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Dear Chris

We are delighted to attach our final report entitled 'A clean economy vision for New Zealand in 2025' – the fulfilment of our agreed contract, dated 22 April 2009. Please note our restrictions and disclaimers on the contents page.

This report is the culmination of our research into the clean economy. We were asked to articulate what a clean economy vision might look like for New Zealand in 2025. This included the economic repercussions of such a vision. We were also asked to identify the drivers that might propel New Zealand towards developing its own economic vision. Expert views were sought to provide substance and an independent opinion.

Many thanks for the opportunity to undertake this project. It was good to work with you and the other experts on a vision for a clean economy.

Yours sincerely

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A clean economy vision for New Zealand in 2025

New Zealand Trade and Enterprise

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Disclaimer

This report has been prepared by PricewaterhouseCoopers for the Centre for New Zealand Trade and Enterprise (NZTE). The report is a discussion document and is provided in accordance with the terms and conditions of the contract dated 22 April 2009. It is a discussion document containing hypothetical situations that could arise should New Zealand decide to pursue a clean economy future.

In preparing this report and forming our views, we have relied upon, and assumed the accuracy and completeness of all information available to us from persons with whom we have spoken in the course of consultation, or from public sources, or furnished to us by NZTE. We have evaluated that information through analysis, inquiry and review but have not sought to verify the accuracy or completeness of any such information. We have assumed the accuracy of the information provided to us by other entities. We have not sought to independently verify this data. Neither PricewaterhouseCoopers nor its partners, employees or agents, accept any responsibility or liability for any such information being inaccurate, incomplete, unreliable or not soundly based, or for any errors in the analysis, statements and opinions provided in this Report resulting directly or indirectly from any such circumstances, or from any assumptions upon which this Report is based proving unjustified. We will not accept responsibility to any other party other than to NZTE, to whom our report is addressed, unless specifically stated to the contrary by us in writing. We will accept no responsibility for any reliance that may be placed on our report should it be used for any purpose other than that for which it is prepared. A list of documents relied on is attached. We reserve the right, but are under no obligation, to revise or amend our report if any additional information (particularly as regards the assumptions we have relied upon) which exists on the date of our report, but was not drawn to our attention during its preparation, subsequently comes to light.

Executive summary

New Zealand's declining economic position relative to other Organisation for Economic Co-operation and Development (OECD) countries has long been a subject for debate.

Even though New Zealanders rate quality of life, quality of the environment and social values (amongst others) as of high importance, the gradual, long term decline of New Zealand's economic position is of growing concern. To achieve the kind of economic prosperity that does not compromise New Zealand's healthy environment, that supports a diverse and vibrant population, and has transparent and accountable social norms and institutions, a step change is needed in New Zealand.

This report puts forward the hypothesis that if New Zealand adopts an economic vision that places these issues centrally, it has the potential to reverse the relative downward economic trend New Zealand is experiencing.

This report considers the current cleantech sector and economy, future projections for the cleantech sector and compiles the views of five leading experts on the elements of a clean economy. It also presents them, with other facts and figures, as an opportunity for discussion. Brief biographies of the five experts confirm their credentials:

- Professor Paul T. Callaghan is the Alan MacDiarmid Professor of Physical Sciences at the University of Victoria, is co-founder of the high-tech start-up company Magritek and is a principal companion of the New Zealand Order of Merit.
- At the University of Auckland, Dr Manuka Henare is a Senior Lecturer in Māori Business Development, Māori and Pacific Development Associate Dean, Mira Szászy Research Centre founder and Director, Huanga Māori Masters Programme Co-ordinator. He is also a board member of the Environmental Risk Management Authority ERMA and Chair of its Audit and Risk Committee.

- John Allen held a position as Chief Executive at New Zealand Post from 1996 to 2009 where he saw the State Owned Enterprise diversify into Kiwibank, Express Couriers and Datamail.
- Dr. Keith Turner was the Chief Executive Officer of the New Zealand electricity company Meridian until 2008 and has been a director of the Auckland International Airport from 2004.
- Dr. Alex Malahoff is the Chief Executive Officer of GNS Science which is the leading supplier of earth and nuclear scientific research and is Chairman of Science New Zealand.

There are numerous global drivers that lend weight to the need for a new economic vision. These include worldwide understanding of the challenges in responding rapidly to climate change, a desire for increased efficiency in resource use and a longer term approach to the economy. "In a world moving to cut carbon emissions, foreign direct investment will start to shift towards low-carbon energy grids and low-carbon economies."¹

New Zealand has many comparative advantages – a sustainable reputation based on the foundations of clean and green, low population density placing less pressure on the environment, renewable energy, abundant water, an isolated geography making it ideal as a test market, a 'can-do' attitude enabling an innovative approach and a stable business environment with few barriers to trade.

Many of these advantages need attention - the 'clean, green' image needs authenticity, less pressure on the environment does not equate to no pressure, and isolated can also mean insular. Building on these to create a new economic vision for New Zealand, that of a clean economy, is not a significant leap in imagination. Embedding a clean economy does, however, require commitment to drive the associated strategic change.

"Key elements in which New Zealanders need to be actively engaged are: the environment; the thinking and debate emerging in world structures and clear consideration of the trade agenda; and the thinking, science and education which underpins creative new technologies, industries and opportunities."

John Allen

A clean economy is one of wealth creation based on five foundations (clean energy, clean transport, clean industry, clean agriculture and clean

¹ McNeil, B. *The Clean Industrial Revolution. Growing Australian prosperity in a greenhouse age.* 2009, Allen & Unwin, Australia, p62.

environment) and values that are important to New Zealanders namely quality of life, quality of the environment and social equity. It involves the development, commercialisation and deployment of clean technologies, and smart thinking to transform existing export sectors and create dynamic new ones.²

Clean energy refers to the exploitation of existing renewable energy sources, the development and use of new renewable energy sources and the use of technologies that support the more efficient utilisation of and/or the clean up of existing energy sources.

The development of efficient, integrated, smart mobility systems is the cornerstone of clean transportation. This might be in the form of a smart grid for electric cars that also supplies domestic energy systems, and the development of an integrated public transport system in larger urban areas. It will also mean smart logistics and efficient distribution systems allowing New Zealand to compete with other world class systems.

Clean industry will rely on clean energy and the development of smart materials processing, New Zealand's brand and the new, clean and efficient transportation options available to transport goods. Also necessary will be global thinking on technological opportunities and New Zealand's investment in human capital to be able to develop talented individuals.

New Zealand's future is strongly tied to agriculture. To remain internationally competitive, clean agriculture will be the pre-requisite. The efficient running of businesses, research into cleaner and more sustainable agri-opportunities and the development of world class solutions to dairy emissions will define New Zealand's agriculture sector.

A clean environment is the bedrock of having a 'clean, green' image. It supports all aspects of a clean economy and needs to be fundamentally central to New Zealand's strategic direction. Investment in solutions to healthy soils, good air quality, rich pasture, clean water and pristine wilderness are part of New Zealand's life cycle approach to resources.

"Transformation to a clean economy will provide us with a competitive advantage globally."

Keith Turner

The vision proposed is multi-faceted - New Zealand's future could be to globally offer low carbon intensity high value goods and services, produced from renewable energy sources and resource efficient processes. A UK study expects the low carbon and environmental goods and services (LCEGS) market to grow by an average of over 4.5% per annum, or a cumulative growth rate of 45% over the next seven years to 2015. Highest growth is expected in the renewables energy sector at a cumulative 63% over the 2008-2015 period.³

New Zealand's investment in world class infrastructure will attract foreign direct investment of a sustainable nature. The business climate will support the incubation of clean technologies and their international commercialisation. This will lead to increased economic prosperity for all New Zealanders. In other words, the choice and opportunities that are consistent with clean industry and a clean environment are also consistent with galvanising a more productive economy.

The global opportunities inherent in creating a clean economy are almost limitless. New Zealand's challenge will be investment in science and technology, particularly cleantech, and the identification of opportunities to meet global demand but also allow New Zealand to differentiate in the marketplace and add real economic value. Competition for attention and funds is fierce. By building on existing capabilities (for example in the dairy sector), developing deeper skills (for example, in the area of commercialisation) and being ambitious enough to reach a worldwide market, New Zealand can capitalise on these opportunities by adding value.

Another challenge will be the cultural shift to de-couple the link in New Zealanders minds that equates economic prosperity with environmental degradation. One does not necessarily lead to the other.

Finally, New Zealand needs to show leadership. Rather than shying away from the opportunities that are presented by the global shift in priorities, New Zealand needs to recognise and embrace them, and turn them to competitive advantage, based on New Zealand's existing strengths and on sustainable values. The central tenet of the clean economy is that a country the size and nature of New Zealand, with the range of advantages

² Investment New Zealand, Chris Mulcare, 2009.

³ *Innovas Report*, commissioned by the Department for Business Enterprise and Regulatory Reform, UK Government, March 2009, United Kingdom.

and resources it has to leverage, should be thinking in terms of opportunity size, not cost, as the world moves towards a low carbon future.

This report suggests the reality of a clean economy vision for New Zealand in 2025. It provides a flavour of what the vision might look like, the constituent elements that will be needed as the foundation, and it presents a new way of measuring the value of the economy in 2025. Punctuated with expert views, this report provokes consideration of a new vision and suggests national debate to identify a planned goal for New Zealanders to strive towards. It does not, however, present a comprehensive bottom-up vision that should be universally adopted.

“We need smart marketers and entrepreneurs who understand market operations, skills and also products. We need to have a blending of scientific, engineering and business entrepreneurship rather than the separate spheres that these three disciplines often operate in.”

Paul Callaghan

It does also suggest the need to identify the gaps between New Zealand’s current position and that of a clean economy vision. Once this gap analysis has been conducted, a strategy to attain the agreed economic vision can be determined with practical actions, an agreed timescale and measurable goals.

“It is critical to show New Zealanders how the vision can be broken down. Specifically, it would need to indicate what will happen in three, five, ten years etc. It is one thing to be enthusiastic but a lack of business engagement will mean the vision is not taken up.”

John Allen

Introduction

In the midst of a global recession and a worldwide focus on achieving economic stability, it is only natural that countries are considering the future positions of their economies.

A clean economy can be defined as one of wealth creation that is based on five foundations (clean energy, clean transport, clean industry, clean agriculture and clean environment) and values that are important to New Zealanders (such as quality of life, quality of the environment and social equity). It involves the development, commercialisation and deployment of clean technologies (commonly known as cleantech), and smart thinking to transform existing export sectors and create dynamic new ones.⁴

This short report is designed to provoke discussion within New Zealand Trade and Enterprise (NZTE) as to New Zealand's economic future. Does New Zealand need a new economic vision? What might a clean economy vision look like? What are the elements that will shape it? What is global sentiment and how might that impact New Zealand in the future? Is New Zealand ready to recognise the changes necessary? Is New Zealand prepared to take action? How will the clean economy be measured?

“The clean economy would lift prosperity, infrastructure and schools. It will preserve the environment and avoid unnecessary consumption of resources.”

Paul Callaghan

A question New Zealanders need to ask themselves is ‘what is our place in a rapidly changing world that is resource constrained and carbon restraining?’ Countries that de-carbonise their economies the quickest and develop the technologies to do so, will be the most prosperous in the 21st Century.

A time for self-scrutiny and clear, hard thinking about short-term survival is necessary. However, short-term survival and long-term viability are two sides to the same coin. A discussion of New Zealand's economic

framework and future leads to the more fundamental question ‘where is New Zealand headed in the long term’?

A vision of a clean economy is an opportunity for New Zealand to re-think economic strategy alongside social equity, cultural capacity and environmental capital. A clean economy vision is also aided by the fact that New Zealand already possesses many of the foundation blocks, to be discussed throughout the report.

“Unless we get a good view of what is possible for New Zealand, we will continue to dissipate energy and activity in minor matters.”

John Allen

By comparing past economic indicators for New Zealand with current, and through engagement with a number of experts⁵, it becomes clear that the health of the New Zealand economy requires attention. New Zealand's place in the world has changed, not only in the last 18 months as a result of recessionary pressures, but over the last 37 years. Then, New Zealand ranked 4th in the OECD measure of Gross Domestic Product (GDP) per capita, relatively slow growth has seen New Zealand's position fall to 22nd out of 30.⁶

With a lack of investment in science and technology⁷, and an over-reliance on a less than authentic ‘clean, green’ image, New Zealand requires an economic transformation in order to regain the prosperity and global position it has in the past enjoyed.

“New Zealanders choose to be poor. We believe that we have a clean economy and a clean green image, and do not see the lack of honesty which surrounds this branding. We are merely a small population spread over a large area which provides an impression of clean and green.”

Paul Callaghan

One of the critical drivers influencing a clean economy is the need for it to be underpinned with clean technology. With a global market of US\$284 billion, projected to increase to over US\$1.3 trillion in 2017⁸, the clean technology sector is an opportunity for New Zealand to broaden its economic focus.

⁵ Alexander Malahoff, John Allen, Keith Turner, Manuka Henare, Paul Callaghan.

⁶ OECD Factbook 2009: Economic, Environmental and Social Statistics, OECD, 2009.

⁷ Science community fading, says PM's adviser, <www.nzherald.co.nz>, extracted 17 July 2009.

⁸ Cleantech: Current Status and Worldwide Outlook, Fuji-Keizai, USA, Inc 2008, executive summary accessed through <Reportlinker.com>.

⁴ In agreeing the parameters of this report, this definition was provided by Chris Mulcare, Investment New Zealand, NZTE, 2009.

Whilst only a portion of the cleantech opportunity, many world governments have recently committed to significant stimulus packages that combine a focus on economic stability, climate change and job creation. These investments are being made into low carbon technologies and environmental goods and services (LCEGS).

New Zealand is in a unique position to capitalise on this growth with an existing clean, green reputation, a 65% renewable electricity profile⁹ and a strong kiwi “can-do” culture. Economic transformation can be achieved for New Zealand by applying its reputation and strengths to these emerging low carbon and cleantech opportunities.

“Fostering clean technological innovation and a low-carbon economy cannot be initiated from market forces alone because, for the time being, the market doesn’t account for the cost of carbon emissions or the inevitable longer-term transition beyond fossil fuels.”¹⁰

“The new global market in low-carbon technologies will be worth trillions of dollars and making our economy carbon trim rather than obese will not only benefit the environment, but is imperative for our long-term prosperity.”¹¹

To benefit from New Zealand’s advantages in capturing these opportunities, the nation needs to ensure its brand is authentic, has requisite commercialisation skills and fosters strategic partnerships. Through developing a better understanding of global markets and growth, New Zealand businesses will need to become more dynamic in attracting foreign direct investment (FDI), identifying revenue opportunities and developing a stronger partnership response. To aim for a prosperous and sustainable clean economy, New Zealand could develop a vision that is held and grown by consensus across government, business and civil society.

“A vision is a distant goal and without vision we will never take steps to achieve the outcomes we may desire. But we need a ladder and clear steps to give us direction on how to realise this vision.”

Keith Turner

⁹ New Zealand Energy Data File, 2008 Calendar Year Edition, Ministry of Economic Development

¹⁰ McNeil, B. *The Clean Industrial Revolution. Growing Australian prosperity in a greenhouse age.* 2009, Allen & Unwin, Australia, p6.

¹¹ McNeil, B. *The Clean Industrial Revolution. Growing Australian prosperity in a greenhouse age.* 2009, Allen & Unwin, Australia, p7.

Purpose and Brief

This report has been prepared by PricewaterhouseCoopers together with Investment New Zealand. It is designed to put forward a vision for a clean economy for New Zealand in 2025.

Specifically this includes:

- An articulated clean economy vision and a measurable goal for New Zealand in 2025 incorporating
 - High level economic analysis and growth projections
 - Cleantech and clean economy opportunities
 - Views of key stakeholders
- International research into global and corporate strategies supporting a clean economy

The main tenet of the report is the vision. The report therefore includes hypothetical scenarios that could be used to guide a clean economy vision, based on assumed decision-making in the short-term. These scenarios are also based on existing data and existing world responses to global drivers. As agreed in formulating the brief, the vision has not been created using a bottom-up approach. The next phase in realising a vision will require further and rigorous analysis to be made of the potential opportunities. This vision should only be taken as a suggestion and is not in any way designed to be complete. The task of fully designing a clean economy vision lies with those government officials, businesses and community groups that take inspiration from this short report, and decide to fully investigate and articulate the opportunities.

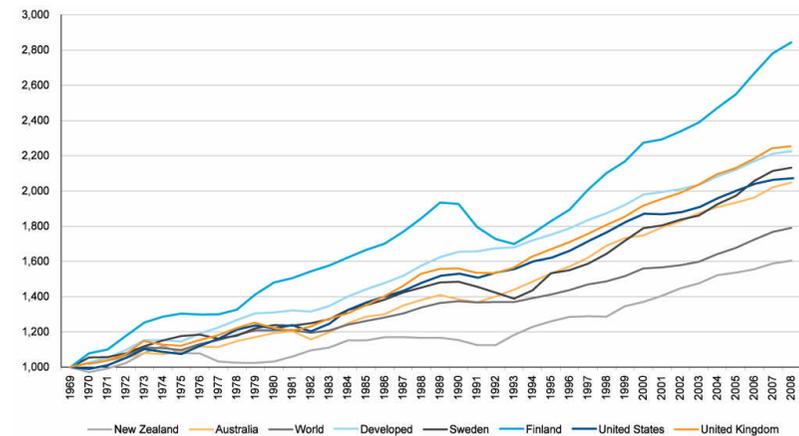
Hypothetical scenarios have been prepared based on the views of experts, and also based on existing literature which, because they are future looking, are not able to be independently verified. Inevitably, some assumptions may not materialise and unanticipated events and circumstances are likely to occur. Therefore, actual results in the future will vary from the scenarios produced in the document. These variations may be material.

New Zealand's current economic position

Understanding New Zealand's current position, relative to global trading partners, is important in the process of developing a future vision. It provides a baseline from which to measure change and, while it identifies New Zealand's achievements, it also demonstrates the gaps that require attention.

Compared to prior decades, New Zealand has experienced strong economic growth in the decade to 2008. This was primarily led by higher world prices for the goods and services it produced, but also from stronger demand due to world economic growth and, in particular, demand from the rising middle class in developing countries. However, by comparison to other OECD countries, New Zealand's performance has been relatively poor. Figure 1 depicts the GDP per capita growth of New Zealand and a sample of other countries from a common 1969 starting point to 2008.

Figure 1: International economic comparison GDP per capita growth paths (1969-2008)



Source:

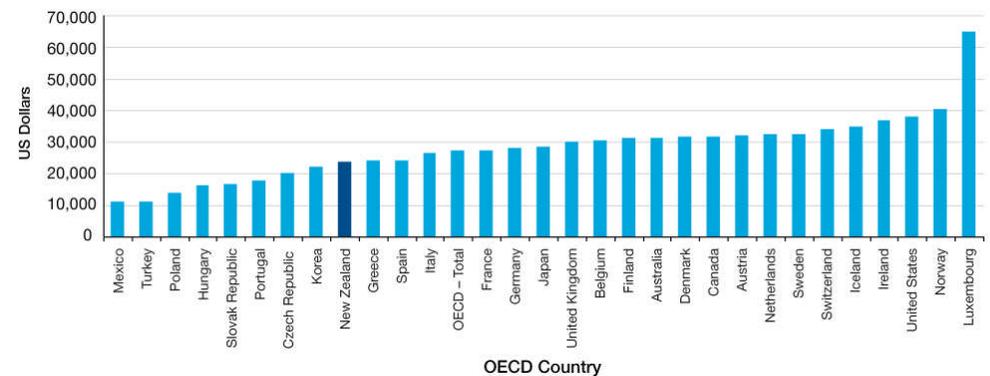
United States Department of Agriculture: Economics Research Service, <www.ers.usda.gov/Data/Macroeconomics/>, extracted June 2009.

New Zealand has managed 60% growth over the period while, by comparison, Finland has increased its GDP per capita by 280%.

“Whichever metric you look at, the curve looks the same over the longer term, it goes downhill. It might oscillate between one commodity spike and the next, but the pattern is the same. Are we in economic crisis? New Zealand's crisis is that we do not know or readily recognise that we are in crisis. We are the slow-boiling frog of the OECD.”¹²

Further economic measurements of New Zealand, as compared to other OECD countries, are real incomes per person (GDP per capita) and how fast it grows (GDP per capita growth). The GDP per capita for 2007 is shown below in Figure 2, where New Zealand is ranked 22nd out of 30 OECD countries. In 1970 New Zealand ranked 9th in this measurement.¹³ The steady decline in relative prosperity over time¹⁴ is partly due to the shift in terms of trade where world prices for New Zealand's exports have declined relative to the prices for New Zealand's imports. Also contributing to the decline are productivity issues which have recently prompted the New Zealand Government to initiate a '2025 Taskforce'¹⁵. Productivity issues are addressed later in this section.

Figure 2: Comparison among OECD countries GDP per capita (constant prices) 2007



Source: OECD Stat Extracts, <http://stats.oecd.org/Index.aspx?datasetcode=SNA_TABLE1>, OECD 2009.

12 Chris Mulcare, New Zealand Trade & Enterprise, 2009.

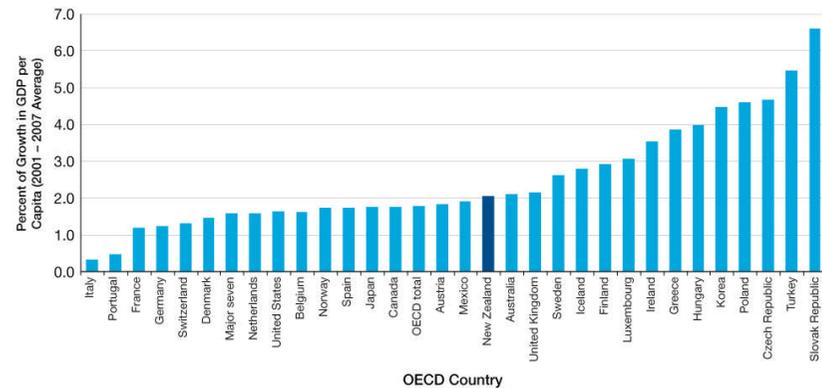
13 Mawson, P. *Measuring Economic Growth in New Zealand*, New Zealand Treasury Working Paper 02/15, September 2002

14 Easton, B., *In Stormy Seas: The Post-war New Zealand Economy*, University of Otago Press, 1997, New Zealand.

15 2025 Taskforce to be established. Rodney Hide. www.beehive.govt.nz. 21 July 2009.

New Zealand's growth in income per capita is ranked 15th out of 30 OECD countries (Figure 3). However, New Zealand's economic growth has been insufficient to move the economy up the OECD rankings in terms of national income per capita, and is unlikely to do so in the foreseeable future.

Figure 3: Comparison among OECD countries of growth in per capita incomes (GDP per capita in constant dollars)



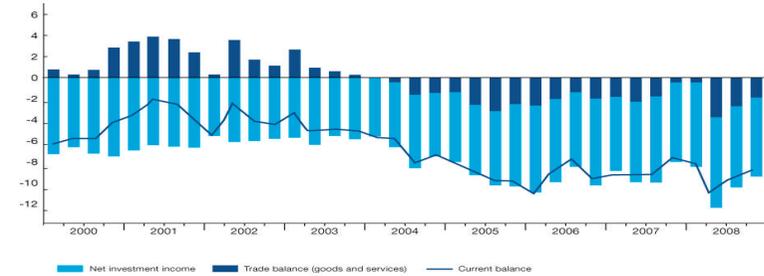
Source: *OECD Factbook 2009: Economic, Environmental and Social Statistics*, OECD, 2009.

Recent economic growth has also exacerbated macroeconomic imbalances in the New Zealand economy, such as the increasing current account deficit¹⁶ as percentage of GDP and a negative net international investment position¹⁷ as a percentage of GDP. Figures 4 and 5 demonstrate the movement in these economic indicators.

¹⁶ this refers to New Zealanders consuming more imports than what are exported.

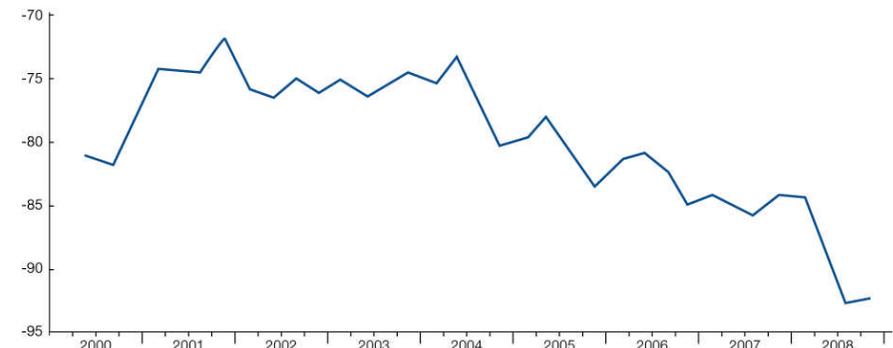
¹⁷ this refers to New Zealanders holding less financial assets overseas than foreigners holding assets in New Zealand.

Figure 4: Current account per cent GDP (spending measure)



Source: *OECD Economic Surveys New Zealand*, OECD, April 2009, p22.

Figure 5: Net international investment position as a percentage of GDP



Source: *OECD Economic Surveys New Zealand*, OECD, April 2009, p22.

As the global economic crisis hit, New Zealand's economic fortunes have reversed rapidly, as recognised by New Zealand's Minister of Finance, Bill English, "*There were some serious imbalances*" in the economy, expressing primary concern for the struggling export sector, "*Our tradeables index (goods produced for international markets) has dropped around 5% in those six years (2003-2009), while non-tradeables (goods produced for domestic consumption only) grew by 18%.*"¹⁸

¹⁸ NZ Herald article on the Minister of Finance's address to the Herald's Mood of the Boardroom breakfast 14 July 2009.

“The global crisis is hitting New Zealand, at a time when a difficult domestic adjustment is underway. Its economy is among the most indebted in the OECD. Falling asset prices and a slump in credit demand mean that a process of debt reduction has started. Nevertheless, persistent, large current-account deficits and a high external debt render the economy especially vulnerable in the face of the ongoing global financial and demand shocks....”¹⁹

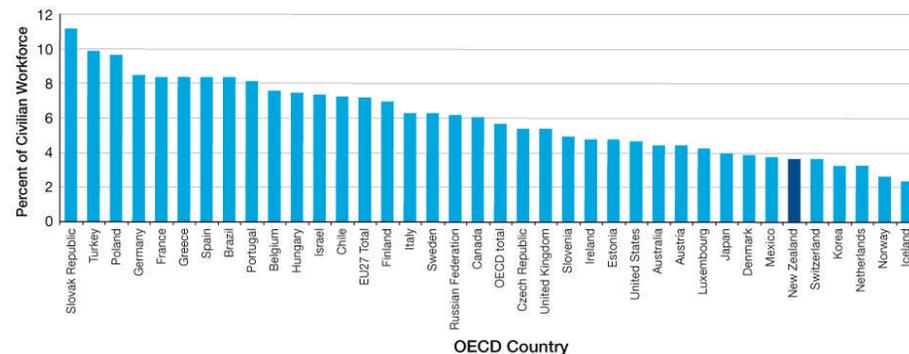
The above weaknesses, while concerning, do not mean that the New Zealand economy lacks strength. It has gone through a long period of structural reforms that have led to more efficiencies, with growth over the last two decades delivering significant employment gains. Over that period, successive governments reformed the country’s institutional environment through deregulation and the opening of the economy to the rest of the world. These reforms served to make the economy more flexible and dynamic.

As a result, New Zealand entered the economic recession with low unemployment rates in relation to both OECD countries but also in relation to New Zealand’s historical performance.

recent events is more orderly and less painful than past recessions. Until recently, New Zealand had run strong budget surpluses which have been applied to repaying debt and pre-funding New Zealand Superannuation liabilities. This has given New Zealand a robust fiscal position that has enabled the Government to run expansionary fiscal policy to take the sharp edges of the recession. Similarly, monetary policy is providing significant stimulus.

New Zealand’s key economic challenge is addressing productivity levels. From a productivity point of view, New Zealand is regarded as a low performer as much less value is generated per capita, compared to other OECD countries. This persistent low labour productivity is related to economic geography (distance to market) as well as structural policy factors (such as a tax system that favours investment in housing).

Figure 6: Unemployment rates 2007



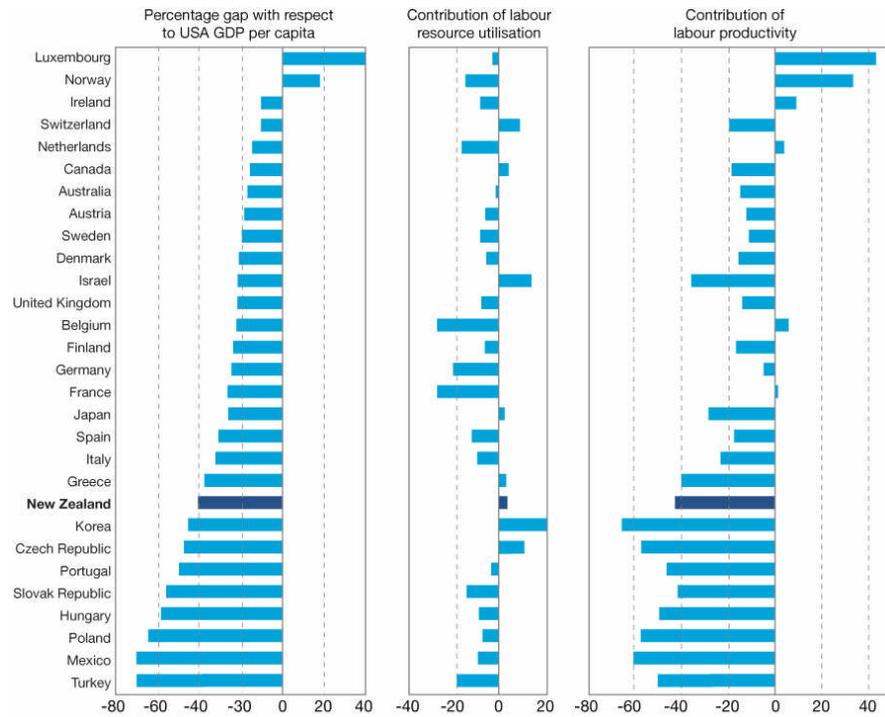
Source: OECD Factbook 2009: Economic, Environmental and Social Statistics, OECD, 2009.

In addition, a floating exchange rate regime and a sound fiscal and monetary policy framework²⁰ have meant that the economic adjustment to

¹⁹ OECD Economic Surveys New Zealand, OECD, April 2009.

²⁰ Growth through innovation: Economic Development Indicators 2005. Ministry for Economic Development, 2005, New Zealand.

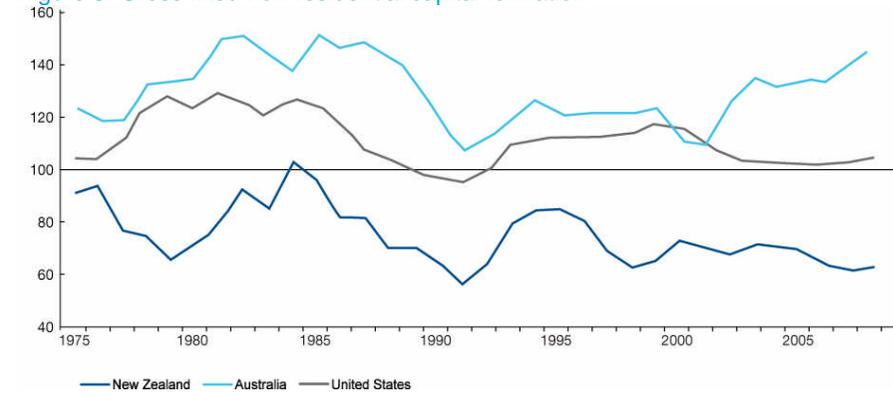
Figure 7: The source of real income differences 2007



Source: *OECD Economic Surveys New Zealand*, OECD, April 2009, p55.

On a purchasing power parity adjusted basis²¹, investment per worker was only 63% of the OECD average in 2008. This was significantly less than Australia whose rate of investment per worker was more than twice New Zealand's (Figure 8).

Figure 8: Gross fixed non-residential capital formation

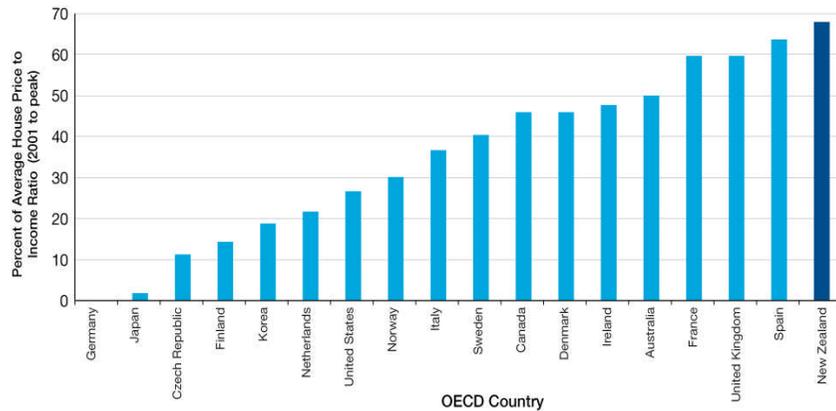


Source: *OECD Economic Surveys New Zealand*, OECD, April 2009, p55.

The OECD suggests that New Zealand has strong impediments to both capital deepening and to multifactor productivity growth which are both key drivers of labour productivity growth. These include macroeconomic imbalances which have seen significant resource allocation to the non-tradables sector (such as housing investment) and low domestic savings. A key question is the cause of these imbalances. In the absence of sufficient high value jobs, households may be making rational choice to prioritise housing investment and may lack disposable income for higher savings. A more productive economy would produce higher overall disposable incomes, free up cash for savings and investment, as well as home ownership. Figure 9 illustrates the relative cost of housing compared to other countries, and why investment in this requires significant resource allocation.

²¹ Purchasing power parity adjustments allow for comparisons on the same basis of what goods and services can be purchased in different countries.

Figure 9: Cumulative increase in the average house price to income ratio for selected OECD countries



Source: *OECD Economic Surveys New Zealand*, OECD, April 2009.

There is a consensus amongst the OECD²², the New Zealand government and the New Zealand Institute²³, that the small size and remoteness of the New Zealand economy can diminish its access to world markets, the scale and efficiency of domestic businesses, the level of competition and access to the world's technology frontier.

The OECD concludes that *"This points to the need for a 'New Zealand policy advantage', that is a set of structural policies attractive and welcoming enough to overcome the geographical handicap and attract the drivers of prosperity – investment, skills and ideas – to New Zealand."*²⁴

Geographic isolation coupled with distance from traditional markets such as Europe, and newer markets such as the United States and Asia, makes transportation critical to import and exporting businesses. Distance can also be a barrier for tourists to reach New Zealand.

The combination of small population size and remoteness is highly unusual – no other OECD country member has such a striking combination. This helps explain that while New Zealand ranks consistently high on openness to trade criteria, our trade in goods and

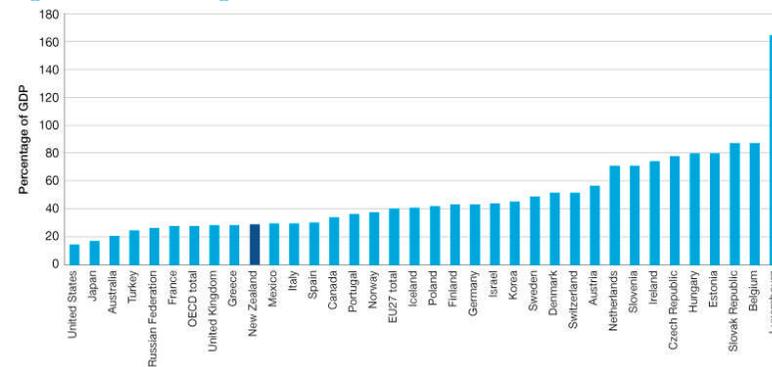
22 *OECD Economic Surveys New Zealand*, OECD, April 2009.

23 Boven, D., and Skilling, D., *So far yet so close: Connecting New Zealand to the global economy*, The New Zealand Institute, March 2007, New Zealand.

24 *OECD Economic Surveys New Zealand*, OECD, April 2009.

services as a percentage of GDP is low compared to other OECD countries.

Figure 10: Trade in goods and services



Source: *OECD Factbook 2009: Economic, Environmental and Social Statistics*, OECD, 2009.

Empirical evidence based on a study by Nicoletti et al, demonstrates that a 10% increase in distance reduces trade by around 10% and this effect has not diminished over the last 30 years.²⁵ Similarly, foreign direct investment is also found to be sensitive to distance.²⁶ Recent OECD research on economic geography confirms that economic geography factors account for a large part of the prosperity gap. This research has generated estimates that New Zealand's distance to markets has reduced its GDP per capita by around 10%.²⁷

The domestic economy is reliant on a few key economic sectors that are in turn reliant on New Zealand's natural capital, to earn external income through exports. The agriculture, horticulture, forestry, mining and fishing industries play a fundamentally important role in New Zealand's economy, particularly in the export sector and employment. Overall, the primary sector directly accounts for about 7% of GDP and contributes over 50% of export earnings. Manufacturing of primary foods accounts for a further 3%

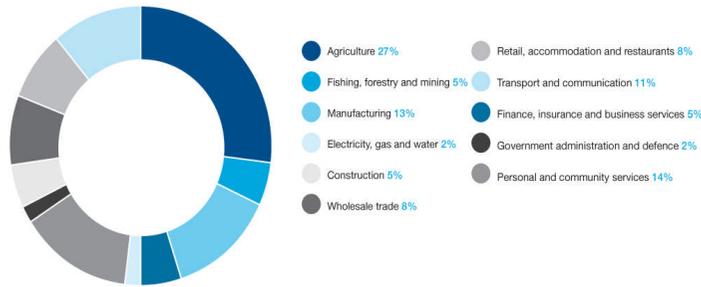
25 Nicoletti et al, *Policies and International Integration: Influences on Trade and Foreign Direct Investment* OECD Economics Department Working papers, No. 359, OECD, 2003, Paris.

26 Nicoletti et al, *Policies and International Integration: Influences on Trade and Foreign Direct Investment* OECD Economics Department Working papers, No. 359, OECD, 2003, Paris.

27 Boulhol, de Serres and Molnar, *Have developed countries escaped the curse of distance?*, Journal of Economic Geography, 2008, <<http://joeg.oxfordjournals.org/cgi/content/full/lbp015>>, extracted July 2009.

of GDP, while further contributions include related downstream activities such as transportation, rural financing and retailing.²⁸

Figure 11: New Zealand's economic profile: per cent of GDP by sector



Source: Economic Profile, Statistics New Zealand, <www.stats.govt.nz>, extracted June 2009.

The New Zealand dairy industry is its largest exporter. It is able to produce sufficient to meet domestic demand and still export 95% of its production. It is the world's largest exporter of dairy ingredients, accounting for more than a third of the traded market.²⁹ Traditionally a low cost producer, the New Zealand dairy industry suffers from high land values, driving farmers to intensify in order to seek productivity gains. To achieve the step change needed to maintain profitability it is likely that farmers will need to identify new opportunities for added value.

“Our agriculture is a wonderful asset to base ourselves on but we need to diversify our economy.”

Paul Callaghan

Tourism generates significant foreign exchange revenue for New Zealand and is a growth industry. It trades heavily on New Zealand's widely advertised 'natural capital' of beautiful and clean landscapes, which are regarded as unrivalled in a global sense, and has seen New Zealand win tourism awards as a top tourist destination. New Zealand also relies on social and human capital in the form of decentralised, local tourist destinations where the reception is critical to tourists' lasting impressions.

²⁸ Facts and Figures, Investment New Zealand, <http://www.investmentnz.govt.nz/section/14341.aspx#gdp>, extracted July 2009.
²⁹ DairyNZ, *Strategy for New Zealand dairy farming 2009/2020*, DairyNZ, April 2009

In summary, the New Zealand economy draws on a rich natural capital base and with previous structural reforms, has a sound platform to grow from. However, there are significant macroeconomic imbalances, as well as other structural and geographical disadvantages, to overcome if New Zealand is to sustainably lift economic productivity to deliver higher living standards to its people. New Zealand needs to recognise it is in crisis.

The OECD supports the analysis by the Treasury that New Zealand needs to act to lift its economic productivity in a sustainable way. Incrementally growing at historical rates will not deliver an economy that can support the aspirations of most New Zealanders. Transformational growth that delivers a step-change in productivity is necessary to drastically improve New Zealanders economic wealth. To achieve this requires bold and strategic thinking to identify the “blue ocean” opportunities that could differentiate New Zealand in the global market place.³⁰

Transformational growth needs to be sustained over time in order to deliver higher living standards for New Zealanders. New Zealand trades heavily on a number of its capital bases: financial, natural, produced, social and human. In order to provide sustainable benefit it is critical that these capitals are not eroded over the long term by an increase in economic activity. One of the ways to address this is to have a better picture of New Zealand's various capitals, in a capitals framework – assessing the capability to generate future sustainable growth.

³⁰ Kim, W.C. and Mauborgne, R., *Blue Ocean Strategy*, Harvard Business School Press, 2005, USA.

Financial, produced, natural, human and social capital

Introduction

As previously defined, a clean economy includes clean energy, clean transport, clean industry, clean agriculture, clean environment and is based on the development and commercialisation of clean technologies. The definition also includes smart thinking to transform existing export sectors and create dynamic new ones.³¹

Measuring progress in a new clean economy will be critical. Traditional economic measures need to be supported by a wider set of measures to fully value the breadth of activity. This chapter suggests a five capitals framework that is consistent with the approach to generating growth in a clean economy. It has been adopted to lend further credibility to the ways that New Zealand could develop from the existing economy.

Building on New Zealand's existing capitals, such as natural and human capital, is important in achieving economic growth. However, it is also important for sustainable development to be able to utilise these assets without eroding them. Similarly, produced capital will be an important prerequisite to the type of economic growth that New Zealand is seeking. The OECD and the World Bank have developed a capitals framework to allow an assessment of the capabilities of countries/regions to generate and sustain economic growth.³² PricewaterhouseCoopers, independent of this work, has also developed a capitals framework, primarily aimed at cities.

“With the right frameworks and competencies in place, cities can start to manage the different assets they possess and begin to address the specific challenges that each type of capital presents.”³³

Congruence between the two models leads to the identification of five broad categories of capitals:

- **Financial Capital:** this is any asset for which a counterpart liability exists somewhere on the part of another institutional unit. The value of financial capital is recorded in the balance sheet accounts of the national accounts.
- **Produced capital:** includes fixed assets that are used repeatedly or continuously in production processes for more than a year, for example buildings, computer software. The value of produced capital is recorded in the balance sheet accounts of the national accounts.
- **Natural Capital:** is the renewable and non renewable natural earth resources, land and the ecological systems that provide goods and services necessary for the economy, society and all living things.
- **Human capital:** can be defined as “the knowledge, skills, competencies and the attributes in individuals that facilitate the creation of personal, social and economic well-being”.³⁴ The application of this can be seen in the OECD finding that one extra year of full-time education leads, on average, to an increase of output *per capita* of between 4 and 7%.³⁵
- **Social capital:** is “networks, together with shared norms, values and understandings which facilitate co-operation within or among groups” (OECD, 2001). The benefits of social capital are associated with institutions (for example the administration of justice) and culture.

The ability to generate and sustain growth over time without harming the environment and quality of life depends on how much of these capitals a country possesses and how well the country is managing and leveraging off these capitals without eroding them. This chapter investigates the state of New Zealand's five capitals across the economy. Full discussion of the methodology and the results of an assessment of New Zealand's current indicators is contained in Appendix II.

Financial capital

New Zealand has a negative international investment position, meaning, as a country we owe the world more money than the world owes us.

As at December 2008, New Zealand's net debtor position of \$168 billion was comprised of \$140 billion of international assets and \$307 billion of

31 Investment New Zealand, Chris Mulcare, 2009

32 *Measuring Sustainable Development*: Report of the Joint UNECE/OECD/Eurostat Working Group on Statistics for Sustainable Development, United Nations, 2008.

33 *Cities of the future: global competition, local leadership*, PricewaterhouseCoopers, 2005.

34 *The Well-being of Nations: The Role of Human and Social Capital*, OECD Centre for Educational Research and Innovation, 2001, Paris, France.

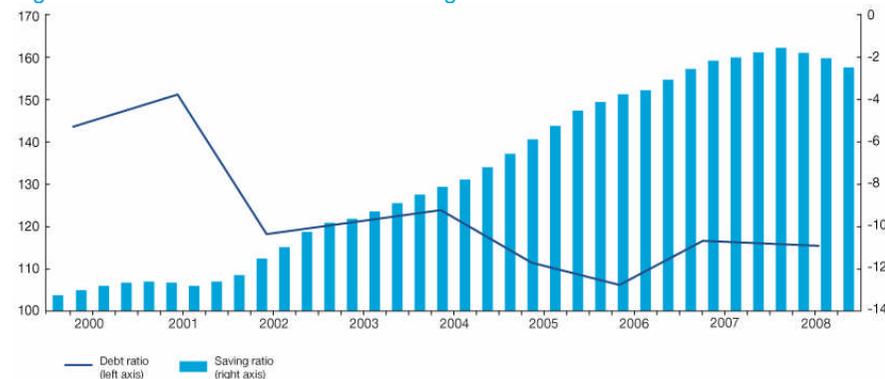
35 *The Well-being of Nations: The Role of Human and Social Capital*, OECD Centre for Educational Research and Innovation, 2001, Paris, France.

international liabilities.³⁶ This position represents a significant macroeconomic imbalance, and the recent history is one of rapid deterioration where the net debtor position moved from around 75% of GDP five years ago to 93% at the end of 2008³⁷.

OECD estimates are that a current account deficit of 3.8% of GDP is required to stabilise New Zealand's negative net international investment position at 80% of GDP, assuming nominal GDP growth of 5% per annum³⁸. The current account deficit at the end of 2008 was nearly 9% of GDP. The analysis suggests New Zealand needs to be able to reduce the current account deficit by around 4% of GDP to stabilise the negative net international investment position. This can be achieved through either stronger exports or lower imports, or a combination of both.

The household debt picture is not encouraging either. Household debt as a proportion of net disposable income deteriorated from under 110% to more than 150% at the end of 2008 as illustrated in Figure 12 below.

Figure 12: Household debt and net saving



Source: Goh, K., *Savings and the household balance sheet*, Reserve Bank of New Zealand: Bulletin, Vol. 68, No. 2; and OECD statistics <<http://stats.oecd.org/index/asp>>, extracted July 2009.

36 *Balance of Payments and International Investment Position: December 2008 quarter*, Statistics New Zealand, <<http://www.stats.govt.nz/store/2009/03/balance-of-payments-and-iip-dec08qtr-hotp.htm>>, 2008, extracted June 2009.

37 *Balance of Payments and International Investment Position: December 2008 quarter*, Statistics New Zealand, <<http://www.stats.govt.nz/store/2009/03/balance-of-payments-and-iip-dec08qtr-hotp.htm>>, 2008, extracted June 2009.

38 *OECD Economic Surveys New Zealand*, OECD, April 2009.

These macroeconomic imbalances mean that New Zealand households are significantly exposed to adverse economic events. Should there be a sudden stop in capital inflows due to change in foreign investor sentiment, New Zealand would be faced with, amongst other factors, a sharp depreciation of the New Zealand dollar, higher inflation, a sharp rise in unemployment and higher interest rates.

Case Study: Singapore³⁹

In the 1960s Singapore was a developing country with a Gross National Product per capita of less than US\$320. Infrastructure was limited and there was little capital with massive unemployment and labour unrest. The few industries that were present produced only for the domestic market. In the 1970s unemployment levels decreased as industrial development surged ahead. The global recession of 1975 slowed progress. However, Singapore's economy remained flexible. The 1980's saw Singapore embark on the "Second Industrial Revolution", a move into knowledge intensive activities such as research and development and computer software services. In the 1990s, Singaporean companies looked to moving up the value chain, focussing on technologically intensive areas.

The Singapore Economic Development Board (EDB) was formed in 1961 and industrialisation programmes then began, along with capital and technology intensive projects. The EDB marketed Singapore as a quick operations start up location. An Overseas Training Programme was drawn up in 1971 placing young Singaporean workers in apprenticeships in Germany. During the 1980s the Government adopted a high-wage policy to accelerate the move away from labour-intensive industries and towards high-technology industries. The promotion of local enterprises also became increasingly important. During the 1990s companies started to intensify their use of technology. The EDB strengthened its focus on key manufacturing industries, such as chemicals, electronics and engineering. The 2000s have become an era where research and development is now the cornerstone of the country's economic development. In 2006, the Government set aside more than US\$13 billion to promote research and development for the following five years. Today, there is a strong and established network of public and private sector research and development centres working closely together to commercialise new technologies, processes and products.

The Government has focused on a primary weakness – access to water – and turned that to strategic advantage, developing important water and wastewater management programmes. The Government also hopes to reduce fine particle emissions and have gone on to set plans to reduce pollution from the transport and industry sectors. These plans include boosting the use of public transport, trials of diesel hybrid buses, testing of electric vehicles, setting up a vehicle-emissions test lab, encouraging cycling with a US\$43 million network of bike paths and bike parks as well as working with major industry emitters to cut sulphur dioxide levels. The EDB have identified opportunities in three business growth areas where Singapore requires good solutions and can serve as a test for new ideas, these are: urban solutions; health, wellness and aging; and lifestyle products and services.

39 *Look forward to much fresher air by 2020*, Straits Times, 28 April 2009 <www.edb.gov.sg/edb/sg/en_uk/index/about_edb/our_history.html>, extracted June 2009.

Produced capital

As a nation endowed with innovators, some of whom are experienced in translating assets into produced capital, New Zealand is presented with many potential opportunities. However, New Zealand also has a small population with a small domestic market. This provides limited economies of scale or access to global knowledge. It will be critical to New Zealand's future, to be able to further translate those assets into produced capital, regardless of the asset source. The Treasury has found that knowledge created abroad is an important source of ideas.

“Greater openness to countries with large stocks of knowledge helps generate productive growth in the home country. For New Zealand, this is particularly important given that almost all new ideas will be generated overseas”⁴⁰

There are many great examples of New Zealand's ingenuity. Throughout history these include: the invention of powered flight by Richard Pearse in 1903; splitting the atom in 1919 by Ernest Rutherford, the electric fence, invented by Bill Gallagher and launched in 1938; the Hamilton Waterjet invented by Bill Hamilton in 1951, who was knighted for his services to manufacturing in 1974; the tranquiliser gun by Colin Murdoch that has saved countless animals since its invention in the late 1950s (he also patented the disposable, pre-filled syringe in 1956); and quartz oscillators used in Global Positioning Systems (GPS) by Warren Robinson in 1967.

These selected examples of New Zealand's creative minds at work show the potential for continuous discovery of key advances in technological innovation. However, this creativity needs to be nurtured and encouraged with the support of readily available research and development and a cultural shift in New Zealand attitudes to supporting entrepreneurship.

On the whole, New Zealand is not well resourced, with a lack of investment in the academic science and technology arenas. Lower priority support of world class academics to research and develop innovative new technologies, culminates in a climate where retaining top class talent is difficult.⁴¹ Recently, the fostering of an entrepreneurial culture in New Zealand's universities and academic research institutions was bolstered.

40 *International Connections and Productivity: Making Globalisation Work for New Zealand*, Treasury Productivity Paper 09/01, New Zealand Treasury April 2009.

41 *Science community fading, says PM's adviser*, <www.nzherald.co.nz>, 17 July 2009.

John Key commented at the launch of the University of Auckland Business School Entrepreneurs' Challenge, that 'supporting emerging business into export markets will be pivotal for New Zealand's future prosperity'.⁴² The existing low venture capital input to New Zealand technology, and the relative lack of expertise in the commercialisation of innovative ideas, may be set to change.

“With the expansion of our clean energy resources, it will be necessary to have a corresponding expansion of New Zealand's transmission and infrastructure.”

Alex Malahoff

New Zealand's transport and logistics infrastructure has been subject to ad hoc and provincial decision-making which has created poor inter-modal integration between road, rail and port infrastructure and a duplication of port facilities.⁴³ Inadequate infrastructure is the most serious barrier to doing business in New Zealand.⁴⁴ An historic lack of investment in the country's infrastructure has also meant that New Zealand now needs to deal with a backlog of infrastructure renewal and development in order to reach acceptable world class standards attractive to foreign investment.

The OECD argues that investment in infrastructure is important, as investments in network industry infrastructure are thought to yield positive externalities on other sectors.⁴⁵ Transport infrastructure investment is critical to the economic agglomeration process, and helps with raising productivities through a number of channels such as improving linkages between firms and creating deeper labour markets.

Transportation constitutes 42% of the nation's energy sector emissions profile, and is the fastest growing source of greenhouse gas emissions in New Zealand, making it a prime target for reduction measures.⁴⁶ A drive for more fuel efficient vehicles is likely to be the first step in the evolution of New Zealand's transportation emissions profile, followed up by a speedy transition to low carbon fuels, low carbon vehicles and low carbon journeys. Such technologies already exist, however, the financial viability

42 *Entrepreneurial support vital for NZ, says PM*, <www.nzherald.co.nz>, 24 July 2009.

43 *Taxation*. A report from *Economic Values*, part of the *New Zealand Values Study*, Massey University, June 2005

44 *The Global Competitiveness Report 2008-2009*, *World Economic Forum*, 8 October 2008

45 *OECD Economic Surveys New Zealand*, OECD, April 2009.

46 *New Zealand Energy Greenhouse Gas Emissions*, Ministry of Economic Development, 2008 Calendar Year Edition.

needs to be determined more accurately through the removal of distortions in the market place. The imperative is to put in place carbon constraints and complementary public policies to ensure that emissions from the use of fossil fuels is minimised.⁴⁷

“We can’t build New Zealand’s future as a commodity trader. It is vital we have value added.”

John Allen

Social capital

One of the most prominent experts in social capital, Professor Robert D. Putnam, defines the idea of social capital as social networks and the associated norms of reciprocity that create value for people who are involved in them. Putnam identifies formal and informal forms of social capital.⁴⁸

New Zealand’s social and cultural landscape is made up of a number of inter-related aspects. These include governance, social norms, well-being and both formal and informal institutions. New Zealand, on the whole, holds a good global reputation and appears top of the Transparency International 2008 Corruption Perceptions Index (alongside Denmark and Sweden) – an index that ranks perceived levels of corruption in 180 countries globally with the least corrupt being top of the list.⁴⁹

“Our history as a stable, free-trade country with ethical firms, good shareholder protections and very little corruption is a sound foundation for good business.”⁵⁰

However, good governance is also critically important to the functioning of public institutions that in turn have an impact on the well-being of New Zealanders. There is a strong correlation between high levels of social capital and positive experiences of:

- Education and employment;
- Housing, transport and urban design;

47 *Living in a low carbon world: the policy implications of rationing*, UK Energy Research Centre, June 2005, England.

48 *Cities of the future: global competition, local leadership*, PricewaterhouseCoopers, 2005.

49 Transparency International 2008 Corruption Perceptions Index, <www.transparency.org>, 2008, extracted July 2009.

50 Phil O’Reilly’s comment on The Global Competitiveness Survey 2008-9, <www.weforum.org/documents/GCR0809/index.html> extracted July 2009.

- Crime and community safety (i.e. neighbourhood watch); and
- Physical and mental health (i.e. through sport and volunteering).⁵¹

The role of the government in demonstrating positive social behaviours of transparency and accountability, contributes to the shaping of New Zealand’s social norms.⁵²

“Good governance is broadly conceived as arrangements constraining the use and abuse of coercive power that are founded on individual rights, open and democratic practices, tolerance of diversity and the rule of the law.”⁵³

The combination of diverse values in a multi-cultural society shapes the over-arching values of the New Zealand culture. However, although it is often facile to make sweeping generalisations about a nation’s characteristics, sometimes there are underlying traits that explain a country’s cultural approach to a modus operandi.

In New Zealand, the use of the term “number 8 wire” is reference to the belief that Kiwis are practical, inventive and can make-do. It also implies ingenuity, that Kiwis possess a wild card unconstrained by convention or perceived limitations. New Zealanders are also proud of their sporting prowess and therefore tend to use sporting metaphors in all areas of life, to emphasise a successfully competitive nature. These characteristics suggest that New Zealanders are well-placed to innovate in a carbon-constrained world.

New Zealand’s social capital is important in that having the social norms, networks and institutions in place will further aid the ability to develop a clean economy.

“New Zealanders are good at social networking. GDP does not recognise that kind of social capital.”

Manuka Henare

51 *Cities of the future: global competition, local leadership*, PricewaterhouseCoopers, 2005.

52 Petrie, M., *Institutions, Social Norms, and Well-being*. NZ Treasury Working Paper 02/12, NZ Treasury, June 2002, New Zealand.

53 Petrie, M., *Institutions, Social Norms, and Well-being*. NZ Treasury Working Paper 02/12, NZ Treasury, June 2002, New Zealand.

Natural Capital

Natural capital refers to the natural resources and ecosystem services that sustain life. It is directly relevant to the New Zealand perception of self, as part of what defines New Zealanders is the strong relationship with nature. It is also an inherent part of Maori identity – “cultural principles are embedded in the linkages to land”.⁵⁴ The connection to nature is apparent in many other ways - images of New Zealand’s beautiful landscapes are a strong drawcard for tourists, exercising a point of difference in the tourist experience. The hugely successful ‘100% Pure New Zealand’ marketing brand has been a significant impetus for bolstering the belief that New Zealand is in fact, ‘clean and green’.

Delving deeper into New Zealand’s resource position uncovers unsettling statistics; for example, the water quality in farmed and urban catchment areas is poor, primarily due to non-point source pollution (such as animal effluent, fertiliser run-off and urban stormwater).⁵⁵

In a survey of 2,000 New Zealanders, the quality of various aspects of New Zealand’s environment was measured on a five-point Likert scale.⁵⁶ Rivers and lakes were considered to be in the worst condition, with 22.1% of respondents rating them as ‘bad’ or ‘very bad’. When compared to other countries’ environments, however, over 95% of respondents rated New Zealand’s natural environment as ‘adequate’, ‘good’, or ‘very good’.⁵⁷

61% of groundwaters in New Zealand that are monitored have normal nitrate levels: the remainder have nitrate levels that are higher than the natural background levels, and 5% have nitrate levels that make the water unsafe for infants to drink. 20% of monitored groundwaters have bacteria levels that make the water unsafe to drink.⁵⁸

Despite slight easing in some regions of New Zealand, hill country erosion is estimated to cost New Zealand between \$100 million and \$150 million each year through the loss of soil and nutrients; loss of production;

damage to houses, fences, roads, phone and power lines; and damage to waterways and aquatic habitats.⁵⁹

Land use has changed somewhat in the last ten years, with native forest covering 24% of New Zealand, hill country sheep and beef farming covering 15% and intensive sheep and beef farming covering 14%, as the top three land use classes.⁶⁰

On the whole, New Zealand has good air quality in most locations for most of the time. However, coal and wood used for home heating and exhaust emissions from transport affects air quality in about 30 locations, particularly during winter. About 53% of New Zealanders live in these affected locations.⁶¹

In terms of New Zealand’s climate, the average surface temperature has increased by 0.9°C between 1920 and 2000⁶², consistent with global increases in temperature. In New Zealand, likely climate change impacts include: higher temperatures, more in the North Island than the South, (but still likely to be less than the global average); rising sea levels; more frequent extreme weather events such as droughts (especially in the east of New Zealand) and floods; and a change in rainfall patterns - higher rainfall in the west and less in the east.⁶³

The largest elements of New Zealand’s greenhouse gas emissions profile are attributable to agriculture and transportation.

“Human civilisation thought oil and fossil fuels were valuable in the 20th century – but any nation that harnesses even a fraction of the sun, wind, waves, or Earth’s interior energy will become the new Saudi Arabia: the world’s leading clean-energy supplier for the 21st century.”⁶⁴

54 Manuka Henare interview.

55 *Environment New Zealand 2007*, Ministry for the Environment, December 2007, New Zealand.

56 *Public Perceptions of New Zealand’s environment*: 2008, Lincoln University, 2008, New Zealand.

57 *Public Perceptions of New Zealand’s environment*: 2008, Lincoln University, 2008, New Zealand.

58 *Environment New Zealand 2007*, Ministry for the Environment, December 2007, New Zealand.

59 *Environment New Zealand 2007*, Ministry for the Environment, December 2007, New Zealand.

60 *ibid*

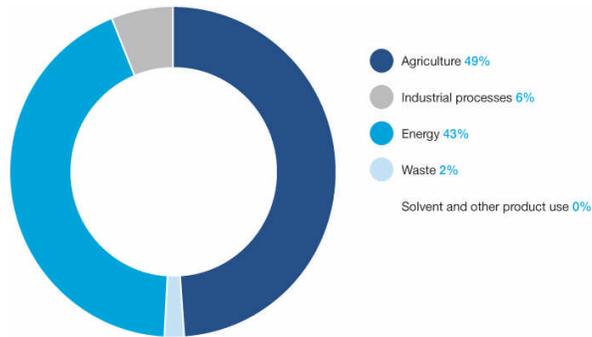
61 *ibid*

62 *ibid*.

63 *New Zealand Climate Change*, Ministry for the Environment, <www.mfe.govt.nz/issues/climate/>, 2008, extracted June 2009.

64 McNeil, B. *The Clean Industrial Revolution. Growing Australian prosperity in a greenhouse age*. 2009, Allen & Unwin, Australia, p91.

Figure 13: New Zealand's greenhouse gas emissions by sector 2007



Source: *New Zealand's Greenhouse Gas Inventory 1990-2007*, Ministry for the Environment, 2007, New Zealand, p21.

Due to the dominance of agriculture in New Zealand's emissions profile (and the current global lack of solutions to address methane emissions), on the strong base of renewable energy, New Zealand has less opportunity to make rapid and obvious measures to reduce emissions, compared to countries reliant on fossil fuels. Despite its overall contribution to global emissions being relatively low, New Zealand is still expected to demonstrate commitment to fiscal measures to achieve reduction targets alongside other OECD economies. Coverage of considerable stimulus packages by global trading partners has now identified this area as the new engine for growth.⁶⁵

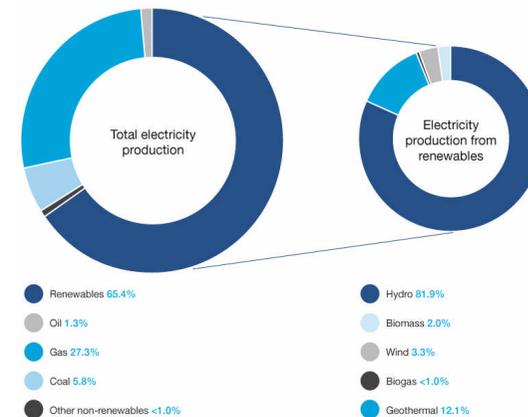
New Zealand is a long, thin country with mountain ranges and hilly country dominating the topography above the ground, and an area of volcanic and geothermal activity dominating below the ground, as a result of New Zealand's location between the Indo-Australian and Pacific tectonic plates. This geography (natural capital) has made transportation (produced capital) difficult, leading to poorly developed logistics infrastructure and a reliance on individual passenger travel and air travel for long distances.

The construction of hydroelectric dams throughout the 20th century has endowed New Zealand with a considerable renewable element in its electricity portfolio. Taking advantage of New Zealand's location, geothermal energy is utilised and contributes 12.1% to New Zealand's

⁶⁵ This includes investments in emissions reduction technologies, clean technologies and employment opportunities in the 'green' sector.

renewable electricity share, primarily providing base load electricity. The potential energy that geothermal could contribute to New Zealand's overall profile is 2,000 MW using existing technologies and respecting environmental constraints.⁶⁶ New Zealand also generates 3.3% of renewable electricity's share using wind technology, which contributes to peak load electricity.

Figure 14: Gross electricity production in 2007



Source: *Green Electricity Making a Difference: An international survey of renewable electricity labels*, PricewaterhouseCoopers, May 2009.

Despite the advantage of New Zealand's enviable energy profile, when compared to OECD counterparts, New Zealand is ranked 11th highest in emissions per capita.⁶⁷ This is due, in part, to the agricultural dominance, but it is also due to the combination of both production and consumption methodologies being applied to New Zealand's emissions profile (agricultural emissions are calculated on a production basis and oil is on a consumption basis).

⁶⁶ *Emissions Trading Scheme Submission*, Institute of Geological and Nuclear Sciences, February 2009, New Zealand.

⁶⁷ *OECD Economic Surveys New Zealand*, OECD, April 2009.

Case Study: Finland⁶⁸

Finland is a remote, sparsely populated nation with agricultural roots. In the early 1990s, the Finnish economy disintegrated, mainly as a result of the Soviet Union collapse (the Soviet Union was a major importer of Finnish goods). There was a severe banking crisis; within three years the GDP decreased by 11% and by 1994 the unemployment rate exceeded 18%.

Finland has developed a blend of capitalism which maintains strong values of social responsibility and support for industry. Finnish companies and the Government support local ventures, resulting in the successful development of a range of biotech, telecommunications and hi-tech manufacturing companies. Success can be attributed to significant investment in research and development (R&D) and an emphasis on education in general. OECD statistics show that Finland invests more of their GDP (6%) than any other country, except Sweden.

Finland has since transformed from a resource based economy to a knowledge based economy, in the process developing one of the best-performing economies in the world. This has seen the development of Nokia; the world's largest maker of cell phones which accounts for 3% of Finland's GDP and 23% of exports.

The transformation has resulted in Finland being ranked top in international comparators measuring competitiveness or knowledge economy developments (for example the World Bank Knowledge Economy Index). Finland's success also extends to sustainability where Yale and Columbia have ranked Finland first for their ability to protect the natural environment over the next decades in a 'sustainability index'.

Finland's focus for the future is to continue to push R&D spending into three bodies. The first is Tekes, a national technology agency supporting both basic & applied research where 40% of its funds are applied to universities and research institutions and the remaining 60% to businesses. Sitra is the Finnish National Fund for R&D and will continue to act as a venture capitalist and finally, the Finnish Academy of Science and Letters to fund basic science.

Emphasis will remain on ensuring a highly co-operative partnership approach to industry development, with a range of private/public alliances driving growth. This is demonstrated in public sector decision making where the Prime Minister heads a Science and Technology Policy Council responsible for setting the national agenda. With representation from both the government and private enterprises, this council is more than just a bureaucratic think-tank or committee. It is a major force in decisions about how to best grow the industry and the economy.

New Zealand's biodiversity is of global importance and due to its geographic isolation New Zealand has a high number of endemic species.

68 Sources: *Finland enjoys status as lone nordic wolf in Euro*, Dow Jones Business News, *Emissions Trading Scheme Submission*, Institute of Geological and Nuclear Sciences, February 2009, New Zealand; *Green Electricity Making a Difference: An international survey of renewable electricity labels*, PricewaterhouseCoopers, May 2009; *Ireland should imitate Finland's rescue via education and R&D*, Irish Times 30 October 2008; *In Finland's Footsteps: if we're so rich and smart, why aren't we more like them*, The Washington Post, August 2005; *Knockers should take a long look at Nokia*, The Australian, 29 April 2003; *Innovation Gives Finland a Firm Grasp on its Future*, Washington Post, 14 July 2005.

In addition, New Zealand's flora and fauna are important to the nation because of the ecosystem services provided, such as the control of pests, decomposition of waste, maintenance of health soils, the regulation of local climate, and the clarity of air and water. One study valued the ecosystem services provided each year at \$46 billion.⁶⁹

Clearly, the state and quality of New Zealand's natural capital will consistently play a critical part in how the nation is perceived internationally and domestically. The ability to build on New Zealand's natural capital to produce financial capital is already a strong part of the modus operandi. The need to authenticate that natural capital is becoming increasingly clearer.

Human capital

Human capital is: "the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being"⁷⁰

The contribution of people, their knowledge, experience, skills and talents, are a key factor in the ability for an economy to grow. Literacy levels are directly correlated to economic growth. China's fast pace of growth since the early 1990's has been attributed to the fact that 90% of adults can read, compared to 61% in India.⁷¹ Traditionally, a person's level of education has been a way to measure this. However, with a focus on increasing focus on intangible assets as also important to company value, intangible assets such as knowledge, skills and competencies are likewise critical to an educated workforce.

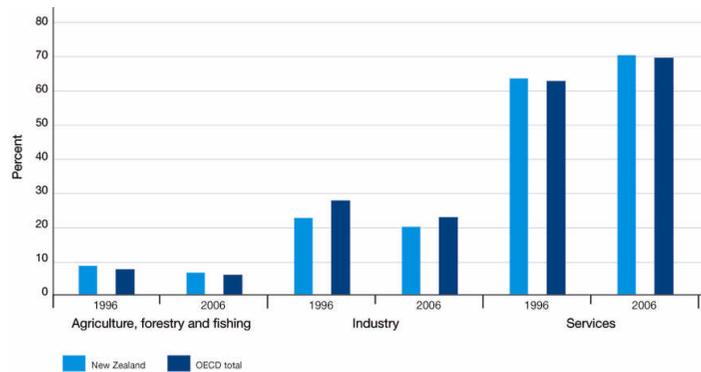
When analysing the percentage of workforce in different sectors in New Zealand as compared to the OECD average, those in the services sector (based largely on skills, competencies and knowledge) significantly outweigh those in more 'physical' industries, as seen in Figure 15.

69 Cole, A., and Patterson, M., *Assessing the value of New Zealand's Biodiversity*, 1999, Palmerston North: School of Resource and Environmental Planning, Massey University.

70 *The Well-being of Nations: The Role of Human and Social Capital*, OECD Centre for Educational Research and Innovation, 2001, Paris, France.

71 Keeley, B., *Human Capital-OECD Insights*, February 2007, OECD.

Figure 15: Percentage of workforce in agriculture, industry and service sectors



Source: *OECD in Figures 2008*, OECD, <www.oecd.org/document/32/0,3343,en_2649_34489_41722336_1_1_1_1,00.html>, 2008, extracted June 2009.

Clearly, New Zealand's education and health systems are key influencers in the quality of human capital. Investment in these areas will have an impact in determining future economic prosperity. On the whole, New Zealand's percentage of the population at school is on par with the OECD average.

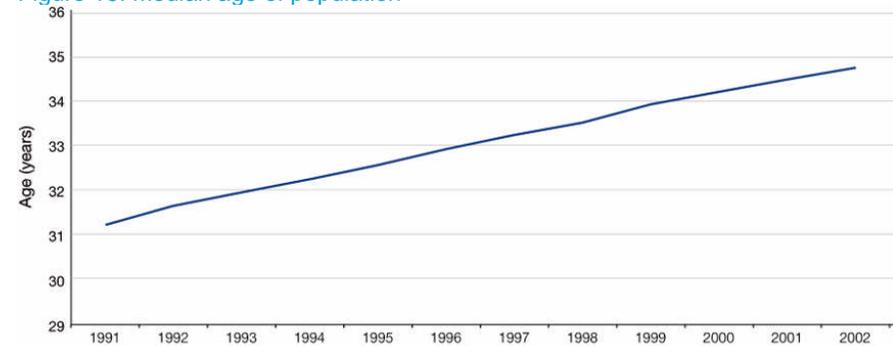
Having said this, there are other factors that are also important in developing human capital and dictating levels of economic growth. For example, with technological innovation - openness to foreign trade, demography and the social norms, institutions and culture of a country will also contribute to development of human capital and economic growth.

With the New Zealand population ageing, the age dependency ratio is changing. More people are needed in the workforce to support increasing numbers of aged people. The likely outcome is that the workforce will be expected to stay in employment for longer, and will also be expected to continue learning, updating skills and maintaining access to new forms of knowledge.

In New Zealand, the indicator for capacity to change is 'upper secondary education of 45-54 year old adults', as compared with 'upper secondary education of 25-34 year old adults'. Analysis of this indicator suggests there is little difference in generational improvement, leading to New

Zealand's declining OECD position.⁷² New Zealand also invests less in education than many OECD countries, and national research and development is not even two thirds of the OECD average.⁷³

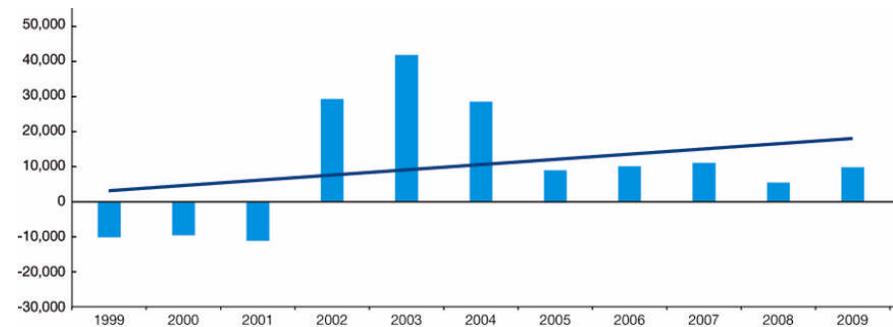
Figure 16: Median age of population



Source: Human capital statistics, Statistics New Zealand, <<http://www.stats.govt.nz/analytical-reports/human-capital-statistics/part-1-demographics-and-health.htm>>, extracted June 2009.

In New Zealand, positive net migration also provides a new source of potential human capital.

Figure 17: Net permanent and long term migration



Source: *International travel and migration*, Statistics New Zealand, <<http://www.statistics.govt.nz/store/2009/05/international-travel-and-migration-apr09-hotp.htm?page=para004Master>>.

⁷² *Facets of Wealth in New Zealand: Human Capital Statistics*, Statistics New Zealand, www.stats.govt.nz, extracted June 2009.

⁷³ *Facets of Wealth in New Zealand: Human Capital Statistics*, Statistics New Zealand, www.stats.govt.nz, extracted June 2009.

Human capital is emerging as a key determinant of international competitiveness and its very long development period makes it necessary to understand the stock of the capital, the influences on it, and the way in which that capital and those influences alter as a result of generational change.⁷⁴

“The non-economic returns to learning, in the form of enhanced personal well-being and greater social cohesion, are viewed by many as being as important as the impact on labour market earnings and economic growth.”⁷⁵

Summary

In preparedness for a clean economy, New Zealand has some vulnerabilities that need to be addressed.

New Zealand's relatively weak position with respect to financial capital poses significant risks of a real and negative real economy impact if sentiment changes. A way forward is to develop an explicit foreign direct investment strategy consistent with developing a clean economy. To the extent that policy setting promotes capital inflows and that investor sentiment towards investing in New Zealand is good, it will be possible to source the necessary financial capitals required to generate economic growth.

New Zealand is weak in terms of produced capital, but given the size of the country (in addition to its geographical isolation), as long as policy settings promote open trade and investment flows both ways, it will be possible to gain access to the produced capital that is necessary to generate economic growth. The key challenge is in balancing the economy to consume less and invest more in produced capital and other capitals that will generate greater but sustained economic growth.

Well-endowed with natural capital, New Zealand could leverage significantly to create and sustain economic growth, if managed appropriately. However, investment in protecting rather than eroding that natural capital will be critically important.

In terms of New Zealand's social capital, and the linked human capital, many of the social norms and institutions are in place, and investment in the capitals is supportive.

Redefining how value is measured in New Zealand will better recognise the five capitals described and their impact on the long term future. Appendix II provides a summary overview of New Zealand's current position on indicators supporting the five capitals. Inclusion of the five capitals in a framework that monitors the economy is an approach that focuses knowledge about growth on both economic output and the manner that the output is generated.

As the world also moves to seek a more updated measure of a country's overall prosperity, New Zealand will be better positioned to recognise and respond to global drivers if it follows a strategy aimed at balancing short and long term investment in the five capitals.

⁷⁴ *Facets of Wealth in New Zealand: Human Capital Statistics*, Statistics New Zealand, www.stats.govt.nz, extracted June 2009.

⁷⁵ *The Well-being of Nations: The Role of Human and Social Capital*, OECD Centre for Educational Research and Innovation, 2001, Paris, France.

Drivers for a clean economy

The economic recession has altered the world's views of capital markets, the global economy and the roles of government and business. From the United States to China, economies have been surprised at the scale of the mistakes made and the speed of the repercussions. Significant hardship is being experienced by many, through job losses, closure of businesses and lack of available credit. However, from such large scale global change opportunities emerge: the opportunity to re-think what is important, the opportunity for a fresh perspective, the opportunity to create a vision for the future.

Resource scarcity is a major driver for global change. By 2025, 1,800 million people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under stress conditions⁷⁶. Availability of clean water is essential for the economic growth of all types of business, either directly or indirectly⁷⁷. This in turn affects the economic prosperity of countries. Those nations with abundant water, such as New Zealand, will stand to derive economic advantage from this resource, if properly valued.

Another driver for global change is increasing greenhouse gas emissions. The cost of not addressing increasing emissions, global temperature rises and changing weather patterns is likely to be greater in the long term.

“We need an ambitious but achievable goal for 2020 that balances the environmental risks of climate change with the economic impacts on New Zealand of reducing emissions.”⁷⁸

Despite the current economic situation, and testament to how seriously other countries are seeing the climate change threat (and its inherent opportunities), global investment has been committed as can be seen in South Korea's case study.

76 *Hot Issues: Water Scarcity*, Food and Agriculture Organisation of the United Nations, <www.fao.org> extracted July 2009.

77 *Water scarcity and access to water: why is this important for business?* <www.yourenvironmentalguide.com> extracted July 2009.

78 Hon Dr Nick Smith, Minister for Climate Change Issues, *New Zealand's 2020 Emissions Target*, July 2009, New Zealand.

Case Study: South Korea⁷⁹

South Korea has been progressively challenged by its aging population. In 1948 the average lifespan of Koreans barely reached 50 years old. At that time, the focus was on survival. However, average lifespan now has an expectancy of over 80 years old, and the focus has shifted from survival to achieving a better quality of life.

South Korea has invited and welcomed more foreign direct investment over the past ten years. By 2007, more than 15,000 foreign companies, such as Samsung and LG, had invested in Korea. In August 2008, President Lee Myung-bak made an announcement stating his vision for a “green, great and unified Korean Peninsula”. He made clear that steps needed to be taken looking forward to gain international respect. The Government at that time planned to raise the share of new and renewable energy from 2% to at least 11% of power consumption, through making major investments by 2030. The Government went on to say that investment in research and development would be doubled to encourage the country to become leaders in green technology.

In July 2009, plans were unveiled to invest Won107,000 billion in ‘green growth’ areas over the next five years. This would be the equivalent of approximately 2% of the country's GDP each year to 2013 and could potentially create 1.56 to 1.81 million new jobs. They are now striving towards increasing energy efficiency by eco-friendly projects. For example, carbon credit training, hybrid cars and biofuels.

South Korea's mission is to shift its growth paradigm away from the 60 year long manufacturing-based and export-orientated growth approach, and towards an environment-friendly and energy efficient one with an objective to achieve sustainable economic growth and protect the Earth. There are parallels with New Zealand and during recent official visits, comments were tabled that both countries share a common view in tying economic development to a green economy, and would complement each other well.⁸⁰

“The aim is for South Korea to become the world's seventh most competitive country by 2020 in terms of energy efficiency and ability to adapt to climate change,” a statement from the presidential Blue House said. The government is striving to boost energy efficiency by encouraging eco-friendly projects such as developing renewable energy including solar and wind power, carbon credit trading, hybrid cars and biofuels. It plans to expand fiscal support for research and development. “The plan will not only help reduce greenhouse gas emissions, but it will also provide us with a new growth engine,” said Kwon Tae-shin, minister for policy coordination.⁸¹

79 Sources: *Economic Survey of Korea*, OECD, December 2008; *The Export juggernaut*, The Economist, 25 Sept 2008; *Lee Eyes Green, Great, Unified Korea*, Korea Times, 15 Aug 2008; *Korea Seeks Low-Carbon, Green Growth*, Korea Times, 15 Aug 2008, South China Morning Post, 16 May 2008; *South Korea to Spend \$85bn on Green Industries*, Financial Times, 6 July 2009.

80 Dr Kim - Chairman of Daesung and Vice President Asia Pacific, World Energy Council and upcoming visit by Korean President, Email correspondence with Chris Mulcare, NZTE

81 *S Korea to spend \$85bn on green industries*, Financial Times article 9 July 2009, accessed via <http://www.ft.com/cms/s/0/45bf6c4e-6a1e-11de-ad04-00144feabdc0.html>, extracted July 2009.

New Zealand businesses need to identify the economic opportunities and progress in developing innovative solutions. Those that do choose to recognise and exploit the significant opportunities afforded by climate change will reap rewards. The opportunities are driven by market demand for low carbon intensity products and services and new technologies developed to contribute problem-solving. However, businesses are expecting clear guidance from governments in order to create a level playing field for climate change response.

***CEOs want more government action, particularly in areas where regulation enables business, such as climate change. More than 80% of CEOs favour clear, consistent government policies to address climate change.*⁸²**

Global security of energy supply is linked to both climate change and global economic stability. '61% of CEOs say that the dependence on carbon-based energy will have an impact on the long-term success of their businesses. 56% say the same about climate change, 55% about overpopulation, and 50% about a scarcity of fresh water.'⁸³

Another driver for clarity of future vision is the widely perpetuated myth of 'clean, green' that New Zealand promulgates globally. Many global consumers and local customers are influenced by this branding. But how true is it? The reality is that New Zealand's care of its natural capital has not been adequate enough. The Living Planet Report 2008 reveals New Zealand's standing on its ecological footprint (humanity's demand on the planet's living resources) where it is sixth highest per capita of the countries measured and over three times that of the world average.⁸⁴

The foundations are there, but 'clean, green' New Zealand needs to be authenticated to avoid global reputation risk. Building that authenticity needs to be immediate, integrated and informed. And it needs to be spearheaded by a new economic vision, one that will support New Zealand into creating a greater prosperity in the widest sense of the word – social, economic, environmental and cultural.

Another driver to create a clean economy is that of non-tariff trade barriers impacting New Zealand's exports. Standards and certification are the most frequently cited sources of barrier. However, by better understanding

overseas consumer requirements and developing the skills required to anticipate them, New Zealand will be able to translate the barriers into opportunities. New Zealand will also be able to differentiate itself in the global marketplace. Global CEOs are still concerned about the problem that 'the gap is widest where cross-border flows of capital, labour, goods, services and information spread risk beyond the control of any one business or nation.'⁸⁵ Clearly the global connectedness that services global trade can also bring negative consequences.

Drivers for businesses to adapt include the fact that CEOs are taking responsibility for issues that were once considered outside the scope of any single business.⁸⁶ They believe the criteria for success needs to change accordingly. Part of the criteria must include an investment in large-scale opportunities that have less predictable returns and the mitigation of risks that have the potential to erase years of incremental gains.

***As long as predictable, quarterly earnings remain the ultimate measure of success, short-termism will continue, ultimately creating more crises in the future.*⁸⁷**

Being much more aware of the international value of resources should be a critical part of a clean economy. For some parts of the world, valuing resources is about survival rather than authenticating a brand. As water scarcity increases in Australia, the value of water is likely to increase. Water rich countries such as New Zealand can build value by better understanding and recognising this in how the nation operates across the clean economy. It may also attract higher value industries that respect and support these decisions.

Analysis of New Zealand's current economic position indicates a number of areas for concern. The first is the ranking on the OECD scale. Whilst reaching the top of the scale may not be New Zealanders' primary motivation (for example in the Growth and Innovation Survey 2004, quality of life rated as most important, over quality of education (2nd), quality of natural environment (3rd), the public health system (4th), race relations

82 12th CEO Survey, PricewaterhouseCoopers, 2009.

83 12th CEO Survey, PricewaterhouseCoopers, 2009.

84 *Living Planet Report 2008*, WWF, Zoological Society of London and the Global Footprint Network, October 2008, United Kingdom.

85 12th CEO Survey, PricewaterhouseCoopers, 2009.

86 12th CEO Survey, PricewaterhouseCoopers, 2009.

87 12th CEO Survey, PricewaterhouseCoopers, 2009.

(5th), employment prospects (6th), and potential to increase wealth (7th)⁸⁸), clearly New Zealanders would welcome greater economic prosperity.

Increasing attractiveness for investment should be part of a clean economy vision for New Zealand, and focusing on the right kind of strategic investment opportunities will fit the ethos of being a New Zealander (i.e. the widely held values and quality of life motivators).

One of the ways this will be important is in growing interest in new technology solutions across all sectors. The low carbon and environmental goods and services market⁸⁹ was recently estimated to have globally been worth £3 trillion in 2008, the United Kingdom government speculates that as international action on climate change gathers momentum, this could grow to an estimated £4.3 trillion by 2015.⁹⁰

“It is vital that we portray a positive message which empowers with a belief that we can do what we set out to do. We need to be honest, get over the myths by which we live, and see potential in our opportunities.”

Paul Callaghan

New Zealand businesses are dependent to a large degree on exports to distant markets. Many New Zealand businesses lack a full awareness of what international consumers need and want. Operating in this perception vacuum means that New Zealand businesses are not able to quickly respond to, and capitalise on, emerging opportunities. A recent study by The Climate Group conducted in the United States, United Kingdom and China identified a ‘strong consumer demand for innovative solutions that will help people reduce their impact on the climate. But this demand continues to be ahead of supply – so there remains a receptive and largely untapped market.’⁹¹ Savvy consumers are buying products and services that support their inclinations towards sustainability and climate change, and New Zealand businesses have yet to fully identify and capitalise on this market.

A rising middle class in developing countries signals the shift in demand for high protein lifestyles. New Zealand’s export markets need to shift

accordingly from distant ‘developed’ to closer ‘developing’ economies, such as Asia. However, to enable this to happen, New Zealand needs to access more sophisticated intelligence about these new markets – cultural nuances, language, operating styles, needs and wants, as well as the more traditional financial metrics. Engagement with appropriate groups of stakeholders will feed this requirement for market intelligence, helping New Zealand to develop targeted penetration of these marketplaces.

As an export-based economy, New Zealand’s access to market intelligence that recognises global demand, identifies potential business opportunities or pinpoints possible technological niches to be exploited, is a critical success factor. Future exporting success hinges on more than just identifying information; it is also about understanding the varying pressure points in different markets, recognising the signals that are given out and translating them into tangible opportunities to be exploited.

“New Zealand should strive to utmost excellence and quality. We need to adopt the highest levels of international standards in what we do in New Zealand.”

Paul Callaghan

Developing a clean economy supported by smart thinking, technology solutions and New Zealand’s values base will be a global differentiator for the nation. Investment in this is what will begin to build New Zealand’s global reputation as a solutions-oriented player in the market. It should also boost the country’s economic aspirations.

88 *Research on Growth and Innovation: prepared by the Growth and Innovation Advisory Board, Ministry of Research Science and Technology, 2004 (printed publication 83), page 3.*

89 Made up of environmental, renewable energy and low carbon technologies.

90 *The UK Low Carbon Industrial Strategy*, HM Government (Department for Business, Innovation and Skills and Department of Energy and Climate Change) 2009.

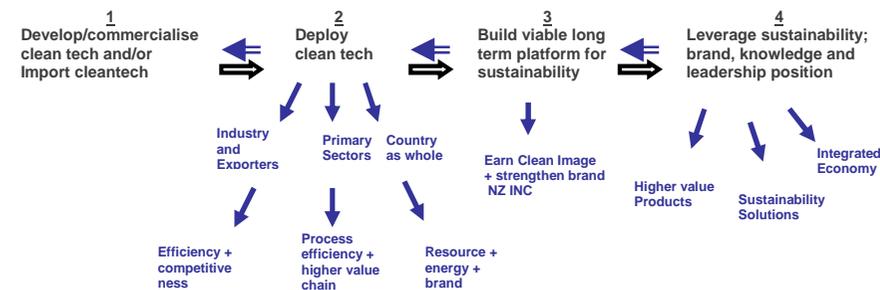
91 *Consumer, Brands and Climate Change: Helping Business to Focus*, 2008, The Climate Group.

The cleantech market

Global recognition is growing that resource degradation and depletion is putting the viability of sustaining future generations at risk. Concern surrounds the future availability of resources and that resource consumption is contributing to global climate change. To this extent drastic emissions target setting has been proposed by members of the G8 in a recent summit.⁹²

Much focus has been placed on a “Clean Economy”. While it appears there is no common agreement on what the clean economy is, generally it means an economy that is built on sustainable foundations. Adoption of sustainability principles and practices across all industry sectors in the economy can help change an economy to a clean economy.

Figure 18: Evolution of New Zealand’s clean economy



Source: Chris Mulcare, Investment New Zealand, 2009

An element of the clean economy is “cleantech” which is “technologies, services, or products aimed at reducing greenhouse gas emissions and other pollutants and promoting energy efficiency and the conservation of natural resources”.⁹³ Cleantech goods and services can be applied in every industry to create a more sustainable industry. Furthermore,

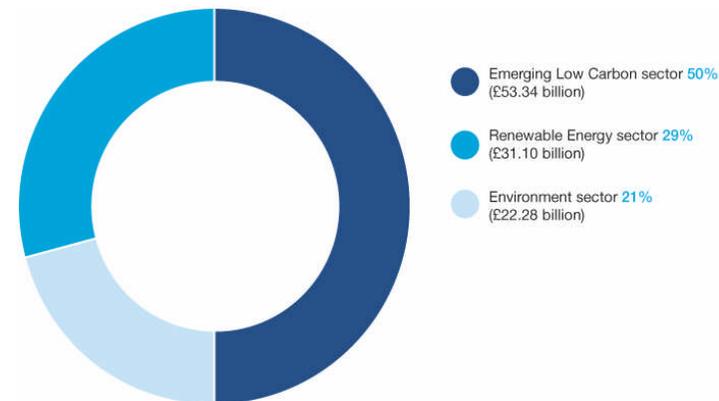
92 Fact Sheet Climate Change: Major Economies Forum on Energy and Climate (MEF), www.g8italia2009.it/G8/Home/Summit/G8-G8_Layout_locale-1199882116809_TemiPrincipali.htm
93 *Cleantech Comes of Age. Findings from the MoneyTree Report*, PricewaterhouseCoopers, April 2008, USA.

cleantech is seen a global driver for job creation and a means of tackling the global recession.⁹⁴

While the meaning of cleantech lacks a common definition, it embodies that which is labelled low carbon and environmental goods and services (LCEGS). The LCEGS industry is comprised of three main sectors and the mix of these sectors is represented in Figure 18 below:

- Environmental - relatively mature products and activities such as air, noise / marine pollution and land and water contamination solutions,
- Renewable Energy - hydro, wind, wave and tidal power etc, and
- Emerging low carbon - alternative fuels, building technologies, nuclear energy etc.⁹⁵

Figure 19: The low carbon and environmental goods and services sector



Source: *Innovas Report*, commissioned by the Department for Business Enterprise and Regulatory Reform, UK Government, March 2009, United Kingdom.

Research has shown that the United Kingdom LCEGS market is worth £106 billion representing about 7% of the United Kingdom economy.⁹⁶ Figure 20 below illustrates the market value of LCEGS sector of major countries in the 2008 financial year.

94 *Cleantech Nation. Cleantech playing a central role in the national recovery agenda.*

PricewaterhouseCoopers, February 2009.

95 *Innovas Report*, commissioned by the Department for Business Enterprise and Regulatory Reform, UK Government, March 2009, United Kingdom.

96 *The UK Low Carbon Industrial Strategy*, HM Government (Department for Business, Innovation and Skills and Department of Energy and Climate Change) 2009, United Kingdom.

Figure 20: Market value of LCEGS sector of major countries, 2007/08

Country	Market value, £bn	% global total
United States	629	20.6
China	411	13.5
Japan	191	6.3
India	191	6.3
Germany	128	4.2
United Kingdom	107	3.5
France	93	3.0

Source: *Innovas Report*, commissioned by the Department for Business Enterprise and Regulatory Reform, UK Government, March 2009, United Kingdom.

The United Kingdom government commissioned a study in 2009 which found the global market for LCEGS was already worth £3 trillion in 2008. The United Kingdom government speculates that as international action on climate change gathers momentum, this could grow to an estimated £4.3 trillion by 2015.⁹⁷

Although there are various estimates, there is no single authoritative source on the size of the cleantech sector. A market research consultancy estimates the current global market for cleantech products and services is approximately \$284 billion, growing to over \$1.3 trillion by 2017.⁹⁸ The size of the sector tends to be significantly related to the public investments that governments are putting into the sector. The public investments in turn leverage private sector investment, generally of a venture capital nature.⁹⁹

Cleantech is gaining a rising share of the global venture capital investment market. It is the fastest growing venture capital investment sector in the US, growing from \$271 million in 2003 to \$4.1 billion in 2008. Its share of the market surged from 5% in 2006 to 15% in 2008.¹⁰⁰ Similarly, its venture capital market share in Europe increased from 1.6% in 2001 to 4.4% by 2007.¹⁰¹ More than one-third of the cleantech sector is attributable

97 *Innovas Report*, commissioned by the Department for Business Enterprise and Regulatory Reform, UK Government, March 2009, United Kingdom; The UK Low Carbon Industrial Strategy, HM Government (Department for Business, Innovation and Skills and Department of Energy and Climate Change) 2009, United Kingdom.

98 *Cleantech: Current Status and Worldwide Outlook*, <Reportlinker.com>, extracted July 2009.

99 *Cleantech Comes of Age. Findings from the MoneyTree Report*, PricewaterhouseCoopers, April 2008, USA.

100 *PricewaterhouseCoopers/National Venture Capital Association MoneyTree(TM) Report* (data: Thomson Reuters). <www.pwcmoneytree.com> extracted June 2009.

101 *Cleantech: Current Status and Worldwide Outlook*, <Reportlinker.com>, extracted July 2009.

to renewable energy sources, such as biofuels, solar, tidal and wind power. These segments are expected to grow from a current value of \$104 billion to approximately \$467 billion in 2017.¹⁰²

The drive towards a clean economy and associated cleantech investment is also linked to addressing the global recession. The United States government has formulated a \$787 billion economic stabilisation and jobs growth package including \$83 billion for cleantech spending and tax plans. The measures target doubling renewable energy generating capacity - sourced largely by wind, solar and geothermal - over three years, equal to powering six million homes. Provisions also target efficiency, expanded electricity transmission networks and modernisation of electricity grids including advanced metering, energy management software, and usage-monitoring sensors.¹⁰³

The Singaporean government has allocated SGD\$700 million (US\$453 million) to develop five key pillars of Singapore's cleantech growth blueprint: research and development, manpower capabilities, Singapore-based enterprises, international industry brand and a vibrant industry ecosystem. The Singaporean government aims to supply technology and products to 3 % of the global water market. Achieving this is expected to increase the water sector's contribution to GDP from SGD\$0.5 billion (US\$0.3 billion) in 2003 to SGD\$1.7 billion (USD\$1.1 billion) in 2015.¹⁰⁴

The evolving cleantech market presents significant opportunities for New Zealand. Cleantech fits with New Zealand's strengths of innovation and leadership and the global perception of being 'clean, green'.

102 *Cleantech: Current Status and Worldwide Outlook*, <Reportlinker.com>, extracted July 2009.

103 *Cleantech Nation. Cleantech playing a central role in the national recovery agenda*. PricewaterhouseCoopers, February 2009.

104 *High hopes for Singapore Cleantech*, The Cleantech Group, 2009, <http://cleantech.com/news/4256/setting-high-hopes-singapore-cleant> extracted June 2009.

New Zealand's slice of cleantech

Currently there is no authoritative information available as to the scale of the cleantech industry in New Zealand. Research has shown that to date some New Zealand businesses have recognised the opportunities that the cleantech sector has to offer. To this extent, more than 250 companies and organisations are researching, developing and commercialising cleantech in the following five areas.¹⁰⁵

- Agriculture and food production – includes biotechnology, pastoral management and carbon farming, weed and pest control, food processing, agricultural waste recovery and treatment, nutraceuticals and phenotypic engineering.
- Energy and fuels – includes bio fuels, energy efficiency and renewable energy such as wind, tidal, hydro and geothermal.
- Transportation - includes mechanical and fuel efficiency, hybrid vehicles, engine design and logistics planning.
- Industry – includes process efficiency, nanomaterials, biomaterials and industrial biotechnology.
- Environmental protection – includes waste minimisation, carbon accounting, carbon sequestration and water supply.

If New Zealand chooses to target the cleantech sector, then what share might it get and to what does this equate? Additionally, cleantech should be locally deployed and embedded across industries and New Zealand's primary sector.

A study on LCEGS indicates the largest market is United States followed closely by China, Japan and India. The study includes Australia but excludes New Zealand. Australia's market value of the LCEGS sector is nearly £31 billion representing about 1% of the estimated global market.¹⁰⁶

Using the above information it is possible to make a range estimate on the potential market share that New Zealand could capture of the cleantech industry. Bearing in mind that New Zealand is approximately one-fifth of the population of Australia, has an existing clean and green branding but relative geographic isolation New Zealand's share of this could be

between 0.1%-0.3% of the global market. This would mean New Zealand's current LCEGS market would be between £3 to £9 billion (NZD\$7.5 to NZD\$22 billion) which represents between 6 and 17% of the New Zealand economy.¹⁰⁷

If New Zealand exports were commensurate with the United Kingdom share, then New Zealand's current exports of LCEGS can be estimated to be about £1 to 3 billion which represents between 0.3% to 1% of the current global market for LCEGS.

The study expects the LCEGS market to grow by an average of over 4.5% per annum, or a cumulative growth rate of 45% over the next seven years to 2015. Highest growth was expected in the renewables energy sector at a cumulative 63% over the 2008-2015 period.¹⁰⁸

In the expectation that New Zealand will focus efforts in the cleantech sector, two scenarios are suggested here to identify the fiscal opportunities that could be inherent in a change in focus.

The first is based on New Zealand's market share in LCEGS growing at the same rate as global markets (£4.4 to £13 billion by 2015). This scenario could represent an additional £1.4 to £4 billion in GDP. This converts to an increase in per capita incomes of between NZD\$900 and NZD\$2500 by 2015. If such growth can be sustained to 2025, the increase in per capita incomes by 2025 would be between NZD\$2400 to NZD\$7000 more than in 2008.¹⁰⁹

The second scenario is based on New Zealand's market share increasing by three times (£9 to £27 billion by 2015). This scenario could represent an additional £6 to £18 billion in GDP. This converts to an increase in per capita incomes of between NZD\$4,000 and NZD\$11,000 by 2015. If such growth can be sustained to 2025, the increase in per capita incomes by 2025 would be between NZD\$7,000 to NZD\$20,000 more than in 2008.¹¹⁰

The estimates for scenario two are consistent with the analysis that explored from a top down perspective, the implication of a doubling in New Zealand's real incomes per capita growth rates. Achieving these growth

¹⁰⁵ Draft New Zealand Clean Technology Capability and Value Proposition Statement, URS, July 2009.

¹⁰⁶ *Innovas Report*, commissioned by the Department for Business Enterprise and Regulatory Reform, UK Government, March 2009, United Kingdom.

¹⁰⁷ PwC hypothetical calculations that should not be relied on

¹⁰⁸ *Innovas Report*, commissioned by the Department for Business Enterprise and Regulatory Reform, UK Government, March 2009, United Kingdom.

¹⁰⁹ PwC hypothetical calculations that should not be relied on
¹¹⁰ PwC hypothetical calculations that should not be relied on

rates would, at a minimum, enable New Zealand to climb back up the OECD per capita income rankings slowly but steadily.¹¹¹

In summary, the strategic move to a clean economy could be the impetus to accelerate the cleantech market. The above analysis examines the likely size and scale of the cleantech market and its growth implications. It explores reasons why New Zealand is well placed to capture a greater market share of the large and growing cleantech market and in doing so, transforms its own economy into a "clean economy". Finally, it explores the implications for New Zealand incomes under a number of market share scenarios.

¹¹¹ Skilling, D., *Creating a global New Zealand economy*, The New Zealand Institute, August 2006, New Zealand.

Introduction to the clean economy vision for New Zealand

“New Zealanders have not decided on what they want to grasp for the future. There is an insular view of New Zealand and New Zealanders are not engaged in the outside world. New Zealanders are nervous of thinking about new ideas.”

John Allen

Whilst other nations are more clear about their futures, with announcements of investment into cleantech, job creation programmes and strong growth drivers, there is the perception that New Zealand is rudderless in terms of an end goal. This is not surprising given the current low wage levels and low level of GDP per capita compared with other developed economies. The response of the average New Zealander has been to work harder as that is where they could make a contribution. The requirement is to work smarter and this can be achieved following the lead of our five experts.

“From a productivity perspective, we should be thinking how can we get a greater return from possibly less productive units, by capturing a greater part or the high value end of the value chain, rather than simply trying to extend our productive base.”¹¹²

“New Zealand also needs to address fundamental systematic issues. We are not commercialising our clever thinking and ideas. We are mostly squandering our opportunities, due in part to systemic issues in our innovation system, in part due to underlying attitudinal issues.”¹¹³

As a nation, New Zealanders are action-orientated and leaders. They are positive about their emotional wellbeing (90.3%), and are satisfied with life in general (87.9%). The majority of New Zealand residents feel positive about the balance between work and other aspects of their life (77.8%) and they feel a sense of pride in the way their area or city looks and feels

(64.6%).¹¹⁴ “Land is how we identify ourselves.”¹¹⁵ That strong connection to the land is the bond that New Zealanders have with New Zealand.

When questioning stakeholders on their views, there are huge positives to New Zealand... *“our democratic way of life, the diversity of population, our tolerance of others, the high levels of education and the principles that underlie the Treaty of Waitangi”*.

Paul Callaghan

But there are some negatives too...

“Currently, we are a relatively undeveloped nation that has grown up with high value for the environment. However, we are too preoccupied with Australia and at times fail to recognise we are a country in our own right.”

Keith Turner

By visioning a clean economy, New Zealanders can channel their energy, *“we should be very optimistic and need to wake up and take our opportunities”*.¹¹⁶ It is important that New Zealanders begin to connect the dots and develop a goal that supports and reinforces the strengths already possessed, but that also builds new strengths that will bridge the significant gaps in the picture. This needs to be based on New Zealand's existing assets, on what the world wants and needs, and the fundamental values that New Zealanders hold dear.

The visionary suggestions presented in the following chapter are based on a high level and top-down focus, not a bottom-up build. The next phase should comprise a bottom-up approach to help to justify potential opportunities highlighted in this report. None of the possibilities have been fully analysed to quantify the cost implications and a future cost benefit analysis may deem them unacceptable options. A separate analysis should be undertaken to establish the cost benefits.

112 Chris Mulcare, New Zealand Trade & Enterprise, 2009.
113 Chris Mulcare, New Zealand Trade & Enterprise, 2009.

114 *Quality of Life 2008*, <www.nielsen.com>, 2008, extracted July 2009.
115 Paul Callaghan interview, 2009.
116 Alex Malahoff interview, 2009.

New Zealand's clean economy vision in 2025

“Global markets are driving towards certified clean products and we do have the capacity to provide this. Our primary production would result in returning a higher value than other competing countries. But to effect this we need traceability and authenticity. We need to clean up and we need good measurement systems and standards. We need a national brand, a national identity and a focus on productivity.”

Keith Turner

What if...New Zealand's clean economy increased per capita incomes in New Zealand between \$2,400 to \$7,000 more than 2008 figures?¹¹⁷

Should New Zealand decide to invest in a clean economy in 2010, and were to achieve an average growth rate of 3.6% per annum to 2015 and a similar rate to 2025¹¹⁸, New Zealand's economic landscape would change dramatically. Integrated investment across all five foundations of the clean economy (clean energy, clean transportation, clean agriculture, clean environment and clean industry) would demonstrate New Zealand's leadership globally. It would help to develop a culture more orientated towards science and technology, and one that supports entrepreneurial activity. Investment across the five capitals would succeed in re-establishing New Zealand's reputation as a clean, green destination.¹¹⁹

What if...New Zealand's economy grew by more than 50% over the 2008-2025 period based on the sustainable goods and services required by the rest of the world?

Incomes for each and every New Zealander would have increased, in real terms, with higher living standards and more people saving regularly. The increase in income would occur because New Zealand strategically

117 Based on extrapolations from global cleantech figures as discussed in previous chapter: The cleantech market

118 As suggested in the following chapter: New Zealand's economic vision 2025

119 *New Zealand's Future Competitive Advantage Report* Consultation draft only, Ministry of Economic Development, March 2009, New Zealand.

reinvested the export earnings from its world class natural-capital based industries into produced capital of greater technology and innovation. This would have contributed to New Zealand producing more of what the world wants and is willing to pay more for. In creating this cycle of upward growth and strengthening competitiveness, New Zealand would have further enhanced its natural and human capital base from which it derives its sustainable competitive advantage.

“If a carbon price is introduced gradually, rather than in all economies at the same time, long-term costs are lower for early movers, and higher for economies that delay. The economies that defer when a carbon price is eventually introduced, face greater costs, particularly because global investment is redirected to early movers.”¹²⁰

With the increasing flows of financial capital from increased exports and repatriation of foreign investment earnings, New Zealand would be able to develop advanced technology that delivers greater tourism experiences as well as clean renewable energy which is required to drive new forms of clean industrial production. New Zealanders would be educated to a high standard, not only from a knowledge point of view but with a stronger sustainability consciousness.¹²¹ New Zealanders would be known for innovation and the ability to create value exponentially using resource appropriately and efficiently and with low carbon technologies.

“Transformation to a clean economy will provide us with a competitive advantage globally.”¹²²

What if...New Zealand agriculture was regarded as the benchmark of 'clean and sustainable agriculture'?

New Zealand's economy in 2009 is largely agrarian based. To maintain profitability and market share against low cost producers, New Zealand could develop higher value added products that the world is prepared to pay for. By investing heavily in developing healthy resources (soil, water, plantlife) upon which to authenticate the brand, New Zealand would be

120 *Australia's Low Pollution Future: The economics of climate change mitigation*, Department of Treasury, Commonwealth of Australia, 20 October 2008.

121 *Measuring New Zealand's Progress Using a Sustainable Development Approach*, 2008, Statistics New Zealand.

122 Keith Turner interview, 2009.

able to develop a brand and reputation that attracts strong inward investment. Due to its values basis, sustainable approach and care of resource use, New Zealand would also enjoy the enviable position of being the sustainable dairy producer of choice.

Agriculture would be a base for generating export earnings for New Zealand and would be a long term viable business model that relies on natural capital being sustained. New Zealand would be world-renowned for the health of its resources such as water, soil and air.

What if...New Zealand's 90% renewable electricity was a significant differentiator for the nation's economy?

"The installed plus 'under construction' capacity of the high temperature geothermal energy convection system fields is 758 MW, but industry experts have suggested up to 2,000 MW of generation is feasible using existing technologies and respecting environmental constraints."¹²³

Additionally, clean micro-power generation distributes energy much more efficiently than a few big power stations in locations far away from population centres that require expensive and leaky transmission cables.¹²⁴ Presented with this information in 2009, New Zealand might have decided to invest. In 2025, New Zealand's renewable electricity portfolio would be higher than many other countries globally.

Having heavily invested in existing renewable energy sources to perfect them, and in new renewable energy sources to commercialise them, New Zealand might possess a 90% renewable electricity profile and be continuously looking at the potential capacity for renewable electricity. This would provide the nation with significant advantages over nations dependent on high carbon-based energy. A diversified portfolio that provides both base and peak load needs, New Zealand would be able to generate excess that could be used in marketing the low carbon intensity advantage that attracts new high-value businesses. It would also be complementary to New Zealand's wider understanding of sustainable solutions.

123 *Emissions Trading Scheme Submission*, Institute of Geological and Nuclear Sciences, February 2009, New Zealand.

124 McNeil, B. *The Clean Industrial Revolution. Growing Australian prosperity in a greenhouse age*. 2009, Allen & Unwin, Australia, p141.

Because New Zealanders have continued to invest in protecting and enhancing natural capital, the renewable focus has not been to the detriment of other aspects of the environment.

New Zealand's energy proposition would be enhanced by the global focus on resources. The policy that supported increased investment on renewable technologies could mean that many energy dependent businesses have relocated to New Zealand. The key attractors would be the renewable electricity focus, the excellent infrastructure and the guiding ethos of New Zealanders.

In 2007, trends towards automating business processes required companies to purchase more server space, with servers in turn becoming smaller and more powerful. Energy requirements to power and cool them increased resulting in only 5-15% of the average server's capacity actually being used, with \$140 billion of wasted excess server capacity worldwide."¹²⁵

"The locations of Google's new data centres are decided largely on the grounds of energy costs, reliability and security."¹²⁶ New Zealand is an ideal place for this as it is politically stable and isolated, has abundant renewable energy and a well educated population, all that New Zealand needs is a world class data pipe.¹²⁷ Low-productivity gains can present themselves within the new low-carbon economy from the roll-out of widespread fibre-optic broadband capabilities.¹²⁸

Recognition of early signals meant that New Zealand's resource aware brand, renewable electricity provision and world class internet infrastructure would be able to capture the market. New Zealand could be the location of choice for cloud computing. For example, Iceland has been attempting to attract aluminium smelters and data centres for some number of years. This is due to 99% of its electricity supply coming from

125 *Best practices in sustainability to lower costs, increase shareholder value, and gain competitive advantage*, PricewaterhouseCoopers, 2007, USA.

126 McNeil, B. *The Clean Industrial Revolution. Growing Australian prosperity in a greenhouse age*. 2009, Allen & Unwin, Australia, p159.

127 Chris Mulcare, New Zealand Trade & Enterprise, 2009.

128 McNeil, B. *The Clean Industrial Revolution. Growing Australian prosperity in a greenhouse age*. 2009, Allen & Unwin, Australia, p187.

hydro or geothermal power ensuring stable supply and no difficulties with price volatility of fossil fuels.¹²⁹

What if...New Zealand's products, services and processes are world renowned for their low relative carbon intensity?

If New Zealand decided to invest in 90% renewable energy¹³⁰, it would significantly impact the carbon content of industrial processes and subsequently the carbon content of resultant goods. Potentially this could enable future businesses that rely on a high energy content in their manufacturing processes, to relocate to New Zealand. New Zealand could become the location of choice for foreign direct investment.

What if...New Zealand's transportation infrastructure was world leading?

If New Zealand were to decide to focus on developing a well planned and integrated approach to transport planning, with inter-nodal integration between road, rail and port infrastructure, particularly at the urban level, it might mean that the nation's emissions profile would alter significantly.^{131, 132} If there had been revitalisation investment in existing rail infrastructure in 2010, both for passenger and freight use, this could change the pattern of movements across New Zealand and would cement New Zealand's reputation as a desirable location for business.

New Zealand's entrepreneurial and sustainable approach to new technologies would lead to local investment in liquid fuel alternatives, feeding the longer term transition to low carbon transportation. Further to this, if New Zealand had also invested significantly in renewable energy, an electrification network could be developed that would significantly impact the nation's energy emissions profile.

If New Zealand was the first country in the world to introduce electric vehicles on a mass scale in 2010, one of the results would likely be that in

2025, New Zealand would have fully developed a recharge system with a high percentage of users compared to traditional forms of oil-based transportation. New Zealand's imported oil bill would have substantially reduced due to the switch to NZ Inc renewable energy¹³³ and the reduced reliance would have made New Zealand less vulnerable to oil price fluctuations in the late 2000s. The need for smart grids to manage electricity demand meant that New Zealand grown technology would have been an important innovation critical to electric vehicle success.¹³⁴

As in Europe, major city centre developments might no longer rate car park spacing so highly and large investment in public transport in the major cities of Auckland, Wellington and Christchurch would mean that existing public transport passenger figures might be more in line with Europe. With better developed infrastructure there might also be less need for more than one vehicle per family.¹³⁵

"It is important that we sell usage not the intellectual property."

Manuka Henare

What if...New Zealand became known for its innovative resource accounting?

New Zealand is already working on different methodologies to value natural resources. The New Zealand Greenhouse Gas (GHG) Footprinting Strategy for the Land-based Primary sectors is an initiative aimed at responding to the need for information on the carbon intensity of primary products.¹³⁶ Should the nation continue to invest in this area, New Zealand could be renowned globally for the degree of attention placed on appropriately valuing resources such as carbon, water, waste i.e. natural capital. With the nation's wider perspective on how to value the economy, measurement systems could be in place that integrate such values into decision-making processes across the country. Being able to fully value

129 McNeil, B. *The Clean Industrial Revolution. Growing Australian prosperity in a greenhouse age.* Allen & Unwin, Australia, 2009.

130 New Zealand's energy profile discussed in the chapter on capitals

131 *Rethinking the Economic Recover - A Global Green New Deal*, United Nations Environmental Programme, April 2009, USA.

132 *Taxation. A Report from Economic Values. Part of the New Zealand Values Study*, Massey University, June 2005, New Zealand.

133 *Taxation. A Report from Economic Values. Part of the New Zealand Values Study*, Massey University, June 2005, New Zealand.

134 *New Zealand Energy Strategy to 2050. Powering our Future*, Ministry for Economic Development, October 2007, New Zealand.

135 *Capturing the Energy Opportunity: Creating a Low-Carbon Economy*, November 2007, Center for American Progress, USA.

136 *Greenhouse Gas (GHG) Footprinting Strategy*, Ministry of Agriculture and Forestry, <www.maf.govt.nz/climatechange/slm/ghg-strategy/> extracted July 2009.

what were once seen as externalities, might mean that a strong signal could be sent out to potential investors regarding how New Zealanders plan to evaluate success. Purely economic measures would be insufficient for measuring success.

New Zealand would be well-known for its integrated approach to resource accounting that drives policy, investment and technology. Businesses would have taken an industry approach to resource accounting and might be reaching targets set in 2009 to generate economic prosperity.

“It is important that we preserve what we have today intact, holding it in trust as part of our country values we have from an intergenerational perspective.”

Keith Turner

What if...New Zealand was truly resource efficient?

Building on existing residential energy efficiency campaigns¹³⁷, and at the same time as investing in further renewable energy sources, New Zealand might also develop further expertise in resource efficiency. With global companies also striving to be as efficient as possible in the internationally competitive marketplace, a focus on resource use might net significant cost savings. If initial studies into the cost savings to be made from energy efficiency and waste minimisation measures were completed in 2010, the type of savings identified might include reduced purchase of raw materials, one-off savings, reduced costs of processing inputs that are ultimately wasted, reduced costs due to substitution, sale of recovered product, reduced management costs, reduced waste disposal costs and unattributable costs. New Zealand would be able to build on examples of costs savings identified in the United Kingdom's manufacturing sector (England and Wales), where some £2 - £2.9 billion in cost savings from resource productivity process improvement were identified. To put this figure into context it equated to 1.25-2% of United Kingdom manufacturing value added and 5-7% of the sector's profits in 2000.¹³⁸

137 For example, the insulation and clean heating programme under the EECA's ENERGYWISE™ funding programme.

138 *The Benefits of Greener Business*, Cambridge Ecometrics / AEA Technology, April 2003, England.

Properly costing all resources in New Zealand might have created a resource aware nation of business and residential customers. Residential customers would be aware of issues such as air quality in urban areas, water scarcity around the world and might have minimised waste production. New Zealand business customers might have been prominent players on the global carbon accounting stage and developed methodologies to suit other types of resource accounting. A focus on good housekeeping may have helped to demonstrate savings and by developing better resource accounting methodologies, where embedded/added value was no longer ignored, more accurate figures would convince the market of this fundamental shift in perception. A change in focus from costing raw materials and waste disposal, to full value chain accounting might also mean that New Zealand's products and services would attain desirability status, thus growing market share and enhancing New Zealand companies' competitiveness.

What if...New Zealand's cleantech culture was world renowned?

If New Zealand were to develop policy that would attract investment into technology and innovation, and build on the clear vision to work towards, New Zealand's place on the world technology stage might be secure. Renowned for strong inventive ideas, ability to grow scalable businesses and the know-how to adapt existing proven technologies, would mean that New Zealand attracts leading scientists, innovators and angel investors that demonstrate long term values. New Zealand might also have developed an attractive proposition for overseas investment, encouraging global businesses to develop strategic growth plans that would include use of New Zealand's world leading low carbon energy resources. Alongside this goal, New Zealand would have developed a strong culture that supports the growth and development of clean technology options. Synonymous with sustainable values, the cleantech approach would not be at the expense of New Zealand's environment. It would address intractable global problems (such as climate change), enhance New Zealand's existing image and generate a virtuous cycle of entrepreneurial investment. The creation of this cleantech culture would filter through to the earliest opportunity – schools and other educational establishments. Translated as an investment in human capital, New Zealand's intellectual

property would have benefited considerably. The number of patents that New Zealand would produce would be significantly higher than in 2007.¹³⁹

What if...the policy and regulatory regime also connected all the dots?

From a policy point of view, New Zealand might have spent considerable time and effort into developing a more stream-lined approach to policy and regulation to move forward a vision for a clean economy. In December 2008, Sweden allocated additional funds to make it easier to take the step from research and development of technologies to commercialisation.¹⁴⁰ A national network for wind power was established, with the Swedish Energy Agency as its hub, and a Government inquiry looked into the possibilities to simplify sections of the regulatory framework affecting conditions for establishing wind power.¹⁴¹

New Zealand might have decided to adopt a similar approach to second-generation biofuels and other energy technologies, and also allocated funds to assist energy technology not yet established on the market.

The Primary Growth Partnership in 2009 involved significant programmes of research and innovation to boost the economic growth and sustainability of New Zealand's primary and food sectors, including forestry.¹⁴² The success of this partnership could mean that in 2025, New Zealand's primary sectors have successfully demonstrated their competitive advantage and built value-add in international markets.

What if...talented individuals are attracted to what New Zealand has to offer?

As a nation of people, New Zealanders are proud of who they are and where they live. They live in healthy and prosperous communities, have access to fulfilling jobs where their input is valued and they retain a strong focus on education and family life. Quality of life is of paramount

139 In 2007, 3,592 patents were granted in total for New Zealand. *World Patent Report: A Statistical Review*, 2008, World Intellectual Property Organisation.

140 *Towards a low carbon society – Sweden*, Ministry for the Environment / Regeringskansliet, December 2008, Sweden.

141 *Actions and initiatives in climate work - The Government's climate change policy*, Ministry for the Environment / Regeringskansliet, April 2008, Sweden.

142 <http://www.maf.govt.nz/mafnet/press/2009/090528-primary-growth-partnership.htm#q6> extracted July 2009

importance and time is a highly valued commodity.¹⁴³ New Zealanders are inventive, solutions oriented, tenacious and friendly people. If the nation were to have a shared vision of where New Zealand should be on the global map, New Zealanders might also be actively involved in the journey to that goal.

“All should contribute to discourse in a small country. Do we use smallness to our advantage?”

Manuka Henare

What if...New Zealand lives up to its brand of 100% pure and is clean and green, in every sense?

New Zealand is globally renowned for its beautiful landscapes, pristine environment and clean streams and rivers. If New Zealand were to further invest in its natural capital, tourists would not only see and experience the beauty, those that stayed a little longer, would begin to realise that it is built on a sound basis of authentic values, scientific evidence, demonstration of practices and local/central government policy. Statistics would hopefully support the fact that New Zealand's natural capital is exemplary and world class. New Zealanders also put a high value on their natural capital, and this would be demonstrated by the economic value factored into decision-making for the future. New Zealand's emissions trading scheme would be regarded as innovative, effective and globally credible, and the approach to water-pricing would mean that both government and corporate planners would develop innovative solutions to the use of resources. The political consensus that achieved this shared vision might mean that the ultimate end goal would be a shared one that New Zealanders could work towards, regardless of political leadership.

143 *Research on Growth and Innovation: prepared by the Growth and Innovation Advisory Board*, Ministry of Research Science and Technology, 2004.

What if...New Zealand's approach to inward investment was governed by clear sustainable criteria?

For overseas investors looking to invest in New Zealand, sustainability criteria would need to be met, ensuring that flows of investment into the country would meet economic, social, environmental and cultural parameters. New Zealand might attract significant international investment that is built on a values based approach. This might constitute a key market differentiator for the nation. With New Zealand's embedded approach to sustainable inwards investment, the care that has been applied to protecting and enhancing natural capital, and New Zealand's own approach to investment would mean that New Zealand's authenticated 'clean, green' image would have started to pay dividends. In return, investors would have received benefit by association with New Zealand's renewable energy portfolio, low carbon intensity of goods and services and sustainable values.

"If we are going to have a clean economy, we need a fundamental change programme."

Manuka Henare

What if...New Zealand's economy was regarded as world class?

Internally, New Zealand might have decided to focus investment efforts on pinpointing key sectors that meet this broad range of critical criteria. To support this investment strategy, there would have been strong investment in both secondary and postgraduate education to supply the trained and talented individuals needed, a new drive to develop world-class infrastructure that could support a world-class economy, and efficient and enviable logistics and transport systems that could connect the nation to consumers. At the same time, the internal investment focus would have been to identify opportunities that move New Zealand's key products and services from natural capital to that of produced capital. Whilst the natural capital would have been, and would continue to be, an important global differentiator, New Zealand's economy would have primarily grown due to an evolution in developing and exporting produced capital, based on the advantages of natural and social capital.

"We must be sure that we improve our intergenerational capacity for the future."

Paul Callaghan

What if...New Zealand was world-renowned for its integrated economy?

To achieve a world class economy, New Zealand government, businesses competing across different industry sectors and civil society would be wedded to the same ideal, supporting the NZ Inc brand, proud in the country's achievements and positive about the integrated opportunities and the wealth they could provide.

What if...New Zealand's Unique Selling Point is cleantech incubation and demonstration and it attracts talented individuals?

One of the key areas of investment could have been that of developing technologies. Entrepreneurial solutions-orientated people would mean that innovative ideas would continue to be abundant in New Zealand. An existing focus on sustainable thinking would mean that New Zealand was ahead in certain exploratory fields. However, incubating ideas and hatching ideas into fully fledged and commercial business opportunities that are potentially world-scalable, would be two different propositions. For example, the University of Auckland Business School Entrepreneurs' Challenge where growing companies get a chance to win up to \$1 million of funding and mentoring from business leaders. Schemes, such as this, are vital for NZ given its distance from major markets and thus the need to compete globally at a much earlier stage.¹⁴⁴

New Zealand would have grown to understand this dilemma and would have developed an enviable reputation not only as a hotbed of ideas, but would also attract world leading investors ready to fund that incubation period. This might have occurred by investing in New Zealand's science and technology at under and post-graduate levels, protecting and enhancing reputation, building world class amenities and the overall prospects that are congruent with a 'clean, green' nation.

¹⁴⁴ *Entrepreneurial support vital for NZ, says PM, The NZ Herald, Friday 24 July 2009.*

“We need an increase in rigorous academic programmes and university resources to enable focus to be channelled into research.”

Alex Malahoff

Retention of the brightest people at an earlier age through sponsorship opportunities, innovative jobs, appropriate remuneration levels and lifestyle opportunities is critical. It would mean that talented individuals experienced in the start-up sector would see New Zealand as an opportunity to increase their skills and continue to build their experience and standard of living, such that they wanted to stay. Organisations need to focus on the attraction of talent rather than solely on ‘retention’.

“Organisations need to exhibit foresight and remember that retaining top talent requires more than just retaining jobs. Employees who feel nervous and undervalued will soon show themselves the door if you do not develop proactive strategies to keep them on your team”.¹⁴⁵ Ongoing investment into the field, coupled with an increasing number of successful technologies taken to the world market, would mean that New Zealand’s reputation in high tech and cleantech research would be reinforced.

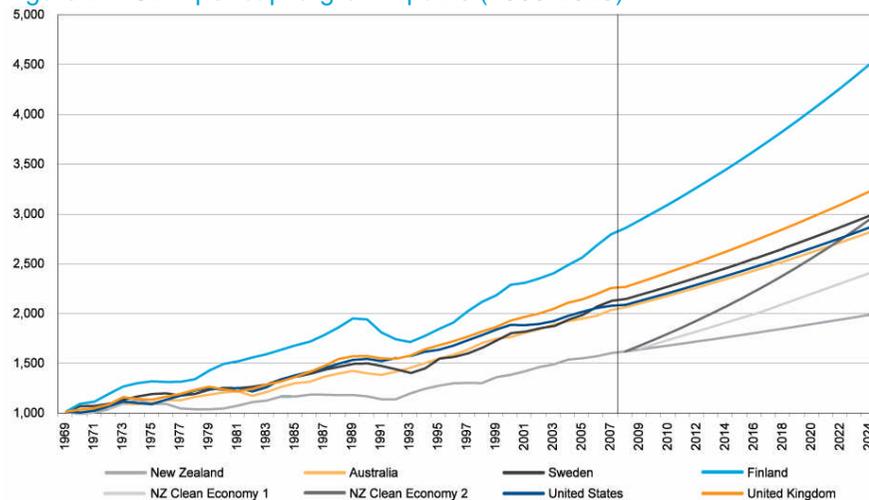
¹⁴⁵ *Retaining Talent in Tough Times*, Hays Press Release, Scoop Independent News, Tuesday 17 February 2009, extracted via <<http://www.scoop.co.nz/stories/BU0902/S00286.htm>>.

New Zealand's economic vision 2025

Using key economic indicators and outlining hypothetical possibilities, this chapter suggests a 2025 picture of what New Zealand's economy could look like.

With historical GDP per capita growth rates significantly below main trading partners, figure 21 projects into the future to provide a picture of economic growth in New Zealand.

Figure 21: GDP per capita growth paths (1969-2025)



Source: United States Department of Agriculture: Economics Research Service, <www.ers.usda.gov/Data/Macroeconomics/>, extracted June 2009; PricewaterhouseCoopers calculations.

With an average growth rate of 1.2% per annum for the period 1969 – 2008 New Zealand has lagged behind the comparison countries. Based on transparent assumptions it is possible to make 'robust' speculation on New Zealand's economic picture.

The first assumption is that every other country grows at the same rate over the 2008-2025 period, as it has over the last four decades (1969-2008). Increased growth assumptions are then adopted for New Zealand. The first hypothesis is to double New Zealand's historical growth rate at 2.4%, and the second is to triple its historical growth rate at 3.6%.

As Figure 21 shows, the first hypothesis enables the New Zealand real income per capita to grow to nearly 2.5 times its 1969 size by 2025. In 2025, New Zealanders' real incomes would be 50% higher than they were in 2008. This compares favourably to growth remaining similar to historical rates (1.2%) which would have resulted in real incomes increasing only 23% between 2008 and 2025. This suggestion also compares favourably with Australian incomes which would have only grown by 37%.

The second hypothesis paints an even more positive picture. New Zealanders' real income per capita would grow to three times its 1969 size by 2025. In 2025, real incomes would be 82% higher than what they were in 2008. There is still some way to go to recover the ground lost between 1969 and 2008 but the gap begins to narrow.

This naturally leads to the question – what is necessary to achieve growth rates in excess of 2% when the historical performance has been on average 1.2%? Statistically it is challenging as illustrated below, showing the historical and more recent performance of a selection of countries' growth rate of GDP per capita.

Figure 22: Growth rates per capita

Annual growth rate	Time Period	
	1969-2008	1990-2008
New Zealand	1.2%	1.8%
Australia	1.9%	2.2%
World	1.5%	1.5%
Developed	2.1%	1.7%
Sweden	2.0%	2.0%
Finland	2.7%	2.2%
Singapore	5.2%	3.9%
United States	1.9%	1.7%
United Kingdom	2.1%	2.1%

Source: United States Department of Agriculture: Economics Research Service, <www.ers.usda.gov/Data/Macroeconomics/>, extracted June 2009; PricewaterhouseCoopers calculations.

Although challenging, achieving growth rates of greater than 2% is plausible: growth rates of greater than 3% have been achieved by a small number of other countries. Over the 1969 to 2008 period, according to IMF statistics, more than 30 countries have achieved such performance levels. Singapore, featured previously, has achieved real income per capita growth rates of 5.2% per annum. Ireland is another example with growth rates of 4% over the same period.¹⁴⁶

Whilst it is challenging to achieve a higher a growth rate it is also very difficult to sustain over time, only a handful of countries have been able to keep the growth rate consistently high over time. What does achieving such real growth rates mean?

If New Zealanders' current real incomes per capita growth doubles, then real incomes per person in New Zealand (in United States dollars, 2000 base year) would be USD\$31,700 in 2025 compared to the current \$25,800. This increase in real incomes of nearly USD\$6,000 multiplied by 4 million New Zealand residents today, translates to an increase of USD\$24 billion in the New Zealand economy. Depending on exchange rate assumptions used, by illustrative example this increase would be sufficient to fund at least 10 Eden Park stadium redevelopments for each of the 13 regions in New Zealand.

¹⁴⁶ Ireland has experienced rapid decline in growth recently.

If on the other hand, real incomes per capita growth trebles, then real incomes per person in New Zealand would be USD\$47,000 in 2025. This increase in real incomes of nearly USD\$21,000 translates to an increase of USD\$84 billion in the New Zealand economy. This would clearly result in a significant increase in the living standards of ordinary New Zealanders.

If we produce more of what the world wants efficiently, then the increased productivity will tend to increase trade.¹⁴⁷ Therefore, the increase in real incomes per capita driven by increased productivity will drive an increase in export performance. Given the size of the small New Zealand domestic market, the increased production of goods and services from any significant productivity improvements would tend to be exported. One can therefore expect New Zealand's export intensity (which currently sits at 29% of GDP) to increase substantially.

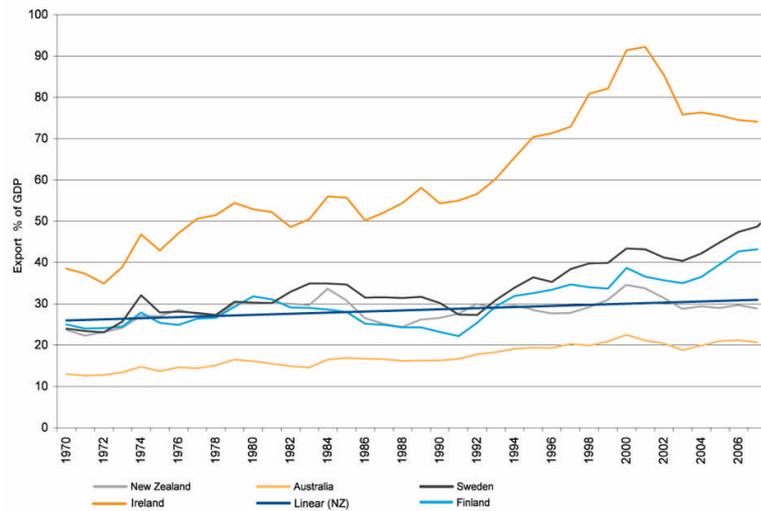
Based on the suggested alternatives,¹⁴⁸ export intensity would be expected to increase to, conservatively, at least 40% of GDP or more speculatively to around 50% of GDP. A simple straight line regression of past trends in export intensity suggests that could improve to 33% of GDP by 2025. As the graph over shows, this level of improvement has historical precedents.

An increase in export share of GDP of 7%, in today's figures, represents an increase of NZ\$12 billion in export earnings (or a 30% increase compared to current exports).

¹⁴⁷ This was explored in a Treasury paper on productivity where the point was made that "Causality runs most strongly from productivity to exporting, not the other way around." *International Connections and Productivity: Making Globalisation Work for New Zealand* Treasury Productivity Paper 09/01, New Zealand Treasury April 2009.

¹⁴⁸ Necessarily speculative as the relationship between productivity growth, increased exports and changes to forward and backward linkages is complex with factors such as distance to markets, at-the-border and behind-the-border policies all playing an important role.

Figure 23: Comparison of selected OECD countries export intensity (export as a percentage share of GDP)



Source: OECD Factbook 2009: Economic, Environmental and Social Statistics, OECD, 2009.

Research has found that “primary sector directly contributes 6.8% to GDP. If the primary sector’s backward and forward links to the rest of the economy are included as well, the contribution grows to around 17% of GDP ... and two-thirds of New Zealand’s merchandise exports.”¹⁴⁹

While different economic sectors have different forward and backward linkages, the implication is clear. An increase in **new**¹⁵⁰ export earnings could potentially have an impact on GDP of between 1.5 to 3 times the initial earnings. Therefore, the NZ\$12 billion increase in export earnings could potentially have an impact on GDP of up to NZ\$36 billion or an increase in per capita incomes of about NZ\$9,000 per annum.

Not all the gains of successfully achieving a clean economy vision will come through gains in export earnings. Treasury reports that increasingly, trade will be in tasks rather than services. Parts of the value chain will be

increasingly separated, often across national borders.¹⁵¹ To the extent that New Zealand successfully invests in controlling parts of the global value chain, then contributions to the New Zealand economy will be in the form of repatriation of profits and reflected in national economic accounts in services growth and in balance of payment improvements. The net international investment position can be expected to improve significantly to below 70% of GDP from the current 93% of GDP which will stabilise recent macroeconomic imbalances.

Natural resource rents (or returns on natural capital, i.e. financial capital) that are reinvested wisely in developing both the human capital and produced capital, can create an upwards cycle that in turn will help foster greater social capital. Social capital, or increased trust between the key participants in the economy, would also be an ingredient in ensuring a pro-growth focus that is consistent with enhancement of natural and human capitals.

In terms of other key performance indicators that have been recommended, the challenge in terms of projecting forward what the aspirational indicators may look like is in Appendix II.

The work in establishing the set of indicators is emerging and the conceptual methods for valuing some of the capitals, such as human, natural and social, are very new. More importantly, many countries do not yet have official measures of these capitals.¹⁵²

Models integrating the economic capitals (financial and produced) and other capitals (natural, social and human) have not yet been developed into a form sufficient to enable forward projections.

Accordingly, our approach in this study is to make an educated estimate of the level of improvement of some of the indicators. This is based on a combination of factors such as plausible income growth, focus and direction of likely policies required to successfully achieve the clean economy vision and current world trends as reported internationally in publications, such as the OECD Key Environmental Indicators report.

A table of indicators is provided in Appendix II in which stock and flow indicators for the five natural capitals are presented.

149 *The Contribution of the Primary Sector to New Zealand's Economic Growth*, Treasury Policy Perspective Paper 05/04, NZ Treasury, 2004.

150 that is to say it doesn't crowd out an existing sector in terms of resource use.

151 *International Connections and Productivity: Making Globalisation Work for New Zealand* Treasury Productivity Paper 09/01, New Zealand Treasury April 2009.

152 *Where is the Wealth of Nations? Measuring Capital for the 21st Century*, The World Bank, 2006, Washington, USA.

Conclusions and recommendations

“New Zealand has unusual vulnerability and needs to embrace a vision. It can’t afford the luxury of doing nothing.”

John Allen

New Zealand’s current economic position, as discussed in an earlier chapter, is important in developing a baseline against which to measure the impacts of significant policy changes. The outcome of the analysis of this economic picture is that New Zealand needs to address a number of economic factors if it is to gain position alongside the leaders in the OECD ranking. Also discussed is the need for New Zealand to widen its repertoire measures of wealth. Fortunate in many ways to have access to abundant natural and human capital, New Zealand needs to consider how to value its wealth across the five capital bases – financial, produced, social, human and natural. A new approach to considering New Zealand’s economic position will include a wider perspective on such measures, echoing a path towards sustainability that many other countries are beginning to adopt. New Zealand needs to capitalise on the existing advantages (such as the clean green reputation, geographic isolation, appropriate test market size, etc.) rather than eroding them.

Business drivers for addressing a clean economy are widespread. Changing global sentiment towards addressing climate change, a demand for more sustainable goods and services, markets requiring more information about sustainable business practices in the value chain and a need domestically to re-address the economy are the more obvious drivers. In terms of the opportunities available to New Zealand, and the possibility to economically benefit from them, there needs to be a marked attempt to better understand them and translate that into policy. Clear investment by many international governments into cleantech opportunities has demonstrated a global move in the direction of more sustainable economies. New Zealand’s pre-established reputation (although this rapidly needs authenticating to avoid reputation risk) potentially sets this country ahead of many others. Investigation of the

appropriate priorities would help New Zealanders identify the nature of the vision they would like to pursue. This report, hopefully, provides food for thought and presents an opportunity to open up such an important debate.

Whilst some ideas may have been planted in this short report, the ultimate vision needs to be discussed and debated across the country. It is suggested that the first step to be taken is the development of a nationwide stakeholder engagement exercise that asks, identifies and imparts the key elements of a vision for a clean economy for New Zealand in 2025. Stakeholder groups need to include central and local government, small and large businesses, urban and rural communities, civil society organisations. A stakeholder engagement exercise opens the door to the possibility of visioning a future New Zealand, based on true New Zealander values, utilising New Zealander talents and New Zealand’s assets (i.e. capitals), and building a clear sense of purpose.

“The biggest debate will be about the strategy for how to agree the vision, but in fact the debate about strategy will also illuminate the vision.”

Keith Turner

The second step along this path is the need to conduct a gap analysis between where New Zealand is currently positioned and where it could be positioned if some significant decisions were made to reach the proposed vision. The third piece of work that needs to occur, once a clear vision has been established, is the development of a strategy for New Zealand to become a clean economy. With clarity around a vision, staged steps to reach it cannot be left to chance. The strategy should therefore include practical actions, an agreed timescale and measurable goals. It would build on the established elements of the vision – education to develop talented individuals, investment in science and technology, research and innovation to elicit technological solutions, new cultural approaches to combine venture capital with commercialisation skills, market intelligence to better identify global consumption demand and sustainability understanding to build capability in the long term.

Finally, it is pivotal to New Zealand’s clean economy vision, that all capitals (economic, social, natural, produced and human) are properly valued. This will provide a distinctiveness that is unique to New Zealand, and one that differentiates it in the global economy.

Appendix I:

Research methodology

This report on the clean economy was written by PricewaterhouseCoopers for New Zealand Trade and Enterprise as part of their wider three year project considering the value of investing in clean technology in New Zealand.

Although primarily concerned with discussing (the need for) a potential economic vision for New Zealand, it has touched on a number of complex and inter-related issues at a high level. Our research methodology and engagement with interested parties is discussed here to demonstrate the breadth of our approach. A short report such as this has not been designed to provide in-depth analysis of where New Zealand's economy could be placed in 2025. It has been written with a view to providing a different perspective on the need for a new economic vision and how that could draw on New Zealand's existing strengths, whilst also bridging the gaps.

Background research

In order to create a coherent and well-constructed vision of a clean economy in New Zealand, it is necessary to ensure it is based on solid and robust research. A clear, methodical approach was taken to provide research resources that underpin the comments made in this report. This bottom-up approach to the research can be summarised into a number of steps as follows:

- Widespread national and international research on keywords such as clean economy, clean technology, sustainability, brand NZ, innovation, investment, etc.
- Review and collation of research material into a summarised format, identifying key research themes and important points.
- Translation of key research themes, important points and quotes into subject categories (such as brand, capability, economics, education,

energy profile, environment, industry profile, innovation, investment, leadership, politics, public health, sustainability, talent and resource, technology, trade, transportation, workforce) to inform the vision.

- A summary of the research material is included in Appendix II. The translation of this extensive research then informed the overall development of the report.

Stakeholder engagement

To also ensure that this report presents a balanced view of where New Zealand could be in 2025, a number of people were invited for interview. The aim was to gain a wider perspective on some of the critical questions that we pose throughout the document and better understand peoples' views across a number of different sectors. Effort was made to identify people representing a cross-section of well-established, known commentators with differing but clear views that can provide important guidance.

The people actually interviewed were Professor Paul T. Callaghan, Dr. Keith Turner, Dr. Alex Malahoff, John Allen and Dr. Manuka Henare.

All sessions were face to face interviews. The following set of questions was used to guide all interviews:

- Do you think we need a shared economic vision for NZ – what are your thoughts on this and how do you think we should develop this, who should we engage with and how?
- What do you think are the key questions that should be asked and can you suggest key attributes/characteristics/considerations for an economic vision for NZ?
- NZTE has postulated an idea for an economic vision based on a concept called the Clean Economy. What are your thoughts and understanding of what this might mean for NZ?
- NZTE are evolving some thinking on this and are undertaking this study to investigate the veracity of an economic vision for New Zealand based on a concept called the Clean Economy and a pathway

towards the 2025. The Clean Economy has been defined [thus far] as a high value low carbon export economy. It is vision of wealth creation based on five foundations [clean energy, clean transport, clean industry, clean agriculture and clean environment] and values that we think are important to New Zealanders namely quality of life, quality of the environment and social equity. It involves the development, commercialisation and deployment of clean technologies and smart thinking to transform our existing [export] sectors and create dynamic new ones. What is your reaction to this definition and this concept?

- We are suggesting a measurable goal is needed. In the context of the Clean Economy, how do you think this measurable goal might be derived?
- What are the critical elements of a clean economy that should be included in a report about The Clean Economy (in NZ) in 2025?
- Should any of those elements receive more attention than the others? Why?
- Do you have general points about The Clean Economy that you feel should come across in a report? What are they?
- What are the critical messages to get across about where NZ is heading/should be heading?
- Any quotes you think sum up your thinking on the Clean Economy?
- Any references/documentation you think we should be looking at?
- Any other comments?

Responses were collated and confirmation sought regarding the quotations that could be used throughout the report.

Appendix II: Clean economy Indicators

As discussed previously in this report, traditional economic measures of performance, such as GDP per capita, may not provide a full picture when assessing the performance of a clean economy. To this end, a series of indicators have been adopted to portray appropriate measures that New Zealand could use to assess itself against, in a clean economy of the future.

This table provides assessments of both New Zealand's current status against the indicators, and also aspirational goals for 2025.

Indicator domain	Stock Indicators	New Zealand Current	Suggested New Zealand 2025 aspirations
Foundational well-being	Health-adjusted life expectancy M F	78.1 ¹⁵³ 82.2 ¹⁵⁴	10% increase
	Percentage of population with post-secondary education Upper secondary Tertiary	46.3 ¹⁵⁵ 29.8 ¹⁵⁶	40-50% increase
	Temperature derivations from normals		Less deviations
	Ground-level ozone and fine particulate concentrations	298 DU ¹⁵⁷	30-40% improvement
	Quality-adjusted water availability	TBA	30-40% improvement
	Fragmentation of natural habitats	TBA	40-50% decrease
Economic well-being	Real <i>per capita</i> net foreign financial asset holdings	-\$31,000 ¹⁵⁸	30% reduction
	Real <i>per capita</i> produced capital	\$36,227 ¹⁵⁹	30-40% increase
	Real <i>per capita</i> human capital	\$163,481 ¹⁶⁰	40-50% increase
	Real <i>per capita</i> natural capital	\$43,226 ¹⁶¹	40-50% increase
	Reserves of energy resources	\$7.5 billion ¹⁶² (2001)	Decrease of non-renewables, Significant increase in renewables capacity
	Reserves of mineral resources	TBA	Decrease
	Timber resource stocks	\$14.5 billion ¹⁶³ (2000)	40-50% Increase
	Marine resource stocks	\$3.8 billion ¹⁶⁴ (2006)	40-50% increase

153 *OECD Health Data 2008*, http://stats.oecd.org/Index.aspx?datasetcode=SNA_TABLE1, figures are for 2006.

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Appendix V: Key terms of business and restrictions

Restrictions

This Report has been prepared solely for the purposes stated herein and should not be relied upon for any other purpose. We accept no liability to any party should it be used for any purpose other than that for which it was prepared.

To the fullest extent permitted by law, PwC accepts no duty of care to any third party in connection with the provision of this Report and/or any related information or explanation (together, the “Information”). Accordingly, regardless of the form of action, whether in contract, tort (including without limitation, negligence) or otherwise, and to the extent permitted by applicable law, PwC accepts no liability of any kind to any third party and disclaims all responsibility for the consequences of any third party acting or refraining to act in reliance on the Information.

We have not independently verified the accuracy of information provided to us, and have not conducted any form of audit in respect of the Company. Accordingly, we express no opinion on the reliability, accuracy, or completeness of the information provided to us and upon which we have relied.

The statements and opinions expressed herein have been made in good faith, and on the basis that all information relied upon is true and accurate in all material respects, and not misleading by reason of omission or otherwise.

The statements and opinions expressed in this report are based on information available as at the date of the report.

We reserve the right, but will be under no obligation, to review or amend our Report, if any additional information, which was in existence on the

date of this Report was not brought to our attention, or subsequently comes to light.

We have prepared hypothetical scenarios about future events which, by their nature, are not able to be independently verified. Inevitably, some assumptions may not materialise and unanticipated events and circumstances are likely to occur. Therefore, actual results in the future will vary from the scenarios which we have produced. These variations may be material.

This report is issued pursuant to the terms and conditions set out in our engagement letter and the Terms of Business attached thereto.

In addition the following should be noted:

- Certain numbers included in tables throughout this report have been rounded and therefore do not add exactly.
- Unless otherwise stated all amounts are stated in New Zealand dollars.

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