

Gisborne District Environment-Economy Model

Business-As-Usual Scenario

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- market economics

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1 INTRODUCTION

1.1 AIM OF THE PROJECT AND SCOPE OF THE REPORT

The key aim of this project has been to derive an integrated environment-economy model for the Gisborne District, hereafter referred to as the 'Gisborne Environment Economic Model' (GEEM). Essentially the GEEM describes the Gisborne District economy, its critical inter-industry relationships and associated natural resource requirements and environmental residuals (i.e. emissions, pollutants and wastes). The use of environmental input-output tables has been critical in the development of this model. A more detailed description of the way in which this model was constructed is however found in Section 2.

One of the real advantages of constructing a model such as GEEM is that it can be used to test out the environmental and economic implications of future scenarios. In this report the findings of a Business as Usual (BAU) scenario for Gisborne District with a 20 year outlook are established. This scenario was developed by using the following information: (1) quantitative projections on an industry-by-industry basis of domestic and export consumption, and (2) qualitative information regarding the Gisborne District and its likely future obtained from relevant literature (e.g. academic articles, industry reports, economic commentaries and newspaper articles) and interviews with key industry representatives. A detailed description of the information used and assumptions made in developing the BAU scenario is found in Section 4 of this report. To provide background to this scenario, a description of the Gisborne District as it existed in 2003-04 (the base year used in the model) is presented in Section 3. In Section 5 the outcomes of the BAU scenario are given.

In addition to the BAU scenario the GEEM will be used to report on two alternative scenarios of growth for the Gisborne District. At this stage the details of the alternative scenarios have not been set out. It is envisaged that the alternative scenarios will be developed jointly by Gisborne District Council and Market Economics Ltd with the results released in a supplementary report.

Overall it is hoped that that the GEEM and the findings of this report will be beneficial to Gisborne District Council by allowing it to move towards more holistic development of policy with recognition of key environmental-economy tradeoffs.

1.2 THE IMPORTANCE OF ENVIRONMENT-ECONOMY INTERACTIONS

Before outlining the methodology used in creating the GEEM and the BAU scenario, it considered important to describe in more detail what we mean by environment-economy tradeoffs, their relevance to policy formation and the use of environmental input-output models.

Gross Domestic Product (GDP) has traditionally been used to measure the performance of a nation, and similarly at the regional level regional GDP or Gross Regional Product (GRP) is commonly used. Over the preceding 20 years the GDP indicator has however been severely criticised on the grounds that it does not measure all aspects of life valued by communities, including nature's provision of clean air, water and other critical biogeochemical processes. Short term, it is likely that GRP would rise if there was a net depletion/degradation of Gisborne's environmental base. Long term, however, it is likely that GRP would gradually fall in response to a depleted/degraded regional environment.

Economic activities such as farming, forestry and tourism contribute substantially to the local economy, but they may also have detrimental impacts on the regional environment. The farming of Gisborne's hill country has, for example, been associated with erosion and the loss of the valuable soil resources.

Often the environmental implications of economic change are hidden or indirect in nature. The environmental implications of tourism, for example, are often far removed from the activities tourists are directly involved in. This is due to the presence of indirect 'upstream' or 'backward linkage' effects within the economy. While there may be no direct effect associated with a tourist dining out, there are however indirect environmental effects associated with providing the energy to cook food, the provision of the food itself and so on. The indirect impacts associated with an industry are often greater than its direct impacts.

Understanding the relationships between economic activity and the environment, particularly with regard to future trends and prospects, is essential if policy trade-offs are to be understood. Such relationships may be analysed using environmental input-output tables. These tables describe, in monetary terms, flows of (1) factor inputs (e.g. labour, capital), (2) commodities (i.e. goods and services) within an economy, and (3) final consumption of commodities (e.g. by households or export markets). The implications of economic activity on the environment are studied by augmenting the input-output table, in physical terms, with natural resource use and environment degradation (e.g. pollution, waste, emissions) on an industry-by-industry basis. Using the extended input-output tables it is possible to study the direct, and also the indirect, impacts of economic change.

2 METHODOLOGY

The approach used by Market Economics Ltd to develop the GEEM and BAU scenario is summarised in the Figure 1 below, with a full explanation provided in the following sections.

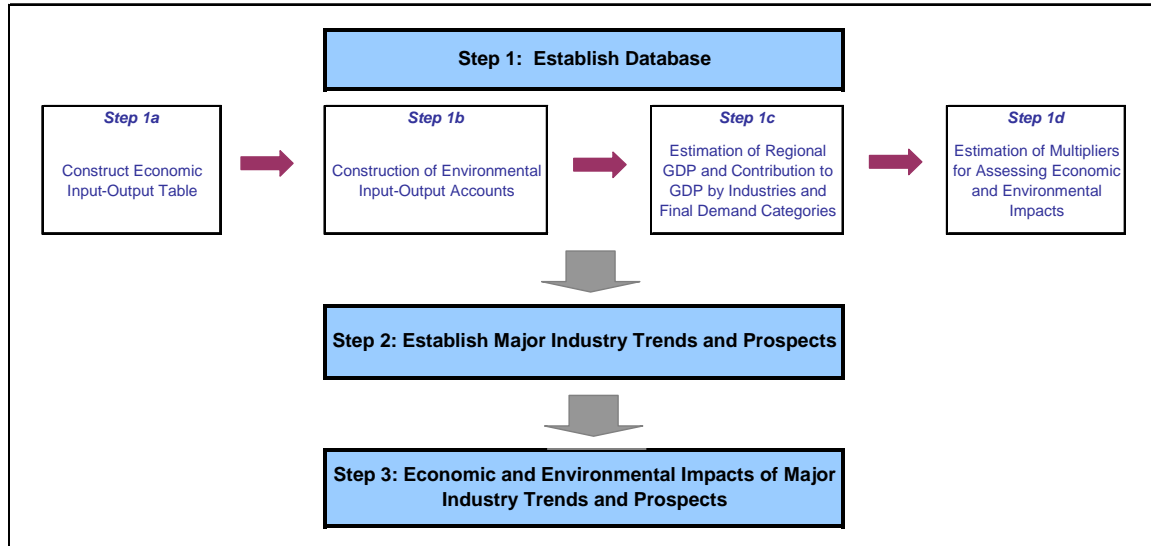


Figure 1 Methodology

2.1 CONSTRUCTION OF THE GEEM

In order to construct the GEEM, a database of economy-environment linkages was generated for Gisborne. This database is in the form of a set of economic and environmental accounts presented in an input-output format. For each industry and final demand (e.g. household consumption, exports and gross fixed capital formation) category of the economy, the economic accounts cover intermediate inputs (i.e. as provided by other economic industries), primary inputs (e.g. wages and salaries, operating surplus and depreciation of fixed capital) and imports. The economic accounts also cover key economic indicators including gross output, Gross Regional Product (GRP) and full time equivalent employment (FTEs). Similarly, for each economic industry (and for household consumption) environmental accounts were created for land-use, energy-use (by delivered energy type), energy related emissions (CO₂, CH₄ and N₂O by delivered energy type) and solid waste (by type). This process consisted of the following steps:

Step 1A Construction of Input-Output Table

An input-output table for the Gisborne District economy was constructed for the financial year ending 31 March 2004. The table was generated by following the GRIT (Generating Regional Input-Output Tables) procedure as developed at the University of Queensland by Jensen *et al.* (1979). In brief this required the following steps:

1. Statistics New Zealand's (SNZ) 1995-96 Inter-Industry Study of the New Zealand Economy (the latest national input-output table available) was updated to the 2004 financial year. Updating is conducted on a per industry basis accounting for volume, price, and productivity changes over the intervening eight year period.

2. The 2004 national input-output table was 'regionalised'. Regionalisation is undertaken by estimating the degree of regional self-sufficiency relative to the nation as a whole. Simple Location Quotients (SLQs)¹ are used for this purpose.

The 2004 Gisborne District Input-Output Table generated covers 48 industries, 8 primary inputs and 8 final demands. Appendix A provides a concordance relating standard industrial classifications (ANZSIC) to the 48 input-output industries (Table A.1).

Step 1B Construction of Environmental Input-Output Accounts

To evaluate the environmental implications of future scenarios a set of environmental accounts covering resource use and residual (i.e. waste, pollution, emissions) generation was constructed for the district. Specifically, accounts were constructed for 2004 for land, delivered energy (petrol, diesel, fuel oil, geothermal, wood, aviation fuel, black liquor, natural gas and LPG), energy related air emissions (by delivered energy type for CO₂, CH₄, N₂O), and cleanfill and landfill solid waste (construction and demolition waste, and landfill waste including metal, glass, plastic paper, potentially hazardous, organic matter and other solid waste). Development of environment accounts is a costly and time consuming endeavour, but if environment-economy tradeoffs are to be more fully understood, then further environmental accounts (e.g. water, ecosystem service, soil, etc) may be warranted.

Step 1C Estimation of Gross Regional Product

Estimates of GRP² and its contribution on an industry basis were made, along with historical comparisons with the New Zealand economy, on an industry-by-industry basis.

Step 1D Estimation of Economic and Environmental Multipliers

A full set of economic (output³, value added, and employment) and environment (for each natural resource and residual environmental account) multipliers were then produced for Gisborne District. Type I (direct and indirect) and Type II (direct, indirect and induced) economic multipliers were produced along with direct and indirect environmental multipliers. An input-output multiplier shows the relationship between an additional unit of spending and an increase in economic output, value added or employment. Type I multipliers measure the direct and indirect (i.e. 'upstream' linkage) impacts associated with the initial change. Type II multipliers measure not only the direct and indirect impacts, but also the induced (i.e. as brought about by consumer spending) impacts. These multipliers are not reproduced within this report, but are available in an accompanying Microsoft Excel spreadsheet. A workshop will be held to teach Council staff in the correct application of these multipliers in assessment of the impacts of future economic developments within the Gisborne District.

¹ Refer to Section 3.3 for a full explanation of Simple Location Quotients.

² GRP is a measure of the total flows of goods and services produced by an economy over a year. It is obtained in input-output terms by summing the value of the primary inputs economy-wide and subtracting total imports. It excludes the value of intermediate goods and services as these are implicitly included in the price of final goods.

³ Output is a measure of the total flow of goods and services within an economy. This includes intermediate demand, primary inputs and final demands. It should not be confused with value added (i.e. GRP), which does not include intermediate demand.

2.2 DEVELOPMENT OF THE BAU SCENARIO

The rationale for developing the GEEM was to assess possible future implications (including environmental implications) of economic change within the Gisborne District. It is however important to note that environment-economy interactions are characterised by complex feedbacks, time lags and non-linearities, all of which are unpredictable. In this way, the GEEM cannot 'predict' or 'foretell' the future, but rather assesses the likely tradeoffs of simple scenarios characterised by limiting assumptions.

The key feature of the GEEM is that it establishes not only direct economic growth in key economic industries, but also the indirect growth associated with flow-on effects. Growth in the Wood Product Manufacturing industry, for example, will most likely result in growth in other industries, particularly through supply chain linkages. Furthermore, if additional workers are required as a result of this growth, then additional expenditure by households will occur. This, in turn, will result in further flow-on growth, particularly services supporting households. The model furthermore captures economic inter-linkages between the Gisborne and New Zealand economies. In this way, the implications of growth in key New Zealand industries on the Gisborne economy are also captured.

The GEEM works by taking estimates of future household consumption and export demand for 2006, 2011, 2016, 2021 and 2026 and determining economic activity required to produce these demands – including all of the associated flow on implications. Growth in household consumption is based on population projections, while projections of export demand are derived using econometric analysis. The outcomes initially derived from these projections are validated and adjusted as appropriate based on a qualitative research. The repercussionary or flow on implications are then calculated using input-output mathematics⁴, with growth rates by the 48 industries for each five year period from 2006 to 2026 being the major output. These growth rates, with productivity allowances, are then used to estimate the future economic and environment implications associated with growth.

To date, the model has been set up to analyse only the BAU scenario with a 20 year outlook. The BAU scenario assumes the following: (a) the current economic interdependencies between industries within the Gisborne District will continue to prevail, and (b) only crude judgements about technological change and eco-efficiencies may be made.

The following information informed this approach:

1. *Quantitative econometric projections of population and international export growth.* Growth in population was based on SNZ's medium sub-national population projections for the Gisborne District. A couple of adjustments were however made to the projections. The reasons for this approach are more fully explained in Section 4. Both the employment and export growth projections were derived econometrically using time series data covering the time period 1987 to 2005. The export projections are based on data obtained from SNZ's New Zealand Harmonised System (NZHS).

⁴ Input-output tables have been widely used throughout New Zealand to estimate economic impact e.g. for events such as the America's Cup and the proposed 2011 Rugby World Cup.

2. *Qualitative research of key economic industries as derived from literature sources.* Based on comparative strength and GRP contribution, 10 key industries were identified in the Gisborne District: Livestock and Cropping Farming, Services to Agriculture, Hunting and Trapping, Horticulture and Fruit Growing, Beverage, Malt and Tobacco Manufacturing, Other Food Manufacturing, Forestry and Logging, Wood Product Manufacturing, Education and Health and Community Services. A literature review was then undertaken (i.e. of academic articles, industry reports, economic commentaries and newspaper articles) which focused on the prospects of these key industries. The tourism industry was also selected for consideration due to the growing importance of this industry nation wide.⁵ The reference section lists all of the publications reviewed.
3. *Qualitative research from face-to-face interviews with key industry and community representatives.* A total of 36 in-depth face-to-face interviews were conducted during March and April 2007 by GDC staff. Representatives from the following organisations were included: Tairāwhiti District Health, the Chamber of Commerce, Eastland Wood Council, Tourism Eastland, Federated Farmers, the Department of Labour, Eastland Infrastructure, AG First, the New Zealand Real Estate Institute, Moana Pacific, Gisborne Fisheries, Tairāwhiti Polytechnic, the wine industry and Horticulture New Zealand.

2.3 REPORT ON THE BAU SCENARIO

The growth rates established under the BAU scenario were then applied to the environmental input-output table constructed in Step 1A and 1D above. This enabled generation of estimates of future change in key economic (e.g. population, employment and GRP) and environmental (i.e. natural resource use and environmental degradation) variables.

⁵ Under current national accounting conventions Tourism is not considered to be an industry *per se*, but instead is represented by an amalgam of industries including bars, restaurants and hotels; accommodation; and retail trade. For this reason any results derived for tourist related economic industries will include not only tourist related impacts, but also the impact derived from domestic growth.

3 GISBORNE 2003-04

3.1 INTRODUCTION

The Gisborne District encompasses the far East Coast of New Zealand and is one of the more isolated regions in the nation. The district is principally made up of steep hill country, with rolling land on the hilltops, and valleys of fertile alluvial planes and terraces. The only major urban area within the district is Gisborne City which is situated on the Poverty Bay Flats.

Importantly, Gisborne is one of New Zealand's four unitary authorities. This means that it is possible to consult regional level statistics and literature in order to gain information regarding the district. As will be seen from the following sections of this report, we have generally also found it more convenient to compare Gisborne with other regions, rather than other districts, as part of the process of determining the district's unique characteristics.

3.2 THE GISBORNE POPULATION

The total population of Gisborne District in 2004 is estimated at 45,000 or 1.1 percent of the total New Zealand population (Statistics New Zealand, 2004). In terms of population and demographics, the Gisborne District is quite interesting and unique. First, the district contains one of the youngest populations in New Zealand. Although no statistics are available for the 2003-04 base year; it can be noted that in 2001 Gisborne had the highest proportion of people under the age of 15 years out of all regions at 27.7 percent. This can be compared with the national average of 22.5 percent. Furthermore for all of the censuses 1986-2001, the proportion of the population at 0-14 years of age was greater than the national level by more than three percentage points (Pool *et al.*, 2005b). Interestingly though the region does not have a high proportion of young working age people. In 2001 the people in the district aged between 20 and 29 years accounted for 11.2 percent of the population, compared with a national average of around 13.7 percent. These results are most likely a reflection of young adults moving to other centres for tertiary education and/or work opportunities.

Out of all the regions Gisborne also has the highest proportion of Maori by a significant margin. Again no figures are available for the 2003-04 base year, but in 2001 Maori made up 44.0 percent of the population compared with a national average of 29.1. In Gisborne, Maori are more likely to be rural than Pakeha, but this is not true of most New Zealand regions (Pool *et al.*, 2005c).⁶

3.3 THE GISBORNE ECONOMY

3.3.1 Overview

The economy of the Gisborne District has been built on its natural and physical resources, and the development and growth of the primary sector. Among the most important economic activities within the district is livestock farming, which is linked to the extensive areas of hill country pastoral lands within the district. Overall livestock farming is the predominant land use in the district, with a ratio of 84 sheep stock to 16 beef stock estimated for 2004 (Gisborne District Council, 2004).

⁶ In 2001 77.7 percent of Gisborne's Pakeha population lived within the urban area while 65.0 of the district's Maori population lived within the urban area (Pool *et al.*, 2005c).

Forestry has also become increasingly important to Gisborne, particularly since the 1990s. This has occurred both through the conversion of whole farms to forestry, and the conversion of steeper, erosion-prone land within farms for smaller forestry blocks. In total there is now around 160,000 hectares in the district devoted to forestry, which accounts for around 8.8 percent of New Zealand's total exotic forest plantations (Ministry of Agriculture and Forestry, 2006e).

Horticulture, fruit growing and grape growing (for wine production) make up the other significant primary activities in the district, and they are for the most part concentrated on the highly productive soils of the Poverty Bay Flats. Importantly, Gisborne is the third most significant viticulture region in the country, producing around 10 percent of all New Zealand's wine grapes (Statistics New Zealand, 2003a). In addition to grapes, the main crops include sweetcorn, squash, outdoor tomatoes, citrus fruit and kiwifruit.

Relative to the New Zealand economy, the Gisborne economy is also more heavily reliant on a few downstream processing activities associated with the region's primary production. Among the most important are wine manufacturing and fruit packhouses. By contrast, Gisborne is under-represented, relative to the New Zealand economy as a whole, in most services industries. Business services is a particularly small sector for the district, relative to the rest of the country (NZIER, 2004).

Over recent times the Gisborne economy has generally performed at a lower level than the New Zealand economy as a whole. The New Zealand Institute of Economic Research (NZIER), for example records that the average real GDP per capita for Gisborne in 2003 was lower than the New Zealand average, as was the GDP growth rate for 2000 to 2004. These results are partly explained by the district's heavy reliance on sectors which have been relatively slow growing, particularly agriculture and natural resources. Although not strictly relevant to the 2003-04 base year, some of the more recent reports and statistics have however reported increased growth for the district. The National Bank, for example, recorded that Gisborne was one of the fastest growing areas in the 12 months to September 2006, expanding 3.4 percent from the previous year. In these respects Gisborne recorded the strongest increase in retail sales, the second fastest rise in residential buildings, and commercial motor vehicle registrations and accommodation guest nights also grew faster than national averages (The National Bank, 2006).

3.3.2 Economic Production and Employment

Gisborne's Gross Regional Product (GRP) for 2003-04 is estimated as \$1.33 billion. It can be noted that this accounts for only 0.95 percent of the Gross Domestic Product (GDP) estimated for New Zealand for that year. Furthermore Gisborne's share of GDP in 2003-04 is slightly less than the district's share of the national population (1.09 percent).

As discussed in the methodology section, all economic activities occurring within Gisborne and New Zealand have been aggregated into 48 different industries. In Table 3.1 the top 20 of these industries, in terms of their contribution to Gisborne's GRP, are listed in rank order. The difference between the Gisborne ranking and national ranking for each industry is also provided. For example, the Health and Community Services industry is ranked as the third highest contributor to Gisborne's GRP. This ranking is however 2 places higher than the industry's New Zealand ranking, meaning that Health and Community Services provides the 5th highest industry contribution to New Zealand's GDP.

Table 3.1 Contributions to Gross Regional Product by Gisborne District's Top 20 Industries, 2003-04

Industry	Gisborne Region GRP\$ ₂₀₀₄ million (in Rank Order)	Difference in Rank Gisborne Region c.f. New Zealand
Livestock and cropping farming	104	12
Forestry and logging	98	24
Health and community services	83	2
Ownership of owner-occupied dwellings	74	-2
Retail trade	72	-1
Education	71	2
Construction	66	0
Business services	65	-7
Wholesale trade	62	-6
Beverage, malt and tobacco manufacturing	60	19
Other food manufacturing	50	7
Real estate	45	-6
Horticulture and fruit growing	44	15
Central government administration, defence, public order and safety services	35	-2
Services to agriculture, hunting and trapping	32	25
Wood product manufacturing	28	14
Road transport	23	5
Accommodation, restaurants and bars	22	-2
Personal and other community services	20	1
Communication services	18	-9
Other	253	
TOTAL	1,325	

It is obvious from Table 3.1 that the two primary industries, Livestock and Cropping Farming and Forestry and Logging, are significantly more important to the Gisborne economy compared with the national economy, as their rankings are 12 and 24 places higher in Gisborne respectively. Horticulture and Fruit Growing, and the related industry of Beverage, Malt and Tobacco Manufacturing (mainly wine production), are also much more significant in Gisborne compared with the nation. By comparison many of the services, including Business Services, Wholesale Trade, Real Estate, Accommodation, Restaurants and Bars and Communication services, are comparatively less important in the Gisborne economy than in the national economy.

The patterns are broadly similar in regards to employment. Table 3.2 lists Gisborne District's top 20 industries, but this time in regards to the total number of full time equivalent employees (FTEs). As with GRP, the difference in the ranking of each industry compared with the New Zealand average is also shown. Once again the three primary industries, Livestock and Cropping Farming, Horticulture and Fruit Growing and Forestry and Logging, are shown to be more significant in Gisborne than in New Zealand as a whole. Services to Agriculture, Hunting and Trapping, Beverage, Malt and Tobacco Manufacturing and Wood Product Manufacturing, are also more important employers in Gisborne compared with the nation. Interestingly, the Accommodation, Restaurant and Bars industry has a slightly smaller rank in

Gisborne District, both in terms of GRP contribution and employment. This is likely to partly reflect of a lower importance of tourism to the district compared with the nation.

Table 3.2 Gisborne District's Top 20 Employers by Industry, 2003-04

Industry	Gisborne Region Full-Time Equivalent Employment (in Rank Order)	Difference in Rank Gisborne Region c.f. New Zealand
Retail trade	1,894	0
Health and community services	1,636	1
Livestock and cropping farming	1,635	6
Education	1,532	1
Construction	1,223	-1
Business services	1,066	-4
Services to agriculture, hunting and trapping	974	16
Horticulture and fruit growing	852	13
Wholesale trade	682	-3
Accommodation, restaurants and bars	677	-3
Forestry and logging	643	22
Other food manufacturing	575	8
Central government administration, defence, public order and safety services	519	-5
Road transport	405	-1
Personal and other community services	401	-5
Wood product manufacturing	390	9
Beverage, malt and tobacco manufacturing	243	23
Cultural and recreational services	222	-7
Machinery and equipment manufacturing	164	-5
Real estate	157	-4
Other	1,527	
TOTAL	17,416	

Broadly speaking, these results show that the Gisborne economy is more oriented towards primary production than the New Zealand economy. There are in addition a few manufacturing and service industries closely related to primary production, namely Beverage, Malt and Tobacco Manufacturing, Wood Product Manufacturing and Services to Agriculture, Hunting and Trapping, which provide comparatively high contributions to the Gisborne economy. Overall the Gisborne economy is however comparatively weak in the manufacturing and service sectors.

To further illustrate the nature of Gisborne's economy, Figure 3.1 shows the 10 most significant industries in Gisborne in terms of the contribution they make to the equivalent industry in the national economy (measured in terms of GRP contribution).

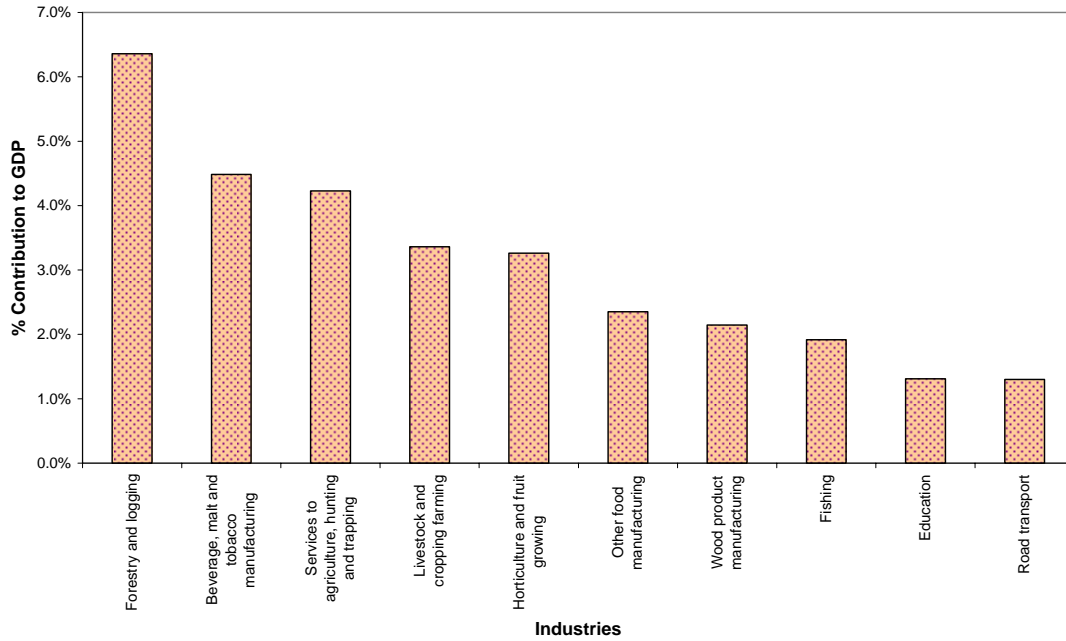


Figure 3.1 Top Ranking Gisborne Industries in Terms of Percentage Contribution to National GDP

By comparison, the industries where the contribution from the Gisborne District to the national economy is of least importance are shown in Figure 3.2. An interesting result is that despite Dairy Cattle Farming and Dairy Product Manufacturing being among the most important industries in New Zealand, the Gisborne region is responsible for very little of the total value added contribution made by these industries. Similarly, Gisborne contributes very little to New Zealand's Finance and Insurance industries. This is not surprising given that these services tend to locate in major urban areas.

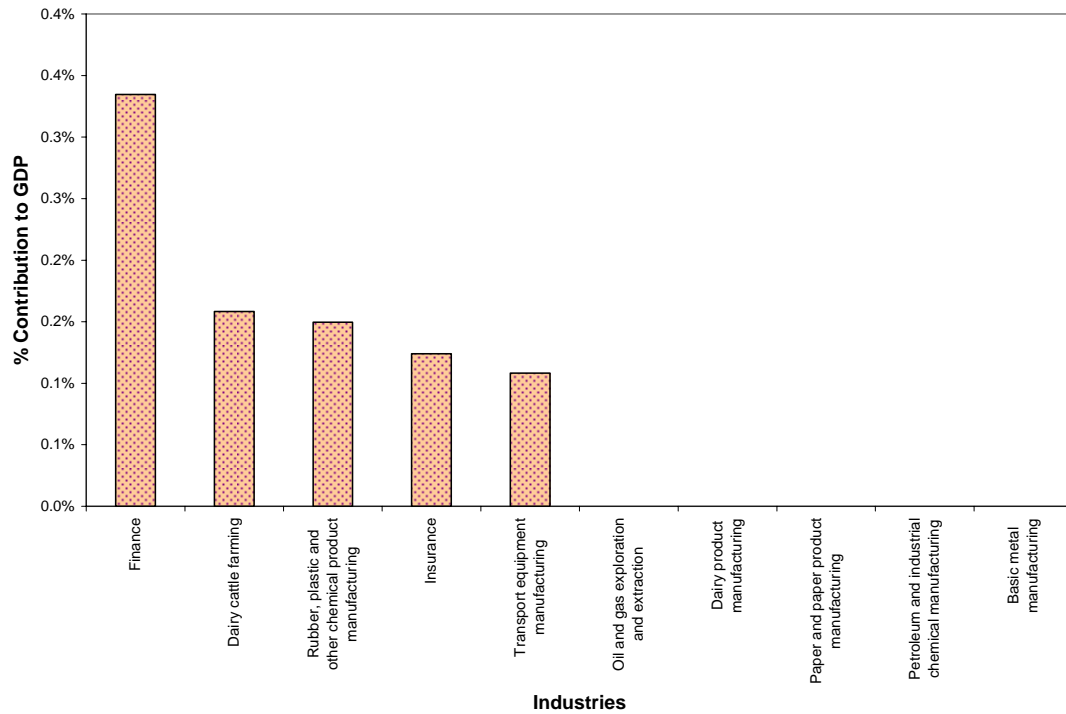


Figure 3.2 Lowest Ranking Gisborne Industries in Terms of Percentage Contribution to National GDP

3.3.3 Economic Specialisation and Comparative Advantage

The comparative strength or weakness of an industry in a particular district, relative to the nation, can be further analysed through the use of location quotients. In this report we have used the Simple Location Quotient (SLQ) index, as it is based on readily available and reliable employment data.⁷ Stated simply, if the Simple Location Quotient calculated for a Gisborne industry is greater than 1 (SLQ>1), then the industry is deemed to be 'strong' (i.e. able to satisfy local demand and export) in the Gisborne District. Conversely, industries with a Simple Location Quotient less than 1 (SLQ<1) are deemed to be 'weak' industries (i.e. unable to satisfy local demand).

Table 3.3 lists all the industries in Gisborne for which the SLQ is greater than 1. In order to provide a means of comparison, the table also includes the SLQ calculated for the equivalent industries in a select number of other New Zealand regions.

Table 3.3 Gisborne District's 'Strong' Industries by Location Quotient and Location Quotient Results for Comparable Regions, 2003-04

Industry	Simple Location Quotients					
	Gisborne	Northland	Bay of Plenty	Hawkes Bay	Marlborough	Tasman
Forestry and logging	6.11	2.72	3.76	1.56	1.89	6.75
Beverage, malt and tobacco manufacturing	4.90	0.15	0.30	3.29	14.74	1.48
Services to agriculture, hunting and trapping	4.04	1.01	2.26	3.44	4.43	1.93
Horticulture and fruit growing	3.38	1.91	3.38	3.01	4.09	6.79
Livestock and cropping farming	3.17	1.87	0.53	1.91	1.66	1.63
Other food manufacturing	2.30	0.36	0.83	2.15	3.96	2.33
Wood product manufacturing	2.03	2.27	2.40	0.76	1.23	5.62
Fishing	1.83	2.43	1.13	1.11	9.97	4.27
Education	1.32	1.00	0.97	1.01	0.55	0.55
Gas supply	1.17	0.39	0.70	0.00	0.00	0.00
Road transport	1.17	1.21	1.10	1.00	0.92	1.13
Health and community services	1.15	1.30	1.06	1.00	0.78	0.41
Water supply	1.02	0.46	0.61	0.39	0.29	0.37

While the SLQ is very helpful in determining industries in which there is a comparative strength, it is also important to keep the size of each industry in perspective. The Water Supply industry in Gisborne, for example, while calculated to have a SLQ greater than 1, is estimated to contribute only \$2 million to Gisborne's

⁷ Mathematically speaking, the SLQ for a given industry, i , is calculated as:

$$SLQ_i = \left(\frac{(Emp_i^r / Emp_i^n)}{(Emp^r / Emp^n)} \right)$$

where Emp_i^r is the total number of people employed in the industry in the district or region in question, Emp_i^n is the total number of people employed in the industry in the nation, Emp^r is total employment in the region or district, and Emp^n is the total employment in the nation. All employment figures are measured in FTE equivalents excluding those in management structures.

total GRP or 0.18 percent. Water supply activities are therefore not actually of particular significance to the district. Overall, the industries that are of most importance to the Gisborne economy are those which are both strong in the region (i.e. the SLQ is greater than 1) and of a significant size. It has been identified that there are a total of 10 industries in Gisborne satisfying both of these criteria (refer to Table 3.4).

Table 3.4 Gisborne District's Industries with Comparative Advantage and Significant Contribution to GRP, 2003-04

Industry	GRP Contribution (\$ ₂₀₀₄ mil)	Rank by GRP (out of 48 Industries)	SLQ - Excluding Management Structures	Rank by SLQ (out of 48 Industries)
Livestock and cropping farming	104	1	3.17	5
Forestry and logging	98	2	6.11	1
Health and community services	83	3	1.15	12
Education	71	6	1.32	9
Beverage, malt and tobacco manufacturing	60	10	4.90	2
Other food manufacturing	50	11	2.30	6
Horticulture and fruit growing	44	13	3.38	4
Services to agriculture, hunting and trapping	32	15	4.04	3
Wood product manufacturing	28	16	2.03	7
Road transport	23	17	1.17	11

Given the nature of the Gisborne District and economy, the industries that have been identified in Table 3.4 are not surprising. In short these industries consist of the following activities (for further detail refer to Appendix A):

- *Livestock and Cropping Farming* – As described above, Gisborne's comparative strength in Livestock and Cropping Farming is linked to its extensive areas of hill country sheep and beef farming. Also included in this industry are maize growing, cereal grain growing and various other cropping activities.
- *Forestry and Logging* – This industry is comprised of those engaged in growing standard timber as well as various forestry services such as forest planting, fire-fighting and forest nursery operation.
- *Health and Community Services* – Included within this industry are hospitals, nursing homes, medical, dental, physiotherapy and chiropractic services, child care services and homes for the aged.
- *Education* – This industry is predominantly comprised of pre-school, primary and secondary education providers as well as the Tairāwhiti Polytechnic. Various other education activities are also included such as music, ballet and art teaching and tutoring services.
- *Beverage, Malt and Tobacco Manufacturing* – In Gisborne this industry is predominantly made up of activities associated with wine manufacturing, and

the industry's strength is clearly related to the extensive areas devoted to grape production in the district.

- *Other Food Manufacturing* – This industry is mainly comprised of activities associated with the packaging and processing of fruit and vegetable products and is therefore clearly reliant on the region's horticulture activities. Other activities that fit within the category include bread, cake and pastry manufacturing and seafood processing.
- *Horticulture and Fruit Growing* – Among the activities included in this industry are plant nurseries, vegetable growing (incl. sweetcorn and squash) and grape, apple, stonefruit, kiwifruit, citrus and various other fruit growing.
- *Services to Agriculture, Hunting and Trapping* – Among the activities included in this industry are sheep shearing and aerial crop spraying. Essentially this industry exists to support the district's primary producers.
- *Wood Product Manufacturing* – Activities classified within this industry include log sawmilling, wood chipping, timber dressing and plywood, veneer, particle board and hardboard manufacturing.

3.4 THE GISBORNE ENVIRONMENT

3.4.1 Introduction

Gisborne District's dependence on the environment as a source of natural resources (e.g. land and energy), and as a sink for its wastes and emissions, is described below. This dependence cannot be understated as it is the very basis for much of the economic wealth generated from within the region, particularly the wealth gained from primary industries and their associated processing. Key accounts describing the economy-environment interface include:

- Land use (ha)
- Delivered energy by type (TJ). This includes aviation fuel, coal, fuel oil, diesel, petrol, black liquor, wood, natural gas, LPG and geothermal.
- Energy related emissions (tonnes)
 - Carbon dioxide (CO₂) by delivered energy type
 - Nitrous Oxide (N₂O) by delivered energy type
 - Methane (CH₄) by delivered energy type⁸
- Solid waste (tonnes) covering both cleanfill and landfill sites. Solid waste is decomposed into 8 types, namely: construction and demolition, metal, glass, plastic, paper, potentially hazardous, organic matter and other.

These environmental accounts were derived from several data sources. Estimates of land use and delivered energy were developed as part of Ministry for the Environment's update of regional Ecological Footprints to 2003-04 (refer to Smith and McDonald (forthcoming)), while the solid waste estimates were derived from McDonald (2005).

3.4.2 Land Use

Table 4.1 shows the top 10 land using industries in the Gisborne District for the year ending March 2004.

In total, the Gisborne District economy covers some 784,000 hectares of productive economic land (excludes non-economic land uses such national parks, forest parks, land occupied by lakes, waterways and wetlands and so on). The most dominant

⁸ Farm animal CH₄ emissions are not included in these estimates.

land users are Livestock and Cropping Farming (73.7 percent of all productive land) and Forestry and Logging (21.5 percent). Other significant land users are the Cultural and Recreational Services industry (1.8 percent, comprising golf courses, sports fields, botanical gardens, domains, local parks, reserves etc), Other Farming (1.0 percent), Dairy Cattle Farming (0.7 percent) and Horticulture and Fruit Growing (0.6 percent). Residential housing amounts to 2,979 ha or 0.4 percent. These seven combined account for 99.8 percent of all productive land area in the Gisborne District.

Table 3.5 Top 10 Land Using Industries in the Gisborne District, 2003-04

	Land Use	Share of Total Land Use
	ha	
Livestock and cropping farming	550,989	73.7%
Forestry and logging	160,713	21.5%
Cultural and recreational services	13,268	1.8%
Other farming	7,596	1.0%
Dairy cattle farming	5,131	0.7%
Horticulture and fruit growing	4,822	0.6%
Households	2,979	0.4%
Water and rail transport	352	0.0%
Road transport	339	0.0%
Mining and quarrying	244	0.0%
Other	1,201	0.2%
TOTAL	747,634	100.0%

3.4.3 Delivered Energy

Delivered energy is a measure of the total energy delivered (used in) each industry of the Gisborne District economy. Energy use is measured in Terrajoules (heat equivalents). Table 3.6 shows the 10 industries which used the most energy in the Gisborne District in the year ending March 2004 by the main types of energy. It is important to note that the energy accounts cover only energy consumption, not energy production.

It is estimated that a total of 4,834 terrajoules (TJ, heat equivalents) of energy was consumed by the Gisborne District economy for the year ending March 2004. Just over 50 percent of this energy was consumed as Diesel (25.7 percent) and Petrol (26.5 percent). Electricity accounted for 18.9 percent of energy consumed and wood for 8.7 percent.

The ten largest energy using industries accounted for 81 percent of all energy consumed in 2003-2004. Household consumption captured 1,886 TJ (heat equivalents) or 39.0 percent of total consumption. Road Transport was the single largest industrial consumer of energy at 575 TJ (heat equivalents) or 15 percent of all energy consumed, almost all of which was from fossil fuels. Wood product manufacturing was the next largest industrial consumer of energy, estimated at 381 TJ (heat equivalents) with over half of this being electricity. The third largest industrial consumer of energy was Other Food Manufacturing (estimated at 195 TJ, heat equivalents; or 10 percent) – predominantly derived from natural gas.

Table 3.6 Gisborne District's Top 10 Energy Consumers by Energy Type, 2003-04

	Households	Road transport	Wood product manuf	Other food manuf	Printing , publishing & recorded media	Retail trade	Forestry & logging	Livestock & cropping farming	Fishing	Horticulture & fruit growing	Other	TOTAL	Share of Total by Fuel Type
	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents	TJ, Heat Equivalents		
Aviation Fuel	0	0	0	0	0	0	1	1	0	1	68	72	1.5%
Black Liquor	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
Coal	1	0	1	1	0	1	0	0	0	0	22	26	0.5%
Diesel	143	493	1	15	0	10	92	107	100	73	210	1,245	25.7%
Electricity	479	1	63	4	14	72	43	9	7	6	214	912	18.9%
Fuel Oil	0	0	1	1	3	0	0	0	34	0	70	109	2.3%
Geothermal	0	0	0	0	12	0	0	0	0	0	0	12	0.3%
LPG	28	16	4	1	0	4	0	0	0	0	11	65	1.3%
Natural Gas	120	0	58	161	88	45	0	0	0	0	233	706	14.6%
Petrol	1,040	65	0	12	0	28	24	25	0	17	70	1,279	26.5%
Wood	74	0	252	0	57	2	0	0	0	0	23	408	8.4%
TOTAL	1,886	575	381	195	175	162	160	142	140	97	921	4,834	100.0%
Share of Total by Industry	39.0%	11.9%	7.9%	4.0%	3.6%	3.4%	3.3%	2.9%	2.9%	2.0%	19.0%	100.0%	

3.4.4 Energy Related Air Emissions

Energy related emissions are air borne emissions (or pollutants) that result from the consumption of energy (delivered energy). The three types of emissions that are most commonly measured are:

- Carbon dioxide (CO₂). The release of CO₂ is thought to be a key contributing factor to global warming and the big increases in CO₂ levels reported overseas have also been seen in New Zealand. Scientists have, for example, been measuring CO₂ concentrations at Baring Head in Wellington since 1973 and have noted that concentrations have risen from 320 parts per million in 1973 to 374 parts per million in 2003, more than twice the increase in the preceding 20 years. There are numerous sources of atmospheric CO₂ including burning of coal, oxidation of carbon monoxide in the atmosphere, volcanic eruptions, biota respiration and decomposition of organic material. Only human related CO₂ emissions resulting from delivered energy consumption (i.e. energy obtained from the combustion of fossil fuels and biomass) are however captured in the analysis below.
- Nitrous oxide (N₂O). N₂O is another gaseous emission created as a result of human activities (although there are also a number of natural sources of atmospheric N₂O). Only N₂O emissions resulting from the combustion of biomass and fossil fuels are considered here.
- Methane (CH₄). Methane is another potent greenhouse gas and is New Zealand's most significant anthropogenic greenhouse gas emission. Methane's dominant source is farmed livestock (90 percent) with the remaining emissions primarily resulting from the degradation of materials at landfills. Once again, only energy related CH₄ emissions resulting from the combustion of fuels are however captured in the analysis below.

The following sub-sections describe the top 10 emitting industries for each emission type.

Carbon dioxide (CO₂)

Table 3.7 shows the 10 largest CO₂ emitting industries in the Gisborne District for the year ending March 2004. Over the 2003-04 period, it is estimated that 334,000 tonnes of CO₂ was released as a result of energy consumed in the Gisborne District. Households were the largest emitters of CO₂ (37.3 percent of all CO₂ emitted in the district), followed by the Wood Product Manufacturing (12.2 percent) and the Road Transport industry (11.8 percent). In total, the top 10 CO₂ emitting industries in the Gisborne District accounted for 82.3 percent of all CO₂ emissions.

Nitrous Oxide (N₂O)

Table 3.8 shows the 10 largest N₂O emitting industries in the Gisborne District for the year ending March 2004. In 2003-04, it is estimated that just over 5,000 tonnes of N₂O were emitted as a result of energy consumed in district. Once again Households accounted for the largest share of N₂O emissions (38.1 percent of all N₂O emitted in the Gisborne District), followed by the Road Transport industry (13.8 percent) and Wood Product Manufacturing (6.4 percent). In total, the top 10 N₂O emitting industries in the Gisborne District accounted for 82.1 percent of all N₂O emissions.

Methane (CH₄)

The estimated CH₄ emissions resulting from the top 10 industries in Gisborne District for 2003-04 are described in Table 3.9. As with CO₂ and N₂O emissions, Households emerge as the top source of CH₄ emissions (54.7 percent). Road Transport is the next largest industry source of CH₄ emissions (7 percent), followed by Wood Product Manufacturing (5.8 percent). All the remaining industries have less than a 10 percent share respectively.

Table 3.7 Top 10 CO₂ Emitting Industries in Gisborne District, 2003-04

	Households	Wood product manufact	Road transport	Printing , publishing & recorded media	Other food manuf	Forestry & logging	Fishing	Retail trade	Livestock & cropping farming	Horticulture & fruit growing	Other	TOTAL	Share of Total by Fuel Type
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	
Aviation Fuel	0	0	0	15	16	87	15	1	94	64	4,663	4,954	1.5%
Black Liquor	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
Coal	90	97	0	0	62	0	0	89	0	0	2,049	2,387	0.7%
Diesel	9,824	77	33,883	11	1,060	6,325	6,863	710	7,325	5,007	14,429	85,513	25.6%
Electricity	27,305	3,608	41	794	226	2,467	381	4,108	518	354	12,168	51,970	15.6%
Fuel Oil	0	101	0	212	50	0	2,470	15	20	14	5,163	8,046	2.4%
Geothermal	0	0	0	137	0	0	0	0	0	0	0	137	0.0%
LPG	1,719	232	974	8	87	0	0	269	0	0	643	3,931	1.2%
Natural Gas	6,367	3,068	24	4,674	8,491	0	0	2,366	0	0	12,337	37,326	11.2%
Petrol	69,263	2	4,314	1	781	1,577	3	1,846	1,633	1,116	4,648	85,184	25.5%
Wood	9,869	33,505	0	7,589	0	0	0	255	0	0	3,066	54,282	16.3%
TOTAL	124,436	40,691	39,235	13,440	10,773	10,457	9,730	9,657	9,590	6,555	59,166	333,729	100.0%
Share of Total by Industry	37.3%	12.2%	11.8%	4.0%	3.2%	3.1%	2.9%	2.9%	2.9%	2.0%	17.7%	100.0%	

Table 3.8 Top 10 N₂O Emitting Industries in Gisborne District, 2003-04

	Households	Road transport	Wood product manuf	Fishing	Water & rail transport	Forestry & logging	Livestock & cropping farming	Retail trade	Other food manuf	Printing, publishing & recorded media	Other	TOTAL	Share of Total by Fuel Type
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	
Aviation Fuel	0	0	0	0	0	1	1	0	0	0	74	78	0.3%
Black Liquor	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
Coal	21	0	23	0	0	0	0	21	15	0	487	567	2.0%
Diesel	994	3,428	8	694	30	640	741	72	107	1	1,937	8,653	30.6%
Electricity	2,347	3	310	33	0	212	45	353	19	68	1,076	4,467	15.8%
Fuel Oil	0	0	28	672	1,257	0	5	4	14	58	152	2,190	7.7%
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
LPG	77	44	10	0	0	0	0	12	4	0	29	177	0.6%
Natural Gas	335	1	161	0	0	0	0	124	446	246	649	1,963	6.9%
Petrol	6,626	413	0	0	0	151	156	177	75	0	551	8,149	28.8%
Wood	371	0	1,260	0	0	0	0	10	0	285	115	2,041	7.2%
TOTAL	10,771	3,890	1,800	1,400	1,287	1,004	949	773	681	659	5,070	28,284	100.0%
Share of Total by Industry	38.1%	13.8%	6.4%	4.9%	4.6%	3.6%	3.4%	2.7%	2.4%	2.3%	17.9%	100.0%	

Table 3.9 Top 10 CH₄ Emitting Industries in Gisborne District, 2003-04

	Households	Road transport	Wood product manuf	Other food manuf	Retail trade	Printing , publishing & recorded media	Forestry & logging	Livestock & cropping farming	Accomm., restaurants & bars	Horticulture & fruit growing	Other	TOTAL	Share of Total by Fuel Type
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	
Aviation Fuel	0	0	0	0	0	0	2	2	0	1	102	108	0.1%
Black Liquor	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
Coal	3	0	4	2	3	0	0	0	0	0	76	89	0.1%
Diesel	1,246	4,299	10	134	90	1	802	929	16	635	2,685	10,849	10.0%
Electricity	9,053	13	1,196	75	1,362	263	818	172	581	117	3,579	17,230	15.9%
Fuel Oil	0	0	7	3	1	14	0	1	2	1	488	517	0.5%
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0.0%
LPG	838	475	113	42	131	4	0	0	53	0	260	1,916	1.8%
Natural Gas	3,005	11	1,448	4,007	1,116	2,206	0	0	998	0	4,825	17,616	16.3%
Petrol	44,037	2,743	1	497	1,174	1	1,003	1,038	120	710	2,837	54,159	50.1%
Wood	1,039	0	3,527	0	27	799	0	0	0	0	323	5,714	5.3%
TOTAL	59,221	7,541	6,305	4,762	3,904	3,288	2,625	2,143	1,770	1,464	15,177	108,199	100.0%
Share of Total by Industry	54.7%	7.0%	5.8%	4.4%	3.6%	3.0%	2.4%	2.0%	1.6%	1.4%	14.0%	100.0%	

3.4.5 Solid Waste

Another measure of the link between the economy and the environment is the production of solid waste. In this study we have produced estimates of landfill and cleanfill solid wastes generated by Gisborne District household and industries. Values of solid waste output are uncertain and hard to estimate due to difficulties in matching wastes to industry types and converting volumes to tonnages. It is also important to note that a proportion of the solid waste produced by Gisborne industries will be disposed on-site and therefore is not included in this analysis.

Table 3.10 shows the ten industries that are estimated to have produced the largest amounts of solid waste for the 2003-04 base year. In total it is estimated that some 58,000 tonnes of landfill and cleanfill waste were produced by Gisborne residents and industries during the year. Not surprisingly, nearly two thirds of the waste (63 percent) was cleanfill waste produced by the Construction industry. In total, the Construction Industry was far and away the largest producer of solid waste accounting for 63 percent of all solid waste produced in the Gisborne. Households were the next largest producers of waste at 9,390 tonnes or 16 percent.

It is also important to consider the different types of waste produced. Households are for example estimated to be the largest producers of plastic waste at 1,850 tonnes or 57 percent of total plastic waste, while the Rubber, Plastic and Other Chemical Manufacturing industry is estimated to be the largest producer of potentially hazardous waste (1,130 tonnes or 54 percent).

Table 3.10 Top 10 Solid Waste Producing Industries in Gisborne District, 2003-04

Sub-Type	Construction	Households	Meat & meat product manuf	Wood product manuf	Rubber, plastic & other chemical product manuf	Other food manuf	Furniture and other manuf	Structural, sheet, & fabricated metal product manuf	Beverage, malt & tobacco manuf	Machinery & equipment manuf	Other	TOTAL	Share of Total by Solid Waste Type
	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	
<i>Landfill</i>													
Cons. & demolitn waste	750	1,090	0	1,750	10	0	430	30	0	0	290	4,350	7.5%
Metal	50	720	50	10	30	10	50	420	60	220	100	1,720	3.0%
Glass	30	350	0	0	20	0	0	10	90	60	50	610	1.1%
Plastic	20	850	190	10	210	80	10	20	0	40	50	1,480	2.6%
Paper	10	1,850	20	0	80	10	10	10	60	20	460	2,530	4.4%
Potentially hazardous	0	110	290	130	1,130	30	40	60	10	110	180	2,090	3.6%
Organic matter - kitchen & garden	0	3,900	3,070	0	20	1,020	0	0	290	0	200	8,500	14.7%
Other	0	520	0	0	70	0	20	0	10	10	160	790	1.4%
<i>Cleanfill</i>													
Cons. & demolitn waste	35,900	0	0	0	0	0	0	0	0	0	0	35,900	61.9%
TOTAL	36,760	9,390	3,620	1,900	1,570	1,150	560	550	520	460	1,490	57,970	100.0%
Share of Total by Industry	63%	16%	6%	3%	3%	2%	1%	1%	1%	1%	3%	100%	

4 THE BUSINESS AS USUAL SCENARIO

The following sections describe the information used and assumptions made in order to derive the BAU scenario.

4.1 THE PAST PERFORMANCE OF THE GISBORNE ECONOMY

The National Bank of New Zealand regularly produces data on regional economic performance for every region in New Zealand. The index provided is an aggregated measure of around 30 individual indicators including the retail interest rate, exchange rate, commodity prices, business and consumer confidence, retail sales, house sales, building permits issued, employment growth and new vehicle registration. Figure 4.1 shows that the index for the Gisborne Region (or district) has been consistently below the index for New Zealand, and that the gap between the two indices has been increasing over time.

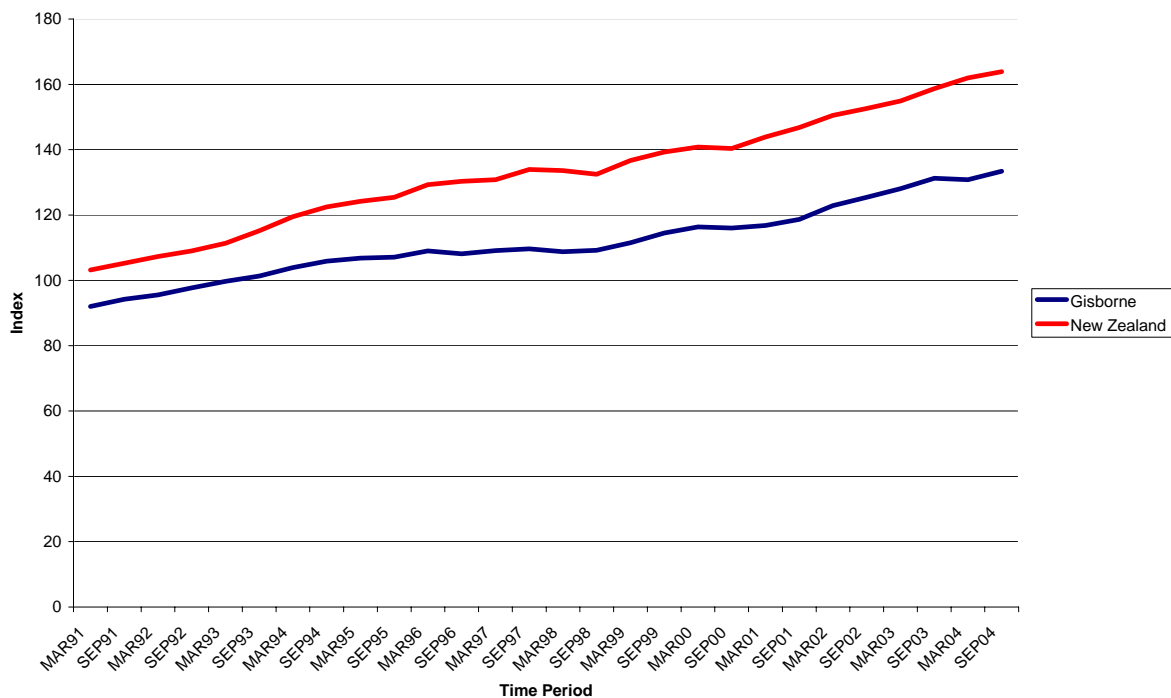


Figure 4.1 National Bank Economic Activity Indicator, 1991-2004. Source: The National Bank of New Zealand (Economics Division)

It must be kept in mind that this is only a very aggregate measure of a number of selected indicators, and therefore must be interpreted with some caution. Nevertheless the results provide a general indication that, in terms of economic performance, Gisborne District has been consistently below that of the nation over the last 15 years, and that this trend is therefore likely to continue in the near future. The results also imply that a conservative approach is required when using trends at the national level to help project future outcomes for Gisborne.

4.2 GROWTH AND DECLINE IN INDUSTRIES

The following parts of Section 4 discuss in some detail the likely BAU scenario outcomes for the key industries identified in Section 3.3.3 i.e. Livestock and Cropping Farming, Forestry and Logging, Health and Community Services, Education, Beverage, Malt and Tobacco Manufacturing, Other Food Manufacturing, Horticulture

and Fruit Growing, Services to Agriculture, Hunting and Trapping, and Wood Product Manufacturing. We have also given particular consideration to Tourism and Fishing due to their early identification as possible growth industries for the District. The projections for population under the BAU scenario are also included in this section as they are one of the key drives of the model, particularly in regards to industries that are driven by domestic demand. Similarly, the quantitative projections of export growth (the other key economic driver) are provided.

4.3 INDUSTRIES DRIVEN BY LOCAL DEMAND

4.3.1 Population Growth

For the purposes of establishing the Business-As-Usual Scenario SNZ's sub-national population projections have been applied, albeit with some modification.⁹ In this section a review of the key components of population growth is undertaken and the projections for a BAU scenario established. Population is a key driver of economic activity within the region, particularly with regards to services such as retailing, education, health, personal and community services and government.

Components of Population Growth

Regional population projections are typically performed by considering the following key components of growth: natural increase (i.e. as resulting from births and deaths¹⁰) and migration, both domestic and international (Pool *et al.*, 2004).

It is a relatively straightforward task to determine natural increase figures by applying fertility and mortality rates to a given age-sex population stock.¹¹ In Gisborne's case it is also imperative that ethnicity, explicitly Maori, be considered when determining natural increase figures (Pool *et al.*, 2004)¹². The Population Studies Centre at the University of Waikato, for example, estimate Gisborne's Total Fertility Rate (TFR) over the periods 1990-92, 1995-97, 2000-02 to be respectively 2.72, 2.62 and 2.61. These are the largest TFRs of any region in all three periods; all well above the 2.1 births per woman replacement rate (Pool *et al.*, 2005a). These findings are the results of significantly larger TFRs for Maori e.g. the 2000-02 Gisborne Maori TFR is estimated at 2.85 (2nd highest among Maori for any region) (Pool *et al.*, 2004). Ethnicity is equally important when considering mortality. When comparing the probability of surviving and life-expectancy at birth ratios for Maori, Maori levels fall below the New Zealand average in all regions – a non-Maori boy can expect to outlive his counterpart by 8.2 years, while a non-Maori girl by 8.8 years (Baxendine *et al.*, 2005, Pool *et al.*, 2005a). Over the period 2000-02, Gisborne had the lowest life expectancies at birth for males (72.3 years) and females (78.3 years) of all ethnic groups over all regions.

⁹ It is important to note that only the usually resident population is considered in deriving the forecast of population growth under the Business-As-Usual scenario. The impact of tourists on the Gisborne District economy are considered separately in Chapter 4 of this report.

¹⁰ Statistics on births and deaths are available from Statistics New Zealand Vital Statistics by Regional Council from 1991 onwards. The Population Studies Centre at University of Waikato has however argued that death data taken from unit records for the New Zealand Health Information Service may be more appropriate. It is argued that due to the application of 'data smoothing' techniques Statistics New Zealand's population projections real patterns may be eliminated [35].

¹¹ This is typically performed by demographers by applying a Total Fertility Rate (TFR) and Probability of Surviving Rate (PSR) across an entire population stock. Such rates eliminate the need to adjust for differences in age cohort composition.

¹² Rates of Maori natural increase are hard to determine across time due to changes in ethnicity classification which is an ever-changing concept influenced by historical, social and political factors [36].

There are several other important trends captured in the Gisborne fertility and mortality rates. There has been a notable delaying in the parenting experience. Since 1991 the median age for having children has risen from 27.9 years to 29.8 years in 2001, with more women in their thirties and forties having children. Teenage childbearing is however significant. Despite these trends there is considerable uncertainty with what might happen to fertility over the longer term (Pool *et al.*, 2005a). Declines in mortality are occurring in all cohorts; however the rates of decline are slower in the 15 to 19 and 20 to 24 year old male cohorts – possibly the result of vehicle accidents. Coupled with the declines in mortality has been an ageing of the population, although this is not as significant as other regions. Overall, Gisborne over the period 1986 to 2001 experienced positive rates of natural increase. The population declines experienced by Gisborne District during this period must therefore be attributed to migration flows.

Net migration is a measure of both international and domestic inflows and outflows. Changes in migration are generally measured by analysing answers given to census questions on place of residence one/five years ago or by imputation using methods such as the Census Survival Rate¹³. Between 1986 to 1991, 1991 to 1996, and 1996 to 2001, Gisborne's net migration across all ages was combined was negative, respectively at 8.6 percent, 5.8 percent and 9.0 percent as a percentage of the initial population at the start of each period (Pool *et al.*, 2004). These declines were the largest of any region in 1986 to 1991, and second largest in the other two periods. Moreover, Gisborne experienced outflows in all age groups, over the two periods 1986 to 1991 and 1991 to 1996, with the losses greatest in the 15 to 24 year age group (Pool *et al.*, 2005a). This is typical of a region without a major tertiary education facility; many young adults feel the need to move away for education, and in turn, may move to larger urban areas or overseas (Pool *et al.*, 2005b). Some commentators have attributed the losses to dwindling job opportunities – a trend which has certainly been reduced in recent times (New Zealand Herald, 2006b).

The historical large net outflows of people from the Gisborne Region are unfortunately no indicator of what might happen in the future. Net migration flows are notoriously difficult to project and even harder to control (Baxendine *et al.*, 2005). It has been noted, for example, that at a national level the only way the government can control the volatility of international migration is to encourage immigration during recessions when net outflows are largest – which is politically unacceptable. As hinted at above, a critical problem with forecasting future migration patterns is that it is reliant on analysis of historical trends and often takes no account of prevailing economic conditions. This is certainly the case in Gisborne where significant additional population may be required to fulfil growth in the Forestry and Logging and Wood Product Manufacturing industries¹⁴. Several commentators have also noted that potential growth may also be driven out of people seeking out-of-the-way relaxed lifestyle and cheaper retirement¹⁵ options (The New Zealand Herald, 2006a, 2006b).

¹³ This is an indirect method of measuring migration that takes account of changes in survivorship, international and internal migration in both directions, and 'self-corrections' for any significant reporting errors (Lee *et al.*, 1957; Shryock *et al.* 1976).

¹⁴ The degree to which increased mechanisation is adopted will however be a critical factor in determining future employment growth in the Wood Product Manufacturing industry (Pers. Comm. Gisborne District Council).

¹⁵ Gisborne has many attributes that retirees are looking for including a pleasant climate, friendly, easy to get around, and significant healthcare facilities (Pers. Comm. Lifecare Solutions Ltd). Lifecare Solutions Ltd are, for example, currently working on a 174 unit complex covering 10 ha at an estimated cost of \$65 million, including intensive landscaping and walking tracks [M1]. Construction of a further 55-plus sector lifestyle village is also underway with an estimated cost of \$55 million. It is estimated that during the construction of this project an additional 60 jobs will be created. Lack of infrastructure and

I think that you need to address this point, as well as the forestry-related growth, in the next paragraph – i.e. explain why it hasn't formed part of a Business as usual scenario – perhaps explain that information to date still shows that we have a net migration loss. There seems to be way too much confidence in some sectors that we are just going to grow and people believe it is already happen – therefore it is important to expand on this point.

Establishing the Business-As-Usual Population Growth

Based on the above discussion it was felt that population growth should be based on an adjusted SNZ medium sub-national population projection for Gisborne District. There are several reasons and caveats associated with adopting this stance. Firstly, Gisborne has high rates of natural increase and if better education and job related opportunities were to prevail longer term then retention of this increase might occur. Secondly, migration dynamics are particularly difficult to project. Such projections should not solely be based on analysis of historical trends, but should also take account of prevailing economic conditions within the District. Thirdly, known investment decisions in forestry and wood processing industries, in particular the new Hikurangi mill, are clearly out of context from Gisborne's recent history and are likely to lead to population inflows different from recent trends. For these reasons it was felt appropriate to adjust SNZ's medium projection upwards by an additional 420 people in the period 2006 to 2011 to take account of the new workers (and their families) required for the Hikurangi mill. It is further assumed that these people will remain indefinitely in the Gisborne District as decline is not expected in Forestry and Logging or wood processing production after 2011. The entire series has also been moved down by 300 people to account for the fact that the 2006 results showed 300 less people in Gisborne District than that projected by the medium series. It must however be reiterated that, in the end, this is only an assumption of future population growth for the District.

We wish to make it clear that in deriving the BAU scenario we have not given consideration to the so called 'buzz' reported for the district by many commentators,. Except as discussed above in relation to wood product manufacturing, we have not found sufficient justification to abandon Statistics New Zealand's medium population projection series for the district. In this regard it is noted that despite the recent 'buzz', the latest census results show that Gisborne's population for 2006 was in fact less than that projected by Statistics New Zealand in their medium series, by some 300 people.

It should however be pointed out that more dramatic population increase is a plausible outcome for the district, particularly as a result of further investment decisions and additional jobs created in forestry. Importantly, as is discussed in the forestry and logging sections below, some 3,800 additional jobs could potentially be created in the industry (assuming no efficiency gains) to meet projected growth in log harvest. Such employment and associated population growth has not however been incorporated in the BAU scenario because it is simply so 'out of sink' with the recent history of the region and there are a number of potential limitations to this growth, including future export prices, possible difficulties in attracting staff and so on¹⁶ It is instead recommended that further population growth emanating from forestry be investigated as a separate scenario.

isolation may however be a limiting factor to further retirement village development (Pers. Comm. Council Staff).

¹⁶ Allowance was however made for investment in the new Hikurangi mill.

4.3.2 Education

The Gisborne District has around 30 pre-schools and Kohanga Reo, 53 primary schools, two intermediate and seven secondary schools. In addition to Te Wananga o Aotearoa, Tairāwhiti Polytechnic is a major government funded Tertiary Education Institute in Gisborne that offers around 70 formal qualification programmes and over 100 short courses (APR Consultants, 2006e). It has been noted (APR Consultants, 2006e) that over the last five years the number of education businesses/providers within Gisborne has decreased slightly from 149 to 145 businesses over the last five years, with an accompanying decrease in employment by around 140 people or 8.1 percent.

Early Childhood Education

Over recent years there has been growth in early childhood education nationwide. For the period 1992 to 2001 the number of children enrolled in early childhood education rose from around 133,000 to approximately 170,000; an increase of nearly 28 percent (Statistics New Zealand, 2003b). If we are to assume that the proportion of children under 5 years old attending early childhood education is now relatively static, the future of early childhood education becomes solely dependant on Gisborne's future population demographics.

Primary and Secondary Education

Within the Gisborne Urban area there has recently been a decline in primary and secondary students, reflecting a changing age structure within the district, although this decline has not been to the extent projected (Per. Comm. representative Ministry of Education). Although there may be some growth in child numbers in certain areas (particularly Wainui and Sponge Bay) as a result of re-zoning, it is anticipated that this additional demand can be captured by existing schools and thus no new schools are planned for the area (Pers. Comm. representative Ministry of Education).

School retention rates measure the percentage of students staying through to the final year of school (year 13). In 2001 Gisborne had a relatively high school retention rate for males (57.3 percent compared with a national average of 55.3 percent for New Zealand) but a low retention rate for females (50.2 percent compared with 59.0 percent for New Zealand) (Pool *et al.*, 2005d). Some growth in secondary education could therefore be achieved by improving the school retention rates within the district, particularly for females. It is however envisaged that population demographics will remain the most important determinant for primary and secondary education providers.

Tertiary Education

Nation wide the population is becoming better educated and a tertiary level qualification is becoming a more common phenomenon (Baxendine *et al.*, 2005). We have not however found evidence to suggest that there shall be growth in tertiary education providers in Gisborne. On the contrary, there has recently been a change in funding away from social-type non-industry based courses, which has resulted in a corresponding drop in student numbers for these courses (Pers. Comm. representative, Ministry of Education). The Tairāwhiti Polytechnic also expects student numbers to decrease in the next 10 years and is considering down-sizing the campus (Pers. Comm. representative, Tairāwhiti Polytechnic). Gisborne is likely to find it difficult to compete with tertiary providers in other centres because it lacks a

'student vibe'. We are furthermore likely to see more Gisborne residents studying over the internet (Pers. Comm. representative, Tairāwhiti Polytechnic). Although an opportunity may exist for increased forestry training, such schemes have proved difficult to develop thus far (Pers. Comm. representative, Tairāwhiti Polytechnic).

Overall it is anticipated that the future of the Education industry shall be primarily determined by the future demographics of the district. In these regards it is important that the number of school aged children is likely to decrease in the district, even in periods of small population increase, as is shown by Statistics New Zealand's Gisborne District population projections (Statistics New Zealand, 2006). The results initially produced by the GEEM showed a small increase in the Education industry of the period 2006-2011 (i.e. less than 1 percent) and further small changes in the five year periods thereafter. We altered the change in demand for education services over the period 2006-2011 to 0 percent growth. This reflects both a likely decline in school aged children due to cohort change, but at the same time a recognition that expenditure on education is unlikely to decrease even though school roles may fall. For the remaining periods the levels of demand were left as determined by the GEEM. Overall with the incorporation of these factors an annual average growth rate of near 0.0 percent per annum was determined for the Education industry for the period 2006-2026.

4.3.3 Health and Community Services

With respect to health services, it is important that Gisborne has a history of poor performance in health statistics compared with the rest of the nation. For example, in the period 1991 to 2001, Gisborne residents had the highest number of hospital bed days per person out of all the regions at 0.56 days for females and 0.67 days for males.¹⁷ This can be compared to the national average of 0.44 days for females and 0.52 days for males (Pool *et al.*, 2006b). In 2001 Gisborne also had the second highest proportion of its population on the sickness benefit, 5.8 percent, compared with a national average of 4.2 percent.¹⁸ It is significant that across the nation Māori generally perform less well in health statistics than most other ethnic groups, and that Gisborne's results have been carried along by its high Māori population.

Over the nation health requirements are likely to increase as a result of the ageing population. SNZ, for example, on the basis of the 2001 census data, have predicted that the medium age for the Gisborne District will increase from 34.5 years in 2006 to 40.7 years in 2026 under a medium projection (Statistics New Zealand, 2006). In the case of Gisborne it is also important that the proportion of the population that is Māori has been projected to increase (Te Puni Kōkiri, 2001) and that the rate of diabetes is also increasing (Per. Comm. representative, Medical Officer of Health).

The Health and Community services industry also consists of various other services such as nursing homes, accommodation for the aged and physiotherapy, chiropractic and child care services. For many of these activities, future growth will be highly dependent on population changes. Accommodation for the elderly will for example be highly impacted by the number of elderly living within the district. In these regards it can be noted that a new, 174 unit, retirement complex is to be constructed within the district. A representative of the company involved in the project has commented

¹⁷ The figures for hospital bed days and the sickness benefit were age standardized so as to remove the influence of different age proportions on the results of each region.

¹⁸ As outlined by Pool *et al.* (2006b), sickness/invalid benefit statistics must be interpreted with some caution as although people on sickness/invalid benefits need to meet set medical criteria to be eligible, when the economy is doing well people who might be eligible often hold down a job. Conversely when the economy is not doing well they are often the first to end up on the benefit.

that the opportunity exists for more retirement developments in Gisborne as it has many attributes that retired people are looking for, i.e. a pleasant climate, friendly atmosphere, easy to get around and a large enough centre to have major facilities (Per. Comm. representative, Lifecare Solutions).

From the above information it is determined that growth in Health and Community Services is likely to be positive over the 20 year period of the study, although the magnitude of the growth is more difficult to determine. As one means of gaining an indication of plausible future growth, the potential change in hospital bed days over the period were estimated. This was undertaken by applying 2001 hospital bed day rates, as set out by Pool *et al.* (2006), to the likely changes in cohort structures indicated by Statistic New Zealand's population projections for the Gisborne District. Total increases ranging from around 3.0 to 6.0 percent were determined for the five year increments covered by the model (i.e. 2006-2011, 2011-2016, 2016-2021 and 2021-2026), primarily as a result of the district's ageing population. It must however be noted that these rates do not take account of likely efficiency gains in health care, or that healthcare makes up only a portion of the Health and Community Services industry. Overall, an increase in demand of around 2 percent in Health and Community Services was considered appropriate for each of the five year increments. Once incorporated into the model this translates to an annual average growth in output of approximately 0.4 percent in the industry for the period 2006-2026.

4.3.4 Tourism

We have included the analysis of tourism within Section 4.3 as the industries which are most affected by tourism, i.e. Accommodation, Restaurants and Bars, Cultural and Recreational Services and Retail Trade, also exist to serve local demand. Strictly speaking however, tourism growth is not related to local demand but rather emanates from additional demand from those living outside of the district and/or nation.

Long sunshine hours, coupled with an extensive coastline and golden sand beaches, natural bush, mountains and river areas and pleasant inner city redevelopments make Gisborne a desirable tourist destination [Scoop Independent News, 2005a]. Opportunities exist for a wide range of outdoor and recreational activities including surfing, boating, fishing, and adventure sports. One commentator noted that where "Gisborne used to be seen as distant and 'behind the times' – it is now seen as an exciting, innovative and attractive niche destination" [Scoop Independent News, 2005a]. Ministry of Tourism (2006) projections suggest that by 2012 total visits to Eastland Regional Tourism Office (RTO) will increase from a 2005 base year of 62,600 visits to 901,600 (7.5 percent), with international overnight visits up 18,100 (28.1 percent) to 82,400, domestic overnight visits up 23,300 (7.3 percent) to 344,100, international day visits up 6,600 (31.4 percent) to 27,500, and domestic day visits up 14,600 (3.4 percent) to 447,500. Or, alternatively, in expenditure terms these visits equate to an additional \$27.9m (24 percent); taking the overall tourist related expenditure to \$143.9m¹⁹. It is also important to note that international visits and expenditure is growing significantly faster than the domestic equivalent. Nevertheless, the bulk of tourist expenditure in 2012 will still be made by the domestic market (61.9 percent).

¹⁹ This is comprised of an additional \$8.1m from international overnight spend (up to \$26.9m), domestic overnight spend \$14.9m (up to \$84.4) international day spend \$200,000 (up to \$900,000) and domestic day spend up \$4.7m (up to \$31.7m) (Ministry of Tourism, 2006).

Tourism expenditure is becoming a major 'player' in the Gisborne economy; currently accounting for an estimated 3.0 percent of total regional Gross Output²⁰. Evidence of the increase role being played by tourism is the growth in airport passenger numbers which over recent years have grown by an estimated 8 percent per year compounding (Pers. Comm. representative, Eastland Infrastructure). One major impediment to future Tourist growth is, despite Gisborne being only one hour away from the Auckland and Wellington metropolitan populations, high airfares. This largely prohibits access to the lucrative 'spur of the moment' or 'weekend away' domestic traveller. Airfares are thought to be high because of a lack of competition between carriers (Pers. Comm. representative, Real Estate Institute; representative, Eastland Tourism).

Unlike the growth impacts already considered in this study, Tourism growth is not clearly attributable to a single economic industry. Tourism per se influences several economic industries, but its impacts are mostly felt within the Accommodation, Restaurants and Bars, Retail Trade, and Cultural and Recreational Services industries. To analyse the potential tourism growth impacts on these particular industries it is necessary to apportion tourist expenditure to the industry within which it occurred. For the purposes of this study, this has been undertaken using national level estimates of 'direct tourism sales' (DTS) obtained from SNZ's (2006) Satellite Tourism Account 2005. The DTS share of each industry's total industry output (TIO) is provided in Table 4.1. These figures tell us the share of tourist expenditure spent in each economic industry, for example, \$5,311 of Accommodation, Restaurants and Bars expenditure is from tourism. The 'tourism industry ratios' then tells us the share of each industry's Gross Output attributable to tourism, namely: Accommodation, Restaurants and Bars 49 percent, Cultural and Recreational Services 14 percent and so forth.

Using the 'DTS as Share of TIO' and 'tourism industry ratios' it is possible to disaggregate Gisborne's forecast tourist expenditure of \$143.9m in 2012 into \$70.5m for Accommodation, Restaurants and Bars, \$20.1m for Cultural and Recreational Services, and \$14.2m for Retail Trade. In overall terms, these equate to 3.1 percent per annum annual average growth across the three industries.

Table 4.1 National Direct Tourism Sales as a Share of Total Industry Output and Tourism Industry Ratios

	Accomm., Rest. & Bars	Cultural & Rec. Svcs	Retail trade	Transport	All Other Industries	Imports	TOTAL
Direct Tourism Sales (DTS)	2,586	538	1,564	4,776	5,248	1,084	15,796
Total Industry Output (TIO)	5,311	3,935	14,808	9,134	238,775		271,963
Tourism Industry Ratio	49%	14%	11%	52%	2%		
DTS as Share of TIO	16.4%	3.4%	9.9%	30.2%	33.2%	6.9%	100.0%

Source: Statistics New Zealand (2006).

Accommodation, Restaurants and Bars

By 2012 total visitor nights in the Eastland RTO are projected to increase by 15,400 (11.7 percent) to 1.43 million, with international visitor nights up 88,500 (25.0

²⁰ Gross Output is a measure of the total monetary transactions, both sales and purchases, within an economy. It should in no way be confused with Gross Regional Product (GRP), which represents the total flow of goods and services production by an economy, excluding all intermediate (i.e. between industries) inputs. The contribution made by Tourism to Gisborne's GRP is likely to be less than the contribution made to its Gross Output.

percent) to 442,400 and domestic visitor nights up 61,900 (6.7 percent) to 991,400 (Ministry of Tourism, 2006). Such growth rates have been a key catalyst behind quality accommodation initiatives such as the new Emerald Hotel. Further potential also exists for conferences (Pers. Comm. representative, Horticulture Industry; representative, Real Estate Institute; representative, Tourism Eastland), with business travellers expected to make up a greater share of travellers in the foreseeable future (Scoop Independent News, 2006c). Boutique restaurants by wineries common in Hawke's Bay and Marlborough have not however eventuated; such initiatives are still considered uneconomical due to insufficient customers over the winter months (Pers. Comm. representative, Tourism Eastland).

Overall it was generally considered appropriate to apply the 3.1 percent annual average growth rate established above to the demand generated by other regions and nations (i.e. tourist demand) for Gisborne's Accommodation, Restaurants and Bars industry. Once incorporated into the GEEM, the total growth in output for the Accommodation, Restaurants and Bars industry is projected at 1.2 percent annual average over the period 2006-2026.

Cultural and Recreational Services

As noted above, the annual average growth rate for tourist related Cultural and Recreational Services over the next 20 years is expected to be around 3.1 percent. Potential for further growth exists with sporting events such as surf lifesaving and Rhythm and Vines concert (Pers. Comm. representative, Horticulture Industry). Other potential initiatives which could lead to further growth include a possible charter heritage steam passenger rail line opening up to Napier (Pers. Comm. representative, Tourism Eastland; Scoop Independent News, 2005a), more cruise ship visits (Scoop Independent News 2006c), development of the Voyaging Centre (Pers. Comm. representative, Tourism Eastland), and cultural based tourism e.g. by the Tairāwhiti Development Partnership (Pers. Comm. representative, local iwi).

With the incorporation of an annual average growth rate of 3.1 percent for tourist related demand, the GEEM projects a long run annual average growth in output of Cultural and Recreational Services of 0.7 percent for the period 2006-2026.

Retail Trade

Once again, the average annual growth rate for Retail Trade resulting from tourist activity is expected to be around 3.1 percent. Over the last year, Gisborne retailers have had strong growth, although March figures indicate a possible softening or slow down due to the ending of the peak tourist season (Pers. Comm. representative, Heart of Gisborne). Some commentators note however that the positive mood in Gisborne retailing may be unjustified (pointing to the departure of Spotlight as an example) and question the demand for growth (Pers. Comm. representative, Valuer). A key indicator of confidence in growth in the retail sector may be whether several large rumoured developments eventuate. Others have warned that retailing is expanding ahead of demand and may see vacancies in buildings within certain areas of the City (Pers. Comm. representatives, GDC Economic Development Unit).

As with Accommodation, Restaurants and Bars and Cultural and Recreational Services, an annual average increase in tourist demand of 3.1 percent for the Retail Trade industry was incorporated into the GEEM. When other changes in demand projected for the period 2006-2026 are also applied, an annual average growth in output of approximately 1.0 percent is projected for Retail Trade for the 2006-2026 period.

4.4 INDUSTRIES DRIVEN BY INTERNATIONAL DEMAND

4.4.1 Export Projections

Quantitative estimates of export growth on an industry-by-industry basis were developed using time series analysis of commodity outputs taken from SNZ's Harmonised System (HS). Given that this data is only available at the national level, rather than by source region, it was necessary to assume that national export trends were representative of regional export trends.

Future estimates of physical commodity exports were determined in two steps. First, the HS data was aggregated from 13,000 commodities into a single homogenous commodity per industry. This was undertaken for every year covering the period 1988 to 2005. Second, the trends in each industry were determined through time series analysis. For those industries involving intangible (i.e. primarily service) exports, future estimates were assumed to equate to FTE growth rates in each industry. The FTE growth rates were determined from a time series analysis covering the period 1987 to 2005.

The resulting long-run average export growth rates are depicted in Table 4.2.

Table 4.2 Annual Average Percentage Growth in Exports by 48 Industries

Industry	Annual Average Growth (%)
1 Horticulture and fruit growing	2.3%
2 Livestock and cropping farming	0.0%
3 Dairy cattle farming	2.1%
4 Other farming	3.4%
5 Services to agriculture, hunting and trapping	0.0%
6 Forestry and logging	-1.8%
7 Fishing	-1.1%
8 Mining and quarrying	0.0%
9 Oil and gas exploration and extraction	5.6%
10 Meat and meat product manufacturing	1.4%
11 Dairy product manufacturing	2.1%
12 Other food manufacturing	1.3%
13 Beverage, malt and tobacco manufacturing	4.0%
14 Textile and apparel manufacturing	-1.0%
15 Wood product manufacturing	2.8%
16 Paper and paper product manufacturing	-2.1%
17 Printing , publishing and recorded media	1.0%
18 Petroleum and industrial chemical manufacturing	-1.3%
19 Rubber, plastic and other chemical product manufacturing	0.4%
20 Non-metallic mineral product manufacturing	-0.5%
21 Basic metal manufacturing	0.4%
22 Structural, sheet, and fabricated metal product manufacturing	1.6%
23 Transport equipment manufacturing	4.1%
24 Machinery and equipment manufacturing	3.2%
25 Furniture and other manufacturing	0.0%
26 Electricity generation and supply	-2.9%
27 Gas supply	0.0%
28 Water supply	0.0%
29 Construction	0.6%
30 Wholesale trade	0.6%
31 Retail trade	0.6%
32 Accommodation, restaurants and bars	1.6%
33 Road transport	0.1%
34 Water and rail transport	-2.3%
35 Air transport, services to transport and storage	1.0%
36 Communication services	-0.1%
37 Finance	-1.0%
38 Insurance	-1.4%
39 Services to finance and investment	1.7%
40 Real estate	4.3%
41 Ownership of owner-occupied dwellings	0.0%
42 Business services	1.9%
43 Central government administration, defence, public order and safety services	-0.3%
44 Local government administration services and civil defence	-1.4%
45 Education	1.6%
46 Health and community services	1.7%
47 Cultural and recreational services	2.5%
48 Personal and other community services	1.7%

The above export growth rates were then incorporated into the model as a starting point. The next part of the process was to identify from the key industries identified in

section 3.3.3, those that were driven by international demand. Each of these industries were subjected to a detailed qualitative analysis and if required, the growth rates derived by the GEEM were adjusted in order to fit the results of the analysis.

4.4.2 Livestock and Cropping

As with all commodity producers, international exchange rates are extremely important, and New Zealand's sheep and beef producers have recently been hit hard by the high New Zealand dollar, making their products less competitive on the international market, particularly in the United Kingdom (The National Bank, 2006). In these regards it is important that MAF has predicted the New Zealand dollar to weaken over the next five years. Factors driving this fall include (1) the rise of interest rates, particularly in the US, (2) the worsening current account deficit in NZ, and (3) the weakening outlook for New Zealand's Gross Domestic Product (Ministry of Agriculture and Forestry, 2006d). On the negative side, energy costs, which account for approximately 20 percent of farm expenditure will remain a critical factor for growth, and there is little relief in sight from high oil prices (MAF, 2006a).

A number of other potentially positive or negative factors have been identified in regards to the future of this industry. On the positive side, changes in sheep breeds and pasture varieties are expected to continue to improve farm productivities over New Zealand. MAF (2006d) has also predicted healthy returns over the period 2007 to 2010 for lamb producers. The supply of bovine foetal blood for growth hormones and other proteins is becoming another growth industry where it is being used for pharmaceuticals, diagnostic reagents and dietary supplements (MAF, 2006b). It can furthermore be noted that climate change scenarios generally do not forecast as significant impacts on New Zealand as other countries, potentially benefiting the nation's primary producers.

On the negative side, MAF (2006d) has predicted a decline in beef cattle numbers nation wide, reflecting the increasing contribution of the dairy industry to beef production, as well as a fall in beef prices from 2007 to 2010. Wool prices are also expected to fall over this period, with wool increasingly seen by farmers as a by product of lamb production as a result of low wool prices and the ongoing battle with synthetics and high shearing costs. With respect to lamb, greater international competition in lamb exports is likely through to 2010 as a result of Australian producers shifting their focus from wool to lamb (MAF, 2006d). Some other potential difficulties for sheep and beef producers include drench resistance, access to good quality permanent or contract labour (MAF, 2006a; Pers. Comm. Federated Farmers), increasing compliance costs (MAF, 2006a), degradation of the rural roading infrastructure, lack of a lightweight-based selling system at the Matawhero sale yards (MAF, 2006b), and security of electricity supply to isolated areas (Pers. Comm. Federated Farmers).

In the case of Gisborne, the loss of pastoral land, especially erosion prone land, to sustainable planting is another important factor impacting on the industry. In these regards it can be noted that Rakaikura Ltd (representing Maori landowners and SFM Australasia Ltd) announced last December a proposed venture that will see up to 30,000 hectares of Ngati Porou lands in Gisborne turned into new permanent forests under the government's Permanent Forests Sinks Initiative (Scoop Independent News, 2006a). Furthermore GDC's District Conservator estimates that there is around 13,000 ha of currently farmed erosion prone land within the district that could potentially be converted to forestry under the Sustainable Hill Country Project over the period 2011 to 2021.

In addition to sheep and beef producers, Gisborne's Livestock and Cropping industry is made up of a number of crop producers, such as maize growers situated on the Poverty Bay and Tolaga Bay flats. No particular reasons for growth in cropping were identified in the qualitative analysis. Once again increasing energy costs have been identified as a concern, particularly in regards to machinery operation, transportation and fertilisers (MAF, 2006a). The creep of housing/lifestyle blocks and rising land prices as well as losses in soil fertility as a result of monocultures and soil compaction were also identified as threats (Pers. Comm. representative, AG First). Additionally the potential impacts of climate change may be more significant in respect to cropping due to its more intensive use of irrigation, as well as the potential for increased storm events.

Overall, our GEEM showed for the New Zealand Livestock and Cropping industry a moderate growth of 5.4 percent for the period 2006-2011, or an annual average growth rate of 1.11 percent for the period 2004 to 2011. This is generally considered appropriate and notably is also generally consistent with MAF'S (2006d) estimate of 6.3 percent growth in national agricultural revenue for the period 2006-2010 (average annual growth of 1.5 percent). With respect to Gisborne's Livestock and Cropping industry, the GEEM also projects growth of around 15.1 percent for the period 2006-2026, or 0.70 average annual growth for 2006 to 2026. A growth rate of less than the New Zealand average is also considered appropriate given the land conversions that are expected to take place within the district.

4.4.3 Horticulture, Fruit Growing, Beverage Manufacturing and Other Food Manufacturing

Horticulture and Fruit Growing

Through a variety of ad hoc sources (Ministry of Agriculture and Forestry, 2006a; New Zealand Winegrowers, 2006; Statistics New Zealand, 2002), it is estimated that grape production or viticulture makes up around 70 percent of the value of the horticulture and fruit growing industry in Gisborne. The qualitative analysis has identified a number of positive factors that could potentially lead to growth in the district's wine industry. These include a favourable climate, good soils which are suitable for a range of grape varieties and less expensive land than other regions. It has furthermore been identified that Montana is developing a new Lindauer wine that could potentially lead to more demand for Chardonnay grapes within the district (Pers. Comm. representatives, wine industry). At the national level, large multinationals have also continued to derive new plantings or acquire vineyards, providing confidence in the long term prospects of the industry (Ministry of Agriculture and Forestry, 2006c), and increased cooperation between different growers and producers has enhanced the ability to address marketing, research and sustainability issues (Per. Comm. representatives, wine industry). Another factor potentially leading to growth is the development of Asia as a wine market.

On the negative side, there is potential for the industry to be hindered by labour shortages in the future, increased severe weather events, land fragmentation, lifestyle block encroachment and increasing compliance costs (Pers. Comm. representatives, wine industry). Other concerns with respect to the industry are rising energy costs (e.g. in regards to machinery use, frost protection and transportation), possible increased international competition in Chardonnay especially from Australia, and biosecurity threats (Ministry of Agriculture and Forestry, 2006c). It is furthermore recognised that over recent years Gisborne has not experienced the same level of growth in viticulture as other regions (Pers. Comm.

representatives, GDC Economic Development Unit; Ministry of Agriculture and Forestry, 2006c)

On balance we are overall optimistic towards the future of Gisborne's wine industry, and project positive growth for the district, although not as high as growth in other grape producing regions. In these regards New Zealand Wine Growers (2006) estimate that the producing vineyard area for Gisborne will grow by 11 percent between 2006 and 2009 (annual average growth of 3.5 percent). If this is used as a proxy to indicate the growth of the industry over the period 2006-2011, we would expect the industry to grow by 18.9 percent over the period. It is however important to recognise that the on-going profitability for the industry is highly dependant on international marketing and the maintenance of New Zealand's position as a provider of premium to super-premium quality wine. This will require cooperation across the industry in New Zealand and is highly dependant on the investments made by some of the larger players.

In order to determine and appropriate growth rate of the Horticulture and Fruit Growing industry is also necessary to consider the other activities that are included within the industry, particularly sweetcorn, squash, kiwifruit, avocado, citrus and apple growing. On the positive side with respect to these activities, Gisborne has versatile soils that can grow a multitude of crops and it is expected that citrus production will triple within the next 2 years (Pers. Comm. representative, horticulture industry). Policy changes put forth by the New Zealand Fair Trading Coalition may also provide a more fair trading environment for small to medium businesses. As with other commodity producers, horticulture and fruit growers are however strongly influenced by international competition, international prices and exchange rates. Some of the other potential difficulties identified include labour shortages; rising land prices as a result of increased viticulture and residential/lifestyle block encroachment; pacific competition; small orchard sizes in the district making expansion difficult (Per. Comm. representative, Fruit Federation and Vegetable Federation); and disease/pest infestations such as powdery mildew (squash), rust (sweetcorn) and Argentine ants (citrus). Rising fuel prices are also important, affecting margins, particularly for crops requiring frequent cultivation, as well as increasing transport costs (2006c). Taking in to account all these issues we overall expect a reasonably stagnant future for horticulture and fruit growing over the period of the study.

Overall for the Horticulture and Fruit Growing industry we have decided to apply an average annual increase in demand of 2 percent. This figure is a balance between moderate growth anticipated in grape production, at least for the first period 2006-2011, and generally static growth anticipated in other horticulture and fruit growing activities. This translates to an average annual increase in total output of around 1.9 percent for the period 2006-2026.

Beverage, Malt and Tobacco Manufacturing

As discussed above, in the Gisborne district this industry is primarily made up of wine manufacturing. Once the GEEM is updated for a 1.9 percent annual average growth in Horticulture and Fruit Growing (as discussed in the preceding section) 0.8 percent annual average growth is projected for the industry. Growth that is somewhat smaller than that of grape production is considered generally appropriate as Gisborne growers tend to export a proportion of their grapes to other regions for wine manufacturing.

Other Food Manufacturing

No indication of significant growth in this industry has been identified from the qualitative research. It can be noted that while Gisborne's citrus production is identified to increase over the next few years, New Zealand is unlikely to be able to compete in the processed citrus market due to significantly larger operations undertaken in Brazil and other countries (Pers. Comm. representative, horticulture industry). We have therefore not altered the average annual growth rate initially projected for this industry by the GEEM for the period 2006-2026 of 0.5 percent).

4.4.4 Forestry and Wood Product Manufacturing

Forestry and Logging

Due to the long term production planning required by the forestry industry, in both production and processing terms, the modelling of growth patterns and trends is less suited to econometric analysis of historical trends of export trends than other industries. Therefore, the growth rates for Forestry and Logging are solely dependent upon the results of the qualitative assessment as outlined below.

Qualitative information regarding the possible future of the Forestry and Logging industry has been examined both at the national and local level. At the national level, MAF (2006d) has forecast total roundwood production to grow from 20.481 million m³ in 2006 to 26.809 million m³ in 2010. This equates to an increase of 30.9 percent or an annual average increase of approximately 7.0 percent.

At the local level, the East Coast Forestry projection (Eastland Wood Council, 2006) estimates that total East Coast Harvest will increase from 750,000 (JAS) tonnes in 2006 to approximately 3.4 million (JAS) tonnes in 2026. This however will be characterised by several large step-wise increments (Figure 4.1). Notably a 40 percent increase in harvest is projected between 2006 and 2011, while in the period 2011 to 2016 growth curtails to only 5.2 percent. A further expansion is projected in the period 2016 to 2021, after which production harvests are expected to stabilise (i.e. 0 percent growth per annum). Over the entire study period, 2006 to 2026, this equates to 357 percent growth in harvest tonnages or 7.9 percent average annual growth, i.e. 0.9 percent above the average annual growth projected at the national level for 2006-2010.

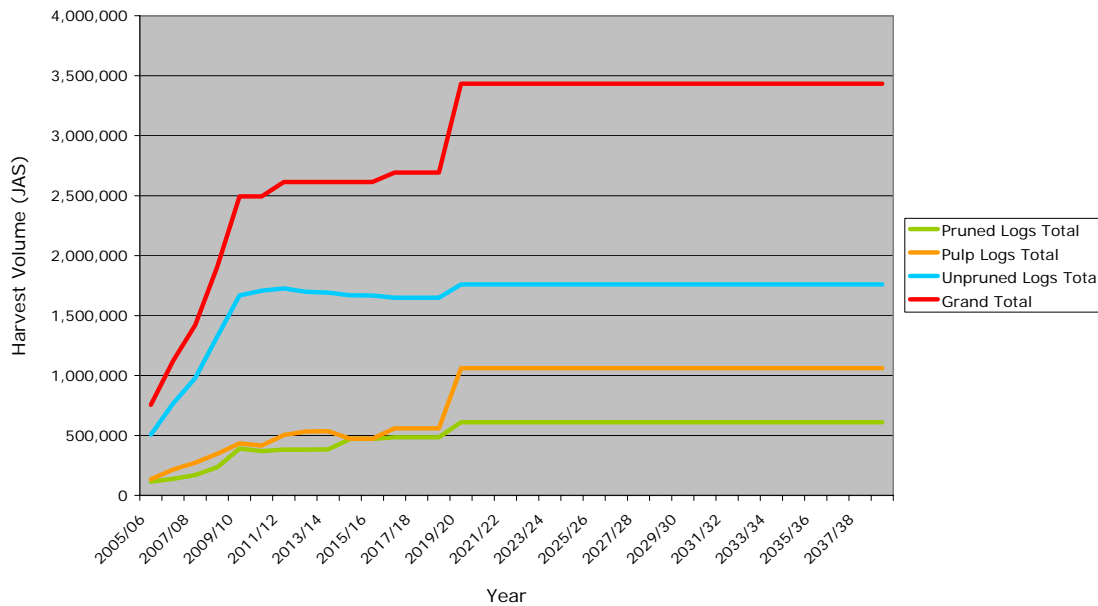


Figure 4.1 East Coast Forestry Projection – Eastland Wood Council

It is estimated that the Forestry and Logging industry currently employs around 618 FTEs, with an additional 391 FTEs in the associated Wood Product Manufacturing industry (discussed further below). If the current number of jobs to harvest volumes are to remain, the above projections would equate to an increase of around 2,360 FTEs in the Forestry and Logging Industry (bringing the total employment to around 3,000 FTEs). Furthermore if the same proportion of harvested logs are processed, and the number of jobs to processing volumes remains, a further 1,400 FTEs can be expected to be employed in Wood Product Manufacturing (a total employment of around 1,800 FTEs). These estimates however take no account of technology and related labour productivity gains and therefore represents absolute upper limits.

A shortage of good quality and reliable labour to meet the projected growth is however one of the most important and critical issues facing the Forestry and Logging industry (Pers. Comm. representative, Eastland Wood Council; representative, Eastland Infrastructure Ltd; representatives, GDC Economic Development Unit; representatives Chamber of Commerce). Already Olsens, HFF and Ernslaw are trying and struggling to get sufficient crews and the circumstances will most certainly become worse if harvests continue to grow as projected. The situation is compounded by the time it takes to train staff and there has been limited success of Polytech schemes thus far (Per. Comm. representative, Eastland Wood Council). In a 2005 survey of organisations within the Gisborne region, a number of employment issues were identified specific to forestry and other primary industries, these included (APR Consultants, 2006a):

- A perception that the industries do not look after their workers, e.g. large unpaid travel times, isolation, low pay, seasonal work, exposure to weather, no maternity leave,
- No guaranteed work or employment certainty,
- Parents not wanting their children to work in the industries,
- Beneficiaries afraid that they will have to stand down from the benefit for a period if the job does not work out,

- Transportation issues,
- Lack of childcare,
- Drug and alcohol abuse, and
- Unhealthy workers (poor personal hygiene, obesity etc).

The forestry industry will clearly need to work at improving working conditions, pay levels and people's general perception of employment within the industry if it is to successfully compete in New Zealand's tight labour market for reliable and quality workers. Other potential impediments to growth are strong competition in New Zealand's traditional markets (i.e. South Korea, Japan, China) from Russian logs and rising costs associated with fossil fuels and New Zealand's distance from markets (MAF, 2006d). It has also been noted that the Forestry industry has become particularly subject to cyclical commodity prices and has developed without significant value added production (Scoop Independent News, 2006b).

In light of the above discussion it was assumed only the first harvest 'growth spike' identified in Figure 4.1 would occur during the study period. The 'window of opportunity' for plantation harvest is reasonably large, given a typical 28 year rotation for *Pinus radiata*, potential thus exists for harvest between 20 and 36 years. On this basis, it was projected that the Forestry and Logging industry would grow by just on 250 percent over the entire study period. Or, put alternatively, by an annual average growth rate of 6.4 percent. Growth in this industry is a major determinant of Gisborne District's economic future, not only in direct investment terms, but also through 'backward linkage' supply chain purchases to other industries and 'forward linkage' wood product manufacturing sales. It is therefore strongly recommended that further analysis is undertaken of the forestry sector, and that at least one alternative growth scenario is investigated, along with the associated economic implications.

Wood Product Manufacturing

As stated above, there are currently around 391 FTEs employed in the Wood Product Manufacturing industry. Importantly, it has been suggested that employment in the industry could as much as double as a result of the development of the new Hikurangi processing mill (Pers. Comm. Council Staff), with the first 200 FTEs of this additional growth appearing in the next two years, and the remainder in the following two years. Added to this is the possibility of an additional 100 to 150 employees in other processing mills, with the potential for co-generation with the Hikurangi mill. The share of logs exported without processing versus the share sent on for further processing is another important consideration for the future of the industry. It is, for example, a goal of the Eastland Wood Council to capture 60 percent of the additional growth in harvest for processing within 8 to 10 years.

Through forward linkages in the economy, growth in the Wood Product Manufacturing industry is closely aligned to Forestry and Logging growth. Given the potentially high growth rates projected for Forestry and Logging, it is thus not surprising that quite significant growth is anticipated in Wood Product Manufacturing. Additionally, one might argue that the employment increases noted in the previous paragraph are reflective of only increases in harvest in the short term, and that further employment increases in the industry are possible as harvest volumes continue to increase. The potential for further processing mills and/or expansions to existing mills is however an area of great uncertainty for the district, and simply cannot be predicted. For this reason we considered it appropriate to incorporate into the BAU scenario only those employment increases which we know are planned for i.e. as associated with the new Hikurangi mill.

In the BAU scenario we have overall assumed that a further 400 wood processing workers will be employed to meet the needs of the new Hikurangi mill. It is further assumed that over the period 2006 to 2026 the Wood Manufacturing industry will increase its share of district-wide log consumption to around 40 percent. With these assumptions it is projected that the Wood Product Manufacturing industry will grow by 112 percent over the entire study period; equating to a long run annual growth rate of 3.8 percent. As stated above, it is recommended that a separate scenario is developed to examine alternative growth pathways possible for the forestry sector.

4.4.5 Fishing

The Fishing industry serves both local and export demand.

The qualitative research undertaken as part of the project did not point to any reasons to expect a significant growth in traditional fishing in Gisborne in the near future. Impediments to fishing growth identified included limitations on the total allowable catch, availability of quota, compliance costs and physical constraints such as lack of shelter on the East Coast (Pers. Comm. representative, Gisborne Fisheries).

During the interview process aquaculture or fish farming was however identified as a possible source of growth in the medium to long term due to international trends in fish farming (Pers. Comm. representative, Moana Pacific) and possible investment by local iwi following treaty claim settlement (Pers. Comm. representative, local iwi). It is interesting to note however that growth in aquaculture employment between 1993 and 2003 over the whole of New Zealand equated to 27.1 percent or 2.4 percent per annum, which is only a moderate growth rate for a New Zealand industry over the period. Even in key aquaculture areas such as Marlborough, growth amounted to only 65 percent over the period (5.1 percent per year), or put alternatively, 130 Full Time Equivalent Employees over the period.

Overall, given the lack of indications of growth in fishing, and the uncertainty as to what may happen in the future in regards to aquaculture investment in Gisborne, we have chosen to maintain the conservative growth rate which emerges in the GEEM for the Fishing industry of near zero percent. Should GDC wish to investigate a possible future involving large expansion of aquaculture, this could be investigated as a part of a separate scenario.

4.5 INDUSTRIES DRIVEN BY INTERMEDIATE DEMAND

4.5.1 Road Transport and Services to Agriculture, Hunting and Trapping

Road Transport and Services to Hunting and Trapping are both termed 'intermediate demand industries' as they primarily exist to serve other industries, rather than household or export demand. The very nature of the GEEM is however to capture the indirect effects resulting from changes in household or export demand on outputs of the intermediate demand industries. The checks and adjustments made to the GEEM to take into account the qualitative findings in regards to Gisborne's other key industries have therefore already created flow on implications in the results for the Road Transport and Services to Agriculture industry. Given this factor, plus the fact that no further evidence of future growth or decline was identified in either of these industries, it has not been considered necessary to alter the growth rates produced by the GEEM for the industries (i.e. 6.0 percent average annual growth for Road Transport and 3.0 percent average annual growth for Services to Agriculture, Hunting

and Trapping). It is important to note these growth rates capture the flow-on effects of the projected high growth in the Forestry and Logging and Wood Product Manufacturing industries.

4.6 Technological Progress

There is a severe shortage of data on the implications of technological progress on growth at an industry level both nationally and regionally. Black *et al.* (2003) estimated the Total Factor Productivity (TFP) within the New Zealand economy to be 0.82 percent per annum between 1988 and 2002. TFP is a measure of the productivity change from all factors of production i.e. labour, capital, materials etc. The exact rate of technological change is likely to be less than the TFP; this is because the TFP includes influences such as simply working harder or longer. Nevertheless, adjustment for labour and land productivities on future economic activity within Gisborne District was considered to be imperative. To this end the following methods were used:

- *Crude adjustment of employment figures for labour productivity changes.* Labour productivity estimates were generated by assuming, at an industry level, that the change in real income per FTE is representative of labour productivity. This approach has been used internationally by authors such as Jackson (1998) and Lahr (2001) to adjust input-output table coefficients for labour productivity change. Real income per FTE for each industry in the GEEM was derived by SNZ from Census of Population and Dwelling data for 1996 and 2001. Each industry's annual average growth in real income per FTE was then determined. These crude estimates of labour productivity were used to adjust the GEEM's projected employment estimates for labour productivity.
- *Crude adjustment of land use requirements based on land productivity changes.* Land productivity change was crudely estimated using changes in ha per FTE contributions between 1998 and 2004 for Gisborne District. Land use estimates by industry for 1998 and 2004 were taken from Ministry for the Environment's (forthcoming) update of Ecological Footprints of New Zealand and its Regions. Land productivity changes were then applied to land use estimates.

5 RESULTS OF SCENARIO ANALYSIS

5.1 Introduction

This section presents the Business-As-Usual (BAU) scenario results derived from the GEEM. It is important to note that the results outlined below are only one set of results that could be derived from the model. The model is designed to test the impacts of a range of scenarios on both the economy and the environment. Furthermore the intention of the model is not to predict the future (by definition no model is able to do this), but rather to assess the likely economy-environment tradeoffs of plausible scenarios. The BAU scenario draws on the quantitative, qualitative and technical change/productivity projections developed Section 4 to generate the implications of changes in economic activity on the economic and environment at an industry level.

Measures are reported for the BAU scenario at five yearly intervals covering the 2006 to 2026 period. Additionally, results are also reported at a more disaggregated level for the following 17 industries and households (as appropriate):

- Horticulture and fruit growing
- Livestock and cropping farming
- Services to agriculture, hunting and trapping
- Forestry and logging
- Fishing
- Other food manufacturing
- Beverage, malt and tobacco manufacturing
- Wood product manufacturing
- Retail trade
- Accommodation, restaurants and bars
- Road transport
- Education
- Health and community services
- Cultural and recreational services
- Other primary (aggregation of remaining primary industries)
- Other secondary (aggregation of remaining secondary industries)
- Other tertiary (aggregation of remaining tertiary industries)

5.2 Impacts on Population and Economy

Four key measures are used to describe future impacts on the population and economy of the Gisborne District under the BAU scenario. These are population, employment, Gross Regional Product (GRP) and compensation of employees.

5.2.1 Population

According to the recently released statistics from the 2006 census, the 2006 population base of the Gisborne District is 44,500 (Statistics New Zealand, 2007). Figure 5.1 below shows the projected population for the Gisborne District out to 2026, based on the assumptions set out in Section 4.3.1. As previously discussed, the projection below is based on Statistics New Zealand's medium projection series for the Gisborne District, except in regards to two adjustments. First, an additional 420 people are added to the projections in the period 2006-2011 to take into account the new workers (and their families) required for the Hikurangi mill. It is further assumed that these people are retained throughout the remainder of the study period. The entire series has also been moved down by 300 people to account for

the fact that the 2006 Census of Population and Dwelling results showed 300 less usually resident people in Gisborne District than that projected by the medium series. Based on these adjustments it is projected that Gisborne District's population will decline by approximately 1,780 people over the study period (an annual average decline of 0.20 percent).

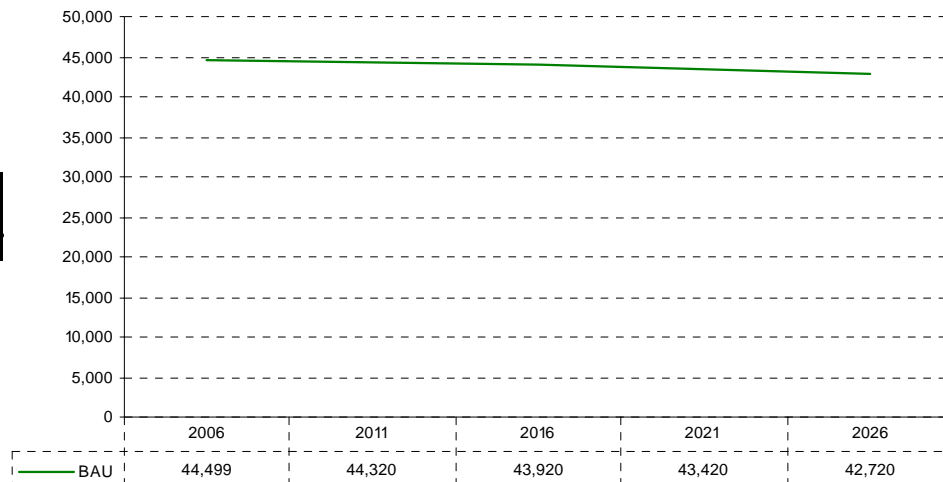


Figure 5.1 Gisborne District's Projected Population under the BAU Scenario, 2006-2026

5.2.2 Employment

In 2006, it is estimated that there are 17,083 Full Time Equivalent employees (FTEs) in the Gisborne District (Figure 5.2 and Table 5.1). Based on the BAU scenario total employment in the district is projected to increase by an additional 575 FTEs by 2026 (an annual average growth of 0.2 percent). These employment gains will need to be met mainly through the district's changing age-cohort structure, internal migration, and perhaps slightly higher labour participation rates.

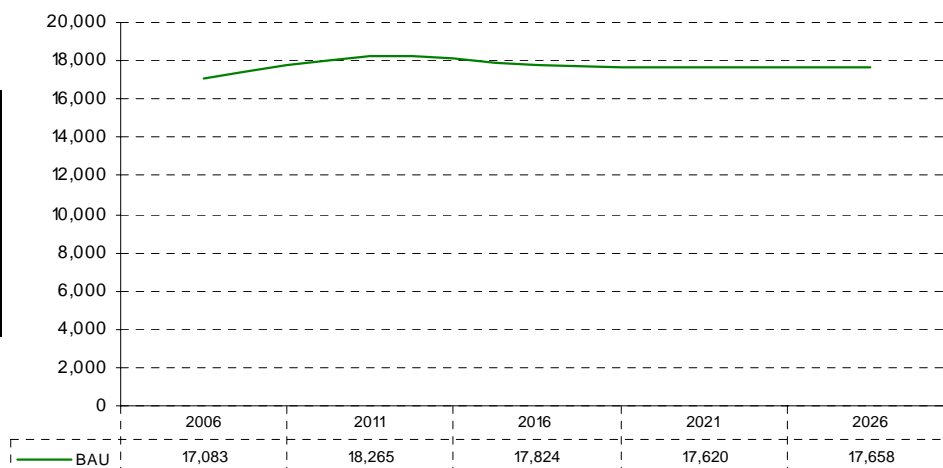


Figure 5.2 Gisborne District's Projected Employment under the BAU Scenario, 2006-2026

Over the projection period there will be significant changes to the structure of the Gisborne District economy. Firstly, Forestry and Logging will increase its share of total employment from 3.6 percent in 2006 to 7.7 percent in 2026; an annual average increase of 4.0 percent. Secondly, the significant growth in Forestry and Logging will

also flow on to Wood Product Manufacturing where a significant increase in the share of total employment will be experienced (from 391 FTEs in 2006 to 845 FTEs in 2026). The bulk of the additional employees occur in the period 2006-2011 and as discussed in the description of the BAU scenario (Section 4.4.4), this is primarily related to the new Hikurangi mill. Thirdly, some key industries will experience declines in employment, namely: Livestock and Cropping (-3.4 percent annual average), Education (-2.2 percent) and Health and Community Services (-1.6 percent). The aggregate Other Tertiary industry will also experience a 0.2 percent annual average decline. These trends occur primarily as a result of population decline and/or efficiency gains.

Table 5.1 Gisborne District's Projected Employment under the BAU Scenario, 2006-2026

Industry	Full Time Equivalent Employees (FTEs)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	858	902	926	954	985	0.7%	5.0%	5.6%
Livestock & cropping	1,519	1,292	1,080	905	761	-3.4%	8.9%	4.3%
Services to agriculture	946	1,125	1,113	1,120	1,148	1.0%	5.5%	6.5%
Forestry & logging	618	1,098	1,155	1,244	1,368	4.0%	3.6%	7.7%
Fishing	83	85	88	90	93	0.6%	0.5%	0.5%
Other food manuf	577	580	581	582	582	0.0%	3.4%	3.3%
Beverage etc manuf	252	275	301	330	363	1.8%	1.5%	2.1%
Wood product manuf	391	835	837	840	845	3.9%	2.3%	4.8%
Retail trade	1,876	1,953	1,924	1,910	1,913	0.1%	11.0%	10.8%
Accomm, restaurants & bars	687	712	737	767	802	0.8%	4.0%	4.5%
Road transport	393	604	624	659	711	3.0%	2.3%	4.0%
Education	1,474	1,346	1,199	1,069	951	-2.2%	8.6%	5.4%
Health & community svcs	1,603	1,480	1,366	1,260	1,163	-1.6%	9.4%	6.6%
Cultural & recreational svcs	224	232	236	241	247	0.5%	1.3%	1.4%
Other primary	184	186	185	190	203	0.5%	1.1%	1.1%
Other secondary	814	893	960	1,044	1,148	1.7%	4.8%	6.5%
Other tertiary	4,583	4,666	4,512	4,415	4,375	-0.2%	26.8%	24.8%
Total	17,083	18,265	17,824	17,620	17,658	0.2%	100.0%	100.0%

5.2.3 Gross Regional Product

The GRP of the Gisborne District is currently (2006) estimated at \$₂₀₀₄1.25 billion from a production perspective i.e. excluding the contribution made by final demand categories (Figure 5.3 and Table 5.2). Under the BAU scenario GRP is projected to grow at an average annual rate of 1.7 percent to \$₂₀₀₄1.76 billion by 2026. This represents a total increase of 41.2 percent over the 2006 to 2026 period.

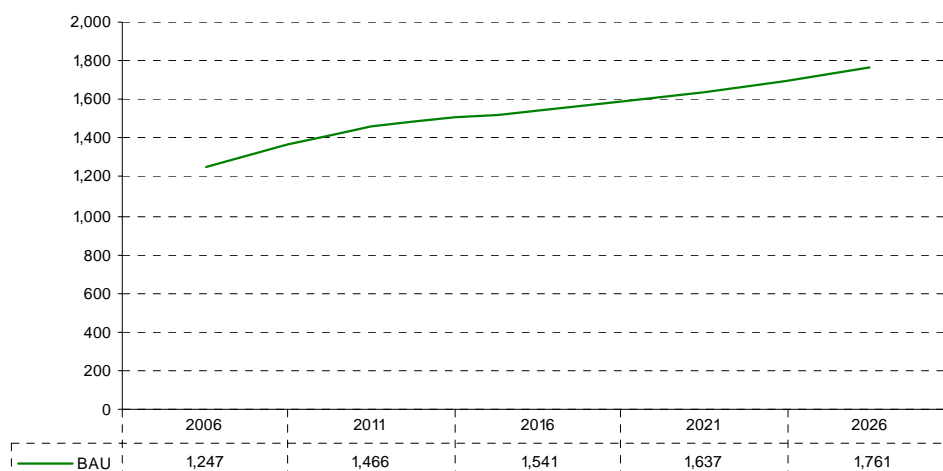


Figure 5.3 Gisborne District's Projected GRP under the BAU Scenario, 2006-2026

In 2026, the greatest contribution to GRP under the BAU scenario will be generated by Forestry and Logging (19.6 percent), Livestock and Cropping (7.0 percent) and Health and Community services (5.3 percent).. The contribution made by the aggregate Other Secondary and Other Tertiary industries will be significant at 33.6 percent combined.

Growth in GRP between 2006 and 2026 will be strongest in Forestry and Logging (6.4 percent), Road Transport (5.1 percent annual average growth), Wood Product Manufacturing (4.0 percent) and Services to Agriculture (3.0 percent). Annual average growth in GRP to 2026 will be slowest in Fishing (0.0 percent), Education (0.0 percent) and Health and Community Services (0.4 percent).

Table 5.2 Gisborne District's Projected GRP by Industry under the BAU Scenario, 2006-2026

Industry	Gross Regional Product (\$ million)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	45	51	55	61	67	1.9%	3.6%	3.8%
Livestock & cropping	105	111	114	118	122	0.8%	8.4%	7.0%
Services to agriculture	32	42	46	52	59	3.0%	2.6%	3.3%
Forestry & logging	99	197	232	280	345	6.4%	7.9%	19.6%
Fishing	7	7	7	7	7	0.0%	0.5%	0.4%
Other food manuf	51	52	54	55	56	0.5%	4.1%	3.2%
Beverage etc manuf	61	63	66	69	72	0.8%	4.9%	4.1%
Wood product manuf	28	60	60	61	61	4.0%	2.2%	3.5%
Retail trade	72	79	82	86	90	1.1%	5.8%	5.1%
Accomm, restaurants & bars	23	24	26	27	29	1.2%	1.8%	1.7%
Road transport	23	39	44	52	62	5.1%	1.8%	3.5%
Education	71	73	72	72	72	0.0%	5.7%	4.1%
Health & community srvc	85	87	89	91	93	0.4%	6.8%	5.3%
Cultural & recreational srvc	13	14	15	15	16	0.7%	1.1%	0.9%
Other primary	16	17	17	18	19	0.9%	1.3%	1.1%
Other secondary	54	58	60	62	64	0.8%	4.4%	3.6%
Other tertiary	461	492	501	513	528	0.7%	36.9%	30.0%
Total	1,247	1,466	1,541	1,637	1,761	1.7%	100.0%	100.0%

5.2.4 Compensation of Employees

Compensation of employees (CoE) consists of salaries and wages, whether in cash or kind, and in general all those allowances to employees that are taxable. It includes directors' fees, honoraria, jurors' fees, employers' contributions to superannuation, pension schemes, payments of Accident Compensation Corporation levies by employers, staff discounts and other fringe benefits provided by employers. The total CoE paid out in 2006 to all employees within the District is estimated to be \$₂₀₀₄544 million or 43.6 percent of GRP (Figure 5.4 and Table 5.3). In 2026 CoE payments are expected to rise by \$₂₀₀₄31 million to \$₂₀₀₄575 million; an annual average growth rate of 0.3 percent. CoE is a direct mirror of employment growth, but expressed in pecuniary (\$) rather than FTE terms.

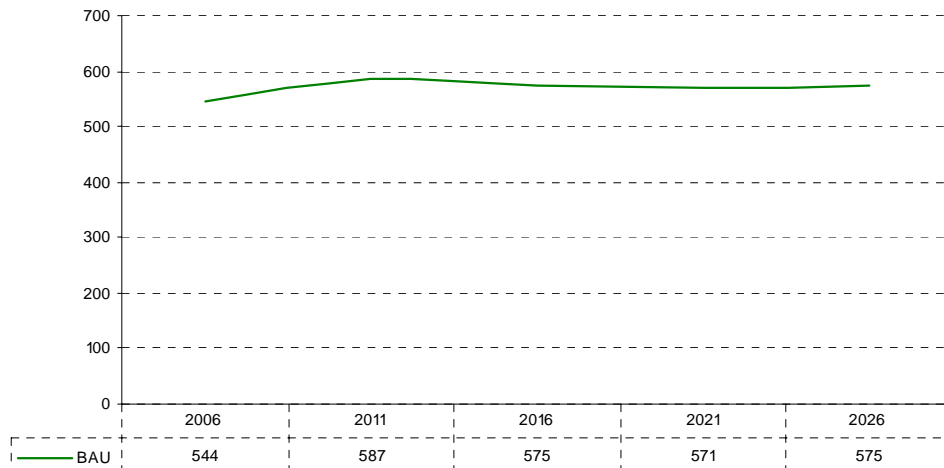


Figure 5.4 Gisborne District's Projected Compensation of Employees under the BAU Scenario, 2006-2026

Table 5.3 Gisborne District's Projected Compensation of Employees under the BAU Scenario, 2006-2026

Industry	Compensation of Employees (\$ million)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	18	19	20	20	21	0.7%	3.4%	3.7%
Livestock & cropping	18	16	13	11	9	-3.4%	3.4%	1.6%
Services to agriculture	14	17	16	16	17	1.0%	2.6%	2.9%
Forestry & logging	22	39	41	44	48	4.0%	4.0%	8.4%
Fishing	2	2	3	3	3	0.6%	0.4%	0.5%
Other food manuf	21	21	21	21	21	0.0%	3.9%	3.7%
Beverage etc manuf	17	18	20	22	24	1.8%	3.1%	4.2%
Wood product manuf	16	35	35	35	35	3.9%	3.0%	6.1%
Retail trade	42	44	43	43	43	0.1%	7.8%	7.5%
Accomm, restaurants & bars	14	15	15	16	17	0.8%	2.6%	2.9%
Road transport	11	17	18	19	20	3.0%	2.1%	3.6%
Education	60	55	49	44	39	-2.2%	11.1%	6.8%
Health & community svcs	65	60	55	51	47	-1.6%	12.0%	8.2%
Cultural & recreational svcs	7	8	8	8	8	0.5%	1.3%	1.4%
Other primary	2	3	3	4	5	3.5%	0.5%	0.8%
Other secondary	32	35	38	41	45	1.7%	5.9%	7.8%
Other tertiary	180	183	177	173	172	-0.2%	33.1%	30.0%
Total	544	587	575	571	575	0.3%	100.0%	100.0%

5.3 Impacts of the Economy on the Environment

A key feature of the GEEM is that it analyses not only the economic impacts associated with growth, but also the associated environmental effects; albeit these effects are currently limited to only a few selected natural resources and residuals (i.e. emissions, pollutants and wastes). The BAU scenario as presented establishes a baseline against which other scenarios may be compared and evaluated. A range of measures were used to describe future impacts of the economy on the environment under the BAU scenario. These are:

- Land use
- Delivered energy
- Energy related emissions
 - carbon dioxide (CO₂)
 - nitrous oxide (N₂O)
 - methane (CH₄)
- Solid waste

5.3.1 Land Use

It is estimated that approximately 745,000 hectares of land in the Gisborne District are currently (2006) used for economically productive purposes (Figure 5.5 and Table 5.4). It is important to note that all the land use estimates reported in this Section are expressed in 2006 hectare equivalents. Under the BAU scenario it is therefore possible that the land use requirements economy-wide may not equal actual available land area. In actuality this is infeasible (assuming the amount of productive land remains unchanged over time). If the projected land requirements are lower than the actual productive land area available then land conversions or land productivity gains must have occurred which result in less land requirements and *vice versa*. Other reasons for such changes include changes in land management practices, use of fertilisers, changes to stocking rates, land scarcity or retirement and so on. Under the BAU scenario land in productive use is estimated to marginally decline at an annual average rate of -0.02 percent to 741,000 hectares by 2026.

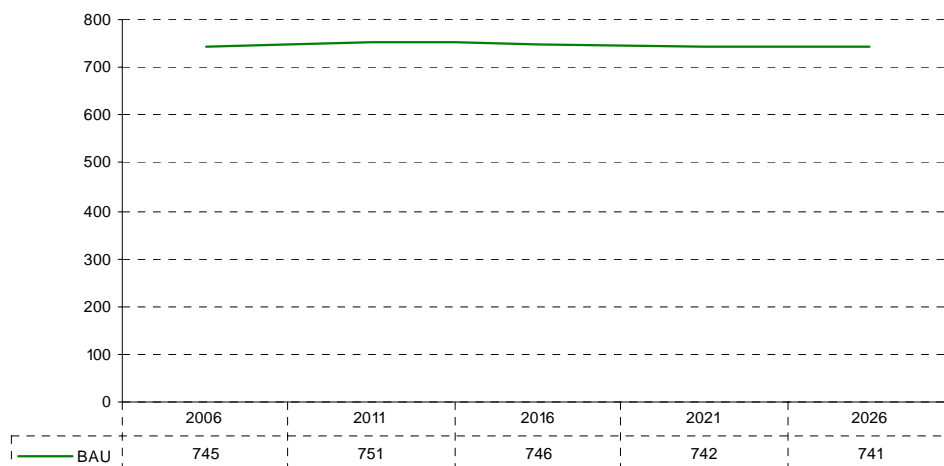


Figure 5.5 Gisborne District's Projected Land Use under the BAU Scenario, 2006-2026

Livestock and Cropping currently dominates productive land use in the Gisborne District (73.6 percent of the total productive land area) and will continue to do so through to 2026 (67.0 percent) under the BAU scenario. Nevertheless, conversion will occur between land used for Livestock and Cropping and Forestry and Logging. This is consistent with the sustainable hill country land management expectations. Other major land users include Forestry and Logging (27.5 percent in 2026), Other Primary (2.2 percent), Cultural and Recreational Services (1.9 percent) and Horticulture and Fruit Growing (0.8 percent).

Table 5.4 Gisborne District's Projected Land Use by Industry under the BAU Scenario, 2006-2026

Industry	Land Area (000s Hectares)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	5	5	5	6	6	1.1%	0.7%	0.8%
Livestock & cropping	548	542	526	511	497	-0.5%	73.6%	67.0%
Services to agriculture	0	0	0	0	0	2.2%	0.0%	0.0%
Forestry & logging	161	171	181	192	204	1.2%	21.6%	27.5%
Fishing	0	0	0	0	0	-0.5%	0.0%	0.0%
Other food manuf	0	0	0	0	0	0.0%	0.0%	0.0%
Beverage etc manuf	0	0	0	0	0	0.3%	0.0%	0.0%
Wood product manuf	0	0	0	0	0	3.5%	0.0%	0.0%
Retail trade	0	0	0	0	0	0.3%	0.0%	0.0%
Accomm, restaurants & bars	0	0	0	0	0	0.4%	0.0%	0.0%
Road transport	0	1	1	1	1	4.6%	0.0%	0.1%
Education	0	0	0	0	0	-0.5%	0.0%	0.0%
Health & community srvc	0	0	0	0	0	-0.1%	0.0%	0.0%
Cultural & recreational srvc	13	14	14	14	14	0.2%	1.8%	1.9%
Other primary	13	14	15	15	16	1.1%	1.8%	2.2%
Other secondary	0	0	0	0	0	0.3%	0.0%	0.0%
Other tertiary	1	1	1	1	1	0.0%	0.1%	0.1%
Households	3	3	3	3	2	-1.0%	0.4%	0.3%
Total	745	751	746	742	741	0.0%	100.0%	100.0%

5.3.2 Delivered Energy

In 2006, it is estimated that 4,873 terrajoules (TJ) of energy was consumed by the Gisborne District economy (Figure 5.6 and Table 5.5). Adopting the BAU Scenario to 2026, delivered energy is projected to increase by 44.3 percent to 7,034 TJ (an annual average increase of 1.9 percent).

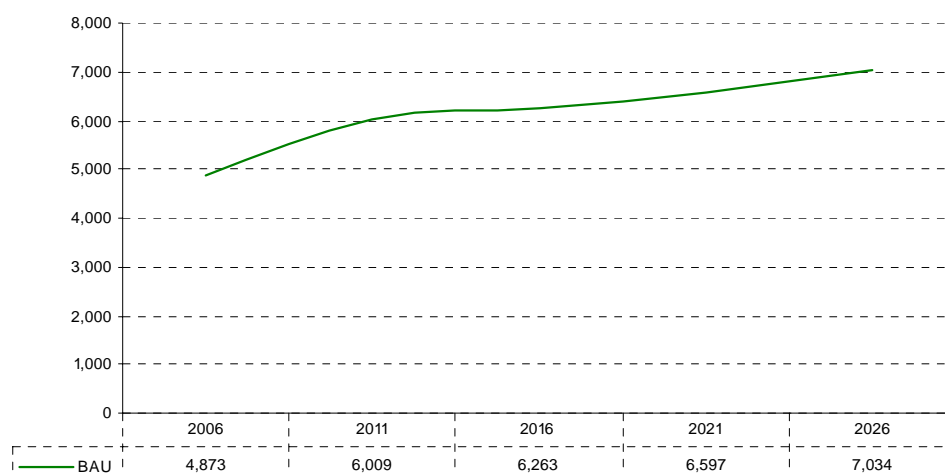


Figure 5.6 Gisborne District's Projected Total Delivered Energy Consumption under the BAU Scenario, 2006-2026

Under the BAU scenario Households will remain the largest consumer of energy in 2026, but with a significantly lower share (26.0 percent of all delivered energy in 2026 down from 38.9 percent in 2006). In actual consumption terms, household delivered energy consumption will decline by only 3.4 percent over the entire study – representing an annual average decline of only 0.2 percent. The substantial drop in total share is more an artefact of change in other industries contributions, namely large increases in Forestry and Logging, Wood Product Manufacturing and Road Transport. Road Transport will be the second largest consumer of energy in 2026 (22.4 percent). Growth in energy consumption to 2026 will be highest in Forestry and Logging (6.4 percent annual average growth to 2026), Road Transport (5.1 percent) and Wood Product Manufacturing (4.0 percent).

Table 5.5 Gisborne District's Projected Total Delivered Energy Consumption by Industry under the BAU Scenario, 2006-2026

Industry	Delivered Energy (Terrajoules)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	100	112	122	134	147	1.9%	2.1%	2.1%
Livestock & cropping	143	151	155	161	167	0.8%	2.9%	2.4%
Services to agriculture	93	123	135	150	170	3.0%	1.9%	2.4%
Forestry & logging	161	321	379	457	563	6.4%	3.3%	8.0%
Fishing	140	140	140	140	140	0.0%	2.9%	2.0%
Other food manuf	197	203	209	214	220	0.5%	4.0%	3.1%
Beverage etc manuf	25	26	27	28	29	0.8%	0.5%	0.4%
Wood product manuf	382	818	822	827	833	4.0%	7.8%	11.8%
Retail trade	164	180	186	194	205	1.1%	3.4%	2.9%
Accomm, restaurants & bars	80	84	89	95	101	1.2%	1.6%	1.4%
Road transport	582	988	1,130	1,320	1,576	5.1%	11.9%	22.4%
Education	42	43	43	43	43	0.0%	0.9%	0.6%
Health & community srvc	62	64	65	66	68	0.4%	1.3%	1.0%
Cultural & recreational srvc	7	7	8	8	8	0.7%	0.1%	0.1%
Other primary	56	59	61	63	65	0.8%	1.1%	0.9%
Other secondary	349	374	384	395	408	0.8%	7.2%	5.8%
Other tertiary	392	424	432	444	460	0.8%	8.0%	6.5%
Households	1,896	1,891	1,876	1,858	1,831	-0.2%	38.9%	26.0%
Total	4,873	6,009	6,263	6,597	7,034	1.9%	100.0%	100.0%

For the purposes of reporting, fuels have been categorised as either fossil fuels, electricity, and wood. A further breakdown of delivered energy fuel types (fossil fuels in particular) is available within the results produced by the GEEM, including Petrol, Diesel, Fuel Oil and Aviation Fuel.

Figure 5.7 depicts delivered energy requirements by fuel type under the BAU scenario. Clearly, energy consumed as a result of fossil fuel consumption comprises the highest share (in the range of 71-73 percent over the period) of total delivered energy. Electricity requirements account for 17-19 percent of delivered energy and wood 8-11 percent.

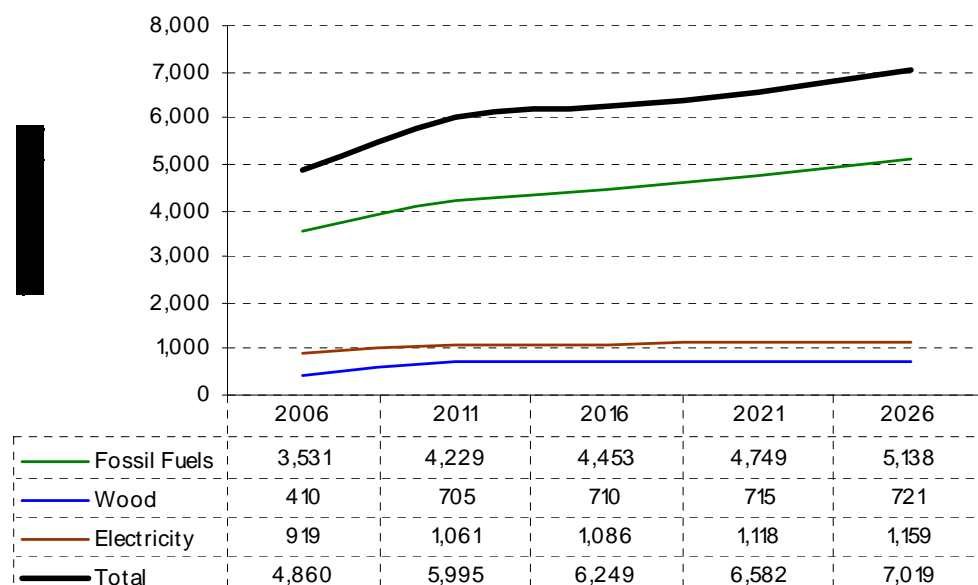


Figure 5.7 Gisborne District's Projected Delivered Energy Consumption by Fuel Type under the BAU Scenario, 2006-2026

Figures 5.8 to 5.10 show the projected growth of delivered energy by fossil fuels, electricity and wood the BAU scenario.

It is estimated that 3,531 TJ of energy are currently (2006) consumed as a result of **fossil fuel** use. The BAU scenario estimates this to rise to 5,138 TJ in 2026 at an annual average growth rate of 1.89 percent. **Electricity** under the BAU scenario is projected to grow at an average annual rate of 1.17 percent to 1,159 TJ in 2026. Energy consumed as a result of **wood** use is currently estimated at 410 TJ. This is expected to increase substantially between 2006 and 2011 as a result of growth in Forestry and Logging and Wood Product Manufacturing, after which an almost zero growth path is expected to prevail. Over the entire study period growth in wood consumption equates to an annual average of 2.86 percent.

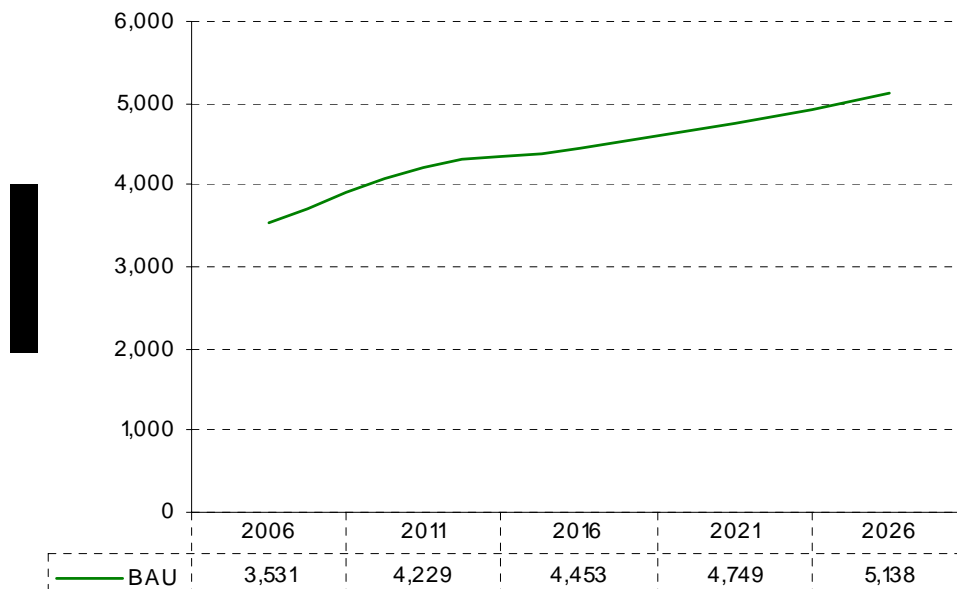


Figure 5.8 Gisborne District's Projected Fossil Fuel Consumption under the BAU Scenario, 2006 – 2026

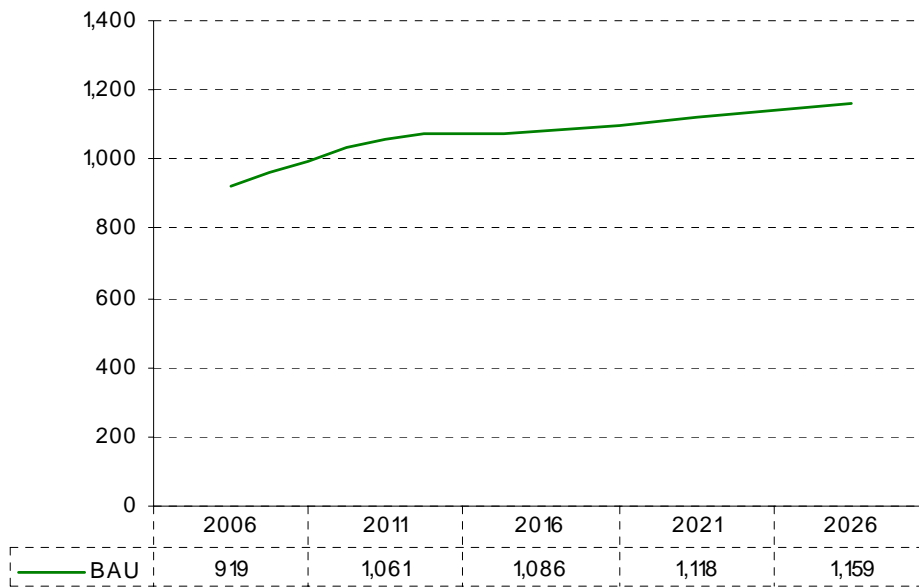


Figure 5.9 Gisborne District's Projected Electricity Consumption under the BAU Scenario, 2006 - 2026

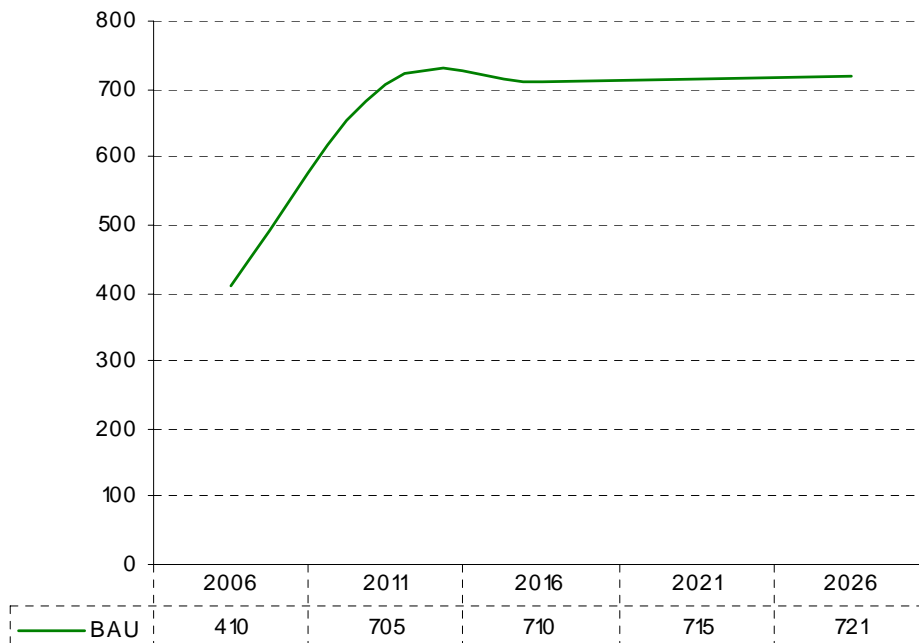


Figure 5.10 Gisborne District's Projected Wood Consumption under the BAU Scenario, 2006 - 2026

5.3.3 Energy Related Air Emissions

This section considers the future of energy related air emissions under the BAU scenario. Specifically, this includes:

- Carbon dioxide (CO₂)
- Nitrous oxide (N₂O)
- Methane (CH₄)

Carbon dioxide (CO₂)

It is estimated that 336,000 tonnes of CO₂ is currently (2006) emitted as a result of energy consumption in the Gisborne District. Under the BAU scenario a total increase in CO₂ emissions of 48.5 percent to 499,400 tonnes is projected (Figure 5.11 and Table 5.6).

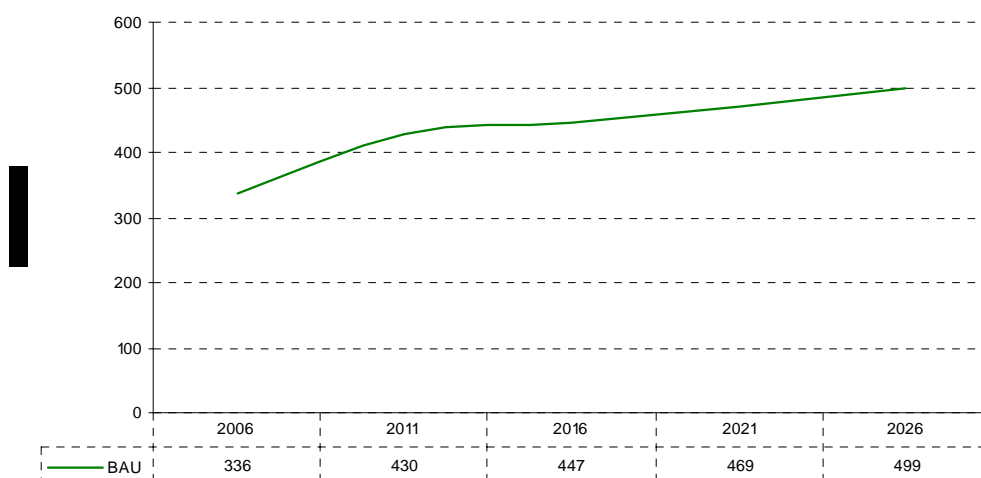


Figure 5.11 Gisborne District's Projected Carbon Dioxide Emissions under the BAU Scenario, 2006 – 2026

Households are currently the largest contributors to CO₂ emissions (37.2 percent of all CO₂ emissions in 2006), and will remain the largest out to 2026 (24.2 percent), but will hold a lesser share of the district-wide total under the BAU scenario for reasons previously alluded to. Wood Product Manufacturing will move up one rank to the second largest contributor, 17.8 percent, by 2026. Road transport will also make a sizeable contribution by 2026 at 21.5 percent, up from 11.8 percent in 2006. Forestry and Logging (6.4 percent), Wood Product Manufacturing (4.0 percent), and Road Transport (5.1 percent) will also experience the greatest annual average growth in emissions of CO₂ over the study period under the BAU scenario.

Table 5.6 Gisborne District's Projected Energy Related Carbon Dioxide Emissions by Industry under the BAU Scenario, 2006-2026

Industry	CO2 Emmissions (000s tonnes)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	7	8	8	9	10	1.9%	2.0%	2.0%
Livestock & cropping	10	10	11	11	11	0.8%	2.9%	2.3%
Services to agriculture	6	8	9	10	11	3.0%	1.8%	2.3%
Forestry & logging	11	21	25	30	37	6.4%	3.1%	7.4%
Fishing	10	10	10	10	10	0.0%	2.9%	1.9%
Other food manuf	11	11	12	12	12	0.5%	3.2%	2.4%
Beverage etc manuf	1	1	2	2	2	0.8%	0.4%	0.3%
Wood product manuf	41	87	88	88	89	4.0%	12.1%	17.8%
Retail trade	10	11	11	12	12	1.1%	2.9%	2.4%
Accomm, restaurants & bars	4	5	5	5	6	1.2%	1.3%	1.1%
Road transport	40	67	77	90	107	5.1%	11.8%	21.5%
Education	2	2	2	2	2	0.0%	0.7%	0.5%
Health & community srvc	3	4	4	4	4	0.4%	1.0%	0.8%
Cultural & recreational srvc	0	0	0	0	0	0.7%	0.1%	0.1%
Other primary	4	4	4	4	4	0.8%	1.1%	0.9%
Other secondary	26	28	28	29	30	0.8%	7.7%	6.0%
Other tertiary	26	28	28	29	30	0.8%	7.6%	6.0%
Households	125	125	124	123	121	-0.2%	37.2%	24.2%
Total	336	430	447	469	499	2.0%	100.0%	100.0%

Nitrous oxide (N₂O)

In 2006, it is estimated that approximately 28,500 tonnes of nitrous oxide (N₂O) was emitted as a result of energy consumption in the Gisborne District (Figure 5.12 and Table 5.7). An annual average increase of 1.9 percent is expected under the BAU scenario resulting in total emissions of approximately 41,500 tonnes in 2026.

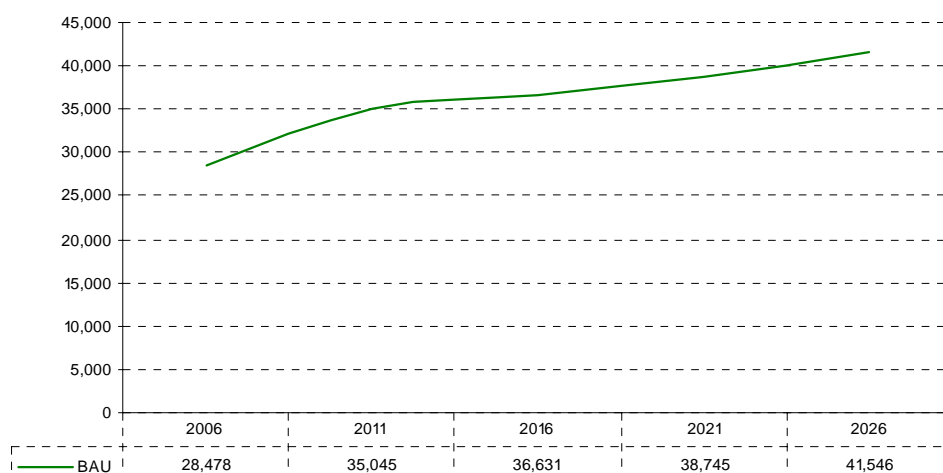


Figure 5.12 Gisborne District's Projected Energy Related Nitrous Oxide Emissions under the BAU Scenario, 2006 – 2026

As is the case with CO₂ emissions, households are currently the largest contributors of N₂O emissions (38.0 percent of all emissions in 2006) and this will remain the case through to 2026 (25.2 percent), although for reasons already alluded to their share of the district-wide total will decline significantly. Road Transport will be the second largest emitter of N₂O emissions (25.6 percent) by 2026.

Forestry and Logging (6.4 percent), Road Transport (5.1 percent), Wood Product Manufacturing (4.0 percent) and Services to Agriculture (3.0 percent) will experience the greatest annual average growth in emissions of N₂O over the 2006 to 2026 period. This outcome is similar to delivered energy and CO₂ emissions and reflective of the substantial growth in Forestry and Logging economic activity. Over the same

period, Household emissions are projected to decline slightly by an average annual growth rate of 0.2 percent.

Table 5.7 Gisborne District's Energy Related Nitrous Oxide Emissions by Industry under the BAU Scenario, 2006-2026

Industry	N2O Emmissions (tonnes)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	670	750	817	890	980	1.9%	2.4%	2.4%
Livestock & cropping	960	1,010	1,039	1,080	1,120	0.8%	3.4%	2.7%
Services to agriculture	610	800	876	980	1,110	3.0%	2.1%	2.7%
Forestry & logging	1,010	2,010	2,371	2,860	3,520	6.4%	3.5%	8.5%
Fishing	1,400	1,400	1,397	1,400	1,400	0.0%	4.9%	3.4%
Other food manuf	690	710	730	750	770	0.6%	2.4%	1.9%
Beverage etc manuf	90	100	102	110	110	1.0%	0.3%	0.3%
Wood product manuf	1,810	3,870	3,887	3,910	3,940	4.0%	6.4%	9.5%
Retail trade	780	850	886	920	970	1.1%	2.7%	2.3%
Accomm, restaurants & bars	310	330	352	370	400	1.3%	1.1%	1.0%
Road transport	3,930	6,680	7,642	8,930	10,650	5.1%	13.8%	25.6%
Education	180	190	186	190	180	0.0%	0.6%	0.4%
Health & community srvc	250	260	264	270	280	0.6%	0.9%	0.7%
Cultural & recreational srvc	40	40	38	40	40	0.0%	0.1%	0.1%
Other primary	420	450	459	470	490	0.8%	1.5%	1.2%
Other secondary	1,720	1,840	1,883	1,940	2,000	0.8%	6.0%	4.8%
Other tertiary	2,770	2,960	2,986	3,040	3,120	0.6%	9.7%	7.5%
Households	10,830	10,800	10,715	10,610	10,460	-0.2%	38.0%	25.2%
Total	28,470	35,050	36,631	38,760	41,540	1.9%	100.0%	100.0%

Methane (CH₄)

It is estimated that approximately 109,000 tonnes of methane (CH₄) are currently (2006) emitted as a result of energy consumption in the Gisborne District. The BAU scenario projects a total increase in CH₄ emissions of around 29.4 percent to 141,000 tonnes (Figure 5.13 and Table 5.8).

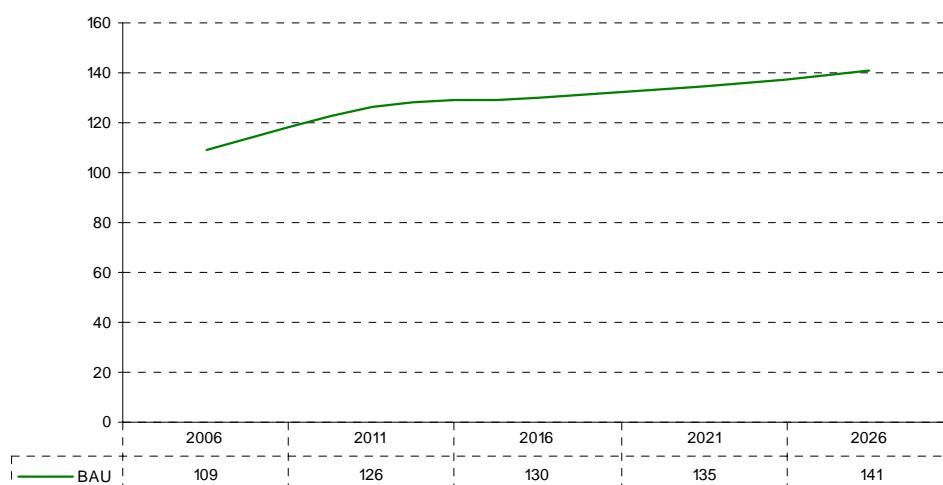


Figure 5.13 Gisborne District's Projected Energy Related Methane Emissions under the BAU Scenario, 2006 – 2026

Like the other emission types considered, households are the greatest producers of energy related CH₄ emissions and will remain so through to 2026 (40.8 percent of all CH₄ emissions in 2026). Road Transport will be the second largest contributor in 2026, but at less than a third of the emissions by households (10.9 percent, approximately 21,000 tonnes).

Table 5.8 Gisborne District's Projected Energy Related Methane Emissions by Industry under the BAU Scenario, 2006-2026

Industry	CH4 Emmissions (000s tonnes)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	2	2	2	2	2	1.9%	1.4%	1.6%
Livestock & cropping	2	2	2	2	3	0.8%	2.0%	1.8%
Services to agriculture	1	2	2	2	3	3.0%	1.3%	1.9%
Forestry & logging	3	5	6	7	9	6.4%	2.4%	6.5%
Fishing	1	1	1	1	1	0.0%	1.1%	0.8%
Other food manuf	5	5	5	5	5	0.5%	4.4%	3.8%
Beverage etc manuf	1	1	1	1	1	0.8%	0.5%	0.5%
Wood product manuf	6	14	14	14	14	4.0%	5.8%	9.8%
Retail trade	4	4	4	5	5	1.1%	3.6%	3.5%
Accomm, restaurants & bars	2	2	2	2	2	1.2%	1.7%	1.6%
Road transport	8	13	15	17	21	5.1%	7.0%	14.7%
Education	1	1	1	1	1	0.0%	0.9%	0.7%
Health & community svcs	1	1	2	2	2	0.4%	1.3%	1.1%
Cultural & recreational svcs	0	0	0	0	0	0.7%	0.1%	0.1%
Other primary	1	1	1	1	1	0.8%	0.7%	0.6%
Other secondary	6	7	7	7	8	0.8%	5.9%	5.3%
Other tertiary	6	6	6	7	7	0.8%	5.3%	4.8%
Households	60	59	59	58	58	-0.2%	54.6%	40.8%
Total	109	126	130	135	141	1.3%	100.0%	100.0%

5.3.4 Solid Waste

Solid waste (covering both landfills and cleanfills) is the final measure of environmental impacts of economic change under the BAU scenario. It is estimated that the Gisborne District economy currently (2006) produces 58,410 tonnes of solid waste. Under the BAU scenario solid waste is projected to increase only marginally by 310 tonnes to 62,970 tonnes (Figure 5.14 and Table 5.9).

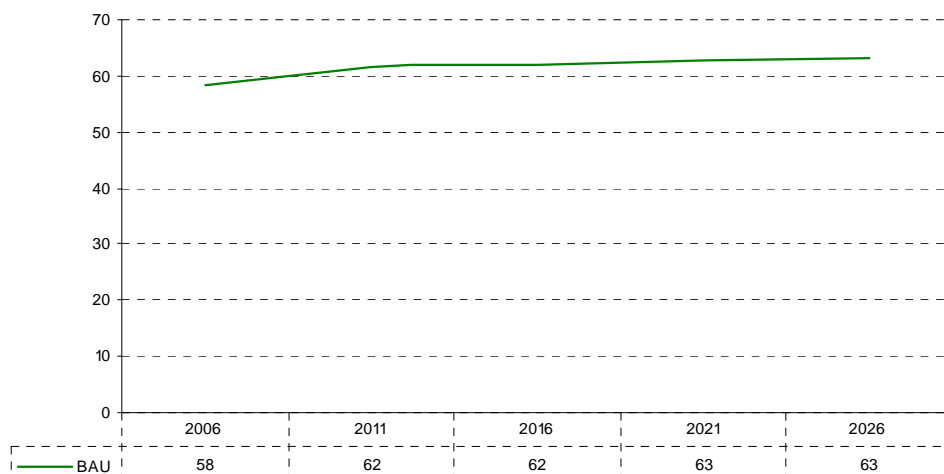


Figure 5.14 Gisborne District's Projected Solid Waste under the BAU Scenario, 2006 – 2026

Other Services (which includes Construction) is clearly the most significant producer of solid waste and under BAU scenario, and this is expected to remain the case through to 2026 (60.5 percent of all solid waste production in 2026) (Table 5.8). Households contribute the second largest share – just over 14.7 percent of the district-wide total in 2026. The Other Secondary and Wood Product Manufacturing industries are the only other industries producing more than 6 percent of the solid waste total (14.7 and 6.2 percent respectively in 2026).

Growth in output of solid waste between 2006 and 2026 is projected to occur fastest in Wood Product Manufacturing (4.0 percent annual average growth), while all remaining industries show only marginal (<1.0 percent) changes.

Table 5.9 Gisborne District's Projected Solid Waste by Industry under the BAU Scenario, 2006-2026

Industry	Solid Waste (tonnes)					Ann. Av. Growth	Share	
	2006	2011	2016	2021	2026		2006	2026
Hort. & fruit growing	10	10	10	0	20	3.5%	0.0%	0.0%
Livestock & cropping	10	10	10	0	20	3.5%	0.0%	0.0%
Services to agriculture	0	0	0	0	10	0.0%	0.0%	0.0%
Forestry & logging	0	0	0	0	0	0.0%	0.0%	0.0%
Fishing	0	0	0	0	0	0.0%	0.0%	0.0%
Other food manuf	1,170	1,210	1,240	1,300	1,310	0.6%	2.0%	2.1%
Beverage etc manuf	540	560	580	600	630	0.8%	0.9%	1.0%
Wood product manuf	1,930	4,120	4,140	4,200	4,200	4.0%	3.3%	6.7%
Retail trade	120	130	130	100	150	1.1%	0.2%	0.2%
Accomm, restaurants & bars	110	120	130	100	140	1.2%	0.2%	0.2%
Road transport	0	0	0	0	0	0.0%	0.0%	0.0%
Education	0	0	0	0	0	0.0%	0.0%	0.0%
Health & community svcs	10	10	10	0	10	0.0%	0.0%	0.0%
Cultural & recreational svcs	0	0	0	0	0	0.0%	0.0%	0.0%
Other primary	30	30	30	0	30	0.0%	0.1%	0.0%
Other secondary	7,830	8,270	8,570	8,900	9,230	0.8%	13.4%	14.7%
Other tertiary	37,220	37,810	37,930	38,000	38,110	0.1%	63.7%	60.5%
Households	9,430	9,400	9,330	9,200	9,110	-0.2%	16.1%	14.5%
Total	58,410	61,680	62,110	62,400	62,970	0.4%	100.0%	100.0%

Figure 5.15 shows the relative contributions over time of Gisborne District's projected landfill and cleanfill waste. Cleanfill represents the highest share of solid waste at 58.7 percent in 2026.

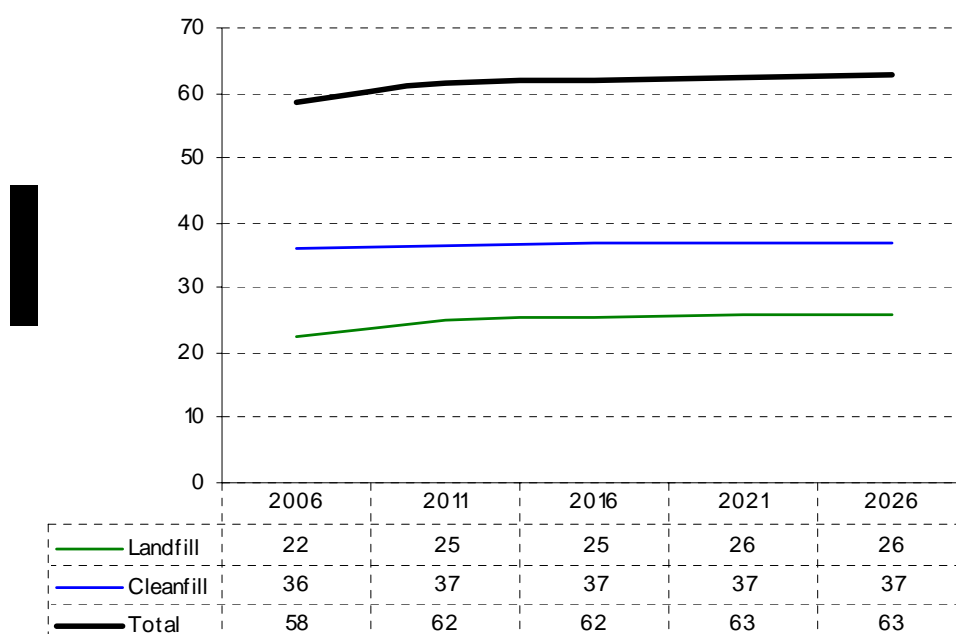


Figure 5.15 Gisborne District's Solid Waste by Type under the BAU Scenario, 2006 – 2026

Figures 5.16 and 5.17 show respectively the expected growth of landfill and cleanfill waste output under the BAU scenario. It is estimated that the Gisborne District economy currently outputs 22,000 tonnes of landfill waste. Under the BAU scenario the increase in landfill waste is expected to be small, reaching 26,000 tonnes in 2026. A near no growth outcome is similarly projected to prevail for cleanfill waste.

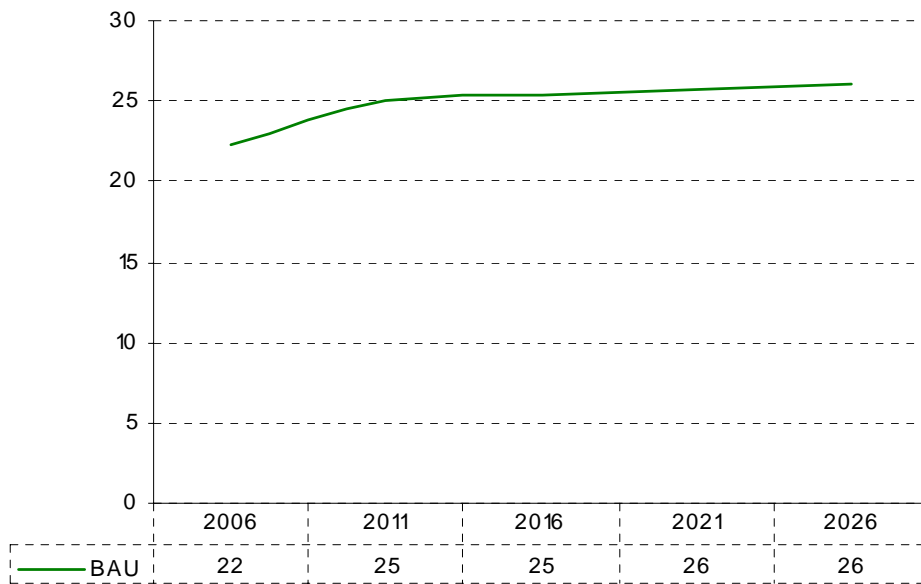


Figure 5.16 Gisborne District's Projected Landfill Solid Waste under the BAU Scenario, 2006-2026

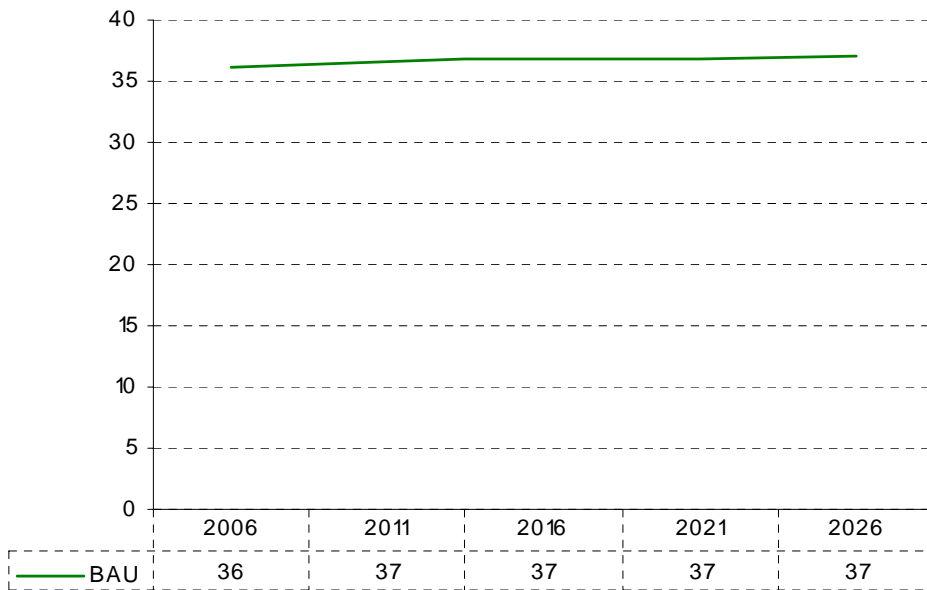


Figure 5.17 Gisborne District's Projected Cleanfill Solid Waste under the BAU Scenario, 2006-2026

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Persons Interviewed

APPENDIX A INPUT-OUTPUT TABLE DEFINITIONS

Table A.1 Concordance Relating ANZSIC Codes to the 48 Input-Output Industries

48 Industry Name	Corresponding 6-Digit ANZSIC Code
1 Horticulture and fruit growing	A011100-A011990
2 Livestock and cropping farming	A012100-A012500, A015910
3 Dairy cattle farming	A013000
4 Other farming	A014100-A015300, A015930-A016990
5 Services to agriculture, hunting and trapping	A021200-A022000
6 Forestry and logging	A030100-A030300
7 Fishing	A041100-A042000
8 Mining and quarrying	B110100-B110200, B131100-B142000, B151400-B152000
9 Oil and gas exploration and extraction	B120000, B151100-B151200
10 Meat and meat product manufacturing	C211100-C211300
11 Dairy product manufacturing	C212100-C212900
12 Other food manufacturing	C213000-C217900
13 Beverage, malt and tobacco manufacturing	C218100-C219000
14 Textile and apparel manufacturing	C221100-C226200
15 Wood product manufacturing	C231100-C232900
16 Paper and paper product manufacturing	C233100-C233900
17 Printing, publishing and recorded media	C241100-C243000
18 Petroleum and industrial chemical manufacturing	C251000-C253500
19 Rubber, plastic and other chemical product manufacturing	C254100-C256600
20 Non-metallic mineral product manufacturing	C261000-C264000
21 Basic metal manufacturing	C271100-C273300
22 Structural, sheet, and fabricated metal product manufacturing	C274100-C276900
23 Transport equipment manufacturing	C281100-C282900
24 Machinery and equipment manufacturing	C283100-C286900
25 Furniture and other manufacturing	C291100-C294900
26 Electricity generation and supply	D361000
27 Gas supply	D362000
28 Water supply	D370100
29 Construction	E411100-E425900
30 Wholesale trade	F451100-F479900
31 Retail trade	G511010-G532900
32 Accommodation, restaurants and bars	H571010-H574000
33 Road transport	I611000-I612300, I661100-I661900
34 Water and rail transport	I620000-I630300, I662100-I662900
35 Air transport, services to transport and storage	I640100-I650900, I663000-I670900
36 Communication services	J711100-J712000
37 Finance	K731000-K734000
38 Insurance	K741100-K742200
39 Services to finance and investment	K751100-K752000
40 Real estate	L771110-L772000
41 Ownership of owner-occupied dwellings	N/A
42 Business services	L773010-L786900
43 Central government administration, defence, public order and safety services	M811100, M812000-M820000, Q963100-Q963300
44 Local government administration services and civil defence	M811300
45 Education	N841000-N844000
46 Health and community services	O861100-O872900
47 Cultural and recreational services	P911100-P933000
48 Personal and other community services	D370200, Q951100-Q962900, Q963400-Q970000