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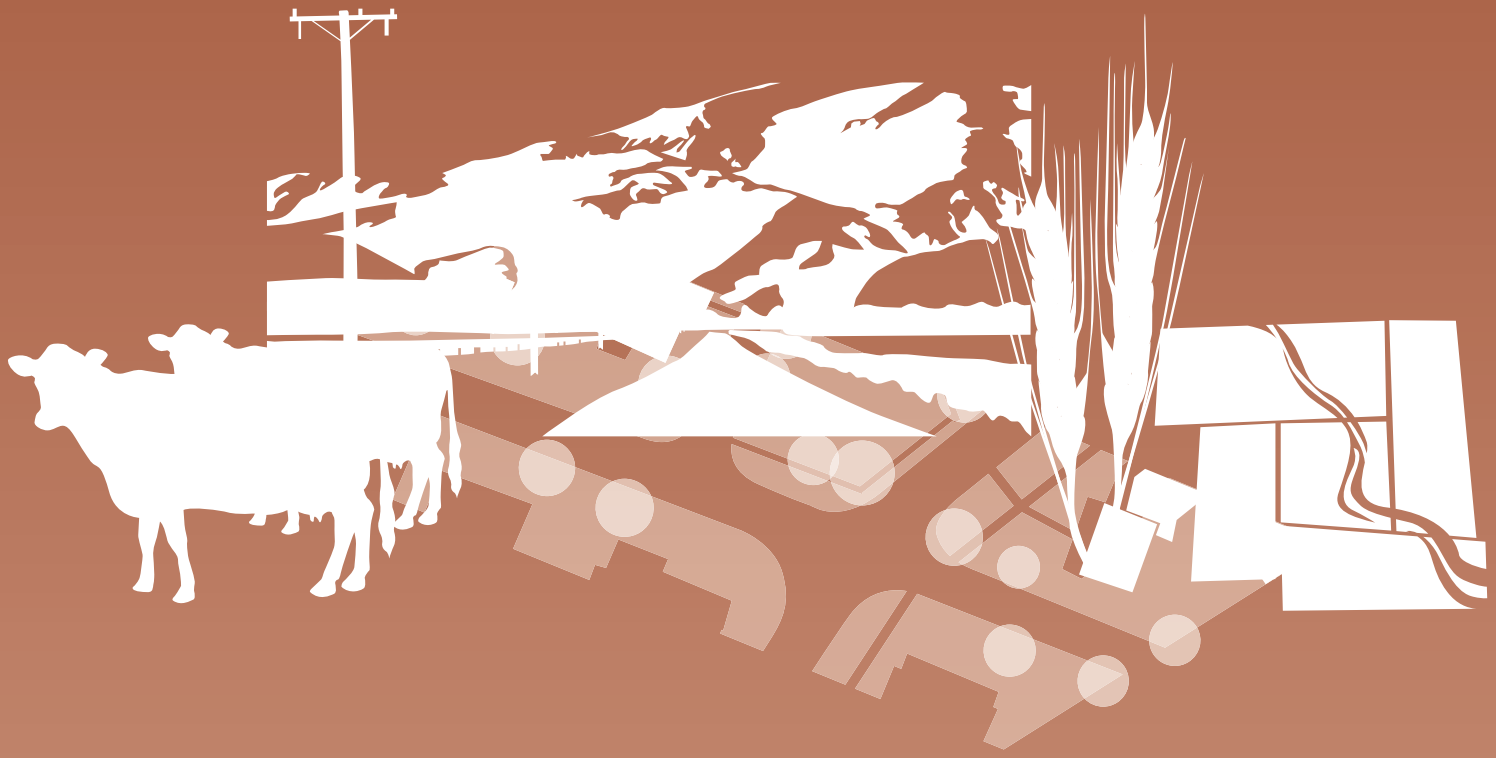

RESOURCE EFFICIENCY IN NEW ZEALAND

FRAMEWORK FOR DETERMINING RESOURCE EFFICIENCY

February 2010

Boffa Miskell

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Prepared for

Ministry for the Environment

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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.

This report provides a resource efficiency framework which will assist with the Ministry's broader aims. The key outputs from the framework include: a process for measuring and reporting resource efficiency (the framework), the collation of existing data, and the reporting of results of selected resource efficiency outputs for the following priority sectors:

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

The accompanying *Resource Efficiency in New Zealand*: *Literature Review* provides an analysis of international approaches and justification for key components of the framework outlined in this report. This document provides the framework developed from that research. The framework will be tested and refined based on findings during the next phase of work. Those findings are reported separately in *Resource Efficiency in New Zealand*: *Assessment of Business Sectors* along with reporting results and a gap analysis of relevant data.

2.0 Summary of Framework Research

2.1 Resource Efficiency

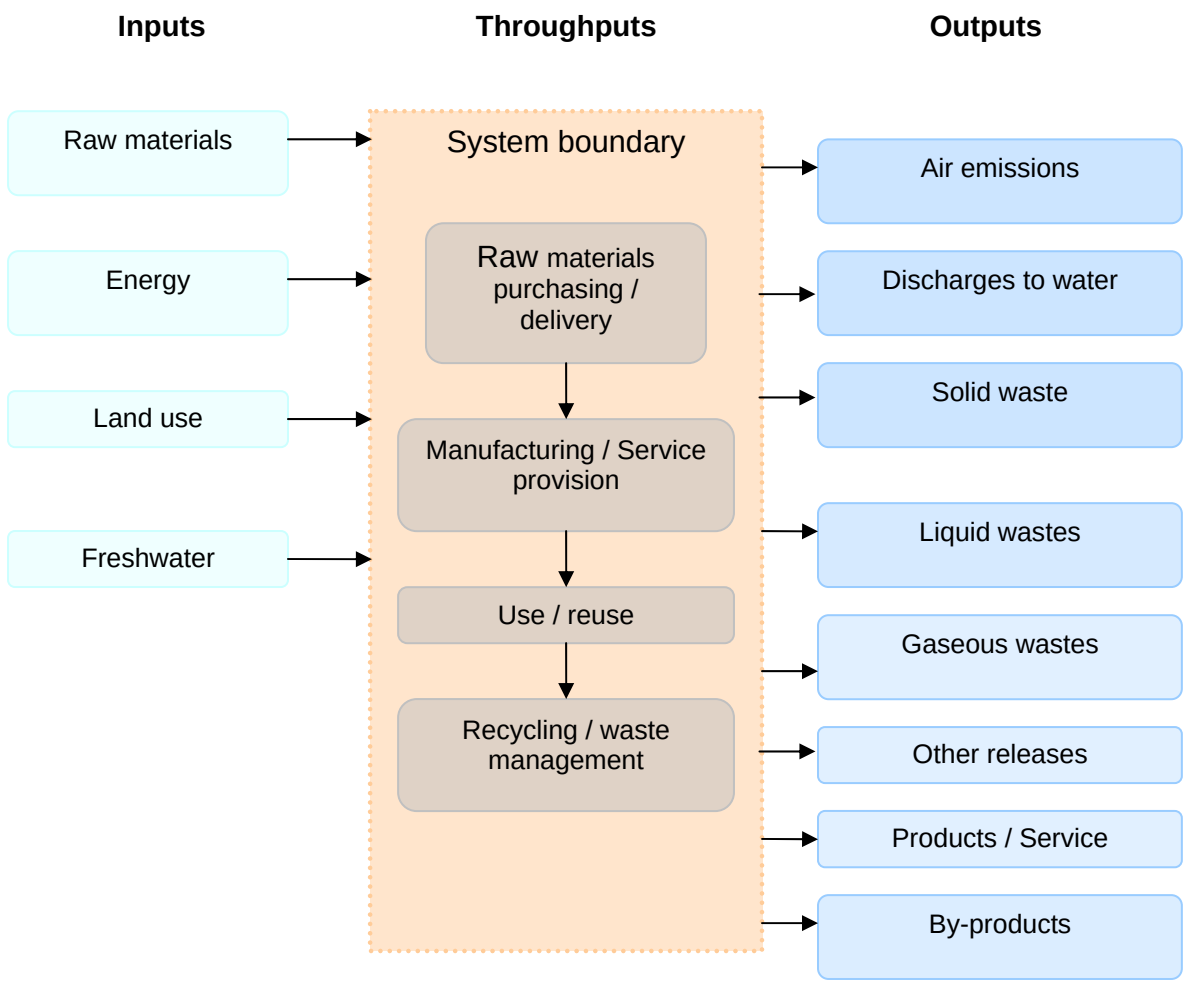
Resource efficiency is a ratio of product or service value and environmental influence (resource use or waste output), as shown in Figure 1.

Figure 1: Resource efficiency ratio (Source: WBCSD)

$$\frac{\text{product or service value}}{\text{environmental influence}}$$

Resource efficiency is based on the input / output view of production, as shown in Figure 2.

Figure 2: Input / Output view of Production



2.2 Approach to Framework

The following section provides a summary of key elements identified during the literature review that are recommended for application when developing a sector-based resource efficiency framework for New Zealand:

- a core set of physical indicators identified
- raw materials could be used as a supplementary physical indicator for selected sectors
- economic indicators to include GDP, employee number and export value
- production unit should be used as a supplementary economic indicator for selected sectors
- indicators should be developed using the selection criteria identified in this report
- a data filter should be applied to manage data quality.

Details on each of these elements are provided in Table 1 along with a summary of key findings regarding each element of ratio frameworks. The table also discusses how, and why, this aspect should be applied in the New Zealand context.

Table 1: Summary of Key Findings and Application to New Zealand Framework

MEASURING RESOURCE EFFICIENCY	
Key Findings	*Measuring resource efficiency using an input-output ratio is common across examples. Resource efficiency frameworks commonly include:* • *A boundary to the business sectors and their interaction with the environment.* • *Indicators that provide a measure for the environmental and economic parameters.*
New Zealand Application	It is considered appropriate to use international approaches as a basis for a resource efficiency measuring framework for New Zealand. The resource efficiency ratio approach is well documented and tested across countries. International approaches have been in place since the earlier 1990's and New Zealand is likely to benefit from those experiences and current developments in resource efficiency approaches. Boundary selection is less relevant in New Zealand as data collection is determined by sector – essentially the sector defines the boundary.
Key Findings	*Few approaches attempt to measure overall resource efficiency (i.e. full input-throughput-output analysis) and even fewer address overall sustainability. To do so, a full range of social-economic and environmental aspects would need to be assessed required in conjunction with a detailed understanding of material flows and throughputs.*
New Zealand	Environmental and economic indicators would be selected (see 'Indicators'

Application	below). Socio-cultural indicators may be developed in the future but are considered beyond the scope of the framework, requiring input from relevant ministries. As such, socio-cultural indicators require further consideration before they can be applied as a resource efficiency indicator in New Zealand. Detailed assessment of the sustainability of sectors is beyond the scope of the framework. The key outcome at this stage is to provide an indicator of resource efficiency that prompts further analysis and/or action. As such, a resource efficiency approach that measures an economic-environmental ratio is considered adequate to provide the indication of resource efficient required at this stage. Socio-cultural indicators are considered an important aspect of sustainability and should be given further consideration as the resource efficiency programme develops.
Key Findings	*Information provided through resource efficiency framework (measurement) is indicative and the aim is generally to provide an overview of effects rather than more precise environmental assessment of production and processes that might, for example, be developed through tools such as life cycle assessment and material flows analysis.*
New Zealand Application	As noted above, a more detailed sustainability assessment is beyond the scope and purpose of the framework being developed for New Zealand. The proposed framework should serve, in time, to generally inform businesses, provide information for stakeholders, and compare industry performance.
Key Findings	*Each of the frameworks emphasise the importance of comparability over time and between reporting entities.*
New Zealand Application	This should be taken into consideration for the development of a draft framework for New Zealand. Data management is considered an important aspect of achieving comparability over time and between reporting entities and will be factored in to the data filter.
Key Findings	*The terminology used in frameworks varies.*
New Zealand Application	For this project a consistent terminology should be applied to the framework. A more detailed glossary of terminology could be developed in the long-term as part of policy development using national and international terms that are widely understood and comparable across sectors and countries.
INDICATORS	
Key Findings	*The development of physical and economic indicators is a key aspect of resource efficiency frameworks. The purpose of an indicator is for it to indicate the general*

	performance of business, and not necessarily disclose all aspects. *The selected indicators need to be sufficient to provide an approximate, yet reasonably robust, description of performance of sectors. Key considerations when developing indicator sets are completeness, feasibility, and communicability of indicators. A balance needs to be struck between oversimplifying and overcomplicating indicators within the resource efficiency framework.*
New Zealand Application	The selection criteria summarised from literature (Section) is consistent with the Ministry's core indicator selection. Given this consistency, it is considered appropriate to apply the selection criteria to the indicators for the resource efficiency framework for New Zealand. Having a small number of indicators required to describe resource use / waste outputs assists with simplifying the task of data collection and analysis and can improve the practicability of performance measurement. However, this simplifying step should be balanced with retaining a sufficiently broad picture of the different and relevant dimensions of resource efficiency being measured.
Key Findings	*International examples demonstrate that it is possible to achieve a relatively robust approach using a minimum set of indicators - these are relatively well-defined across approaches.* *Indicators should also address key global issues, such as climate change and water quantity to allow international comparisons over time.* *Supplementary indicators are appropriate for sectors that use resources or create emissions / waste that do not fit within the core set*
New Zealand Application	A set of core physical indicators is considered appropriate for New Zealand. A list of supplementary indicators based on existing indicator sets could be developed over time to refine the resource efficiency framework. The following are recommended for the draft framework: ***Core*** o Water use o Solid waste o Energy use o Greenhouse gas emissions o Wastewater ***Supplementary*** o Material use (specific to a sector) These indicators are recommended for the following reasons: ***Water use:*** Water is an important indicator category for New Zealand. It will provide a ratio of water use to productive output and assist with understanding sector demand

	for freshwater resources. Freshwater quality is a key environmental issue in New Zealand. Water quality and quantity are also important issues for business, particularly in high demand areas such as agriculture. The volume of water allocated for irrigation, domestic use and manufacturing increased by approximately 50 per cent between 1999 and 2006. It is anticipated that the demand for freshwater will continue to increase. At 2006, 77% of allocated water was used for irrigation. The remaining 33% is shared among public water supply, manufacturing and industry, and stock water. ***Solid waste:*** Waste minimisation is a key policy area in New Zealand. The Waste Minimisation Act, 2008, was introduced to encourage waste minimisation and a decrease in waste disposal in order to protect the environment and provide environmental, social, economic, and cultural benefits. A solid waste indicator category provides information on the amount of waste produced in each sector. ***Energy use:*** Energy is an important issue affecting all sectors and production. Energy use is constrained by supply of oil and the supply of electricity. Energy from fossil fuels is likely to become more constrained as prices increase and supply is reduced. Therefore, monitoring the efficiency of sectors can indicate how vulnerable sectors are to energy supply changes. ***Greenhouse gas emissions:*** GHG emissions and climate issues are a significant national and international environmental and economic issue. As signatory to the Kyoto Protocol, New Zealand reports its GHG emissions at an international level. This indicator is considered an important aspect of the framework to support climate change policy. ***Wastewater:*** Water quality is a key issue in New Zealand, and the discharge of wastewater to water is contentious in many communities, particularly around coastal lagoons, recreation areas, and traditional food gathering areas. Wastewater may also provide an indicator of the waste of freshwater. ***Supplementary indicator - Materials Use:*** Materials use is a fundamental part of the input / output equation in productive industries, and a key measure of the reliance on natural resources. Materials use is sector-specific making cross-sector comparisons difficult. It is considered useful to highlight key materials use in one or two sectors to provide an indication of the production throughput.
Key Findings	***Economic indicators*** *are less consistent in the literature; they are generally determined by the size and type of organisation or sector being measured. Research indicates that economic indicators should adequately reflect the size and / or the activity of the production unit.* *Like physical indicators, economic indicators need to be objective, understandable and allow for meaningful comparisons. They must also be workable insofar as the data required to implement them is accessible and widely available.*

	Sector or national approaches commonly cite GDP as the numerator denoting the economic values in resource efficiency indicators for the whole economy.
New Zealand Application	As the New Zealand framework is aimed at the sectoral level it is considered appropriate to provide some cross-comparison of performance between sectors by using measures that are standardised (such as monetary or financial) rather than by production unit. Based on availability of data in New Zealand, monetary output expressed in GDP is considered an adequate measure of sector outputs at the national level. GDP is considered to meet this requirement and the selection criteria outlined above, if used in conjunction with other economic indicators. GDP removes the value of intermediate consumption and provides a value of production that is free of duplication. While GDP can vary and possibly skew results over time, it remains a useful measurement that is widely used, measured and relatively comparable across countries. As stated above, to ensure the analysis is robust, economic indicators would not be used in isolation. For example, GDP and employee number could provide useful economic indication of resource efficiency when reported together. Exports per commodity and production unit also provide useful economic indicators for New Zealand's export based economy. Production unit is not a viable indicator for each sector as it would be extremely time-consuming and costly to collate the data. However, because it provides a meaningful indicator of actual output (without the monetary variables), it is recommended that production unit be applied to a selection of sectors during initial application of the framework to further test its applicability for the long-term use in the framework. **Supplementary indicators** should be developed in collaboration with sectors/industry to ensure they meet the selection criteria. This is not considered feasible for the development phase of the framework although in the long-term it may be reasonable to develop sector specific indicators for targeting specific policy responses as resource efficiency policy develops in New Zealand.
DATA COLLECTION	
Key Findings	*It is essential to maintain a consistent approach to collecting and classifying data for meaningful, long term data collection and interpretation.* *A balance needs to be struck between the complexity of measuring environmental impacts of business and the practicality, particularly in the initial stages.* *Any comparison of indicators must be undertaken with indicators determined and derived using the same methods. Ongoing data collection will also lead to the refinement of this aspect which may limit availability of information required to achieve these aspects.*
New	Sector-based physical and economic indicators based on publicly available regional

Zealand Application	or national data sets is considered a feasible approach for New Zealand. It is therefore recommended that data should be collected at a national level to provide a sectoral indicator of resource efficiency, rather than using business or sector data to calculate resource efficiency ratios for each sector. There may be exceptions where, for example, industry associations maintain data sets. A data filter will be included as part of the framework to ensure a consistent approach to collecting and classifying the quality of data for meaningful, long term data collection and interpretation. Data on each indicator selected will not be available for all sectors. It is important to identify these gaps as part of the framework which may assist with prioritising any future data collection requirements. The level of detail, and completeness of information obtained from this approach, is dependant on data availability. Gaps in data will be identified during Phase 2 of this project.

2.3 Assumptions and Limitations of Resource Efficiency

The following section provides a summary of key limitations associated with resource efficiency frameworks identified during the literature review. While these are not fundamental flaws in the approach, they do need to be considered when applying resource efficiency frameworks.

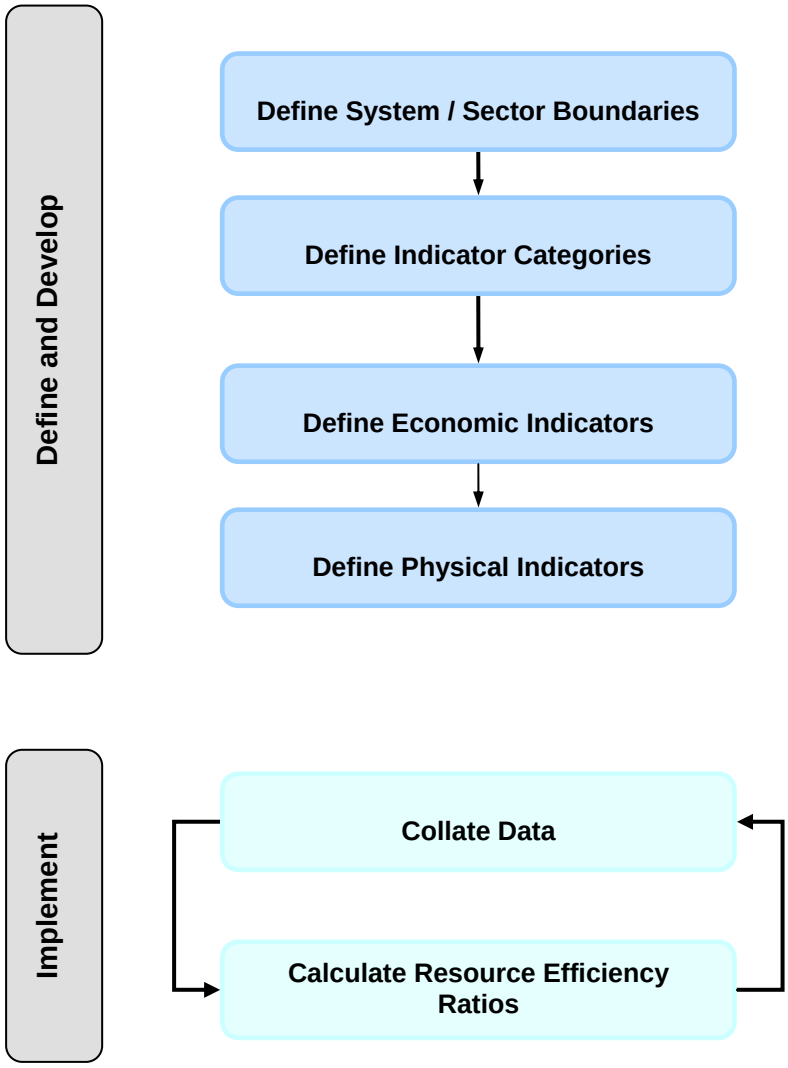
- The resource efficiency concept is only one tool of many used to measure or address aspects of sustainability. Hukkinen (2003) refers the “rebound effect” that can occur with resource efficiency implementation i.e. that improved resource efficiency can be accompanied by increased resource consumption that undermines the original environmental improvements.
- Increases in welfare alone do not suffice to further sustainable development, as gains in resource efficiency are still likely to be outpaced by global growth in consumption.
- Resource efficiency is a relative measure, and is not a sufficient condition on its own for measuring environmental impacts or sustainability; in most cases, absolute reductions in environmental pressures are required to achieve sustainability (Moll and Gee, 1999). Resource efficiency is only intended to give business a businesslike way into approaching or responding to the challenges of sustainable development (WBCSD, 2006).
- Some indicators are commonly applied but do not provide any indication of the consumption of natural resources or the emission of waste. Energy use, for example provides a useful indicator of consumption however, the source of energy (e.g. hydro, gas, coal fired) used in production needs to be identified and aggregated to provide the greenhouse gases indicator and meaningful information.
- Little guidance is available for selecting economic indicators however, aggregated, broad indicators such as GDP, exports, employment, and net value are more commonly applied for national measurement.

- Use of a single economic indicator in isolation can skew the results. To lessen this effect, economic indicators should be used as a compact set of indicators which review the economic performance at the macro level and sectoral level, where possible.
- A common shortcoming of existing indicator frameworks is the lack of clear and detailed guidance on how to implement indicator measurement in practice. For example, the GRI lists ninety-six sustainability indicators (both generally applicable and organisation- specific) but does not provide any guidance on selection and implementation.
- While there has been some convergence on approaches to measuring resource efficiency, there are variations in emphasis, often due to the origin of the framework. As a result a variety of terms are used and a need for standardisation of terminology and approaches would be beneficial.
- Comparability of resource efficiency ratios between sectors is not well developed - it is more commonplace to compare similar businesses within sectors. Sector comparisons require the use of core indicators, which can sometimes provide oversimplified results that provide no real insight into the performance of the sector.

3.0 Framework Overview

The framework and its development are as shown in Figure 3.

Figure 3 Framework Overview



The key facets of the framework have been defined and developed according to the initial policy goals of the Ministry. The implementation phase is a process methodology, which will be tested and refined through the draft framework development project. Once the framework is finalised, the "Define and Develop" phase would only need to be revisited when policy goals change or where new data sets become available.

The framework is based on the ideal scenario of data requirements for each of the sectors. However the outcomes of initial implementation will be dependant on the quality and availability of existing data. As such, it is anticipated that the framework will be modified through the testing phase, and reported in the final report (*Assessment of Business Sectors)*.

4.0 System / Sector Boundaries

Priority sectors have been selected by the Ministry. The system boundary for the framework is determined by defining the extent of each sector. The key aims for defining the sectors, and the approaches for this framework are listed in Table 2:

Table 2 Key Aims and Approaches for Defining Sector Boundaries

Aim	Approach
To align to international definitions of business sectors to allow for long term and international comparisons.	Use of the ANZSIC Industry Codes 2006.
To report on the most detail possible for each business sector.	Collect data at the lowest ANZSIC Code possible, based on availability and quality. Have a flexible data management and reporting process that can separate or collate data to the lowest or highest ANZSIC Code.
To report relevant information at the gross / highest sector level.	Where possible, exclude (or separate out) subsectors within ANZSIC codes that would skew the relevance of results at the gross level.
Identifying existing data for a sector is important, even where it does not fit into the ANZSIC code framework.	Have a flexible data management and reporting process that can report on data that sits across or outside of the ANZSIC code definitions. Adapt the final sector boundaries based on available data.
To ensure that the sector boundaries are identified in reporting.	Have a flexible data management and reporting process that can separate or collate data to the lowest or highest ANZSIC Code and reference data accordingly.

Table 3 lists each of the priority sectors, and the ANZSIC 2006 sector definition used for this study.

Table 3: 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*

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.*

5.0 Indicator Categories

5.1 Physical Indicators

The following physical indicator categories are selected for the framework:

Core Physical Indicators

- Water use
- Solid waste
- Energy use
- Greenhouse gas emissions
- Wastewater discharges

An explanation for the selection of these indicator categories is provided in Table 4. The matters included for each indicator category are consistent with current approaches and definitions in New Zealand.

Table 4: Physical Indicator Definitions and Sources

Indicator category	Indicator Definition	Unit	Potential Data Sources
Water use	Fresh water abstracted for consumptive use from surface and groundwater sources. Consented, from private and public supply schemes. This does not include the use of sea water, non-consumptive uses (i.e. hydropower), or the use of recycled or waste water. *Total water allocated is more likely to be achievable than actual water use, based on available data.*	m^3	MfE. Regional Councils. Sector based studies.
Solid waste	All solid waste disposed of to consented landfills and cleanfills (as defined by the Waste Minimisation Act. This does not include waste that is incinerated, reused, recycled, composted, or exported.	Tonnes	MfE and MfE-engaged studies. Waste levy data.
Energy use	Electricity provided by the national grid, and other direct energy use from transportation and stationery sources, such as boilers, furnaces, and off-grid electricity generation, from the following energy sources: • gas	PJ	Ministry for Economic Development

Indicator category	Indicator Definition	Unit	Potential Data Sources
	• coal • liquid fuels (oil, diesel) • bio fuels (solid and liquid) • wind, hydro and solar This does not include transport-related energy use.		
Greenhouse gas emissions	As defined by the NZ Emissions Inventory for each relevant sector. • Relevant sectors for the NZEI are: • Agriculture • Manufacturing (non-food) • Manufacturing (food) • Commercial and Institutional (as a proxy for finance, and business services)	Tonnes CO_2e	NZ Emissions Inventory
Wastewater discharges	Permitted trade waste discharges. Consented discharges to land and water. Wastewater does not include stormwater.	m^3	Regional Councils MfE

5.2 Economic Indicators

Three economic indicators have been selected for the framework as follows:

1. **Number of employees (FTE)** – provides a proxy for production / service activity and for social welfare. All sectors.
2. **Gross Domestic Product (GDP)** – Financial measure which reflects the contribution to the national economy. All sectors.
3. **Production output** - sector-relevant outputs. The number of sectors will depend on the availability of data and timeframes available for data collection. At least two sectors (agriculture and construction) will include production output data.

6.0 Data Filter and Collection

6.1 Overview

For each of the sectors and indicators, data will be identified from the various government agencies and sector-based research. All data sets will be evaluated through the data filter, and the priority data (high quality, availability, relevance, etc) will be selected for use in the final reporting process.

This process will be updated and finalised into detailed steps in the final framework.

6.2 Data Filter

Appropriate data collection and management is fundamental to the resource efficiency framework. To ensure data used in the framework is robust, a ranking system will be applied to data sources. There are two components in determining the appropriateness of data; quality and cost.

Quality consists of; frequency, repeatability, quality of source or data owner and sector relevance. Cost is 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. Each dataset will be ranked against each set of criteria, using a simple 0 – 3 rating.

The results can be ranked in a table, and / or graphed (quality versus cost), to be able to make a decision on which ones to go after.

Showstoppers (ie confidentiality) will also be ranked, and will immediately void the data set.

Table 5 Example of the data filter table

	Quality					Cost			
Data	**Currency**	**Repeatability**	**Source**	**Sector**	**Total**	**Source no**	**Availability**	**Manipulation**	**Total**
Data 1	3	2	3	3	11	1	2	1	4
Data 2	1	2	1	2	6	3	3	3	9

In the example above, Dataset 2 has a higher ranking than Data set 1 for cost, but a lower ranking for quality. They both rank the same overall.

Table 6 Summary of Draft Data Quality and Cost Criteria

Quality Criteria	Options	Rating	Notes
Currency How frequently is the data collected?	One off study Less than annually Annually Biannually 2-5 years 5 years +	1 3 3 2 2 1	If the data is from a one off study, or collected at periods longer than 5 yearly, it is not as robust as data collected annually.
Is the data collection easily repeatable?	One off study has a repeatable methodology One off study does not have a repeatable methodology	3 1	
Source Reliability Is the data owner reliable?	Statistics NZ or other Government department CRI / Research study Consultant / market research / industry survey	3 3 2	A value will be placed on the data owner, or the source of the original survey or data collection process.
Sector relevance Does this source of data cover all sectors / ANZSIC codes?	All sectors 4 or more sectors 3 or less sectors 1 sector	3 2 1	
Indicator relevance Does this data meet the definition of the indicator?	Yes, directly relevant Yes but a proxy data set, with little / no aggregation / modification Yes but a proxy data set, with high aggregation / modification No, does not meet the definition	3 2 1 0	Proxy may mean extrapolated, developed from samples (ie one representative region, city or business cluster), or modelled.

Cost Criteria	Options	Rating	Discussion
Availability Is the data publicly available?	Yes, on website Yes, free, by request Yes, requires payment No, requires request to author / data owner for raw data sets No, confidential or data owner unwilling to provide.	3 3 2 2 1	
Source How many individual sources are required to obtain the data?	1 2-5 >5	3 2 1	The objective of the question is to review sources of data such as regional councils as low scores, due to the high number of individual data sources that have to be contacted.
Manipulation Does the data require conversion / manipulation?	None Minor, easy (ie conversion of units) Complicated and time consuming (various sources, aggregation etc)	3 2 1	

6.3 Data collation and Manipulation

The priority data from the data filter will be collated and stored according to the sector codes and indicator categories. Data manipulation will depend on the data.

Methodologies will be specific for each data set, and will be detailed in the final framework once the data sets have been identified and used in the test phase.

7.0 Reporting Results

All data will be provided in table format.

$$\text{Resource efficiency} = \frac{\text{Economic indicator}}{\text{Physical indicator}}$$

Table 7 Summary of Resource Efficiency Ratios

Sector	Agriculture			Finance, Insurance, Property and Business services			New Zealand-based Manufacturing (excluding Food and Beverage			Food and Beverage Manufacturing including Agricultural products			Infrastructure/ Building and Construction			Retail			Tourism		
Economic	GDP	Employees	Production output	GDP	Employees	Production output	GDP	Employees	Production output	GDP	Employees	Production output	GDP	Employees	Production output	GDP	Employees	Production output	GDP	Employees	Production output
Physical																					
Water use	Ratio result																				
Solid waste	Ratio result																				
Energy use																					
Greenhouse gas emissions																					
Wastewater																					

8.0 Summary

This report outlines the framework for determining resource efficiency of selected business sectors in New Zealand. The framework sector-based and includes the following elements:

- physical indicators to include freshwater, wastewater, GHG emissions, energy and
- economic indicators to include GDP, employee number and export value
- a data filter to manage data quality.

The framework will be tested during a second work phase, focussing on data collection and analysis. The results of the testing phase will be outlined in a subsequent report *Resource Efficiency in New Zealand: Assessment of Business Sectors*. Further development of the framework will be undertaken in light of the results, subject to data availability, and policy direction of the Ministry.