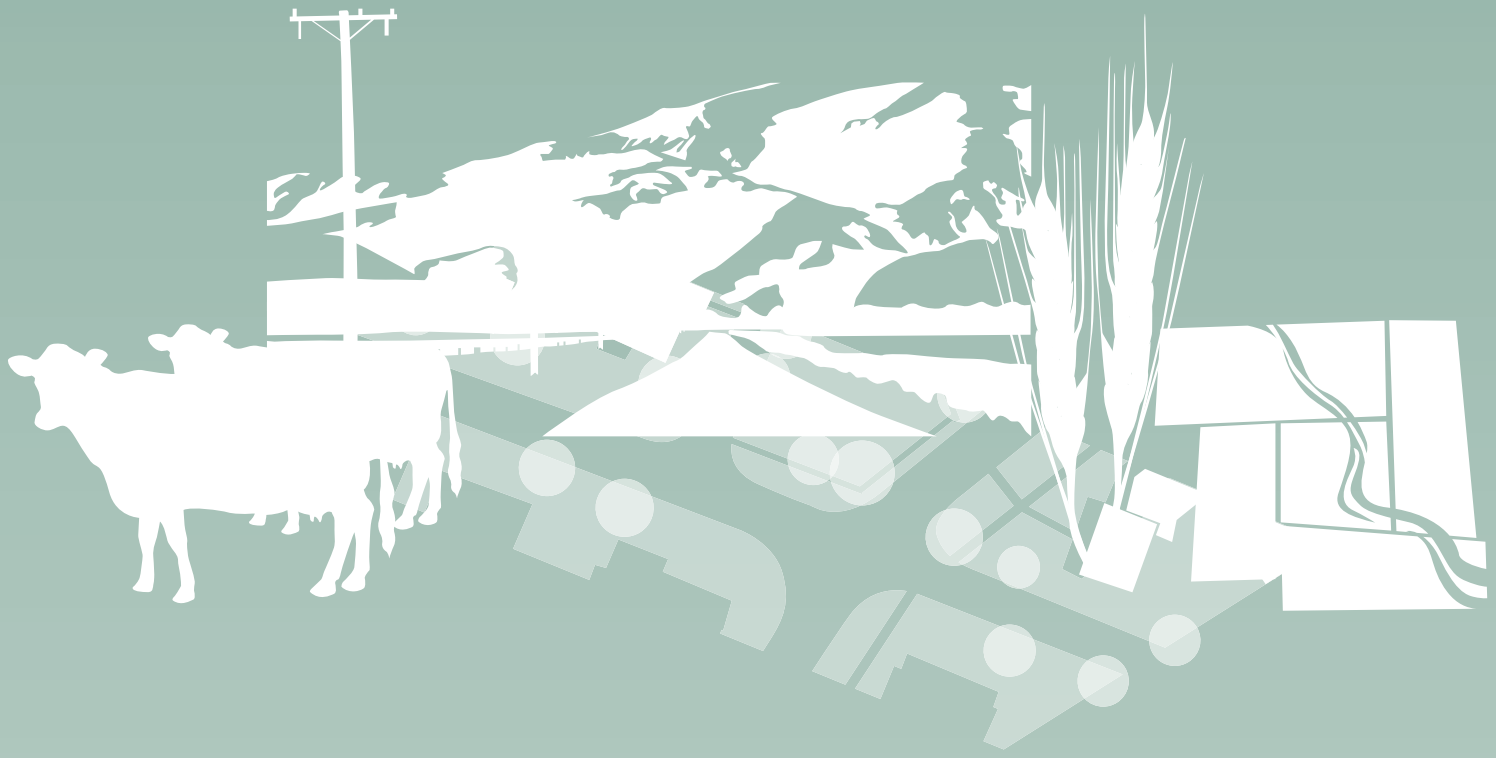
C09067



RESOURCE EFFICIENCY IN NEW ZEALAND

ASSESSMENT OF BUSINESS SECTORS

June 2010

Boffa Miskell

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Prepared for

MINISTRY FOR THE ENVIRONMENT

by

Boffa Miskell Limited

June 2010

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EXECUTIVE SUMMARY

The Ministry for the Environment's resource efficiency policy work aims to foster improved productivity while reducing the negative environmental impacts of the production and consumption of goods and services. To be able to effectively target policy in this area, the Ministry needs to build a robust evidence base on resource use, efficiency, and the potential for efficiency improvements. The Ministry's intention is to build this evidence base by implementing a framework for measuring the resource efficiency of key New Zealand business sectors, based on common, or well-tested, approaches from overseas.

This report builds on Phase 1 findings and presents data gathered on environmental and economic indicators of selected business sectors in New Zealand to support the Ministry's work. A resource efficiency framework is proposed which relies on data inputs for priority sectors, using economic and physical indicators. This report identifies the existing available data and current gaps. Resource efficiency ratios are calculated where there is data for at least one environmental indicator and one economic indicator for a single sector.

Most data identified in this study is directly allocated to an ANZSIC code, or could be interpreted by ANZSIC code for use in this project. The level of ANZSIC code varies between data sets and each data set does not necessarily contain data for all sectors at the particular ANZSIC code level.

In discussion with staff at the Ministry, Statistics New Zealand, and the Ministry for Economic Development during the project it is well understood that there is very little data at a national level regularly reported for environmental indicators, and even less data reported by industry sector. Attempts have been made in the past to collect this type of data, particularly for material / resource flow studies, but no agency has attempted an ongoing measurement and reporting process.

National data sets, official statistics, and research based on industry sectors' resource use or environmental footprint are more reliable, relevant, representative, and repeatable compared with individual company data. This is primarily due to the difficulty with using data from one entity to represent an entire sector, and not being able to compare case study data with national data sets. Data from case studies and published research is less adequate due to issues relating to sector representativeness, repeatability, and reliability of the case study or research. Data collection, management, and interpretation at the business or research level are less consistent and the risk of inaccurate results increases dramatically. However, a number of significant gaps remain in the national data sets.

The limited range of environmental statistics available for NZ business is a continuing concern and obstacle to quantitative sustainability analysis. To apply the proposed resource efficiency framework to New Zealand effectively, gaps in data collection and management will need to be resolved. On the whole, businesses make little data publically available and there is little emphasis on capturing this type of information in corporate reporting, other than for economic elements.

Key issues which need to be resolved to be able to effectively apply the resource efficiency framework:

- Expansion of type of data on priority sectors and economic and environmental indicators collected at a national level, and

- Responsibility for ongoing management of data and its collection at a national level.

Once these matters are resolved, it will be feasible to apply the resource efficiency ratio to selected sectors.

A series of recommendations is provided addressing:

- Data gaps
- Opportunities for Expanding National Data Sets, and
- Refinement of Indicators

KEY RECOMMENDATIONS

The following recommendations are made in this report. Each of these matters is discussed in further detail in Sections 5 to 7 of this report.

Addressing Data Gaps

- It is recommended that the following issues are resolved to be able to effectively apply the resource efficiency ratio framework:
  - Expansion of the type of data collected at a national level;
  - Responsibility for ongoing management of data and its collection at a national level;
  - Accessibility to existing data to support national collection and use of data.

Opportunities for Expanding National Data Sets

- It is recommended that the Environmental Domain Plan process be used to assist with prioritisation and coordination of the data requirements for the resource efficiency framework, in collaboration with other Ministry and government departments and agencies

Refinement of Environmental Indicators

- It is recommended that the environmental indicators are reduced in number to focus on the key sustainability issues facing the NZ economy, and to reduce the data requirements for the framework.
- These key sustainability issues are considered to be: climate change and freshwater. The environmental indicators should be amended as follows:
  - *Water use (m^3):* Retain current definition
  - *GHG emissions (CO_2e*): Retain current definition
- The framework should also allow sufficient flexibility to refine indicators in the face of changing environmental and economic issues.
- In the long term supplementary indicators could be developed for example, material inputs.

Refinement of Economic Indicators

- It is recommended that the GDP and FTE indicators be retained, while the export indicator be removed. It is also recommended that a productive output (tonnes of product etc) for industry sectors at Level 3 and below be included to allow inter-sector comparisons.

1.0 Introduction

The Ministry for the Environment (the Ministry) aims to achieve high environmental standards for New Zealand, while sustaining and enhancing social and economic development.

The overall aim of the Ministry's resource efficiency policy work is to foster improved productivity while reducing the negative environmental impacts of the production and consumption of goods and services.

To be able to effectively target policy in this area, the Ministry needs to build a robust evidence base on resource use, efficiency, and the potential for efficiency improvements. The Ministry has sought to build this evidence base by implementing a framework for measuring the resource efficiency of key New Zealand business sectors, based on common, or well-tested, approaches from overseas.

The aim of this report is to: present data gathered on environmental and economic indicators from selected business sectors in New Zealand, produce an inventory of resource efficiency factors for each sector (a ratio of environmental to economic indicators), and provide an analysis of data findings. The selected indicators and the resource efficiency ratio framework were developed in an earlier report[1].

A comprehensive data search of existing sources of information including, but not limited to, central government agencies, Statistics New Zealand, local government, relevant industry groups, and Crown Research Institutes was undertaken. Secondary sources and cases studies were also accessed and analysed via the internet, academic papers (journals), company annual reports, other sources of published data and personal communication with research organisations, government agencies, interest groups, sector programmes, and sector groups. This process identified current data gaps and potential alternative sources or approaches to data collection.

[1] *Resource Efficiency in New Zealand: Framework for Determining Resource Efficiency*, Prepared for Ministry for the Environment by Boffa Miskell Limited, December 2009.

2.0 Background to the Draft Framework

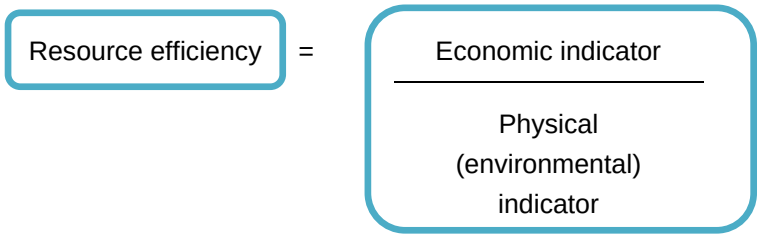
A draft resource efficiency framework was provided in earlier phases of this study as part of the Ministry's broader resource efficiency aims. The key outputs from earlier work include a framework for measuring and reporting resource efficiency, the collation of existing data, and the reporting of results of selected resource efficiency outputs for the following priority sectors (as selected by the Ministry):

- Agriculture;
- Finance, insurance and business services;
- Manufacturing (excluding food and beverage);
- Food and beverage manufacturing including agricultural products;
- Retail;
- Tourism; and
- Construction.

2.1 Draft Resource Efficiency Framework

Two previous reports (*Resource Efficiency in New Zealand: Literature Review* and *Resource Efficiency in New Zealand: Framework for Determining Resource Efficiency*) provide (i) an analysis of international approaches and justification for key components of the framework outlined in this report and (ii) a draft resource efficiency framework developed from that research. This report provides the results from testing the framework via further data collection and analysis. The proposed resource efficiency measuring framework is as follows:

Figure 1: Draft resource efficiency framework



The resource efficiency ratio approach is well documented and applied in many countries. International approaches have been in place since the early 1990s and New Zealand is likely to benefit from those experiences and current developments in resource efficiency; these matters are discussed in further detail in the literature review report.

The proposed resource efficiency framework relies on data inputs for each of the sectors, for each of the economic and physical indicators. The purpose of this phase of the study was to identify the

existing available data, calculate resource efficiency ratios where possible, and to identify and discuss the gaps.

2.2 Industry Sector Definitions

The Ministry selected seven priority sectors as listed above. In order to maintain consistency with government statistics, each of the priority sectors is defined in accordance with the Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006.

The ANZSIC was developed by Statistics New Zealand and the Australian Bureau of Statistics in the 1990s to reflect the structure of Australian and New Zealand industries and improve the comparability with other countries' statistics[2]. ANZSIC 2006 also aligns, as far as practicable, with the *International Standard Industrial Classification of All Economic Activities* (Revision 4) and the *North American Industry Classification System* at the subdivision level.

ANZSIC 2006 is a hierarchical classification with four levels: divisions (the broadest level), subdivisions, groups, and classes (the finest level). The divisional level provides a limited number of categories that show a broad picture of a sector. The subdivision, group, and class levels provide increasingly detailed dissections of these categories.

The hierarchical structure of the ANZSIC is illustrated below (adapted from Statistics New Zealand www.stats.govt.nz):

Level 1 (Division)	C	Manufacturing
Level 2 (Subdivision)	C11	Food product manufacturing
Level 3 (Group)	C111	Meat and meat product manufacturing
Level 4 (Class)	C1111	Meat processing

Table 1 lists each of the priority sectors, and the ANZSIC 2006 sector definition used for this study.

Table 1: Selected ANZSIC 2006 Codes for Resource Efficiency Framework Inventory

Priority Sector	Proposed Primary ANZSIC Code and Level(s)	Sector Definition / Inclusions (including next level ANZSIC Code)
Agriculture	Level 2: *A01-Agriculture*	Includes all land-based agriculture and horticulture. Level 3 sectors and below: *A011 Nursery and Floriculture Production* *A012 Mushroom and Vegetable Growing* *A013 Fruit and Tree Nut Growing*

[2] http://www.stats.govt.nz/reports/economy/introduction-to-anzsic-06.aspx. 12 May 2010.

Priority Sector	Proposed Primary ANZSIC Code and Level(s)	Sector Definition / Inclusions (including next level ANZSIC Code)
		A014 Sheep, Beef Cattle and Grain Farming *A015 Other Crop Growing* *A016 Dairy Cattle Farming* *A017 Poultry Farming* *A018 Deer Farming* *A019 Other Livestock Farming* Separate reporting was proposed where possible on: *A02 Aquaculture* *A03 Forestry and Logging*
Finance, insurance, and business services	Office-based industries. Level 1 combined: *K Financial and Insurance Services* *M Professional, scientific and technical services* *N Administrative and Support Services*	This includes Level 2 sectors and below: *K62 Finance* *K63 Insurance and Superannuation Funds* *K64 Auxiliary Finance and Insurance Services* *M69 Professional, Scientific and Technical Services (except Computer Systems Design and Related Services)* *M70 Computer System Design and Related Services* *N72 Administrative Services* *N73 Building Cleaning, Pest Control and Other Support Services*
Manufacturing (excluding food and beverage)	Part of Level 2, of: C manufacturing.	This includes the following level 2 sectors and their respective sub-sectors: *C13 Textile, Leather, Clothing and Footwear Manufacturing* *C14 Wood Product Manufacturing* *C15 Pulp, Paper and Converted Paper Product Manufacturing* *C16 Printing* *C17 Petroleum and Coal Product Manufacturing* *C18 Basic Chemical and Chemical Product Manufacturing* *C19 Polymer Product and Rubber Product Manufacturing* *C20 Non-Metallic Mineral Product Manufacturing* *C21 Primary Metal and Metal Product Manufacturing* *C22 Fabricated Metal Product Manufacturing* *C23 Transport Equipment Manufacturing* *C24 Machinery and Equipment Manufacturing* *C25 Furniture and Other manufacturing*
Food and beverage manufacturing including agricultural products	Part of Level 2, of: C manufacturing.	This section includes the remaining manufacturing sectors at ANZSIC code level 2 and below: *C11 Food Product Manufacturing* *C12 Beverage and Tobacco Product Manufacturing*
Retail	Level 1: G Retail Trade	Level 2 and below: *G39 Motor Vehicle and Motor Vehicle Parts Retailing*

Priority Sector	Proposed Primary ANZSIC Code and Level(s)	Sector Definition / Inclusions (including next level ANZSIC Code)
		G40 Fuel Retailing *G41 Food Retailing* *G42 Other Store-Based Retailing* *G43 Non-Store Retailing and Retail Commission Based Buying and/or Selling*
Tourism*	Tourism sector	Defined by the Tourism Satellite Account
Construction	Level 1: E Construction**.**	This includes level 3 and below: *E30 Building Construction* *E31 Heavy and Civil Engineering Construction* *E32 Construction Services*

*Not defined by ANZSIC 2006, but by the *Tourism Satellite Account* (Statistics NZ, 2009) for economic contribution to the economy.

2.3 Economic and Physical Indicators

Indicators are a fundamental aspect of the recommended framework. Indicators summarise extensive environmental or economic data to provide key information and allow simple resource efficiency ratios to be calculated.

Selection criteria for core indicators were identified in the *Literature Review* as follows:

- *Direct relevance* – the indicators selected must be closely linked to environmental issues and economic measures that are relevant to the sector and the national context.
    - With regard to *physical indicators* consideration should be given to key environmental issues, resource availability issues, central government policy direction, and international reporting responsibilities.
    - *Economic indicators* should be selected from current macro-economic reporting, but also need to be relevant to the business sector. A macro and micro level indicator are suggested to achieve this.
- *Limit the number* – a small set of well chosen indicators is considered effective and adequate for providing an overview of environmental issues arising from sectors.
- *Clarity in design* – indicators should be clearly defined in order to avoid confusion during the development, or misinterpretation of results.
- *Realistic collection or development costs* – the cost of collection and development of indicators in an important consideration. Excessive data collection costs may lead to trade-offs between the information content of various indicators and the cost of collecting them.

- *High quality and reliable data* - indicators, and the information they provide, are only as good as the data from which they are derived. The quality of the data collected and its longevity are fundamental to providing useful measures of environmental issues.
- *Appropriate spatial and temporal scale* - appropriate spatial and temporal scale of indicators require consideration; generally data is collected for annual measurement of performance.

The draft indicators proposed in the Phase 1 work are summarised in **Table 2.** The matters included for each indicator category are consistent with current approaches and definitions in New Zealand.

Table 2: Draft Indicators for Measuring Resource Efficiency

Physical Indicators		**Proposed Unit[3]**
Water use	Fresh water abstracted for consumptive use from surface and groundwater sources and consented, from private and public supply schemes. *Does not include the use of sea water, non-consumptive uses (i.e. hydropower), or the use of recycled or waste water*.	m^3
Solid waste	All solid waste disposed of to disposal facilities (as defined by the Waste Minimisation Act). *Does not include waste that is incinerated, reused, recycled, composted, or exported.*	Tonnes
Energy use	Electricity provided by the national grid, and other direct energy use from stationary sources, such as boilers, furnaces, and off-grid electricity generation, from the following energy sources: • gas • coal • liquid fuels (oil, diesel) • bio fuels (solid and liquid) • wind, hydro and solar *Does not include transport-related energy use.*	PJ
Greenhouse gas emissions	New Zealand's greenhouse gas inventory is the official annual report of all anthropogenic (human induced) emissions and removals of greenhouse gases in New Zealand. The inventory measures New Zealand's progress against obligations under the Climate Change Convention and the Kyoto Protocol. The inventory reports emissions and removals of: • carbon dioxide (CO_2),	Tonnes CO_2e

[3] This represents the proposed unit of measurement identified in the *Framework for Determining Resource Efficiency*. In the application of the resource efficiency framework in this testing stage, units may vary to reflect data collection approaches and provide more meaningful interpretation of data.

	• methane (CH_4) • nitrous oxide (N_2O) • hydrofluorocarbons (HFCs) • perfluorocarbons (PFCs) and • sulphur hexafluoride (SF_6). The gases are reported under six sectors: energy; industrial processes; solvent and other product use; agriculture; land use; land-use change and forestry (LULUCF), and waste.	
Wastewater discharges	Permitted trade waste discharges and consented discharges to land and water. *Does not include stormwater.*	m^3
Economic Indicators		**Unit**
Number of employees	Provides a proxy for production / service activity and for social welfare	FTE
Gross Domestic Product (GDP)	Financial measure which reflects the contribution to the national economy	$M
Exports	For sectors where relevant data is available.	$M

2.4 Data Requirements

A principal goal of this initial attempt at a resource efficiency framework is to identify the existing data that is currently available to the Ministry for each of the relevant sectors and indicators. No primary research was required by the Ministry as part of this study.

It is important to get accurate and meaningful data for each sector and each indicator, to have confidence in the resource efficiency ratios. The nature of indicators and ratios is that they are small sets of data to represent much larger issues, and any inaccuracies or compromises in the data sets can distort the results.

To determine the suitability of data in the search for existing data sets the following criteria were used:

1. **Currency**: the preference is for the application of data for this trial to be no older than 2007 i.e. three years old or less, and for the same time period across all indicators. For future application of the resource efficiency the same approach would be recommended. The currency of data is important to produce an up-to-date baseline for policy development. It is also important to build a more recent picture of resource use across industry sectors. The material flow study funded by the Ministry, which produced results on industry sector resource used data from the early to mid 2000s (pers. comm. Eric Park, MfE 2009).

   Overall, it is important to use data from the same timeframe to ensure that the ratio of physical and economic indicators is more meaningful. As such, economic and environmental data years need to match. Ideally, to effectively compare ratios, data across sectors needs to

be from the same timeframe to avoid comparing different time-sets where inputs and outputs may vary from year to year. Finally the preference is for data that is routinely collected rather than using data from one off studies.

2. **Repeatability**: The preference is for data from sources that ensure repeatable data collection and reporting methodologies. This includes both the ability to understand and rely on the data collection methodology from third party sources, and also that the Ministry is able to regularly obtain the data from the source without prohibitive costs, delays, conflicts or confidentiality issues.

3. **Source Reliability**: The preference is for data collected by reputable agencies such as Statistics New Zealand, government departments, or agencies working on their behalf. Official statistics are preferred over data collected by industry or business.

4. **Industry Sector Representativeness**: The preference is for data that is representative of entire sectors (at any specified level of ANZSIC 2006), rather than a small subset, or a mixture of industry sectors defined using lower level ANZSIC codes. "Representative" means statistically significant, or data from all entities in the sector. This criterion also means that national data is preferred to regional data.

5. **Indicator Relevance**: The preference is for data that specifically meets the definition of the physical or economic indicator. For example, solid waste data by source of industry is preferable to solid waste data by type of waste. For the purposes of this study, the preference is for data that does not require conversions or manipulations to meet the definition of the indicator. This is to achieve accuracy for each indicator without too many caveats on the data, but also to reduce the amount of time required to prepare the data for the framework (given limited resources in this study and in the long term at the Ministry).

3.0 Data Collection and Reporting Methodology

The key focus of this phase of work was to populate the proposed resource efficiency framework using existing data sets, and to identify data gaps and other significant issues with data. Data collection occurred during a two month period from March to May 2010.

The first step in data collation was to identify and evaluate current available national data sets on each of the indicators for the priority industry sectors as defined above. This included a data search of existing sources of information including, but not limited to, central government agencies, Statistics New Zealand, local government, relevant industry groups, and Crown Research Institutes.

Where national data sets proved inadequate it was agreed with the Ministry that data from case studies (of resource efficiency, life cycle analysis, or material flows), research papers, and corporate annual reports could be used to fill gaps. Published information was identified using the internet, research publication databases, and direct contact with business and resource efficiency scheme providers.

Each data source was ranked based on quality, reliability, relevance of data to this project, how much work was required to manipulate the data into a form of use for measuring resource efficiency, and whether it could be repeatedly used for ongoing resource efficiency reporting by the Ministry. This ranking was undertaken using the data filter described below, and show in **Table 3**.

Once all potential sources of data were explored and ranked, the data was collated into the attached Data Matrix spreadsheet and summarised in this report for each sector and indicator. Where possible, resource efficiency factors were calculated.

All data source references and the rankings are provided in the Data Matrix spreadsheet.

3.1 Data Filter Limitations and Refinement

The data filter was introduced as part of the framework in Phase 1 work. The aim of the filter was to rank each national dataset against a set of criteria, using a simple 0 – 3 rating. The original filter had two components to determine the appropriateness of data for use in the framework, as follows:

(i) Quality (i.e. frequency, repeatability, quality of source or data owner and sector relevance) and
(ii) Cost (i.e. the amount of effort required and expenditure to obtain and process data, and the category consists of the number of sources, availability, and required manipulation).

The approach required revision for this report due to the use of case study data (as per Table 3) including removal of the ‘cost’ component.

Case study data indentified during this stage was not collated in a comparable or consistent manner, compared with national data sets, and there was considerable variation between what, and how sectors (at an industry level) record data. To partly address this, the filter was refined to include a weighting for representativeness. Where 100% of sectors are represented by a data set, these were ranked higher. The representativeness score was weighted because information that covers an entire sector (or sub-sector) is considered more accurate and complete set of information of relevance to

this project, compared with data that only covered part of a sector i.e. it represents what is occurring nationally. As such, data sources with a rank of greater than 21 were considered appropriate to use in the application of the framework; while data scoring below this range was not considered robust enough for calculating ratios. These data are used in Table 4.

Data ranking lower than 21 is, however used in and Tables 6 and 7, for illustrative purposes only (*see Section 4.2 for further discussion).*

It is noted that this approach still has limitations. For example, a data set may cover 50-75% of companies and score well on all other criteria but may be discarded as it does not score 21. However, for this study, none of the case study data scored at the highest level across the criteria and only two national sets (MED Energy Supply and Demand Data and New Zealand's Greenhouse Gas Inventory 1990–2007) scored three or more across the criteria. In addition, if data collection is improved (as discussed in Section 7 of this report) the need for a data filter would be eliminated.

Table 3: Data Filter

Currency		Repeatability		Source Reliability		Representativeness		Indicator relevance	
Less than annually, annually, or biannually	3	Has repeatable methodology	3	Statistics NZ or other Gov Dept	3	100% of entities / companies)	15	Yes, data is directly relevant	3
2-5 years old and / or a one off study	2	ISO14001, GRI or similar approach used / signed up to, other research approach defined	2	CRI / Research study	2	50-75% of entities / companies	3	Yes relevant, but a proxy data set, with little / no aggregation / modification	2
5 years + old	1	Does not have a repeatable methodology, or is the methodology unclear	1	Consultant / market research / industry survey / individual company data	1	25-50% of entities / companies	2	Yes relevant, but a proxy data set, with high aggregation / modification	1
						One company	1	No, does not meet indicator definition	0

4.0 Results

A full set of data found during the research is provided in a Data Matrix (See Appendix 1). The appendix also includes a full reference list of all data sets evaluated for the study, and the results of the data filter. The results are summarised and reported separately in the tables, below:

1. Data from national data sets and / or official statistics collected by central government agencies.
2. Data from case studies, corporate reports, and industry-based research.

The purpose of reporting separately is due to incomparability between data sets. National data sets, defined to a particular ANZSIC 2006 industry code can be compared against each other. Case study or research data that does not conform to ANZSIC 2006 industry codes, and / or only reflects part of a sector, is generally not representative or consistent enough for comparison to national data sets (refer to the data filter discussion above).

4.1 Resource Efficiency Based on National Data Sets

4.1.1 Available Indicator Data from National Data Sets

The following table provides a summary of available indicator data from national data sets.

The data sources and other references are included in Appendix 1. Only data that scored high enough through the data filter is summarised below. There was insufficient data on water use, wastewater, and solid waste and these indicators are not included in the summary report. In addition, the industry sectors that did not have data are not included in the summary table. The ANZIC codes are applied where applicable – where data has been obtained that has no specific ANZSIC code is assigned in the data sets – for example, where industries represent a combination of differently coded sectors – these are coded "NA" (i.e. not applicable).

As context, the total NZ's resource use and economic productivity is provided below (these figures include *all* resource use unless otherwise stated).

- Freshwater: Allocation: 615.16 m^3/s[4] (includes stockwater, manufacturing processes and irrigation)
- Energy Use: 792 PJ[5]
- GHG: 32653.10 Gg[6]
- Solid Waste: 3.156 million tonnes[7]

[4] Source: MfE (2007) *Environment New Zealand 2007* http://www.mfe.govt.nz/publications/ser/enz07-dec07/environment-nz07-dec07.pdf

[5] Source: MED (2008) New Zealand Energy in Brief August 2008 (include renewable and non renewable sources)

[6] Source: Statistics NZ (2009) *Measuring New Zealand's Progress Using a Sustainable Development Approach: 2008*, Energy-related greenhouse gas emissions

- Waste water: No data on industrial discharges obtained
- Nominal GDP: NZ$ 183.4 billion
- Employment: 1.919 million

[7] Source: MfE (2007) *Environment New Zealand 2007* http://www.mfe.govt.nz/publications/ser/enz07-dec07/environment-nz07-dec07.pdf

Table 4 Summary of Available Indicator Data

Industry Sector		Environmental Indicators		Economic Indicators[8]		
ANZSIC Level 1 / 2	ANZSIC Level 3, 4 And Non-ANZSIC Sector Definition (code NA)	Energy Use (Pj)	GHG Emissions (Gg CO_2e[9]) 2007	GDP ($millions) 2008	Employment (FTE) 2008	Production Output 2008
A Agriculture, Forestry and Fishing						9,366.3M net sales
A01 Agriculture			36,340	6,382		
	A013 Fruit and Tree Nut Growing	3.07				
	A014 Grain, Sheep and Beef Cattle Farming	8.33				
	A016 Dairy Cattle Farming	9.227				
	A017, A018, A019 Poultry, Deer and Other Livestock Farming	1.229				
A02 Aquaculture						
	A020 Aquaculture	0.191				
A03 Forestry and Logging		1.878		1,488		
	A030100 Forestry		-24,527.90			

[8] StatsNZ note that 2008 economic data may be influenced by the economic downturn (recession). However, this is a trial / test application of the framework and results are indicative only.

[9] This has been refined here to reflect units used for data collection at the national level.

Industry Sector		Environmental Indicators		Economic Indicators[8]		
ANZSIC Level 1 / 2	ANZSIC Level 3, 4 And Non-ANZSIC Sector Definition (code NA)	Energy Use (Pj)	GHG Emissions (Gg CO_2e[9]) 2007	GDP ($millions) 2008	Employment (FTE) 2008	Production Output 2008
	A030200 Logging					19,385,427 m^3
	NA[10] Forestry and mining				10,700	
A04 Fishing, Hunting and Trapping		6.194		197		
A05 Agriculture, Forestry and Fishing Support Services		4.624				
	NA Agriculture and hunting	16.32				
C Manufacturing						
C11 Food Product Manufacturing		18.88				
	C111 Meat and Meat Product Manufacturing	7.976				
	NA Other food manufacturing processes	8.502				
C 12 Beverage and Tobacco Product Manufacturing						

[10] "NA" applies to sectors where no specific ANZSIC code is assigned in the data sets – for example, where industries represent a combination of differently coded sectors.

Industry Sector		Environmental Indicators		Economic Indicators[8]		
ANZSIC Level 1 / 2	ANZSIC Level 3, 4 And Non-ANZSIC Sector Definition (code NA)	Energy Use (Pj)	GHG Emissions ($Gg\ CO_2e$[9]) 2007	GDP ($millions) 2008	Employment (FTE) 2008	Production Output 2008
	NA Food and Drink Manufacturing		6.61			
	C11 and C12 Food, Beverage and Tobacco Product manufacturing			6,708		
C13 Textile, Leather, Clothing and Footwear Manufacturing		2.434		701	15,000	
C14 Wood Product Manufacturing						
	C141 Log Sawmilling and Timber Dressing					3,734,000 m^3
	C149400 Reconstituted Wood Product Manufacturing					905,089. tonnes
C15 Pulp, Paper and Converted Paper Product Manufacturing			7.51			
	C151 Pulp, paper and Paperboard Manufacturing					4,651,610.1 tonnes
	C15 and C16 Pulp, Paper and Converted Paper Product Manufacturing, and Printing	47.408				
C18 Basic Chemical and Chemical Product		11.604	603.21			

Industry Sector		Environmental Indicators		Economic Indicators[8]		
ANZSIC Level 1 / 2	ANZSIC Level 3, 4 And Non-ANZSIC Sector Definition (code NA)	Energy Use (Pj)	GHG Emissions ($Gg\ CO_2e$[9]) 2007	GDP ($millions) 2008	Employment (FTE) 2008	Production Output 2008
Manufacturing						
C20 Non-Metallic Mineral Product Manufacturing		7.539	860.38	900		
C21 Primary Metal and Metal Product Manufacturing		45.095		2,100		
C22 Fabricated Metal Product Manufacturing			2265.56			
C24 Machinery and Equipment Manufacturing				2,764		
C25 Furniture and Other Manufacturing				543		
E Construction		7.91		6,528	101,200	$10,508.6M net sales
E30 Building Construction						8,523,620 m^2 floor area consented
G Retail Trade				8,376	130,800	$10,027.1M net sales

Industry Sector		Environmental Indicators		Economic Indicators[8]		
ANZSIC Level 1 / 2	ANZSIC Level 3, 4 And Non-ANZSIC Sector Definition (code NA)	Energy Use (Pj)	GHG Emissions (Gg CO_2e[9]) 2007	GDP ($millions) 2008	Employment (FTE) 2008	Production Output 2008
G41 Food Retailing		47.409				
H Accommodation and Food Services				2,076	81,900	$3,069.9M net sales
H 44 Accommodation		4.49				
K Financial and Insurance Services		5.767		9,179	46,600	$4520.5M net sales
R Arts and Recreation Service				2,366	66,000	$3,348.2M net sales
	NA Tourism (Tourism Satellite Account)		**2,537**	**6,660**	**94,200**	32.1M guest nights

Table 5 Resource Efficiency Calculations

Industry Sector	Resource Efficiency Calculation					
	GDP / Energy Use ($M/PJ)	GDP / GHG Emissions ($M/Gg)	FTE Employment / Energy Use (#/PJ)	FTE / GHG Emissions (#/Gg)	Production Output / Energy Use	Production Output / GHG Emissions
A Agriculture, Forestry and Fishing						
A01 Agriculture		0.18				
A03 Forestry and Logging	792.33					
A04 Fishing, Hunting and Trapping	31.80					
C Manufacturing						
C13 Textile, Leather, Clothing and Footwear Manufacturing	288.00		6162.70			
C20 Non-Metallic Mineral Product Manufacturing	119.38	0.94				
C21 Primary Metal and Metal Product Manufacturing	46.57		2,100			
E Construction	825.28		12,697.61		1318.52	
K Financial and Insurance Services	1,591.64		8080.46		783.86	
NA Tourism (Tourism Satellite Account)		2.63		37.13		12,652.74

4.1.2 National Data Resource Efficiency Calculations

Resource efficiency ratios could only be calculated where there was data for at least one environmental indicator and one economic indicator for a single sector. The relevant calculations are provided in **Table 5,** above, for a very small subset of sectors.

4.1.3 Comment on Results

- The resource efficiency calculations indicate that tourism contributes more GDP per tonne of CO_2e compared with agriculture or non-metallic mineral product manufacturing.
- The calculations indicate that the financial and insurance services contribute more GDP per PJ of energy than any of the other industries listed, and that fishing, hunting and trapping has the highest energy intensity (lowest energy efficiency).
- For every FTE, the ratio indicates that the construction industry uses less energy than manufacturing or the financial and insurance services sectors listed in the table.

4.2 Resource Efficiency Based on Published Research and Case Studies

The results of the review of case studies and published research are also included in the Data Matrix at Appendix 1, and the indicators for selected case studies are summarised in **Table 6,** below. At the request of the Ministry, resource efficiency ratios have also been calculated from this selection (**Table 7**).

The data from case studies and published research did not rank high enough in the data filter to provide data input into the resource efficiency framework. This is primarily due to sector representativeness, repeatability, and reliability of the case study or research. Data collection, management, and interpretation at the business or research level are inconsistent and the risk of inaccurate results increases dramatically. This is discussed in further detail in the Section 5.0 of this report.

In addition, because high level economic indicators such as GDP are not appropriate to use at the business level, it is more accurate to use productive output specific to a particular business. The case studies selected below (**Table 6**) therefore measure productivity specific to their industry or business.

The results in **Table 7**, allow some comparisons between companies that use similar productivity measures and environmental indicators. For example, Sanford (fishing, aquaculture, and seafood processing industries) is more productive per tonne of waste than Hubbard's (cereal, pasta, and baking mix industry) however Hubbard's is more productive per cubic metre of water compared to Sanford.

Table 6 Summary of Relevant Available Data – Case Studies

Codes included where applicable – see footnotes for further information

Case Study	Environmental Indicator:					Economic Indicator:
	Freshwater use (m^3)	Solid Waste	Energy Use GWh	Net GHG Emissions (CO_2e Tonnes)	Wastewater (m^3)	Productivity
Sanford [11]	757,472	2143 T	25.91	82,544	No data	83,225 tonnes of product
Fonterra (*C113 Dairy Product Manufacturing)*	34,000,000	5,500,000 T	5,666.66	14,000,000	29,800,000	1,500,000 m^3 of milk
Hubbard's (*C116200 Grain Mill and Cereal Product Manufacturing)*	5,472	520.8 T	No data	2,041.5	No data[12]	6,069 tonnes of cereal
Carter Holt Harvey [13]	308,142	23,308 T	1061.83	304,493	No data	1,098,092m^3 of plywood and veneer
Woolworths (Supermarkets (G411)[14]	No data	21.6 T	0.3	58,711	No data	$47 billion sales Australia and NZ

[11] Includes a number of sectors: aquaculture, deepwater fishing and on-board processing; Inshore species and on-shore processing.

[12] "No data" means, either no data identified in report, or it was not in a useable format - for example, energy use or solid waste production may be aggregated by a business to CO_2e and not include raw data on solid waste per se.

[13] Includes a number of sectors covering: timber, plywood, particle board, laminate, mouldings

[14] The source used for this example is Trans-Tasman. The company owns and operates Supermarkets (G411) and Electrical and Electronic Goods Retailing (G422) – data for G422 has been excluded where possible. Freshwater data for this example was only recorded for Australian sites and cannot be included here.

Case Study	Environmental Indicator:					Economic Indicator:
	Freshwater use (m^3)	Solid Waste	Energy Use GWh	Net GHG Emissions (CO_2e Tonnes)	Wastewater (m^3)	Productivity
The Warehouse *(G426 Department Stores)*	No data	22,972 m^3	77.8	23,107	No data	465,530 sq m retail space
Landcare Research *(M691 Scientific Research Services)*	10,532.56	23.67 T	0.16	Carbon neutral	No data	$60.25 million revenue
IAG *(K632 Health and General Insurance)*	No data	No data	5.42	2,911	No data	1,860 Full time employees

Table 7: Indicative Resource Efficiency Calculations

Case Study	Physical (Environmental) Indicator					Economic Indicator	Resource Efficiency Calculation: Economic indicator / Physical (environmental) indicator			
	Freshwater use (m^3)	Solid Waste	Energy Use (GWh)	GHG Emissions (CO_2e tonnes)	Wastewater[15] (m^3)	Productivity Measure (as used by Business)	Freshwater use (m^3)	Solid Waste	Energy Use	GHG Emissions
Sanford	757,472	2143 T	25.91	82,544	No data	83,225 tonnes of product	0.11	38.84	3212.08	1.01
Fonterra	34,000,000	5,500,000 T	5,666.66	14,000,000	29,800,000	1,500,000 m^3 of milk	0.04	0.27	264.71	0.11
Hubbard's	5,472	520.8 T	No data	2,041.5	No data	6,069 tonnes of cereal	1.11	11.65	insufficient data	2.97
Carter Holt Harvey	308,142	23,308 T	1061.83	304,493	No data	1,098,092m^3 of plywood and veneer	3.56	47.11	1034.15	3.61

[15] Due to lack of data, resource efficiency has not been calculated for waste water.

Case Study	Physical (Environmental) Indicator					Economic Indicator	Resource Efficiency Calculation: Economic indicator / Physical (environmental) indicator			
	Freshwater use (m^3)	Solid Waste	Energy Use (GWh)	GHG Emissions (CO_2e tonnes)	Wastewater[15] (m^3)	Productivity Measure (as used by Business)	Freshwater use (m^3)	Solid Waste	Energy Use	GHG Emissions
Woolworths	No data	21.6 T	0.3	58,711	No data	$47 billion sales Australia and NZ	Australia and NZ data not separated	Australia and NZ data not separated	Australia and NZ data not separated	Australia and NZ data not separated
Warehouse	No data	22,972 m^3	77.8	23,107	No data	465,530 sq m retail space	insufficient data	20.27	5983.68	20.15
Landcare Research	10,532.56	23.67 T	0.16	0[16]	No data	$60.25 million revenue	0.01	2.55	376.56	0.00
IAG	No data	No data	5.42	2,911	No data	1,860 Full time employees (FTE)	insufficient data	insufficient data	343.17	0.64

[16] Carbon neutral. Offsets are not recorded in other case studies.

5.0 Key Findings on Data

The following section provides a discussion regarding data collected for this study.

5.1 Sources of Data

5.1.1 National Data Sets / Official Statistics

The key sources of data used in this study were:

- Statistics New Zealand Online Infoshare Service including:
  - GDP
  - FTE Employees
  - Net sales
  - Agricultural Production Statistics

- Statistics New Zealand
  - Tourism Satellite Account

- Ministry for the Environment
  - Greenhouse gas emissions and productivity data from the New Zealand Greenhouse Gas Inventory

- Energy Efficiency and Conservation Authority (EECA)
  - Energy demand data - Energy End-Use Database (EEUDB)

- Ministry of Agriculture and Forestry
  - Forestry, Wood Product and Paper Product Statistics

Most of this data was either directly allocated to an ANZSIC code, or could be interpreted by ANZSIC code for use in this project. The level of ANZSIC code varied between data sets and each data set did not necessarily contain data for all sectors at the particular ANZSIC code level.

There are no national data sets or official statistics on:

- Solid waste produced by industry sector
- Water use by industry sector
- Wastewater produced by industry sector

In discussion with staff at the Ministry, Statistics New Zealand, and the Ministry for Economic Development during the project it was well understood that there is very little data at a national level regularly reported for environmental indicators, and even less data reported by industry sector. Attempts have been made in the past to collect this type of data, particularly for material / resource flow studies, but no agency has attempted an ongoing measurement and reporting process.

5.1.2 Case Study and Research Data

A common source of environmental indicator data used for this report is **company sustainability / environmental reporting.** Where these are not available, annual company reports provided alternative sources of information, particularly economic data. Information in both types of reports is often derived from a variety of sources including data warehouse, sales, and inventory systems, financial reporting systems, payroll systems and energy management systems. Third parties such as waste and recycling companies may also provide information used in the reports.

Data from company reports is considered relatively reliable as a discrete set of information however, there is no common method for collating information, and approaches and types of data collected vary widely. In addition, any changes to aspects such as company structure, staffing, or other reporting approaches to data collection may skew results and reduce the ability to compare data, or resource efficiency, over time.

Where a corporate commitment has been made to sustainable management, reporting tends to be more sophisticated and consistent, within a given business. For example, businesses which have signed up to reporting frameworks or are accredited to environmental management systems, such as ISO14001, retain more complete records. These are single data samples that represent *better* practices rather than *typical* practice. In addition, many small companies and operations may have an environmental policy in place but do not measure performance.

Few businesses report specifically on sustainability or environmental issues. Larger industries tend to undertake more data collection, compared with smaller businesses. This is possibly due to better resourcing, for example they may have a dedicated environmental manager. Given the large percentages of SMEs in New Zealand only a small proportion of each sector may be captured via analysis of sustainability and/or annual reports. The level of reporting, and data gleaned from it, represents only a fraction of information and one that is skewed towards more proactive responses[17].

On the whole, organisations have little public data available and there is little emphasis on capturing this type of information in corporate reporting, other than for economic elements.

Single studies or case studies are commonplace. EnviroMark for example, include a number of case studies on its website, although very few include actual data on the environmental improvements discussed in the studies. Subsequent research and discussion with EnviroMark revealed that information is often *ad hoc* and not collated in any central system. Once again, these represented best practice examples and are unlikely to represent sectoral trends.

Resource efficiency programmes (run by industry or councils) either do not collect data on environmental or economic indicators, or have not been able to provide the data to this project due to confidentiality issues with the companies which with they are working.

Research reports sourced from Crown or research institutes and universities provide a secondary source of data. The time lapse between research and publication of reports can result in data being included that is more than two years old. Resource efficiency calculation requires a ratio of

[17] For example SMEs account for 40.7% of the economy's total output, few of these businesses report on resource use, or are unable to provide the information if requested.

inputs : outputs using economic data and environmental inputs or outputs covering the same period, to ensure accuracy. Data from different years would result in inaccurate measures.

5.2 Data Repeatability

Data repeatability is an important consideration for comparing resource efficiency over time. It also has implications for cross-business and cross-sector comparisons which require consistency in data collection to ensure accurate results.

National data sets have repeatable methodologies, and are regularly collected, and therefore are the most value for comparing resource efficiency over time.

A number of individual businesses use specific methods for collecting data in environmental / sustainability reports. The Global Reporting Initiative (GRI) checklist is used as a guide by a small number of businesses for sustainability reporting. The GRI checklist provides some consistency in types of data recorded but is not commonly use in New Zealand. Similarly, companies with ISO 14000, or similar environmental management system accreditation, record information of relevance to those systems and in particular, the targets set out in their overriding policies. With the large variation in data collection (or at least data reporting) methods, data from companies is not easily comparable with other entities in the same, or different sectors.

5.3 Sector Data

The research identified that the agriculture sector, wood product manufacturing, food manufacturing, heavy industry and tourism sectors have a larger amount of research or statistical data collection than other sectors. There is very little information on the productive output or environmental footprint of the retail, financial and business services and construction industry sectors.

5.4 Indicator Data

Water use, waste water discharges, and solid waste represented the largest data gaps. Although data is collected in some form on each these issues, the type of data collected was not found to be applicable to resource efficiency calculations for industry sectors.

Freshwater data is difficult to access at ANSZIC level; data on water use is only available at a very broad level e.g. by region, and not reported by the type of use. At the case study level, few industries disclose information of this nature. Personal communications with some producers indicate that water use is factored into productivity but is not publicly available due to competitive interests. No single study was found that provided a current set of data for water use by industry.

Regional Council resource consent databases are unreliable and difficult to access for water use information. In addition, resource consent database typically only provide information on water *allocation*, not *use*, and the industry sectors are not well documented. Because the data is held in several different agencies, in a variety of formats, it is time consuming and costly to compile and report. This data set does not include the industries that obtain water from town supply. This data is even more disparate and costly to obtain from all of the water suppliers (primarily City or District Councils).

Solid waste data is not available by sector. New Zealand solid waste data tends to be collected at a regional or district level to assess the weight and type of waste but no information the source of waste is available. The most common source of waste data by sector is corporate sustainability reports.

Energy and greenhouse gas emissions are the most robustly and comprehensively reported data, at a national level, and in corporate reports[18].

5.5 Economic Indicator Data

Economic data is more readily available for businesses and sectors. By sector, GDP, full time equivalent employees and net sales is available through the official statistics at Statistics New Zealand. The difficulty in this project was getting data at the lower level ANZSIC 2006.

At a business level economic data is readily available in annual reports where annual profits, production outputs and employee numbers are typically recorded. However, accessing this information is a time consuming exercise and there is often inconsistency in types of information recorded and its interpretation. Data from companies that have offices or activities offshore can skew results. For example, a company which has off shore entities does not always separate out New Zealand data from the offshore data.

Business data is not directly comparable to national economic data, and data from a single business cannot be used to represent earnings or employment for an entire sector (at any ANZSIC level).

5.6 Tourism Sector

The tourism sector is unlike other sectors in the economy as it is not defined by the goods and services it produces. Data is defined by the distinctive set of goods and services consumed by tourists. As such, Tourism is defined on the basis of consumption rather than production. Furthermore, the definition of tourism varies with approaches – some case studies include domestic travel within their calculations; whereas others may only include international visitors. For this study, the definition in the Tourism Satellite Account, from Statistics New Zealand, has been used to define the sector.

Considerable research was found during this study on the tourism sector and environmental impacts of the industry however, much of the data is old, or only parts of the data needed to measure resource efficiency are provided and the methodology used to collect and record data varies widely.

5.7 Accessibility / Availability of data

Government agency data is straightforward to access in an aggregated manner from Statistics New Zealand and other agencies, and all data is available electronically through websites. Disaggregated

[18] Companies or sectors which produce sustainability reports often include social sustainability aspects. As noted in the *Phase 1 Literature Review*, it is more difficult to measure these in an efficiency ratio. While some attempts have been made to include a socio-cultural factor these tend to be more commonly applied at the national or regional reporting level. However, as noted in the Phase 1 report, these indicators are beyond the scope of the current research.

data by sector (to level 3 and 4 ANZSIC 2006 levels) was most often not available through these means.

Accessibility to data from business and industry sectors was problematic during the study for two main reasons; a lack of measurement of environmental data and a lack of publicly available information. As noted above, national sustainability schemes such as EnviroMark do not collate or provide environmental or economic data from businesses involved in the programmes. As such, general information on businesses' environmental improvements is available, but no specific data is held.

Other resource efficiency schemes that do keep data on environmental and economic indicators for businesses they work with are not prepared to share the data due to client confidentiality issues.

Confidentiality issues are also prevalent for large monopoly / duopoly industries. For example their productive outputs are recorded as 'confidential' in the greenhouse gas emissions inventory, and no data is provided. It is unlikely this data will ever be available in a disaggregated form.

It is anticipated that many entities and sector groups are relatively aware of resource use compared to productive output, but this information is rarely disclosed due to commercial sensitivity.

Finally, accessibility was made difficult during this study because some relevant data from research programmes was not available for external purposes or, in many cases there was a simple reluctance to provide information due to perceived time and resource constraints to extract and forward the data.

5.8 Currency of Data

Currency of data is a particular issue where routine data collection systems are not in place, or where research has been used as a data source (as for this trial).

Timeframes for collating data for research often results in research reports being published some time after the collection of data. For example, a number of reports were produced using EcoLink data from the 1997/98, but not published until the early 2000s.

To be able to accurately compare sectors, and compare environmental with economic data to obtain accurate ratios, it was considered important to use data from the same year where possible. This ruled out the use of much previous research due to a lack of data currency.

5.9 Research Integration

A range of research relevant to this study has been is undertaken in New Zealand which typically requires some level of data collection[19]. Research is funded via different sources and for different purposes, and it appears that this is resulting in little, if any, research integration and no apparent shared access to information. The Foundation for Research, Science and Technology, MAF, MfE, AgResearch, Landcare Research and the Agricultural Research Group on Sustainability (ARGOS[20])

[19] A snapshot of relevant research that may be of interest to the Ministry is provided at Appendix 2 of this report.

[20] ARGOS is an unincorporated joint venture between the Agribusiness Group, Lincoln University, and the University of Otago. It is funded by the Foundation for Research, Science, and Technology (FRST) and various industry stakeholders and

are frequently cited in research programmes in production and/or sustainability related work; however, accessing information to results and raw data was not possible for this study. It can also result in one-off studies where data collection methods are not repeatable and data quickly reaches its 'use-by' date.

5.10 Data Requirements at the Relevant Sector Level

For resource efficiency to be most relevant to a particular sector, the definitions of the environmental and economic indicators need to be relevant to the nature and scale of the industry process. This is particularly the case with production output.

The lower the level of ANZSIC code at which data is collected and reported, the more relevant it is to the entities in that sector. For example, water use aggregated at the ANZSIC Level 01 A1 Agriculture, is not as relevant to the sheep or stone fruit industry, than water use aggregated at A013500 Stone Fruit Growing and A014100 Sheep Farming (specialised). These two smaller industries would use water very differently to each other, and an aggregated indicator at the higher level provides no information to the Ministry or the sector about resource efficiency.

National data sets on environmental indicators are not collated to the lower ANZSIC code levels and therefore could not be reported in this way for this study. Case study and corporate reports can provide data at this level of ANZSIC code, but only for one entity. That data is not representative of an entire sector and therefore has limited use as a proxy data set.

5.11 Comparability of Different Data Sets

To calculate a resource efficiency ratio that can be compared within and between sectors, it is important to have consistency with the data sets in terms of the sector definition, indicator definition, and the time period. The following barriers were identified in this study:

- The lack of the consistent use of ANZSIC codes for data at a national level (either government statistics or research), and the lack of data collection at a particular ANZSIC code level, for each sector within that level.
- The variation in timeframes and currency of data sets, particularly from large research projects.
- The inability for a single entity to represent an entire industry sector (at any ANZSIC level). This is because the environmental and economic data cannot be accurately extrapolated. This means that there is a lack of comparability between data from a single entity and national statistics.

5.12 Summary

The evaluation of data shows that national data sets, official statistics, and research based on industry sectors' resource use or environmental footprint were more reliable, relevant, representative and repeatable than using individual company data from case studies and corporate reports. This is primarily due to the difficulty with using data from one entity to represent an entire sector, and not

commenced in October 2003. ARGOS has a mandate to examine the environmental, social, and economic sustainability of New Zealand farming systems.

being able to compare case study data with national data sets. However, a number of significant gaps remain in the national data sets for the purposes of this study. These are documented in the following section.

6.0 Indicator Data Gap Analysis

The following section summarises the key gaps for each proposed indicator, and the issues around the quality and accessibility of data. Overall this research and resource efficiency framework trial have highlighted that there are currently significant gaps in data needed to adequately measure resource efficiency of businesses.

6.1 Gaps in Indicator Data

The key gaps in the national data sets for each proposed indicator are summarised in the following table. Typically, data is not sufficiently accessible or recorded in New Zealand for most sectors.

Table 8: Summary of Data Gaps for Each Indicator

Indicator	Current Situation	Gaps
Water use (m^3)	There is no national set of statistics on actual water use by industry sector. Water intensive industries such as agriculture and manufacturing maintain data on water use but this information is based on research trials and studies, and is not currently accessible or collated and reported at a national level by ANZSIC code. Water allocation volumes are recorded by Regional Councils where water permits apply. The availability and quality of actual water use records vary widely across Regional Councils. Access to allocation or actual use records is currently constrained due to the time it takes to retrieve and process the data from the large number of sources. This data is not allocated ANZSIC code. Few records exist on permitted activity water use. Water supply data from town supply systems is kept by City and District Councils but not consistently defined by industry sector or ANZSIC code, and most are not metered for actual water use.	Yes
Solid waste (tonnes, m^3)	There is no national set of statistics on the volume or weight of solid waste to landfill or cleanfill by industry sector. Solid waste data recorded in NZ (e.g. as part of MfE's core set of national environmental indicators) focuses on trends in quantity (by weight) and composition of solid waste to landfill. This is a requirement under the Waste Minimisation Act for disposal facilities only and is recorded by facility operators.	Yes
Energy use (petajoules)	National statistics on energy use by type of fuel and supply is currently collated by the Ministry for Economic Development. EECA collate data on energy use based on demand. The data is	Partial

Indicator	Current Situation	Gaps
	then converted using the proportion of GDP per industry sector to provide estimates of energy demand, as opposed to actual energy use.	
GHG emissions (Gg CO_2e)	GHG emission data is collected in order to fulfil reporting requirements under the Kyoto Protocol by the Ministry for the Environment. This data is very accurate for a small number of industries, but does not cover all relevant ANZSIC industry sectors for this project. Single studies have been done on the GHG emissions of the Tourism sector, but this is not an ongoing data collection process.	Partial
Wastewater discharges (m^3)	There is no national set of data on the volume of wastewater discharged to land, water, coast or trade waste, by industry sector. Wastewater discharge volume allocations (to land, water, and coast) are recorded by Regional Councils where discharge permits apply. The availability and quality of actual discharge records vary widely across Regional Councils. Access to allocation or actual discharge records is currently constrained due to the time it takes to retrieve and process the data from the large number of sources. This data is not allocated ANZSIC codes. Few records exist on permitted activity discharges. Discharge volumes to trade waste are recorded differently across territorial authorities, and access to the data is currently constrained due to the time it takes to retrieve and process the data. This data is not allocated ANZSIC codes.	Yes
GDP ($millions)	GDP is currently collated by Statistics NZ. This data is available at ANZSIC code Level 2, but cannot be disaggregated to level 3 and beyond online database of statistics. GDP varies due to macro-economic influences and therefore is not as accurate an indicator for resource efficiency as production unit.	Partial
Employees (filled jobs or FTE)	Full time equivalents (FTE) and filled jobs are currently collated by Statistics NZ for ANZSIC code Level 2, but cannot be disaggregated to Level 3 and beyond using Infoshare, the online database of statistics.	Partial
Export value ($millions)	Export value is currently collated by Statistics NZ for ANZSIC code to Level 2. This data is cannot be disaggregated to level 3 and beyond using Infoshare, the online database of statistics.	Partial
Production Unit	Production units are collated by Statistics NZ for some industries but	Partial

Indicator	Current Situation	Gaps
	not all. Production units vary greatly between industry sectors.	
Net sales	Net sales are collated by Statistics NZ for some industry sectors but not all. "Net sales" is a common unit between all industries, but varies due to micro and macro-economic influences and therefore is not as accurate an indicator for resource efficiency as production unit.	Partial

7.0 Discussion and Recommendations

Based on the outcome of the data gathering process and the attempt at documenting the results of the indicators and resource efficiency ratios for the priority industry sectors, the following provides a summary of the key findings and recommendations for the ensuring adequate, long term data collection to support the development of a resource efficiency framework.

7.1 Framework Limitations

Typically, resource efficiency ratios are calculated at the business or sector level allowing intra-sector comparisons. The Ministry intends to develop a resource efficiency framework at an appropriate level, once data is collated If applied at the broadest sector level, i.e. ANZSIC code Level 1 or 2, the framework will only provide a very general indication of resource efficiency, and will not be able to differentiate the wide range of sub-sectors. The ratio is also limited in the ability to compare different sectors because of the lack of detail around productive output and the potential for more efficient resource use in each sector. Some further discussion and recommendations around these two issues are provided below.

Regardless of these two issues the development of data collection required to calculate the resource efficiency ratios will be a valuable starting point for long-term resource efficiency policy and programmes.

7.2 Industry Sector Definition

As discussed in Section 3.0 of this report, priority sectors were selected for the trial, and defined by ANZSIC 2006.

The ANZSIC 2006 industry code system for the priority sectors is considered an appropriate reference for the framework outputs. The use of these codes ensures that sectors are consistent with international definitions of business sectors, and is how New Zealand's business and economic data is collated, and therefore allows long term and international comparisons. To be effective, relevant information should be collected and reported down to at least Level 3 to allow for meaningful interpretation of results for each sector. Higher level interpretation is considered too broad to allow sufficient focus on a specific sector's resource efficiency potential or development of useful policy.

The framework also allows for the inclusion of sectors not defined by the ANZSIC code framework, namely Tourism (defined instead by the Tourism Satellite Account). The tourism sector is subject to ongoing measurement and management and it is considered that using the same industry sector definition should allow a consistent application of data to this sector for the framework.

Recommendations

- Develop the framework to Level 3 of the ANZSIC Code 2006 - this will require appropriate data collection, as discussed in Section 7.4.
- Include Tourism as defined by the Tourism Satellite Account.

7.3 Priority Industry Sectors

This study has identified many gaps in the environmental footprint and productive output data of particular industry sectors (retail, financial and business services, construction), and fewer gaps in the agriculture, food manufacturing, heavy industry and tourism sectors.

Recommendation:

- It is recommended that long-term data collection be used to redefine and / or prioritise sectors, where necessary. Prioritisation could be based on:
    - The identification of potential savings illustrated by calculations of resource efficiency for each sector (i.e. as a result of longer term Ministry research and understanding of key issues, demands / impacts) and,
    - Identification of priority sectors considered in other Ministry policy work, (e.g. current sustainability initiatives) and /or
    - Identification of priority sectors that are known to have a high dependence on key natural resources (e.g. those that consume large amounts of freshwater, and / or emit greenhouse gas).

7.4 Data Gaps and Requirements

7.4.1 Data Gaps

The limited range of environmental statistics available for NZ business is a continuing concern and obstacle to quantitative sustainability analysis. Data collection and management is fundamental to an effective resource efficiency framework. Data needs to be collected in a consistent manner and regularly reported to, or accessible by, the Ministry if data is to be of value to the resource efficiency framework.

This research was subject to a limited timeframe for data collection. While the project spanned nine months, concentrated data collection occurred for approximately three months. Realistic timeframes that take into account the matters discussed here, will need to be implemented to allow for initial and ongoing data collection[21].

A consistent approach to collecting and classifying data is required for meaningful, long term data collection and interpretation. This will ensure that comparison of data or results is undertaken with indicators determined and derived using the same methods.

The data filter highlights that, at present, there are significant gaps in data needed to adequately measure resource efficiency. Typically, data is not sufficiently accessible or recorded in New Zealand for most sectors.

[21] EcoLink represents one of the more comprehensive examples of similar work that has been undertaken in NZ;, it is understood that data collection for that project spanned six years (Garry MacDonald, pers. comm. 2010).

Recommendation:

The key issues which need to be resolved to be able to effectively apply the resource efficiency framework:

- Expansion of the type of data collected at a national level
- Responsibility for ongoing management of data and its collection at a national level
- Accessibility to existing data to support national collection and use of data.

This phase of work has verified that national data sets provide the most adequate data source (i.e. in terms of reliability, quality, repeatability, and relevance to this project, manipulation requirements) for the resource efficiency framework. While national data sets are considered more reliable (compared with case study data) the types of data available are limited (to energy, greenhouse gas emissions, and economic data) and limited by the sectors that are covered. Other data sources (e.g. research publications and annual environmental reports) do provide alternative data sources of information, although there are limitations, as discussed in Section 5.1. Information collected at the business level may also provides some insight into current scale and breadth of environmental reporting and measurement in NZ, and resource issues currently being focussed on by some businesses.

7.4.2 Opportunities for Expanding National Data Sets – The Environmental Domain Plan 2010

The Ministry is currently involved in a joint Ministry for the Environment, Statistics New Zealand, and Department of Conservation programme to establish a shared understanding of priorities for environmental statistics (The Environmental Domain Plan). This may provide an opportunity to identify and address data gaps constraining the application of the resource efficiency framework.

The *Stocktake for the Environment Domain Plan: 2010* provides an overview of the environmental statistics and data that are currently available for current environmental issues affecting New Zealand. The stocktake includes all national level environmental official statistics, and the source data, relevant to the key topics and their associated research questions. Table 9 provides a summary of the data sources identified in the *Stocktake for the Environment Domain Plan: 2010,* that are considered relevant to the core indicators used during the trial framework application.

There is further opportunity for the Ministry to address data gaps through the domain plan process. To assist, a summary of data sources - drawn from the Domain Plan - that may fulfil physical indicators is provided below, alongside recommendations for capturing data.

Recommendation:

- Use the Environmental Domain Plan process to prioritise and coordinate data requirements for the resource efficiency framework with other Ministry and government departments and agencies.

Table 9: Environmental Domain Plan Evaluation of National Data Sources and Recommendations for the Resource Efficiency Framework

Indicator	Environmental Domain Plan Data Source	Recommendations for the Resource Efficiency Framework
Solid Waste	No relevant data sources identified.	Include the collection of waste data by industry source, at landfill and cleanfill. Consider using the Waste Minimisation Act for this purpose.
Energy Use	*Energy Audit Database (EECA)*: Commercially confidential information from energy audits. Technical processes and opportunities can be benchmarked to determine wider applicability and cost effectiveness across other businesses. *Energy End-Use Database (EEUDB):* Energy Data File, sector studies (to be replaced by energy end-user surveys), and Statistics NZ's GDP data to regional and territorial local authority level. *Energy and the economy (Stats NZ, EECA and MED):* Energy end use in petajoules by industrial activity (including households) and energy type.	As noted in Section 6.1, this data is converted using the proportion of GDP per industry sector to provide estimates of energy demand, as opposed to actual energy use. A method which does not rely on a conversion rate using GDP from supply data may be useful for resource efficiency data requirements. In addition, defining the industry sectors in accordance with ANZSIC codes, and disaggregating data to ANZSIC code Level 3 would provide more useful data for the framework.
GHG Emissions	*New Zealand's Greenhouse Gas Inventory:* Reports emissions from six greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, SFs) under six sectors (energy, industrial processes, solvent and other product use, agriculture, land use, land-use change, and forestry, waste). *New Zealand Energy Greenhouse Gas Emissions:* Estimates contribute to the Ministry for the Environment's national greenhouse gas inventory	Identify methods of data collection for priority sectors that are not part of the GHG Inventory.
Wastewater Discharges	*New Zealand Wastewater Information Database (*MfE): Data on a number of	Develop a data collection and reporting programme from councils

Indicator	Environmental Domain Plan Data Source	Recommendations for the Resource Efficiency Framework
	areas of wastewater treatment plants including volume treated, population served, treatment processes used, effluent quality.	for actual discharges from industry, or at the very least, consented allocations to land, water, coast and trade waste. Recommend coding industries to the ANZSIC system.
Freshwater Use	*Snapshot of Water Allocation in New Zealand:* Data provides a national picture of allocated water in New Zealand by collating of regional data to assess the amount of water that is being allocated to various consumptive uses (e.g. irrigation, domestic, industrial). It includes the amount of water allocated volume by use and type (i.e. groundwater, surface water, storage).	Develop a data collection and reporting programme from councils for actual water use from industry, or at the very least, consented allocations from natural water bodies and metered water use from town supply. Recommend coding industries to the ANZSIC system.

7.5 Refinement of Environmental Indicators

As noted in Section 2.3 of this report, physical (environmental) indicators were selected for trial of the framework's application during the test phase. The indicators selected during the development phase of this study reflect existing environmental issues addressed by central government.

Separate from the issues around data availability, the application and testing of the indicators during Phase 2 allowed further consideration of the using the selection criteria outlined in Section 2.3. It also provided additional insight into current and future regional and global sustainability issues and their relevance to business. This allowed further consideration of the proposed core indicators against those key sustainability issues of actual resource use (compared to resource availability or sustainability) and economic development.

Based on the premise that the focus of indicators should be on key issues affecting long-term sustainability of New Zealand businesses, some of the original indicators are not considered to provide sufficient information to address key sustainability issues. In addition, central and local government initiatives on certain areas, such as solid waste management and waste water management, are considered sufficiently advanced that businesses / sectors are addressing performance in these areas, as follows:

- **Solid waste** – this issue is addressed via a number of initiatives and many companies are now well attuned to solid waste reduction and recycling initiatives. At a business level, a number of companies have solid waste reduction in place as reduction at source and recycling have become a key focus. The Waste Minimisation Act has the potential to further influence business behaviour in this area through market signals and research funding.

- **Energy use** – energy efficiency and other programmes are an important focus of existing central government initiatives.

- **Waste water** – data on this issue is difficult to obtain due to the large number of consents and trade wastes controlled by local authorities. Although this waste source is of interest, the effort to extract this data outweighs the information gain - this is because waste water data only provides data on volumes of waste and not data on the types of contaminants present. It is the contaminant effects on the environment that have more risk to environmental sustainability rather than volume alone. There are also a number of existing initiatives addressing waste water contaminants and volume in NZ – for example, the Ministry is partnered with Water New Zealand to develop initiatives to improve environmental performance in the area of wastewater and numerous guidelines have been developed to address waste water issues.

Recommendation:

It is recommended that the indicators are reduced in number to focus on the key sustainability issues facing the NZ economy, and to reduce the data requirements for the framework (see discussion in the section above). These key sustainability issues are considered to be: climate change and freshwater. The environmental indicators should be amended as follows:

- *Water use (m^3):* Retain current definition
- *GHG emissions (CO_2e)*: Retain current definition

In the long term supplementary indicators could be developed for example, material inputs.

7.6 Refinement of Economic Indicators

When the resource efficiency framework was drafted, it was considered that a single economic indicator in isolation can skew the results. For example, net sales or GDP, as micro and macro-economic factors can affect the ratio even when resource use and productive output hasn't changed. To lessen this effect, a set of indicators should be used which reviews the economic performance at both the macro level and sectoral level, where possible.

Case studies used in this research often report productivity in terms of their productive output. As noted in the development phase of this project, productive outputs can be units of product manufactured, hours of service delivery, operating surplus, shareholder returns etc and used to measure and monitor a company's environmental performance. This measure of economic performance would be useful for inter-sectoral comparisons.

Recommendation:

- Maintain the GDP and FTE indicators
- Remove the export indicator
- Include a productive output (tonnes of product etc) for industry sectors at Level 3 and below.

8.0 Conclusions

The proposed resource efficiency framework is considered a useful tool for providing a general indication of environmental performance of businesses in New Zealand and to guide long-term policy for improving efficiency of resource use.

The limited range of environmental statistics available for NZ business is a continuing concern and obstacle to quantitative sustainability analysis. To apply the proposed resource efficiency framework to New Zealand effectively, gaps in data collection and management will need to be resolved. On the whole, businesses make little data publically available and there is little emphasis on capturing this type of information in corporate reporting, other than for economic elements.

National data sets, official statistics, and research based on industry sectors' resource use or environmental footprint are more reliable, relevant, representative, and repeatable compared with individual company data. This is primarily due to the difficulty with using data from one entity to represent an entire sector, and not being able to compare case study data with national data sets. Data from case studies and published research is less adequate due to sector issues relating to representativeness, repeatability, and reliability of the case study or research. Data collection, management, and interpretation at the business or research level are less consistent and the risk of inaccurate results increases dramatically. However, a number of significant gaps remain in the national data sets for the purposes of this study.

Single company studies represent best practice examples but cannot be relied on to represent sectoral trends. In addition, time lapses between research and publication of reports creates problems when applying a resource efficiency calculation which relies on a ratio of *inputs : outputs* where economic data, for example is current, but environmental inputs or outputs are not. Clearly it is important to used data from the same timeframe to ensure that the ratio of physical and economic indicators is more meaningful. As such, economic and environmental data periods need to match. Ideally, to effectively compare ratios, data across sectors needs to be from the same timeframe to avoid comparing different time-sets where inputs and outputs may vary from year to year. There is also a preference or data that is routinely collected rather than using data from one off studies.

Key issues which need to be resolved to be able to effectively apply the resource efficiency ratio framework:

- Expansion of type of data on priority sectors and economic and environmental indicators collected at a national level, and
- Responsibility for ongoing management of data and its collection at a national level.

Once these matters are resolved, it will be feasible to apply the resource efficiency ratio to selected sectors.

It is also recommended that the core indicators be refined to reflect the key sustainability issues facing New Zealand business. Freshwater use and climate change (greenhouse gas emissions) are considered the two main issues affecting economic development and reflect regional, national, and global sustainability issues. Other matters identified for use in the trial application of the framework

(solid waste, wastewater and energy use) are important environmental issues but are considered to be sufficiently addressed through existing initiatives.

The framework should also allow sufficient flexibility to refine indicators in the face of changing environmental and economic issues.

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APPENDICES

Appendix 1: Data Filter and Ranking

Data Filter

Currency		Repeatability		Source Reliability		Representativeness		Indicator relevance	
Less than annually, annually, or biannually	3	Has repeatable methodology	3	Statistics NZ or other Gov Dept	3	100% of entities / companies)	15	Yes, data is directly relevant	3
2-5 years old and / or a one off study	2	ISO14001, GRI or similar approach used / signed up to, other research approach defined	2	CRI / Research study	2	50-75% of entities / companies	3	Yes relevant, but a proxy data set, with little / no aggregation / modification	2
5 years + old	1	Does not have a repeatable methodology, or is the methodology unclear	1	Consultant / market research / industry survey / individual company data	1	25-50% of entities / companies	2	Yes relevant, but a proxy data set, with high aggregation / modification	1
						One company	1	No, does not meet indicator definition	0

Ranking Table

RED = data not included in data matrix and/or no adequate data identified

Source	Published	Currency	Repeatability	Source Reliability	Weighted Representativeness	Indicator relevance	RANK
Hubbard's Foods Ltd, Sustainability Report 2007	2007	2	1	1	1	0	**5**
The Warehouse 2009 society and environment report	2009	3	2	1	1	0	**7**
Sanford Sustainable Development Report 2009	2009	3	2	1	1	1	**8**
How Clean and Green is New Zealand Tourism: Life Cycle and Future Environmental Impacts. Landcare Research Science Series No. 24	n.d.	1	1	2	1	1	**6**
Sanford Annual Report 2009	2009	3	1	1	1	1	**7**
MED Energy Supply and Demand Data	2006	2	3	3	3	3	**14**
Ricoh Sustainability Report 2009	2009	3	2	1	1	1	**8**
Food & Beverage Sector Organic Waste Survey	2009	1	1	2	2	0	**6**
Fonterra Sustainability Report	2009	3	1	1	1	1	**6**
Carter Holt Harvey Sustainability Report	2009	2	1	1	1	1	**5**
Toyota New Zealand	2009	2	1	1	1	0	**4**
BP Sustainability Report	2009	3	1	1	1	0	**5**
IAG Sustainability Report	2009	3	1	1	1	1	**6**
NZ Wine Annual Report 2009	2009	3	1	1	3	1	**9**
Landcare Annual Report 2009	2009	3	1	2	1	1	**8**
The Ecological Footprint of International Tourists in New Zealand	2009	1	1	2	3	2	**9**
The Carbon Footprint of Domestic Tourism: Technical report	2009	1	2	2	3	2	**10**
Confidential Source (Financial Proxy)	2010	1	1	3	2	1	**8**
FRST funded 'Improved Management of Tourist Flows and Effects' series of eight reports	2001	1	3	2	2	1	**9**
Resource Efficiency of the Ski Industry in New Zealand		1	1	1	2	0	**5**

Source	Published	Currency	Repeatability	Source Reliability	Weighted Representativeness	Indicator relevance	RANK
Economics Objective Synthesis Report, 2009	2009	1	2	2	2	1	**8**
ARGOS Comparative Dairy Research 2008	2008	2	2	2	2	1	**9**
2009 Annual ARGOS Sector Report - Dairy	2009	2	2	2	2	1	**9**
2009 Annual ARGOS Sector Report - Kiwifruit	2009	1	1	1	2	0	**5**
Southern Colour Print EnviroMark Case Study	2009	1	2	1	1	1	**6**
New Zealand's Greenhouse Gas Inventory 1990–2007	2007	3	3	3	15	3	**27**
Food Miles – Comparative Energy/Emissions Performance of New Zealand's Agriculture Industry	2006	1	3	2	2	1	**9**
Lion Nathan Sustainability Report	2008	2	2	1	1	2	**8**
TransfieldServices Sustainability Report 2009	2009	3	2	1	1	2	**9**
Westpac Stakeholder Report	2009	3	1	1	1	0	**6**
State of the Environment -Marlborough	2008	2	3	3	1	2	**11**
Auckland Airport Draft Sustainability Action Plan	2008	2	1	1	1	0	**5**
BNZ Group Environmental Policy	2004	2	0	1	1	0	**4**
Silver Fern Farms Environmental Policy	2008	2	1	1	1	0	**5**
MainZeal Environmental Report	2009	1	2	1	1	0	**5**
Holcim NZ Ltd	n.d.	1	2	1	1	0	**5**
Coca Cola	n.d	1	1	1	1	0	**4**
Bunnings Sustainability Report Card	2009	3	1	1	1	1	**7**
Sony Environmental Policy	2009	3	2	1	1	0	**7**
Woolworths Limited, CSR 2008	2008	3	1	1	2	1	**8**
Sustainability in the Australian and New Zealand Gypsum Board Industry Sustainability Report 09	2009	0	1	1	3	0	**5**
Construction and Demolition Waste Reduction - SMF 4195	2004	0	1	2	2	0	**5**
BRANZ / REBRI website[22]	n.d.	0	0	0	1	0	**1**
EnviroMark website	n.d.	0	0	0	1	0	**1**
EcoStore website	n.d.	0	0	0	1	0	**1**

[22] All website research was followed up with direct contact with the company where no information was available online.

Source	Published	Currency	Repeatability	Source Reliability	Weighted Representativeness	Indicator relevance	RANK
Print NZ website	n.d.	0	0	0	1	0	**1**
Beacon Pathways website	n.d.	0	0	0	1	0	**1**
EcoLink Database	1997 - 2006	0	0	0	1	0	**1**
Ag Research	various	0	0	0	1	0	**1**
Film Industry - Green Screen programme	n.d.	0	0	0	1	0	**1**
Chelsea Sugar / Sugar NZ	n.d.	0	0	0	1	0	**1**
Sustainability: Landcare Research indicator list	2009	3	2	2	1	1	**9**
Evaluation of the environmental impacts of apple production using Life Cycle Assessment (LCA): Case study in New Zealand	2005	1	2	2	3	1	**9**
Aggregate eco-efficiency indices for New Zealand—a principal components analysis	2004	1	1	1	2	1	**6**
Eco-efficiency of intensification scenarios for milk production in New Zealand	2007	1	1	2	2	1	**7**
First Life Cycle Assessment of Milk Production from New Zealand Dairy Farms	2003	1	1	2	2	1	**7**
Waste 2 Gold – Feasibility Study for Zespri : Final Report	2008	1	1	1	2	1	**6**
Carbon Footprinting for the Kiwifruit Supply Chain- Report on Methodology and Scoping Study	2008	1	1	2	2	1	7
Zespri Group Ltd Annual Report	2009	3	1	1	1	1	**7**
City and District Council Trade Waste Data: wastewater discharge volumes	2008	3	2	3	2	1	**11**
Regional Council discharge consent / permitted activity data	2008	3	2	3	2	1	**11**
Statistics New Zealand Infoshare www.stats.govt.nz/infoshare: total building and construction floor area	2008	3	3	3	15	2	**26**
Monitoring and Evaluation, Innovation and Research Policy, Ministry of Agriculture and Forestry: Statistics on	2008	3	3	3	15	2	**26**

Source	Published	Currency	Repeatability	Source Reliability	Weighted Representativeness	Indicator relevance	RANK
Forestry, Wood Product Manufacturing and Pulp and Paper Manufacturing							
Dairy, Deer and Sheep & Beef GHG Emissions	2006/07 and 2007/08	1	3	2	15	1	**22**
Total Energy Indicators of Agriculture Sustainability	2001	1	2	2	15	1	**21**
Statistics New Zealand Infoshare: FTE by industry	2008	3	3	3	15	3	**27**
Tourism Satellite Account.	2009	3	3	3	15	3	**27**
Statistics New Zealand Infoshare: Net Sales by ANZSIC division	2008	3	3	3	15	3	**27**
Statistics New Zealand Infoshare:http://www.stats.govt.nz/infoshare Prodn A/C, GDP (Prodn Measure) by Aggregated Ind, Const. Price (Annual-Mar)	2008	3	3	3	15	3	**27**
EECA Energy Database		2	2	3	15	3	**25**
Statistics New Zealand Infoshare : Energy Use Survey	2008	2	3	3	15	3	**26**
City and District Council Water Use Data: water use by industry	2008	3	3	3	3	1	**13**
Regional Council water use consent / permitted activity data	2008	3	3	3	3	1	**13**

Appendix 2: Data Matrix

Resource Efficiency Indicator Data Matrix (As at 14 May 2010)

Case study data are in *italics – these are illustrative only and represent just part of a given sector.*

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
A	**Agriculture, Forestry and Fishing**											9,366.30	
	A01	Agriculture				36,430.00			6,382				
		A011	Nursery and Floriculture Production										
		A012	Mushroom and Vegetable Growing										
			Indoor cropping (level 4)		4.426								
		A013	Fruit and Tree Nut Growing		3.07								
		A013200	Kiwifruit Growing						*731 million*		*100.0 million trays*		*12.37m3/ha*
		A014	Grain, Sheep and Beef Cattle Farming		8.33								
		A014400	Sheep-Beef Cattle Farming										AG GHG 0708'!A1
		A015	Other Crop Growing										
		A016	Dairy Cattle Farming		*9.227*						*995 kg/ms/ha Conventional; 705kg/ms/ha converting*		AG GHG 0708'!A1
		A017	Poultry Farming										
		A018	Deer Farming										AG GHG 0708'!A1
		A019	Other Livestock Farming										
			Poultry, Deer and Other Livestock Farming		1.229								

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
			Level 3 Non-dairy agriculture		9.585								
	A02	Aquaculture											
		A020	Aquaculture		0.191								
			Aquaculture , deepwater fishing and on-board processing; Inshore species and on-shore processing.	*757472*	*0.000025911*	*82554*	*2143*			*1989*	*82339 T*		
	A03	Forestry and Logging			1.878				1,488				
		A030	Forestry and Logging										
		A030100	Forestry			-24,527.90							
		A030200	Logging								19385427m3		
			Forestry and Mining							10,700			
	A04	Fishing, Hunting and Trapping			6.194								
		A041	Fishing		5.49				197				
		A042	Hunting and Trapping										
	A05	Agriculture, Forestry and Fishing Support Services			4.624								
		A051	Forestry Support Services										
		A052	Agriculture and Fishing Support Services										
			Agriculture and hunting		16.32								
C	**Manufacturing**									194,900		20,920.60	
	C11	*Food Product Manufacturing*			*18.88*		*2880*			*17140*			
		C111	Meat and Meat Product Manufacturing		7.976								
		C112	Seafood Processing										

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
		C113	Dairy Product Manufacturing		*20.4 million GJ*	*141,000,000*	*5500000*	*29800000*	*9.24billion*		*15 billion litres of milk*	*$3.1 billion*	*34 million m3 or 2.3 litres per 1 litre of raw milk*
		C114	Fruit and Vegetable Processing										
		C115	Oil and Fat Manufacturing										
		C116	C116200 Grain Mill and Cereal Product Manufacturing										
		C116200	*Cereal, Pasta and Baking Mix Manufacturing*	*5472*		*2041.5*	*520.812*			*125*	*6069T Cereal*	*1517258 (net profit before tax)*	
		C117	Bakery Product Manufacturing										
		C118	Sugar and Confectionery Manufacturing										
		C119	Other Food Product Manufacturing										
			Level 3 Other food manufacturing processes		8.502								
	C12	Beverage and Tobacco Product Manufacturing											
		C121	Beverage Manufacturing										
		C122	Cigarette and Tobacco Product Manufacturing										
			Food and Drink manufacturing			6.61							
			Food, Beverage and Tobacco product Manufacturing						6,708				
		C121400	Wine and Other Alcoholic Beverage Manufacturing										
			Wine manufacturing								*205.2 million litres*		

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
	C13	Textile, Leather, Clothing and Footwear Manufacturing			2.434				701	15000			
		C131	Textile Fibre, Yarn and Woven Fabric Manufacturing										
		C132	Leather Tanning and Fur Dressing										
		C133	Textile Product Manufacturing										
		C134	Knitted Product Manufacturing										
		C135	Clothing and Footwear Manufacturing							6130			
	C14	Wood Product Manufacturing											
			Source										
		C141	Log Sawmilling and Timber Dressing								3734000m3		
		C149	Other Wood Product Manufacturing			2007 ghg inventory pdf					2007 ghg inventory pdf		
		C149300	Veneer and Plywood Manufacturing										
			Timber, plywood, particle board, laminate, mouldings	*308, 142*	*3822614 Gj*	*304, 493 tonnes*	*23, 308 tonnes*			*7500*	*1,098, 092 tonnes*		*2.06 GJ/m3*
		C149400	Reconstituted Wood Product Manufacturing								905089.4638		
	C15	Pulp, Paper and Converted Paper Product Manufacturing				7.51					4651610.145		
			Pulp, binding and coating pigment	*7,303 m3*		*152, 352 tonnes*	*28, 764 T*	*7,666m3*			*190, 702 tonnes*		
		C151	Pulp, Paper and Paperboard Manufacturing								2325805.072		
		C152	Converted Paper Product Manufacturing										

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
			Wood and Paper Products						2,394				
	C16	Printing							1,423				
		C161	Printing				*3.42*						
		C162	Reproduction of Recorded Media										
			C15 and C16		**47.408**								
	C17	Petroleum and Coal Product Manufacturing											
		C170	Petroleum Refining and Petroleum and Coal Product Manufacturing										
	C18	Basic Chemical and Chemical Product Manufacturing			11.604	603.21							
		C181	Chemical Manufacturing										
		C182	Basic Polymer Manufacturing										
		C183	Fertiliser and Pesticide Manufacturing										
		C184	Pharmaceutical and Medicinal Product Manufacturing										
		C185	Cleaning Compound and Toiletry Preparation Manufacturing										
		C189	Other Basic Chemical Product Manufacturing										
	C19	Polymer Product and Rubber Product Manufacturing											
		C191	Polymer Product Manufacturing										
		C192	Natural Rubber Product Manufacturing										
			Petroleum, Chemical, Plastic and Rubber Product Manufacturing						1,674				
	C20	Non-Metallic Mineral Product Manufacturing			7.539	860.38			900				

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
		C201	Glass and Glass Product Manufacturing										
		C202	Ceramic Product Manufacturing										
		C203	Cement, Lime, Plaster and Concrete Product Manufacturing										
		C209	Other Non-Metallic Mineral Product Manufacturing										
	C21	Primary Metal and Metal Product Manufacturing			45.095				2,100				
		C211	Basic Ferrous Metal Manufacturing										
		C212	Basic Ferrous Metal Product Manufacturing										
		C213	Basic Non-Ferrous Metal Manufacturing										
		C214	Basic Non-Ferrous Metal Product Manufacturing										
			Metal production			2,265.56							
	C22	Fabricated Metal Product Manufacturing			7.016								
		C221	Iron and Steel Forging										
		C222	Structural Metal Product Manufacturing										
		C223	Metal Container Manufacturing										
		C224	Other Sheet Metal Product Manufacturing										
		C229	Other Fabricated Metal Product Manufacturing										
	C23	Transport Equipment Manufacturing											
		C231	Motor Vehicle and Motor Vehicle Part Manufacturing										
		C239	Other Transport Equipment Manufacturing										

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
	C24	Machinery and Equipment Manufacturing							2,764				
		C241	Professional and Scientific Equipment Manufacturing										
		C242	*Computer and Electronic Equipment Manufacturing*			*2535.54*				*214*		*84.2 million*	
		C243	Electrical Equipment Manufacturing										
		C244	Domestic Appliance Manufacturing										
		C245	Pump, Compressor, Heating and Ventilation Equipment Manufacturing										
		C246	Specialised Machinery and Equipment Manufacturing										
		C249	Other Machinery and Equipment Manufacturing										
	C25	Furniture and Other Manufacturing							543				
		C251	Furniture Manufacturing										
		C259	Other Manufacturing										
			Level 2 Other Manufacturing Industries		0.302								
E	**Construction**				7.91				6,528	101,200		10,508.60	
	E30	Building Construction					*420,000*				8,523,620		*Wastewater 38.2 of MJ per m2 (cradle to gate of GIB)*
	E31	Heavy and Civil Engineering Construction											
		E310	Heavy and Civil Engineering Construction										
	E32	Construction Services											
		E321	Land Development and Site Preparation										

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
			Services										
		E322	Building Structure Services										
		E323	Building Installation Services										
		E324	Building Completion Services										
		E329	Other Construction Services										
G	**Retail Trade**								8,376	130,800		10,027.10	
	G39	Motor Vehicle and Motor Vehicle Parts Retailing		*2,500m3*	*149.8kwh/m2*	*1,217 tonnes*				*220 employees*		*2.8 million net profit*	
		G391	Motor Vehicle Retailing										
		G392	Motor Vehicle Parts Retailing										
	G40	Fuel Retailing			*22, 471 mwh*	*14, 355 tonnes*	*2.5 tonnes*			*1,740*		*$1,964m*	
		G400	Fuel Retailing										
	G41	Food Retailing			47.409								
		G411	Supermarket and Grocery Stores		*300000 mWh*	*58,711*	*21.60*			*19,040*			
		G412	Specialised Food Retailing										
	G42	Other Store-Based Retailing											
		G421	Furniture, Floor Coverings, Houseware and Textile Goods Retailing										
		G422	Electrical and Electronic Goods Retailing			*2022.92 tonnes*				*202*		*$80.4m*	
		G423	Hardware, Building and Garden Supplies										

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS Units as described, unless otherwise noted					ECONOMIC INDICATORS Units as described, unless otherwise noted				**Industry Calculated Resource Efficiency Factors** i.e. ratios calculated by business in their reports ***– provided as example only***
				Fresh Water Use (m3)	**Energy Use (Pj)**	**Greenhouse gas emissions (Co2 equivalents, Gg)**	**Solid Waste Produced (T)**	**Wastewater produced m3**	**GDP $millions**	**Employee numbers FTE**	**Production output**	**Net sales $millions**	
			Retailing										
		G424	Recreational Goods Retailing										
		G425	Clothing, Footwear and Personal Accessories Retailing										
		G426	**Department Stores**		*77823886 kW*	*23,107*	*22,972 cubic metres*			*4967 FTE*	*465,530 sq m retail space*	*1,531 million dollars in sales*	*Store Average: kW/sqm 148, Waste M3/$1m 9.5*
		G427	Pharmaceutical and Other Store-Based Retailing										
	G43	Non Store Retailing and Retail Commission Based Buying and/or Selling											
		G431	Non Store Retailing										
		G432	Retail Commission Based Buying and/or Selling										
			Wholesale and Retail Trade - non-food		0.683								
H	**Accommodation and Food Services**								2,076	81,900		3,069.90	
	H44	Accommodation			4.49								
		H440	Accommodation										
	H45	Food and Beverage Services											
		H451	Cafes, Restaurants and Takeaway Food Services										
		H452	Pubs, Taverns and Bars										
		H453	Clubs (Hospitality)										
K	**Financial and Insurance Services**				5.767		*1378.6*		9,179	46,600		4,520.50	
	K62	Finance											

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
		K621	Central Banking										
		K622	Depository Financial Intermediation										
		K623	Non-depository Financing										
		K624	Financial Asset Investing										
	K63	Insurance and Superannuation Funds											
		K631	Life Insurance										
			Source										
		K632	K632 Health and General Insurance		*5, 416 mw*	*2,911 tonnes*				*1,860*		*2.3 billion business volume*	
		K633	Superannuation Funds										
	K64	Auxiliary Finance and Insurance Services											
		K641	Auxiliary Finance and Investment Services										
		K642	Auxiliary Insurance Services										
L	**Rental, Hiring and Real Estate Services**									18,700			
	L67	Property Operators and Real Estate Services											
		L671	Property Operators										
		L672	Real Estate Services										
M	**Professional, Scientific and Technical Services**												
	M69	Professional, Scientific and Technical Services (except Computer Systems Design and Related Services)								154,700			
		M691	*M691 Scientific Research Services*	*10532.56*	*160182kW*		*23.67*			*383*		*$1.4m (net profit)*	

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
		M692	Architectural, Engineering and Technical Services										
		M693	Legal and Accounting Services										
		M694	Advertising Services										
		M695	Market Research and Statistical Services										
		M696	Management and Other Consulting Services										
		M697	Veterinary Services										
		M699	Other Professional, Scientific and Technical Services										
	M70	Computer Systems Design and Related Services											
		M700	Computer Systems Design and Related Services										
R	**Arts and Recreation Services**								2,366	66,000		3,348.20	
	R89	Heritage Activities											
		R891	Museum Operation										
		R892	Parks and Gardens Operations										
	R90	Artistic Activities											
		R900	Creative and Performing Arts Activities										
	R91	Sport and Recreation Activities											
		R911	Sport and Physical Recreation Activities										
		R912	Horse and Dog Racing Activities										
		R913	Amusement and Other Recreation Activities										
	R92	Gambling Activities											

INDUSTRY (by ANZSIC CODE)				ENVIRONMENTAL INDICATORS					ECONOMIC INDICATORS				Industry Calculated Resource Efficiency Factors i.e. ratios calculated by business in their reports – *provided as example only*
				Units as described, unless otherwise noted					Units as described, unless otherwise noted				
				Fresh Water Use (m3)	Energy Use (Pj)	Greenhouse gas emissions (Co2 equivalents, Gg)	Solid Waste Produced (T)	Wastewater produced m3	GDP $millions	Employee numbers FTE	Production output	Net sales $millions	
		R920	Gambling Activities										
	Tourism		*Tourism*										
			Tourism			*1900 for domestic and 637 for visitors*			*16.74 billion*	*94,200*	*49m nights for tourist and 42.65m nights for domestic*		
			Tourism	101131000	107.124	6794783		172,599 000	4.8 billion	94 024			
			Tourism						6,660	*94,200*	*32.1M guest nights*		
			Commercial		49.24								

Appendix 3: Raw Data Tables

Inventory 2002
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1. Greenhouse Gas Emissions Data

Summary Report for CO_2 Equivalent Emissions

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 [1]	CH_4	N_2O	HFCs [2]	PFCs [2]	SF_6 [2]	Total
	CO_2 equivalent (Gg)						
Total (Net Emissions) [1]	**11,316.37**	**26,622.17**	**12,862.64**	**856.63**	**41.67**	**14.70**	**51,714.18**
1. Energy	**31,559.93**	**831.86**	**261.31**				**32,653.10**
A. Fuel Combustion (Sectoral Approach)	30,503.89	126.89	261.31				30,892.10
1. Energy Industries	7,845.32	5.73	16.34				7,867.39
2. Manufacturing Industries and Construction	5,313.75	12.98	54.15				5,380.88
3. Transport	14,661.44	55.23	160.57				14,877.24
4. Other Sectors	2,683.39	52.95	30.25				2,766.59
5. Other	NA	NA	NA				NA
B. Fugitive Emissions from Fuels	1,056.04	704.96	NA,NE,NO				1,761.00
1. Solid Fuels	NA,NE	261.83	NA,NE				261.83
2. Oil and Natural Gas	1,056.04	443.13	NE,NO				1,499.17
2. Industrial Processes	**3,670.62**	**18.26**	**NA,NO**	**856.63**	**41.67**	**14.70**	**4,601.88**
A. Mineral Products	860.38	NA	NA				860.38
B. Chemical Industry	584.95	18.26	NA,NO	NA	NA	NA,NO	603.21
C. Metal Production	2,225.29	IE,NA,NE,NO	NA	NA,NO	40.27	IE,NA,NO	2,265.56
D. Other Production	NA						NA
E. Production of Halocarbons and SF_6				NA,NO	NO	NO	NA,NO
F. Consumption of Halocarbons and SF_6 [2]				856.63	1.40	14.70	872.73
G. Other	NA	NA	NA	NA	NA	NA	NA
3. Solvent and Other Product Use	**NA,NE**		**43.40**				**43.40**
4. Agriculture		**24,069.51**	**12,360.49**				**36,430.00**
A. Enteric Fermentation		23,326.38					23,326.38
B. Manure Management		729.10	57.96				787.06
C. Rice Cultivation		NO					NO
D. Agricultural Soils [3]		NE,NO	12,298.07				12,298.07
E. Prescribed Burning of Savannas		0.88	0.16				1.04
F. Field Burning of Agricultural Residues		13.16	4.31				17.47
G. Other		NO	NO				NO
5. Land Use, Land-Use Change and Forestry [1]	**-23,915.12**	**62.10**	**17.01**				**-23,836.01**
A. Forest Land	-24,565.23	33.89	3.44				-24,527.90
B. Cropland	-520.99	NA,NO	10.71				-510.28
C. Grassland	1,032.61	28.21	2.86				1,063.68
D. Wetlands	0.72	IE,NE,NO	IE,NE,NO				0.72
E. Settlements	97.16	NE	NE				97.16

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 (1)	CH_4	N_2O	HFCs (2)	PFCs (2)	SF_6 (2)	Total
F. Other Land	40.61	NE	NE				40.61
G. Other	IE,NE	IE,NE	IE,NE				IE,NE
6. Waste	**0.93**	**1,640.44**	**180.43**				**1,821.80**
A. Solid Waste Disposal on Land	NE,NO	1,437.95					1,437.95
B. Waste-water Handling		202.49	179.19				381.68
C. Waste Incineration	0.93	0.00	1.24				2.17
D. Other	NO	NO	NO				NO
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Memo Items: (4)							
International Bunkers	3,589.97	3.42	30.67				3,624.07
Aviation	2,611.91	1.54	22.72				2,636.16
Marine	978.06	1.89	7.95				987.90
Multilateral Operations	**NE**	**NE**	**NE**				**NE**
CO_2 Emissions from Biomass	**4,822.42**						**4,822.42**
	Total CO_2 Equivalent Emissions without Land Use, Land-Use Change and Forestry						75,550.19
	Total CO_2 Equivalent Emissions with Land Use, Land-Use Change and Forestry						51,714.18

(1) For CO2 from Land Use, Land-use Change and Forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).

(2) Actual emissions should be included in the national totals. If no actual emissions were reported, potential emissions should be included.

(3) Parties which previously reported CO2 from soils in the Agriculture sector should note this in the NIR

(4) See footnote 8 to table Summary 1.A.

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A-B SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO_2, CH_4 and N_2O

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS (2)			EMISSIONS					
	Production/Consumption quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
	Description (1)	(kt)	(t/t)			Emissions (3)	Recovery (4)	Emissions (3)	Recovery (4)	Emissions (3)	Recovery (4)
						(Gg)					
A. Mineral Products						857.29	NA,NO	NA	NA	NA	NA
1. Cement Production	Cement production	C	C			682.39	NO				
2. Lime Production	Lime production	175.10	0.72			126.68	NO				
3. Limestone and Dolomite Use	Limestone & Dolomite use	C	C			48.22	NO				
4. Soda Ash						IE,NO	NO				
Soda Ash Production	Soda Ash Production	NO	NO			NO	NO				
Soda Ash Use	Soda Ash Use	C	IE			IE	NO				
5. Asphalt Roofing	Asphalt Roofing	0.30	NA			NA	NA				
6. Road Paving with Asphalt	Total bitumen use for roading	170.27	NA			NA	NA				
7. Other *(please specify)*						IE	NA	NA	NA	NA	NA
Glass Production	Glass Production	C	IE	NA	NA	IE	NA	NA	NA	NA	NA
B. Chemical Industry						579.58	NA,NO	IE,NA,NO	NA,NO	NA,NO	NA,NO
1. Ammonia Production (5)	Ammonia Production	235.51	1.51	IE	NA	354.68	NO	IE	NO	NA	NA
2. Nitric Acid Production	Nitric Acid Production	NO			NO					NO	NO
3. Adipic Acid Production	Adipic Acid Production	NO	NO		NO	NO	NO			NO	NO
4. Carbide Production	Carbide Production	NO	NO	NO		NO	NO	NO	NO		
Silicon Carbide	Silicon Carbide	NO	NO	NO		NO	NO	NO	NO		
Calcium Carbide	Calcium Carbide	NO	NO	NO		NO	NO	NO	NO		
5. Other *(please specify)*						224.90	NA,NO	IE,NA,NO	NA,NO	NA,NO	NA,NO
Carbon Black	Carbon Black Production	NO		NO				NO	NO		

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS (2)			EMISSIONS					
	Production/Consumption quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
						Emissions (3)	Recovery (4)	Emissions (3)	Recovery (4)	Emissions (3)	Recovery (4)
	Description (1)	(kt)	(t/t)			(Gg)					
Ethylene	Ethylene Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Dichloroethylene	Dichloroethylene Production	NO		NO				NO	NO		
Styrene	Styrene Production	NO		NO				NO	NO		
Methanol	Methanol Production	C		IE				IE	NO		
Hydrogen	Hydrogen production	35.76	6.29	NA	NA	224.90	NO	NA	NA	NA	NA
Production of Fertilisers	Superphosphate fertiliser (including H2SO4 production) production	1,917.62	NA	NA	NA	NA	NO	NA	NO	NA	NO
Production of Formaldehyde	Formaldehyde Production	36.00	NA	IE	NA	NA	NA	IE	NO	NA	NA

(1) Where the IPCC Guidelines provide options for activity data, e.g. cement production or clinker production for estimating the emissions from Cement Production, specify the activity data used (as shown in the example in parentheses) in order to make the choice of emission factor more transparent and to facilitate comparisons of implied emission factors.

(2) The implied emission factors (IEF) are estimated on the basis of gross emissions as follows: IEF = (emissions plus amounts recovered, oxidized, destroyed or transformed) / activity data.

(3) Final emissions are to be reported (after subtracting the amounts of emission recovery, oxidation, destruction or transformation).

(4) Amounts of emission recovery, oxidation, destruction or transformation.

(5) To avoid double counting, make offsetting deductions for fuel consumption (e.g. natural gas) in Ammonia Production, first for feedstock use of the fuel, and then for a sequestering use of the feedstock.

C-G SECTORAL BACKGROUND DATA FOR INDUSTRIAL PROCESSES
Emissions of CO_2, CH_4 and N_2O

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS [2]			EMISSIONS					
	Production/Consumption quantity		CO_2	CH_4	N_2O	CO_2		CH_4		N_2O	
						Emissions[3]	Recovery[4]	Emissions[3]	Recovery[4]	Emissions[3]	Recovery[4]
	Description [1]	(kt)	(t/t)			(Gg)					
C. Metal Production						2,224.62	NA,NO	IE,NA,NE,NO	NA,NO	NA	NA
1. Iron and Steel Production			C,IE,NO	IE,NA,NE,NO		1,645.66	NA,NO	IE,NA,NE,NO	NA,NO		
Steel	Steel slab production	C	C	NE		1,645.66	NO	NE	NO		
Pig Iron	Pig iron production	IE	IE	IE		IE	NO	IE	NO		
Sinter		NO	NO	NO		NO	NO	NO	NO		
Coke		NO	NO	NO		NO	NO	NO	NO		
Other *(please specify)*						NA	NA	NA	NA		
2. Ferroalloys Production		NO	NO	NO		NO	NO	NO	NO		
3. Aluminium Production	Hot metal aluminium production	352.99	1.64	NA		578.96	NO	NA	NA		
4. SF_6 Used in Aluminium and Magnesium Foundries											
5. Other *(please specify)*						NA	NA	NA	NA	NA	NA
D. Other Production						NA	NO				
1. Pulp and Paper											
2. Food and Drink	Food & Drink manufacturing	3,796.34	NA			NA	NO				
G. Other *(please specify)*						NA	NO	NA	NA	NA	NA
Panel products (fibreboard)	Panel Products (fibreboard)	734.82	NA	NA	NA	NA	NO	NA	NA	NA	NA

(1) Where the IPCC Guidelines provide options for activity data, e.g. cement production or clinker production for estimating the emissions from Cement Production, specify the activity data used (as shown in the example in parentheses) in order to make the choice of emission factor more transparent and to facilitate comparisons of implied emission factors.

(2) The implied emission factors (IEF) are estimated on the basis of gross emissions as follows: IEF = (emissions plus amounts recovered, oxidized, destroyed or transformed) / activity data.

(3) Final emissions are to be reported (after subtracting the amounts of emission recovery, oxidation, destruction or transformation).

(4) Amounts of emission recovery, oxidation, destruction or transformation.

TABLE 3.A-D SECTORAL BACKGROUND FOR SOLVENT AND OTHER PRODUCT USE

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA		IMPLIED EMISSION FACTORS [1]	
	Description	(kt)	CO_2 (t/t)	N_2O (t/t)
A. Paint Application		64.77	NE	
B. Degreasing and Dry Cleaning		0.70	NE	NA
C. Chemical Products, Manufacture and Processing		27.23	NE	
D. Other				
1. Use of N_2O for Anaesthesia		NA		NA
2. N_2O from Fire Extinguishers		NE		NA
3. N_2O from Aerosol Cans		NE		IE
4. Other Use of N_2O		NE		IE
5. Other *(please specify)*[2]				
Aerosols		NE	NE	NA
Domestic & Commercial Use		10.80	NE	NA
Other non-specified		IE	NA	NA
Printing Industry		3.06	NE	NA
Steel Production		NA	NA	NA

(5) (1) The implied emission factors will not be calculated until the corresponding emission estimates are entered directly into table 3.

(6) (2) Some probable sources to be reported under 3.D Other are listed in this table. Complement the list with other relevant sources, as appropriate.

2: Forestry Production

Source: *Monitoring and Evaluation, Innovation and Research Policy, Ministry of Agriculture and Forestry.* http://www.maf.govt.nz/statistics/forestry/

Symbol P= Provisional.

Estimated Roundwood removals from New Zealand forests[1]

	Removals from indigenous forests[2]							Removals from planted production forests								
	Saw logs	Peeler logs	Small logs	Pulp logs	Export chips	Export logs	Total natural forest removals	Saw logs	Peeler logs	Small logs	Pulp logs	Export chips	Export logs	Total planted production forest removals	Total removals for quarter ended	Total removals for year ended
31 Mar 2003	8	-		-	-	-	**8**	2 009	256	324	788	92	1 714	**5 183**	**5 192**	**22 472**
30 June 2003	8	-		-	-	-	**8**	2 030	266	378	593	72	2 355	**5 694**	**5 702**	**22 529**
30 Sep 2003	9	1		-	-	-	**10**	2 048	269	352	814	73	1 852	**5 409**	**5 418**	**22 142**
31 Dec 2003	8	-		-	-	-	**8**	1 851	257	354	801	52	1 618	**4 934**	**4 942**	**21 252**
31 Mar 2004	6	-		-	-	-	**6**	1 811	248	365	849	81	1 488	**4 842**	**4 848**	**20 909**
30 June 2004	8	1		-	-	-	**9**	2 077	291	369	799	31	1 340	**4 906**	**4 915**	**20 122**
30 Sep 2004	6	-		-	-	-	**6**	2 216	314	378	816	67	1 413	**5 205**	**5 210**	**19 914**
31 Dec 2004	5	-		-	-	-	**5**	1 951	288	428	850	36	1 278	**4 832**	**4 837**	**19 810**
31 Mar 2005	5	-		-	-	-	**5**	1 768	276	311	821	65	1 092	**4 333**	**4 338**	**19 301**
30 June 2005	6	-		-	-	-	**6**	2 029	311	368	811	80	1 293	**4 892**	**4 898**	**19 284**
30 Sep 2005	6	-		-	-	-	**6**	2 080	301	386	825	62	1 370	**5 024**	**5 030**	**19 103**
30 Dec 2005	6	-		-	-	-	**6**	1 790	243	371	859	53	1 439	**4 754**	**4 760**	**19 026**
31 Mar 2006	7	-		-	-	-	**7**	1 743	265	354	740	66	965	**4 133**	**4 139**	**18 827**
30 June 2006	5	-		-	-	-	**5**	1 920	288	385	819	49	1 425	**4 884**	**4 889**	**18 818**
30 Sep 2006	5	-		-	-	-	**5**	2 097	344	384	811	52	1 495	**5 184**	**5 189**	**18 977**

	Removals from indigenous forests[2]							Removals from planted production forests								
	Saw logs	Peeler logs	Small logs	Pulp logs	Export chips	Export logs	Total natural forest removals	Saw logs	Peeler logs	Small logs	Pulp logs	Export chips	Export logs	Total planted production forest removals	Total removals for quarter ended	Total removals for year ended
30 Dec 2006	5	-		-	-	-	**5**	1 928	292	326	838	65	1 692	**5 140**	**5 145**	**19 363**
31 Mar 2007	3	-		-	-	-	**3**	1 823	274	315	816	100	1 361	**4 688**	**4 691**	**19 915**
30 June 2007	7	-		-	-	-	**7**	1 982	327	331	881	61	1 701	**5 282**	**5 289**	**20 315**
30 Sep 2007	4	-		-	-	-	**4**	2 161	338	335	876	100	1 531	**5 341**	**5 345**	**20 471**
30 Dec 2007	6	-		-	-	-	**6**	2 010	286	322	885	103	1 384	**4 988**	**4 994**	**20 320**
31 Mar 2008	2	-		-	-	-	**2**	1 687	254	302	851	100	1 582	**4 776**	**4 778**	**20 406**
30 June 2008 [P]	3	-		-	-	-	**3**	1 818	293	289	768	86	1 523	**4 777**	**4 780**	**19 897**
30 Sep 2008 [PR]	4	-		-	-	-	**4**	1 770	314	321	858	100	1 800	**5 162**	**5 166**	**19 718**
31 Dec 2008 [P]	1	-		-	-	-	**1**	1 477	246	288	805	65	1 780	**4 661**	**4 662**	**19 385**

Production of panel products [1, 2]

	Quarter ended				Year to 31
	31 March	30 June	30 September	31 December	December
	(m^3)	(m^3)	(m^3)	(m^3)	(m^3)
Fibreboard - all types[3]					
2002	195 849	218 804	234 726	230 922	**880 301**
2003	198 665	226 166	221 096	222 612	**868 540**
2004	203 237	220 522	227 706	221 943	**873 408**
2005	175 492	220 022	236 053	229 472	**861 039**
2006	221 391	238 410	236 567	185 655	**882 022**
2007	176 124	195 976	198 515	193 708	**764 323**
2008	176 845	157 265 P	180 474 P	153 933 P	**668 517** P
Veneer[4]					
2002	110 276	141 676	149 287	151 501	**552 740**
2003	159 136	160 656	162 554	155 210	**637 556**
2004	150 327	172 644	186 405	171 311	**680 687**
2005	163 941	184 445	179 031	144 113	**671 529**
2006	157 618	165 307	197 701	167 936	**688 562**
2007	157 368	139 096	143 739	121 566	**561 769**
2008	108 174	124 516 P	133 565 P	104 599 P	**470 854** P
Plywood[5]					
2002	63 102	72 286	81 983	81 685	**299 056**
2003	85 701	81 647	90 120	86 247	**343 714**
2004	87 088	96 753	114 333	103 973	**402 147**
2005	93 577	109 551	110 701	91 146	**404 974**
2006	92 410	104 006	116 543	103 107	**416 067**
2007	98 137	114 695	118 083	96 678	**427 593**
2008	86 927	105 623 P	108 220 P	84 856 P	**385 626** P
Particleboard[6]					
2002	49 603	54 818	51 149	49 080	**204 650**
2003	54 930	63 774	50 612	52 539	**221 855**
2004	63 453	55 480	62 744	62 121	**243 799**
2005	49 625	64 976	64 380	58 810	**237 790**
2006	50 039	59 298	67 094	65 392	**241 823**
2007	64 455	67 872	66 459	57 480	**256 266**
2008	53 498	63 241 P	62 573 P	57 260 P	**236 572** P

NOTES

[1] These series are available on the INFOS database of Statistics New Zealand. The identifiers are:

(a) Production of fibreboard: quarterly - FLTq.SBDA; annual - FLTa.SBDA;

(b) Production of plywood: quarterly - FLTq.SMAA; annual - FLTa.SMAA;

(c) Production of particleboard: quarterly - FLTq.SMBA; annual - FLTa.SMBA.

[2]Individual entries may not sum to totals shown due to rounding.

[3] Fibreboard includes hardboard, softboard and medium density fibreboard (mdf) from the December 1996 quarter. Prior to this, triboard and strandboard had been included in this category. The change has been made in line with HS export and import codes.

[4] Veneer production includes veneer intended for further production into plywood or laminated veneer lumber in New Zealand.

[5] Plywood production includes laminated veneer lumber production.

[6] Particleboard includes particleboard, triboard and strandboard from the December 1996 quarter.

Production of paper and paperboard [1, 2]

	Quarter ended				Year to 31 December
	31 March	**30 June**	**30 September**	**31 December**	
	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)
Newsprint					
1998	97 861	96 972	96 503	98 505	**389 841**
1999	91 392	87 377	89 009	93 113	**360 890**
2000	91 124	98 494	96 902	91 610	**378 130**
2001	93 608	88 250	77 320	83 230	**342 408**
2002	85 258	89 549	90 853	85 925	**351 585**
2003	89 242	89 920	90 411	92 557	**362 130**
2004	95 533	93 853	95 287	95 240	**379 913**
2005	95 248	90 890	94 681	97 362	**378 181**
2006	84 131	88 911	64 874	69 483	**307 399**
2007	68 747	73 366	75 804	66 533	**284 451**
2008	69 951	69 004 P	75 903 P	74 678 P	**289 536** P
All other paper and paperboard[3]					
1998	118 317	118 657	99 127	108 813	**444 915**
1999	104 345	114 811	112 490	115 978	**447 625**
2000	125 910	127 147	114 017	131 815	**498 890**
2001	118 014	130 886	116 290	131 431	**496 621**
2002	134 062	126 527	126 818	130 748	**518 156**
2003	112 001	70 182	137 269	128 060	**447 512**
2004	141 490	123 616	129 587	142 657	**537 349**
2005	145 851	145 630	135 234	146 305	**573 020**
2006	146 227	149 981	142 066	151 949	**590 223**
2007	135 935	151 260	138 734	149 555	**575 483**
2008	145 880	150 108 P	144 408 P	142 154 P	**582 550** P
Total paper and paperboard					
1998	216 178	215 629	195 630	207 318	**834 756**
1999	195 737	202 188	201 499	209 091	**808 515**
2000	217 034	225 641	210 919	223 425	**877 020**
2001	211 622	219 136	193 610	214 661	**839 028**
2002	219 320	216 076	217 671	216 673	**869 741**
2003	201 243	160 102	227 680	220 617	**809 642**
2004	237 023	217 469	224 874	237 897	**917 262**
2005	241 099	236 520	229 915	243 667	**951 201**
2006	230 358	238 838	206 967	221 461	**897 623**

	Quarter ended				Year to 31 December
	31 March	30 June	30 September	31 December	
	(tonnes)	(tonnes)	(tonnes)	(tonnes)	(tonnes)
2007	204 681	224 626	214 538	216 087	**859 933**
2008	215 831	219 112 P	220 311 P	216 832 P	**872 086** P

[1] Some of these series are available on the INFOS database of Statistics New Zealand. The series identifiers are: Production of Paper and Paperboard: quarterly - FLTq.SPGA and annual - FLTa.SPGA.

[2] Individual entries may not sum to totals shown due to rounding.

[3] All other paper and paperboard includes printing and writing paper, other paper and paperboard.

Production of Pulp[1, 2]

	Quarter ended				Year to 31 December
	31 March	30 June	30 September	31 December	
	(air-dry tonnes)	(air-dry tonnes)	(air-dry tonnes)	(air-dry tonnes)	(air-dry tonnes)
Mechanical pulp[3]					
1998	193 042	192 952	188 144	186 885	**761 023**
1999	187 726	183 329	193 553	195 635	**760 243**
2000	201 163	206 947	208 978	206 736	**823 824**
2001	204 625	207 473	182 641	200 347	**795 086**
2002	210 215	216 205	210 900	201 643	**838 963**
2003	199 667	196 974	193 009	205 744	**795 394**
2004	212 638	209 490	217 394	213 265	**852 787**
2005	219 331	208 135	187 384	177 348	**792 197**
2006	184 743	195 472	186 262	178 255	**744 733**
2007	184 007	189 106	188 907	186 020	**748 040**
2008	181 255	162 620 P	186 757 P	169 946 P	**700 578** P
Chemical pulp[4]					
1998	173 231	157 585	151 806	173 888	**656 510**
1999	161 753	172 561	186 140	186 147	**706 601**
2000	209 037	195 122	191 072	185 982	**781 213**
2001	172 815	178 752	172 567	181 878	**706 012**
2002	189 857	190 980	165 192	165 332	**711 361**
2003	162 683	86 936	196 595	177 223	**623 437**
2004	193 537	176 264	176 698	197 172	**743 671**
2005	177 175	183 312	184 054	203 227	**747 768**
2006	172 206	185 398	191 372	212 363	**761 339**
2007	195 863	200 991	198 975	205 743	**801 572**
2008	195 470	177 724 P	193 214 P	186 732 P	**753 141** P
Total pulp[5]					
1998	366 273	350 537	339 950	360 773	**1 417 532**
1999	349 479	355 890	379 693	381 782	**1 466 844**
2000	410 200	402 069	400 050	392 718	**1 605 037**
2001	377 440	386 225	355 208	382 225	**1 501 099**
2002	400 072	407 185	376 092	366 975	**1 550 324**
2003	362 350	283 910	389 604	382 967	**1 418 831**

	Quarter ended				
	31 March	**30 June**	**30 September**	**31 December**	**Year to 31 December**
	(air-dry tonnes)	(air-dry tonnes)	(air-dry tonnes)	(air-dry tonnes)	(air-dry tonnes)
2004	406 175	385 754	394 092	410 437	**1 596 458**
2005	396 506	391 447	398 351	414 426	**1 600 729**
2006	356 950	381 133	377 698	390 312	**1 506 093**
2007	379 848	390 098	387 882	391 763	**1 549 590**
2008	376 724	340 344 P	379 972 P	356 678 P	**1 453 719** P

[1] Some of these series are available on the INFOS database of Statistics New Zealand. The series identifiers are: Production of All pulp: quarterly - FLTq.SPFA and annual - FLTa.SPFA

[2] Individual entries may not sum to totals shown due to rounding

[3] Mechanical pulp includes thermo and chemi-thermo mechanical pulp.

[4] Chemical pulp includes semi-chemical pulp.

[5] Total pulp includes both captive and market pulp.

Annual Sawn Timber Production [1, 2]

(units: 000 cubic metres of sawn timber)

	Sawn timber from indigenous forests for the year ended [3]				Sawn timber from planted production forests for the year ended [4]				Total sawn timber production for the year ended			
	31 Mar	30 Jun	30 Sep	31 Dec	31 Mar	30 Jun	30 Sep	31 Dec	31 Mar	30 Jun	30 Sep	31 Dec
North Island												
2003	4	4	4	4	3 271	3 283	3 212	3 138	3 274	3 287	3 216	3 141
2004	3	3	3	3	3 063	3 089	3 170	3 220	3 066	3 092	3 173	3 223
2005	3	3	3	3	3 213	3 203	3 152	3 092	3 216	3 206	3 155	3 095
2006	3	2	3	2	3 084	3 031	3 028	3 075	3 087	3 033	3 031	3 077
2007	2	2	2	2	3 098	3 131	3 185	3 212	3 099	3 133	3 187	3 214
2008	2	1 P	1 P	1 P	3 144	3 048 PR	2 832 PR	2583 P	3 145	3 049 PR	2 833 PR	2 584 P
South Island												
2003	15	14	13	13	1 157	1 161	1 152	1 147	1 172	1 174	1 165	1 159
2004	12	13	12	11	1 143	1 149	1 166	1 176	1 156	1 162	1 178	1 187
2005	10	9	9	9	1 166	1 162	1 151	1 133	1 176	1 171	1 160	1 142
2006	10	9	8	8	1 138	1 130	1 142	1 172	1 148	1 140	1 151	1 181
2007	7	8	8	8	1 194	1 196	1 178	1 195	1 201	1 204	1 185	1 203
2008	8	6 P	6 P	4 P	1 187	1 192 PR	1191 PR	1146 P	1 195	1 198 PR	1 197 PR	1 151 P
Total New Zealand												
2003	19	18	17	16	4 427	4 444	4 364	4 284	4 446	4 461	4 381	4 301
2004	16	16	15	14	4 206	4 238	4 336	4 397	4 222	4 254	4 351	4 411
2005	13	12	12	12	4 379	4 365	4 304	4 226	4 392	4 378	4 315	4 238
2006	12	11	11	11	4 223	4 162	4 171	4 248	4 235	4 173	4 183	4 259
2007	9	10	10	10	4 292	4 325	4 361	4 406	4 301	4 336	4 371	4 416
2008	9	7 P	7 P	5 P	4 331	4 240 PR	4 024 PR	3717 P	4 341	4 248 PR	4 031 PR	3 734 P

[1] These series are available on the INFOS database of Statistics New Zealand. The series identifiers are:

(a) Sawn Timber from Indigenous Forests: FLTa.SBEA1;

(b) Sawn Timber from Planted Production Forests: FLTa.SBEA2 (series formerly known as Exotic Sawn Timber Production);

(c) Total Sawn Timber Production: FLTa.SBEA3.

[2] Individual entries may not sum to totals shown due to rounding.

[3] There has been a change in methodology for reporting indigenous sawn timber from September 2007.

[4] North Island series revised after updated historical annual data was provided to MAF.

3: Tourism Statistics – Tourism Satellite Account

Symbols:
P provisional
R revised

Summary of Tourism Expenditure Components [(1)(2)]

Year ended March	Direct tourism value added	Indirect tourism value added[(3)]	Imports used in production of goods and services sold to tourists; and imports sold directly to tourists by retailers	GST on purchases by tourists	Total tourism expenditure	Value added as a percentage of total industry contribution to GDP		
						Direct tourism value added	Indirect tourism value added	Total tourism value added
	$(million)					Percent		
1999	3,549 R	5,130 R	2,809	888	12,376	3.7 R	5.4 R	9.1
2000	3,930 R	5,653 R	3,164	978	13,725	3.9 R	5.6 R	9.5
2001	4,107 R	6,542 R	3,579	1,087	15,314	3.8 R	6.1 R	9.9
2002	4,481 R	6,801 R	3,710	1,172	16,165	3.9 R	5.8 R	9.7
2003	5,154 R	6,836 R	3,902	1,261	17,154	4.3 R	5.6 R	9.9
2004	5,504 R	6,894 R	3,931	1,300	17,629	4.2 R	5.3 R	9.6
2005	5,845 R	7,094 R	4,233 R	1,381 R	18,552 R	4.2 R	5.1 R	9.3
2006P	6,029 R	7,522 R	4,410 R	1,435 R	19,396 R	4.1 R	5.2 R	9.3 R
2007P	6,388 R	7,877 R	4,630 R	1,502 R	20,397 R	4.2 R	5.2 R	9.3 R
2008P	6,660	8,371	4,905	1,574	21,511	4.1	5.1	9.2
2009P	6,364	8,665	5,115	1,594	21,737	3.8	5.2	9.1

[(1)] Individual figures may not sum to stated totals due to rounding.
[(2)] Revisions between 1999 and 2007 reflect the impact of the new international standard for the derivation of value added.
[(3)] Results from input-output tables for 1996 have been used in the calculation of indirect tourism value added.

Summary of Tourism Employment [(1)(2)(3)(4)]

Year ended March	Employment (FTE[(5)] persons)			Employment (FTE persons) in tourism as a percentage of total employment in New Zealand		
	Direct employment in tourism	Indirect employment in tourism	Total tourism employment in New Zealand	Direct employment in tourism	Indirect employment in tourism	Total tourism employment in New Zealand
				Percent		
2001	85,200 R	73,400 R	158,600	5.3 R	4.6 R	9.9
2002	87,600 R	76,400 R	164,000	5.3 R	4.6 R	10.0
2003	94,000 R	82,000 R	176,000	5.6 R	4.9 R	10.4
2004	90,700 R	81,200 R	171,900	5.2 R	4.7 R	9.9
2005	90,100 R	84,200 R	174,200 R	5.0 R	4.7 R	9.7 R
2006P	93,100 R	85,000 R	178,100 R	5.0 R	4.6 R	9.6 R
2007P	92,600 R	88,500 R	181,100 R	4.9 R	4.7 R	9.6 R
2008P	94,200	89,600	183,900	5.0	4.7	9.7
2009P	94,600	90,200	184,800	4.9	4.7	9.6

[1] As a result of a change in methodology, this data is only available from 2001.
[2] Revisions between 2001 and 2007 reflect the impact of the new international standard for the derivation of value added on direct and indirect employment calculations.
[3] Individual figures may not sum to stated totals due to rounding.
[4]Percentage changes are calculated from unrounded employment numbers.
[5] FTE is an abbreviation for full-time equivalent

4: Energy Demand Data

Source: Energy End-Use Database (EEUDB)

Includes all fuels, and transport / all uses

Sector (2009)	Delivered Energy (TJ)
Basic Metals Industries	45,095.06
Central Government Administration	1,355.72
Central Government Defence Services	3,480.46
Chemicals, Related Products and Plastics	11,603.65
Communication	2,406.83
Concrete, Clay, Glass and Related Minerals Manufacture	7,538.72
Construction	7,910.16
Dairy Agriculture	9,226.81
Dairy Products	16,616.85
Education Services: Pre-School, Primary and Secondary	2,841.11
Education Services: Tertiary Education	1,835.31
Fabricated Metal Products, Machinery and Equipment	7,016.33
Financing, Insurance, Real Estate and Business Services	5,767.21
Fishing and Hunting	6,193.97
Forestry and Logging	1,877.67
Health and Welfare Services	5,365.97
Household	64,876.11
Household (Private Transport)	103,553.45
Indoor Cropping	4,425.52
Local Government Administration	2,307.22
Mining and Quarrying	5,759.79
Motels, Hotels and Guest Houses	4,490.70
Non-Dairy Agriculture	9,585.50
Other Food Processing Sectors	8,502.23
Other Manufacturing Industries	302.387
Other Social and Related Community Services	2,868.60
Paper and Paper Products, Printing and Publishing	47,408.69
Retail Trade - Food	7,784.53
Sanitary and Cleaning Services	680.351
Slaughtering and Meat Processing	7,976.45
Textile, Apparel and Leathergoods	2,434.46
Transport and Storage	88,864.29
Water Works and Supply	682.989
Wholesale and Retail Trade - Non Food	11,957.85
Wholesale Trade - Food	1,232.15
Wood Processing and Wood Products	32,614.25

Total	544,439.33

Energy Use by Fuel Type and Industry (2008)

Industry	Fuel type										Total
	Electricity	Petrol	Diesel	Fuel oil	LPG	Aviation fuel	Natural gas	Coal	Wood	Other[1]	
Terajoules (TJ)											
Horticulture and fruit growing	542.93	506.84	1,612.21	2.37	25.91	38.76	42.58	203.41	95.32	0.00	3,070.34
Sheep, beef cattle, and grain farming	1,814.22	1,779.11	4,003.48	47.12	39.62	19.03	C	52.03	574.65	C	8,330.12
Dairy cattle farming	3,692.66	1,119.86	2,388.51	32.93	17.23	0.67	0.07	6.87	530.87	0.00	7,789.66
Poultry, deer, and other livestock farming	323.38	196.67	555.87	1.53	77.15	1.76	0.11	7.89	64.16	0.00	1,228.51
Forestry	54.38	46.97	123.31	23.41	0.72	0.00	C	107.79	48.39	0.00	404.97
Logging	3.26	201.91	1,718.38	60.55	0.15	11.58	C	C	C	C	1,998.06
Aquaculture	20.75	22.31	141.98	1.26	1.36	C	C	0.00	3.27	0.00	191.06
Fishing	11.65	56.76	2,488.27	1,942.51	1.21	0.00	0.00	0.00	4.06	0.00	4,504.46
Services to agriculture, forestry, and fishing	234.15	419.69	3,332.10	8.47	27.58	570.24	10.81	1.88	19.53	0.00	4,624.44
Mining	1,908.84	41.00	4,924.29	79.33	119.41	C	2,972.39	C	C	C	10,146.65
Total	8,606.22	4,391.12	21,288.40	2,199.46	310.34	655.99	3,026.77	467.20	1,342.55	0.20	42,288.27
Physical Unit											
	kWh(000)	**L(000)**	**L(000)**	**L(000)**	**kg(000)**	**L(000)**	**TJ**	**Tonnes**	**m^3**		
Horticulture and fruit growing	150,814	14,510	42,083	58	523	1,122	43	9,130	8,220		
Sheep, beef cattle, and grain farming	503,951	50,934	104,502	1,158	800	551	C	2,335	49,552		
Dairy cattle farming	1,025,738	32,060	62,347	809	348	19	0	308	45,777		
Poultry, deer, and other livestock farming	89,827	5,630	14,510	38	1,558	51	0	354	5,533		
Forestry	15,106	1,345	3,219	575	15	0	C	4,838	4,173		
Logging	906	5,780	44,855	1,488	3	335	C	C	C		
Aquaculture	5,763	639	3,706	31	27	C	C	0	282		
Fishing	3,236	1,625	64,951	47,751	24	0	0	0	350		
Services to agriculture, forestry, and fishing	65,042	12,015	86,977	208	557	16,514	11	84	1,684		
Mining	530,233	1,174	128,538	1,950	2,412	C	2,972	C	C		
Total	2,390,618	125,712	555,688	54,067	6,268	18,998	3,027	20,969	115,767		

[1] Includes other fuels not captured anywhere else (e.g. steam)

Symbol:
C confidential

Appendix 4: Current and Recent Research Projects in New Zealand

The following provides a small selection of current or past research being undertaken in New Zealand that has overlaps of implications for resource efficiency work. There may be collaborative opportunities to access or build on data collected during this research.

Water Research Strategy – Jointly funded Foundation for Research, Science and Technology and the Ministry for the Environment research to improve the management and use of freshwater (surface and groundwater; lakes, rivers, estuarine waters and wetlands). The Research Strategy is intended, as a minimum, to guide the Foundation for Research Science and Technology and the research sector and is targeted at ensuring that the science system delivers, over the next ten years, the information and tools required to enable world class management of water resources in New Zealand. This is the timeframe for current and emerging science to be delivered and converted into the tools required for better water management.

Project completion date: 2019

Carbon Embodied in Trade - The NZ Centre for Ecological Economics (NZCEE) MAF-funded research the greenhouse gas emissions embodied in New Zealand's international trade. This 2-year project will include input from a group of experts from around the world and key New Zealand researchers. Preliminary work on this subject was conducted under the FRST-funded 'Ecological Footprint Plus' programme. Further work is required to improve the model and the datasets, and to estimate the uncertainties associated with the analysis.

Project completion date: June 2010

The Life Cycle Management (LCM) Project - A five-year project which aims to build capability among New Zealand manufacturing companies in product-oriented environmental management. LCM Champions in six case study companies are implementing Life Cycle Management, and are being upskilled and mentored through an LCM Training Programme.

Projected completion date: June 2013

EcoLink – A relational database that allows the creation of economic and environmental Accounts. EcoLink contains databases and models to identify economic and environmental flows among industries. The model structure is based on an inter-industry input-output model which identifies the purchases of goods and services from throughout the economy associated with increased demand for the output of any given sector. The *Eco*Link database enables this conventional economic model to be compiled for territorial local authorities and regional councils, or combinations of them, using detailed data on the character and distribution of economic activity. Model output covers gross economic output, value added and its components, intermediate and final demand, employment, and various economic indicators that can be calculated for 23 or 48 sectors using ANZIC.

Completed: 2001 and transferred to Agribusiness and Economics Research Unit (AERU) operates from Lincoln University

How Clean and Green is New Zealand Tourism? – Landcare Research and Massey University project studying the lifecycle and future environmental impacts of tourism on the New Zealand environment. The study covers the use of natural resources (land, energy, water) and the production of pollutants. The report constructs environmental accounts of the tourism sector for the base year of 1997/98 measuring eco-efficiency of tourism and includes LCA.

Completed: 2001

Energy Efficiency and Conservation Authority - EECA maintain and develop the national energy end use database. New studies associated with this include the Building Energy End-use Survey being undertaken by BRANZ and the Primary Sector End-use Survey being undertaken by Statistics New Zealand.

Current