

ENERGY BRIEFING 2014



A NEW VOICE ON OUR ENERGY FUTURE

The BusinessNZ Energy Council (BEC) is a relative newcomer to New Zealand's energy scene. Building on its predecessor, the Energy Federation of New Zealand, its goal is to support New Zealand's economic well-being through the active promotion of the sustainable development and use of energy for everyone's benefit, both here and abroad.

The BEC is a cross-sectoral entity comprising leading energy-sector businesses and business organisations, government agencies and research entities. Through our close association with the World Energy Council, we bring back expertise from around the world and share our New Zealand expertise on the international stage.

This provides helpful perspective on domestic energy debates, and helps generate new ideas and approaches to our energy advocacy.

This perspective, supported by evidence, tells us that we have a positive energy future if we do not squander the gains made over the last couple of decades. The underlying market framework is broadly sound, so a strategy of stability and incremental improvement is appropriate. Let's not throw the baby out with the bathwater but instead have a richer, more mature debate about our energy future.

The work of the BEC, especially its BEC2050 Energy Scenarios Project, will help inform this debate.



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WE NEED TO GET ENERGY POLICY RIGHT

Our natural resource abundance provides us with choices and opportunities that are envied around the world. The challenge we now face as a country is how to come together to leverage these opportunities in a way that allows businesses to thrive on the global stage and the economy to grow in an environmentally responsible way.

The energy sector can play a greater role in achieving this, with systems that reflect and support New Zealand's specific economic, environmental and cultural make-up. We need royalties that will attract explorers to the bottom of the world, environmental practices that suit our location and terrain, resource allocation and consenting systems that show we are a sound investment destination, and competitive markets that drive the right behaviour to invest in and to use energy that is provided at the lowest possible cost.



Dramatic shifts in policy aren't required. In fact, business places a premium on stable policy settings, as unpredictable settings make investment more expensive, dampening the desire to invest, creating energy security risks and reducing the international competitiveness of New Zealand businesses.

This briefing provides a perspective on several energy policy matters, offering solutions that can unlock a more secure, environmentally sustainable and competitive energy sector in New Zealand.



John Carnegie
*Manager Energy, Environment and
Infrastructure*

INTRODUCTION - THE WORLD ENERGY COUNCIL AND THE BUSINESSNZ ENERGY COUNCIL

About the World Energy Council

The World Energy Council (WEC) is the principal international network of leaders and practitioners, promoting an affordable, stable and environmentally sensitive energy system for the greatest benefit of all.

Formed in 1923, the WEC is the United Nations-accredited global energy body, representing the entire energy spectrum. It has more than 3,000 member organisations in over 90 countries, drawn from governments, private and state corporations, academia, non-government organisations and energy-related stakeholders. The WEC informs global, regional and national energy strategies by hosting high-level events, publishing authoritative studies and using its extensive member network to facilitate the world's energy policy dialogue.

www.worldenergy.org

About the BusinessNZ Energy Council

The BusinessNZ Energy Council (BEC) is the New Zealand member committee to the WEC. The BEC was established on 1 January 2013, as part of the BusinessNZ family.

Consistent with the WEC approach, BEC members comprise a wide cross-section of leading energy-related organisations whose shared

goal is to support New Zealand's economic well-being through promoting sustainable development and use of energy, both domestically and globally.

It brings together the memberships of the BusinessNZ Major Companies Group and the former Energy Federation of New Zealand.

A list of the BEC members can be found at <http://www.bec.org.nz/about/our-members>.

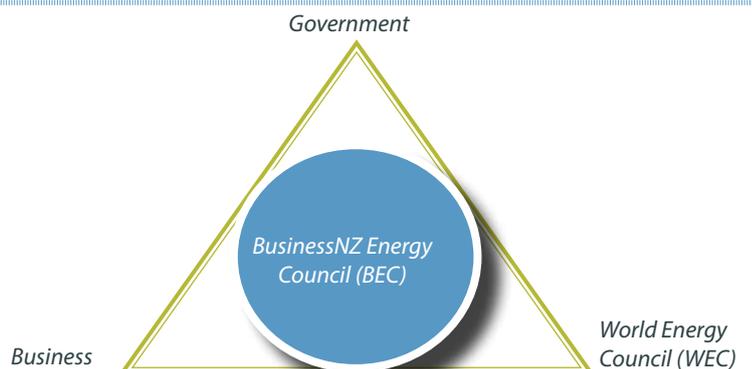
The BEC has the ability to speak to energy sector issues as a broad-based business community in a way that no other New Zealand energy-related association can. Its broader network and membership encompasses the entire energy value chain from upstream explorers to downstream users, government and research entities. Figure 1 (below) highlights this key strength.

The BEC supports consistent and well-structured policies that underpin New Zealand energy conditions and the goals of the BEC and the WEC. Access to the WEC international network stimulates dialogue, promotes the exchange of ideas, aids development of new business partners and investment opportunities and provides collaboration and information sharing across the New Zealand energy sector.

BEC members actively engaged in the WEC work programme are set out in Appendix One.

The BEC has also recently established a young energy professionals network, to be officially launched later this year. The network provides a vehicle for young energy professionals to discuss issues of relevance to them and the future of the energy sector.

Figure 1: Bringing parties together



THE ENERGY SECTOR

The energy sector is large and affects every other sector of the economy. Policies that touch on its various component parts (such as petroleum exploration, the transformation of energy into fuel, steel, milk powder, methanol or electricity, or inputs such as resource, labour and capital availability) matter a lot to New Zealand's future prospects as an internationally competitive economy.

Increasing access to and use of competitively priced energy is associated with many positive economic and social outcomes, including more productive businesses, growing incomes, increased penetration of information

technologies, improved health, longer life expectancy, higher educational attainment, greater mobility and many others.

New Zealand has an abundance of natural resources to draw on. World Bank research has shown that New Zealand is second only to Saudi Arabia in natural resource wealth per capita.¹

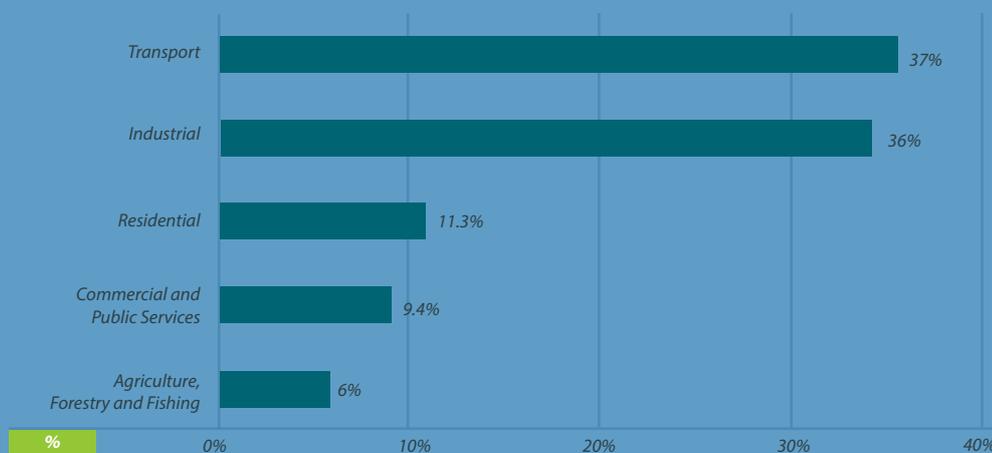
Our geology provides rich mineral, coal and petroleum resources, only a small proportion of which have been tapped to date. Our geography and climate provides us

¹ World Bank Environment Department paper entitled 'Estimating National Wealth: Methodology and Results', January 1998.

with mountains from which large rivers flow, enabling hydro power. Sitting on the Pacific ring of fire, we have access to geothermal energy. Our wind resources are amongst the world's best. We have plentiful solar energy and could harness the power of the oceans that surround us for marine energy. Extensive farming and forestry areas offer opportunities to utilise biomass to yield heat, electricity and biofuels.

Despite this abundance and our relatively small population, New Zealand is a net importer of energy, predominantly in the form of petroleum products on which the economy relies.

Figure 2: Consumer energy demand share by sector in 2013



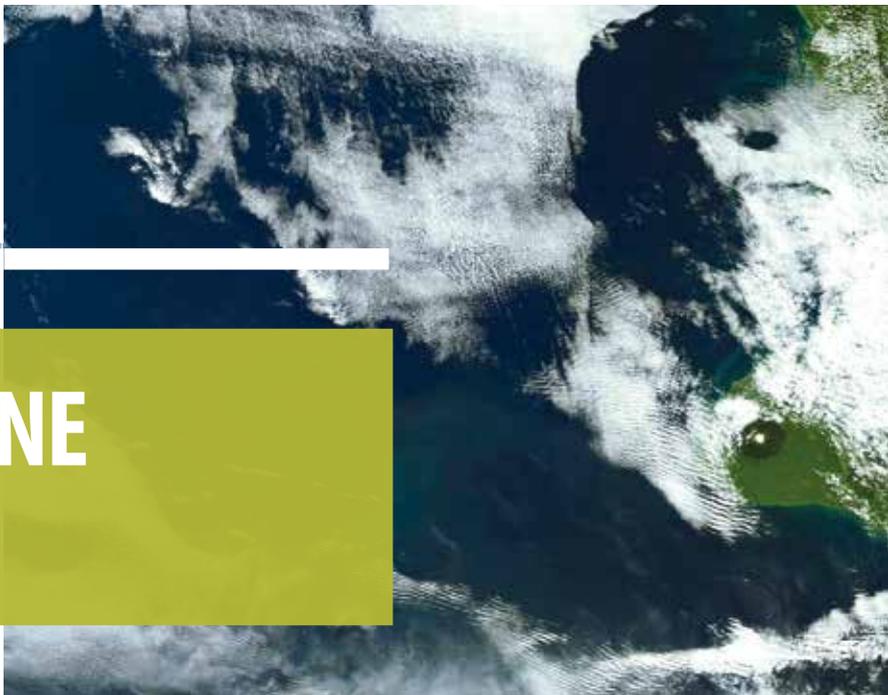
Source: Ministry of Business, Innovation and Employment report entitled 'Energy in New Zealand 2014', page 6.

- Oil and electricity make up the bulk of consumer energy demand in 2012, comprising over two-thirds of energy needs, followed by natural gas at around 20%.
- The industrial and transport sectors comprised just over 70% of energy demand in 2012.
- In 2011, the total asset value across the energy sector was around \$29 billion.¹
- The sector contribution to GDP for the same period was approximately \$4.3 billion out of a total real GDP of approximately \$152 billion (or 2.8% of GDP).²
- There are around 22,500 full-time equivalents (or around 1.5% of total workforce) working in the energy sector.³

¹ National Infrastructure Unit report entitled 'National Infrastructure Plan 2011', pages 6-7.

² Statistics New Zealand, Gross Domestic Product, Annual Value, Table 5, Mining, and electricity, gas, water, and waste services.

³ Statistics New Zealand, Quarterly Employment Survey: March 2014 Quarter, Table 3, Full-time equivalent employees (FTEs) by ANZSICO6 industry.



SETTING THE SCENE

New Zealand's physical infrastructure, energy markets and energy regulations form a complex set of integrated systems. The output of this is energy at a certain price, with a certain level of reliability within a particular range of environmental impacts. A change in any of the components creates a ripple effect and typically alters the outputs in some way.

In this context it is the investment and employment plans of business, rather than central or local government, that matter to the day-to-day production and delivery of energy. What central and/or local government does to help is crucial to creating the right conditions for the energy sector to flourish and be a source of competitive advantage.

New Zealand has at times been one of the international leaders in energy sector reform. New Zealand's economic history has been shaped by its ability to turn energy opportunities into projects in ways that balance commercial and environmental interests and grow overall economic activity. We have not always got this right, but many of the core elements of those reforms remain largely in place and continue to be appropriate.

However, this is a time of increasing complexity and unprecedented uncertainty for the global energy sector. In a world where new

technologies foster quicker innovations and require changes in our policy responses, the task of business and policy makers predicting what might happen in the future becomes harder.

In the wake of the global financial crisis, global energy demand will renew. This will be driven by non-OECD economic growth underpinned by the use of fossil fuels as the developing world returns to double-digit growth rates and aspires to western standards of living. Uncertainties around the international climate change agreement and carbon prices, the impact of shale gas and unconventional oil, collapsing solar prices and the rise of 'big data' are playing out now. The pressure and challenge to develop and transform the global energy system is immense. Policy makers and business leaders have to take critical decisions on our future energy infrastructure in this context.

Decision-making tools that facilitate long-term business planning beyond political cycles will help provide greater certainty.

New Zealand's challenges and opportunities are nearly all global in origin. We are a price and technology-taker, competing globally for capital and skills, investing in long-lived, high cost assets and trying to be resilient to cyber threats, weather and other risks.

How we respond to this growing complexity and uncertainty will define our future.

New Zealand faces some increasingly difficult choices. Do we continue to rely on open, decentralised, competitive energy markets as the most appropriate, flexible and adaptable way of delivering effective and efficient long run outcomes for consumers, or do we respond with policies that are more directive? Whatever the choice, it will remain with us for decades to come, as has the legacy of the 'Think Big' projects.

It is clear that we should not foreclose options but neither should we blindly pursue them. Balance is required. Only a sound policy framework that balances energy security, energy equity and environmental sustainability will enable the delivery of robust and resilient energy infrastructure.

In contrast, opportunistic policy approaches are more likely to endanger energy security, decrease social equity and hamper environmental viability, and ultimately heighten political and investment risk.

ENERGY MARKET PERFORMANCE

“New Zealand’s energy system appears to be a well-oiled machine”

Christoph Frei, Secretary-General of the World Energy Council, Wellington, March 2014

Unprecedented uncertainty in the global energy system does not mean that New Zealand’s energy system is broken. In fact, evidence tells us the system is generally performing well.

As shown in Figure 3 below, the overall energy intensity of the economy has reduced in real terms by an average rate of 1.4% per annum since 1990. This reflects a transforming economy. A structural factor contributing to this long-term reduction is the growth of service industries, which are less energy intensive than industries such as manufacturing. It also reflects one

of the few positive outcomes from the recession, which businesses used to resize and reshape, and take advantage of the high dollar to import capital goods that are more productive and more energy efficient.

The petroleum and minerals sector remains one of the economy’s most productive, and the markets for these resources are global and growing.

Exports for 2013 totalled around \$1.7 billion, including more than \$300 million for coal, making this one of New Zealand’s largest export earners. Total royalties in the 2013 financial year were just under \$400 million.

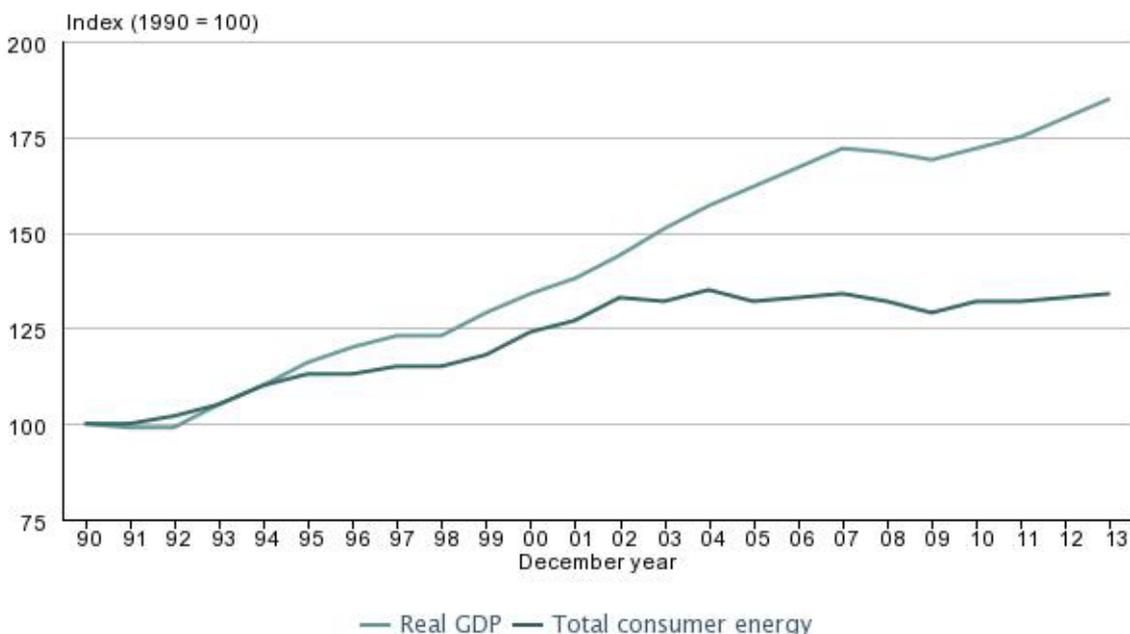
Oil and gas exploration and development expenditure exceeded \$1.5 billion in 2013.

In the same period, around 4.6 million tonnes of coal was produced, of which 2.5 million tonnes were consumed in New Zealand, mostly in industrial processes.

Diesel use, which tends to correlate to economic performance, rose 4% in 2013, reaching its highest consumption on record of 52,200 bbl/day.¹

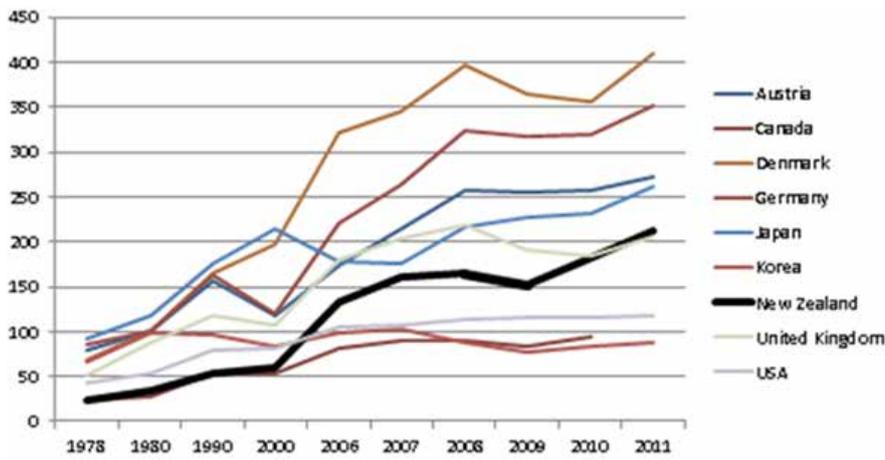
¹ Ministry of Business, Innovation and Employment report entitled ‘Energy in New Zealand 2014’, page 33.

Figure 3: Energy intensity of the economy 1990 - 2012



Source: Ministry of Business, Innovation and Employment, and Statistics New Zealand.

Figure 4: Electricity prices for households in US dollars/MWh



Source: IEA Statistics, Electricity Information (2012 Edition) Part III, Table 3.7. III.56, page 132.

Consumers are adopting energy management technologies which result in energy savings to business of \$8 million per year, while product standards and labelling have saved businesses \$145 million in energy costs since 2002.

More than 250,000 homes have benefited from energy efficient insulation retrofits since 2009, which will deliver about \$1.7 billion in net national health and energy benefits over the lifetime of the measures.

Few other countries have systems that can so easily accommodate the range and expansion of generation types, sizes and variety of market participants.

The New Zealand electricity market is now characterised by generators being subject to capital and product market disciplines, costs being set by the market (conditioned by the entry cost of new plant), financial risks being borne by shareholders and a

pipeline of new (predominantly renewable) development projects.

For example, of the 4,503MW total generation capacity either under construction or consented (and not subject to appeal), there is 3,299MW of geothermal, hydro, wind and marine sources of generation.

In an energy hungry world on a transition to a renewable future, New Zealand is well placed to leverage globally off its skills and experience. For example, of the 1,100MW of geothermal energy installed around the world in the last six years, half of it was in New Zealand.

New Zealand ranks consistently in the top three nations in the OECD in terms of the share of electricity generation from renewable sources (behind Iceland and Norway). Most of New Zealand's renewable energy production is used in electricity generation, which met 78% of New Zealand's electricity generation in the June 2014 quarter.

New Zealand also fares well in comparisons on energy sector greenhouse gas emissions per capita, ranking below the USA, Australia, the European Union and Japan.

We sit in the middle of the pack for transport emissions per capita.

New Zealand is unique among developed economies in that its roll-out of advanced meter infrastructure (AMI) has been market-driven rather than mandated via regulation. Australia is currently moving towards a similar market-led approach after its regulated distributor-led AMI roll-out failed to deliver the expected net benefits to consumers.

The majority of legacy meters in New Zealand are contracted for replacement and over 65% of households already have AMI installed (this equates to around 1.2 million meters). High AMI penetration has enabled significant innovation, particularly in the residential consumer sector.

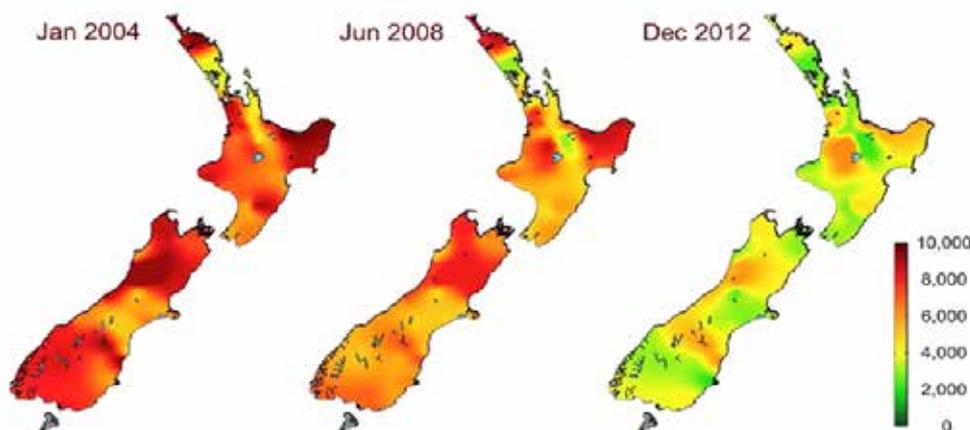
With regard to self-sufficiency, New Zealand's ability to meet its own energy requirements sat at a creditable 84% in 2013.²

When ranked in 2013 against the 24 largest energy user countries (which account for about four-fifths of total world energy demand), New Zealand came third in energy security, maintaining its ranking from the previous year. Our energy security risk rating, undertaken by the US Chamber of Commerce, has consistently ranked in the top five.³

While energy prices have risen more than the national average income over the last 13 years, expenditure on electricity has remained fairly flat as a proportion of household income.

Price increases have generally been driven by the costs of transmission upgrades with energy prices either flat-lining or falling (with some of the generator-retailers committing to

Figure 5: Trends in electricity retail market concentration (Herfindahl-Hirschman Index)



Source: Electricity Authority

² Indigenous production/total primary energy. See <http://www.med.govt.nz/sectors-industries/energy/energy-modelling/data>

³ Institute for 21st Century Energy, U.S. Chamber of Commerce report entitled 'International Index of Energy Security Risk, Assessing Risk in a Global Energy Market', 2013 edition, pages 40-41. New Zealand is clearly not one of the largest twenty-five energy users. Its inclusion in the index is as a favour to the author.

keep their energy prices unchanged through to 2015, so declining in real terms).

Figure 4 shows how New Zealand residential electricity consumers fare amongst a group of their international peers. In the United Kingdom, the average price of electricity paid by households rose by around 20% in real terms between 2007-2012.⁴ More recently in Germany, electricity prices for households increased by more than 10% from 2012 to 2013.⁵

A more competitive market structure is taking hold in the residential electricity retail market, as shown in Figure 5.

In December 2013, VaasaETT (a Finland-based energy think-tank which tracks customer switching trends in 38 competitive electricity markets) ranked the New Zealand electricity retail market as the most active in the world for customer switching.

VaasaETT also ranked New Zealand's gas market as world leading, with an annual switching rate of around 18%.

New Zealand's Energy 'Trilemma' performance

New Zealand also ranks well in the WECs 2013 Energy Sustainability Index. The index provides a tool to assess the overall sustainability of a country's energy system and how well it manages trade-offs between three competing dimensions (energy security, energy equity and environmental sustainability⁶).

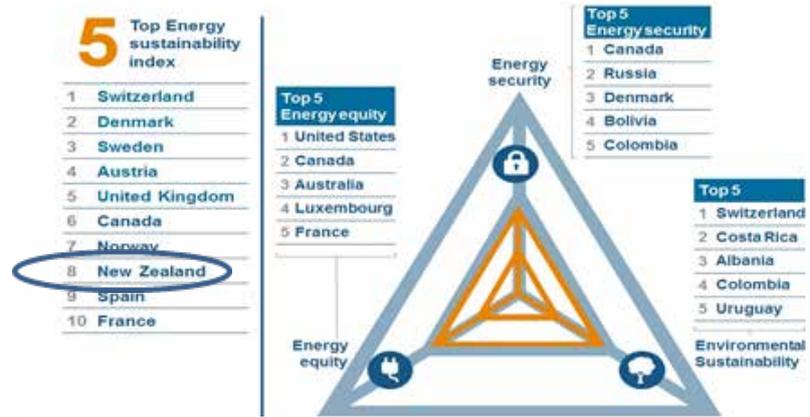
When ranked against 129 other countries for managing the energy trilemma, New Zealand came 8th with a 'balance score' of AAB (AAA being the highest and DDD the

⁴ WEC 2014 Trilemma Index analysis, unpublished draft, page 3, drawn from Department of Energy and Climate Change, UK, March 2013.

⁵ *op cit*, page 3, drawn from International Energy Agency Energy Prices and Taxes, Quarterly Statistics (First Quarter, 2014).

⁶ Energy security: the effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of participating energy companies to meet current and future demand. Energy equity: the accessibility and affordability of energy supply across the population. Environmental sustainability: the achievement of supply and demand-side energy efficiencies and the development of energy supply from renewable and other low-carbon sources.

Figure 6: Energy Sustainability Index pack leaders



lowest)⁷. The WEC considers New Zealand to be one of its 'pack leaders', as shown in Figure 6.

In comparison with countries who have similar electricity market design, Germany ranks 11th with a score of BBB, and Brazil, ranks 34th with a lopsided balance score of ABC.

Germany is an example of a mature developed economy seeking a transition from an energy system largely developed and built 50 years ago to a system that serves the needs of the next 50 years and beyond.

Germany has progressively fallen out of the trilemma index top ten. A recent report from the German WEC member committee noted that 76% of global experts who responded to the question "Could Germany's current energy policy serve as a blueprint from the world?" said no.⁸

In response to the question about what impact respondents expected Germany's current energy policy to have on its economic power in the short to medium term (to 2020), only 24% of respondents thought that it would strengthen Germany's economic power.

⁷ The index is calculated using 70+ data points from 40+ datasets used to develop 23 indicators.

⁸ Weltenergieat-Deutschland report entitled 'Energy for Germany 2013: Facts, outlook and opinions in a global context', dated September 2013, page 111.

New Zealand cannot rest on its laurels. Figure 7 unbundles New Zealand's trilemma scores for the previous three years. Two of the dimensions – energy equity (affordability rather than access in New Zealand's case) and environmental sustainability - are trending in the wrong direction (though the environmental dimension is reasonably static and reflects the high energy intensity of our industrial base).

While these rankings may speak to possible areas for future improvements in policy settings, they have two important policy implications:

- they don't imply dramatic changes are required but more targeted initiatives; and
- they suggest that energy hardship should be a key focus of any policy improvements.

What keeps New Zealand energy executives awake at night

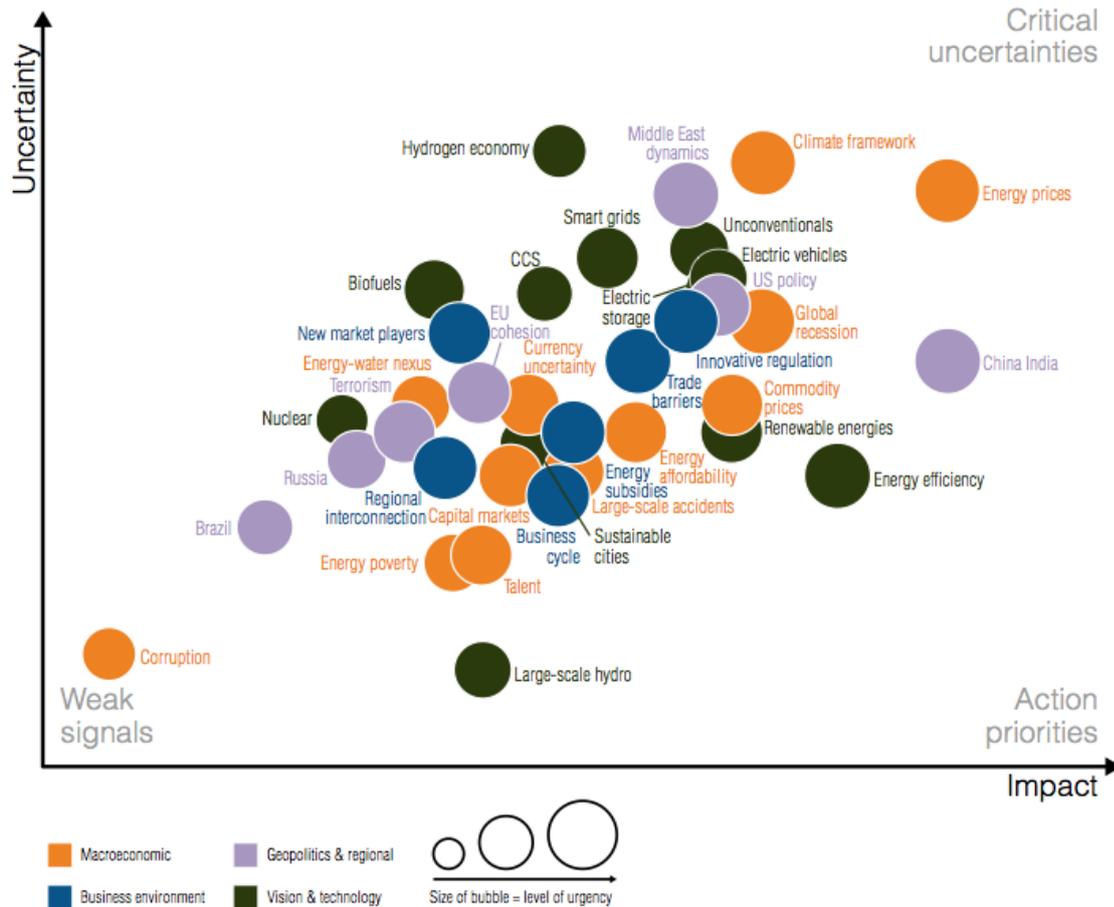
The WEC World Energy Issues Monitor provides a high-level perception of what constitutes global issues of critical uncertainty, in contrast to those that require immediate action or act as a developing signal for the future.

The monitor has developed into an essential tool in understanding the complex and uncertain environment

Figure 7: New Zealand's trilemma scores

	2011	2012	2013	Trend	Score
Energy security	20	19	15	↑	A
Energy equity	15	18	26	↓	A
Environmental sustainability	40	36	37	↓	B
Overall rank and score	9	7	8	↓	AAB

Figure 8: New Zealand's energy issues map 2013



How to read the Energy Issues Map: Issues with high uncertainty and high impact ("critical uncertainties" – in the upper right corner) include those issues which will most benefit from multi-stakeholder dialogue and scenario analysis. The issues on the high-impact/low uncertainty ("need for action" - in the lower right corner) are those where immediate action finds easy consensus. The low impact/low uncertainty ones include issues of perceived lesser importance but also "weak signals" (bottom left), which may be issues that are still badly understood. The urgency of an issue is proportional to the size of its bubble.

within which energy leaders must operate and a tool through which business and policy decision-makers can challenge their own assumptions on the key drivers within the energy landscape.

For the first time last year, the WEC invited a small number of its national committee members to develop national energy issues maps. New Zealand was one of the countries chosen. The results from last year's survey are in Figure 8.

This year's map is not yet available for publication, however a preview has allowed some initial observations to be made:

- New Zealand energy executives are, like their global counterparts, concerned about a mix of global and domestic factors. The global factors are:
 - the absence of a climate framework. This is now the

number one "keep me awake at night" issue in New Zealand;

- energy prices (oil/gas volatility);
 - China and India (the growth of Asia);
 - electric vehicles and the smart grid (the impact of new technology);
- energy affordability and energy-water are now the two top "heating up" issues (moving towards higher "keep me awake" and "busy" space);
 - China, unconventional and trade barriers are among top "cooling down" issues (China's shift possibly reflecting reduced concerns about its economic growth path);
 - energy efficiency, electric vehicles and electric storage are among key robust issues (with the lowest movements between the two maps);

- energy efficiency continues to present an immediate opportunity;
- energy efficiency and climate framework uncertainty have among the lowest variances / greatest homogeneity of feedback; and
- there is a much better correlation between urgency and the need for action in the 2014 map, as reflected in the non-uniform bubble size.

RECOMMENDATIONS

- Support the current energy market framework as the appropriate platform on which to deliver least cost, reliable energy

APPLYING WEC IDEAS IN NEW ZEALAND

The WEC works closely with its national member committees to develop and share insights from its network of leaders and practitioners. This knowledge sharing can help strengthen New Zealand's energy policy dialogue.

Using the WEC Trilemma to manage trade-offs between competing objectives

Delivering policies which simultaneously address energy security, access to affordable energy services, and environmentally-sensitive energy production is one of the most formidable challenges facing governments and businesses.

These three goals, constituting the WEC Trilemma, entail complex interwoven links between the public and private sectors, governments and regulators, economic and social factors, national resources, environmental concerns, and individual behaviours.

The WEC Trilemma provides a framework for considering trade-offs in the energy system in a more sophisticated way, encouraging balanced energy policies, enabling dialogue among public and private stakeholders, identifying issues and supporting action and solutions.

Policy makers must be confident that energy market policy settings deliver the desired energy outcomes in a balanced way.

There are many areas where energy policy impinges negatively on, or contributes positively to, other policy areas.

While climate change policy is the most obvious, other areas such as welfare policy (for example, energy hardship) and environmental policy (for example, resource consenting and water allocation) are others.

Climate change is a challenging issue that overlaps most other policy areas. Electricity generation contributes around 19% of New Zealand's energy greenhouse gas emissions and 8% of total greenhouse gas emissions. While this is modest compared to most other countries, it is not insignificant on a national scale.

Scenarios as a useful tool: the BEC2050 Energy Scenarios Project

The energy system is undergoing significant changes and the pace of change is increasing due largely to consumers' rapidly increasing propensity to absorb new technologies.

Our ability to predict the future beyond the next few years is challenged. No-one has a crystal ball. Consequently, our ability to develop scenarios and test them against different potential states is becoming a far more relevant and insightful way to think about the future.

Last year, the WEC released scenarios of two potential futures. These scenarios ("Jazz" and "Symphony") are not exhaustive descriptions; rather, they stake out two possible world states with coherent, believable storylines, using a methodology consistent with one of the seminal works in the field of scenario analysis.¹

At a high level, the Jazz scenario describes a future that is market-led (WEC use phrases like "consumer-led", "free market" and "bottom up"). The Symphony scenario is characterised by higher degrees of government involvement in determining investment, technology choices, and a higher degree of global co-operation around carbon and even domestic

¹ Peter Schwartz, 'The Art of the Long View: Planning for the future in an uncertain world', Crown Business, 1991.

"There cannot be climate change policy without robust energy policy" – Christoph Frei, Secretary-General of the World Energy Council

constraints on trade.

These scenarios are a useful analytical tool as they:

- challenge us to answer the question "how could this play out differently?";
- are neither right or wrong, good or bad, but instead equally plausible;
- help highlight the trade-offs that exist between these states of the world when combined with good modelling; and
- set up a framework which allows consistent and robust evaluation of proposed policies and business plans against the states of the world implied by the storylines.

The BEC has seized an opportunity to follow the WEC scenario development process specifically for New Zealand.

The importance of the BEC project, known as 'BEC2050', is reflected in the widespread involvement of energy sector businesses, government agencies, academia and non-government organisations (consistent with the WEC approach).

A list of those involved in the scenario development workshops is attached as Appendix Two.

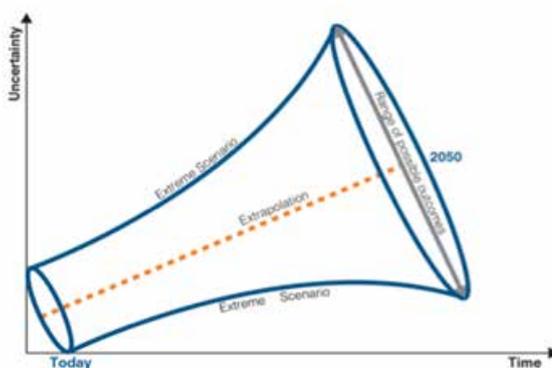
The aim of BEC2050 is to assist government and business by helping their decision-making become more resilient and adaptable to a world which is yet to be revealed.

As time passes and information about the actual path we are on emerges, we are able to deduce how best to adapt depending on which of the scenarios is more reflective of reality (see Figure 9).

BEC2050 also helps depoliticise the energy sector, helping decision-makers look beyond the political cycles into the medium and longer term, and helping the sometimes fractious and disconnected energy debate to reach a new level of maturity.

The current expectation is that BEC2050 will be completed around July 2015.

Figure 9: The funnel of plausible outcomes



Source: World Energy Scenarios: Composing Energy Future to 2050, page 28.



ENERGY MARKET DESIGN

Dramatic changes are not needed, but some areas of the market need attention. However, there is no agreed basis by which to assess desired changes, and the absence of agreement creates uncertainty for investors and consumers.

Any changes to the system need to be based on evidence and not wishful thinking. Policy solutions need to be matched to real problems.

The cure also needs to be better than the disease. Sometimes the cost of dealing with a problem can exceed the cost caused by the problem itself (this is known as government failure).¹

To ensure any intervention is sound, market failures must be carefully defined - not as something that isn't liked or wasn't expected, but clearly identified as the failure of competition, the provision of public goods, incomplete markets, or information failures, for example.

A market failure occurs where the market fails to allocate resources efficiently. Types of market failure include:

- a. **social inefficiency** – where external costs and benefits are not accounted for;
- b. **allocative inefficiency** – where resources could have been used to

¹ Sources of government failure include market distortions, welfare impacts, disincentive effects, short-termism, electoral pressure, impact on environment, regulatory capture and imperfect knowledge.

supply other products and services that consumers value more highly;

- c. **technical inefficiency** – where products and services are not produced with the minimum amount of resources;
- d. **productive inefficiency** – where products and services are not produced at lowest factor cost; or
- e. **dynamic inefficiency** - where long-term opportunities and incentives for market entry, exit, investments and innovation are foregone.

Providing energy efficiency information, using the emissions trading scheme to internalise the environmental cost of carbon, and using competition to deliver secure and affordable energy are ways of addressing market failures.

They can help deliver an energy system with a range of desirable attributes, such as:

- a. **downward price pressure:** in a world of rising input costs and (eventually) growing demand, prices will tend to increase. However, competition, innovation and efficiency generally exert downward pressure on prices;
- b. **choice:** competition entails diverse views on which investment will deliver the best value for least cost. Markets work best if investors have the flexibility to form their own views of future demand paths, future supply costs, future system needs, future technologies

and consumer needs, and then to invest accordingly. Restricting participants' options risks raising prices and worsening security of supply challenges;

- c. **predictability:** energy assets are long-lived and capital intensive, so adopting a consistent and stable approach to regulation is appropriate. For policy-makers to act otherwise carries the risk of destroying value and deterring investment, ultimately to the detriment of consumers. The regulatory environment has contributed to investment predictability increasingly over recent years and it would be disappointing to return to a period of rising risk and price premiums being factored into investment decisions, increasing costs and diminishing the international competitiveness of our exporting businesses;
- d. **proportionality:** policy responses should be proportionate to the size of the problem being addressed. An incorrect decision by policy makers may potentially impose very large costs on businesses and the economy. Such costs occur through distorted resource use and reduced investment and innovation (they impair allocative and dynamic efficiency). Reduced investment results in a compounding loss of value that may become quite substantial over a long period. This suggests a preference for small



scale and single policy measures (at least initially) where possible, so that their effectiveness can be assessed. If the expected benefits do not materialise, then the original intervention can be intensified or additional measures deployed. This is generally known as the 'option value of waiting'; and

- e. **durability:** different governments make different political commitments to the electorate and this is not expected to change. But a bipartisan approach to the over-arching framework within which changes will be assessed is desirable given the long-life nature of the assets involved. Interventions that favour one competitor or fuel-type over another, either directly or indirectly, are unlikely to be durable and risk damaging competition and worsening outcomes. This creates challenges for investors in long-lived assets and the least-cost delivery of reliable energy to end-consumers.²

Approaches that deliver these outcomes are more likely to result in improved confidence that prices

² The thermal baseload generation ban – introduced and abandoned by respective governments in 2008 – is a case in point. Developers of new renewable generation faced the risk of the inevitable removal of the ban by a future government and being faced with assets that were under utilised and no longer earning a profitable rate of return. Had the thermal ban endured for longer than it did, developers of new renewable generation (or more likely, their financiers) would have been reluctant to face this risk, resulting in worsening, not improving security margins.

reflect costs and are in the long-run interests of end-consumers.

Are energy sector strategies helpful?

While sector strategies can galvanise sector engagement and drive positive outcomes they can just as easily do the reverse, raising expectations of action that cannot be easily delivered or delivering policy prescriptions that force non-market outcomes. Picking winners and molycoddling losers is often the outcome, even if not intended, and resources get redirected across sectors in search of more favourable treatment.

Energy strategies of the early 2000s did not rely primarily on markets and market mechanisms to deliver competitive, least-cost outcomes. Policy settings were somewhat directive in order to assure the government that certain outcomes would occur, and strategies essentially became de facto central plans³, able to justify any intervention but with the end result of hidden additional costs imposed on end-consumers and businesses.

Non-market interventions, such as the Whirinaki power station and the new baseload thermal generation ban had their origins in the strategies of the early 2000s.

Strategies are often justified on the basis that business needs long-term

³ The 2001 strategy, for example, set out five 'action programmes' for government, energy supply, industry, buildings and appliances, and transport to achieve the strategy targets.

certainty and that plans are required to provide this. But what business really wants is predictability of the conditions and frameworks in which they operate, so they can plan with greater confidence, knowing that the assumptions they make about the future are likely to hold into the medium and longer term.

Strategies that are too determinative risk stifling the vigour of markets, the pursuit of innovative responses and the contest of ideas.

If strategies are to be useful, their role must be to reduce operating uncertainty and lower basis risk. To do this, they must deliver a consistent and coherent policy framework for business, not direct the delivery of outcomes.

Does New Zealand need to subsidise renewable electricity generation?

New Zealand is blessed with a rich endowment of natural resources and has, without subsidies, reached a point where we generate over 70% of electricity from renewable sources, and where most future sources of electricity have lower environmental impacts.

New renewable sources of generation have at least an extra 1-2 c/kWh advantage over new baseload thermal projects. They do not require additional subsidies or a carbon price to make them commercially feasible.

But even in this environment, there are two pertinent questions for policy makers to consider:

- a. are there any barriers preventing the next cheapest increment of energy from coming to market?, and;
- b. should we bring forward the production of more expensive sources of energy by lowering its production costs in preference to other sources?

New Zealand's high Trilemma ranking is largely thanks to energy markets that have delivered high levels of investment in renewable electricity, good access to reliable energy supplies, and reasonable environmental outcomes. But constant improvement is required and new technologies need to be facilitated.

The BEC supports efforts to ensure that new technologies are market ready, and acknowledges that in some instances support for new technologies in which New Zealand has a comparative advantage may be appropriate in the form of research and development grants or other support.

One area that could benefit from such support is the generation of renewable thermal energy. For example, in the transition to a low carbon future, it is important that clear market signals are sent to forest research entities and forest owners to ensure there is sufficient fuel stock available to meet growing demand.

But care must also be taken, as emphasising one technology or fuel type above others can prevent the development of balanced, sustainable energy systems.

Provided the price signals are correct, the right investment will result.

In the WEC 2050 scenarios, electricity generation from renewable sources will increase around four to five times by 2050. This is strongest in the Symphony scenario, where solar technologies will take off, promoted by feed-in tariffs for electricity, production subsidies and net pricing in Europe, and tumbling solar technology prices.

Neither scenario offers a clear policy prescription for New Zealand and whether, for example, more solar is desirable. But the scenarios do help us better understand the consequences of policy choices and to test them against progress toward a balanced, sustainable energy system.

Subsidised solar power in New Zealand will displace two unsubsidised sources of power generation - geothermal and wind. These are currently the most economic investment options for electricity. Solar requires the use of more expensive thermal peaking plant to back it up when there is no sun.

It is unlikely to address energy hardship. Solar incentives are typically taken up by middle-class home owners, who end up being subsidised by other power consumers. In Germany, renewable electricity subsidies are costing every man woman and child around NZ\$400 per year raising concerns about their industry's international competitiveness.

As a technology taker, our market is too small for our subsidies to help bring down the world price of solar. Instead, they will encourage the early uptake of solar power technology at a time when its performance is still improving and its cost is falling rapidly.

Our market framework needs to be ready to accommodate the greater uptake of solar as offshore subsidies lower its installation cost in New Zealand.

The WEC energy trilemma and scenarios highlight the need for a clear objective and the need to understand the complex trade-offs involved. Decisions to disrupt a functioning market should not be made without them.

RECOMMENDATIONS

- Apply a consistent approach to market analysis that is durable long-term
- Implement changes to the energy market based on evidence of its performance
- Choose sector strategies that deliver a consistent, coherent and stable policy framework for business
- Use the WEC trilemma framework to inform trade-offs between energy equity, energy security and environmental sustainability
- Collaborate with the BEC in its BEC2050 Energy Scenarios project



IMPROVING THE ELECTRICITY MARKET

The electricity market is more competitive than ever before. Substantial gains have been made, but must continue to be made.

Consumers are benefiting from the ability to switch retailers to gain lower prices. An increasing number are also taking advantage of metering and home energy management systems to make further savings.

Current policy settings are expected to continue to apply greater downward pressure on prices. But experience shows that if the rules under which the market operates and the conduct of the energy companies do not keep pace with changing economic or societal conditions, then unbalanced market outcomes can emerge.

Greater price transparency

Consumers' perception is that electricity prices are too high and there is a widespread lack of confidence in the electricity market.

We have seen how poor perception can quickly give rise to political risk.

"The NZ Power proposal is the industry's reward for its slow response to consumer calls for transparency and simplification."

Contact Energy Chief Executive Dennis Barnes

In other words, past effort to achieve good market results can unravel quickly if balanced outcomes across the three trilemma dimensions are not evident.

International experience shows likewise. For example, Christoph Frei, the WEC Secretary-General has called the UK Labour Party announcement that they will freeze power prices for 18 months when they become government as "the greatest contribution to UK energy insecurity in a generation".

Although price rises have slowed significantly since 2010, energy companies could do a better job of explaining input cost factors and pricing decisions. Transparency is particularly weak in the interface between wholesale and retail pricing.

The industry needs to develop clearer, more consistent and coherent explanations. For example, the Ministry of Business, Innovation

& Employment (MBIE) carries out weekly monitoring of importer margins for regular petrol and automotive diesel. As a result, the narrative around petrol price movements is much more mature than in the electricity market, with conversation focusing around why fuel prices aren't going up slower and coming down faster. While it's not possible to easily compare the two examples (due to the relative complexity of the electricity market) the shift in the nature of the debate in the fuel sector over the past decade has been informative.

Developing rules for information disclosure about the operation of generation versus retail arms of energy companies would be useful.

On the other hand, efforts to further expand the information contained on residential consumers' bills may not be useful. As noted in a recent Electricity Authority consultation document:

"...a large majority of survey respondents were satisfied that bills from their power company were easy to understand (78%) and contained all the information they needed (76%), with 48% very satisfied that their bills were easy to understand and 44% very satisfied that all the information they needed was there. Only 7% of respondents were not satisfied with their power companies on these matters."¹

Greater consistency in the way electricity prices are reported is also needed. For example, MBIE has recently developed a sales-based methodology which reflects the actual costs faced by retail electricity consumers. MBIE calculated that there was an increase in the price of electricity in the June quarter of 2.4%, of which energy prices comprised 0.7%. However, Statistics New Zealand uses a sampling methodology as part of estimating the Consumer Price Index (CPI) and reported a 4% increase for the same quarter. This has led to confusion among consumers and is unhelpful from a public policy development perspective.

Hedge market improvements

Having improved disclosure of electricity market prices improves the effectiveness of the hedge market. Significant progress

has been observed over the last few years. However, questions remain about whether the forward price curves are truly reflective of underlying costs and risks. More transparency around pricing would aid consumer confidence in the market, as well as investors' confidence in their decisions.

The risks from purchasing electricity at spot prices, without any offsetting risk management strategy and adequate tools, can be significant. Improvements to the hedge market should be made before any other substantial structural changes are initiated.

The Electricity Authority is currently working on a programme of improvements to the hedge market. These changes need to be afforded top priority and advanced with haste.

Energy hardship

New Zealand's energy equity has fallen in the WEC trilemma ranking for the last three years, as outlined earlier in this document. At the same time, energy affordability has become a more urgent issue.

In New Zealand, energy equity and affordability are better characterised as energy hardship. This is a problem for a segment of residential consumers. Access to energy efficient appliances, income levels, household size and composition, state of housing stock, location, health, and fewer individuals living in aged care or other institutions are some of the factors that can lead to energy hardship.

What this characterisation does allow is a more sophisticated look at which aspects of energy hardship can be addressed by energy companies and which should be addressed by government welfare and other policies.

Electricity prices and affordability are only a part of the overall picture of energy hardship. Some consumers may benefit only marginally from more competition and lower prices. For example, consumers experiencing energy hardship may not be able to keep their homes warm regardless of the price restraining effects of competition.

The energy companies understand that this characterisation is not intended as a means by which they can shirk their responsibility

¹ Electricity Authority consultation document entitled 'Improving transparency of consumers' electricity charges', dated 24 June 2014, page 13, paragraph 2.4.2

to compete and keep prices at levels that reflect costs, or to make the problem someone else's (like the government's).

The absence of affordable energy could be viewed as a market failure where a lack of competition is allowing prices to rise above efficient levels, but there is little evidence to support this contention. Disconnection policies and access to pre-pay meters are within the scope of the energy companies, but income levels and building standards are not. Blurring the boundary between these issues is akin to saying that the labour market can be used to solve poverty.

Despite this, energy companies have yet to convince the public that they are doing everything that is within their control and that could be expected of a competitive market. It remains unclear whether more can be done to address vulnerable consumers.

There may yet be instances of market failure that would extend the reach of market-led solutions if rectified. The power companies need to start bringing these forward if they are to avoid regulation.

Factors other than the price and structure of electricity tariffs are important and legitimately fall outside of the scope of what a competitive market can address.

We recommend research to determine the nature and size of the energy hardship problem and whether the best response lies with energy companies or with government policies such as welfare payments, electricity supplements or other assistance.

Efficient tariff structures encourage innovation

Barriers to innovation at the retailer – consumer level can be more detrimental to electricity costs in the long run than almost any other factor.

One barrier that warrants consideration is a better targeted low fixed-charge tariff. The current tariff is set in regulations and can only be changed by the government.

The tariff has three aims:

- a. encouraging energy conservation and efficiency by changing the balance between the fixed and variable components;

- b. helping to provide consumers with greater control over their electricity bills; and

- c. improving electricity affordability.

Unfortunately, setting the tariff on the basis of consumption benefits high income consumers, whose homes are often vacant during the day, and fails households with large at-home families:

“...it's not dealing to the people who need it most. If you want to turn to affordability the low-fixed-charge tariff is the last place you would start.”

Doug Heffernan, former CEO of Mighty River Power

Setting fixed tariffs at a low rate distorts price signals, and means one half of consumers subsidises the other.

Rigid regulation of retail tariff structures also limits innovation. In a competitive market, retailers want to structure their tariffs to enhance value for consumers. The scope for innovation is expected to expand markedly in coming years with the use of meters and the more sophisticated use of the data they will provide.

As one of the drivers of consumer behaviour, innovative retail tariff structures could have a significant impact over time on the way energy is consumed. If demand can be flattened to reduce peaks, then the overall cost of supply can be reduced.

Achieving innovative retail tariff structures requires a closer examination of network charging arrangements. Lines companies, power companies and regulators should be encouraged to collaborate on the removal of unnecessarily complex network charges.

Lines companies

While demand for electricity is relatively flat and the threat of disruptive technology is growing, the long term sustainability of lines companies and their traditional business models comes into focus.

The emerging problem of falling use and rising fixed costs appears to be here to stay and could lead to dramatic, unplanned and disruptive changes. Lines companies need to seize the initiative and present a pathway forward for government.

The politics of this are difficult and many lines companies are reluctant to change. Some larger lines companies, such as Vector, Unison and Wellington Lines are actively considering the issues, but others less so.

Disruption to the traditional lines company business model by rapidly changing technologies is only a matter of time. For lines companies that fail to recognise the challenges, the disruption (in the form of stranded assets) could be severe.

The BEC appreciates that any appetite for large scale changes is limited. However, there are insufficient incentives for the lines companies to initiate change. The government needs to collaborate with business and the Electricity Networks Association to develop a strategy for the next evolution of development.

Transmission pricing

While the threat of disruptive technology weighs heavily on the future of lines companies, getting the incentives right, including the appropriate use of demand-side responses, is also important for transmission development. At the heart of this is the proposition of balancing the incentives on the investor (Transpower) to meet the needs of the consumers who pay for the infrastructure. Achieving the right balance, especially given the long life and lumpy nature typical of these investments, is neither an easy nor trivial undertaking, and arguments as to how to do it have been raging in the sector since the early 2000s.

Transpower's challenge is to invest the appropriate amount at the right time and be able to recover its reasonable costs (including a rate of return), while consumers, both large and small, face transmission prices that allocate costs in as efficient and non-distortionary a manner as possible. Another challenge is who should bear the cost of investments that turn out to have no economic value.

Considerations should include enabling localised alternative solutions where more efficient. For example, does South Island consumers paying for North Island upgrades affect their consumption or investment decisions? Should generators have to consider the sunk costs of transmission investments in their short-run operational decision-making? Or should they be

encouraged to make full use of the grid we have in place, rather than be disincentivised to do so?

These are significant issues to all businesses, but especially to those that pay a substantial share for grid upgrades. Getting these complex incentives right is important to avoid the inappropriate allocation of costs and the erosion of New Zealand businesses' ability to remain internationally competitive.

However, the solutions need not be complex. Feedback on the Electricity Authority's current review process suggests the majority of stakeholders would prefer a much more simple methodology, founded on established best-practice cost allocation principles, than what has been proposed.

The case for a consumer council

The meaningful participation of consumers is critical to the quality, performance and accountability of the Electricity Authority's work. The absence of significant stakeholder input was a key failure of the NZEM and MARIA models, and this was (albeit in a different form) carried over into the Electricity Commission.

The Electricity Authority has been more successful than its predecessor in engaging with a wider group of stakeholders. But, this must be seen in context. Stakeholder views about the competitiveness of various markets reflect improvements already achieved. However, concerns remain about whether prices only rise in line with costs.²

In a highly complex and interconnected market, it is essential to have ongoing engagement between the regulator and consumer stakeholders.

² <http://www.ea.govt.nz/about-us/corporate-projects/2014-2017-planning-and-reporting/implementation/consumer-and-stakeholder-surveys-2014/>

The formal establishment of a consumer panel from across the range of consumer stakeholders to assist in the development of the Electricity Authority's strategic priorities would achieve broader-based expertise and greater strategic buy-in to the issues.

RECOMMENDATIONS

- Investigate information disclosure rules for the operation of generation versus retail arm of energy companies
- Require Statistics New Zealand and MBIE to work together to reach a consistent methodology to use in reporting electricity prices
- Advance the Electricity Authority's hedge market work programme as a top priority
- Investigate the issue of energy hardship and implement solutions in a systemic, whole-of-government way
- Replace the poorly targeted low fixed-user charge to facilitate the introduction of innovative tariffs
- Encourage lines companies, power companies and regulators to collaborate on the removal of unnecessarily complex tariff structures
- Collaborate with business and lines companies to develop a strategy for the next evolution of lines business development
- Ensure lines companies face appropriate regulatory incentives to manage the impact of rapid technology diffusion
- Require regulators to ensure transmission pricing changes support ongoing business investment in New Zealand
- Investigate the establishment of an Electricity Authority Consumer Council

THE PERMITTING AND CONSENTING OF NATURAL RESOURCES

Effective regulatory systems enable investment and support economic growth, particularly in the regions. Countries with more effective and better executed regulatory frameworks are more likely to achieve investment at lower cost and better address the risk of vital energy resources not being available when needed.

Unfortunately, it is not always clear that the New Zealand energy regulatory environment has reached this level of maturity, especially with regard to the operation of the Crown minerals regime, the risk of regulatory change for existing assets and investment decisions, and consenting of energy-related projects.

Recent improvements to the permitting and consenting processes for energy projects are welcome and have served to increase interest in New Zealand's mineral estate. But more can be done to improve alignment across the relevant legislation and its implementation. It is no longer clear that the various laws associated with permitting and consenting (primarily the Crown Mineral Act 1991 [the CMA], the Resource Management Act 1991 [the RMA], the Environmental Protection Authority Act 2011, and the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012) are all pulling in the same direction for the same purpose.

Recent regulatory decisions¹ have raised the question whether New Zealand's regulatory framework for the permitting and consenting of natural resources is fit for purpose. At the heart of these decisions is the issue of government on the one hand being ambitious for business to prosper and grow the economy through greater exports, yet on the other hand having regulatory settings that stifle this objective from being achieved.

We do not wish to comment on the specifics of these cases (not least on the basis that some are still proceeding through the regulatory process), nor do we wish to question the validity of the decisions made. However, the level of the risks that they raise with regard to future investment decisions

(whether the risk in New Zealand is greater than the risk in other jurisdictions) leads us to query whether there are any systemic resource allocation questions to be asked about the Crown minerals regime as well as the consenting of economic activities more generally.

We observe that complex and disconnected permitting and consenting processes, which unnecessarily extend the reach of regulatory powers, and a lack of system-wide co-ordination and predictability is limiting investor interest even for the most financially attractive projects.

Understanding the Crown's regulatory interest

The CMA regulates businesses that contract with the Crown to find and extract Crown-owned resources.

For the businesses that carry out the prescribed activities, they must meet certain requirements of being of good standing and having suitable health and safety and environmental practices.

This is appropriate, but how far should the Crown intervene in the operational aspects of those businesses?

As owner of the resources in question, the Crown has a legitimate interest in the efficiency with which the resources are extracted, relating to:

- the desire of the Crown to influence the speed of their extraction (it can be generally assumed that the Crown wishes to see the resources extracted in a way that best balances its needs with the needs of the miner); and
- the Crown's ability to convert the resource into cash via the royalty regime, and therefore apply it to other, higher priority uses (such as hospitals and schools).

This legitimate interest provides a rationale for the Crown to place technical and financial requirements on permit applicants.

Getting the boundaries in the right place matters

Despite recent changes to the CMA, we remain unconvinced that the boundaries between the Crown's legitimate interest and

its need to get involved in the operations of the exploration businesses are in the right place.

There appears to be an unnecessary extension of the Crown's reach into applicants' operational business practices.

We acknowledge that where to draw the boundary is ultimately a matter of judgement, and appreciate that such requirements as set out in the CMA are not intended to be onerous, especially with the welcome creation of the tiered system. However, it must be asked whether the current intrusion into applicants' operational practices is required to protect the Crown's legitimate interests, or whether any additional regulation in the areas of health or safety or environmental matters is required. These are legitimate questions in light of the already burgeoning roles and responsibilities of New Zealand Petroleum and Minerals (NZP&M) and the evidence of inter-agency coordination difficulties.

Resetting the regulatory dial

Our sense of the CMA is that many of the issues considered by policy makers are wrongly assumed to require Ministerial accountability (as reflected in Figure 10 by the crosses in the upper left-hand quadrant).

A closer reassessment of these issues would be likely to see the possibility for a lower accountability (that is, the Departmental Chief Executive) to be applied instead of the application of powers by the Minister (as reflected in Figure 10 by the stars in the lower right-hand quadrant).

This can give rise to a serious potential misalignment in the practical operational decisions and the Crown's strategic objectives to make its mineral estate more available for exploration.²

This problem of the Crown being too involved in operational matters is magnified when it comes to subsequent consenting processes. Businesses can have applications for environmental and other consents declined despite approval having already been granted to access the resource. This

¹ These diverse decisions include King Salmon, the Ruataniwha Dam, Horizons, Bathurst, Trans Tasman Resources, United Fisheries and the Basin Reserve Flyover.

² The reference to exploration is intended to include all of the various stages for the discovery of petroleum, such as appraisal, mining and production, and for the discovery of minerals, such as prospecting, exploration, development and mining.

effectively requires businesses to run the gauntlet twice by having to justify its right to use a resource to one part of government where its right to access it has already been granted previously by another part of government.

The government effectively acts as both judge and jury, not once but multiple times. With the CMA process it gets to decide what resource is made available and then what hurdles are put in place before a permit is granted, along with other operational hurdles that may still prevent the activity from proceeding even if a permit has been granted.

This sends the message to potential investors that the Crown is uncertain whether it wants its resources to be explored or not. For activities that require multi-million dollar commitments, this confusion in roles between resource owner and resource regulator is preventing New Zealand from reaching its full resource potential.

From problem to solution

We propose that the government do two things:

- a) more clearly separate its strategic ownership interest from the operational permitting decisions; and
- b) more clearly align the wide range of other operational decisions with its overall set of strategic objectives for the utilisation of New Zealand's natural resources.

Improvements can therefore be made at two crucial points in the current permitting and consenting processes.

In the case of resource access, there needs to be a prior, clearer, more evidence- and broad-based conversation between the Crown and the public, leading to a broader social consensus at the first step about the acceptability or not of resource access and, if acceptable, any limits or constraints to be placed on its use.

Ultimately, the government must make considered decisions about access to New Zealand's resources.

This step will provide businesses with a higher degree of confidence than currently exists. Time and resources will not get wasted subsequently applying for other consents if it is not publicly acceptable or commercially feasible to access the resource in the first place.

In the case of Crown minerals and the CMA more specifically, the government should review those areas currently slated as requiring ministerial action, as well as those issues where the Crown's interest may have expanded unnecessarily.

Having made a decision to allow a Crown-owned mineral to be explored, the subsequent operational decisions should not require ministerial oversight and should be rules-based (where appropriate) and at arms-length from the government of the day. The role of the government must be one of ensuring, within reason, that exploration occurs and that unnecessary roadblocks are avoided to allow this to occur.

We do not believe that the current organisational form of NZP&M is fit for this reconfigured role.

A Crown Minerals Exploration Authority

We consider that an approach similar to that of the Electricity Authority would be appropriate. The Electricity Authority is a sector-focused Crown entity operating within a legislative framework where day-to-day operational decisions that have substantial potential impacts on investors and the wider economy are appropriately taken at arms-length from the government.

We recommend the establishment of a Crown Minerals Exploration Authority or similar. The new entity would operate within the strategic choices provided to it about what resources are available but

then be allowed the operational flexibility to maximise the return to the Crown in the way it considers best from an operational perspective, informed by best practice in New Zealand.

Its role would be one of ensuring that companies who wish to make commitments to explore are able to deliver on them. This should not be an onerous process. The worst risk is that the business cannot deliver on its obligations, but this is an exceptionally low risk. In any case, the resource is still there to be explored.

As with the electricity market, we believe that much of the permitting process can be rule-driven to assist with investor confidence and aid in the achievement of the attributes outlined in the Energy Market Design section.

However, we recognise this may not be appropriate in all cases, with different processes requiring activity specific information.

In addition, the new organisation could be expected to have a strong data collection, assessment and information reporting function, to audit royalties and address unitisation issues for example, which would provide operational data and support marketing.

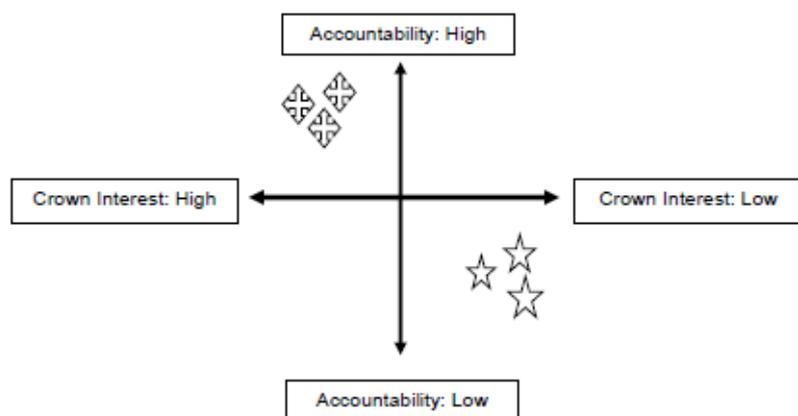
A further comparison to the electricity market is informative. The Crown does not (or at least should not) say who can build a power station, where it should be situated, how large it should be or what technology should be used though the operational risks are extensive. The rules associated with the ability to participate in the electricity market are equally extensive for this reason. They must be complied with to participate but, by the same token, agreement to comply with them essentially provides automatic entry to the market. Non-compliance is penalised.

But as noted above - presumably because of its ownership interest in the resource - the Crown considers its interest in the issuance of permits (the Crown minerals equivalent to gaining the right to enter the electricity market) extends deeply into the operational details for those who would wish to drill an oil well or develop a mine.

It is unclear how this more onerous interest is justified in the public interest simply because the Crown owns the resource. This extension is unnecessary, duplicative and inefficient given the alternative means available to manage the risks involved.

As with the Electricity Authority model, we also consider that the rules for health and safety and environmental requirements

Figure 10: The Crown minerals accountability matrix





should be separately regulated, in order to minimise the risk of multiple and conflicting objectives interfering in the effective execution of its legislative duties. This also avoids the risk of a business facing two penalties for the same offence, as is currently the case with health and safety matters under both the Crown Minerals Act 1991 and the Health and Safety in Employment Act 1992.

A one-stop shop for Crown mineral permitting and consenting applications

Finally, given the breadth of the government's regulatory interest in minerals and petroleum exploration (across environment, conservation, marine and heritage regimes) and the strong interface between them, we consider that this sector warrants a feature not afforded to others – the creation of a virtual one-stop shop. This would be a portal behind which the sharing of information would occur in order for each requirement to be met.³

Should a rules-based approach be adopted, a joined-up process via a single point of entry into the bureaucracy (presumably via the new Electricity Authority-type entity) would be possible. This would facilitate the common use of information across regulatory requirements, the elimination of duplicate information and the alignment of timeframes. This would need to be done in conjunction with a review of the relevant legislation (for example the Wildlife Act 1953 and Conservation Act 1987).

The New Zealand Business Number (the 'NZBN') is currently being consulted on by MBIE. The objectives sought from the NZBN's implementation would appear to be aligned to the purpose of a resources one-stop shop and could support its implementation.

Applying these improvements more broadly - reforming the RMA

The development of a broader social consensus regarding resource use would allow greater predictability at the next environmental consenting step for everyone, regardless of the nature of the project. Potential investors would be better placed to make informed judgements about whether the investment should proceed, and whether any resource use constraints can be managed.

If the business decision was to proceed with the investment, then the next consenting

stage would involve an uncontested private process whereby the investor demonstrates whether or not pre-determined environment impact rules can be met (in other words, a more technical, rules-based, process appropriate to the nature of the project). The ability to comply with these rules (again, similar to the electricity market example) should automatically see the project proceeding.

The current process for environmental consenting sees case-by-case expensive and disruptive objections proceeding, when in reality the objection is often less with specific environmental effects (though these may be legitimate) than with the original decision to allow access.

While couched in terms of new investments, care will need to be taken to consider the impact of such changes on the re-consenting of existing assets, especially if expectations of access to natural resources such as water change over time.

Investment certainty is critical for existing energy assets given their long life.

What our members tell us

The implementation of a better targeted environmental consenting regime is also supported by our broader BusinessNZ membership. When asked in the Deloitte-BusinessNZ Election Survey 2014 if they thought that the RMA could be made to work if it constrained what could be regulated in its name (in other words, a narrowing of its scope with greater reliance on private arrangements), 30% agreed.

This would be a step forward, but not a large one. It reflects the reform package that was unable to progress earlier this year. But with the emphasis on planning process improvements, our sense is that the current legislative proposals on the table do not sufficiently facilitate better overall quality decision-making, but might simply facilitate bad decisions sooner.

However, when asked if they thought that the RMA was fundamentally broken and legislators should go back to first principles, 36% of respondents agreed. This demonstrates an appetite for a step-change of the nature outlined above.

Only 6% thought the RMA didn't require any further change.

Water policy reform

Water policy reform has been signalled in previous years and more recently by the Ministry for the Environment and we support progress in this area.

Due to the potential for reforms to affect existing water users, this particular area of reform has far reaching implications for the energy sector and businesses more broadly.

Measures to address water quality should consider the sources of contaminants, along with the economic implications of methods to address these. Given 75% of New Zealand's electricity is generated from renewable sources, there are a number of catchments that have hydrological modifications. Amendments to the operation of existing assets within the electricity market will have subsequent impacts on a complex integrated system.

Given the significant scale and long life of water dependent electricity generation assets, the need for ongoing reinvestment and the fact that costs in this area are already sunk, particular care needs to be taken to consider investment incentives and deliver regulatory predictability and stability as noted elsewhere in this paper.

Water reform can also have negative implications for gas supply and security if not done with care.

Careful consideration should be given to the constituents of any group tasked with reviewing and making recommendations on water allocation reform.

Should local authorities have a prior claim on exploration royalties?

Local Government New Zealand (LGNZ) has recently started to lobby for what it is calling a "local share" of royalties. These are currently paid by minerals and petroleum producing companies to the Crown, but would, under the LGNZ proposal be paid in some proportion to the local authorities who have producing companies in their regions. The reason royalty payments are made is based on the Crown's ownership of the resource that is being extracted.

On the face of it, the case for such a diversion of monies is seductive. So long as the producing companies do not have to pay more in royalties, they should be at worst indifferent, and at best delighted to see a direct link being made between their local activity and the funding of local communities' proposals based on the royalties they pay. And the objective – to make local communities more resilient, especially beyond the exhaustion of the resource – is a laudable one.

It is a case whose merits warrant further debate.

However, there are also reasons not to support it. Not least of which are that the

³ The purpose of this proposal is to address a key frustration for business of the need to deal with multiple government agencies each with its own idiosyncrasies. Business is happy to provide bespoke information where this is necessary but generally has a strong preference to only deal with one, not multiple agencies, especially if it requires the same information.

two other jurisdictions used as comparable examples - Western Australia and Ghana - are not really comparable at all. First, its introduction in Western Australia was based on a political deal, as a condition of political support to form a state government. And in Ghana, the paucity of political and civil institutions means direct funding from royalties to the regions in which the activity occurs is hardly surprising.

It also appears to be a specific proposal that is, in reality, aimed at a far broader issue – that of the funding base of local government and the range of tools it has available to it.

Immediate recourse to Crown royalties funding is not necessarily the right answer, nor may it be appropriate longer term to address the larger issue.

Other problems that would need to be satisfactorily addressed are:

- a. the potentially high opportunity cost of the reallocation. For example, reducing Crown funding means reducing the number of hip operations and early childcare centres that would have otherwise proceeded;
- b. the basis of the allocation of the royalties. Allocation based on location of a resource appears a capricious way to allocate Crown funds. Allocating royalties on this basis would risk the creation of two-tiered local authorities – those regions that are 'gold-plated' and those who are not;
- c. how to ensure local communities remain self-sustaining after the mining activity has ceased. The chances are that on the closure of a mine, the workforce would move to a new mining location, leaving a pocket of poverty but with excellent infrastructure;
- d. how to ensure that the region does not become dependent on the funding stream, making it extremely difficult to remove it once the activity has ceased; and
- e. ring-fenced funds, which risk constraining choices and forcing a set of trade-offs that may not be in the country's long-term interests. They don't stop poor spending decisions from being made - in fact they can encourage them with their very existence loosening fiscal discipline.

Other issues would need to be resolved before BEC could support the proposal, these being that local authorities:

- a. may not be effectively using the full range of funding tools already available to them. Are they spending money only on those

things that are absolutely necessary (and so can free up funding for more important infrastructure), and have they reviewed their asset base to see if any can be sold and funding recycled?;

- b. are actively encouraging the establishment of new exploration activities. It is important that the focus of all parties is on growing the overall size of the pie, rather than simply reallocating the existing pie; and
- c. are not simply using this as a stalking horse or precedent for a grab at other revenue streams. For example, Craig Stevenson, CEO of the South Taranaki District Council asked at the proposals launch "Why stop at royalties? Why not PAYE and tax too?"

Indeed, with all of the additional demands on regions from the dairy sector, it is unclear what the practical difference is between mining activity and dairying.

Finally, there are some practical considerations. We don't yet have substantial petroleum and minerals activity outside of Taranaki, so it's important that we don't count our chickens before they roost.

There is also, as of yet, no indication from LGNZ as to some of the more practical elements to the high-level proposition set out, such as the level of royalties to be diverted to local government (though the level of 25% share was used during the launch), whether it includes the energy levies, the basis of how it would be administered and the conditions attached to the fund.

RECOMMENDATIONS

- Review and streamline the allocation and permitting processes set out in the Crown Minerals Act
- Investigate the establishment of a Crown Minerals Exploration Authority
- Investigate the creation of a one-stop shop for Crown minerals permitting and consenting applications
- Advance reforms to the RMA and other relevant Acts, taking the systemic problems identified with the allocation and use of natural resources into account
- Consider the most appropriate nature and form of water policy reform, including implications for the broader energy sector and long-term climate change goals
- Carefully assess Local Government New Zealand's proposal for a local share of royalties

FUEL SECURITY

Continued access to secure, competitively-priced sources of fuel is critical to the economy. The risks, options and opportunities are diverse, and often dependent on location. We need to unlock the right mix in the right place to ensure New Zealand business remains internationally competitive.

Gas

Business continues to be concerned about the long term security of New Zealand's gas supply. This issue has a number of dimensions including the amount available (and accessible) and the quality of the gas network infrastructure.

Recent exploration activity has failed to find significant new commercial quantities of gas. Even if a large find was made, the chances of it being processed onshore remains slight and, if it were, it is unclear what its net benefit would be as a number of complex factors would need to be considered.

The ability for petroleum companies to quickly adopt the use of innovative drilling techniques in an environmentally responsible way, such as hydraulic fracturing (fracking), is important to New Zealand's gas security story. The Todd Corporation has provided a comprehensive statement on the risks and opportunities of fracking in their submission to the review undertaken by the Parliamentary Commissioner for the Environment.¹

Gas reserves have improved in recent years (increasing 31% since 2012) and trading through New Zealand's first wholesale gas market platform is improving the allocation of gas transmission capacity into Auckland. Industry supply/demand scenarios confirm that it is extremely unlikely that capacity upgrades will be required, particularly because gas-fired generators in Auckland have been reducing their output. The focus of industry efforts is accordingly on improving transmission capacity allocation mechanisms.

While rare, unexpected gas outages can impose a substantial economic cost. This was highlighted by the Maui Pipeline outage in 2011. While such events are managed under detailed critical contingency management regulations, there is still no consumer notification and visibility on the

risks to pipeline integrity and the plans to mitigate risk areas under the regulations governing pipeline standards.

Diesel can act as short-term back-up fuel. However, there would be concerns with diesel security if many industries were to install diesel capability as a contingency measure to a gas pipeline outage.

Gas continues to play a crucial role in the country's economy. It is important that arrangements continue to develop in a way that will maintain ongoing investor confidence, from upstream explorers through to end-consumers.

Coal

Coal continues to be an important input into New Zealand business such as steel and cement making, food growing and processing, manufacturing, industrial heating of schools and hospitals and electricity generation. Access to this relatively cheap, abundant and domestically available fuel supply is a source of international competitive advantage for many New Zealand businesses.

New Zealand has barely started to tap its vast resources and our coal deposits for both domestic use and export are substantial. The WEC's World Energy Scenarios to 2050 show fossil fuels will still play a crucial role for power generation and transport, particularly in its Jazz scenario. Coal will be important in the long run, especially for power generation in China and India, the two most rapidly growing demand centres.

The debate around the future role of coal in the New Zealand economy has been polarising and often ill-informed. The real debate should be how to utilise New Zealand's abundant natural energy resources in a measured way to deliver a step change in New Zealand's economic growth and the prosperity of its citizenry. In this case, the key question is how coal and other energy-related initiatives fit more generally within a broader strategic approach to New Zealand's productive capacity.

New Zealand has an emissions trading scheme whose purpose is to internalise the cost of the carbon. The benefit of an emissions trading scheme is that businesses can choose whether it is economic to use coal with a carbon price and pay for their emissions or use an alternate, lower carbon-intensive fuel.

Mining for coal is likely to continue unless banned or priced out of the market by a high price of carbon. In any case, in a progressively carbon-constrained world, New Zealand companies will increasingly look to fuel switch. But there are challenges in doing so.

One of these challenges is the lack of low cost thermal energy alternatives available in the South Island.

Shifting from coal to other sources of fuel (such as woody biomass) is subject to security of supply risks and added capital costs. As a source of process heat, coal in the South Island and coal and gas in the North Island cost roughly one-third the price of electricity. Coal prices would have to rise substantially to encourage switching.

If the domestic price of carbon were higher than the price imposed in other coal-producing countries, this would have the effect of either suppressing economic activity or imposing higher fuel costs, making local production uneconomic or reducing profit.

Technology will play an important role in the transition to lower emissions-intensive energy sources. CRL Energy and other research providers have been exploring co-generation of industrial heat energy using coal and biomass. Alternatives such as wood chips or pellets are still more expensive than coal as a heat source, although prices have been coming down. New Zealand Steel has been trialling 9000 tonnes of biomass-sourced carbon for steel-making (800,000 tonnes of coal were consumed at Glenbrook in 2012). It will take time to assess whether or not this product could make significant inroads into steel making in New Zealand.

Even with these developments, there is an ongoing role for coal. Substantial progress will require further reductions in the cost of new technologies and a much increased global commitment to reduce emissions. This could bring on technologies such as carbon capture and storage, which the WEC considers can play an important role after 2030 as a cost efficient CO₂ mitigation option.

Thermal heat and steam and other fuels

While uncertainty and risk beset some aspects of New Zealand's fuel security, other aspects support opportunity and diversity. Under the right conditions, the extensive geothermal steam resource

¹ www.toddenergy.co.nz/operations/production/hydraulic-fracturing

located in the central North Island not only provides a stable base-load power supply but, as demonstrated by Miraka, Gourmet Mokai and others, is increasingly facilitating a move from energy creation to high, added-value food, horticulture, nutraceuticals and fuel via direct use. This supports the growing Maori economy and regional economies through greater local employment.

Biofuels also have a small but growing role in assisting fuel security. For example, New Zealand Steel hosts LanzaTech, an

innovative New Zealand-bred business that uses microbes to convert waste gases into fuel and other chemical products.

As another example, Z Energy is about to commence production at a new site in Wiri, Auckland producing a 100% biodiesel fuel from tallow and, in partnership with Norske Skog, is investigating 'stump to pump' biofuels produced with geothermal energy.

RECOMMENDATIONS

- Implement a visible consumer notification system for pipeline outages to help assess pipeline integrity risks
- Support the quick adoption by exploration companies of innovative drilling and mining techniques in an environmentally responsible way
- Collaborate with businesses in their efforts to switch to low carbon fuels





SECTOR GOVERNANCE ARRANGEMENTS

A recent Productivity Commission report¹ noted that regulatory agencies at the central government level are not only doing similar activities differently, creating unnecessary costs for cross-infrastructure business, but are often required to deliver competing objectives with limited guidance on how to consider any trade-offs between these objectives.

While not targeted specifically at the energy sector regulatory agencies, the Productivity Commission's report provides a timely opportunity to assure ourselves that energy market governance arrangements remain fit for purpose.

The existing set of regulatory agencies governing the energy sector were established in response to varying drivers, using varying institutional design approaches. The Gas Industry Company has been in existence for ten years and the Electricity Authority for almost five. Now is an appropriate time to ensure that both sets of regulatory institutions remain suited to the country's needs and continue to deliver on intended objectives.

Despite the changes made in the 2009 Ministerial Review, various aspects of the regulation of energy markets involving competition over common networks (that is, most gas and electricity transmission and distribution) is split across the Commerce Commission, the Electricity Authority, the Gas Industry Company and MBIE. This results in:

- a. some duplication of efforts and resources between agencies and within the sector;
- b. sometimes divergent objectives and approaches between agencies; and
- c. tensions or gaps where jurisdictions interface or overlap.

¹ Productivity Commission report entitled 'Regulatory Institutions and Practices', dated June 2014.

While there are no immediate or pressing problems with either entity (unlike the case with the Electricity Authority's predecessor organisation, the Electricity Commission), it would be appropriate sometime during the next electoral term for the government to go back to the BusinessNZ report prepared by LECG (now Sapere Research Group)² and:

- a. assess energy sector regulatory institutions against the five enduring policy outcomes set out in the LECG report; and
- b. undertake a review of the Electricity Authority against the expectations regarding its performance as set out in the 2009 Ministerial Review.

There would be value in considering:

- a. what lessons can be learned from the range of governance arrangements between the regulatory agencies (for example, the Gas Industry Company is a co-regulatory model, the Electricity Authority is an independent Crown entity with a government appointed board);
- b. whether related functions could be placed together in a single entity (for example, an Energy Commission, a Utilities Commission or a Competition Commission) and what type of entity would be appropriate;
- c. if bringing together regulation of gas and electricity markets within a single entity would be appropriate given it is increasingly difficult to maintain a clear separation between the issues facing each market;
- d. how governance should function at the political-regulatory and regulatory market interfaces, what levels of sector and

² 'Determining outcomes or facilitating effective market processes: a review of regulation and governance of the electricity sector', prepared for BusinessNZ by Kieran Murray, Graham Scott, and Toby Stevenson, dated 4 February 2009.

consumer engagement are appropriate and what levels of independence and accountability are appropriate; and

e. what roles regulators should have.

If a review of the Electricity Authority and the Gas Industry Company were undertaken, it should also cover the Energy Efficiency and Conservation Authority (EECA), the Electricity and Gas Complaints Commissioner (EGCC), the energy-related functions of the Commerce Commission and MBIE. There could also be a case to consider synergies with other sectors where there is competition over common networks (for example, telecommunications).

RECOMMENDATIONS

- Review the governance arrangements for the energy sector to ensure they remain fit for purpose

'BIG DATA' AND INNOVATION

Data lies at the very heart of our lives. Its use (within acceptable privacy constraints) will mean quite dramatic shifts for the way we live and do business. Its impact on the ownership, provision and use of energy is likely to be profound over the coming decades.

The need to act may seem too far away to be immediately relevant. But the shift from traditional, commodity provider utility to service provider is underway.

It is worthwhile bearing in mind that what might have been thought improbable a decade ago is increasingly within reach. For example, we now carry more computing power in our pockets (~ 64GB Apple iPhone 4S) than the Apollo astronauts carried to the moon (~ 4kB) and, depending on the model, there can be over 15 sensors on a smart phone.

With the increasing use of power applications on cellphones and around 65% of residential consumers already connected to AML, it has never been more possible to reveal end-user preferences with such accuracy, enabling better targeted consumer-orientated solutions.

The improved collection and use of data will increasingly facilitate a more sophisticated understanding of energy users and their needs, based on better assessments of current and future trends.

Choices that traditionally get made by politicians, regulators and utilities may come to be made directly by end-users via their smartphones.

Innovation may also come from unexpected sources. In a recent note, PwC says:

"We expect to see metering and data services become a very open market offering and there will be major competition from energy retailers, telcos, ISPs and other technology players. We expect the bulk of the value in this space to be captured by current data and content players rather than traditional utility companies."¹

¹ PwC note entitled 'Utility of the future: a customer-led shift in the electricity sector, a New Zealand context', 2014.

We are on a new technology frontier of smart appliances that is likely to touch the entire energy delivery chain from upstream exploration to end-consumers who can turn on an appliance with their smartphone or recharge their car at the charging station.

The rise of the shared economy

The exponential advance of social media, mobile and cloud computing in today's world – combined with relentlessly escalating financial and regulatory pressures – will pressure energy providers to rethink the way they use technology, create markets and operate their business model.

Consumers with more discretion in their energy use will put pressure on business models to be reviewed and refocused. The linear relationship from generator to end-consumer is likely to change with services rebundled. Traditional business distinctions will break down.

Business models that allow users to bypass the central incumbent and go through a new service provider (for example, Google) will facilitate the rise of the shared economy, where businesses unbundle existing assets to allow value to be exchanged.

Changing risk profiles will be at the heart of the signal to change business behaviour – as shareholders perceive the emergence of new risks this will be priced-in, opening up new incentives and opportunities in the process.

The risk of asset stranding or obsolescence can be minimised or heightened depending on the nature of the infrastructure and the business response. While transport fuel infrastructure is an obvious example (in light of electric cars), other infrastructure types are not immune.

In the electricity sector, the rise of the prosumer (consumers who also produce electricity via a distributed source of generation such as solar PV) is another example where the impact of technology combined with new business models (electricity as a service offered by solar panel lease companies) can potentially revolutionise the transmission and distribution elements of the sector.

Put simply, the provision of reliable energy supply is no longer enough.

The key question is how to unlock access to emerging technologies, markets and business models to enable change to occur. Policy frameworks need to be resilient and adaptable to such eventualities. Regulatory systems will need to keep up or keep out of the way. Policy makers and regulators will need to be flexible and facilitate reshaped energy and related services markets to keep pace with developments.

An approach to service delivery that allows users to signal their preferences and facilitates the efficient allocation of scarce resources to those services of highest value will be a good starting point.

RECOMMENDATIONS

- Remove barriers (within accepted privacy constraints) to the collection and use of data for the purposes of more efficient energy delivery
- Remove regulatory barriers to the adoption of new business models, technologies, innovative energy-related finance and pricing tools

ACCESS TO A SKILLED WORKFORCE

Access to a sufficiently skilled workforce is a critical determinant to whether energy projects proceed when required.

The energy sector has a skilled and adaptable workforce and places a high importance on training and development.

Demand for labour is set to surge in coming years as the economy continues to grow. Quality deficits and cost blow-outs can result if projects commence without the appropriate human capital to plan and successfully execute projects. This is heightened by an ageing workforce.

Also, there is a global market for technical skills and global demand is likely to continue to grow due to other countries facing similar challenges to those here.

As a result, firms' confidence to invest in growth and therefore create jobs can be constrained.

Energy businesses need more young people coming out of educational institutions with world-class trade, engineering, ICT and management skills.

These skills play a key role not only in major energy projects but underpin innovation in a number of other sectors.

We support the Tertiary Education Commission's work to increase the supply of engineers through a demand-led approach.

However, we believe that coordinated efforts rather than one-point actions are required.

It is often the case where one arm of government creates skill demands in the private sector (for example, through increased spending on roading) that are not adequately supported by allocations to the wider education and training system, despite the fact that government determines the number of students funded through the system.

The ability of the Tertiary Education Commission (that is, government) to link funding decisions to industry need in recent years has been hampered

by inadequate funding mechanisms, price controls, weak incentives for high performance, and a focus on the internal metrics of the system rather than investing for outcomes.

The quality of education and training provision is an ongoing concern for business. Care must be taken to ensure that skills provision is focused on quality (for example, education and training that produces value for business and employees).

This includes refreshing the school curriculum, strengthening teacher capability to support science achievement, continuing to support Futureintech¹, and improving access to quality careers advice, information and guidance.

Firms should also take a more systematic approach to the attraction, retention and utilisation of skills.

Competition for skilled workers from other sectors of the economy is becoming acute. This is exacerbated by growth in the infrastructure sector and the demand for workers driven by the reconstruction of Christchurch.

In telecommunications, there is the need to adapt and expand assets to suit an increasingly interconnected and ultra-fast world. In construction, there is a large forward book of projects with more to come.

If New Zealand is to make the most of its oil and gas reserves, then demand for technically skilled labour will also grow within that sector.

There will be an ongoing need to recruit skilled workers from overseas. An internationally competitive immigration system is important to offset skills and labour shortages.

RECOMMENDATIONS

- Review education and training strategic objectives to align with government energy development goals
- Review labour market and immigration policies to support the provision of an appropriately skilled labour force in the energy sector in the coming years

¹ Futureintech is a national coordination mechanism for outreach to schools with strong employer support.

APPENDIX ONE: NEW ZEALAND PARTICIPANTS IN WEC WORKING GROUPS

BEC Member	WEC Working Group
Dr Rob Whitney, Chair, BusinessNZ Energy Council, Chief Science Advisor, CRL Energy, & Coal Association.	World Energy Scenarios
Mike Underhill, Chief Executive, Energy Efficiency and Conservation Authority (EECA)	Energy Efficiency Policies and Indicators
John Carnegie, Manager, BusinessNZ Energy Council	World Energy Trilemma World Energy Perspectives - Global Frameworks
Nathan Bittle, Senior Policy Advisor, Ministry of Business, Innovation and Employment	Future Energy Leader Programme: The Future of Alternative Transport Fuels World Energy Scenarios
Sheena Thomas, Communications Advisor, Z Energy	Future Energy Leader Programme: The Future of Alternative Transport Fuels World Energy Scenarios
Jenny Lackey, Manager, Residential Projects, Energy Efficiency and Conservation Authority	Future Energy Leader Programme: Acceptance for Clean Energy Projects
Tim Henshaw, Director Portfolio Manager, Westpac Institutional Bank	Financing Resilient Energy Infrastructure
Greg Visser, General Manager, Business, EECA	Energy Efficient Technologies Knowledge Network ¹
John Rampton, General Manager, Market Design, Electricity Authority	Solar Knowledge Network Energy Storage Knowledge Network World Energy Scenarios
Chris Baker, Chief Executive, Straterra	Coal Knowledge Network
Ted Montague, Geothermal Development Manager, Contact Energy	Geothermal Knowledge Network
Dr. James Tipping, Regulatory Strategy Manager, Trustpower	Wind Knowledge Network
Pamela Caird, Senior Advisor, Gas Industry Company	Gas Knowledge Network

1. The knowledge networks form an integral part of the World Energy Resources project. The World Energy Resources project team and its 13 knowledge networks (including the Energy Efficiency Technologies) collect and analyse data on specific resources and reserves.

APPENDIX TWO: CONTRIBUTORS TO THE DEVELOPMENT OF THE BEC2050 SCENARIOS

Auckland University	Heliocon	National Energy Research Institute
Beca	GNS Science	New Zealand Oil and Gas
BP	Ideaforge	New Zealand Steel
Centre for Sustainable Cities, Victoria University	Landcare Research	NZ Youth Delegation
Contact Energy	MacDiarmid Institute	Sapere Research Group
Chevron	Massey University	Siemens
CRL Energy	Meridian Energy	Straterra
Electricity and Gas Complaints Commission	Mighty River Power	Todd Energy
Energy Efficiency and Conservation Authority	Ministry of Business, Innovation and Employment	Transpower
EPEC, University of Canterbury	Ministry for the Environment	Trustpower
Fonterra Cooperative Group	Motor Trade Association	Toyota NZ Ltd
	MOTU	Woodward Partners
		Z Energy

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