Modelling the economic impact of Te Utanganui freight hub projects on the Manawatū-Whanganui economy

for Central Economic Development Agency

July 2023

Infometrics
Economics put simply

Authorship

This report has been prepared by Rob Heyes and Adolf Stroombergen

Email:

Adolf.Stroombergen@infometrics.co.nz

Rob.Heyes@infometrics.co.nz

Table of contents

Executive summary

Central Economic Development Agency (CEDA) commissioned Infometrics to carry out an economic impact assessment of Te Utanganui freight projects to understand how the projects will benefit the Manawatū-Whanganui economy.

As agreed with CEDA, the Te Utanganui projects within scope of this analysis are as follows.

1. KiwiRail's Regional Freight Hub
2. The North East Industrial Zone (NEIZ)
3. The Ruapehu Business Park (AeroPark)
4. The Palmerston North Airport development
5. The Regional Freight Ring Road

This report details the results of our economic impact assessment, our approach to assessing the economic impacts, and our analysis of when the construction phases of the Te Utanganui projects should take place considering the capacity of the local construction industry.

- Our baseline scenario is a 'business as usual' (BAU) scenario under which the Te Utanganui projects do not go ahead.
- Scenario 1 assumes Te Utanganui is fully operational from 2035 onwards. Scenario 1 also incorporates the assumptions outlined in the 'assumptions and approach' section.
- Scenario 2 sees thee Manawatū-Whanganui Region's share of national freight activity rise from 77% to 81%.

Our economic impact assessment estimates the addition to national and Manawatū-Whanganui regional GDP that Te Utanganui makes from 2035 onwards, when it becomes fully operational. This addition to GDP is expressed in percentage terms per annum and as a NZ Dollar amount in 2035 (in 2019/20 prices), based on our estimate of the size of the national and regional economies in 2035. We also express the NZ Dollar amount per person and per household based on our population and household projections.

The percentage addition to GDP resulting from Te Utanganui is assumed to remain constant from 2035 onwards. As the size of the national and regional economies grow, this percentage addition will be worth more in NZ Dollar terms.

We estimate that under scenario 1, Te Utanganui will increase national GDP by 0.03% per annum from 2035 onwards. This additional GDP is worth **$122 million** in 2035, or an average of **$21 per person** and **$57 per household** nationally.

Under scenario 1, we estimate that 77% of the total national economic impact of Te Utanganui will occur in the Manawatū-Whanganui region. Therefore, the regional impact totals **$93 million** in 2035 or an average of approximately **$328 per person** and **$833 per household**, which represents an increase of 0.5% to GDP per annum from 2035 onwards.

Under scenario 2 Te Utanganui increases national GDP by a further $40 million to **$162 million** in 2035, an average of **$28 per person** and **$76 per household**. The impact on Manawatū-Whanganui Region is **$132 million** in 2035, an average of approximately **$463 per person** and **$1,174 per household**.

The construction of the KiwiRail Regional Freight Hub, at an estimated cost of $667 million over an estimated five years, is a significant project in the context of the broader Manawatū-Whanganui Region non-residential construction sector and will stretch the capacity of the sector. An expected fall in non-residential construction activity in Manawatū-Whanganui Region from 2023 should create some spare capacity. The region could also draw on resources from non-residential construction sectors in surrounding regions where activity is also expected to fall away this year or next.

The Regional Ring Road, at an estimated cost of $530 million over an estimated 10 years is a moderately significant project in the context of the broader Manawatū-Whanganui Region infrastructure construction sector. Any resulting capacity shortfalls could possibly be filled from the local residential construction sector, in which activity is expected to fall away steeply from 2023 onwards.

Economic impact in 2035

Assumptions and approach

The new freight hub and surrounding transport-related developments are modelled as if they are a distinct industry – call it the Te Utanganui Synthetic Industry (TUSI). The industry's cost structure is taken as a weighted average of that for other transport industries, emphasising rail and freight hub activities, based on data supplied by various partners to the development and drawing on the 2019/20 inter-industry table.

Table 1

TUSI cost structure

	Industry	Weight
ROAD	Road transport	10%
RAIL	Rail transport	30%
AIRS	Air transport	10%
POST	Postal & courier	10%
TRNS	Transport support services	20%
WHST	Warehousing & storage	20%

Source: Infometrics

The TUSI is modelled as selling its services to other industries in proportion to those other industries' use of the various transport services listed in the above table, and in proportion to the 2023 shares of freight tonne kilometres that flows through Manawatū-Whanganui Region. The shares are 16% for rail transport and 8% for road transport.[1] We assume a further 3% for transport support services, warehousing, and storage.

Paling (2021)[2] estimates that the new regional freight hub will reduce costs to transport users by $11.4m in 2032, rising to $14.3m in 2052.[3] We use the $11.4m as an input 'shock' to the model for 2035. Thus, the modelling should produce at least that value of overall net benefit.

In the two scenarios below for 2035, total national employment (measured in full-time equivalent jobs, is assumed to remain the same as in the Business as Usual (BAU) scenario. Total employment in New Zealand is not expected to be affected by whether or not the Te Utanganui development occurs, although more employment in Manawatū-

[1] Source: Ministry of Transport statistics. See https://www.transport.govt.nz/statistics-and-insights/transport-outlook/sheet/updated-future-state-model-results#element-1526

[2] Paling (2021) KiwiRail Regional Freight Hub Section 92 Response: Economic Development Impact. The $11.4m by 2032 is based on figures in Table 8: benefits to Palmerston North users ($2.8m), benefits to longer distance users ($6.3m) and total congestion benefits ($2.3m)

[3] In addition to user and congestion benefits Paling also estimates other benefits in the form of lower crash costs and lower emissions. Emissions are included in our modelling. Crash costs are out of scope.

Whanganui Region is expected. Further detail on other BAU assumptions that are retained in the two scenarios is provided in Appendix A.

We first estimate the economic impact of the TUSI nationally then we estimate how much of these effects will be captured within Manawatū-Whanganui Region based on information about what proportion of spending by households and industries in Manawatū-Whanganui Region is derived from local suppliers within the region.

Scenarios

- Our baseline scenario is a 'business as usual' (BAU) scenario under which the Te Utanganui projects do not go ahead.
- Scenario 1 incorporates the assumptions outlined in the 'assumptions and approach' section.
- Scenario 2 raises the Manawatū-Whanganui Region's share of national freight activity by 20%, so for example the rail share increases from 16% to19.2%.

How we express the economic impact of Te Utanganui

Our economic impact assessment estimates the addition to national and Manawatū-Whanganui regional GDP that Te Utanganui makes from 2035 onwards, when it becomes fully operational. This addition to GDP is expressed in percentage terms per annum and as a NZ Dollar amount in 2035 (in 2019/20 prices), based on our estimate of the size of the national and regional economies in 2035. We also express the NZ Dollar amount per person and per household based on our population and household projections.

The percentage addition to GDP resulting from Te Utanganui is assumed to remain constant from 2035 onwards. As the size of the national and regional economies grow, this percentage addition will be worth more in NZ Dollar terms.

Results

The economic impacts of scenario 1 in terms of the percentage change over and above BAU across a range of economic indicators are summarised in Table 2. We stress at the outset that although Te Utanganui is a significant development for Manawatū-Whanganui Region, from a national perspective it represents a small increase in economic activity.

Scenario 1: National impact

The increment of 0.03% additional Gross Domestic Product (GDP) per annum from 2035 onwards under scenario 1 in Table 2 is worth **$122 million** (in 2019/20 prices) in 2035. Table 2 also shows the components that make up the $122 million GDP: $94 million in private consumption, $29 million in investment and $32 million in additional exports, minus $34 million in additional imports.

Table 2

National economic impact of Te Utanganui summary results

	Scenario 1		Scenario 2		
	% change per annum on BAU	Additional benefits ($m) on BAU in 2035	% change per annum on Scenario 1	Additional benefits ($m) on scenario 1 in 2035	Additional benefits ($m) on BAU in 2035
Private consumption	0.04%	94	0.01%	27	121
Gross investment	0.03%	29	0.01%	9	38
Exports	0.03%	32	0.01%	11	43
Imports	0.03%	34	0%	6	40
GDP	0.03%	122	0.01%	40	162
Real wage rates	0.06%		0.02%		
Gross CO_2e	-0.14%		-0.01%		
Transport CO_2e	-0.82%		-0.06%		

Source: Infometrics

Table 3 shows that the $122 million translates into an average of **$21 per person** and **$57 per household** nationally in 2035.[4]

Table 3

National and regional economic impact of Te Utanganui

	New Zealand	Manawatū-Whanganui Region
Scenario 1		
GDP increase in 2035	$122m	$93m
Per person	$21	$328
Per household	$57	$833
Scenario 2		
GDP increase in 2035	$162m	$132m
Per person	$28	$463
Per household	$76	$1,174

Source: Infometrics

Comparison with Paling's estimates

Our estimated economic gain of $122 million in 2035 does not invalidate Paling's estimates of $11.4 million in 2032 and $14.3 million in 2052.[5]

The model picks up a wide range of indirect and flow-on effects not estimated by Paling such as improved export competitiveness, fewer emissions (about 90kt in 2035) from more use of rail (saving almost $16m in foreign exchange resulting from New Zealand not needing to buy international emission units from other countries to offset its own emissions), higher investment and higher wage rates linked to greater productivity leading to higher household consumption.

[4] Based on Infometrics national population projection of 5.7 million and household projection of 2.1 million by 2035.
[5] Paling (2021) op cit

In addition, Paling's estimates relate only to KiwiRail's Regional Freight Hub whereas our modelling relates to the entire hub development including the ring road, the NEIZ, the AeroPark and the Palmerston Airport development. In contrast Paling also identifies crash reduction benefits of $1.5 million, which are excluded from our modelling.

Scenario 1: Effect on Manawatū-Whanganui Region

We estimate that 77% of the total national economic impact of Te Utanganui will occur in the Manawatū-Whanganui region. Therefore, the regional impact totals **$93 million** (76.6% of the national impact of $122m) in 2035.

Infometrics doesn't forecast regional GDP out to 2035. However, we can make a broad estimate based on historical trends. Between 2009 and 2022, Manawatū-Whanganui region GDP rose 32% in real terms. If we assume the same growth from 2022 to 2035, GDP will reach just under $18.5 billion in 2025. The increment of $93 million represents an increase of 0.5% on $18.5 billion. We assume therefore that Te Utanganui will add around 0.5% per annum to Manawatū-Whanganui region's GDP from 2035 onwards.

Table 3 shows that the $93 million corresponds to approximately **$328 per person** and **$833 per household** in the Manawatū-Whanganui region in 2035.[6] Not all of those benefits appear as a direct increase in household income. Some of the $93 million will be in the form of lower prices and increased investment to support future income growth.

Scenario 2: National effect

An efficient new freight hub with associated new transport links such as to Hawke's Bay, and better integration between Horowhenua and Wellington, could see Manawatū-Whanganui Region obtain a larger share of national freight activity. Having more freight activity flowing through the more efficient regional fright hub benefits both the Manawatū-Whanganui Region and the country as a whole.

Under Scenario 2 we raise the share of freight passing through Te Utanganui by 20%. This increase lifts the share of the nation's total direct and indirect effects that occur in Manawatū-Whanganui Region from 77% to 81%. This increase is consistent with updated projections supplied by KiwRail. As shown in Table 2 this increase in Manawatū-Whanganui Region freight activity leads to an additional national increase in GDP (over and above that in Scenario 1) of 0.01%, equal to $40 million in 2035 over and above scenario 1 and **$162 million** over and above BAU. The $162 million translates into an average of **$28 per person** and **$76 per household** in 2035 as shown in Table 3.[7]

Under scenario 2, gross emissions fall by another 0.01% (relative to Scenario 1) or about 4kt CO_2e. Therefore, if New Zealand needs to buy international emission units from other countries to meet its emission reduction targets, Te Utanganui could generate a cost saving of $16.5m (at a carbon price of $175/tonne).

[6] Based on Infometrics projected population of the Manawatū-Whanganui region of just under 285,000 and projected households of just over 112,000 in 2035.

[7] Based on Infometrics national population projection of 5.7 million and household projection of 2.1 million by 2035.

Scenario 2: Effect on Manawatū-Whanganui Region

Manawatū-Whanganui Region is estimated to capture 81% of the national **$162 million**. Therefore, the regional impact of scenario 2 totals **$132 million** in 2035. The $132 million corresponds to approximately **$463 per person** and **$1,174 per household** in the Manawatū-Whanganui Region in 2035 as shown in Table 3.[8] These benefits will continue every year from 2035 and will get larger as the local economy gets larger.

Sensitivity analysis

Sensitivity analysis can be used to assess the level of confidence that may be associated with the conclusion of an economic analysis. Sensitivity analysis involves varying key assumptions made in an analysis and observing the impact on the final results. In consultation with CEDA, the sensitivity analysis for the economic impact assessment of Te Utanganui involved varying assumptions about the carbon price in the Emission Trading Scheme and the scope of Te Utanganui activities.

- A lower domestic carbon price of $111/tonne CO_2e was modelled instead of $175/tonne.
- The scope of Te Utanganui was narrowed to focus more on the transport of freight and less on ancillary services such as logistics and warehousing. This entailed a change to the cost structure given in Table 1.

The result of varying both the carbon price and the scope of Te Utanganui activities were very similar to the results of Scenario 1. Lowering the carbon price produced slightly smaller economic benefits as moving more freight by rail is relatively less beneficial if the carbon price is lower. In contrast, narrowing the scope of Te Utanganui activities led to somewhat larger economic benefits as this variation placed greater relative emphasis on rail. The sensitivity analysis is explained in greater detail in Appendix B.

[8] Based on Infometrics projected population of the Manawatū-Whanganui region of just under 285,000 and projected households of just over 112,000 in 2035.

Construction sector capacity

The construction of the KiwiRail Regional Freight Hub, at an estimated cost of $667 million over an estimated five years, is a significant project in the context of the broader Manawatū-Whanganui Region non-residential construction sector and will stretch the capacity of the sector. An expected fall in non-residential construction activity in Manawatū-Whanganui Region from 2023 could create some spare capacity to carry out the Freight Hub construction work. Manawatū-Whanganui Region could also draw on resources from non-residential construction sectors in surrounding regions where activity is also expected to fall away this year or next. However, if there are additional non-residential construction projects in the pipeline any spare capacity could be quickly soaked up.

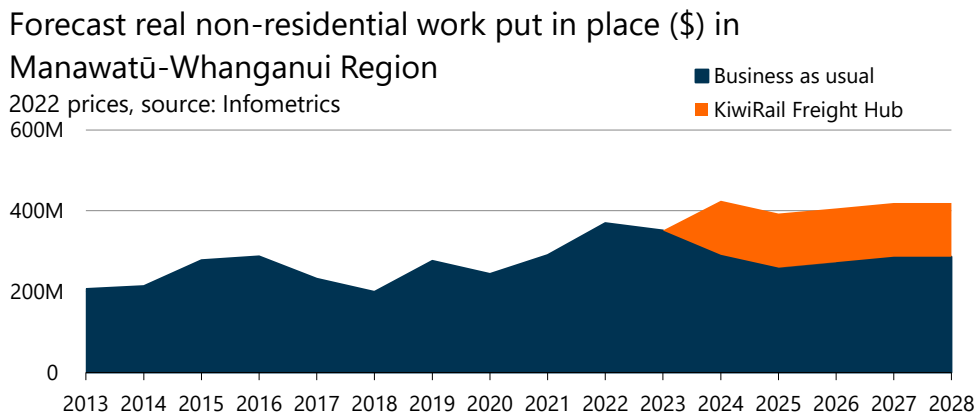
The Regional Ring Road, at an estimated cost of $530 million over an estimated 10 years is a moderately significant project in the context of the broader Manawatū-Whanganui Region infrastructure construction sector. Beginning the Ring Road construction in 2024 would continue the upward trajectory of activity in the region's infrastructure construction sector. Any resulting capacity shortfalls could possibly be filled from the local residential construction sector, in which activity is expected to fall away steeply from 2023 onwards.

The KiwiRail Regional Freight Hub

Based on information provided to us from KiwiRail, we assume that the Regional Freight Hub will cost $667 million to construct over a period of an estimated five years, or $133.4 million per annum. This is a significant project for the regional non-residential construction sector. The annual figure is equivalent to over one-third (36%) of the business-as-usual non-residential construction work that took place in Manawatū-Whanganui Region in 2022.

Chart 1 shows that if construction of the Freight Hub began in 2024, an expected decline in business-as-usual non-residential construction activity would mean that some spare capacity existed in the sector. However, the sheer size of the Freight Hub construction would mean activity would reach an unprecedented high of $425m in 2024, surpassing the recent peak of $369 million in 2022 and the 30-year peak of $400 million (in 2022 prices) in 2008.

Chart 1



Anecdotal feedback from construction sector clients nationwide is that there is relatively little substitution of workers between the non-residential construction sector and the residential and infrastructure construction sectors because non-residential work requires specific skill sets. So, any shortfall in the Manawatū-Whanganui Region non-residential construction sector's capacity is likely to be more readily filled by non-residential construction workers from other regions. Labour market flows data suggests that, nationally, growth in the non-residential construction sector has also been partially met by workers from a wide range of other sectors particularly manufacturing.

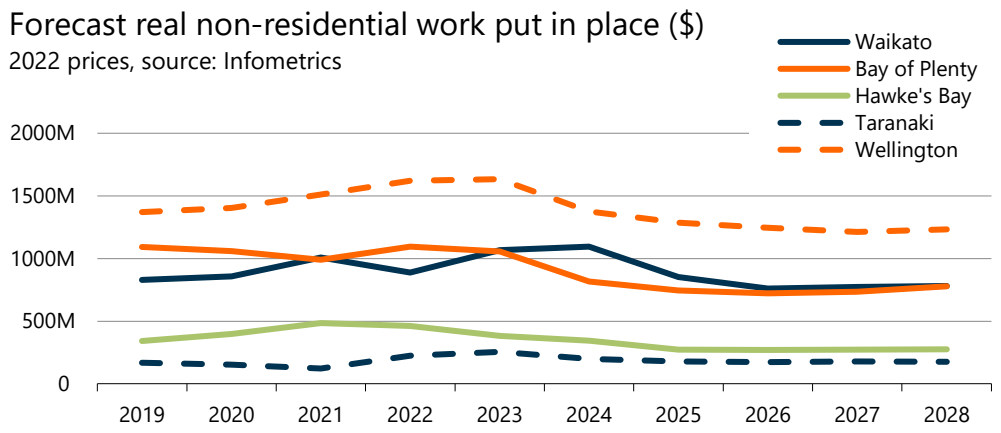
As shown in Chart 2, the Wellington, Hawke's Bay, Bay of Plenty and Waikato Region non-residential construction sectors are expected to experience a downturn in activity in the next five years, which should free up resources for Manawatū-Whanganui Region. Our estimates of the non-residential construction work needed to repair damage made by Cyclone Gabrielle and other adverse weather events are small so should not affect our outlook.

The broader downturn in non-residential activity nationally reflects weaker investment intentions and slower economic growth, particularly between now and 2025.

Migrants could also potentially add to the supply of skilled labour in the non-residential construction sector. But historically this has not been the case. The latest estimates from Stats NZ suggest that net international migration to New Zealand surged to just over 64,000 in the year to March 2023.[9] Infometrics is currently forecasting net migration to settle at around 30,000 to 40,000 per annum from 2025 onwards. Although, this forecast could change as Stats NZ estimates are revised over the next 12 months. However, historically migrants have made up only a small share of the Manawatū-Whanganui Region building construction workforce (an average of 1% between 2012 and 2019).

[9] Source: Stats NZ, International Migration: March 2023, https://www.stats.govt.nz/information-releases/international-migration-march-2023/

Chart 2



Our forecasts of non-residential construction activity do not extend beyond 2028. But we expect Manawatū-Whanganui Region non-residential construction activity to remain relatively subdued for the foreseeable future, which creates a window of opportunity for the Freight Hub construction to begin, assuming construction of other major projects are begun in the meantime.

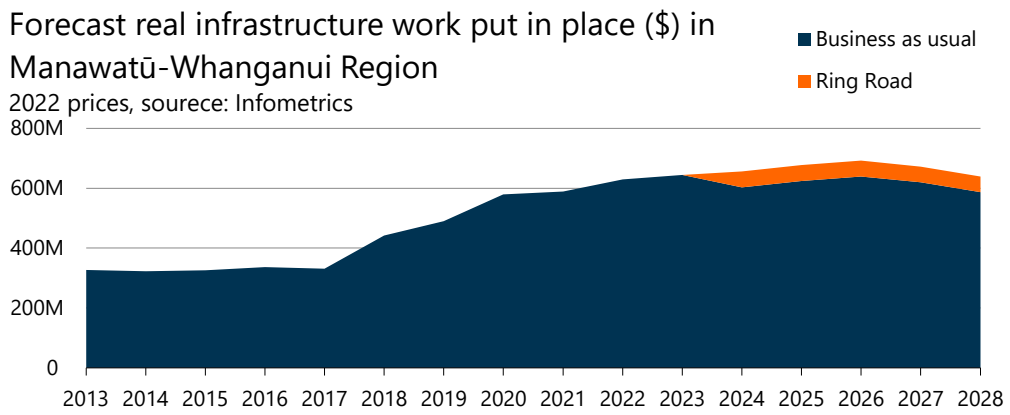
The Regional Freight Ring Road

Based on information provided to us from Palmerston North City Council, we assume that the Regional Freight Ring Road will cost $530 million to construct over a period of an estimated 10 years, or $53 million per annum. This figure includes the Palmerston North Eastern Access, the East/West Access, the Palmerston North SH56 and SH57 connections and various safety improvements projects. The costs are estimated at between $424 million and $636 million. We took the midpoint.

The Ring Road is a moderately significant project for the regional infrastructure construction sector. The annual construction figure of $53 million is equivalent to an estimated 8% of the business-as-usual infrastructure construction work that took place in Manawatū-Whanganui Region in 2022.

As Chart 3 shows, infrastructure construction activity in Manawatū-Whanganui Region has been on an upward trajectory since 2017. Business-as-usual activity is expected to fall away a little in 2024 but remain elevated. Beginning the Ring Road in 2024 would maintain the sector's upward trajectory until 2026 after which we would expect to see activity fall away (assuming no other major infrastructure projects are started between now and then).

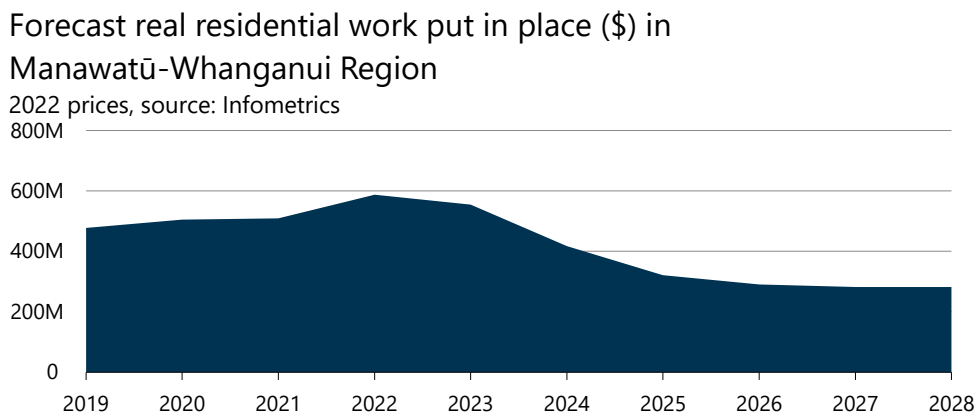
Chart 3



Anecdotal feedback from construction sector clients is that there is a reasonable degree of substitution of workers between the residential construction sector and the infrastructure construction sector because the two sectors require similar skill sets. Therefore, any shortfall in the Manawatū-Whanganui Region infrastructure construction sector's capacity could be filled by residential construction workers from the region.

As Chart 4 shows, high interest rates, high construction costs and falling house prices are expected to cause residential construction activity in Manawatū-Whanganui Region to fall away quickly from this year. With little prospect of residential activity to pick up in the foreseeable future, beginning construction of the Ring Road could be effective in utilising spare capacity in the sector.

Chart 4



Labour market flows data suggests that, nationally, growth in the road and bridge construction sector has also been partially met by workers from a wide range of other sectors such as manufacturing, engineering, logistics and infrastructure operations sectors.

Our estimates of the infrastructure repairs resulting from Cyclone Gabrielle and other adverse weather events are significant, particularly in Hawke's Bay, and are likely to involve five years to compete. This could constrain the infrastructure construction workforce available in Manawatū -Whanganui Region.

Migrants could also potentially add to the supply of skilled labour in the local infrastructure construction sector. However, historically this has not been the case. Between 2012 and 2019, migrants made up just 3% of the heavy and civil engineering and construction workforce in Manawatū -Whanganui Region.

Appendix A: ESSAM Model

The ESSAM (Energy Substitution, Social Accounting Matrix) model is a general equilibrium model of the New Zealand economy. It models the main inter-dependencies in the economy, such as flows of goods from one industry to another, plus the passing on of higher costs in one industry into prices and thence the costs of other industries.

Features

Some of the model's features are:

- 55 industry groups, as detailed in Table 4 below.
- Substitution between inputs into production - labour, capital, materials, energy.
- Four energy types: coal, oil, gas and electricity, between which substitution is also allowed.
- Substitution between goods and services used by households.
- A Social accounting matrix (SAM) for tracking financial flows between households, government, business and the rest of the world.
- Households disaggregated into income quintiles.
- Greenhouse gas (GHG) emissions by fuel type and industry.

The model's output is extremely comprehensive, covering a wide range of macroeconomic and industry variables.

- GDP, private consumption, exports and imports, employment.
- Economic output, employment, and exports across industries.
- For each industry the proportion of supply that originates overseas and the proportion that comes from domestic suppliers.
- The main types of taxes paid by industries and households, and benefits received by households.

Model Structure

Production Functions

These equations determine how much output can be produced with given amounts of inputs. For most industries a two-level standard translog specification is used which distinguishes four factors of production – capital, labour, and materials and energy, with energy split into coal, oil, natural gas and electricity.

Intermediate Demand

A composite commodity is defined which is made up of imperfectly substitutable domestic and imported components - where relevant. The share of each of these components is determined by the elasticity of substitution between them and by relative prices.

Price Determination

The price of industry output is determined by the cost of factor inputs (labour and capital), domestic and imported intermediate inputs, and tax payments (including tariffs). World prices are not affected by New Zealand purchases or sales abroad.

Consumption Expenditure

This is divided into Government Consumption and Private Consumption. For the latter eight household commodity categories are identified, and spending on these is modelled using price and income elasticities in an AIDS framework. An industry by commodity conversion matrix translates the demand for commodities into industry output requirements and also allows import-domestic substitution.

Government Consumption is usually either a fixed proportion of GDP or is set exogenously. Where the budget balance is exogenous, either tax rates or transfer payments are assumed to be endogenous.

Stocks

The industry composition of stock change is set at the base year mix, although variation is permitted in the import-domestic composition. Total stock change is exogenously set as a proportion of GDP, domestic absorption or some similar macroeconomic aggregate.

Investment

Industry investment is related to the rate of capital accumulation over the model's projection period as revealed by demand for capital in the horizon year. Allowance is made for depreciation in a putty-clay model so that capital cannot be reallocated from one industry to another faster than the rate of depreciation in the source industry. Rental rates or the service price of capital (analogous to wage rates for labour) also affect capital formation. Investment by industry of demand is converted into investment by industry of supply using a capital input- output table. Again, import-domestic substitution is possible between sources of supply.

Exports

These are determined from overseas export demand functions in relation to world prices and domestic prices inclusive of possible export subsidies, adjusted by the exchange rate. It is also possible to set export quantities exogenously.

Supply-Demand Identities

Supply-demand balances are required to clear all product markets. Domestic output must equate to the demand stemming from consumption, investment, stocks, exports and intermediate requirements.

Balance of Payments

Receipts from exports plus net capital inflows (or borrowing) must be equal to payments for imports; each item being measured in domestic currency net of subsidies or tariffs.

Factor Market Balance

In cases where total employment of a factor is exogenous, factor price relativities (for wages and rental rates) are usually fixed so that all factor prices adjust equi-proportionally to achieve the set target.

Income-Expenditure Identity

Total expenditure on domestically consumed final demand must be equal to the income generated by labour, capital, taxation, tariffs, and net capital inflows. Similarly, income and expenditure flows must balance between the five sectors identified in the model – business, household, government, foreign and capital.

Input-Output Table

The model is based on Statistics New Zealand's latest input-output table which relates to the year ended March 2020. Input-output tables are an analytical tool for describing the structure of New Zealand's economy. Input-output tables show the relationships between industries, the goods and services they produce, and who uses them.

Industry Classification

The 55 industries identified in the ESSAM model are defined in Table 4. Industries are defined according to the Australian and New Zealand Standard Industrial Classification (ANZSIC06).

Baseline 'Business as usual' Scenario

In the Business as usual (BAU) scenario, the carbon price is $175/tonne CO_2e, consistent with projections by the Climate Change Commission. It is assumed that international emission units can also be bought at that price. In other respects, the BAU is broadly in line with the Commission's pathway projections as follows.

- Methanex and NZAS have ceased operation by 2035 and there is no domestic oil refining.
- Biogenic CH_4 is in the ETS with 95% free allocation, declining linearly at 1%pa to 2030, 2%pa to 2040 and 3%pa to 2050.
- The oil price is US$80/bbl.
- Forestry sequestration is 14,500 Kt.
- There is an emissions target of 42.5Mt. The government does not have annual targets, but 42.5Mt is consistent with its carbon budgets and a trending decline towards net zero for long lived gases by 2050.
- The population and labour force projections equate to Stats NZ's 50th percentile projections.
- Increases in energy efficiency are assumed to be as follows: Coal 2%pa; Gas 1% pa; Oil 1.5% pa; Electricity 1.0% pa.

BAU assumptions that were retained in the two scenarios

In the two scenarios the following are kept at levels that occur in a Business as Usual (BAU) scenario.

1. Wage rates adjust within the model to keep total employment unchanged.

   Any change in the demand for labour is reflected in changes in wage rates, not changes in total employment. This prevents the long run level of total employment being driven more by transport or emissions policies (for example) than by the forces of labour supply and demand, and the skills of the workforce. Over time education and training programmes respond to a different set of market demands so that those entering the labour force acquire the necessary skills.

2. Balance of payment as a percentage of GDP.

   The current account balance is fixed as a percentage of GDP. This means for example that if New Zealand needs to purchase international emissions units to meet an emissions reduction target – such as if there is less sequestration by forestry, that liability cannot be met simply by borrowing more from offshore with indefinitely deferred repayment.

3. Post-tax rate of return on capital. Investment and capital stock.

   The post-tax rate of return on investment is unchanged between scenarios. This acknowledges that New Zealand is part of the international capital market and ensures consistency with the preceding closure rule.

4. Government fiscal balance. The fiscal balance is fixed across scenarios.

   This means for example that if the government needs to purchase overseas emission units it must ensure that it has matching income. If it earns insufficient income from the sale of domestic emission units (because of free allocation for example) it would have to adjust tax rates. Personal income taxation as representee by household effective income tax rates are the default equilibrating mechanism.

Table 4

Industry abbreviations in the ESSAM model

	Abbrev	Description
1	HFRG	Horticulture and fruit growing
2	SBLC	Sheep, beef, livestock and cropping
3	DAIF	Dairy and cattle farming
4	OTHF	Other farming
5	SAHF	Services to agriculture, hunting and trapping
6	FOLO	Forestry and logging
7	FISH	Fishing
8	COAL	Coal mining
9	OIGA	Oil and gas extraction, production & distribution
10	OMIN	Other Mining and quarrying
11	MEAT	Meat manufacturing
12	DAIR	Dairy manufacturing
13	OFOD	Other food manufacturing
14	BEVT	Beverage, malt and tobacco manufacturing
15	TCFL	Textiles and apparel manufacturing
16	WOOD	Wood product manufacturing
17	PAPR	Paper and paper product manufacturing
18	PRNT	Printing, publishing and recorded media
19	PETR	Petroleum refining, product manufacturing
20	CHEM	Other industrial chemical manufacturing
21	FERT	Fertiliser
22	RBPL	Rubber, plastic and other chemical product manufacturing
23	NMMP	Non-metallic mineral product manufacturing
24	BASM	Basic metal manufacturing
25	FABM	Structural, sheet and fabricated metal product manufacturing
26	MAEQ	Machinery and other equipment manufacturing
27	OMFG	Furniture and other manufacturing
28	EGEN	Electricity generation
29	EDIS	Electricity transmission and distribution
30	WATS	Water supply
31	WAST	Sewerage, drainage and waste disposal services
32	CONS	Construction
33	TRDE	Wholesale and retail trade
34	ACCR	Accommodation, restaurants and bars
35	ROAD	Road transport
36	RAIL	Rail transport
37	WATR	Water transport
38	AIRS	Air Transport
39	TRNS	Transport services
40	PUBI	Publication and broadcasting
41	COMM	Communication services
42	FIIN	Finance and insurance
43	HIRE	Hiring and rental services
44	REES	Real estate services
45	OWND	Ownership of owner-occupied dwellings
46	SPBS	Scientific research and computer services
47	OBUS	Other business services
48	GOVC	Central government administration and defence
49	GOVL	Local government administration
50	SCHL	Pre-school, primary and secondary education
51	OEDU	Other education
52	MEDC	Medical and care services
53	CULT	Cultural and recreational services
54	REPM	Repairs and maintenance
55	PERS	Personal services

Source: Infometrics

Appendix B: Sensitivity analysis

Two sensitivity tests were carried out to investigate the robustness of the modelling results for Scenario 1.

A lower carbon price

The carbon price in New Zealand is set at $111/tonne CO_2e, which adjusts the $175/tonne used in Scenario 1 by approximately the same percentage that the current ETS price has dropped below its 2022 maximum. The world price at which New Zealand can purchase (or sell) international emission units is kept at $175/tonne. We assume no substitutability or arbitrage between New Zealand ETS units and international units (businesses can't buy a carbon credit in New Zealand for $111/tonne CO_2e and sell it on the international market for $175/tonne).

As this is a sensitivity test with regard to the effect of the carbon price, the BAU is also re-run with the lower carbon price. Not doing that would confound the effects of Te Utanganui with the effects of a different carbon price, with the latter likely to be considerably larger.

A narrower scope of Te Utanganui activities (cost structure)

This sensitivity test is another variation on Scenario 1 which assumes a less ambitious Te Utanganui development that emphasises the transport of freight with a diminished role for ancillary services. This test requires an alteration in the cost structure of the TUSI industry shown in Table 1. The share associated with postal, transport support services and warehousing is reduced from 50% to 25% (pro rata for the sub-categories). The difference is reallocated to the road, rail, and air categories – again pro rata. Commensurately, the 3% assumed for the regional share of transport support services and warehousing is also halved. The narrower cost structure is compared with the original cost structure in Table 5.

Table 5

TUSI cost structure under narrowed Te Utanganui scope sensitivity test

	Industry	Weight	
		Original	Narrow
ROAD	Road transport	10%	15%
RAIL	Rail transport	30%	45%
AIRS	Air transport	10%	15%
POST	Postal & courier	10%	5%
TRNS	Transport support services	20%	10%
WHST	Warehousing & storage	20%	10%

Source: Infometrics

Table 6 shows the results of the sensitivity tests. The benefits under a lower carbon price are very similar to those in Scenario 1, but overall are slightly smaller.

Table 6

National economic impact of Te Utanganui sensitivity test results

	Scenario 1		Lower carbon price		Narrower Te Utanganui scope	
	% change per annum on BAU	Additional benefits ($m) on BAU in 2035	% change per annum on BAU	Additional benefits ($m) on BAU in 2035	% change per annum on BAU	Additional benefits ($m) on BAU in 2035
Private consumption	0.04%	94	0.04%	94	0.04%	100
Gross investment	0.03%	29	0.03%	30	0.03%	30
Exports	0.03%	32	0.02%	25	0.06%	73
Imports	0.03%	34	0%	31	0.05%	56
GDP	0.03%	122	0.03%	116	0.03%	147
Real wage rates	0.06%		0.05%		0.06%	
Gross CO_2e	-0.14%		-0.16%		-0.12%	
Transport CO_2e	-0.82%		-0.86%		-0.77%	

Source: Infometrics

Although the model is not inherently linear, we can infer that an increase in the domestic carbon price by the same amount (to around $240/tonne) would have roughly symmetrical effects in the opposite direction.

Looking at a narrower Te Utanganui scope, benefits are slightly larger compared with Scenario 1, suggesting that the main competitive advantage of Te Utanganui is in actual transport services, especially in securing a switch of freight movement from road to rail. We should caution, however, that in reality the ancillary transport services of warehousing and logistics etc may well be necessary for the full success of the development.