tr>
<td></td>
<td>Water (na)</td>
<td>Accommodation &amp; food</td>
</tr>
<tr>
<td></td>
<td>Chemical additives (ha)</td>
<td>Visiting people, destinations</td>
</tr>
<tr>
<td></td>
<td>Lubricants, inks, solvents (na)</td>
<td>Experiencing, participating in activities</td>
</tr>
<tr>
<td></td>
<td>Packaging (na)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Office &amp; cafe supplies (na)</td>
<td></td>
</tr>
<tr>
<td>Plastics</td>
<td>Imported plastic granules (236,755 tonnes)</td>
<td>Planning, design</td>
</tr>
<tr>
<td></td>
<td>Water (na)</td>
<td>Planning, booking</td>
</tr>
<tr>
<td></td>
<td>Energy (na)</td>
<td>Travel</td>
</tr>
<tr>
<td></td>
<td>Chemical additives (ha)</td>
<td>Accommodation &amp; food</td>
</tr>
<tr>
<td></td>
<td>Lubricants, inks, solvents (na)</td>
<td>Visiting people, destinations</td>
</tr>
<tr>
<td></td>
<td>Packaging (na)</td>
<td>Experiencing, participating in activities</td>
</tr>
<tr>
<td></td>
<td>Office &amp; cafe supplies (na)</td>
<td></td>
</tr>
</tbody>
</table>

**Key:** a = figures for 2001, b = figures for 2000, c = excludes deer and goat, d = homes and offices, e = 1997/1998, f = for codes see: Ch. 8 Appendix 1, na = not available. Sources: see sector group chapters)
| Sector Group | Dairy
dairy | Meat
meat | Forestry
forestry | Built environment
built environment | Tourism	tourism | Retail
retail | Plastics
plastics |
---|---|---|---|---|---|---|---|
**Main products** | Milk powder, cheese, casein, butter, anhydrous milkfat, whey protein, other (1.7 million tonnes) Liquid milk (350 million l) | Dressed carcasses or cuts (1.3 million ‘bone-in’ tonnes”), edible & inedible offal, runners & casings, skins/hides, meat & bone meal, tallow, dried blood, gelatine | Logs, poles, lumber, chips, pulp & paper, panels, re-manufactured products (16.5 million m³) | Homes, offices (na) Urban environments (na) | Attractions, activities Adventure tourism Retail, hospitality Transport Eco/nature tourism Conference, incentives, events Culture, heritage | All products manufactured, imported and sold in NZ | PET, HDPE, PVC, LDPE, PP, EPS and other plastic products |
| **Main wastes (pa)** | Air emissions (na) Wastewater (12.8 billion litres) Material wastes (na) Wasted energy (na) | Air emissions (1 million te CO₂) Wastewater (13.4 million m³) Material wastes (na) Wasted energy (na) | Air emissions (na) Wastewater (na) In-forest harvest residues (1.87 million m³) Residues (1.6 million m³) Wasted energy (na) | Wasted space (na) Ecological impacts (na) Social, cultural impacts (na) Air emissions (1.4 million tonnes CO₂) Traffic congestion (na) Loss of biodiversity & food producing land (na) Traffic congestion (na) Loss of public space & amenity areas (na) Wasted space (na) Ecological impacts (na) Social, cultural impacts (na) Air emissions (na) | On-site wastage of water, energy (na) Air emissions (na) [Post-consumer wastage of products & packaging] (na) [Energy & water wasted during use] (na) [Air emissions during use] (na) | Granules and other ingredients wasted during processing (na) Water (na) Energy (na) Packaging (na) |
reduction of greenhouse gas emissions. It is probable that without direct pressure, either in the form of the drive to increase yields or regulatory requirements (or the threat thereof), quantification will always be limited. In the absence of qualitative information such as this, it seems unlikely that waste minimisation will make much progress beyond the bare minimum that is warranted by economic and legal imperatives.

The majority of case studies on resource use and waste minimisation provided by the industry sectors in Part Two reflect these imperatives, although there are some noteworthy exceptions that suggest that some progress towards resource stewardship is occurring. Since resources are used and wastes are generated throughout the lifecycle of a product or the delivery of a service, it was decided that it would be useful to present the cases as part of a matrix. This is shown in Table 13.3. The sectors covered in the industry chapters are listed on the left of the matrix and the life cycle stages are shown across the top. This method was chosen to make it easy to see which life cycle stages are represented in the case studies for each sector and where the gaps are. The idea was to provide some sort of baseline against which to ‘measure’ progress, and for sectors that were represented in this report to continue the process by attempting to develop new case studies that fill the gaps, and for sectors that were not represented to add themselves and their cases to the list, and so on.

The matrix becomes too unwieldy when details of the cases are included, so it is presented in Table 13.3 without details of the cases (apart from the numbers that correspond with those in the sector chapters). Another version, with the sectors collapsed, but including summaries of the cases is presented in Table 13.4.

<table>
<thead>
<tr>
<th>Sector Group</th>
<th>Life-cycle stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Product or service design</td>
</tr>
<tr>
<td>Dairy</td>
<td>5.1</td>
</tr>
<tr>
<td>Meat</td>
<td>6.1; 6.2</td>
</tr>
<tr>
<td>Forestry</td>
<td>7.1</td>
</tr>
<tr>
<td>Building</td>
<td>8.2; 8.5; 8.6</td>
</tr>
<tr>
<td>Tourism</td>
<td>9.1</td>
</tr>
<tr>
<td>Retail</td>
<td></td>
</tr>
<tr>
<td>Plastics</td>
<td>11.3</td>
</tr>
</tbody>
</table>

Table 13.3: Categorisation of sector group case studies according to life cycle stage. (Numbers are those given to the case studies in the sector chapters.)

From Table 13.3 it can be seen that, while the case studies do span the full range of life-cycle stages, they do not do so for each specific sector. Not surprisingly, case studies for dairy, meat and forestry are concentrated in the manufacturing or processing life cycle stage, although there are also some in the cultivation or harvesting stages. For dairy and meat, this reflects the pressure these industries are under (for different reasons) to ensure the quality of their products. This pressure has led them to begin to extend waste minimisation-related activities into on-farm practices, and the case studies outline the programmes they are trying to institute within the farming sector. From Table 13.4 it can be seen that the two programmes are similar, but differ in that the dairy industry’s ‘market-focused’ programme is consistent with more traditional, quality-oriented programmes, while the meat industry’s ‘Green Project’ incorporates the social, economic and environmental prongs of sustainability. The latter is particularly significant, given the sheer number of meat producing farms, the extent of the land area that they cover and their wide geographic distribution (see Table 13.2). Successful on-farm initiatives are bound to have a far-reaching effect on New Zealand’s sustainability as a whole.
The similarities (and differences) between the two programmes raise the issue of integration and co-ordination. Since they both deal with on-farm issues and are trying to extend responsibility down the supply chain, it seems logical to suggest that perhaps they should be combined into one specification for all farms. It is important when considering this to remember the results of previous research, which strongly suggest that programmes are likely to be more effective if they are customised according to the activities, needs and culture of the particular organisation or group they are targeting. While it may be useful to integrate the two programmes, it is important to ensure that they resonate with their target audiences.

Like dairy, in-forest programmes in the forestry industry appear to be driven more by the desire to enhance yield than by sustainability imperatives (see Table 13.5). However, their value in terms of extending responsibility for resources along the supply chain cannot be under-estimated.

The case studies presented in the built environment chapter (Chapter 8) that showcase urban and building design provide further examples of how responsibility can be extended. Traditionally, case studies in this sector have focused on the wastes that are generated in the construction and generation phases. While these are included, the cases also show how urban design can reduce the use of land as a resource, and how building design can reduce the use of not only energy, but also other resources.

The case studies presented in the tourism sector chapter (Chapter 9) also extend across a broader range of life cycle stages including cultivation and harvesting, and transport. They are characterised by a high level of resource recovery-types of activities, although the vineyard example does include the principles of sustainable land management, and the tour operator includes optimised fuel consumption.

The cases for the retail sector (Chapter 10), while significant in that they exist at all, are the least extensive. This is not really surprising, given that initiatives to encourage waste minimisation in this sector are relatively recent. There appears within this sector to be a strong focus on on-site resource efficiency (energy) and off-site recovery (separation of materials for recycling). However, the cases also show how supply chain management can be used to reduce the level of waste that is generated not only in the supply for sale, but also to enhance the potential for post-consumer recovery and recycling. This sector is a real lynchpin in the battle to make production and consumption sustainable. This is because it operates at the interface between producers and consumers, and therefore has the potential to greatly influence both. The cases suggest that, while some effort is being put into supply chain management, the imperatives are largely limited to the sites themselves. Without customer pressure and demands for more environmentally sustainable products, the sector as a whole seems a long way from making a meaningful contribution to resource stewardship.

While one of the plastics case studies (Chapter 11) focuses on on-site recovery, the other two suggest that the industry is having to come to grips with the difficult issues that arise from the need to re-think and re-design products. While the industry puts much effort into trying to convince the public that pressure on it is unwarranted, it could be argued that this pressure is probably responsible for the results that the industry has already had (e.g. in product re-design) and what now appears to be developing into a genuine interest in becoming more sustainable. Of course, the real challenge for the sector lies in the non-renewable nature of its feedstock and it is this aspect that needs to become the focus of design efforts.

13.4 Resource Stewardship within the Industry Sectors

The extent to which resource stewardship is (or isn’t) occurring, and the obstacles to, and opportunities for, enhancing the contribution of waste minimisation are summarised in Table 13.5. From Table 13.5, it can be seen that yield improvement is still a major area of focus for the
Table 13.4: Summaries of case studies for each life-cycle stage (case studies are identified by the numbers used in the sector chapters)

<table>
<thead>
<tr>
<th>Product or service design</th>
<th>Extraction, cultivation or harvesting</th>
<th>Processing, manufacture or packaging</th>
<th>Transport</th>
<th>Sale</th>
<th>Use, re-use</th>
<th>Recycling, recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building 5.2 Maree Re-development for mixed, community-focused activities with passive solar design, renewable energy, rainwater collection, re-used &amp; recycled materials</td>
<td>Dairy 2.1 Market-focused on-farm environmental and animal welfare management system for dairy farms</td>
<td>Dairy 2.2 Milk powder recovery reduces air emissions, enables feedstock production</td>
<td>Tourism 6.2 Materials separated for recycling; water &amp; energy use measured; buses serviced to optimise fuel consumption</td>
<td>Retail 7.1 Procurement policy to supply for sale only sustainable forest products</td>
<td>Building 5.1 Medium density, mixed use development on urban heritage site maximises urban space re-utilisation, reduces urban sprawl</td>
<td></td>
</tr>
<tr>
<td>Building 5.5 Integration of energy efficiency into building design reduces energy use in heating, ventilation &amp; lighting</td>
<td>Meat 3.1 Green project sustainability specification for sheep, beef, deer and goat farms</td>
<td>Dairy 2.3 Minimising water use; process water recovery &amp; reuse, reduces water use and wastewater in processing plants</td>
<td>Tourism 6.4 Bulk buying to reduce packaging; company-wide focus on reducing, reuse &amp; recycling; acceptance of responsibility</td>
<td>Retail 7.2 Liaison with suppliers to reduce packing, packaging in retail goods; staff involvement in separation for recycling of in-store wastes</td>
<td>Tourism 6.3 Product choices reduce packaging waste coming onto site; reuse, recycling ethic encouraged; staff member made responsible waste minimisation</td>
<td></td>
</tr>
<tr>
<td>Building 5.6 Energy efficiency combined with environmental design considerations for material &amp; water resource use, air quality, health &amp; economics for a 'eco-friendly' home</td>
<td>Meat 3.2 Farm Environment Award encourages and demonstrates sustainable practices</td>
<td>Dairy 2.4 Whey component isolation &amp; extraction reduces to almost zero whey discharges to water, produces high value &amp; quality products</td>
<td>Retail 7.3 Refit switch to energy efficient lighting</td>
<td>Retail 7.4 Energy management team; improved monitoring &amp; control; reduced energy consumption in heating, ventilation &amp; lighting</td>
<td>Forestry 4.5 Sawdust recovery &amp; use for producing compressed fuel source for domestic heating reduces sawdust waste and recovers energy</td>
<td></td>
</tr>
<tr>
<td>Plastics 8.3 Stakeholder working party formed to develop alternative solutions to farm plastic waste; applications for funding for study to assist; raised awareness of stewardship issues</td>
<td>Meat 3.3 Super heated steam dryer reduces energy use and water losses in bone &amp; meal drying</td>
<td>Meat 3.4 Team involvement in rendering process improvements, increases yield, reduces effluent, improves morale</td>
<td>Retail 7.5 Process mapping; energy recovery and reuse in refrigeration; use of environmentally friendly refrigerants</td>
<td>Building 5.3 Building deconstruction by hand for recovery and reuse of timber, bricks, rubble &amp; iron roofing</td>
<td>Building 5.4 Separation for recovery of waste materials during construction</td>
<td></td>
</tr>
</tbody>
</table>
| Dairy, meat and forestry sectors. However, this focus has led to significant advances in both the dairy and forestry sectors in terms of the reduction of wastes at source, and it is important to recognise the positive effect that these have had on the environmental performance of these industries. In the dairy sector, it is likely that strict adherence to comprehensive loss monitoring and loss avoidance programmes (assisted by the unitary nature of the sector and the drive for dairy, meat and forestry sectors. However, this focus has led to significant advances in both the dairy and forestry sectors in terms of the reduction of wastes at source, and it is important to recognise the positive effect that these have had on the environmental performance of these industries. In the dairy sector, it is likely that strict adherence to comprehensive loss monitoring and loss avoidance programmes (assisted by the unitary nature of the sector and the drive for dairy, meat and forestry sectors. 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Table 13.5: Summary of issues relevant for achieving resource stewardship within sector groups
(continued on the next page)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Main focus of efforts towards stewardship</th>
<th>Contributing factors</th>
<th>Issues relevant for achieving resource stewardship</th>
<th>Contributing factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy</td>
<td>Yield improvement &amp; residue reduction by improved tree growth, enhancing sawmill efficiency &amp; conversion rates</td>
<td>Initially, pressure on environmental and financial benefits caused by milk losses, wastewater &amp; whey discharges</td>
<td>Resource allocation priorities differ</td>
<td>Amalgamation enhances opportunities for standardisation</td>
</tr>
<tr>
<td>Meat</td>
<td>Waste minimisation, product development &amp; by-product recovery</td>
<td>No real pressure on meat industry to improve environmental performance</td>
<td>Manure &amp; by-product management &amp; maximisation</td>
<td>Public concern &amp; stakeholder pressure</td>
</tr>
<tr>
<td>Forestry</td>
<td>Yield improvement &amp; residue reduction by improved tree growth, enhancing sawmill efficiency &amp; conversion rates</td>
<td>Resource allocation priorities vary</td>
<td>Resource allocation priorities differ</td>
<td>Amalgamation enhances opportunities for standardisation</td>
</tr>
<tr>
<td>Tourism</td>
<td>Sustainable tourism growth</td>
<td>Research into expectations &amp; experiences of local &amp; international visitors</td>
<td>Importance of NZ’s natural environment</td>
<td>Amalgamation enhances opportunities for standardisation</td>
</tr>
<tr>
<td>Retail</td>
<td>Focus on recycling &amp; recovery</td>
<td>Local resistance to tourism</td>
<td>Economic well-being &amp; high waste generation</td>
<td>Amalgamation enhances opportunities for standardisation</td>
</tr>
<tr>
<td>Plastics</td>
<td>Recyclable, recyclable</td>
<td>Positive pressure on recycling &amp; recovery</td>
<td>Amalgamation enhances opportunities for standardisation</td>
<td>Amalgamation enhances opportunities for standardisation</td>
</tr>
<tr>
<td>Built environment</td>
<td>Focus on recycling &amp; recovery</td>
<td>Positive pressure on recycling &amp; recovery</td>
<td>Amalgamation enhances opportunities for standardisation</td>
<td>Amalgamation enhances opportunities for standardisation</td>
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</tr>
<tr>
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<td>Focus on recycling &amp; recovery</td>
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</tr>
<tr>
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<td>Recyclable, recyclable</td>
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<tr>
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<td>Yield improvement &amp; residue reduction by improved tree growth, enhancing sawmill efficiency &amp; conversion rates</td>
<td>Resource allocation priorities vary</td>
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<td>Retail</td>
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<td>Amalgamation enhances opportunities for standardisation</td>
</tr>
</tbody>
</table>

standardisation) have helped to embed an ethic of resource conservation. This may be mirrored in the forestry industry, although the more diverse nature of the sector and its non-unitary structure mean that it has to rely on the motivation of individual plant owners for innovation, rather than decrees from above. The meat sector appears to focus its on-site activities on treatment, rather than on reduction at source.

However, concerns over the quality of products (for dairy, to enhance a significant, but fragile
**Table 13.5 (continued)**

<table>
<thead>
<tr>
<th>Dairy</th>
<th>Meat</th>
<th>Forestry</th>
<th>Built environment</th>
<th>Tourism</th>
<th>Retail</th>
<th>Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main means used</strong></td>
<td>Identification of best practice loss levels</td>
<td>“Green Project” for on-farm changes</td>
<td>Computerised truck scheduling to eliminate waste queuing &amp; travel</td>
<td>Recognition of the need for a combination of: managing growth, securing sense of community, enhancing quality of life, preserving the natural environment, better use of natural &amp; supplied resources, better building &amp; infrastructure design</td>
<td>Growing tourism in a way that protects natural, cultural, built and social heritages</td>
<td>Individual business initiatives focusing on: recycling, supply chain management, ‘backloading’ to reduce transport costs, demonstration projects, recycling of in-store packaging waste, agreements with suppliers to reduce packaging and enhance recyclability and/or recoverability of products and/or packaging, attempts to extend activities to include minimisation of packaging, products from sustainable timber, certified environmental management systems, native tree planting, energy efficiency</td>
</tr>
<tr>
<td></td>
<td>Development of loss monitoring techniques</td>
<td>Some good examples of waste minimisation</td>
<td>Electronic tagging to improve inventory control &amp; reduce stocks &amp; costs</td>
<td>Establishment of links between these heritages &amp; growth in order to safeguard sustainability</td>
<td>‘Backloading’</td>
<td>Plastics NZ Sustainability Strategy will be used to enhance: efficiency, environmentally sustainable design, acceptance of responsibility for decision making, supply chain management, risk management, sector development, integration with other groups’ activities, awards</td>
</tr>
<tr>
<td></td>
<td>Development of ‘open channel’ flow meters &amp; samplers for measurement</td>
<td>Focus still primarily on treatment processes, rather than waste reduction</td>
<td>Length &amp; weight limits on trucks to increase efficiency of road transport</td>
<td>A coherent &amp; balanced approach to yield optimisation, including effective pricing, and yield &amp; destination management strategies</td>
<td>Demonstration projects</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Awareness raising &amp; education</td>
<td>Comparative analysis of sites</td>
<td>Modernised sawmills to increase efficiency &amp; ‘conversion’, &amp; costs</td>
<td>Effective partnerships between all stakeholders, incl. local communities, Mori &amp; individual NZers, re-alignment of structures</td>
<td>Recycling of in-store packaging waste, agreements with suppliers to reduce packaging and enhance recyclability and/or recoverability of products and/or packaging, attempts to extend activities to include minimisation of packaging, products from sustainable timber, certified environmental management systems, native tree planting, energy efficiency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comparative analysis of sites</td>
<td>Investigation of variances &amp; instigation of relevant changes</td>
<td>Managed selection of genetic qualities to enhance &amp; speed up improvements in tree characteristics</td>
<td>Matching of materials to products &amp; processes using non-destructive testing</td>
<td>‘Green Globe 21’</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Full cost accounting</td>
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<td></td>
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</tbody>
</table>

**Key:** na = not available. Sources: see sector group chapters.
environmental standards. Because meat processing plants, on the other hand, are owned by a number of companies, farmers could (at least in theory) switch processing companies if they felt unduly pressured. The meat sector would have to rely more on voluntary farmer action and goodwill to extend an ethic of stewardship to on-farm activities.

For forestry, the high value of timber, together with rising waste disposal costs, public concern and stakeholder pressure, has provided an incentive for improving in-forest management and investing in sophisticated yield-improving technologies.

The cases for the built environment sector provide perhaps the best examples of resource stewardship extended beyond just traditional areas of focus. These include urban design, building design and retrofitting, material recovery during construction and dismantling, rather than demolishing buildings. However, the authors do point out that these examples by no means reflect mainstream practice. There is still much debate on urban sprawl: whether it needs to be curbed and what to do about it. In construction, entrenched practices of over-ordering and non-transfer of leftover materials hinder progress. In terms of energy efficiency, the building design process is still largely cost-focused and difficulties are exacerbated by the extensive use of standard house plans. Progress on all these fronts remains hindered by the complex and fragmented nature of the sector.

The tourism sector appears to have a far-reaching vision of sustainability that has the potential to change the face of the industry in New Zealand. This vision is largely because of the well-documented importance of New Zealand’s environment as an attraction and the need to counter risks such as local resistance to tourism. The cases presented do not really reflect the full potential for the sector, but this may be because the vision and strategy are relatively new, and work has only recently begun in earnest. The diverse nature of the sector may make it difficult to implement the vision across the board.

The plastics sector, too, has a vision for sustainability that is driven by the public’s perception of its significance as a source of waste. While the sector appears to be keen to focus on rethinking and redesigning its products (and presents annual awards to this end), pursuit of a more design-oriented approach is believed to be hampered by local government’s predilection for recycling and recovery programmes.

Initiatives in the retail sector have tended to focus mostly on on-site separation of recycling and sometimes energy efficiency, although there is some consideration of broader issues and there are attempts to extend activities to include the procurement of more environmentally considerate products. These initiatives appear to be few and far between and occurring not in response to public pressure, but rather in spite of little or no public pressure. They appear to rely almost solely on a sense of corporate responsibility among a few retailers. It could be argued that the lack of pressure on retailers to provide more environmentally sustainable products has more to do with the massive imbalance in marketing vs. environmental information. Businesses often argue that they only supply what consumers want. However, they actively encourage consumers to buy products, whether they need them or not. At best, this contradicts an ethic of resource stewardship and at worst it actively promotes the opposite. Because of its position at the nexus between producers and consumers, the retail sector needs to explore, come to grips with and respond to its role in terms of resource stewardship. For this sector though, probably more than any other, the close relationship between economic performance and consumption presents a major difficulty.

13.5 Governance Mechanisms and Drivers for Change

The sector chapters in Part Two included sections on governance and drivers for change. The section on governance described relevant standards, guidelines and codes of practice that apply to the sector, and the extent to which they contribute to resource use and stewardship. The
section on drivers for change provided a summary of other influences on the sector, including social, economic and environmental influences, the key relationships within the sector and how sector or producer/provider responsibility is exercised. Because of the inter-related nature of governance mechanisms and drivers for change, the results are summarised together in this section and presented in Table 13.6.

In this context, it is important to realise that the Resource Management Act 1991 (RMA), the Health and Safety in Employment Act 1992 (HSEA), the Local Government Act 1974 (LGA) and the Hazardous Substances and New Organisms Act 1996 (HSNO) will have affected all sectors in some way. However, they (and other instruments) have been included in Table 13.6 only when they were specifically identified by chapter authors as directly relevant to waste minimisation and resource stewardship in the particular sector. The fact that they may have been omitted for some sectors does not imply that they are necessarily irrelevant to the sector as a whole, but rather that they have less relevance with regard to the topic in this case.

From Table 13.6 it can be seen that most sector chapter authors identify the RMA as having had an important influence on the sector. While the RMA does not, in itself, require waste minimisation to be undertaken, the local regulations (plans, etc.) that have resulted from it are likely to have had a more direct influence. This influence is likely to be greater in sectors that directly discharge large quantities of wastes and those that require resource consents for existing discharges, new plants or upgrades. However, it is obvious from the differences in focus for the dairy and meat sectors (reduction at source for dairy and treatment for meat) that the RMA does not require waste minimisation in preference to treatment. Only the effects have to be avoided, remedied or mitigated, and applicants are usually free to choose whichever method they prefer for achieving this.

The extent to which the broader ethic of stewardship that is inherent in the RMA has filtered through to society and informs the choices sectors make is unknown. The effort that is required and the costs that are incurred as a result of the RMA and related instruments (particularly for resource consent applications for large development projects) suggest that the most common response to the RMA in the majority of sectors is more likely to be annoyance than adoption of an ethic of stewardship.

From Table 13.6 it can be seen that the sectors all have a unique combination of instruments that influence them. Some of the instruments listed are specific to the activities and characteristics of the sectors themselves (e.g., the Dairy Industry Environmental and Animal Health Policies, the Animal Products Act 1999, the Code of Practice for the Safe Use of Timber Preservatives and Antisapstain Chemicals, the New Zealand Building Code, the New Zealand Tourism Strategy, the Consumer Guarantees Act, and The New Zealand Packaging Code of Practice). There is also a range of instruments that influence (or have the potential to influence) more than one sector (e.g. the ISO 14000 series of standards, the Kyoto Protocol). Some of these are included in a speculative sense (i.e. it is presumed they will have some influence the sector – e.g., the New Zealand Waste Strategy, the National Energy Efficiency and Conservation Strategy), while others already do so (e.g. the New Zealand Forest Code of Practice, the A/NZ and ISO standards on plastic packaging labelling).

It is necessary to point out here that, without a formal evaluation of the extent of their influence, it is not really possible to say how effective these instruments really are in bringing about progress towards an ethic of resource stewardship. Their influence is also likely to depend on the way in which they integrate with other instruments, sources of influence and drivers for change.

Drivers for change tend to fall into four main categories\(^3\).

\(^3\) Note that these categories are consistent with commonly identified drivers for change in organisations (e.g., see Goodman, 1995; Johnson and Scholes, 1999; Senior, 2002)
### Table 13.6: Summary of instruments of governance and drivers for change (see Part Two)

#### (continued on the next page)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Dairy</th>
<th>Meat</th>
<th>Forestry</th>
<th>Built environment</th>
<th>Tourism</th>
<th>Retail</th>
<th>Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relevant instruments of governance</strong></td>
<td>RMA, HSEA</td>
<td>RMA, CEC</td>
<td>RMA, LGA</td>
<td>RMA, LGA</td>
<td>NZ Tourism Strategy 2010</td>
<td>RMA, HSEA</td>
<td>Hazardous Substances &amp; New Organisms Act 1996 (HSNO)</td>
</tr>
<tr>
<td><strong>Resource Management Act 1991 (RMA)</strong></td>
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<td></td>
<td></td>
<td>Packaging Accord</td>
</tr>
<tr>
<td><strong>Animal Products Act 1999 (APA)</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>NZ Packaging Code of Practice</td>
</tr>
<tr>
<td><strong>Local land, air and water standards</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>NZ Plastics Sustainability Strategy</td>
</tr>
<tr>
<td><strong>RMA, LGPA</strong></td>
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<td></td>
<td></td>
<td></td>
<td>Packaging Accord</td>
</tr>
<tr>
<td><strong>NZS 4404 Landsubdivision &amp; development engineering (in preparation)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NZ Plastics Sustainability Strategy</td>
</tr>
<tr>
<td><strong>NZ Waste Strategy, NEEC Strategy</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Packaging Accord</td>
</tr>
<tr>
<td><strong>NBR 2001</strong></td>
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<td></td>
<td></td>
<td>NZ Packaging Code of Practice</td>
</tr>
<tr>
<td><strong>NZ Building Code clause on energy efficiency &amp; supporting standards</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NZ Plastics Sustainability Strategy</td>
</tr>
<tr>
<td><strong>Energy Saver funding through central government</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Packaging Accord</td>
</tr>
<tr>
<td><strong>Codes of practice, strategic plans, community plans, iwi management plans, conservation covenants, management agreements, bulletins, calculation tools</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NZ Packaging Code of Practice</td>
</tr>
<tr>
<td><strong>Dept. of Conservation</strong></td>
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<td></td>
<td></td>
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<td>NZ Packaging Code of Practice</td>
</tr>
</tbody>
</table>

#### Political drivers include those mentioned earlier with respect to governance (e.g. laws, policies, strategies) that form part of the political context within which an organisation operates.

**Socio-cultural drivers** are those that have social or cultural implications, e.g. market expectations, costs of disposal, etc.

**Economic drivers** are those that have economic implications, e.g. market expectations, costs of disposal, etc.

**Environmental drivers** are those that have environmental implications, e.g. market expectations, costs of disposal, etc.

**Political drivers** are those that have political implications, e.g. laws, policies, strategies, etc. that form part of the political context within which an organisation operates.
### Table 13.6 (continued)

<table>
<thead>
<tr>
<th>Drivers for change</th>
<th>Dairy</th>
<th>Meat</th>
<th>Forestry</th>
<th>Built environment</th>
<th>Tourism</th>
<th>Retail</th>
<th>Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to</td>
<td>'Clean, green' marketing strategy</td>
<td>Fluctuating prices driven by off-shore demand and currency exchange rate</td>
<td>Increasing pressure from councils, indirect influence of a mix of statutory requirements</td>
<td>Visitor expectations</td>
<td>Market signals from importers of NZ products have some impact on products available in NZ, but any positive effect of this is minimised by lack of concern/pressure from local consumers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>international markets</td>
<td>Need for consistency</td>
<td>Food hygiene focus driven by BSE outbreaks in Britain &amp; EU regulations</td>
<td>Urban sprawl: land price &amp; availability, transport, environmental pollution, demographics, quality of life</td>
<td>Questions regarding sustainability of the value of NZ's exports that are attributed to its image</td>
<td>Green Globe 21, Seoul Declaration 2000, including the 'Tourism Charter' for sustainably managing tourism outcomes &amp; impacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food hygiene focus</td>
<td>Need for consistency</td>
<td>Food hygiene focus driven by BSE outbreaks in Britain &amp; EU regulations</td>
<td>Urban sprawl: land price &amp; availability, transport, environmental pollution, demographics, quality of life</td>
<td>Need to maintain competitiveness</td>
<td>Green Globe 21, Seoul Declaration 2000, including the 'Tourism Charter' for sustainably managing tourism outcomes &amp; impacts</td>
<td></td>
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</tr>
<tr>
<td>driven by BSE</td>
<td>Need for consistency</td>
<td>Food hygiene focus driven by BSE outbreaks in Britain &amp; EU regulations</td>
<td>Urban sprawl: land price &amp; availability, transport, environmental pollution, demographics, quality of life</td>
<td>Need to maintain competitiveness</td>
<td>Green Globe 21, Seoul Declaration 2000, including the 'Tourism Charter' for sustainably managing tourism outcomes &amp; impacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>outbreaks in Britain</td>
<td>Need for consistency</td>
<td>Food hygiene focus driven by BSE outbreaks in Britain &amp; EU regulations</td>
<td>Urban sprawl: land price &amp; availability, transport, environmental pollution, demographics, quality of life</td>
<td>Need to maintain competitiveness</td>
<td>Green Globe 21, Seoul Declaration 2000, including the 'Tourism Charter' for sustainably managing tourism outcomes &amp; impacts</td>
<td></td>
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</tr>
<tr>
<td>&amp; EU regulations</td>
<td>Need for consistency</td>
<td>Food hygiene focus driven by BSE outbreaks in Britain &amp; EU regulations</td>
<td>Urban sprawl: land price &amp; availability, transport, environmental pollution, demographics, quality of life</td>
<td>Need to maintain competitiveness</td>
<td>Green Globe 21, Seoul Declaration 2000, including the 'Tourism Charter' for sustainably managing tourism outcomes &amp; impacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Move away from feeding by products to animals could reduce impetus for recovery</td>
<td>Increasing awareness of fibre recovery/conversion as extending to other inputs, incl. chemicals &amp; energy</td>
<td>Need to address identified challenges</td>
<td>Need to 'future-proof' the sector</td>
<td>Benefits of growth must outweigh costs</td>
<td>APEC/PATA Code for Sustainable Tourism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing automation &amp; computer-based systems require higher workforce literacy &amp; numeracy &amp; have led to a shortage of skilled labour</td>
<td>Need to maximise wealth creation, employment &amp; infrastructure</td>
<td>Need to address identified challenges</td>
<td>Need to 'future-proof' the sector</td>
<td>Benefits of growth must outweigh costs</td>
<td>APEC/PATA Code for Sustainable Tourism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avoiding negative publicity</td>
<td>Rising energy prices may increase demand for wood residues as a fuel source</td>
<td>Material waste: Pressures to do with land disposal operations</td>
<td>Need to address identified challenges</td>
<td>Need to 'future-proof' the sector</td>
<td>APEC/PATA Code for Sustainable Tourism</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Decreasing acceptance of waste</td>
<td>Need to address identified challenges</td>
<td>Need to 'future-proof' the sector</td>
<td>APEC/PATA Code for Sustainable Tourism</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Landfill full cost accounting, value of recovered materials</td>
<td>Need to address identified challenges</td>
<td>Need to 'future-proof' the sector</td>
<td>APEC/PATA Code for Sustainable Tourism</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Closure of illegal landfill &amp; closer monitoring of others</td>
<td>Need to address identified challenges</td>
<td>Need to 'future-proof' the sector</td>
<td>APEC/PATA Code for Sustainable Tourism</td>
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<tr>
<td></td>
<td></td>
<td>Lack of regulatory guidance on waste minimisation &amp; recycling</td>
<td>Need to address identified challenges</td>
<td>Need to 'future-proof' the sector</td>
<td>APEC/PATA Code for Sustainable Tourism</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Energy: Enhanced regulatory framework under EEC Act</td>
<td>Need to address identified challenges</td>
<td>Need to 'future-proof' the sector</td>
<td>APEC/PATA Code for Sustainable Tourism</td>
<td></td>
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</tr>
</tbody>
</table>

Political drivers were identified for the dairy, meat, built environment, tourism and plastics sectors. The most common of these were the regulatory drivers already mentioned for dairy, meat and the built environment sectors. For tourism, the political drivers are non-regulatory pressure, corporate responsibility, technological drivers are those that have something to do with technology, e.g. new equipment, automation, etc.
Sector Group Responses

(i.e. the Seoul Declaration and the APEC/PATA Code for Sustainable Tourism), while for plastics, the threat of legislation was identified as a driver.

**Economic drivers** were by far the most commonly identified. These include:

- market pressures and customer expectations or requirements (all sectors);
- fluctuating prices or currency (forestry);
- disposal or compliance costs (built environment); and
- socio-economic well-being (forestry, built environment).

**Socio-cultural drivers** that were identified include:

- community expectations (dairy, meat, built environment, tourism, plastics);
- increased awareness of possibilities (forestry);
- the need to address challenges (tourism, plastics); and
- isolated instances of corporate social responsibility (retail).

The only **technological drivers** that were identified were for forestry, i.e. increasing automation and a corresponding shortage of skilled labour.

While all of the above-mentioned drivers were believed to contribute positively to progress towards resource stewardship, a few drivers were believed to have a negative effect. These included:

- the BSE-related move away from the use of animal by-products for stockfeed (thought to reduce the impetus for recovery in the meat sector);
- lack of regulatory guidance on waste minimisation and recycling (built environment); and
- lack of concern/pressure from local consumers, and in some cases outright rejection of environmentally more considerate products (retail, plastics).

One driver that could have negative or positive effects, depending on different perspectives is the increasing price of energy. This driver was identified as having the potential to increase the use of wood residues as a fuel source (forestry). Its influence could be perceived as being positive if wood residues are seen as a renewable energy source, or negative if they are seen as a greenhouse gas contributor, or as reducing the impetus for waste prevention.

As mentioned earlier, it is important to note that these drivers are not working in isolation, but that they work together to form part of the complex environment within which organisations operate. Important questions that arise included:

- what is their relative significance within the organisational environment;
- how do they interact with other drivers and sources of influence; and
- how can they be harnessed to bring about real progress towards resource stewardship?

### 13.6 Industry Sector Assessments

Each of the industry sector groups were asked to assess the way in which waste minimisation and resource stewardship occur within their particular sector, and to make recommendations for improving the sector’s contribution to resource stewardship in New Zealand. Key conclusions and recommendations for each of the sectors are summarised in Table 13.7. The conclusions are presented as indicative successes and constraints.

From Table 13.7 it can be seen that, in the majority of cases, traditional indicators were used to draw conclusions on the success of waste minimisation. These traditional indicators included:
<table>
<thead>
<tr>
<th>Indicative successes</th>
<th>Dairy</th>
<th>Meat</th>
<th>Forestry</th>
<th>Built environment</th>
<th>Tourism</th>
<th>Retail</th>
<th>Plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milkfat losses: 1.95% to 0.6% over past 30 years</td>
<td>Focus on product integrity throughout the supply chain, including farm practice, has resulted in ‘Green Project’, Ballance Farm Environment Awards</td>
<td>Reducing truck movements</td>
<td>Urban sprawl: Promising mix of legislative &amp; non-statutory components in the framework for urban management</td>
<td>The unifying nature of the strategy</td>
<td>Examples of reduced solid waste generation in some retail outlets, in some cases to zero</td>
<td>Increasing post-consumer recycling 18% of plastic packaging now recycled</td>
<td></td>
</tr>
<tr>
<td>COD &amp; organic N levels: 0.6% by up to 57%</td>
<td>Increasing efficiency of operations</td>
<td>Enhanced conversion/recovery rates</td>
<td>Incorporation within the strategy of sustainability as a cornerstone of future development</td>
<td>High returns of energy efficiency also demonstrated</td>
<td>Recover of PET and HDPE is 25-30%</td>
<td>Light-weighting &amp; ‘down-gauging’ to increase efficiency</td>
<td></td>
</tr>
<tr>
<td>Some good waste minimisation examples</td>
<td>Optimal residue recovery according to economic value</td>
<td>Shift in focus towards strategic planning &amp; guidance to prevent uncontrolled human settlement development</td>
<td>Examples of Green Globe 21 in action</td>
<td>Research suggests that 49% of all packaging is recycled</td>
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<tr>
<td>Industry less resource intensive than 10-15 years ago</td>
<td></td>
<td>Material waste: Economic and environmental benefits identified during trials, possible competitive advantage</td>
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<td></td>
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<td>Energy: 1 d availability &amp; quality of resource materials for &amp; services to assist with design</td>
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<td>Standards &amp; awards</td>
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</tbody>
</table>

**Constraints**

- Autonomy of farmers makes awareness raising & common standard more difficult
- The APA may have diverted attention & resources from waste minimisation efforts
- Waste minimisation not mainstream
- Water and energy reduction seem to be crisis-related
- Limited ability of small to medium-sized plants to modernise
- Voluntary nature of guides
- Lack of understanding about applying the code's
- Complexity of sector
- Lack of awareness & interest amongst architects (historical & current)
- Legislative requirements for energy efficiency in buildings target new buildings only
- Environmental conservation not currently recognised as the responsibility of all who operate in the sector
- Planning & development is fragmented, complex, inefficient & difficult to understand
- Inefficiencies related to number of organisations involved, ineffective relationships
- Small size of majority of retailers results in limited ability to influence supply chain
- Small size of businesses & low profit margins limit resources available to implement waste minimisation
- Low value of solid waste reduction
- Non-renewable nature of the main resources used
- Cost/benefit limitations on recovery & recycling
- Fragility of markets
- Too much focus on end-of-pipe recycling
- Lack of design expertise, leadership and resources to support sustainable product design, cross-sectoral coordination, incentives

- Improved yield or efficiency (dairy, forestry, retail, plastics)
- Reduced resource use (meat, forestry)
- Reduced waste generation (meat, retail)
- Increased recovery of recyclables (retail, plastics)

- The identification of economic, environmental and competitive benefits (built environment).
Table 13.7 (continued)

For the built environment sector and tourism, less traditional indicators were used. For the built
environment sector, these included: a mix of legislative and non-legislative components in the
framework for urban management; a shift in focus towards strategic planning and guidance to
prevent uncontrolled human settlement, and increased availability of resource materials on
design. For tourism, they included the unifying nature of the New Zealand Tourism Strategy
and the incorporation within it of sustainability as a cornerstone of future development.

For two sectors, the extension of waste minimisation or resource stewardship efforts beyond the

Sector Group Responses

Page 223

Recommendations

Dairy
Rely on influence
and size of Fonterra
to ensure
standardisation

Meat

Develop company
policy, monitoring
systems &
accountability

A better trained &
more sophisticated
workforce

Integrate waste
minimisation as a
core principle within
profit improvement
programmes
Marketing of
improvements

More efficient
process management

Environmental
purchasing policies

Energy: Awareness,
tools & motivation
working together in a
mixture of voluntary &
legislative measures

Material waste: A
comprehensive
national programme
including industry
education, incentives
and a statutory
framework

Create partnerships
amongst all
stakeholders

New ideas and
technologies

Supply contracts to
include farm
practices

Built environment
Urban sprawl: Create
an organisational
structure for urban
land management

Forestry
Incorporation of
resource stewardship
into planning
strategies

Continue
coordinated farming
initiatives

Integrate with
regulatory & nonregulatory authorities
to develop further
drivers

Continue to develop
‘toolkits’ to assist in
implementation

Develop Green Globe
21 communities, as
well as companies

Integrate Green
Globe 21 into
Qualmark (national
tourism accreditation
scheme)

Continue to
implement Green
Globe 21 as an
international
benchmark

Tourism

Engage innovative
retailers to assist in
changing consumer
& retail sector values

Extend minimum
performance
standards

Expand central
government support
for and promotion of
environmental
labelling schemes

Introduce & promote
voluntary tools &
develop financial
instruments to
encourage resource
stewardship

Encourage
development in the
retail sector of values
that balance
economic prosperity
and resource
stewardship

Retail

Provide incentives
for business to
achieve best waste
minimisation
practice

Enhance
coordination
between
government depts.,
academia, business
sector projects &
research

Encourage intersector coordination
& leadership at a
national level on
waste minimisation
issues

Support for
sustainable design

Enhance
educational
opportunities for
design at tertiary &
industry levels

Plastics


factory floor were used as an indicator of success: for meat, the inclusion of on-farm improvements and farm awards, and for forestry, the reduction in truck movements to and from the mills.

A number of constraints were also identified. These included:

- lack of understanding, expertise or interest (meat, built environment, tourism, plastics);
- structure, complexity or fragmentation of the sector (dairy, forestry, built environment, tourism);
- limited availability of funds (forestry, retail, plastics);
- poor cost/benefit ratio, particularly for recovery/recycling (retail, plastics);
- competing agendas (meat);
- legislative limitations; and
- the voluntary nature of guides (built environment).

A noteworthy characteristic of the recommendations is that, while a small number of general categories can be identified within which they all fit, the sectors differ quite markedly from each other in terms of specifics. The recommendations can be loosely grouped into four categories.

- **Internal integration**, which refers to integration within individual businesses or organisations. Recommendations in this regard included: integration of waste minimisation and resource stewardship into planning strategies (forestry), and profit improvement programmes (meat), as well as the development of internal policy, monitoring and accountability systems (meat).

- **External integration**, which refers to integration outside the business or organisation. Recommendations in this regard included intra-sectoral integration (i.e. across the supply chain) (dairy, meat, built environment); inter-sectoral integration (plastics, retail and tourism), and the development and integration of a mix of instruments to encourage resource stewardship (built environment, tourism, retail, plastics) and a change in values (retail). It was also recommended that programmes be extended to include whole communities, rather than simply just businesses (tourism).

- **Capacity building**, where the recommendations were for more practical education/training (forestry, built environment, plastics), and the development of innovative technologies (forestry) and ‘toolkits’ (tourism).

- **Standardisation** was the fourth category. Here the recommendations included sector groups calling for enhanced labelling systems (retail), integrated performance standards (tourism), and benchmarking (tourism).

These results are used in the final chapter (Chapter 14) as the basis for conclusions and recommendations for New Zealand as a whole.
Towards Resource Stewardship

Lesley Stone

14.1 The challenge that lies ahead

The first chapter in Part Three (Chapter 12) discussed the way forward and identified some of the challenges that lie ahead in encouraging people, whether as individuals or as part of any sector group or organisation within society, to think of waste minimisation in terms of resource stewardship. The contextual environment in which these challenges must be faced has been described in Part One, and the conclusions and recommendations produced by the industry sector groups in Part Two, and also discussed in the previous chapter (Chapter 13), are indicators of the way forward.

As a final step it is useful to revisit some of the observations that were made in Part One in considering how waste minimisation activities can contribute to resource stewardship and, ultimately, sustainability.

Fig. 14.1 provides a graphic representation of how such a contribution could work. It is based on Fig. 1.2 from Chapter 1, but differs in two ways. Firstly, the contributions that remediation, treatment and re-directed disposal make towards resource stewardship are shown as dotted lines. This is because they are not the focus of this report. Secondly, the terms ‘resource conservation’ and ‘resource recovery’ have replaced ‘reduction [of wastes] at source’, and ‘external re-use, recycling and recovery [of wastes]’. This has been done to emphasise the resource-, rather than waste-related intent of the activities that have traditionally taken place under the waste minimisation banner, and to make very clear their connection to resource stewardship. It is suggested that these more specifically resource-oriented terms be used in preference to the term ‘waste minimisation’. The term ‘waste minimisation’ was coined in the early 1990s and has since become less relevant as it tends to be now mainly used in reference to solid waste in countries with a long history of these types of activities. This is because it is ambiguous and has been subject to capture, e.g., its use by incinerator operators on the basis that their operations too were minimising wastes, in this case, to landfill. More importantly, perhaps, it encourages a waste rather than a resource focus.

This may seem like semantics, but it reflects a key feature of the New Zealand Waste Strategy, and, indeed, sustainability: wastes need to be recognised for what they really are – often valuable resources that need to be recovered, conserved and stewarded so that they are able to assist people to meet not only their own needs, but those of future generations.

This is a massive challenge. Wastes are materials – solid, liquid, gaseous – or energy, that society has traditionally thrown away, disposed of, given to someone else to deal with, or simply just ignored. Research and experience suggest that this is because deeply ingrained within our culture is the underlying assumption that wastes have nothing to do with us: they are simply not our responsibility.

14.2 Changing Values

Donald Schein, a world renown expert on culture and learning, provides a model that may help to explain the difficulties encountered when trying to promote resource stewardship. Schein defines culture as a set of underlying assumptions (or core values) that people have, as a group, ‘invented, discovered or developed’ and learned to help cope with the problems that occur as
part of that group (Schein, 1992). According to Schein’s model, assumptions (or core values) only become part of our culture when they are found to work really well and to the extent that they are taught to new members of the group (infants, children and adults), as the right way to ‘perceive, think and feel’ in relation to those problems (Schein, 1992). They become ingrained because they have been tried and tested, and found to be valid over and over again. So much so, that while they form the basis for acceptable behaviour, people don’t even think about them when deciding what to do in relation to a particular, commonly encountered problem.

The ultimate purpose of all the waste minimisation strategies, laws, policies, economic incentives or disincentives, tools, programmes and activities, which are identified in Parts One and Two, is to change how people behave in relation to wastes. People must be encouraged to stop wasting valuable resources. Manufacturers need to be encouraged to make less wasteful products and to change their production processes so that they generate less wastes, and to recover and re-use those that they do generate, to switch to renewable resources, and to use more efficient machinery, etc. Consumers must demand less wasteful products, compost their organic waste and recycle what’s left. Every day, in a myriad of ways, when rubbish is thrown out, when the toilet is flushed, when cars are driven around, when the lights are left on in an unused room, etc., etc. – nothing happens to indicate that this behaviour might just be unsustainable or, even, socially unacceptable. Instead, there is continual reaffirmation that such behaviour is acceptable and the wastes these activities generate are simply not our responsibility.

Resource stewardship is about accepting responsibility for sustainability, which in turn is about accepting responsibility for the ability of future generations to meet their needs. So, how does society make the shift from an irresponsible culture (at least in terms of resource stewardship) to one that is responsible?

Clearly, knowledge and education have an important role to play. But people need to learn to behave differently, and many waste minimisation programmes try to bring about this change in behaviour. It is possible to change behaviour in a superficial way, e.g. by charging people to dump rubbish, giving them a recycling bin that gets emptied at the kerbside and not charging for recycling. However, stop charging people to dispose of their rubbish, take away the kerbside
collection or impose a charge on recycling, and the majority of people are likely to revert to dumping. In order for a behavioural change to be permanent (i.e. for it to become part of the culture), it is necessary to change basic underlying assumptions (or core values) about waste.

It may seem that the issue of language is a small one, but language is an important part of culture. To begin the process of changing people’s mindset from a waste-focused, disposal and treatment-oriented culture to a resource-focused, stewarding culture, it seems useful to dispel even the possibility of waste. Many waste professionals have argued long and hard that it is impossible to eliminate waste completely. However, the apparent success of the ‘zero waste’ concept suggests that people are quite comfortable with ‘zero waste’, at least as an ultimate goal. It is suggested that increasing familiarity with the use of the terms ‘resource conservation’ and ‘resource recovery’ will help to make the transition towards a waste-free society.

Chris Argyris and Don Schön (two respected behavioural psychologists) have a model that is considered particularly useful in helping to make sense of culture and learning. It is graphically presented in Fig. 14.2. According to the model, societal behaviour is determined by its underlying assumptions (or core values) (Argyris and Schön, 1974). At any time when people choose to behave in a certain way, there are consequences. If these consequences match expectations, this confirms that the choice that was made to behave in a certain way was correct and, although this is seldom a conscious process, it verifies the basic underlying assumptions. However, if the consequences don’t match expectations, then some form of learning occurs. ‘Single-loop’ learning is what Argyris and Schön use to describe learning that only changes behaviour, without changing basic underlying assumptions. They call learning that changes these assumptions, ‘double-loop learning’ (Argyris and Schön, 1974).

![Figure 14.2: The difference between learning that changes behaviour and learning that changes basic underlying assumptions. (After Argyris and Schön, 1974)](image)

People working to promote waste minimisation are basically in the business of creating mismatches. Take for example the introduction of half-size ‘wheelie-bins’ in Auckland City in the late 1990s (see Eve, 2002). Up until the introduction of the new wheelie-bins, people were able to dump whatever could be crammed into a large wheelie bin every week. This behaviour was based on the assumption that council would come and take it away, and it was confirmed over and over for a decade or so when contractors did, indeed, do so, week in and week out. It is really not surprising that people expected to be able to continue this practice. Confronted with this mismatch, a number of different behaviours were possible. They could:

- create an uproar and try to force council to reverse its decision;
- cram what they could into the smaller bin and dump the rest over the fence or in the gully
down the road;

- burn what’s left in their incinerator (probably at night when no one can see the smoke);
- pay a contractor to come and take it all away;
- move to another city;
- recycle;
- compost; or
- buy less wasteful products.

All of these behaviours occurred of course, but the council, through careful marketing (including the use of case studies to show how reductions and recycling could be achieved), managed to still the outcry and encourage the majority of people to reduce the wastes sent to landfill (Eve, 2002). So, the inevitable question is whether or not this is enough. The answer is yes, if the object is to get people to recycle and compost. Not necessarily, however, if the greater goal is to get them to become better resource stewards. In order to do the latter, it is necessary to get people to accept responsibility for wastes, i.e., to change the mindset that wastes are someone else’s problem. Argyris and Schön (1974) argue that in order to do this, it is necessary to get people to critically reflect on their underlying assumptions, and to help them to invent, test and confirm the validity of new ones.

To some extent this is what Auckland City Council’s campaign did. It communicated to people that they no longer had the right to dump a large wheelie bin’s worth of solid waste each week. It asked people to accept some level of responsibility for the recyclable and putrescible parts of their waste: the former, by separating them and putting them in the recycling bin, and the latter, by composting them or taking them to the transfer station for composting. Now, for some people this may have remained only a behavioural change – they would more or less have done what they were told so that they could still get rid of their wastes, albeit split between half-sized wheelie bins and recycling bins. It is quite likely, however, that some people may have begun to think of some wastes as resources, and of their responsibility for helping them to be recovered, recycled and composted. This is the kind of critical reflection that could lead them to change their assumptions about waste. However, it is important to note that a key feature of both Argyris and Schön, and Schein’s models, is that new assumptions will only become ingrained if they are found, through an iterative cycle of learning to work well. This means that the consequences that result from the new behaviour must be confirmed enough times for the new assumptions to be accepted as valid.

Consider now what would have happened if the council’s contractors had not picked up the recyclables the week after the new wheelie bins were put into use. Or if upon arriving at the transfer station with their putrescibles, they were told they wouldn’t be accepted, or that there was a charge. Or if the neighbour’s dog had over-turned the recycling bins, the council had ignored the waste in the street and the householders had to go and pick it all up. Or if, a few weeks later, a large article had appeared in the local newspaper expressing outrage at the growing pile of recyclables at the transfer station that couldn’t be sold because there were no markets. Any of these events may have shed doubt on the validity of the new behaviour (and any new assumption) upon which it was based, and reduced its chances of becoming accepted as the new way to behave, think and feel in relation to wastes.

During a recent visit to Sweden, the author encountered a good example of what it means to have these types of assumptions ingrained within a culture. The town in which she was living appeared to have a strong recycling ethic. The majority of the local residents appeared to wash and separate their solid wastes into a wide range of categories, and then carry them to the nearest depot to drop them individually into 10 or more different bins. She asked some of the people she encountered what was done to get what seemed like the majority of the population
to do this. The people she asked (waste management professionals and lay people alike) simply didn’t understand what she meant by the question. She concluded that this extraordinary level of personal responsibility is because the underlying assumptions that Swedish people have about waste, and their responsibility for it, are clearly very different to those in New Zealand. They appear to simply have accepted responsibility for recovering their wastes and they can’t conceive of not doing so. Through a process of iterative learning, responsibility for the recovery of a wide range of wastes appears to have become part of Swedish culture.

In Fig. 14.2, it can be seen that the diagram includes a dotted return arrow between behaviour and underlying assumptions. This is to show that, while some programmes may initially only bring about changes to behaviour, if the validity of those behaviours are confirmed enough times, they tend to become part of the culture. The line is shown dotted because this may not necessarily always occur. Also, it is important to note that the underlying assumptions that are created in this way (i.e. though repetitive behaviour change), will not necessarily be those that should be encouraged. Recycling, for example, may simply become “what we have to do around here to get rid of all our wastes”, rather than be translated into an ethic of stewardship.

14.3 Making it work

With a little help, resource stewardship can, perhaps, be made to occur. The potential for success will be enhanced by the choice of available instruments and tools, as well as the strategic way in which they are used. Stern et. al.’s model (1995) (see Fig. 14.3), was developed specifically to show the relationship between social institutions (e.g. legal, economic and other social systems), values and environmental behaviour. While it echoes some of the key ideas contained in the models of Argyris and Schön, and Schein, it adds to them by providing some detail on interme-diary factors that may influence the translation of underlying assumptions into action. Understanding of these factors can help in the choice of instruments and tools. The model also shows the relationship between institutional structure, values and behaviour.

Recycling, again, provides an example of how the model would work. The privatisation of landfills in the Auckland region and the resulting competition amongst them, has driven down the prices charged for their use. This has the potential to make recycling programmes less economically appealing. The tenuous nature of recycling is exacerbated by New Zealand’s small population size and hence small market. This means that the majority of recyclables are exported. Since New Zealand has no control of international markets, it is easy for unanticipated market fluctuations to completely erode already tight margins. If these translate into stockpiles of recyclable material and negative publicity about recycling, they can reduce or even eliminate the public’s confidence in the validity of any new assumptions they are testing.

The small dotted arrows in Fig. 14.3 indicate that influences can also occur in the opposite direction (as suggested in Fig. 14.2 and mentioned earlier). Commitment, for example, can be influenced by behaviour. An example is when someone tries something tentatively, and becomes committed only when they find repeatedly that it works. Equally, this can work in a negative way, e.g. when someone makes a commitment to buy more environmentally consider-ate products, but then finds that they are much more expensive or are not as effective or reliable. This will influence their commitment and may work itself back down the line where it may or may not ultimately affect their underlying assumptions.

Similarly, as the dotted line on the left of the figure suggests, people can, through their behav-iour affect institutions. An example of this is the pressure that members of the public have been known to exert on councils to introduce recycling schemes. Submissions on policies, plans, resource consents, etc. are all examples of types of behaviour that influence social institutions. Fig. 14.3 also provides an indication of how instruments and tools can be used to assist in the transition from underlying assumptions to behaviour can be affected by the availability of tools. Step-by-step guides such as those included in the NZBCSD’s “Industry Guide to Zero Waste”
(2002) can help to turn intentions into action. Equally, social norms may influence the extent to which a person feels personally obliged to take a certain course of action, or make a commitment. This reflects on the importance that NGOs place on the networking and mentoring aspects of their work.

Previous research and experience strongly suggests that programmes will be more effective if they respond to existing activities, needs and culture. The components in Fig. 14.3, when considered in terms of a specific industry and its needs, may help to work out what sort of instruments would be useful, and to help to choose and integrate them.

14.4 Conclusions and recommendations

The selection, choice and integration of instruments and tools for encouraging resource stewardship was identified in Part One as being important, and this has been echoed in the conclusions and recommendations of the sector group chapters in Part Two. Part One also showed that a wide range of instruments and tools are available and could be used to improve the contribution that resource conservation and resource recovery make to resource stewardship. However, the preceding chapters all suggest that the instruments and tools that are currently in use have been chosen in a fairly ad-hoc way and are not necessarily contributing effectively towards resource stewardship. Models such as those shown in Fig. 14.3, above, have the potential to assist in the selection and application of appropriate instruments. One essential prerequisite for
Towards Resource Stewardship

this, however, is that people look critically at what has been done in the past, and commit themselves to learning and improvement. Issues raised in Parts One and Two suggest that this climate of learning is not yet in place.

Examples abound. During the latter part of the 1990s, many people were involved in the ‘Target Zero’ project. The project was the largest of its kind, funded by the Ministry for the Environment’s Sustainable Management Fund and involved 23 companies, five councils, and a number of consultants. It used internationally-recognised best practice, developed over more than a decade of experience in a number of countries (the US, Sweden, Netherlands, UK and others), to take businesses through a programme that would enable them to identify and quantify their resources and wastes, and find ways to prevent, reduce and minimise them. Out of that project came a set of recommendations for improving the effectiveness of sustainability programmes for business. The results were widely disseminated, in publications, in presentations to WasteMINZ annual conferences and workshops, and in a series of seminars that were well-attended by businesses and council representatives in the major centres in New Zealand. The results were enthusiastically received by experts working on business sustainability in other countries (Australia, Europe and the US).

Since the results were made available, many sustainability tools (particularly step-by-step types of guides) have been developed in New Zealand. Despite this, only one of those, an educational programme developed by the BusinessCare National Trust, has incorporated the learning that has resulted. The rest are just as mechanistic, and hence ineffective as sources of culture change, as the first guides that were developed in the late eighties and early nineties. They have simply not taken into account any of the learning that has occurred since then.

Why is this? The conclusions drawn from the CAE RS:WM project provide some valuable insights into what needs to happen in New Zealand for real progress to be made towards an ethic of resource stewardship. More than twenty NGOs whose work with businesses is in some way relevant to resource stewardship have been identified. Add to this the 35 or so local councils that are currently identified as ‘Zero Waste’ councils, all those other councils who are doing work in this area despite not having signed up to a ‘Zero Waste’ goal, the Ministry for the Environment, the Ministry of Energy, Local Government NZ, the Energy Efficiency and Conservation Authority, and all the research institutes or sector representative organisations that contributed to this report. The small funding base and the competitive climate that it has engendered are simply more conducive to rivalry than they are to learning. Perhaps this is why the learning from the Target Zero project has been largely ignored.

Questions were also raised in Part One about the need for integration, while the industry sector group chapters in Part Two concluded that integration does need to occur for real progress towards resource stewardship to be achieved. In 1992, the waste minimisation section of the original CAE book “Our Waste: Our Responsibility”, recommended the establishment of a national foundation that would help to integrate waste minimisation (or, more specifically, cleaner production) initiatives. A steering committee was established and preliminary work proceeded, only to be abandoned, because of inter-sector rivalry and the inability to gain support from a range of interest groups. This rivalry is still occurring and it is still hindering progress. In 1999, the BusinessCare National Trust was established with MfE/SMF funding. Its brief was in many ways quite similar to the terms of reference for the foundation that was proposed in 1992, and it included an integrating and co-ordinating role. MfE chose to fund the Trust to undertake this role, because the Trust did not intend to align itself with any particular concept or dogma and undertook to act as a clearing house for all. The Trust has had great difficulty acting in this capacity, largely due to jealousies that were aroused when it was established and that continue to this day. The establishment in 2002 of another group that virtually duplicates what BusinessCare set out to achieve provides the most recent evidence of this.

It is, perhaps, easy to blame MfE for not having foreseen this situation and some fault may lie
with BusinessCare itself, for some mistakes that were made in the first flush of activity. However, it is time to recognise that this situation, while not really surprising given the shortage of funds for this type of work and the challenges involved, is simply not conducive to progressing resource stewardship in New Zealand.

The CAE RS:WM project reconfirms very clearly that integration is necessary if New Zealanders are to build on the considerable gains that have been made during the past 10 years and meet the remaining challenges that lie ahead. The most obvious solution to the problem of integration would be a national organisation that has the full backing of government. A useful aim would be to ensure that the most is gained from the limited funds available, and that there is real society-wide progress towards resource stewardship, and a sustainable New Zealand.

It is interesting to note that when this suggestion was put to a workshop at the 2003 WasteMINZ Conference in Nelson, there was broad consensus on the need for integration, but rejection of a new organisation to undertake it. Participants felt that any one of a number of existing organisations could or should play this role. Suggestions included the Parliamentary Commissioner for the Environment (PCE), the Ministry for the Environment (MfE), and the Ministry for Economic Development (MED). However, it was also felt that it would be important for the integrating body to be independent of the government and for it to be enabled by legislation. Therefore neither the MfE nor the MED would appear suitable. The PCE’s office could potentially undertake the role, but perhaps this would divert it from what is already an important environmental ombudsman audit-type role.

While WasteMINZ was suggested by a few workshop participants, and other organisations volunteered their services after the workshop, the BusinessCare experience suggests that giving any one NGO prominence over the others is unlikely to gain broad support.

The following recommendations are offered in order to facilitate the integration so clearly identified in this report as being essential for further progress.

**Information, measuring and monitoring:**

- Identify the specific roles played by the wide range of NGOs and other groups working in related areas (including the Energy Efficiency and Conservation Authority).
- Use the results of the CAE RS:WM project to develop a set of key performance indicators (KPIs) and a system for measuring and monitoring progress towards resource stewardship.
- Use the system to determine the strengths and weaknesses of the groups currently involved and to help to identify gaps that need to be filled.
- Use the results to adjust the institutional structure and the mix of instruments being used to promote progress towards resource stewardship.

**Institutional development:**

- Develop an institutional structure and a set of mechanisms (including legal, economic and voluntary funding and support mechanisms) that will ensure that the gaps are filled, that duplication is minimised, that groups learn from each other and that maximises resource efficiency.
- Develop, and have enacted, legislation that will give the body the capacity to act in a regulatory capacity, and to carry out its role without having to compete unnecessarily for funding.
- Develop mechanisms to ensure that, where necessary, inter-sectoral integration occurs, and that industry sectors and communities are included in programmes.
- Develop mechanisms to ensure that, where necessary, intra-sectoral integration occurs, including supply chain management and the producer/retailer/consumer interface.
- Select, develop and integrate these mechanisms strategically and in consideration of the
social aspects of learning and change, so that they actually achieve the desired resource stewardship outcomes.


**Capacity building:**

- Assist groups to develop programmes that reflect up-to-date knowledge on effectiveness and that will, as a result, have a greater potential for achieving the underlying changes necessary to bring about progress towards resource stewardship.

- Assist groups to develop and apply appropriate methods for monitoring outcomes, and to respond appropriately to the results.

- Develop mechanisms that will enhance the capacity of the tertiary education sector to contribute towards resource stewardship across all areas, but particularly in the areas of design, technology and innovation.

- Contribute to the development of an appropriate set of toolkits that reflect specific activities, needs and cultures of the different sectors, and monitor their effectiveness and use.

- Work in conjunction with the relevant industry representative bodies and research institutions to develop an appropriate set of standards, that reflect the needs of each sector, but that can also be used in an integrated way to reflect best practice in New Zealand as a whole.

It is difficult to see how many of these recommendations could be achieved without a national body of some sort.

The Energy Efficiency and Conservation Authority (EECA) may provide a model for this type of organisation. However, EECA is focused purely on energy and its role would need to be considerably expanded. As mentioned earlier, one of the key results to come out of research into the effectiveness of waste minimisation initiatives is that they appear to work best when customised according to the activities, needs and culture of the particular organisation. In some cases it may be strategically useful to get a company to work on energy efficiency and conservation, while in other cases another area of focus may be more valuable as a means to get the learning process happening. The strategic value and effectiveness of a new body, as recommended above, would be limited if energy were excluded from its ambit and covered separately by EECA. Since one of the key recommendations in this report concerns integration, it may be far more valuable to disestablish EECA and pass its function over to a new, all encompassing Resource Efficiency and Conservation Authority, underpinned by the existing, and appropriately amended Energy Efficiency and Conservation Act 2000, as well as a new Resource Efficiency and Conservation Act.

We already have two national strategies of which we can be proud. What we need now is an institutional structure that can integrate these strategies and bring the values they represent to fruition. It is a challenging task, but one we can certainly aspire to if we build on what we have already achieved, learn from our experiences, and work together in pursuit of a truly sustainable New Zealand.

**14.5 References**


Hall, Hemel Hempstead.


Appendices

Instruments, Tools and Change Agents
## Appendix 1: A Selection of Regulatory, Economic and Voluntary Instruments and Tools with Examples of their use in a Range of Countries

<table>
<thead>
<tr>
<th>Type of instrument or tool</th>
<th>Example country</th>
<th>Description</th>
<th>Source of information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regulatory instruments/tools</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Laws, by-laws</td>
<td>Europe</td>
<td>European countries have a number of environmental treaties and legislation. The European Environmental Law homepage has the full range of these listed and includes case law.</td>
<td><a href="http://www.eel.nl">http://www.eel.nl</a></td>
</tr>
<tr>
<td></td>
<td>USA</td>
<td>Michigan State law includes bans on out-of-state dumping, fines for polluters, and a beverage container deposit law.</td>
<td><a href="http://www.michigan.gov/deq">http://www.michigan.gov/deq</a></td>
</tr>
<tr>
<td>Policies, plans</td>
<td>International</td>
<td>A wide range of countries have relevant policies &amp; plans. This document was commissioned by the UK’s Royal Commission on Environmental Pollution and provides a comparison of policies &amp; plans in NZ, Germany, The Netherlands, Sweden, France, Republic of Ireland and USA.</td>
<td>[<a href="http://www.rcep.org.uk/%5D/pdf/UWE.pdf">http://www.rcep.org.uk/]/pdf/UWE.pdf</a></td>
</tr>
<tr>
<td>Targets</td>
<td>Canada</td>
<td>The National Packaging Protocol has provided a series of targets for reducing packaging wastes. The 2000 target for reducing total packaging wastes by 50% was achieved four years early in 1996.</td>
<td><a href="http://www.ccme.ca/initiatives/waste.html">http://www.ccme.ca/initiatives/waste.html</a></td>
</tr>
<tr>
<td>Permits</td>
<td>International</td>
<td>A wide range of permitting and charging systems are in use around the world. The World Bank’s New Ideas in Pollution Regulation (NIPR) website provides in-depth insights into how they work.</td>
<td><a href="http://www.worldbank.org/nipr/">http://www.worldbank.org/nipr/</a></td>
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<tr>
<td>Standards</td>
<td>Germany</td>
<td>Germany has a wide range of carefully targeted laws. The website has detailed information on all of these. An example is the Commercial Waste Ordinance that sets standards for the recovery of municipal wastes of commercial origin (municipal wastes from areas other than private households) and of certain construction and demolition wastes.</td>
<td><a href="http://www.bmu.de/english">http://www.bmu.de/english</a></td>
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<tr>
<td>Resource Stewardship and Waste Minimisation</td>
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<td>Bans USA The Battery Act set standards for mercury in dry-cell batteries and bans the sale and use of those that do not conform. The 'miniscule' amounts allowed for household use have resulted in virtual elimination of these batteries. The Act also enhances the recovery &amp; recycling of rechargeable batteries.</td>
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<td><a href="http://www.epa.gov/epr/products/">http://www.epa.gov/epr/products/</a></td>
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<tr>
<td><a href="http://www.epa.gov/epaoswer/hazwaste/recycle/battery.pdf">http://www.epa.gov/epaoswer/hazwaste/recycle/battery.pdf</a></td>
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<tr>
<td>Disclosure USA The Emergency Planning and Community Right to Know Act requires dischargers to provide information on their toxic chemical releases and other waste management activities. This information is publicly available as part of the Toxics Release Inventory.</td>
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<td><a href="http://www.epa.gov/tri">http://www.epa.gov/tri</a></td>
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<tr>
<td>Liability USA The Comprehensive Environmental Response, Compensation and Liability Act is based on the polluter-pays principle. It has a number of mechanisms for ensuring that liability for environmental contamination rests on those responsible. This website provides a good overview of the issues.</td>
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<td><a href="http://www.aallnet.org/sis/ripssis/eis">http://www.aallnet.org/sis/ripssis/eis</a></td>
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<tr>
<td>Economic instruments/tools</td>
<td></td>
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<tr>
<td>Fines, penalties Europe Fines and penalties are possible consequences of infringement of EU law re. wastewater and waste management. This document provides an overview of current practice.</td>
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<tr>
<td><a href="http://www.zalieji.lt/leidiniai/EU-legal">http://www.zalieji.lt/leidiniai/EU-legal</a></td>
<td></td>
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<tr>
<td>Fees Korea Householders must buy official rubbish bags. They can choose from different sizes and pay more the larger the size they use. Recyclables must be separated. Manufacturers are required to indicate which products are recyclable.</td>
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<td><a href="http://www.iisd.org/susprod/displaydetails.asp?id=63">http://www.iisd.org/susprod/displaydetails.asp?id=63</a></td>
<td></td>
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<tr>
<td>Tax, duties Ireland A levy on all plastic bags is required to be passed on by retailers to shopper. The levy is reported to have significantly reduced the use of plastic bags and has raised considerable amounts of funds for environmental initiatives.</td>
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<td><a href="http://www.environ.ie/doei/doeihome.nsf?Open">http://www.environ.ie/doei/doeihome.nsf?Open</a></td>
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<tr>
<td>Liability linked insurance premiums Finland Environmental Damage Insurance Act 1998 provides compensation for environmental damage, funded by compulsory insurance for high risk companies.</td>
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<tr>
<td><a href="http://www.vyh.fi/eng/environ/legis/damage.htm">http://www.vyh.fi/eng/environ/legis/damage.htm</a></td>
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<tr>
<td>Instrument/tool</td>
<td>Country</td>
<td>Description</td>
<td>URL</td>
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<tr>
<td>Tax relief, reductions</td>
<td>USA</td>
<td>New York State encourages developers to build environmentally sound commercial and apartment buildings by providing an incentive package that includes a 'green building credit'.</td>
<td><a href="http://www.dec.state.ny.us/website/ppu/gmnbldg/index.html">http://www.dec.state.ny.us/website/ppu/gmnbldg/index.html</a></td>
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<tr>
<td>Grants</td>
<td>Denmark</td>
<td>The Danish Ministry of Agriculture uses a grant system to support conversion to organic farming. The size of the grant depends on the livestock density and is calculated for each hectare under conversion.</td>
<td><a href="http://www.iisd.org/susprod/displaydetails.asp?id=61">http://www.iisd.org/susprod/displaydetails.asp?id=61</a></td>
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<tr>
<td>Subsidies</td>
<td>UK</td>
<td>The UK government's Non-Fossil Fuel Obligation subsidises electricity generated using renewables such as small-scale hydro, wind and solar. The subsidy is funded by a levy on electricity consumers who use non-renewables.</td>
<td><a href="http://www.iisd.org/susprod/displaydetails.asp?id=111">http://www.iisd.org/susprod/displaydetails.asp?id=111</a></td>
</tr>
<tr>
<td>Loans</td>
<td>Poland</td>
<td>The Polish National Fund for Environmental Protection and Water Management provides soft loans for cleaner production projects. Funds are derived from pollution charges, non-compliance fines and natural resource user fees, as well as investments.</td>
<td><a href="http://www.iisd.org/susprod/displaydetails.asp?id=105">http://www.iisd.org/susprod/displaydetails.asp?id=105</a></td>
</tr>
<tr>
<td>Investment schemes</td>
<td>International</td>
<td>The International Finance Corporation promotes sustainable private sector investment in developing countries. Originally established by the World Bank, the IFC now has strengthened environmental and social policies.</td>
<td><a href="http://www2.ifc.org/sustainability/">http://www2.ifc.org/sustainability/</a> <a href="http://www.worldbank.org/nipr/">http://www.worldbank.org/nipr/</a></td>
</tr>
<tr>
<td>Tradable permits</td>
<td>USA</td>
<td>In 1993, the Chicago Board of Trade held a major auction to sell rights to emit sulphur dioxide. Ownership is open to anyone, including NGOs who can buy rights and retire them.</td>
<td><a href="http://www.iisd.org/susprod/displaydetails.asp?id=115">http://www.iisd.org/susprod/displaydetails.asp?id=115</a></td>
</tr>
<tr>
<td>Deposit &amp; refund systems</td>
<td>Taiwan</td>
<td>The Environmental Protection Agency administers a mandatory deposit and refund system, recycling and price setting system for Hg dry-cell batteries, steel cans, PET bottles, tyres and lubricant oils.</td>
<td><a href="http://www.iisd.org/susprod/displaydetails.asp?id=114">http://www.iisd.org/susprod/displaydetails.asp?id=114</a></td>
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<tr>
<td>Voluntary instruments/tools</td>
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**Voluntary instruments/tools**

- **Voluntary agreements**
  - Canada
  - The National Office of Pollution Prevention runs the Accelerated Reduction/Elimination of
| Codes of practice | International | The chemical industry’s Responsible Care Management System is possibly the most renowned industry-specific code of practice. It has been designed for members of the chemical industry and is based on a set of guiding principles that include product stewardship and resource conservation. | http://www.chemical-industry.org.uk/responsiblecare.htm |
| Guides, manuals | International | There are many, many guides and manuals available around the world for businesses and consumers. The International Network for Environmental Management, the World Business Council for Sustainable Development and the Global Reporting initiative websites are a few that provide information on a wide range of business tools. | http://www.inem.org/  
http://www.wbcsd.ch/  
http://www.globalreporting.org/ |
<p>| UK | The UK government provides an information site for householders wanting to make 'green' consumer choices. The site is part of the National Grid for Learning and includes listings in different product categories. | <a href="http://www.greenchoices.org/">http://www.greenchoices.org/</a> |
| Demonstrations | USA | The Institute for Local Self Reliance has been providing resources that demonstrate how sustainability works for many years. Its website includes in-depth critique, carefully considered advice and documentation of programmes in action. | <a href="http://www.ilsr.org/">http://www.ilsr.org/</a> |
| Award systems | USA | California’s Integrated Waste Management Board runs the Waste Reduction Awards Program (WRAP) in recognition of excellence in the efforts of businesses to reduce non-hazardous wastes. Successful applicants are able to use the programme’s logo to promote themselves. | <a href="http://www.ciwmb.ca.gov/WRAP">http://www.ciwmb.ca.gov/WRAP</a> |
| Educational programmes | USA | There are many, many educational programmes that promote resource stewardship. The Ecology Center in Michigan is an example that includes teacher training programmes, curriculum development and | <a href="http://www.ecologycenter.org">http://www.ecologycenter.org</a> |</p>
<table>
<thead>
<tr>
<th>Centres of expertise</th>
<th>Denmark</th>
<th>The Waste Centre Denmark is an excellent example of a country specific resource designed to assist in the implementation of waste prevention and management. It contains information on literature, local authorities and contacts. (The English version provides only a summary.)</th>
<th><a href="http://www.wasteinfo.dk">http://www.wasteinfo.dk</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Networks, newsletters</td>
<td>International</td>
<td>The United Nations Development Programme has a Sustainable Development Networking Programme that contains tools to help people in developing countries share information and expertise.</td>
<td><a href="http://www.sdnp.undp.org">http://www.sdnp.undp.org</a></td>
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<td></td>
<td>Europe</td>
<td>The European Union’s European Environment Agency provides valuable information on resource-related activities in the Union, and provides links to a range of networks.</td>
<td><a href="http://www.eea.eu.int/">http://www.eea.eu.int/</a></td>
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<tr>
<td>Partnerships</td>
<td>International</td>
<td>The United Nations sponsored World Summit on Sustainable Development in Johannesburg, 2002, resulted in a partnership initiative that is on-going. The website acts as a gateway to in-depth information on change programmes and processes in a wider range of topics and countries.</td>
<td><a href="http://www.un.org/esa/sustdev/partnerships/list_partnerships.htm">http://www.un.org/esa/sustdev/partnerships/list_partnerships.htm</a></td>
</tr>
<tr>
<td>Databases</td>
<td>Chile</td>
<td>The RRojas Databank is produced by an NGO in Chile and includes a significant collection of up-to-date academic writing on sustainable development.</td>
<td><a href="http://www.rojasdatabase.org/dev1000.htm">http://www.rojasdatabase.org/dev1000.htm</a></td>
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<tr>
<td>Books, articles, videos</td>
<td></td>
<td>There are many websites that provide lists of books, articles, videos and other resources. This example is from the University of Michigan’s Centre for Sustainable Systems.</td>
<td><a href="http://css.snre.umich.edu/">http://css.snre.umich.edu/</a> <a href="http://www.umich.edu/~nppcpub/resources/">http://www.umich.edu/~nppcpub/resources/</a></td>
</tr>
<tr>
<td>R &amp; D programmes</td>
<td>Netherlands</td>
<td>The Urban Waste Expertise Program is a Dutch initiative that includes research &amp; pilot programmes, as well as partnerships between government and commerce, and focuses on small-scale technologies for integrated sustainable waste management.</td>
<td><a href="http://www.waste.nl/index.html">http://www.waste.nl/index.html</a></td>
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<tr>
<td>Organisation</td>
<td>Brief description</td>
<td>Contact details</td>
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<td>Anew New Zealand Trust</td>
<td>Independent non-partisan organisation based in Massey University that works towards a vision of a vibrant sustainable society with the highest quality of life in the world. The organisation is run by volunteers and trustees with support from the corporate sector. Anew New Zealand has developed a project called “Conditions for Sustainability” (CFS) based on The Natural Step principles (see below). The project is designed to develop a framework for sustainability using a set of social, economic and environmental conditions that can then be used to guide decision making and strategic planning throughout society at community, business and government levels.</td>
<td>Mail: c/- Massey University, Albany Campus P O Box 32 Albany Village Ph: 09 413-9146 Fax: 09 413-9211 Email: <a href="mailto:anewnz@anewnz.org.nz">anewnz@anewnz.org.nz</a> Website: <a href="http://www.anewnz.org.nz">www.anewnz.org.nz</a></td>
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<tr>
<td>BusinessCare National Trust</td>
<td>A non-profit organisation that works to facilitate environmentally, socially and economically sustainable business throughout NZ. BusinessCare works at the local and national levels. It promotes sustainable management and cleaner production practices to business through a nationwide network of local coordinators; provides “cleaner production” training for these coordinators and for businesses, and provides support and back-up advice with information and on-line access to databases and case studies.</td>
<td>Mail: c/- WastEMNZ P O Box 3180, Milford, Private Bag Ph: 09 486-6722 Fax: 09 486-3722 Email: <a href="mailto:carol@wasteminz.org">carol@wasteminz.org</a> Website: <a href="http://www.businesscare.org.nz">www.businesscare.org.nz</a></td>
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<tr>
<td>Christchurch Environment Centre</td>
<td>A non-profit, charitable incorporated society whose main aim is to provide environmental resources and services to individuals, school and community groups, and business. The centre sources environmental information and publications from different organisations, including government and non-government, local community groups and action groups.</td>
<td>Mail: P.O Box 2657, Christchurch Ph: 03 379-2357 Fax: 03 379-2250 Email: <a href="mailto:info@environment.org.nz">info@environment.org.nz</a> Website: <a href="http://www.environment.org.nz">www.environment.org.nz</a></td>
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<td>Ecologic Foundation</td>
<td>A &quot;citizen membership&quot; organisation with the mission of working for a future that is sustainable – ecologically, economically and ethically – through science, reason and dialogue. The Foundation works with businesses, governmental organisations and community groups, bringing expertise in policy analysis, economics, environmental strategy and triple-bottom-line reporting. The Foundation is also working together with collaborators to develop a longer-term research role, seeking to understand the systemic barriers to sustainability, and how these may transformed through institutional and policy reform.</td>
<td>Mail: PO Box 756 Nelson Ph: 03 548-3336 Fax: 03 548-7525 Email: <a href="mailto:guy@ecologic.org.nz">guy@ecologic.org.nz</a> Website: <a href="http://www.ecologic.org.nz">www.ecologic.org.nz</a></td>
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<td>Envirofunz</td>
<td>A database that holds searchable and detailed information about environmental and conservation project funding. It was commissioned by the Ministry for the Environment and is available to the public free of charge on the Envirofunz website. The database was developed and is maintained by the Funding Information Service (FIS), a not-for-profit organisation that collects and distributes information about funding for the voluntary sector and individuals.</td>
<td>Mail: PO Box 1521, Wellington Ph: 04 499-4090 Fax: 04 472-5367 Email: <a href="mailto:annette@fis.org.nz">annette@fis.org.nz</a> Website: <a href="http://www.fis.org.nz">www.fis.org.nz</a></td>
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<td>Environmental Education for Resource Sustainability Trust (EERST)</td>
<td>Operates throughout the Bay of Plenty with four staff who assist businesses to minimise waste, reduce, re-use and recycle resources, prevent pollution, gain efficiencies, reduce costs and improve their image with a cleaner greener process.</td>
<td>Mail: P O Box 2523, Tauranga Ph: 07 552-4559 Email: <a href="mailto:paulainglis@ihug.co.nz">paulainglis@ihug.co.nz</a></td>
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<tr>
<td>Organisation</td>
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<td>Environmental Defence Society (EDS)</td>
<td>An environmental advocacy organisation based in New Zealand. Its members are professionals who participate voluntarily to advocate for better environmental outcomes. There is also a community of people who support the society financially through their memberships. EDS identifies issues to pursue based on their national impact, or potential to set precedents or policy. It focuses mainly in the areas of landscape, biodiversity and pollution. Its activities include: promotion of policy development; advocacy; involvement in planning cases; litigation, and the provision of advice and support for other groups and individuals when they are consistent with EDS's strategic objectives. EDS's website offers a &quot;Business Good Environmental Practice Guide&quot;.</td>
<td>Mail: P O Box 95 152, Swanson, Auckland 1008, New Zealand  Ph: 09 810-9594  Fax: 09 810-9120  Email: <a href="mailto:manager@eds.org.nz">manager@eds.org.nz</a>  Website: <a href="http://www.eds.org.nz">www.eds.org.nz</a></td>
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<td>Nelson Environment Centre (NEC)</td>
<td>Works within the Nelson region to promote environmental awareness and facilitate environmentally sustainable initiatives. NEC operates the Recycling Centre at Pascoe St, and is currently working with the Kahurangi Trust, as well as Nelson City and Tasman District Councils, to re-establish kerbside recycling in urban areas. In addition: the Centre employs two part-time environmental educators; has a caravan that operates as a mobile environment centre, and has a website for news, events calendar, newsletter, discussion lists and information about the recycling centre.</td>
<td>Mail: 3 Halifax Street (Kahurangi Centre), Nelson  Ph/fax: 03 545 9176  Email: <a href="mailto:nec@tasman.net">nec@tasman.net</a>  Website: <a href="http://www.nec.org.nz">www.nec.org.nz</a></td>
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<tr>
<td>New Zealand Business Council for Sustainable Development (NZBCSD)</td>
<td>An incorporated society comprised of approximately 40 business members. This society focuses on sustainable development, promoting &quot;eco-efficiency&quot;, innovation and responsible entrepreneurship. NZBCSD provides business leadership, demonstrating best practice, policy development and global outreach.</td>
<td>Mail: P O Box 1665, Shortland Street, Auckland  Ph: 09 488-7404  Fax: 09 488-7405  Email: <a href="mailto:office@nzbcsd.org.nz">office@nzbcsd.org.nz</a>  Website: <a href="http://www.nzbcsd.org.nz">www.nzbcsd.org.nz</a></td>
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<td>New Zealand Ecolabelling Trust</td>
<td>The official environmental labelling programme for New Zealand, and is a member of the Global Eco-labelling Network (GEN). While the organisation operates independently from the government, the &quot;Environmental Choice&quot; trademark is government owned and endorsed. Environmental Choice receives direct and indirect funding from the government.</td>
<td>Mail: PO Box 56 533, Dominion Road, Mt Eden, Auckland, 1003  Ph: 09 845-3330  Fax: 09 845-3331  Email: <a href="mailto:info@enviro-choice.org.nz">info@enviro-choice.org.nz</a>  Website: <a href="http://www.enviro-choice.org.nz">www.enviro-choice.org.nz</a></td>
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<td>New Zealand Landcare Trust</td>
<td>An independent body overseen by seven trustee organisations. These are: Federated Farmers, Rural Women NZ, Fish &amp; Game, Federation of Maori Authorities, Ecologic Foundation, Royal NZ Forest &amp; Bird, and Federated Mountain Clubs of NZ. The Trust works with community groups to encourage sustainable land management and biodiversity, and its mission is to achieve sustainable land management through community involvement. Focused mainly on the rural sector and primary industry, the Trust's coordinators facilitate &quot;landcare&quot; groups, and help them set the agenda, establish action plans, and source funding and resources. The Trust also provides training, research, information and funding for specific projects through the Transpower Landcare Trust Grants Programme.</td>
<td>Mail: PO Box 16-269, Christchurch  Ph: 03 349-2630  Fax: 03 349-2640  Email: <a href="mailto:info@landcare.org.nz">info@landcare.org.nz</a>  Website: <a href="http://www.landcare.org.nz">www.landcare.org.nz</a></td>
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<td>New Zealand Recovered Materials Enterprise Trust (RMET)</td>
<td>A charitable trust that has been established to provide financial and technical support to businesses that reduce waste to landfill. The primary vehicle of RMET is the RecyLoans Fund, established to provide financing alternatives for fledgling business initiatives with objectives consistent with the Trust’s primary goal.</td>
<td>Mail: PO Box 33 1695, Takapuna, Auckland  Ph: 09 486-4066  Fax: 09 488-9410  Email: <a href="mailto:recyloans@pl.net">recyloans@pl.net</a></td>
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<td>Packaging Council of New Zealand Incorporated (PCNZ)</td>
<td>Aims to ensure that issues related to packaging usage and waste are addressed voluntarily by industry. PCNZ represents various sectors of the packaged goods industry including manufacturers, fillers, retailers and consumers. It also works with government, industry and the community. The Council’s Environmental Packaging Awards recognise and reward those who contribute to improve the environmental performance of packaging, packaging systems or the operation of their manufacturing facilities. The Council also offers an educational resource called ‘PAC-IT’, that is aimed primarily at schools (years 1-10), but is considered suitable for wider education in both the tertiary and industry sectors.</td>
<td>Mail: P O Box 58899, Greenmount  Ph: 09 262-4044  Fax: 09 262-4111  Email: <a href="mailto:pac.nz@packaging.org.nz">pac.nz@packaging.org.nz</a>  Website: <a href="http://www.packaging.org.nz">www.packaging.org.nz</a></td>
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<tr>
<td>Plastics New Zealand Incorporated (PNZ)</td>
<td>Offers advice and information on plastics and the environment in a number of areas including: plastics recycling, energy conservation, education resources, standards, government/governance, labelling and management.</td>
<td>Mail: P O Box 76 378, Manukau City  Ph: 09 262-3773 ext 104  Fax: 09 262-3850  Website: <a href="http://www.plastics.org.nz">www.plastics.org.nz</a></td>
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<tr>
<td>Recycling Operators of New Zealand (RONZ)</td>
<td>An organisation that represents recycling service providers, operators and educators in the recovered materials and recycling industry. It lobbies and promotes recycling, resource efficiency and waste minimisation in New Zealand. Its members include businesses, organisations, local and regional councils, educators and individuals. Some of the services it offers to members include: advocacy and lobbying of government and industry, education and information through a website and a newsletter, workshops, networking and promotion, and research and development.</td>
<td>Mail: PO Box 33 183, Takapuna, Auckland  Ph: 09 488-9449  Fax: 09 488-9410  Email: <a href="mailto:karuna@ronz.org.nz">karuna@ronz.org.nz</a>  Website: <a href="http://www.ronz.org.nz">www.ronz.org.nz</a></td>
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<td>Redesigning Resources (RR)</td>
<td>A business leadership programme, begun with the inaugural “Redesigning Resources” conference in June 2000. Participating organisations are redesigning their business models and practice based on the principles of Hawken’s “Natural Capitalism” (1991). “The Redesigning Resources Story – 8 Companies Creating New Value” is available through MfE, the organisation or its website. RR includes a bi-annual National Art Award in secondary materials.</td>
<td>Mail: PO Box 578, Christchurch  Ph: 021 43 44 00  Email: <a href="mailto:mark@tippingpoint.co.nz">mark@tippingpoint.co.nz</a>  Website: <a href="http://www.redesigningresources.org">www.redesigningresources.org</a></td>
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<tr>
<td>Sustainable Business Network</td>
<td>The result of a merger between the Auckland Environmental Business Network (AEBN formed in 1994) and NZ Businesses for Social Responsibility (formed in 1998), that took place in October 2002. The Sustainable Business Network is a membership organisation with regional offices in five centres across New Zealand and a national office based in Auckland.</td>
<td>Mail: PO Box 147 263, Ponsonby, Auckland  Ph: 920 2400  Fax: 360-7102  Email: <a href="mailto:office@sustainable.org.nz">office@sustainable.org.nz</a></td>
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The network has taken on the challenge of making sustainable practice mainstream; to see business flourish through sustainable practice and; to design its services, resources and activities to suit the needs of small and medium sized businesses.

<table>
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<tr>
<th>The Natural Step Environment Foundation Aotearoa New Zealand (TNS)</th>
<th>website: <a href="http://www.sustainable.org.nz">www.sustainable.org.nz</a></th>
</tr>
</thead>
</table>
| A national branch of an international non-profit sustainability organisation, The Natural Step, based in Sweden. TNS works predominantly with businesses and government helping integrate sustainability into core strategy and operations. One of the key characteristics of TNS is the development of tools to assess sustainability such as 'The Natural Step Framework'. TNS utilises a 'systems approach', recognising the interconnectedness between different parts of the system and that they affect one another. It advocates the use of 'backcasting' from principles for a sustainable future. TNS provides training and consultancy with respect to the TNS Framework and its implementation. TNS has three main current projects, the 'Pathfinder Programme' which consists of 8 large - medium businesses applying TNS Framework, a small business programme working with 9 companies, and, an education course, run by The Open Polytechnic. | Mail: P O Box 69, Lincoln 8152  
Ph: 03 325-6711  
Fax: 03 325-2418  
Email: natstep@naturalstep.org.nz  
Website: www.naturalstep.org.nz |

<table>
<thead>
<tr>
<th>The Waste Exchange</th>
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| A web-based database that gathers information about resources offered and wanted by different businesses and individuals. This database provides search tools to seek for materials by type and region. Businesses can register for free as users to access detailed information. | Ph: 0800 NO THROW (0800 668 4769)  
Email: pippa@nothrow.co.nz  
Website: www.nothrow.co.nz |

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<thead>
<tr>
<th>Waste Management Institute of New Zealand Incorporated (WasteMINZ)</th>
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| A non-profit organisation that promotes sustainable waste management practices. Its main role is to provide a forum for presentation and dissemination of information and to act as a facilitator for the waste management industry in NZ (WasteMINZ, 2002). WasteMINZ provides an annual conference, conducts workshops and seminars, publishes the "Waste Awareness" newsletter and also offers grants for its members. The organisation has 300 members who represent the public, private and non-profit sectors. In 2001, WasteMINZ developed "lifeafterwaste", an initiative that aims to encourage a cyclical approach to waste. Lifeafterwaste aims at closing the loop on waste and proposes a shift from waste management to waste avoidance. | Mail: PO Box 31 580, Milford, Auckland, New Zealand  
Phone 09 486-6722  
Fax 09 486-3722  
Email: carole@wasteminz.org.nz  
wasteminz@xtra.co.nz,  
Website: www.wasteminz.org.nz |

<table>
<thead>
<tr>
<th>Waste Not Auckland Charitable Trust</th>
<th></th>
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</table>
| Operates the Waste Not consultancy. Waste Not specialises in waste and resource efficiency, and offers waste minimisation services to its clients. Some of the projects in which | Mail: PO Box 33 1410, Takapuna, Auckland  
Ph: 09 486-3635 |

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1 Backcasting is the term TNS uses to describe "the process of planning from a future vision using [TNS] principles".
<table>
<thead>
<tr>
<th>Organisation</th>
<th>Description</th>
<th>Contact Details</th>
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</table>
| Waste Not                            | Waste Not has participated include: a study on the impacts of recycling businesses in a local economy; an audit of hospital clinical waste; development of an organic waste recovery strategy for a local council; investigation work on contaminated sites, and the development of education and training material. | Fax: 09 486-5764  
Email: wastenot@xtra.co.nz  
Website: www.wastenot.co.nz |
| WasteBusters Trust                   | Deliver a “Business Waste Minimisation & Waste Exchange Programme” in the Ashburton and Selwyn Districts under contract to Environment Canterbury. This is a human resources programme whereby trained staff visit local businesses to help them to reduce waste and to find markets for materials that are currently landfilled or burnt. The programme is based on the “pollution prevention” approach, and emphasises reduction, re-use and recycling as priorities over disposal. It also holds annual “Clean Green Business Awards” to recognise and reward businesses that are reducing waste by using materials more efficiently, reducing energy consumption and using less water. | Mail: PO Box 323, Ashburton,  
Ph: 03 308-9998  
Fax: 03 308-9989  
Email: mcwastebusters@clear.net.nz  
Website: http://wastebusters.orcon.net.nz |
| Zero Waste New Zealand Trust (Zero Waste) | An organisation dedicated to the promotion of “zero waste principles” among all sectors of NZ society, with specific focus on solid waste. Taking a “whole system” approach, Zero Waste proposes a redesign of the industrial system allowing for products to be re-used, repaired and recycled back into nature or the marketplace. The organisation’s main goal is to achieve “zero waste” at a national level. This goal is pursued by supporting the Zero Waste Network (including “Zero Waste Councils”, community organisations, businesses, educational facilities and recyclers). Support takes the form of: advocacy and policy development; networking and technology transfer, and funding. Zero Waste distributes information to the Zero Waste Network via a monthly newsletter and its website. | Mail: PO Box 33 1695, Takapuna, Auckland, New Zealand  
Ph: 09 486 0734  
Fax: 09 489 3232  
Email: mailbox@zerowaste.co.nz  
Website: www.zerowaste.co.nz |
Index

‘100% Pure New Zealand’ 137

A
access to wetlands 47
Action Plan for Buildings and Appliances 110
Adventure South 141
Agenda 21 91
air quality 56
AMF see anhydrous milkfat
Anew New Zealand Trust 18
anhydrous milkfat production 38
Animal Product Regulations (2000) 69
Animal Products Act (1999) 69, 70, 218
animal welfare 72
animal welfare management package 36
annual harvest, forestry 75
annual mass balance 195
APEC Tourism Working Group 146
APEC/PATA Code 146, 147
Asian tourists 140
Association of Plastics Manufacturers in Europe 180
Auckland City Council 228
Auckland Regional Council 17, 109
Auctioneers Act 166
Australian Council of Recyclers 184
Australian Packaging Covenant 184
AUT Sports & Recreation Centre 114

B
baghouses 40
Beaumont Quarter 112
beef meats 51, 52
behavioural change 13
Better Building Code 109
bio-energy 79
Bio-energy Association of New Zealand 93
biomass boilers 80
Blows Building 113
BRANZ 105, 109
BSE 70
Building Code see New Zealand Building Code
building consent values 99
Business Council for Sustainable Development see New Zealand Business Council for Sustainable Development
BusinessCare National Trust 17, 18, 190, 199, 231
butter manufacturing 37
butter production 37
buttermilk 37

C
CAE RS:WM project see Resource Stewardship: Waste Minimisation project
CAE see Centre for Advanced Engineering
Canterbury Environment Centre 18
capacity building 224
carbon tax 14, 71
Carters 158
casein manufacture 41
caseinate manufacture 41
caseinates 42
Centre for Advanced Engineering (CAE) 3, 23, 25
change
actions 9
principle 9
cheese manufacture 39
chemical
pulp 79
scorecard 14
chemicals, reuse and recycling 94
chlorine 79
Christchurch City Council 17, 109, 122, 164
cleaner production 25
Cleaner Production Guidelines 16
Cleanfill Guidelines 121
clean-green marketing strategy 48
closing the loop 7
CO₂ emissions 137, 208
coastline 100
Code for Sustainable Tourism 146
Code of Good Practice for Energy Efficiency of Houses 110
Code of Practice for the Safe Use of timber Preservatives and Antisapstain Chemicals 91, 218
coloured rubbish bags 192
Commerce Act 166
community expectations 48
Conservation and Sustainable Management of Temperate and Boreal Forests 92
construction energy 101
costumer goods, availability 153
costumer rights 166
consumerism responses 169
Consumers Guarantees Act 166, 218
contaminated sites 14
customer requirements 48

D

dairy
exports, value of 35
farming 33
products 35
Dairy Industry Environmental and Animal Welfare Policies 47, 218
Dairy Industry Waste Minimisation project 46
demographic profile 105
demolition industry 103
demolition waste 106
Department of Conservation 147
Design Briefs for Energy Efficient Commercial Buildings 110
Design for the Sun 122
Designing Comfortable Homes 110
Destination New Zealand 137, 150
Developers' Design Guide 108
diafiltration 43
Dioxin Action Plan 186
discharge consents 80
dispersed air flotation 85
District Tourism Organisations 145
Dolphin Encounter 144
domestic buildings 103
domestic tourism 133, 137
day trips 134
expenditure 135
Douglas Fir 75
drivers for change 29
dropped meat programme 65
dust emissions 93
Dutch tourists 140

E

economic drivers 219, 221
EECA see Energy Efficiency and Conservation Authority
effluent 79
effluent treatment, forestry 85
Electricity Corporation of New Zealand 25
Emergency Planning and Community Right-to-Know Act (1986) 13
employment
forest industry 76
meat processing 54
energy audits 62
Energy Efficiency and Conservation Act (2001)
10, 16, 93, 110, 118, 158, 167, 205
Energy Efficiency and Conservation Authority
10, 231
Energy Efficiency and Conservation Authority Act (2000) 4
Energy Efficiency and Conservation Strategy
7, 10, 11, 13, 93
Energy Efficiency Regulations 118, 158, 165
energy
labelling 158
recovery 181
use, farming 35
use, built environment 100, 101, 103, 110, 115, 121
engineered landfills 3
Enviro-Mark NZ 160
Environment 2010 Strategy 91
Environment Bay of Plenty 91
Environment Waikato 183
environmental and animal welfare
guidelines 35
Environmental Defense Society 18
Environmental Farm Awards 71
environmental image 149
environmental management systems 47, 91
Environmental Performance Indicator 88
environmental purchasing policies 72
ERMA New Zealand 195
estuaries 100
Eucalyptus 75
European Directive for Waste 181
European tourists 140
export earnings, meat industry 51
exports, forestry 75
Extended Producer Responsibility 8, 174, 187
external integration 224

F

Fair Trading Act 166
farm
dairy effluent 47
distribution 55
quality assurance programmes 66
sector 34
meat 54
Farm Environmental Award scheme 57, 58, 72
fat recovery systems 37, 38
fertiliser usage 47
fibre recovery, forestry 85, 90
fibre, reuse and recycling 94
fibreboard 78
Index

financial instruments 169
Fletcher Challenge 105
floodplains 100
fluid bed dryers 42
Fonterra Research Centre 46, 47
food retailing 165
Forest Industries Training 92
Forest Research 89, 105
Forest Stewardship Council 92, 160
forestry industry 75, 76
Fraser High School 183
Friends of the Earth New Zealand 18
fugitive emissions 93
full-cost pricing 8

G
gaseous emissions 80
GDP, retail sector contribution 154
German tourists 140
Good Solutions Guide 108
Green Globe 21 benchmarking 139, 141, 144,
146, 147, 150, 151
Green Project farm management system 57, 72
‘green’ retail businesses 158
Green Retail project 162
greenhouse gas emissions 212
Greenpeace New Zealand 18, 20, 181

H
Hamilton City Council 109
Hamilton Sealed Air site 183
harvesting, forestry 77, 80
Hazardous Substances and New Organisms Act
(1996) 190, 218
hazardous waste 3
Health Act (1956) 118, 129
Health and Safety in Employment Act (1992)
69, 91, 218
Heat Loss Reduction in Houses 110
holiday/leisure travel 134
human waste 47

I
imported goods 155, 157
Industry Guide to Zero Waste 16
in-forest residues 79
instruments and tools 4
internal integration 224
international visitors 132
international visitor spending 132
ISO 14000 47
ISO 14001 68, 72

ISO 9001 68

K
Kaikoura Winery 139
Kaitia Community Business and Environment
Centre 18
kaitiaki 4, 5
kaitiakitanga 4, 5, 8, 140, 143, 147, 150
kerb-side recycling 66
Kraft pulp and paper machine 84
Kraft Recovery process 83
Kyoto Protocol 4, 14, 15, 62, 71, 76, 91, 119, 122,
146, 208, 218

L
lactose 45
lactose powder 43
laminated veneer lumber 77
landfills 79
disposal, forestry 80
leachate 80
waste 100
Landfill Full Cost Accounting Guide 121
Landfill Guidelines 3
land-use competition 53
Lay-by-Sales Act 166
legislation, retail sector 153
lifeafterwaste programme 7, 9, 13, 205
life-cycle assessments 75
life-cycle principle 8
lifestyle blocks 53
livestock distribution 55
live human waste 56
logs 77
production 75
transport 87
low density polyethylene 176
lumber 77

M
maintenance energy 101
manaakitanga 147, 150
Management of Hazardous Waste 3
marginal agricultural land 75
market focused 36
Maruia Society 18
Massey University 178
material waste 100, 103, 109, 113, 118, 120, 123
MDF 78
MDF production 83
Meat Act 69
meat
exports 51, 65
industry treatment systems 65
packaging technology 64
production 51, 52, 53
sector governance 69
meat processing
operations 60, 61
plants 52
plant distribution 55
waste minimisation 66, 67
water use 63
mechanical pulp 78
mechanical vapour recompression 39
merchandise imports 155
milk powder manufacture 38
milk products 33
Minimum Energy Performance Standards 159
Minister of Energy 10
Ministry for the Environment (MfE) 3, 7, 25, 91, 120, 121, 129, 147, 174, 177, 180, 186, 190, 191, 199, 231, 232
Ministry for the Environment Landfill Guidelines 91
Ministry of Energy 7, 231
Ministry of Tourism 145, 147
Montreal Process 92
multiple-effect evaporation 39

N
nano-filtration 44
National Energy Efficiency and Conservation Strategy 110, 119, 205, 218, 233
natural emissions 35
Natural Step Environment Foundation 18
Nelson Environment Centre 18
new dwellings 99
New Zealand
Building Act (1991) 118, 121, 129
Building Code 90, 106, 121, 218
Business Council for Sustainable Development 16, 18
Code of Practice for Packaging of Goods 184, 191
Dairy Research Institute 47
economy 34
Forest Accord 92
Forest Code of Practice 92, 218
Packaging Accord 175, 179, 185, 191
Packaging Code of Practice 218
Packaging Council 18, 178, 184, 191, 197
Packaging Council Environmental Awards 187
Plastics Sustainability Initiative 17
Recovered Materials Enterprise Trust 18
Retailers Association 157, 165
Tourism Board 138
Tourism Strategy 140, 142, 143, 146, 147, 218
Trade and Enterprise 190
Waste Strategy 3, 7, 8, 9, 13, 15, 91, 92, 118, 120, 124, 179, 185, 187, 197, 205, 218, 225, 233
noise issues 93
non-destructive testing 91
non-residential dwellings 99
North American tourists 140

O
Occupational Safety and Health 91
on-farm environmental management system 36
on-farm quality assurance 36
operational energy 101
Our Waste: Our Responsibility 3, 4, 17, 20

P
packaging 156, 160
Packaging Council of New Zealand see New Zealand Packaging Council
panel manufacture 77
paper 79
Parliamentary Commissioner for the Environment 232
particleboard 78
Passive Solar Design in New Zealand Homes 122
pastoral-based agriculture 56
Pawnbrokers Act 166
permeate processing 43
Pine Manufacturers Association 92
Pinus Radiata 75
plant efficiency, meat 62
plantation forest area 76
plantation forests 75
Plastics New Zealand 18, 173 - 178, 182, 185, 187, 189, 193, 194, 196, 197
Plastics New Zealand Sustainability Initiative 199
plywood 77
political drivers 219, 220
pollution prevention 25
Pollution Prevention Act (1990) 13
polypropylene 176
poultry meat producers 52
precautionary principle 8
primary screening 65
primary treatment 65
process mapping 162, 163
processing sector 34
processing, meat 54
profit improvement programme 66, 72
public relations 71
pulp 78
pulp and paper 83
pulp mill effluent 80

R
REBRI 109
reconstituted panel products 78
Recovered Materials Foundation 189
recycled paper 79
recycled timber 158
recycling 169
Recycling Operators of New Zealand (RONZ) 184, 189, 196, 199
Redesigning Resources 18
refrigeration heat recovery systems 64
Regional Tourism Organisations 145
regulatory requirements 48
remanufacturing 79, 84
rennet casein production 42
Residential Design Guide 108
residue production, forestry 80
residue recovery 94
residues 47, 81, 83
resource inputs, meat processing 54
Resource Stewardship: Waste Minimisation project 17, 23, 28, 205, 231
resource use, retail sector 155
retail
  business distribution 156
  employment distribution 156
  goods 158
  sector employment 154
  sector governance 165
  sector energy savings 161
  sector legislative drivers for change 167
  sector transport 159
  spending 154
  supply chain 155, 157
reverse osmosis 39, 40, 43, 44
RMA see Resource Management Act (1991)
Road Transport Association 87
Rotorua District Council 91
Royal New Zealand Forest and Bird 18
RS:WM project see Resource Stewardship: Waste Minimisation project

S
Sales of Goods Act 166
sawmilling industry 89
sawmills 77, 83
Sealed Air Corporation 183
Second Hand Dealers Act 166
secondary treatment 65
sector challenges 10
Seoul Declaration 146, 147
separator desludges 37
sheep meats 51, 52
shop trading laws 153
Silver Beech 92
single use 168
socio-cultural drivers 219, 221
soil quality 56
solid waste 80
stack emissions 93
standardisation 224
Statistics New Zealand 190
steam, reuse and recycling 94
stock 58
Subdivision for People and the Environment 108
superheated steam dryer 62
Sustainable Business Network 18, 199
sustainable farming 66, 72
sustainable farming practices 557
Sustainable Home Guidelines 109
sustainable land management practices 57
sustainable land use 56
Sustainable Management Fund 3, 185, 231
Sustainable New Zealand 3
sustainable tourism development 146

T
Tapu Te Ranga Marae 112
Target Zero 16, 25, 231
technological drivers 220, 221
texturisers 45
The Body Shop 158
The Warehouse 158, 160, 167
The Waste Exchange 18
The Way Forward: Forestry and the RMA 91
thermal recompression 39