

Bay of Plenty economic scenarios

Exploring alternative Futures

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Background

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Executive Summary

Scenarios are stories that consider “what if?” questions. Whereas forecasts focus on probabilities, scenarios consider a range of plausible futures and how these could emerge from the realities of today.

The scenario analysis in this report builds a picture of alternative futures for the Bay of Plenty region, and its constituent economies. We combine historic information on the Region’s strengths and economic growth patterns with national and global growth factors to project what employment and GDP could be like under various growth trajectories. These growth paths were informed by workshops with the collective councils’ Mayors/Chairs and Senior Officials Group.

The three scenarios that BERL has modelled were:

Scenario 1: Business as Usual. Scenario one is “Business as Usual” and the majority of the assumptions were based on well recognised data and forecasting sets.

Scenario 2: Strategy stretch - realising the Bay of Connections Strategy. Scenario two is based on the sector growth strategies as identified through the Bay of Connections growth strategy.

Scenario 3: Reality check. – taking into consideration international and national externalities Scenario three is based on exogenous factors that will have an influence on the economic growth potential of the region.

The results from the three scenarios show that

- Scenario 1: Employment will grow steadily under the BAU scenario, with the key sectors seeing 480 jobs per annum added to the job market and other industries seeing an increase of 1,330 jobs per annum. GDP will grow steadily under the BAU scenario, with the key sectors adding \$150 million per annum to the economy and the other industries adding a further \$260 million per annum.
- Scenario 2: Employment in the key sectors will see a significant increase per annum, assuming that the strategies have been successfully implemented. Under this scenario the key sectors will see growth of 1,010 jobs per annum, more than double the amount under Scenario 1. GDP in the key sectors will see a significant increase per annum, assuming that the strategies have been successfully implemented. Under this scenario the key sectors will add a \$380 million per annum, more than double the amount under Scenario 1.
- Scenario 3: Employment for the key sectors will see a slightly higher than Scenario 1 increases to 750 per annum and the other industries will see 1,840 jobs added per annum. GDP for the key sectors will see a slightly lower than Scenario 2 increases to \$310 million per annum and the other industries will add \$330 million per annum.

Contents

Executive Summary	1
1 Introduction	4
1.1 What are scenarios	4
1.2 Why are scenarios useful?	4
2 Methodology.....	5
2.1 Three scenarios modelled.....	5
2.2 The BERL New Zealand economy model (CGE)	5
3 Overview of Scenario results	7
4 Scenario One: Business as Usual (BAU).....	10
4.1 Assumptions.....	10
4.2 Results	12
5 Scenario Two: Strategy stretch	13
5.1 Assumptions.....	13
5.2 Results	14
6 Scenario Three: Reality check	15
6.1 Assumptions.....	15
6.2 Results	16
7 Sub-regional impact	17
7.1 People	17
7.2 Jobs.....	19
7.3 Sub-regional implications for other key sectors	23
7.4 Sub-regional implications for other non-key sectors.....	23
8 Looking forward and Limitations	25
8.1 Right time	25
8.2 Right place	25
8.3 Right numbers.....	25
Appendix A The BERL CGE model and what it does	27

Tables

Table 1 Summary of projected employment growth by scenario, 2012-2022	7
Table 2 Summary of projected employment GDP by scenario, 2012-2022	8
Table 3 Macro summary for BAU projections, New Zealand, 2012-2022	11
Table 4: Business-as-usual projected scenario employment growth, 2012-2022	12
Table 5: Business-as-usual scenario projected GDP growth, 2012-2022	12
Table 6 Strategy stretch scenario projected employment growth, 2012-2022	14
Table 7 Strategy stretch scenario projected GDP growth, 2012-2022	14
Table 8 Reality check scenario projected employment growth, 2012-2022	16
Table 9 Reality check projected GDP growth, 2012-2022	16

Figures

Figure 1 Key sector employment (FTEs) by scenario 2012-2022	7
Figure 2 Key sector GDP (2012 \$mn) by scenario 2012-2022	9
Figure 3: Population and employment growth, 2012-2022, by TA	17
Figure 4: Employment growth in Aquaculture sector	20
Figure 5: Employment growth in Marine sector	20
Figure 6: Employment growth in the Forestry sector	21
Figure 7: Employment growth in Energy sector	22
Figure 8: Employment growth in non-key ('other') sectors	23

1 Introduction

This report has been completed for the Bay of Plenty Regional Council in support of its on-going work on preparing for the development of a spatial plan for the region. The purpose of this report is to provide various alternative future scenarios to inform the debate based on the BERL situational analysis for the Bay of Plenty Regional Council.

1.1 What are scenarios

Scenarios are stories that consider “what if?” questions. Whereas forecasts focus on probabilities, scenarios consider a range of plausible futures and how these could emerge from the realities of today. They incorporate different perspectives and views to support various avenues of reality for the future. Looking at the next ten years there will be many factors that will influence the economy of the Bay of Plenty. Scenarios will be a useful tool to explore the various alternatives that might emerge.

1.2 Why are scenarios useful?

The scenarios will be additional tools for helping the Bay of Plenty decision makers to plan for the future—or rather for different possible futures. They will help to focus on critical uncertainties: the things we don't know about that might transform the regional economy, and the things we do know about that might involve issues that cannot be forecasted precisely. They will help with understanding the limitations of our 'mental maps' of the region—and to think the unthinkable, anticipate the unknowable, and utilise both to make better strategic decisions.

Scenarios are alternative stories of how the world may develop. They are not predictions, but credible, relevant, and challenging alternative stories that help us explore 'what if' and 'how'. Their purpose is not to pinpoint future events, but to consider the forces that may push the future along different paths. They will help the Bay of Plenty decision makers and managers to understand the dynamics of the regional economy, business environment, recognise new possibilities, assess strategic options, and take long-term decisions. The three scenarios will enable the Bay of Plenty decision makers to determine the impact of various strategies on employment and GDP.

2 Methodology

Based on the situational analysis undertaken earlier, we developed future growth scenarios. The scenarios explore possible economic growth patterns and feasible future pathways. The scenarios draw on BERL's CGE model, which can identify economic outcomes based on changes in factors of production and other relevant shocks. These scenario outcomes will reflect the impact on employment and GDP.

2.1 Three scenarios modelled

The scenario analysis builds a picture of alternative futures for the Bay of Plenty region, and its constituent economies. We combine historic information on the Region's strengths and economic growth patterns with national and global growth factors to project what employment and GDP could be like under various growth trajectories. These growth paths were informed by workshops with the collective councils' Mayors/Chairs and Senior Officials Group.

The scenarios detail employment and output in the BOC strategy's 13 key sectors, plus the remainder of the economy, over a 10-year horizon to 2022.

Taking 2022 as an end point, we modelled three outcomes using the BERL Computable General Equilibrium (CGE) model. The modelled outcomes illustrate the potential benefits or opportunity costs of various endogenous as well as exogenous factors on the Bay of Plenty economy.

Each scenario has a different set of assumptions to develop and test various alternative futures for the region.

Scenario 1: Business as Usual

Scenario one is "Business as Usual" and the majority of the assumptions were based on well recognised data and forecasting sets.

Scenario 2: Strategy stretch - realising the Bay of Connections Strategy

Scenario two is based on the sector growth strategies as identified through the Bay of Connections growth strategy.

Scenario 3: Reality check

Scenario three is based on exogenous indicators that will have an influence on the economic growth potential of the region.

2.2 The BERL New Zealand economy model (CGE)

BERL's Computable General Equilibrium (CGE) model is a representation of the New Zealand economy. It quantifies the inputs, outputs and value created by the set of industries that make it up.

The CGE model can be used to project what the New Zealand economy will 'look' like at a particular time in the future. The model estimates the direct and flow-on changes in major economic variables (e.g. GDP or employment) according to an expected growth trajectory (e.g. business-as-usual). The model can also be used to conduct 'experiments' to project the state of the economy under an alternative growth trajectory where there has been a 'shock' to the economy, for example increased productivity in a particular industry (or a group of industries).



We began from 2012 to anchor the baseline to the most recently available industry and macroeconomic data. The BAU scenario includes both short-term (2012 to 2017) and medium-term (2017 to 2022) forecasts to indicate how we expect the national economy to grow out over the next decade. We used the national CGE model projection and our knowledge of the Bay of Plenty Region's economy to generate a baseline and growth projection for the Bay's economy. The next task was to specify the two alternative growth scenarios: 'strategy stretch' and 'reality check'.

3 Overview of Scenario results

Table 1 summarises the top-level projections of employment growth in each of the three scenarios. It shows the 2012 base (common across all scenarios) and the alternative futures in the key sectors, other sectors, and the Regional economy overall. Figure 1 focuses on the key sectors and represents the projected employment growth, by scenario, between 2012 and 2022.

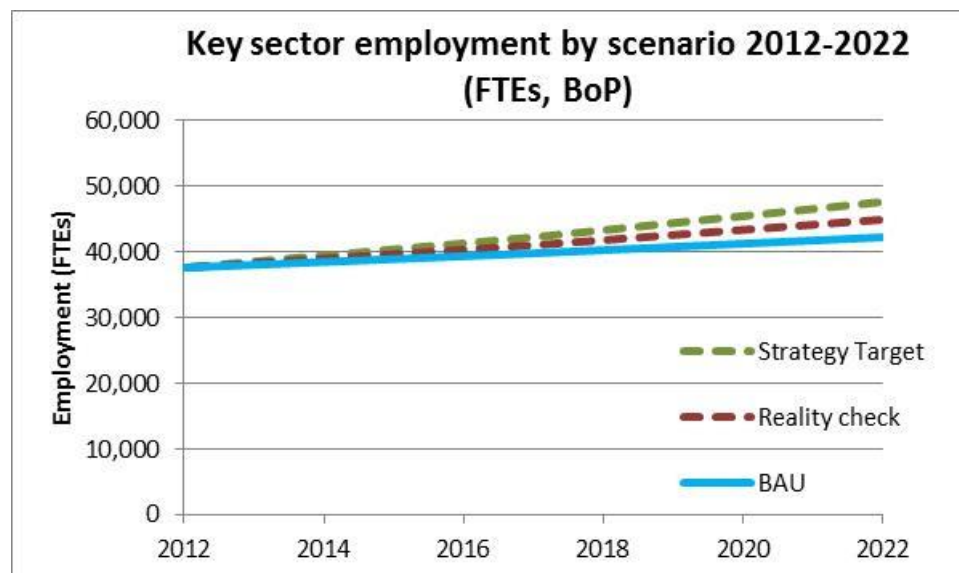
Table 1 Summary of projected employment growth by scenario, 2012-2022

FTEs	2012	2022	difference	%p.a.	FTEs p.a.
BAU (scenario 1)					
Key sectors	37,500	42,300	4,800	1.2	480
Other industries	84,300	97,600	13,300	1.5	1,330
Total (all industries)	121,800	139,900	18,100	1.4	1,810
Strategy stretch (scenario 2)					
Key sectors	37,500	47,600	10,100	2.4	1,010
Other industries	84,300	106,000	21,700	2.3	2,170
Total (all industries)	121,800	153,600	31,800	2.3	3,180
Reality check (scenario 3)					
Key sectors	37,500	45,000	7,500	1.8	750
Other industries	84,300	102,700	18,400	2.0	1,840
Total (all industries)	121,800	147,600	25,800	1.9	2,580

*Note: sub-totals rounded to the nearest hundred.

Source: BERL Regional Database 2012 and CGE Projection to 2022

Figure 1 Key sector employment (FTEs) by scenario 2012-2022



In summary:

- Scenario 1: Employment will grow steadily under the BAU scenario, with the key sectors seeing 480 jobs per annum added to the job market and other industries will see an increase of 1,330 jobs per annum.
- Scenario 2: Employment in the key sectors will see a significant increase per annum, assuming that the strategies have been successfully implemented. Under this scenario the key sectors will see growth of 1,010 jobs per annum, more than double the amount under Scenario 1.
- Scenario 3: Employment for the key sectors will see a slightly higher than Scenario 1 increases to 750 per annum and the other industries will see 1,840 jobs added per annum.

Table 2 summarises the growth in GDP in each of the three scenarios for the Bay of Plenty economy. It shows the 2012 base (common across all scenarios) and the alternative futures in the key sectors, other sectors, and the Regional economy overall.

Table 2 Summary of projected employment GDP by scenario, 2012-2022

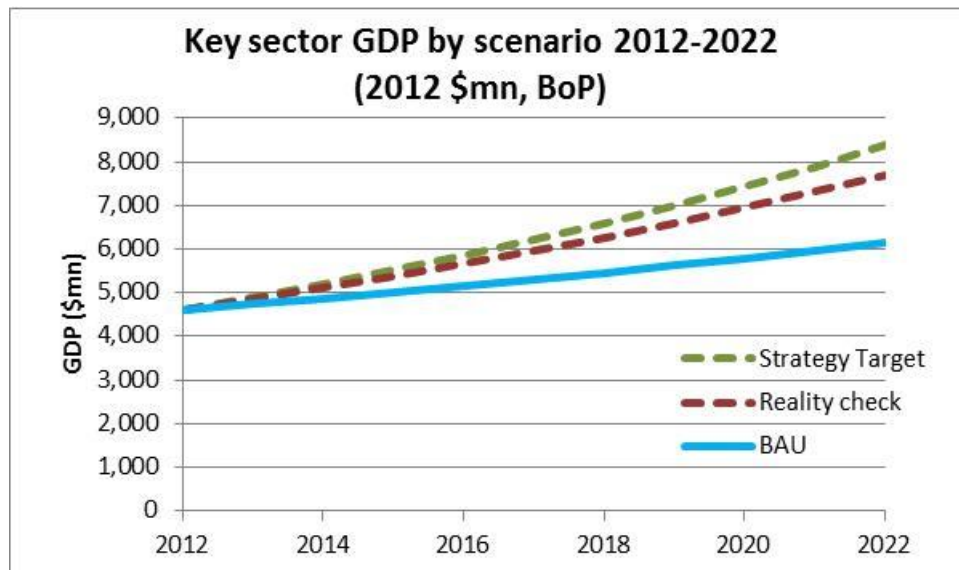
GDP (2012 \$millions)	2012	2022	difference	%p.a.	GDP (\$m) p.
BAU (scenario 1)					
Key sectors	4,610	6,130	1,520	2.9	152
Other industries	8,380	10,980	2,600	2.7	260
Total (all industries)	12,990	17,110	4,120	2.8	412
Strategy stretch (scenario 2)					
Key sectors	4,610	8,380	3,770	6.2	377
Other industries	8,380	12,110	3,730	3.8	373
Total (all industries)	12,990	20,490	7,500	4.7	750
Reality check (scenario 3)					
Key sectors	4,610	7,700	3,090	5.3	309
Other industries	8,380	11,690	3,310	3.4	331
Total (all industries)	12,990	19,400	6,410	4.1	641

*Note: sub-totals rounded to the nearest ten million.

Source: BERL Regional Database 2012 and CGE Projection to 2022

Figure 2 focuses on the key sectors and represents the projected GDP growth, by scenario, between 2012 and 2022.

Figure 2 Key sector GDP (2012 \$mn) by scenario 2012-2022



In summary:

- Scenario 1: GDP will grow steadily under the BAU scenario, with the key sectors adding about \$152 million per annum to the economy and the other industries adding a further \$260 million per annum.
- Scenario 2: GDP in the key sectors will see a significant increase per annum, assuming that the strategies have been successfully implemented. Under this scenario the key sectors will add a \$377 million per annum, more than double the amount under Scenario 1.
- Scenario 3: GDP for the key sectors will see a slightly lower than Scenario 2 increases to \$309 million per annum and the other industries will add \$331 million per annum.

4 Scenario One: Business as Usual (BAU)

In order to measure the effect of the different scenarios, we use a baseline or “business as usual” benchmark scenario. This scenario is our comparator and is the outcome against which we will compare the results of the other two scenarios. That is, the difference between the scenarios and the BAU will illustrate the impact of the growth strategy scenario (number 2) and the reality check scenario (number 3).

The economic climate has a significant impact on the Business-as-Usual (BAU) projection. How the Bay of Plenty economy will grow over the next 10 years is affected by its own local conditions (detailed in the situation analysis), the national economy and the global economic outlook.

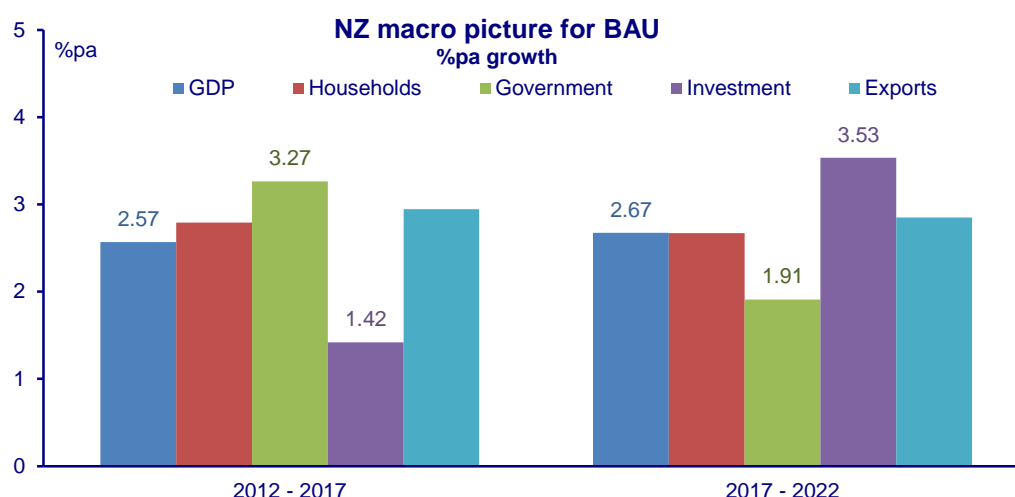
4.1 Assumptions

The model uses a set of 279 macroeconomic variables in the growth projections that link the model to the reality of the New Zealand economy. Each of the 279 variables has specific assumptions based on BERL, national and international data and forecasting sets. These variables and assumptions will be used as our comparators for scenarios two and three. These are detailed in the Appendix and summarised into a macro picture below.

In the business as usual scenario, we have divided the economic parameters into two five year intervals. Figure 3 shows the macroeconomic parameters percentage change per annum for GDP, households, government spending, investment and exports.

Together, the sluggish but warming New Zealand economy and ‘three-speed’ global economy suggest to us a patchy recovery, as shown in the near term 2012-2017 growth forecasts. Over the medium term (2017-2022), we see a rebalancing of the economy towards greater investment growth and away from the government as it dials back the stabilisation stance taken during the GFC.

Figure 3 Macro picture for BAU projections, New Zealand, 2012-2022



In the business as usual situation, national GDP steadily increases from \$206.5 billion in 2012 to \$267.5 billion (measured in 2012 values) in 2022. During this time, employment grows between 1.25 and 1.16 percent per annum resulting in just over one quarter of a million more people in employment in 2022.

Table 3 Macro summary for BAU projections, New Zealand, 2012-2022

Macro summary	Base	BAU	
	2012	2017	2022
GDP (2012 \$m)	206,546	234,452	267,533
%pa from 2012		2.57	2.62
GDP per capita (2012 \$)	47,353	51,396	56,358
%pa from 2012		1.65	1.76
Consumption	123,493	141,718	161,676
Investment	37,281	43,778	48,119
Exports	62,521	72,286	83,186
%pa from 2012		2.94	2.90
Employment (000s)	1,870	1,990	2,098
%pa from 2012		1.25	1.16
Real wage rates	100	104	110
Trade balance (\$m)	1,888	1,288	1,588
Trade balance (%GDP)	0.91	0.49	0.47
Govt balance (%GDP)	-4.49	-3.30	-3.80

Source: BERL

This growth is based on an assumption that world growth and the demand for New Zealand exports a near term recovery followed by a return to expansion at historic averages. The BAU scenario also assumes that the level of productivity across the sectors of the New Zealand economy continue to improve at their historic averages.

We use a top-down approach to project the growth in the Bay of Plenty Regional economy. The 2012 base for the Regional economy's employment and GDP are taken from BERL's Regional Database, which in turn draws on official figures from Statistics New Zealand. The Regional projection adjusts the New Zealand-level employment growth rates (from BERL's CGE model) to take into account the historic growth rates - at an industry level - of the Bay of Plenty relative to New Zealand overall. The Regional GDP projections by industry are then tied to the employment growth projections by industry.¹

¹ The Regional GDP projections are linked to the Regional employment projections via the projected growth rate of GDP per FTE by industry.

4.2 Results

The following Tables depict the industry by industry results for the BAU scenario.

Table 4: Business-as-usual projected scenario employment growth, 2012-2022

Key Industries (FTE employment)	FTEs				
	2002	2007	2012	2017	2022
Aquaculture	303	316	316	352	392
Forestry	7,721	6,618	5,834	5,877	5,921
Kiwifruit	4,038	4,266	4,195	4,372	4,557
Dairy	4,755	5,080	5,780	5,959	6,144
Other Food Cultivation & Processing	3,474	3,594	3,578	3,924	4,305
Energy	478	491	871	1,061	1,293
Transport & Logistics	4,021	3,693	4,284	4,717	5,194
ICT	640	819	872	938	1,010
Marine	312	383	366	425	494
Sport & Recreation	1,647	1,801	1,793	1,893	1,999
Tourism	6,178	6,889	6,513	6,954	7,425
Emerging Techs	878	1,188	1,068	1,285	1,546
Meat	2,324	2,102	2,009	2,037	2,065
Key sectors	36,768	37,240	37,480	39,800	42,300
Other industries	65,839	84,146	84,293	90,700	97,600
Total Industry	102,608	121,385	121,772	130,500	139,900

*Note: sub-totals rounded to the nearest hundred.

Source: BERL CGE Projection to 2022

Table 5: Business-as-usual scenario projected GDP growth, 2012-2022

Key Industries (GDP)	GDP (2012 \$mn)				
	1905	1905	2012	2017	2022
Aquaculture	30	40	39	48	59
Forestry	1,280	1,197	1,226	1,306	1,392
Kiwifruit	374	420	435	492	556
Dairy	446	519	602	678	764
Other Food Cultivation & Processing	305	400	407	488	585
Energy	196	200	307	416	563
Transport & Logistics	505	530	639	764	912
ICT	56	75	80	92	105
Marine	26	34	34	43	54
Sport & Recreation	112	126	124	144	166
Tourism	316	361	387	452	527
Emerging Techs	102	149	114	148	191
Meat	196	225	220	238	258
Key sectors	3,945	4,275	4,614	5,310	6,130
Other industries	6,432	8,231	8,376	9,590	10,980
Total Industry	10,376	12,506	12,990	14,900	17,110

*Note: sub-totals rounded to the nearest ten million.

Source: BERL CGE Projection to 2022

In summary:

- Employment growth in the key sectors will be from 37,480 to 42,300 from 2012 to 2022. The employment growth in the remaining sectors will from 84,293 in 2012 to 97,600.
- GDP in the key sectors will grow from \$4,614 million in 2012 to \$6,130 in 2022. The remaining sectors will see an increase from \$8,376 million in 2012 to \$10,980 million in 2022

5 Scenario Two: Strategy stretch

Scenario two focussed on measuring the impact of the realisation of the Bay of Connections Strategy to promote the development of the key industries. BERL's (2011) situational analysis identified 13 key sectors; these sectors have been incorporated into the Bay of Connections Strategy focusing on increased employment opportunities and the region's growth potential. The 13 key sectors are:

- Aquaculture
- Dairy
- Forestry
- Kiwifruit
- Meat
- Other food cultivation and processing
- Emerging technologies
- Energy
- Freight logistics
- ICT
- Marine
- Sports and recreation
- Tourism

Several sector strategies and working groups focusing on, among other industries, forestry, energy, aquaculture, Maori development and sport and recreation have been set up.

5.1 Assumptions

This scenario modelled the growth potential for the 13 key sectors individually to determine their collective impact on employment and GDP. This is an endogenous scenario, meaning that the key growth parameters reflect the aspirations of the various sectors, and are anchored by historical rates.

Under the Strategy Stretch scenario an effective growth plan, such as a spatial plan, supports the successful implementation of the BOC sector strategies. We capture the effects of this, over and above BAU, through two key (sets of) outcomes:

Market development successfully increases the growth in world demand (exports) by the region's "emerging technology" key sectors. Flow-on effects are captured. For example, a growing energy sector yields lower energy costs increasing the competitiveness of manufacturing and freight industries.² Changes to primary sector exports reflect increasing productivity and competitiveness, which is the second factor, rather as a direct result of market development.

Multifactor productivity growth across the 13 key sectors and industries support an increase in the region's performance. This reflects the investment guided by the sector strategies and economic growth plan to accommodate the key sector growth.

Collectively, higher export demand and greater productivity contribute to greater employment and output growth across the Region's economy. These effects differ at the industry level, however, reflecting that some industries receive both effects directly (emerging technology-type industries), while others receive only the productivity effect; all industries indirectly feel the effects via the upstream and downstream linkages in the CGE model.

² This is modelled as affecting the export demand the following five commodity groups: Fish products, Fabricated metal products, Machinery & equipment, Other manufactures, and Freight.

5.2 Results

The following Tables depict the results for the scenario.

Table 6 Strategy stretch scenario projected employment growth, 2012-2022

Key Industries (FTE employment)	FTEs				
	2002	2007	2012	2017	2022
Aquaculture	303	316	316	363	416
Forestry	7,721	6,618	5,834	6,596	7,457
Kiwifruit	4,038	4,266	4,195	4,657	5,169
Dairy	4,755	5,080	5,780	6,210	6,671
Other Food Cultivation & Processing	3,474	3,594	3,578	3,993	4,456
Energy	478	491	871	1,161	1,547
Transport & Logistics	4,021	3,693	4,284	5,158	6,211
ICT	640	819	872	989	1,123
Marine	312	383	366	456	568
Sport & Recreation	1,647	1,801	1,793	1,950	2,121
Tourism	6,178	6,889	6,513	7,332	8,253
Emerging Techs	878	1,188	1,068	1,398	1,830
Meat	2,324	2,102	2,009	1,903	1,802
Key sectors	36,768	37,240	37,480	42,200	47,600
Other industries	65,839	84,146	84,293	94,500	105,900
Total Industry	102,608	121,385	121,772	136,700	153,500

*Note: sub-totals rounded to the nearest hundred.

Source: BERL CGE Projection to 2022

Table 7 Strategy stretch scenario projected GDP growth, 2012-2022

Key Industries (GDP)	GDP (2012 \$mn)				
	1905	1905	2012	2017	2022
Aquaculture	30	40	39	55	78
Forestry	1,280	1,197	1,226	1,670	2,275
Kiwifruit	374	420	435	573	755
Dairy	446	519	602	755	947
Other Food Cultivation & Processing	305	400	407	556	759
Energy	196	200	307	481	754
Transport & Logistics	505	530	639	891	1,242
ICT	56	75	80	99	123
Marine	26	34	34	48	66
Sport & Recreation	112	126	124	154	191
Tourism	316	361	387	502	652
Emerging Techs	102	149	114	161	227
Meat	196	225	220	259	306
Key sectors	3,945	4,275	4,614	6,200	8,380
Other industries	6,432	8,231	8,376	10,070	12,110
Total Industry	10,376	12,506	12,990	16,270	20,490

*Note: sub-totals rounded to the nearest ten million.

Source: BERL CGE Projection to 2022

In summary:

- Employment growth in the key sectors will be from 37,480 to 47,600 from 2012 to 2022. The employment growth in the remaining sectors will from 84,293 in 2012 to 105,900.
- GDP in the key sectors will grow from \$4,614 million in 2012 to \$8,380 million in 2022. The remaining sectors will see an increase from \$8,376 million in 2012 to \$12,110 million in 2022.

6 Scenario Three: Reality check

Scenario three will be a way of understanding the external forces at work today, such as demographics, globalisation and technological change that will shape the future of the region. This scenario will focus on the impact of various externalities on employment and GDP of the Bay of Plenty. These externalities are based on the discussion that we had with Council members on 23 August 2013.

6.1 Assumptions

This scenario takes account of various positive and negative external factors.

- We re-set the growth in world demand to the BAU rates, to reflect the combined influences of patchy global economic growth but rising commodity prices.
- Multifactor productivity grows as in scenario 2 (rather than BAU) for the 13 key sectors, except for infrastructure and ICT, which reflects a future where national infrastructure spending is re-prioritised away from the Bay of Plenty region.
- Lower overall population growth but an aging population. We capture this by shaving 0.5% per annum off the BAU rates at which the population and labour supply grow and households form. This boosts growth in population over 65 from around 5% to 6%p.a.

The first two effects lower employment and output growth relative to scenario 2 (Strategy Stretch). The third effect, however, results in a tighter labour market and so higher wages. This encourages higher employment/lower unemployment. In addition, a higher proportion of people receiving the pension create a demand for services and also a flow of New Zealand superannuation income to the region. This creates demand for goods and services, and supports greater employment and economic activity, further boosting the economy. The net effect of these factors puts the 'Reality Check' growth path in between Scenario 1 and Scenario 2.

6.2 Results

Table 8 Reality check scenario projected employment growth, 2012-2022

Key Industries (FTE employment)	FTEs				
	2002	2007	2012	2017	2022
Aquaculture	303	316	316	354	396
Forestry	7,721	6,618	5,834	6,360	6,933
Kiwifruit	4,038	4,266	4,195	4,530	4,892
Dairy	4,755	5,080	5,780	6,095	6,426
Other Food Cultivation & Processing	3,474	3,594	3,578	3,616	3,654
Energy	478	491	871	1,122	1,446
Transport & Logistics	4,021	3,693	4,284	5,293	6,540
ICT	640	819	872	983	1,109
Marine	312	383	366	447	545
Sport & Recreation	1,647	1,801	1,793	1,901	2,017
Tourism	6,178	6,889	6,513	7,100	7,739
Emerging Techs	878	1,188	1,068	1,359	1,729
Meat	2,324	2,102	2,009	1,762	1,545
Key sectors	36,768	37,240	37,480	40,900	45,000
Other industries	65,839	84,146	84,293	93,000	102,700
Total Industry	102,608	121,385	121,772	133,900	147,700

*Note: sub-totals rounded to the nearest hundred.

Source: BERL CGE Projection to 2022

Table 9 Reality check projected GDP growth, 2012-2022

Key Industries (GDP)	GDP (2012 \$mn)				
	1905	1905	2012	2017	2022
Aquaculture	30	40	39	54	74
Forestry	1,280	1,197	1,226	1,605	2,103
Kiwifruit	374	420	435	556	712
Dairy	446	519	602	739	907
Other Food Cultivation & Processing	305	400	407	510	640
Energy	196	200	307	463	699
Transport & Logistics	505	530	639	851	1,134
ICT	56	75	80	96	117
Marine	26	34	34	46	63
Sport & Recreation	112	126	124	150	181
Tourism	316	361	387	479	593
Emerging Techs	102	149	114	156	214
Meat	196	225	220	243	268
Key sectors	3,945	4,275	4,614	5,950	7,700
Other industries	6,432	8,231	8,376	9,900	11,700
Total Industry	10,376	12,506	12,990	15,850	19,400

*Note: sub-totals rounded to the nearest ten million.

Source: BERL CGE Projection to 2022

In summary:

- Employment growth in the key sectors will be from 37,480 to 45,000 from 2012 to 2022. The employment growth in the remaining sectors will from 84,293 in 2012 to 102,700.
- GDP in the key sectors will grow from \$4,614 million in 2012 to \$7,700 million in 2022. The remaining sectors will see an increase from \$8,376 million in 2012 to \$11,700 million in 2022.

7 Sub-regional impact

This section seeks to draw some meaningful conclusions about the alternative futures to help build understanding about the challenges and opportunities ahead for the sub-regions. Further work could build on this to identify the economic flows from source to end points of people, employment and output between sub-regions.³

7.1 People

As noted in the BERL (2013) Situation Analysis, population growth is projected to be most rapid in the west – Tauranga and Western Bay of Plenty District, modest in the central areas of Rotorua and Taupo, and stagnant or declining in the east.

The following figures show the projected increase in population and jobs between 2012 and 2022, i.e. it shows the change (not the total).

Figure 3: Population and employment growth, 2012-2022, by TA



³ As the focus of the scenario analysis was primarily on exploring the impacts of three scenarios on the Bay of Plenty Region's growth potential, we have not carried out a detailed analysis of the intra-regional flows and links at a sub-regional level.

The figures highlight quite different population and job growth pathways in the different areas of the Bay of Plenty. A high level observation is that under the Strategy Stretch scenario, job growth is projected to match or exceed population growth. This may have a number of implications.

- **Jobs bring people:** job growth may increase the net migration so that population growth is higher than indicated by the central population growth projections. Higher population growth has the (positive) challenge of housing the workers and their families drawn in by the job opportunities. This may add to the local government rating base, but also create additional demands for social and community infrastructure.
- **Increased employment opportunities:** more job openings may increase the population participation rate⁴ in the labour force. This would be particularly beneficial for the Bay of Plenty region, and its areas, as it had the second highest rate of unemployment in the country (after Northland). More job opportunities would also allow people to find employment – and in a place – that fits their lifestyle.

Given the imbalance between job growth outstripping population is greatest in the east, this area may be one of the first to see rising employment/falling unemployment. And increasing the participation rate tends to be one of the fastest ways to increase average personal and household incomes. This would be particularly meaningful in an area of high deprivation.

- **Better outcomes for Māori:** Evidence from BERL's research on the asset base, income, expenditure and GDP of the 2010 Māori economy showed that savings levels for Māori are much lower than for the rest of New Zealand. Tats research calculated that Māori whānau only direct about 4 percent of their household expenditure towards savings. This suggests that income growth is not converted into wealth. Rather, it is directed to consumption.

The perceived ability of Māori in the Waiariki rohe and Te Arawa Waka to save plays a critical role in the decision making process. This ability is also highly influenced by the link between income and debt levels. Debtors tend to have lower incomes, are less likely to own their own homes, and are less likely to be employed full-time. While increasing household income might not lead to a direct increase in savings, it does contribute to the ability of whānau to create wealth and wellbeing. Wealth allows individuals to smooth consumption over time and protects them from unexpected shocks that could lead to poverty and hardship. Income and wealth also bring non-economic benefits, such as better health and education, higher life satisfaction and the possibility of living in safer and better housing accommodation. Education and home-ownership are mechanisms that can support this.

There is a strategic opportunity related to the supply of higher level training required to support the growth of new and higher productivity jobs. This has sub-regional implications. Rotorua, for example, is a home to forestry industry research and training. It could potentially supply of a wider range of tertiary education services, for example, in relation to bio-fuels. This will leverage its relatively young population, retaining these people, and also attracting new people to a growing and increasingly productive economy. Equally, Whakatane or Opotiki might diversify education services for other high tech industries located elsewhere in the region, such as engineering for the wood product or marine services industries. Further strengthening the bonds between Tauranga and other centres in New Zealand (and abroad?) could enable even higher level tertiary study 'at home' in the Bay.

⁴ The population participation rate (PPR) measures a population's active participation in the labour market. It expresses the proportion of all people in an area that are employed.

7.2 Jobs

The Bay of Plenty has a rich resource-based economy, a strong export orientation, and a growing population. A sound growth path will capitalise on these strengths, and ensure that the right level of investment and connectivity occurs in the right place at the right time.

In addition to economic growth, such a plan can leverage the Region's attractive environment and desirable lifestyle to attract people and potentially further lift productivity. Spatial economics suggests how growth patterns can be leveraged to positively affect the type and pace of economic growth. A coordinated spatial plan, for example, will better harness the skills and drive of the people the Region attracts – i.e. in actuality specific areas – lifting employment and increasing productivity.

The impact of the three scenarios on a sub-regional level depends on the links across the regional economy's current structure and in its projected future.

Below is a visualisation of the employment impact at a sub-regional level for the following sectors:

- Aquaculture
- Marine
- Forestry
- Energy
- All non-key sector industries

The maps show the projected sector employment in each of the three scenarios in 2022. The bar height relates to an area's total employment in its key sectors in 2012. For example, in 2012 the Kiwifruit sector employed an estimated 2,324 FTES, which represented 32 percent of the area's total key sector's employment (7,225 FTES). Under BAU, this employment is projected to rise to 2,672 FTES, or 37 percent of the 2012 level. Therefore, the height of the BAU bar would be shown as 37.

This representation highlights the impact on an area in terms of its own (key sector) employment. This approach helps to tease out the change in a particular area relative to its own current employment, rather than relating it to the overall regional employment. The latter representation would mean small areas would be dwarfed, and meaningful changes would be hard to see. Basing the employment on an area's 2012 key sector employment means the size of each industry can be readily compared across each of the three scenarios.

The projected geographic distribution of employment in each sector is based on the average annual total employment for each industry in the Bay of Plenty region for the 2007-2012 period.⁵ Two exceptions are the geographic patterns of employment in the aquaculture, marine and energy sectors. For these sectors, under the Strategy Stretch and Reality Check scenarios we assume that:

- the investment into Opotiki will attract a greater proportion of the projected regional employment (and a smaller percentage share to Tauranga to ensure the total still tallies)
- some of the energy sector's growth relates to increasing role of bio-fuels, and this occurs in Kawerau (again to ensure the total tallies, a smaller percentage share is assigned to Tauranga).

⁵ A five year period has been used rather than just the 2012 year, as this provides a more robust estimate of the level of employment in each industry over the medium term.

7.2.1 Alternative futures for the Aquaculture and Marine sectors

Figure 4: Employment growth in Aquaculture sector

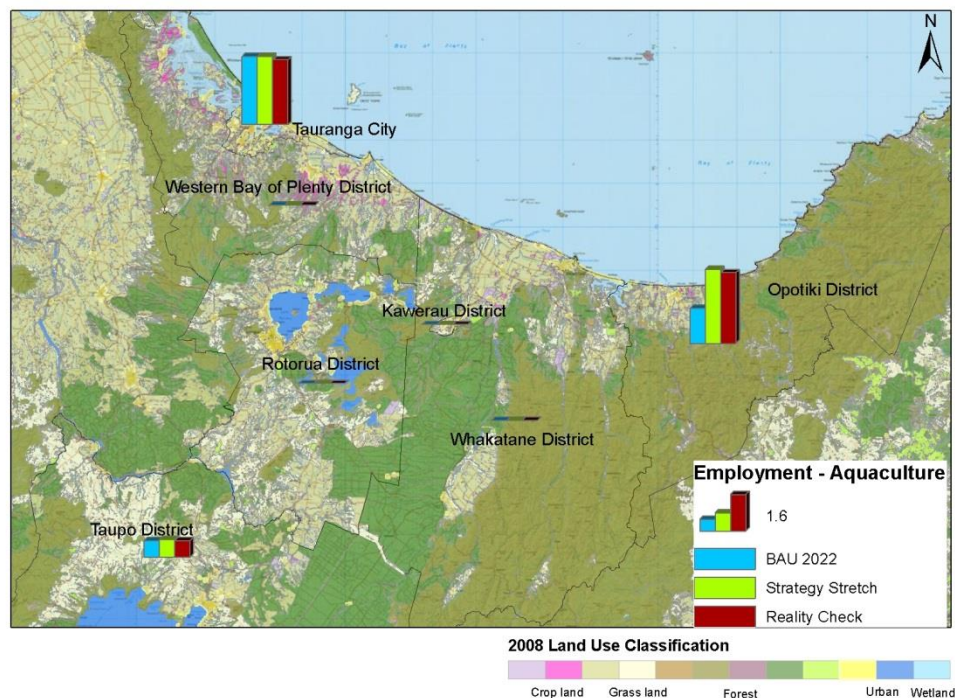
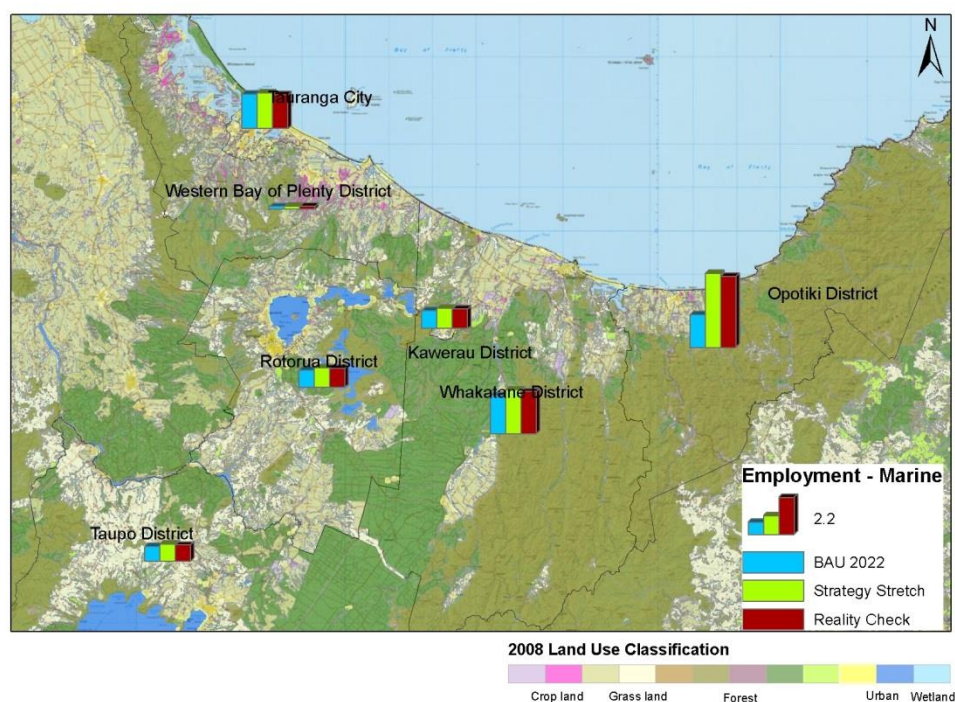


Figure 5: Employment growth in Marine sector



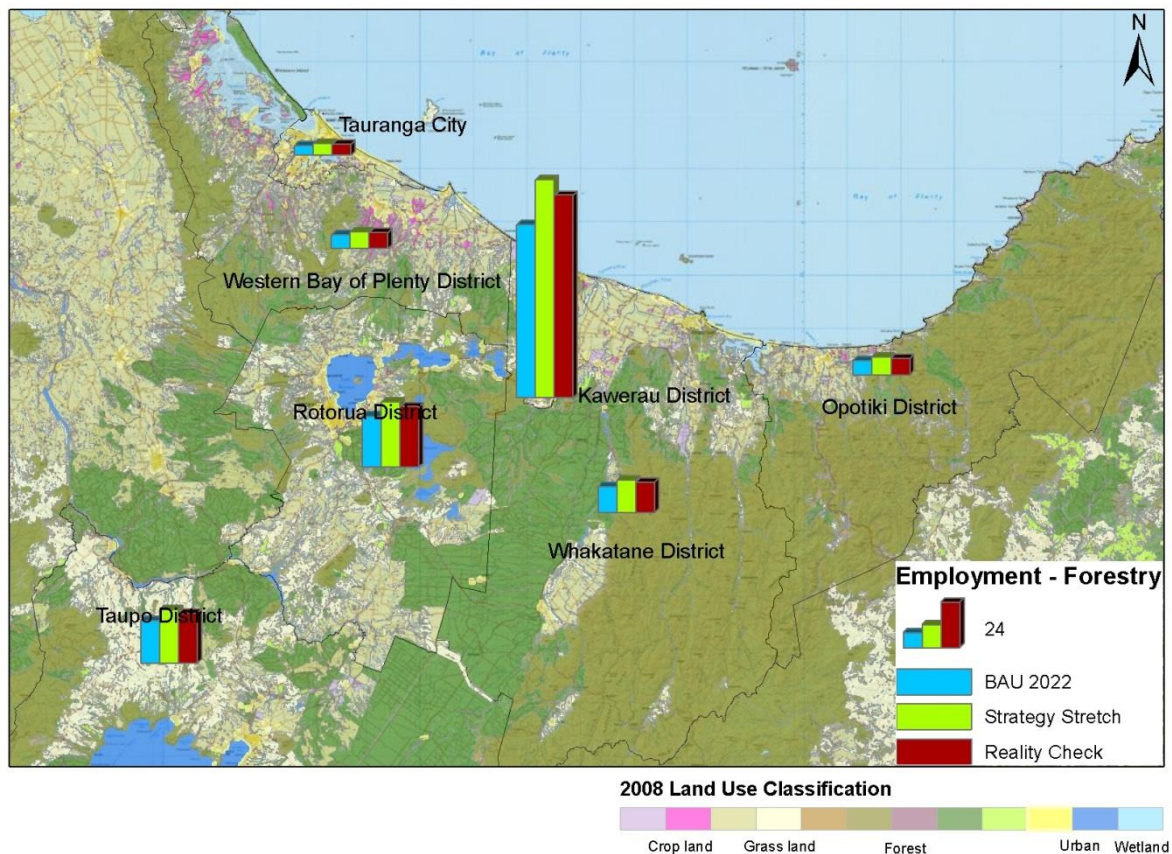
Under the Strategy Stretch and Reality Check scenarios, Opotiki has a dramatically larger role in the Aquaculture and Marine sectors. This role requires investment into the sea port to cope with increased volumes from Opotiki, some of which is already planned.

The scale of this investment depends, to some extent, on the scale of the marine industry and aquaculture/marine services provided at Opotiki (versus alternate locations, for example, Tauranga).

Increased volumes of high value exports may increase the demand for a variety of freight modes: via sea and rodo to Tauranga, and air freight demand via Tauranga (to Auckland) or Rotorua (to time critical international destinations/ linkages).

7.2.2 Alternative futures for the Forestry sector

Figure 6: Employment growth in the Forestry sector

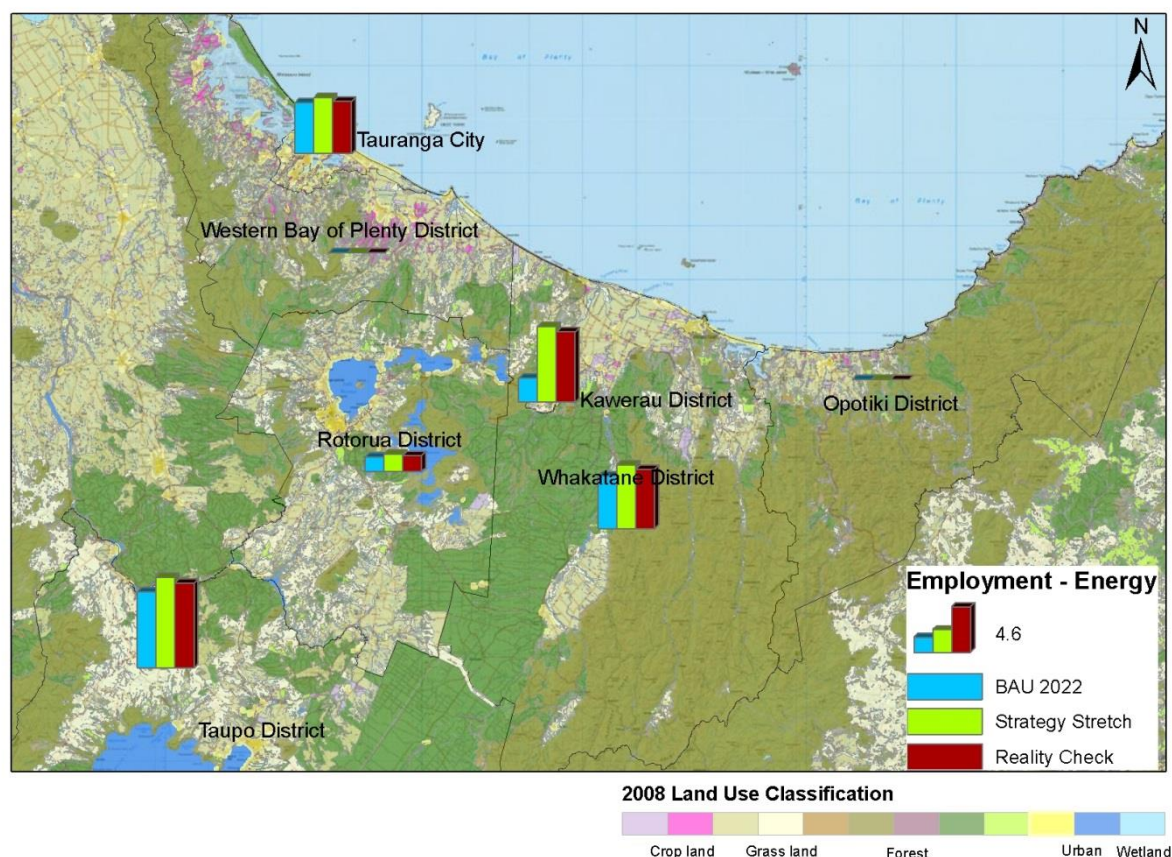


The forestry industry requires a strong transport backbone, to bring people and machinery in and product out. Increasing the road transport function may require investment into the road network from the Eastern Bay to improve connectivity with satellite towns, such as Ruatoki, Galatea and Murapara as well as product handling sites such as Taupo, Rotorua, Kawerau and Tauranga.

For the Kiwifruit industry, route security and surface quality are also issues that may need to be addresses as more (and heavier) forestry loads pass over, particularly in the central West (around Te Puke) and east up to the cape (through to/from Te Kaha).

7.2.3 Alternative futures for the Energy sector

Figure 7: Employment growth in Energy sector



The illustration above shows a substantial increase in the Energy sector, especially in the Kawerau District under the second two scenarios. As the District is currently a major industrial complex, it is likely that it could cope with such a much larger scale geothermal and biofuel based energy sector, as well as other industries locating there to take advantage of this newly harnessed comparative advantage, such as forestry, services to aquaculture, waste processing and resource recovery.

The expanded industrial complex would require suitably zoned land, with re-configured rail, road and power/transmission networks.

While there is currently housing stock and local government infrastructure to serve an expanding residential/commercial base, it is likely that greater transport services will be required between key the employment (Kawerau) and residential (Whakatane and potentially Rotorua, Te Puke or Tauranga) nodes.

The Taupo and Rotorua Districts are also important feeder sources of electricity for the Region. While energy developments in Kawerau may alter this balance, it is likely that expanding industries in the west and the east may increase energy demand from these two Districts. This has implications for the Region's entire electricity distribution network.

7.3 Sub-regional implications for other key sectors

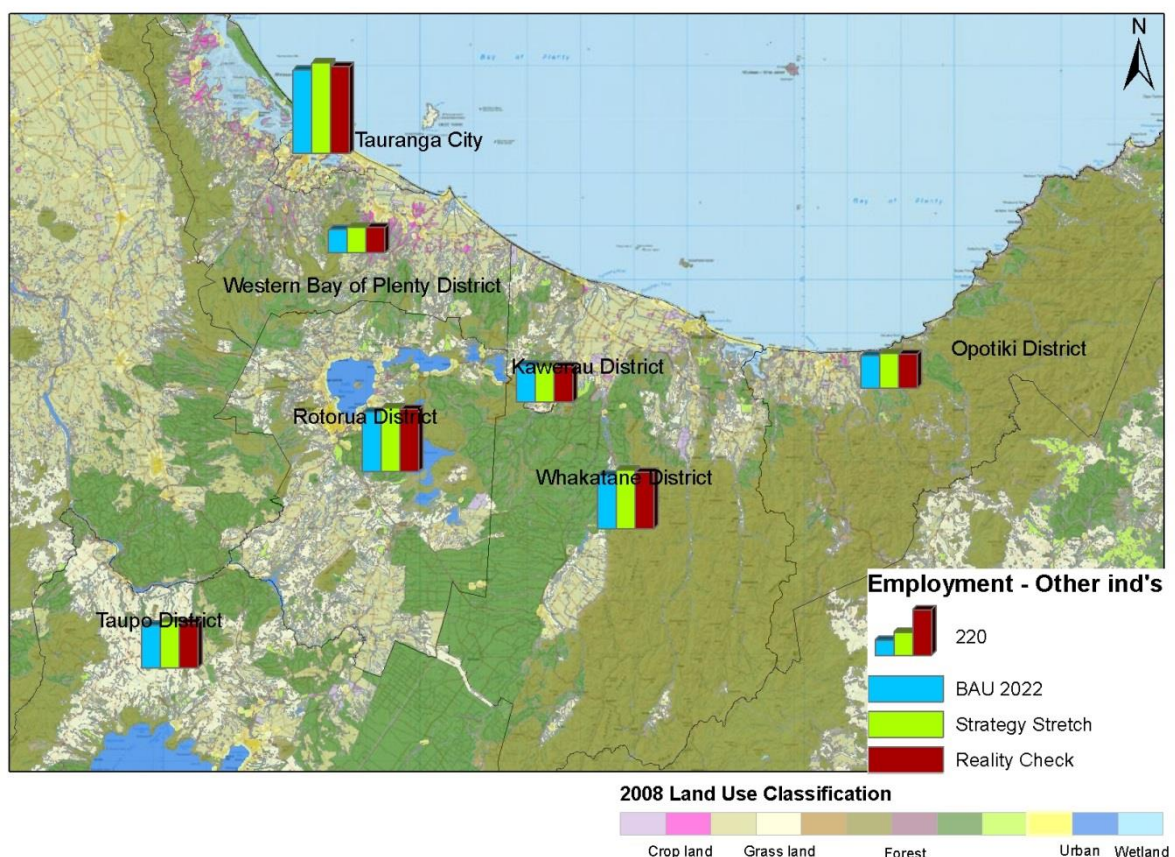
The Western Bay of Plenty has a substantial proportion of the region's kiwifruit orchards and post-harvest facilities. As Tauranga's closest neighbour, one quarter of the Western Bay's employed residents work in Tauranga (according to the 2006 Census). A successful economic growth strategy for the Kiwifruit sector will mean that transport linkages – for moving goods and people – are important to the District's economic success. Given the live-work pattern in the Western Bay, the growth aspirations of Tauranga City will also have a major influence on the economic opportunities of the District's residents.

Rotorua: a secondary hub with advantages in forestry, specialised manufacturing, energy supply, and an international airport. The city is also a major tourist destination. An improved regional road network connecting Rotorua to Kawerau and Tauranga may serve both Rotorua's key industries and encourage tourism activity within the Region as a whole.

7.4 Sub-regional implications for other non-key sectors

The map below illustrates the growth for other sectors under the three 2022 growth scenarios.

Figure 8: Employment growth in non-key ('other') sectors



The differences capture the upstream and downstream linkages between the key industries - where the growth is projected to be the greatest in the second two scenarios – and other parts of the economy. The modelling approach takes into account that growth in the key sectors will both create

pressure and competition on the supply side (for more labour and inputs) and for some industries it will stimulate activity (as upstream suppliers to growing industries, and downstream as workers and households spend their increased incomes)

The large population centres – Tauranga in the west, Rotorua in the centre and Whakatane in the east – play important roles in the settlement hierarchy. These centres may have to invest more in community infrastructure to match the rising expectations of a growing and increasingly large and wealthy population located in and around them.

Tauranga City, for example, is the region's main business service and transport hub. These facilitate the region's imports (to meet the consumer demands of its people and intermediate inputs of its businesses) and exports. The business service functions may be enhanced through greater investment into ultrafast broadband, reducing the tyranny of distance and allowing diversification into high productivity employment opportunities. While Tauranga City is at the top of the Regional settlement hierarchy, such investment may assist Tauranga City to climb up the New Zealand settlement hierarchy.

8 Looking forward and Limitations

8.1 Right time

The scenario growth paths are based on 'smooth' growth, and do not detail when particular actions and results occur over this horizon. This timing, however, is important to ensure that the right resources and infrastructure is in the right place at the right time – a spatial plan with a time dimension.

8.2 Right place

This high level analysis works 'top down' to estimate the economic activity in the local economies of the Bay of Plenty region. The current patterns of employment are used to indicate where the future employment would be. This is likely to be reasonably accurate for the business-as-usual scenario.

If the key sector strategies lead to greater (than historic) growth in some local areas for a particular sector, then employment in that place will differ from the levels illustrated by the scenario projections. This will influence the needs for (and by) people, infrastructure and the environment in those areas. A more detailed understanding of how the strategies will lead to different spatial patterns of growth by industry is important.

8.3 Right numbers

To develop a coherent spatial plan that will garner wide and on-going acceptance across the councils, and also support on-going planning and monitoring, it will be useful to have a set reference point. Or rather, a set of reference points that show the 'now' and the desired 'future'. This report robustly sets out a situation analysis of the now, and the scenario analysis paints alternative futures.

Some further validation and detailing is necessary to identify which growth path is most relevant and credible for the purposes of supporting the development of spatial plan and investment into the Bay. This will provide the right numbers – that is, a reference set against which planning can be carried out, targets set and concrete actions delineated.

This report has emphasised the importance of, and links between, people and jobs. This report has focussed on projecting jobs. Consideration should be given in further work as to how to align the economic growth numbers with population growth numbers. If these projections are not aligned, then the Spatial Plan may fail to attract the right investment to the right place in the right quantities.

We note two potential paths below; we recommend the second.

1. Conduct independent population projections by sub-regional area, and allow this to dictate where infrastructure and other local government action is required. This might be used to reverse out the level of employment by industry, given some industry participation ratios. However, these ratios do not necessarily guarantee that the calculated employment figures would line up with the economic projections. In this case, the implicit assumption made would be that people create jobs and that the industry mix is fixed.
2. Derive population growth from the accepted economic growth scenario. This approach would take into account the inter-industry interactions that determine what and how much economic activity occurs – rather than a simplistic, static mix of what economic activity occurs (as under path 1). Inherent in this growth is a demand and supply of labour, and also assumptions about population growth, demographic structure and household formation.

From this, the 'now' and 'future' population can be extracted. This projection, however, occurs at a relatively high level and it assumes that the people are located where the jobs are located.

Rather than using a simple mechanical application, this approach could be adapted to account for where people are currently living (from 2013 Census data), aligned to total population growth consistent with the economic projections and located according to a demographic projection. That is, the total population growth for the region - or by local authority area - would be consistent with economic projection, and the spatial pattern of this growth could be determined with a standard demographic projection (where the total population growth is calibrated to the high level figure from the economic projection).

Appendix A The BERL CGE model and what it does

This appendix briefly describes what a CGE model, what it does, and how it can be used to quantify the potential economic impacts of a change or 'shock' to the economy.

A Computable General Equilibrium (CGE) model

Economists use economic models to simplify and understand the behaviour and interrelationships between the various sectors and participants in the economy. The Computable General Equilibrium (CGE) is a standard economic model widely used in estimating the impact of a change in one sector on other sectors and the whole-economy.

The CGE model allows us to perform computer simulations to investigate the effect of particular events on macro-economic variables (e.g. GDP and consumption) and industries. For example, we could estimate the changes in macro-economic variables resulting from a:

- change in population growth, which affects household spending growth
- technological breakthrough that results in increased productivity in particular sectors
- world event (e.g., political turmoil) that reduces the demand for our exports
- change in policy (e.g., increased government spending on hospitals)
- change in the price of commodities (e.g., milk solids or oil).

The model is made up of data and equations that depict the workings/flows of economic transactions in an economy. The equations are developed by combining input-output tables⁶ with national account data (GDP, household and government consumption, investment, exports and imports) and behavioural equations reflecting behavioural responses to price changes. Behavioural responses are made by firms and consumers.

BERL CGE model parameters

The BERL computable general equilibrium (CGE) model:

- measures a range of economic indicators, including employment (by occupation), output (or production, or sales), and exports at an industry level;
- employment, Gross Domestic Product (GDP), and exports at the macro aggregate level
- and the trade balance and government balance.

Currently, BERL's CGE model identifies 53 different industries and 40 different occupation (i.e. labour) types. It is based on unofficial inter-industry data for the 2005/06 year, which has been derived by BERL from a variety of sources.⁷

The model uses a set of 279 macroeconomic variables in the growth projections that link the model to the reality of the New Zealand economy.

⁶ Input-output tables indicate how much each industry requires of the production of each other industry in order to produce each dollar of its own output. It shows how the output of one industry is an input to each other industry.

⁷ The latest generally-available official inter-industry data is for the 1995/96 year.

The model's macroeconomic variables are grouped into the following 9 categories:

- Demographics
 - Including labour supply and unemployment
 - Total population, people over 65, welfare recipients, households and owner occupied dwellings
- World commodity demand growth and changes in export prices for these commodities
 - For each of the 25 commodities
- Change in world import prices
 - For each of the 53 industries
- Labour productivity growth
 - Based on the 53 industries
- Investment to capital shift factor
 - Based on the 53 industries
- Change in average return on capital
- Government to household consumption shift factor
- Stock change to gross output shift factor
- Change in trade balance payments

Modelling assumptions

The model must always be in equilibrium. Equilibrium is where the supply of a product is equal to its demand. The CGE model calculates the new equilibrium between the demand and supply of factors of production, and goods and services when there is a change in one sector in the model, which is described as a “shock”. That is, producers, consumers, workers and investors must adjust their supply or demand until they are satisfied with the current market prices and quantities.

In order to assess the interrelationships between changes in one sector on the rest of the economy, these models follow various standard *neoclassical* assumptions to ensure the impact can be measured. These assumptions are:

- **Market-clearing prices** – In line with the condition for equilibrium, prices adjust to their ‘market-clearing’ level; that is to the level where demand in a particular market equals the supply in that market.
- **Zero (pure) economic profit** - Zero economic profit means the return to capital invested in a sector is equivalent to the returns to capital available in alternative investment opportunities.
- **Cost-minimising firms** – Firms are assumed to shift between alternative production processes in order to minimise the unit costs of production of goods and services. The alternative choices are between relatively labour-intensive or capital-intensive processes, as well as between imported or domestically-sourced material inputs.
- **Utility-maximising consumers** – Consumers are assumed to shift their demand for goods and services in response to price and income changes in order to maximise their individual well-being.

