New Zealand Energy Efficiency and Conservation Strategy

Making It Happen

Action plan to maximise energy efficiency and renewable energy

October 2007

New Zealand Government

sustainability

Statutory declaration

The New Zealand Energy Efficiency and Conservation Strategy (NZEECS) has been written in accordance with section 10(2) of the Energy Efficiency and Conservation Act 2000 (the Act). It replaces the National Energy Efficiency and Conservation Strategy (2001). A draft version of this strategy was published in December 2006 in accordance with the Act. The final version has been prepared with consideration of stakeholder feedback on the 2006 draft. A summary of the recommendations and the Minister of Energy's decisions on the recommendations has been provided to submitters in accordance with section 17(2)(a) of the Act.

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Foreword by Jeanette Fitzsimons, Government Spokesperson on Energy Efficiency and Conservation

This is the second five-year strategy under the Energy Efficiency and Conservation Act 2000. Since the first was written in 2001, oil prices have tripled and climate change has accelerated. How we deal with these two defining issues of our time will have a significant impact on our economy, environment and way of life.

Energy efficiency uses smarter technology to deliver the same outcomes. Energy conservation uses smarter behaviour to meet our needs and save us money. They are the fastest, cheapest and most environmentally friendly ways to respond to the challenges of peak oil and climate change.

As well as that, we have now done the analysis to show that renewable energy, at least for electricity, will be cheaper for at least the next 20 years than fossil fuels.

We have consulted widely for three months on the December draft, and I want to thank all of you who have contributed. The final strategy is stronger, with more targets, based on better data and it is clearer who is responsible for delivering it.

This strategy focuses on actions. This means changing what we do and how we invest our time and resources as individuals and as businesses. Together, we can transform our society and economy – saving us money, energy and emissions, while enjoying a better quality of life and creating a more resilient and innovative economy.

Better insulated homes are cheaper to heat and healthier to live in. Businesses that embrace energy efficiency and engage their workers in cutting energy costs are more competitive. Farmers that use modern heat recovery systems and advanced vacuum systems in the dairy shed are more profitable, and vineyards and tourism operators that can demonstrate their commitment to environmental sustainability and going carbon neutral, have an edge in overseas markets.

It's time to really clean up our act in the transport sector. There is no reason why New Zealand should continue to be a dumping ground for thirsty and dirty vehicles. Kiwi families are spending much more than they need to on fuel, our carbon tyre-print is steadily growing and our cars are contributing to hundreds of premature deaths each year.

We have set challenging targets: to clean up the fleet with more efficient vehicles, biofuels and new technologies; and to reduce the number of one-person car trips, with better public transport, safer walking and cycling, and better planned cities.

Government is ready to take the lead by reducing its own energy use in travel, buildings and purchasing policy. Local Government is keen to set an example with its own energy use, and the way it plans for its communities.

It has been a privilege to lead the development of this second strategy under the legislation I introduced as a private member's bill in my first term here. The strategy will succeed if it empowers all our companies, communities and citizens to take action too. I hope you will join with us to make all our lives more sustainable.

Jeanette Fitzsimons

Government Spokesperson

Energy Efficiency and Conservation

Foreword by Hon David Parker, Minister of Energy

The government has a bold agenda for New Zealand to become truly sustainable and carbon neutral.

To do so we need to cut our emissions and make our economy more efficient and competitive. Increasing the uptake of energy efficiency and conservation measures and renewable energy is an excellent way to do this.

Doing so should also leave families better off in terms of having healthier, more comfortable homes that are better to live in; make businesses more competitive; let our transport system be less dependent on oil imports, be cleaner and more efficient; use our electricity systems more efficiently with more of our stationary energy needs being met from renewable sources.

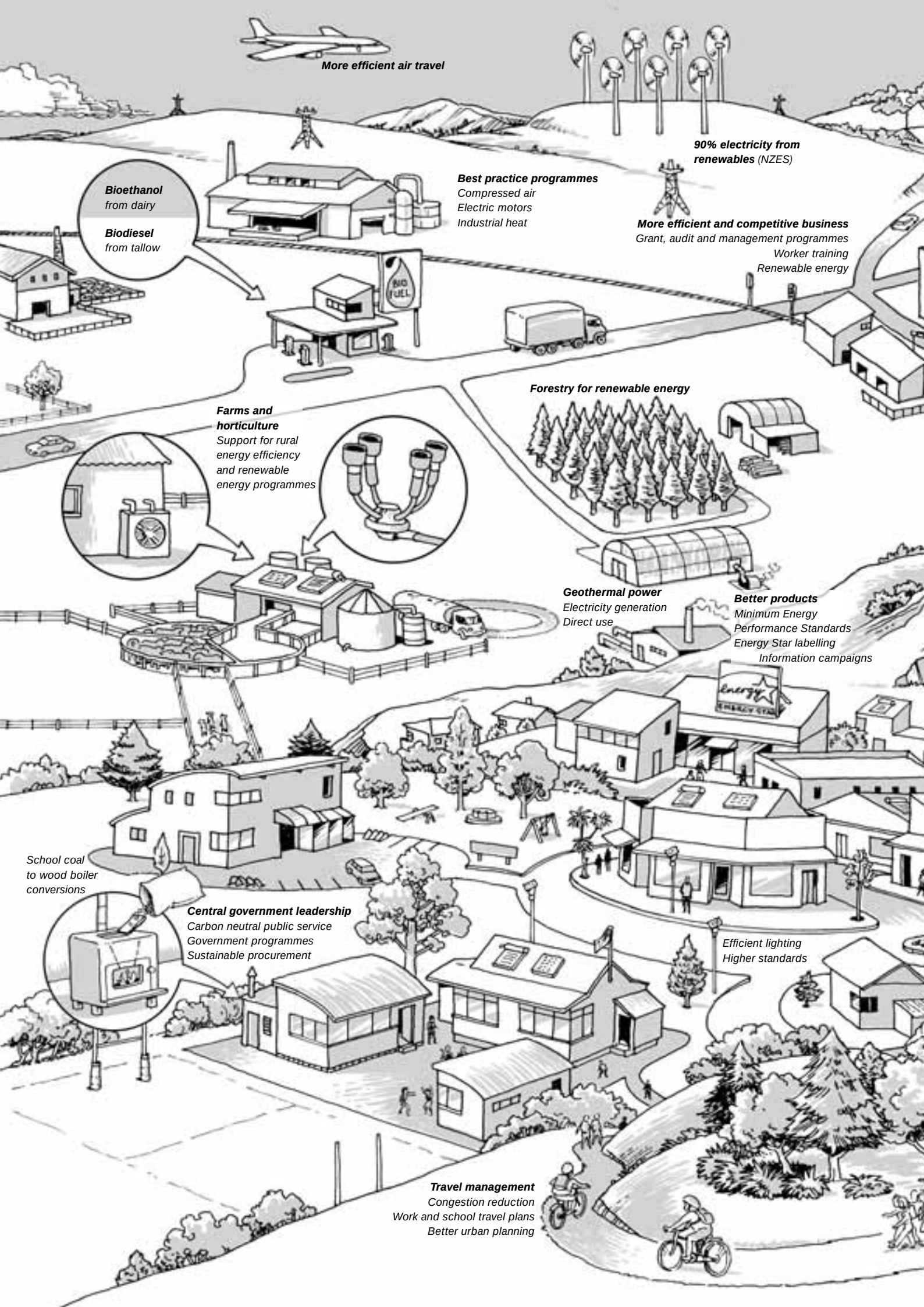
The cost-benefit analysis carried out by the Electricity Commission, the Energy Efficiency and Conservation Authority and the Ministry of Economic Development lies behind this strategy; it is a step up on prior efforts and further shows how these measures make good sense.

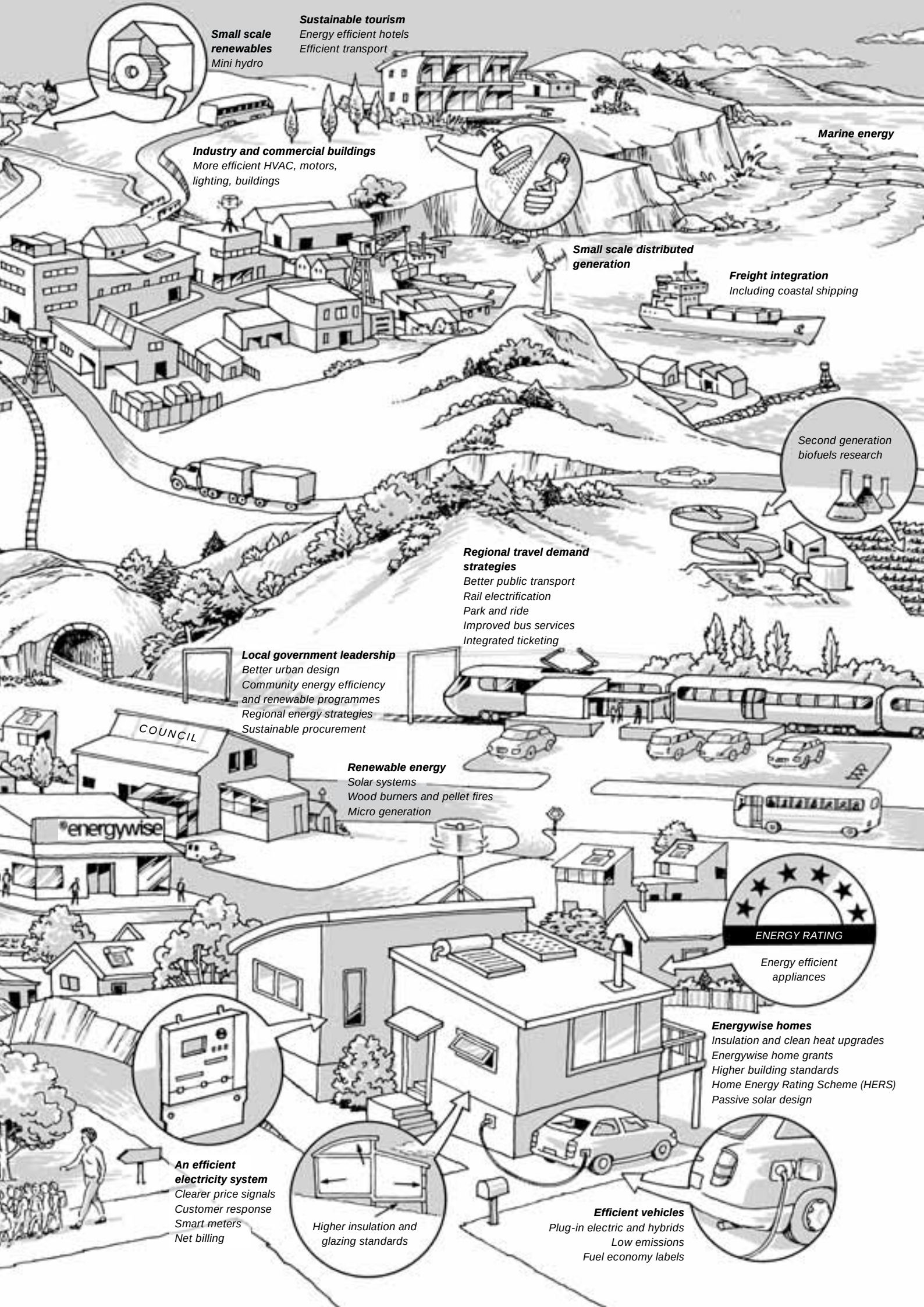
I am grateful to the many submitters who contributed to the development of this strategy, and to the officials for pulling it together. I'd like to thank Jeanette Fitzsimons for her leadership and dedication to improving social, economic and environmental outcomes through driving the uptake of energy efficiency and conservation measures and renewable energy.

Hon David Parker
Minister of Energy

Strategy at a glance

The diagram on the following two pages is a pictorial representation of the main areas of action covered by the New Zealand Energy Efficiency and Conservation Strategy. It has not been drawn to scale and elements within it have been drawn for illustrative purposes only.


More efficient air travel
90% electricity from renewables (NZES)
Best practice programmes
Compressed air
Electric motors
Industrial heat
Bioethanol
from dairy
Biodiesel
from tallow
BIO FUEL
More efficient and competitive business
Grant, audit and management programmes
Worker training
Renewable energy
Forestry for renewable energy
Farms and horticulture
Support for rural energy efficiency and renewable energy programmes
Geothermal power
Electricity generation
Direct use
Better products
Minimum Energy Performance Standards
Energy Star labelling
Information campaigns
School coal to wood boiler conversions
Central government leadership
Carbon neutral public service
Government programmes
Sustainable procurement
Efficient lighting
Higher standards
Travel management
Congestion reduction
Work and school travel plans
Better urban planning


Small scale renewables
Mini hydro
Sustainable tourism
Energy efficient hotels
Efficient transport
Industry and commercial buildings
More efficient HVAC, motors, lighting, buildings
Marine energy
Small scale distributed generation
Freight integration
Including coastal shipping
Second generation biofuels research
Regional travel demand strategies
Better public transport
Rail electrification
Park and ride
Improved bus services
Integrated ticketing
Local government leadership
Better urban design
Community energy efficiency and renewable programmes
Regional energy strategies
Sustainable procurement
COUNCIL
Renewable energy
Solar systems
Wood burners and pellet fires
Micro generation
energywise
ENERGY RATING
Energy efficient appliances
Energywise homes
Insulation and clean heat upgrades
Energywise home grants
Higher building standards
Home Energy Rating Scheme (HERS)
Passive solar design
An efficient electricity system
Clearer price signals
Customer response
Smart meters
Net billing
Higher insulation and glazing standards
Efficient vehicles
Plug-in electric and hybrids
Low emissions
Fuel economy labels

1. Introduction

The New Zealand Energy Efficiency and Conservation Strategy (NZEECS) is a key part of the government's response to meeting its energy, climate change, sustainability and economic transformation goals. It has been written as a companion document to, and will give effect to a number of the objectives set out in, the New Zealand Energy Strategy (NZES).

The NZES provides government leadership for the energy sector to respond to long term challenges of energy security and climate change. It sets out the government's vision for a reliable and resilient system delivering New Zealand sustainable, low emissions energy services. It also provides the high-level strategic direction, goals and a market-operating environment to support the greater uptake of energy efficiency and renewable energy.

The NZEECS is a detailed action plan for increasing the uptake of energy efficiency, conservation and renewable energy programmes across the economy and to make doing so part of the normal behaviour of New Zealanders. It demonstrates the government's commitment to addressing climate change concerns and progressing broader sustainability objectives. It complements a number of other government strategies including the Sustainability Package announced by the Prime Minister in February 2006 and the New Zealand Transport Strategy.

1.1 Lessons from the first strategy

This 2007 version of the strategy builds on the experience and achievements of its 2001 predecessor. Experience has helped build better understanding of the barriers that prevent the uptake of cost effective energy efficiency and renewable energy investments and practices.

A review of the 2001 strategy identified that the strategy was necessary but not sufficient.[1] It was necessary as it increased the profile of energy efficiency and renewable energy. It also acted as a driver for strategic policy change in this area. However its ambition to draw improved energy efficiency from across the economy was not realised.

The review also identified that some programmes were performing exceptionally well, for example the Products programme and Energywise homes grants. Progress towards the original renewable energy target has also been strong.

As a result the 2007 NZEECS has:

- a clearer focus on consumer (demand-side) action
- sector-based actions and targets and clear accountabilities for delivery
- improved resources
- new programmes for specific sectors such as primary production and tourism.

[1] *NEECS Situation Assessment Report 2006* – refer www.eeca.govt.nz/eeca-library/eeca-reports/report/situation-assessment-report-neecs-06.pdf

1.2 Addressing barriers

Barriers that prevent individuals and businesses from taking up energy efficiency and renewable energy in the wider economy include:

Lack of information – Consumers are often unaware of the benefits of energy efficiency, conservation and renewable energy and how to realise them. Education and awareness-raising programmes, including labelling schemes, are designed to help overcome this.

Weak price signals – Energy pricing does not yet fully reflect the environmental and economic cost of energy production and consumption. Decisions around cost-reflective pricing and incentive programmes can help overcome this barrier.

Access to capital – Some consumers struggle to meet the initial costs of energy efficiency and renewable energy measures even though they are cost effective over time. Incentive programmes such as discounted products, and grants and loans can help overcome this.

Split incentives – Landlords who are responsible for paying for building improvements may not directly get the benefits, such as lower energy bills or increased comfort. Likewise, tenants may not want to invest in improving homes or buildings that they don't own or may not occupy for long periods. Incentive programmes, such as assistance to landlords to insulate properties and the setting of minimum standards, can help overcome this.

1.3 Accountabilities

Clear accountabilities for the delivery of this strategy have been established.

The Ministry of Economic Development (MED) is responsible for the overall monitoring of the strategy and reporting on progress. Responsible agencies have been assigned to each programme with other agencies contributing to policy and programme design and implementation.

However, in order for the strategy to be effective, all sectors of the economy must act. This means everyone has a role to play in taking action to develop a sustainable energy future. This is a strategy for all New Zealanders, not just the government.

1.4 Improving information to help the government make policy decisions

The government has undertaken a thorough programme of cost-benefit analysis studies to inform the design of this strategy. This has incorporated studies conducted by EECA, the Electricity Commission and MED.[2] The combined output of these studies provides a broad picture of the potential to make cost effective energy efficiency gains. The results are robust and underpin the development of programmes in this strategy and the projected outcomes.

Such a programme is to be expanded under the proposed New Zealand Energy Domain Plan. This will inform the ongoing development of programmes and how they might best be changed and expanded to take advantage of emerging opportunities, and to make further cost effective gains.

[2] *Sustainable Energy Value Project – Evaluation of Options for Intervention in Stationary Energy Efficiency*, COVEC February 2007; and *KEMA New Zealand Efficiency Potential Study* (draft) Vol 1 2007.

1.5 Targets

Programmes in this strategy will support the attainment of the following high-level targets. Each chapter contains additional targets.

Energywise Homes Warm dry healthy homes, improved air quality and reduced energy costs	70,000 interest free loans for insulation, energy efficiency or clean heat loans by 2015 65,000 insulation retrofits for low income families by 2012 4,000 clean heating upgrades for low income families in areas of poor air quality by 2012 15,000 – 20,000 solar water heating systems by 2010 Minimum Energy Performance Standards (MEPS) on 17 additional product categories, and Energy Star labels on an additional 15, by 2012
Energywise Business More energy efficient and competitive businesses using more renewable energy and emitting less carbon dioxide	To expand the successful Emprove and Energy Intensive Businesses programmes by the end of 2008 To implement an energy efficiency training programme for workers by the end of 2009 Up to an additional 9.5 PJ per year of energy from woody biomass or direct use geothermal by 2025[3] To have plans in place to measure the potential for energy efficiency improvements and to roll out an efficiency programme in the rural sector by the end of 2008 To have a plan in place by the end of 2008 to increase the uptake of energy efficiency measures in the tourism sector
Energywise Transport To reduce the overall energy use and greenhouse gas emissions from New Zealand's transport system	Reduce per capita transport greenhouse gas emissions by half by 2040 For New Zealand to be one of the first countries in the world to widely deploy electric vehicles To have an average emissions performance of 170g/km of CO_2 (approximately 7 l/100km) for light vehicles entering the fleet by 2015 Cut kilometres travelled by single occupancy vehicles in major urban areas on weekdays, by 10 per cent per capita by 2015 (compared to 2007) For 80 per cent of the vehicles to be capable of using 10 per cent biofuel blends or to be electric powered by 2015 Investigate options for improving the efficiency of the North Island main trunk line, including electrification, by 2010
New Zealand's efficient and renewable electricity system	To have 90 per cent of electricity generated from renewable sources by 2025
Government leading the way	Six lead core public service agencies to be carbon neutral by 2012 with the remaining 28 agencies to be on the path to carbon neutrality by then Cut core public service average vehicle fleet emissions by 25 per cent by 2012 A 10 per cent reduction in energy use per employee in core public service buildings by 2012[4] To have plans in place to cut workplace travel by core public service departments by 15 per cent by 2010 Cut use of energy intensive consumables, like paper, by core public service departments by 10 per cent by 2010 Support local government in delivering NZES and NZECS programmes

[3] Covers industrial, commercial and residential sectors. Does not include wood processing residues.

[4] Off a 2006/07 base.

1.6 Potential impacts

The following savings are expected to be delivered as a result of the programmes outlined in the strategy:

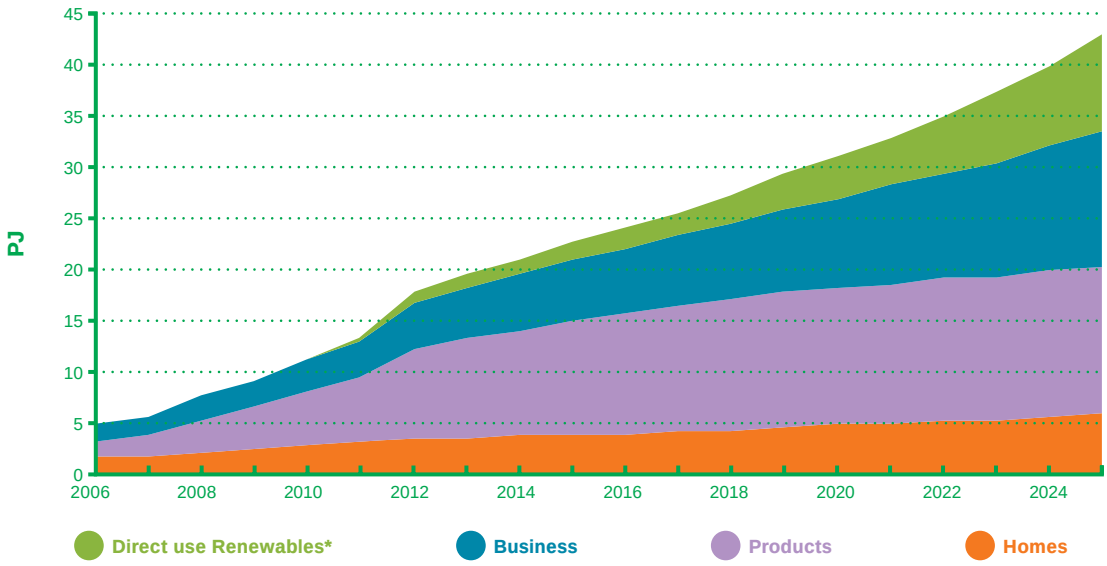
- 30 PJ of savings in non-transport energy per year by 2025
- 9.5 PJ of additional direct use renewable energy per year by 2025
- 20 PJ of energy savings in the transport sector by 2015.

To reach the targets outlined in this strategy, New Zealand will need to lift its rate of improvement in energy efficiency by 40 per cent, moving the rate of improvement from 0.5 per cent per year at present to the OECD average of 0.7 per cent per year by 2012.[5]

Figure 1 outlines how the key aspects of the NZEECS (excluding transport) will contribute to energy savings to 2025. NZES and NZEECS objectives will inform the high-level targets to be developed under the final *Implementing the New Zealand Transport Strategy* (INZTS).

The NZES has set a target for 90 per cent of electricity to be generated from renewable sources by 2025. The outcomes projected in Figure 1 will help to achieve this target by keeping the rate of growth in electricity demand in check.

Figure 1: NZEECS non-transport consumer energy improvements 2006–2025



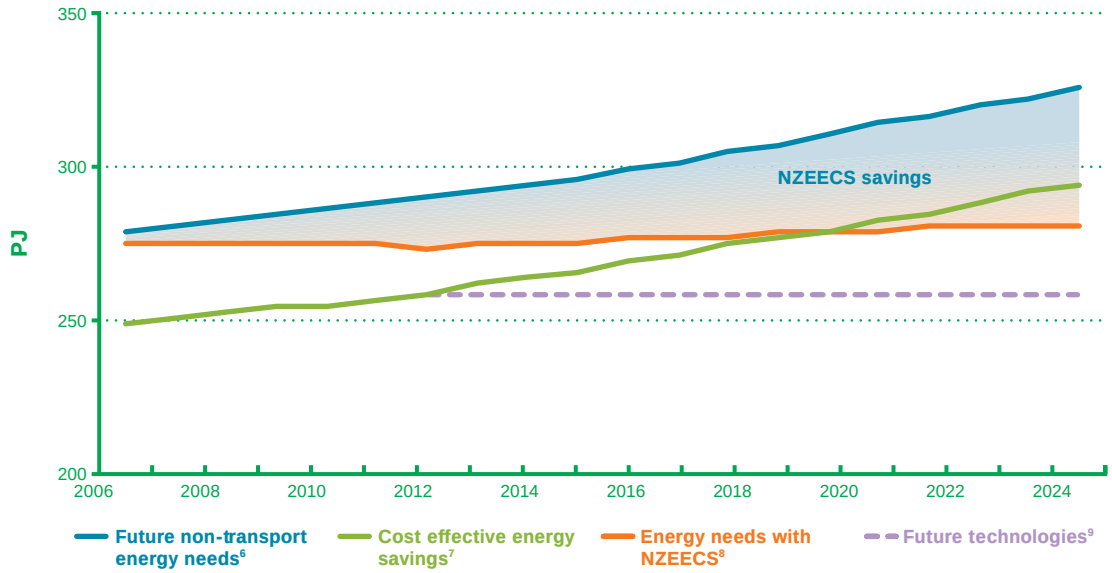
***** Direct-use renewables include meeting new demand and fuel switching from fossil fuels and electricity
Source: EECA

The combined impact of the NZEECS actions in the stationary energy sector (excluding transport) is forecast to be 30 PJ of energy savings and 9.5 PJ of additional direct use of renewable energy leading to 5–6 megatonnes (Mt) CO_2 emissions reductions per year in 2025.

[5] Assumptions: the previous NEECS rate of 0.5% per year for the non-transport energy components of the economy; the NZEECS rate of 0.7% is projected for the non-transport energy components of the economy; the OECD rate 0.7% per year is the average rate for economy-wide change for OECD 11.

Figure 2 shows the forecast impact of the actions in this strategy in the non-transport energy sector (energy needs with NZEECS). This is shown against forecast demand growth if no further action is taken (future non-transport energy needs) and the potential for cost effective savings (cost effective energy savings). The cost effective savings line shows a second track from 2012 (future technologies) that takes into account the likelihood of new technologies becoming available that will offer increased potential for savings from then. The shaded area denotes energy saved as a result of NZEECS programmes.

Figure 2: NZEECS non-transport energy use 2006–2025



Source: EECA

The potential to make cost effective savings is not static. The Energy Domain Plan and the annual reviews of this strategy will identify further opportunities to make improvements. Technology will continue to advance and the potential for cost effective improvements will increase. For instance, the International Energy Agency published an alternative policy scenario in its 2006 World Energy Outlook. This highlights emerging technologies such as: ocean energy, solar photovoltaic, hot rock geothermal, plug-in hybrid vehicles, biomass refineries, and zero energy buildings. These technologies are on a path to commercialisation and could make a significant contribution in the medium term.

The majority of Energywise transport measures are of an enabling nature. Rather than each one producing quantifiable energy savings, in combination they represent opportunities for future energy savings. The NZES envisages a resilient, low-carbon transport future, while the government has agreed in principle to reducing per capita greenhouse gas emissions from transport to half of 2007 levels by 2040.

Targets and actions in this strategy will play a part in achieving these goals. Targets set in this strategy for reducing single occupancy vehicle trips and improving the fuel economy of vehicles entering the light vehicle fleet could, depending on future policy decisions, result in cumulative savings of approximately 20 PJ of energy and approximately 1.3 Mt CO_2 emissions by 2015.[10] Estimated savings to 2025 from the latter target are 175 PJ and 11.8 Mt of CO_2 emissions.

[6] The forecast need for non-transport energy in New Zealand derived from MED outlook.

[7] Forecast non-transport energy needs if the possible cost effective energy efficiency improvements are realised.

[8] Forecast non-transport energy needs in New Zealand with the NZEECS objectives being achieved.

[9] Assumes future technological advances in energy efficiency.

[10] Data supplied by Ministry of Transport, 2007.

A longer-term target has been set to reduce per capita emissions from the transport sector by 50 per cent by 2040. One of the key strategies to achieve this target is to position New Zealand to be one of the first countries, if not the first, to widely deploy electric vehicles.

1.7 Calculating the CO_2 savings resulting from electricity efficiency actions

Emissions reductions attributed to NZEECS programmes are calculated using the marginal emissions factor in the Ministry of Economic Development's model.[11] [12]

1.8 Costing and funding the strategy

Actions in the NZEECS will be funded from a range of sources including the government (including the Electricity Commission appropriation), the private sector, the voluntary sector and individuals.

The government has already agreed to $184 million in funding for a number of programmes in this strategy through previous budget rounds. Other programmes are yet to be funded and are identified in the summary action tables that lead each section. In addition, the government announced $650 million for rail infrastructure improvements in Auckland and Wellington, as well as for national rail improvements.

A principle of the NZES is that investments should be made in energy efficiency measures that are cheaper than the long term costs (including environmental costs) of building additional generation.

Government also considers it appropriate to take into account the value of long term environmental and social benefits associated with energy efficiency, conservation and renewable energy programmes. As such, it will use a 5 per cent real discount rate when analysing the costs and benefits of programmes, where appropriate.

Any regulatory programmes will require Regulatory Impact Statements and be subject to a cost-benefit analysis plus the usual legislative processes, public consultation and government scrutiny before they are introduced.

[11] MED *Benefit Cost Analysis of the New Zealand Energy Strategy* 11 May 2007, pp 2–3 uses 0.698 t CO_2 per MWh.

[12] A future price on carbon may change the marginal generation source and hence the estimates of future emissions reductions.

2. Energywise homes

Objective:

Warm, dry healthy homes, improved air quality and reduced energy costs

The Beckham Family of Wainuiomata.
Photo courtesy of the Ministry for the Environment.

Energywise homes – Summary of actions

Action	Outcome	Delivery
2.1 Improving the performance of existing homes		
Energywise interest-free loans 70,000 insulation and clean heat installations	0.67 PJ 0.13 Mt CO_2 $22m energy and $73m health savings pa in 2025	EECA (Funded)
Energywise home grants 12,000 insulation retrofits pa to 2012 800 clean heat retrofits pa to 2012	0.62 PJ 0.12 Mt CO_2 $29m energy and $18m health savings pa in 2025	EECA (Funded)
State housing energy efficiency upgrades 7,200 retrofits by the end of 2010	0.07 PJ 0.01 Mt CO_2 $3.2m energy and $1.6m health savings pa in 2025	HNZC (Funded)
Expand HNZC retrofit programme (assumes 20,000 retrofits)	0.19 PJ 0.04 Mt CO_2 $9.1m energy and $4.4m health savings pa in 2025	HNZC (Partially funded)
Investigate Minimum Energy Performance Standards (MEPS) for existing homes – especially rentals	Report with recommendations by the end of 2009	DBH (Under consideration)
Totals	**162,000 homes** **1.55 PJ** **0.3 Mt CO_2** **$63.3m energy and** **$97m health savings pa in 2025**	
2.2 Better products		
MEPS – 17 new product classes and update stringency levels for seven existing product classes by the end of 2012	12 PJ 2.33 Mt CO_2 and $179m energy savings pa in 2025	EECA (Funded)
Appliance retirement 450,000 fridges over 20 years	1.8 PJ 0.35 Mt CO_2 $43m energy savings pa by 2025	EECA (Funded)
Efficient Lighting Strategy to accelerate the uptake of better lighting technology	0.01 PJ 2,000 tonnes CO_2 $5m energy savings pa by 2012	EC (Funded)
Subsidise an additional 5.7 million compact fluorescent lamps by the end of 2009	0.6 PJ 0.12 Mt CO_2 $3m energy savings pa by 2012	EC (Funded)
Energy Star – expand programme	15 additional product categories by the end of 2012	EECA (Under consideration from 2008)
Totals	**14.5 PJ** **2.81 Mt CO_2** **$230m energy savings pa in 2025**	

Action	Outcome	Delivery
2.3 Improving the performance of new homes		
Building Code amendments for thermal performance and hot water systems by the end of 2008	1.9 PJ 0.37 Mt CO_2 $47m energy savings pa by 2012	DBH (Funded)
Investigate incorporating carbon life cycle analysis into the Building Code	Recommendations by the end of 2010	DBH (Under consideration)
Investigate Home Energy Rating Scheme (HERS) as a tool for the Building Code	Recommendations by the end of 2009	DBH/EECA (Funded)
Support for local councils to implement energy-related changes to the Building Code	Improved information	DBH/MfE (Funded)
Totals	**1.9 PJ** **0.37 Mt CO_2** **$47m energy savings pa in 2012**	
2.4 Better information		
Introduce a national Home Energy Rating Scheme (HERS) Decide on making disclosure of ratings mandatory by the end of 2008	Improved consumer information	EECA (Funded)
Consider expansion of Eco-design advisor scheme	Decision by the end of 2008	EECA (Under consideration)
Energy efficient technology research through to 2012	Improved product assurance for consumers	EECA (Funded)
Sector development and capacity building	Develop implementation plan by the end of 2008	EECA (Funded)
Energywise information campaign	Build awareness	EECA (Funded)
2.5 Increasing the uptake of household renewable energy		
Information, accreditation and financial assistance for solar water heating	15,000–20,000 solar water heating systems by the end of 2010 0.13 PJ 0.02 Mt CO_2 pa in 2010	EECA (Funded)
Support for the Solar Industries Association's advocacy role	Ongoing support	EECA (Funded)
Totals	**0.13 PJ** **0.01 Mt CO_2 pa in 2010**	

Households consume 63 PJ (13 per cent)[13] of energy per year including 44 PJ (33 per cent)[14] of electricity, and are responsible for 3.4 Mt, or 10 per cent,[15] of New Zealand's annual greenhouse gas emissions from the energy sector.

Our homes are central to the quality of life and health of all Kiwi families. They should be warm, dry, healthy places to live in, with affordable energy costs.

Inadequate insulation and poor-quality heating makes many homes cold, damp and expensive to heat. This contributes towards ill health and lost work and school days. These issues apply to many New Zealand families across both urban and rural communities.

Breathing easier

Asthma costs New Zealand around $825 million per year in terms of medical expenses and days off work.[16] It is the most common cause of hospital admissions and is responsible for 500,000 lost school days each year.

Improving household energy efficiency can make reaching minimum temperatures for good health more affordable. Studies[17] have shown that retrofitted insulation in the homes of people suffering from respiratory illnesses, such as the flu or asthma, was effective in improving their health, and reducing the number of days they took off work and school. In retrofitted homes, visits to the doctor by family members dropped by 19 per cent, admissions to hospital due to respiratory conditions dropped by 43 per cent, days off school reduced by 23 per cent and days off work by 39 per cent.[18]

Image courtesy of He Kainga Oranga/Housing and Health Research Programme.

The way energy is used in households is shown in Figure 3. It is affected by the appliances used, householder behaviours and building design. The programmes outlined here will target all three to ensure energy is used more efficiently and to provide the substantial health, comfort and wellbeing benefits associated with smarter energy choices.

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[13] *New Zealand Energy Data File* MED, 2007.

[14] Ibid.

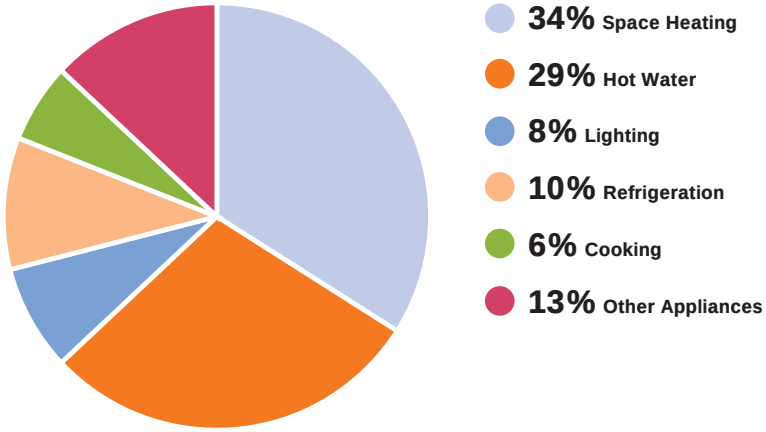
[15] Derived from direct emissions and indirect electricity emissions from *New Zealand Energy Greenhouse Gas Emissions 1990–2005,* MED, 2006.

[16] *The Burden of Asthma in New Zealand*, Dr Shaun Holt, P3 Research, Wellington; Professor Richard Beasley, Medical Research Institute of New Zealand; December 2001.

[17] *Housing, Heating and Health Study*, University of Otago, Wellington School of Medicine and Health Sciences, 2007.

[18] *A Cost-benefit Evaluation of Housing Insulation: Results from the 'Housing Insulation and Health' Study,* Chapman, Howden-Chapman and O'Dea, 2005.

Figure 3: Total energy use by end use



Source: BRANZ Study Report SR 155, 2006

Many families face barriers to investing in energy efficiency and renewable energy.[19] These include difficulty in meeting up-front costs and knowing where to find credible information to help make energy efficiency choices. Split incentives also exist where the person responsible for paying for improvements does not benefit from the day-to-day benefits delivered. For example, tenants, rather than landlords, benefit from lower bills and more comfortable homes while landlords meet the cost of insulation. New Zealand's temperate climate and historical housing design and construction practices also contribute to low levels of adoption of energy-efficient measures. This applies to housing for all income groups.

The government announced an Energywise Homes package in Budget 2007, costing $66 million, to be delivered over four years and comprising eight programmes. This forms the core of the many programmes detailed in this chapter. It enhances existing programmes that target energy efficiency improvements to houses and further addresses the barriers families face in investing in energy efficiency and renewable energy.

The $66 million includes funding for:

- interest-free loans for energy efficiency installations or upgrades
- Energywise home grants
- clean heat upgrades
- the voluntary Home Energy Rating Scheme (HERS)
- an information campaign for householders
- research and sector development to identify new energy-efficient technologies and to ensure that industry has the capability to deliver them to the public
- support for local councils to implement the new Building Code and other energy efficiency-related initiatives
- partnerships with the private sector to develop new financial incentives for energy efficiency.

The Energywise Homes section of the NZEECS will be delivered by central government and in partnership with local government, the private sector, and the community and voluntary sector. Future programme funding will be evaluated through the annual planning process to ensure partnerships and energy efficiency outcomes are delivered to achieve the greatest benefits.

[19] *The Impact on Housing Energy Efficiency of Market Prices, Incentives and Regulatory Requirements*, Centre for Housing Research, 2006.

Making changes in our homes

How to cut your bills by around $600 per year with no cost and low cost actions at the same time as making your home more comfortable to live in:

- Use your heated towel rail for just a few hours per day instead of leaving it on permanently – typical saving $90 per year.
- Scrap (or switch off) the spare fridge – typical saving $150–$300 per year.[20]
- Use cold water for laundry – typical saving $50 per year.
- Set your hot water cylinder back from 70 to 60 degrees Celsius – typical saving $30 per year. You will need an electrician to do this if you don't have a consumer adjustable thermostat.
- Turn appliances off instead of leaving them on standby – typical saving $75 per year.
- Replace five commonly used normal light bulbs with energy saving ones. The Electricity Commission runs voucher schemes with partner organisations, offering reduced-cost energy saving bulbs. One deal has offered five bulbs for $10. Installing five energy saving light bulbs saves around $80–$90 per year.[21]
- Install a low flow shower head. These typically cost around $80 and can cut hot water bills by around $45 per year.[22]
- An $80 hot water cylinder wrap can cut your power bill by around $40 per year.[23]
- Good, thermal backed and lined curtains can cut heat loss through windows by 25 per cent and can save up to $100 per year for a whole house.
- In addition to these low cost and no cost actions, ceiling insulation costs around $1,400, and is estimated to result in $4,600 of health and energy savings over its lifetime. Energy savings alone are estimated to be $140 per year .[24]

Images: EECA

[20] There are estimated to be 430,000 deficient fridges in New Zealand, amounting to 16% of the total number of fridges (BRANZ 2007).

[21] Electricity Commission analysis 2007.

[22] 2007 BRANZ net benefit model.

[23] Ibid.

[24] Ibid, assumes a 30 year life for ceiling insulation.

This chapter is presented as follows:

2.1 Improving the performance of existing homes

The BRANZ 2005 House Condition Survey indicates that around 375,000 New Zealand homes have inadequate ceiling insulation and over one million have inadequate under-floor insulation.[25]

Research has shown that for every dollar spent on improving basic energy efficiency measures, such as draught stopping and insulation, the householder realises $2.20 in health and energy savings.[26]

30,000 warmer homes

In March 2007, the Urwin family of Ellerslie became the 30,000th household to receive energy efficiency measures under the Energywise home grants programme. Eco Insulation installed ceiling and under-floor insulation, and draught stoppers throughout the house.

Before the installation, the Urwin's three-year-old son Jack often suffered from respiratory problems and regularly ended up in Starship Hospital during the winter.

The family has already noticed some big changes. "With Jack we would normally expect some kind of chest infection but since the insulation was put in, we have not had any issues – it has been great."

The 30,000th house was part of the Snug Homes for Auckland project which was jointly funded by the ASB Community Trust, Auckland City Council, Manukau City Council, Procare Network Auckland, Procare Network Manukau, Auckland District Health Board, the Starship Foundation and EECA.

Prime Minister Helen Clark on the right, and Ross Robertson MP Manukau East, on the left, with the Urwin family.

A recent study concluded that air pollution contributed to the premature death of around 1,100 people each year in New Zealand. The total economic cost of air pollution in New Zealand (from both premature death and adverse health impacts) was estimated to be $1.14 billion per year, or $421 per person. Emissions from open fireplaces in homes were identified as a significant contributing source.[27]

[25] *New Zealand House Condition Survey,* BRANZ, 2005 – homes, with roof space access, with less than 100% insulation.

[26] Estimates are based on net benefit modelling developed by BRANZ, for EECA in 2007.

[27] *Health and Air Pollution in New Zealand,* G. Fisher et al 2007.

Clean and efficient water and space heating systems are cheaper to run than inefficient systems and lead to air quality improvements. Renewable options include solar water heating, clean wood burners and wood pellet fires. Other options for space and water heating include heat pumps and flued gas appliances.

A significant problem exists with rental properties. The costs for improvements fall to the owner, but the day-to-day benefits are accrued by the tenant. Programmes like the Home Energy Rating Scheme (HERS) aim to incentivise both owner-occupiers and landlords to take action, as this will allow the market to value improvements. Another approach to overcome split incentives in the rental market is to investigate the possible application of MEPS to rental properties.

Taking action (2.1 Improving the performance of existing homes)

Energywise interest-free loans – A new programme announced in Budget 2007 to finance interest payments on around 70,000 loans for insulation, energy efficiency or clean heat upgrades. EECA is developing partnerships with the private sector, community groups, and local government to deliver this programme.

Energywise home grants – A programme to give grants to low income families and the landlords of properties with low income tenants, for energy efficiency improvements. EECA aims to bring the total number since the programme began to 100,000 by the end of 2012. Around 35,000 had been completed at the end of the 2006/07 financial year. Current commitments are to 12,500 home upgrades per year.

Energywise clean heat grants – A new programme following on from a successful pilot. To be administered alongside Energywise Home Grants. It will install 800 clean heating devices per year in low income homes in areas of poor air quality.

HNZC retrofits – Housing New Zealand will complete an additional 7,200 state house energy efficiency retrofits by the end of 2010. Through its Energy Efficiency Retrofit and Healthy Housing programmes, HNZC will have retrofitted a total of 21,000 properties by the end of 2010. This will leave approximately 20,000 state houses still to be retrofitted. A decision to expand the programme will be made in 2008.

Minimum Energy Performance Standards – Investigate MEPS for existing buildings (especially rental properties) to apply at change of occupancy. Make recommendations to government by the end of 2009.

2.2 Better products

A lack of standards (regulations) can result in poorly performing products, such as whiteware and home electronics, entering the market and locking families into years of extra costs and sub-standard appliance performance.

The EECA products programme utilises some of the most cost effective measures to improve the energy efficiency of domestic appliances and commercial and industrial equipment. The measures include Minimum Energy Performance Standards (MEPS), Mandatory Energy Performance Labelling (MEPL) and voluntary labelling Energy Star®.

MEPS are necessary to stop the least energy efficient products from entering the market; MEPL compares the relative energy performance of similar products and provides a simple indicator to the best- and worst-performing models within a class of products. Energy Star is an endorsement label that helps consumers identify the most energy-efficient models in a product class.

The MEPS programme received $3 million of government funding to March 2006 and resulted in savings of 1.65 PJ (460 GWh) of electricity worth around $60 million.[28]

This programme is to be expanded by the addition of 17 new product categories and the updating of stringency levels for seven existing product categories by the end of 2012. The key priorities over this period will be a lighting strategy that incorporates the phase-out of inefficient incandescent light bulbs and the introduction of the standby strategy that will reduce the amount of electricity used by electronic appliances on standby to less than one watt.

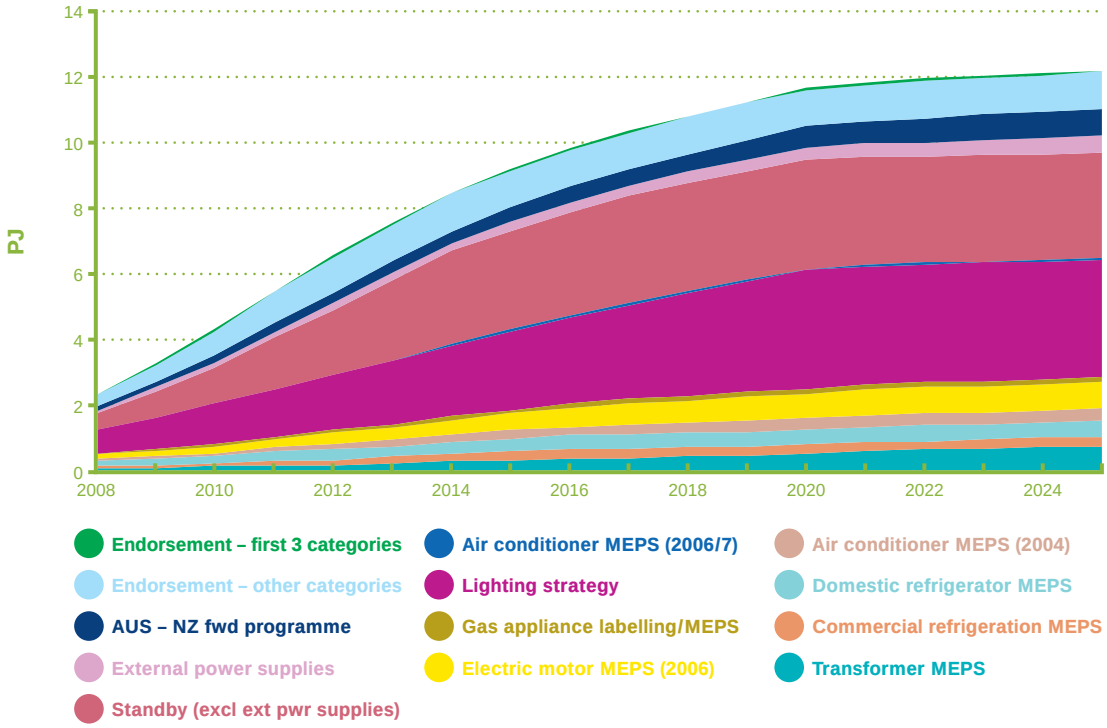
[28] EECA Products Programme sales data analysis February 2007.

New Zealand and Australia share a common economic market; there is a joint approach to developing and implementing MEPS and labelling to common standards and implementation schedules. EECA will continue to work with its Australian counterparts, industry, and consumers to implement an agreed programme.

Combined savings from MEPS and labelling schemes (including Energy Star) are forecast to be:

- 6.5 PJ of energy savings, 1.25 Mt CO_2 and $147m pa in 2012
- 12 PJ of energy savings 2.3 Mt CO_2 and $179m pa in 2025
- cumulative savings of over 23 PJ energy, 4.5 Mt CO_2 and $473m[29] by 2012
- cumulative savings of over 162 PJ energy, 31.5 Mt CO_2 and $2.7 billion by 2025.

Figure 4: Energy savings from NZEECS products programme initiatives



Source: EECA

Research into price trends shows that regulating minimum standards and labelling, such as star ratings, have not resulted in price increases for whiteware products.

[29] Derived from *New Zealand Energy Data File* (MED) Electricity Price and Sales Information.

Efficiency labelling

A modern fridge with a 3.5 star energy rating will cost around $100 per year to run compared to a 10-year-old fridge of the same size that costs $200 per year to run. As the average age of a fridge is around 16 years, the savings made over the life of the new fridge can be as much as the initial purchase price.

A heat pump that qualifies for an Energy Star label can save the consumer around $150 per year compared to one that only meets Minimum Energy Performance Standards.

Taking action (2.2 Better products)

MEPS and MEPL – Standards will be developed for 17 additional product classes and revised for seven existing classes by the end of 2012. Key priorities will be to phase out inefficient incandescent light bulbs and introduce a one watt requirement for standby power.

Product retirement – Design and implement a programme to accelerate the withdrawal of inefficient products, such as a trade-in scheme for refrigerators, targeting 450,000 appliances over 20 years to save 0.1 PJ, 7,000 tonnes CO_2,[30] and $2.3 million per year in 2012.

Efficient lighting strategy – Implement the New Zealand Lighting Strategy with a target to reduce lighting energy consumption by 20 per cent by the end of 2015 by implementing:

- MEPS for a range of light technologies, including incandescent light bulbs, compact fluorescent lamps, commercial and public amenity lighting
- an information and financial incentives programme to accelerate the uptake of better lighting technology including residential (energy-efficient compact fluorescent lamps) commercial and street lighting
- improvements to the Building Code.

Energy saving light bulbs – Continue this Electricity Commission programme to complete contracts for, and put additional contracts in place, for an additional $5.7 million compact fluorescent lamps by the end of 2009.

Energy Star – Expand this voluntary programme that identifies the most efficient products, usually the top 25 per cent, against set energy performance criteria. Energy Star complements MEPS and MEPL to set standards, to endorse high-performing products with the Energy Star label and raise consumer awareness to lift overall product efficiency. The scheme is to be expanded to cover a further 15 product categories by the end of 2012.

[30] Based on average not marginal emissions (EECA 2007).

2.3 Improving the performance of new homes

The standard to which homes are built and renovated has a significant impact on how healthy and comfortable they are to live in, how affordable they are to heat, and overall energy use and emissions for the life of the building.

The Building Code sets minimum performance standards for new homes and renovations. The typical home has a life of 80 years. Recently announced changes to the Building Code for thermal insulation[31] are projected to save families between $760 (Auckland) and $1,800 (Dunedin) per year in energy running costs with a payback period of three to seven years.

Building Code energy efficiency requirements will be progressively improved as new technologies become available and the benefits of energy savings increase. Ultimately it may be cost effective for new homes to be self-sufficient in terms of net energy production (zero energy homes). Ways to increase investment in zero energy homes will be investigated by the end of 2010. One step towards this is to incorporate consideration of the embedded greenhouse gas emissions into the Building Code.

NOW Home®

Beacon Pathway is a consortium of Building Research, Scion, Waitakere City Council, Fletcher Building and New Zealand Steel. It was established to research and educate the sector on how to build cost effective sustainable homes that meet the needs of the average Kiwi family.

The first NOW Home®, in Waitakere, is an architecturally designed, single storey, three-bedroom home. Results from the first year of monitoring show the house uses 40 per cent less water and 55 per cent less electricity for water heating than other Waitakere homes; it only needs additional heating a few days per year. Overall, it uses around one-third less electricity than comparable households, and 45 per cent less energy compared to its family's last home.

Image courtesy of Craig Robertson Photography.

Taking action (2.3 Improving the performance of new homes)

Building Code – Amendments to address thermal performance and hot water systems by the end of 2008.

Carbon lifecycle analysis – Investigate and report on mechanisms to support investment in zero energy houses by incorporating embodied energy (emissions) and carbon lifecycle analysis by the end of 2010.

Home Energy Rating Scheme – Promote the use of the Home Energy Rating Scheme (HERS) as a design and compliance tool for the Building Code to capture energy efficiency services, including passive solar design by the end of 2009.

Support for local councils – To implement changes to the Building Code, consider other energy efficiency measures and work to address the barriers to the uptake of renewable energy technologies.

[31] Biggest energy efficiency steps in 30 years, Frequently Asked Questions, New Zealand Government, May 2007.

2.4 Better information

Lack of information has been identified as a major barrier to the uptake of energy efficiency, conservation and renewable energy in homes. Improved information increases awareness of benefits and promotes uptake by householders and industry.

Taking action (2.4 Better information)

Home Energy Rating Scheme (HERS) – Develop a star energy rating for the energy performance of a home that will advise potential purchasers, or tenants, of its energy performance and how it could be improved. This will act as an incentive to make further improvements and allow for those features to be better reflected in sale prices and rents. Voluntary from 2007, it will be reviewed in 2008 with recommendations made to achieve mandatory disclosure of ratings.

Eco-design advisors – Consideration is to be given to expanding the existing eco-design advisor scheme with recommendations made by the end of 2008.

Research – A five-year research programme to identify future opportunities for energy efficiency and conservation in households. This will include investigating new technologies and products.

Sector development – Working with business to build capacity and develop quality assurance processes for installing new technologies. Implementation plan to be developed by the end of 2008.

Energywise Homes information campaign – A nationwide campaign that will raise awareness of the need to be energy efficient. Actions are likely to include:

- a general awareness campaign supported by partnerships with the private sector, local and regional councils and community groups
- targeted information, including a comprehensive website that inspires families to make homes more energy efficient and sustainable
- the Energywise brand to deliver all government programmes in the area of residential energy efficiency and conservation.

2.5 Increasing the uptake of household renewable energy

Clean and efficient water and space heating systems are cheaper to run than inefficient systems; they can also lead to air quality improvements. Renewable options include solar hot water, log burners (which can use wood and fire logs) and wood pellet fires which meet local air quality standards under the Clean Heat Programme.

Solar hot water promotion

The government is running a comprehensive programme to lift standards and encourage the uptake of solar hot water systems with a medium-term goal to make the industry more competitive and sustainable.

The programme comprises:

- technical programmes, system testing and measurement of cost effectiveness
- $500 grants for homeowners installing qualifying systems or up to $500 towards the cost of interest on a loan
- a grants scheme for volume builders of new homes
- training for installers
- information campaigns and resources, including the www.solarsmarter.org.nz website and call centre
- work with local councils to reduce consenting costs
- an innovation fund.

Government Spokesperson on Energy Efficiency and Conservation, Jeanette Fitzsimons checks the alignment of a solar hot water system.

Taking action (2.5 Increasing the uptake of household renewable energy)

Solar water heating – Install 15,000–20,000 household systems by the end of 2010. The programme is focused on expanding unit sales, improving quality standards, assisting with installer training and reducing financial barriers by offering a range of assistance to homeowners and builders.[32] Review programmes in 2009, including consideration of funding priorities for beyond 2010.

Solar Industries Association – Continue support for industry to advocate for renewable energy technologies and to drive increased capability, training and product performance within the sector.

See also New Zealand's efficient and renewable electricity system (page 61). A target for increasing the supply of woody biomass in the residential (and commercial) sectors is shown under Energywise Business (page 31).

[32] See http://www.solarsmarter.org.nz/

3. Energywise business

Objective:

More energy efficient and competitive businesses using more renewable energy and emitting less carbon dioxide

Biomass heat plant owned and operated by Energy for Industry for Winstone Pulp International (WPI). Photo courtesy of WPI.

Energywise business – Summary of actions

Action	Outcome	Delivery
3.1 Industrial energy efficiency and renewable energy		
3.1.1 Industrial energy efficiency		
3.1.1a Direct assistance		
Capital grants for Energy Intensive Businesses (EIB) Expand programme by the end of 2008	0.14 PJ 2,000 tonnes CO_2 pa in 2025 3.5 PJ 0.06 Mt CO_2 pa in 2025	EECA (Funded) EECA (Under consideration from 2008)
Emprove programme – energy audits and improvement implementation Expand programme by the end of 2008	0.3 PJ 5,000 tonnes CO_2 pa in 2025 4.1 PJ 0.07 Mt CO_2 pa in 2025	EECA (Funded) EECA (Under consideration from 2008)
Totals	**8.1 PJ** **0.14 Mt CO_2 pa in 2025**	
3.1.1b Technology transfer		
Compressed air systems project	0.4 PJ 0.078 Mt CO_2 pa in 2012	EC (Funded)
Electric motor project	1 PJ 0.194 Mt CO_2 pa in 2012	EC (Funded)
Industrial heat processes	1 PJ 0.194 Mt CO_2 pa in 2012	EECA (Under consideration)
Totals	**2.4 PJ** **0.466 Mt CO_2 pa in 2012**	
3.1.1c Information, capacity and capability		
Encouraging the use of best energy management practices	Improved practice	EECA (Funded)
Provide teaching of energy efficiency in worker education and trade training	Implement workers' training programme by the end of 2009 and trade training by the end of 2012	EECA (Funded)
Increase professional energy management services	Enhanced capacity	EECA (Funded)
Enhance energy efficiency advice services for business	Establish advice service by the end of 2009	EECA (Under consideration)
Energy efficiency opportunities reporting	Recommendations to government by December 2008	EECA (Under consideration)
3.1.2 Renewable energy programmes		
Capital grants, information and demonstration projects for increasing the supply of woody biomass	Grants available through FIDA and EIB	EECA (Funded)
Support for BANZ and NZGA	Ongoing support	EECA (Funded)
Pilot scheme to convert school coal-fired boilers to woody biomass	30 boilers converted by the end of 2008. Savings of 1,400 tonnes CO_2 pa in 2009 Decision made by the end of 2009 on converting remaining boilers	EECA (Funded) (Under consideration)
Total	**1,400 tonnes CO_2 pa in 2009**	

Action	Outcome	Delivery
3.1.3 Better commercial buildings		
Improve the performance of lighting and heating, ventilation and air conditioning (HVAC) systems	Amend Building Code by the end of 2008	DBH (Funded)
Support for voluntary commercial building sustainability rating tool – Green Star	Increase the uptake of international best practice in New Zealand	MfE (Funded)
Implement an electricity efficiency programme for commercial buildings	1 PJ 0.194 Mt CO_2 pa in 2012	EC (Funded)
Research energy use in commercial buildings Building Energy End Use Project (BEEP)	Commence by the end of 2008	DBH/EECA (Funded)
Investigate a Building Energy Rating Scheme (BERS)	Recommendation by the end of 2009	DBH (Under consideration)
Investigate Minimum Energy Performance Standards (MEPS) for existing commercial buildings	Recommendation by the end of 2011	DBH (Under consideration)
Totals	**1 PJ** **0.194 Mt CO_2 pa in 2025**	
3.2 Primary production – agriculture, horticulture, forestry and fishing (excluding primary production processing)		
Energy-efficient technologies deployment programme	Potential for future gains quantified and industry led programme developed by the end of 2008	MAF/EECA (Funded)
Investigate, and subsequently demonstrate, leading edge energy efficiency and renewable technologies	At least two demonstration model farms by 2010	MAF/EECA (Under consideration)
Enhance the capacity and capability of rural energy advisors	Programmes established by the end of 2008	MAF (Partially funded)
Encourage energy efficiency and renewable energy in glasshouse production	Capital grants	EECA (Funded)
Promote existing grant funding for primary sector energy efficiency and renewable energy projects	Capital grants	MAF/EECA (Funded)
Encourage the uptake of biodiesel in farm and forestry machinery	Report by the end of 2009	MAF (Under consideration)
Primary production sector energy end-use research	Report by the end of 2008	MAF/EECA (Under consideration)
Greenhouse gas footprinting strategy for the primary production sector	Implement strategy from late 2007	MAF (Funded)
3.3 Tourism		
Increase tourism industry participation in energy saving programmes	Plan of action for increased participation by the end of 2010	EECA (Funded)
Improve the energy efficiency of tourist accommodation	Increased uptake of energy-efficient technologies and practices	EECA/Ministry of Tourism (Funded)
Refine the sustainability tourism charters, including energy use measures	Enhanced sustainable energy in tourism	Ministry of Tourism (Funded)
Include energy efficiency and conservation criteria in Qualmark by the end of 2008	Improved consumer information	Ministry of Tourism (Funded)
Introduce environmental excellence awards including a sustainable energy category by the end of 2008	Recognition of best practice	Ministry of Tourism (Under consideration)
Improve sustainable tourism information to industry including energy use indicators	Improved market information and sharing of best practice	Ministry of Tourism/TNZ (Funded)

The industrial and commercial sectors consume 196 PJ or 39 per cent of New Zealand's energy, and are responsible for 12.6 Mt or 37 per cent of energy greenhouse gas emissions.[33]

New Zealand's economic development depends largely upon the success of its businesses and primary production enterprises.

Business has a real opportunity to enhance its success, and to become more efficient, productive and competitive by adopting energy efficiency and conservation measures and increasing its uptake of renewable energy. In doing so it can better manage energy and emissions prices and become more profitable.

A growing number of businesses also have a specific interest in managing customer demands around taking responsibility for their emissions.

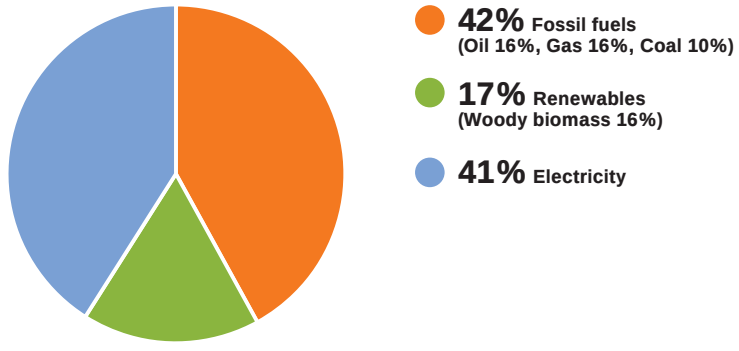
In common with other sectors, the business sector faces barriers to the uptake of energy efficiency and conservation measures including access to capital, lack of information, weak price signals and split incentives.

These barriers tend to be higher for small and medium-sized enterprises. Other barriers include:

- managers being subject to short payback criteria from investments
- smaller businesses are typically not exposed to cost-reflective electricity pricing
- the purchase and control of energy is often separated within businesses.

There is significant potential to increase the utilisation of renewable energy such as woody biomass and, where available, geothermal used directly by businesses and rural enterprises. Figure 5 shows that just 17 per cent of the sector's energy needs is met directly from renewable sources.

Figure 5: Energy consumption by the business sector in 2005: total 218 PJ



Source: EECA

In addition, solar water systems can be used to meet hot water requirements and displace electricity in industrial and commercial settings.

[33] Includes industrial and commercial combustion-based activities and thermal electricity generation emissions allocated on pro-rata basis of electricity use. *New Zealand Energy Greenhouse Gas Emissions* 1990–2006, MED, June 2007.

Renewable fuel savings

Verkerks, a Christchurch-based producer of speciality meat products, has converted its 1.2 MW diesel boiler to burn a renewable fuel, tallow, with the help of the government – resulting in annual savings of $150,000 and a reduction in carbon dioxide emissions by 900 tonnes per year.

Then Verkerks Engineering Manager, Jerry Scales, beside the 8,000 litre heated tallow tank.

This chapter is presented as follows:

3.1 Industrial energy efficiency and renewable energy

3.1.1 Industrial energy efficiency

Around 300 businesses account for about 90 per cent of total business energy consumption, mostly of stationary energy. Energy use in the commercial sector is dominated by several hundred large multi-storey buildings, with much of this space tenanted.

The balance of stationary energy is utilised by a large number of relatively small businesses for which energy is dispersed over many end uses, making it difficult to target and a less significant part of their costs.

Direct assistance

The promotion of energy efficiency through information (including audits) and incentives can increase the uptake of cost effective energy management practices and technologies. Over 4.4 PJ of savings were reported by companies between 2001 and 2005, worth $88 million under the government's Energy Intensive Businesses and Emprove programmes. Further cost effective savings under these programmes of 1.3 PJ per year in 2010 and 3 PJ per year in 2020 could be achieved.[34]

Technology transfer

Many businesses can become more efficient and competitive by adopting modern energy-efficient technologies and practices such as efficient industrial lighting, industrial motor drives and industrial heat processes. Many businesses also use appliances and lighting common to the residential sector that are subject to MEPS (see page 24).

The Electricity Commission has identified economic electricity efficiency potential in the industrial and commercial sectors to save 7 PJ and 6.7 PJ respectively by 2016.[35] However, due to various market barriers, only part of this potential is likely to be realised.

Information capacity and capability

One key way to advance the uptake of energy efficiency measures is to improve the ways businesses manage their energy use, ideally bringing it into line with world's best practice. This relies on businesses having staff who are skilled in energy management and able to access high-quality information and advice from private sector providers of energy management services.

New system means big savings

Tegel Foods Ltd has worked with the government under the Energy Intensive Businesses programme to improve the efficiency of its New Plymouth plant with the introduction of a heat recovery system leading to annual savings of $110,000 and 600 tonnes of carbon dioxide emissions.

The compressor used to compress the ammonia gas during the chilling process.

[34] *Benefit Cost Analysis of the New Zealand Energy Strategy* (preliminary draft #2) 11 May 2007, MED.

[35] KEMA New Zealand Efficiency Potential Study (draft) Vol 1 2007 – the potentials relate to electricity efficiency measures that are cost effective when compared with supply-side alternatives.

Taking action (3.1.1 Industrial energy efficiency)

Direct assistance

Energy Intensive Businesses – Continue and expand capital grants and information programmes for energy intensive businesses to facilitate the uptake of energy efficiency measures, low carbon technologies and renewable energy.

Emprove – Expand this cost effective programme targeting New Zealand's larger energy consumers to help them become more energy efficient and to drive the uptake of renewable energy. Includes energy audits and action plans to implement improvements.

Technology transfer

Compressed air project – Develop and deliver a best practice package for industrial compressed air system operation and maintenance by June 2008.

Electric motor project – Develop awareness programmes and policies for motor replacement and consider a motor replacement incentive programme by June 2008.

Industrial heat processes project – Investigate and establish a best practice programme by the end of 2009. Achieve 3 PJ savings by 2015 through improving energy use in industrial heat processes, such as heating, furnace and boiler systems.

Information, capacity and capability

Energy Management – Continue a programme to partner with business to improve the use of best energy management practices by 30 per cent by the end of 2012.

Training – Encourage workplace participation in energy management by establishing a programme to equip workers to engage in making energy efficiency improvements by the end of 2009. Programme to be developed in partnership with the Council of Trade Unions, Tertiary Education Commission, industry training organisations, employee unions and tertiary education providers.

This includes the provision of energy efficiency and renewable energy training in tertiary education investment plans for building- and engineering-related trade training, such as for architects, builders, plumbers and electricians, by the end of 2012.

Sector support – Double the size of the professional and expert energy management services sector, including accredited energy auditors, by the end of 2012 through the provision of financial assistance to stimulate growth, industry training, continuing education, and the establishment of quality standards.

Energy efficiency advice service – Develop a one-stop shop, including a web resource, linking business to information, demonstration sites, guidelines and a referral service. To be operating by the end of 2009.

Energy efficiency opportunities reporting – Investigate a requirement, and make recommendations to government by December 2008, for businesses over a certain energy threshold to report their energy efficiency opportunities, as currently occurs in Australia. Subject to government approval, develop a reporting system by December 2009.

3.1.2 Renewable energy programmes

Up to an additional 9.5 PJ per year of woody biomass and geothermal energy could be used directly in the industrial, commercial and residential sectors by the end of 2025.[36] If this potential is to be realised, around 0.66 Mt of carbon dioxide equivalent emissions could be avoided each year by displacing fossil fuels and meeting new energy demand with woody biomass and geothermal energy – where it is practical and cost effective to do so.

To help realise this potential, three sector-specific targets for encouraging the uptake of woody biomass and the direct use of geothermal energy have been set:

- **to provide an additional 7 PJ per year of consumer energy from forestry residue by 2025 off a base of 0.8 PJ per year in 2005**

This target will encourage the uptake of forestry residue left over from forest harvesting operations. Barriers to uptake include the costs of collecting, processing and transporting forestry residue. If achieved, around 0.5 Mt of carbon dioxide could be displaced each year by 2025.

- **to provide an additional 3.5 PJ per year of residential and commercial consumer energy from woody biomass by 2025 off a base of 8 PJ per year in 2005**

This target will encourage the uptake of wood pellets, firewood, fire-logs and wood chips in residential and commercial wood burners. If achieved, the target will see woody biomass consumption increase by around 50 per cent by 2025, displacing 0.24 Mt of carbon dioxide each year by 2025.

- **to provide an additional 2 PJ per year of direct use geothermal energy by 2025 off a base of 10 PJ per year in 2005**

There is potential to encourage more use of geothermal heat in industrial and primary production processes. Geothermal heat pumps may also play a useful role in the future. If achieved, this will increase direct use of geothermal by 20 per cent and could potentially displace 0.13 Mt of carbon dioxide each year by 2025.

These targets provide guidance to the sectors responsible for increasing the utilisation of forestry residue, woody biomass and geothermal for heat and power. The targets are interlinked and have been designed taking into account the complex interconnections between them. They therefore cannot be simply added together.

Taking action (3.1.2 Renewable energy programmes)

Capital grants, information and demonstration projects for woody biomass – Provide capital grants for woody biomass projects to overcome information and financial barriers to the uptake of woody biomass through the Forestry Industry Development Agenda (FIDA). Grants for woody biomass and geothermal projects are also available through the Energy Intensive Businesses programme.

Working with and supporting renewable energy industry associations – Continue to work with the Bioenergy Association of New Zealand and the New Zealand Geothermal Association to effectively promote woody biomass and the direct use of geothermal energy.

Pilot scheme to convert school coal-fired boilers to woody biomass – A pilot programme will see 30 coal-fired school boilers converted to woody biomass fuels by the end of 2008. A decision on expanding the programme to other schools to be made by the end of 2009.

See also the Primary production section for the uptake of renewable energy by rural businesses (page 42).

Renewable energy technologies, upon reaching the demonstration and pre-commercial deployment phases, may be able to access funding from the Low Carbon Energy Technologies Fund (see page 60). See also Annex 1 (page 80) for further information on government funding programmes.

[36] This excludes wood processing residues. This form of woody biomass is also likely to make a significant contribution to renewable direct use in the future. The potential however is uncertain, given the strong dependence on the economic performance of the wood processing sector.

3.1.3 Better commercial buildings

Poor energy efficiency in the building stock locks businesses into higher costs and emissions over the life of buildings. The best time to improve energy efficiency is at the design stage or during major refurbishment of building services. Opportunities for energy efficiency gains are mainly in heating, ventilation and air conditioning (HVAC) and lighting systems, and in equipment, such as machinery and appliances, purchased for use within buildings.

Setting minimum performance standards is an effective way of ensuring such buildings are cheaper to run and have lower whole-of-life energy costs.

Work is required to improve the data available on energy use in commercial buildings, to help further identify the economic potential for savings, and to develop appropriate ways of realising them.

Taking action (3.1.3 Better commercial buildings)

Building Code – Improve the stringency of lighting and heating ventilation and air conditioning (HVAC) performance requirements by the end of 2008.

Green Star – Continue support for this voluntary commercial building sustainability rating tool, and ensure consistency with the BERS.

Commercial buildings electricity efficiency project – Develop and implement a commercial building electricity efficiency programme including building HVAC systems and energy management best practice, by June 2008.

Research energy use in commercial buildings – Develop the Building Energy End Use Project (BEEP), a cross-government project to develop understanding of how and where commercial buildings use energy. EECA will work with agencies and the Building Research Council to develop BEEP, ensuring that it is consistent with the Energy Domain Plan, from 2008/09.

Building Energy Rating Scheme (BERS) – Investigate a building energy rating scheme by the end of 2009. Investigate and make recommendations on the merits of the compulsory disclosure of ratings by the end of 2010. This will provide information of likely energy costs to prospective tenants. Landlords will have an incentive to make improvements and realise better value from high-performing buildings.

Building Minimum Energy Performance Standards (Building MEPS) – Investigate and make recommendations by the end of 2011 on introducing Minimum Energy Performance Standards for existing commercial buildings.

3.2 Primary production – agriculture, horticulture, forestry and fishing

The primary production sector accounts for 21.4 PJ (4.3 per cent) of total national energy use including 5.4 PJ of electricity (4 per cent) and is responsible for 1.6 Mt, or 4.8 per cent[37], of New Zealand's annual greenhouse gas emissions from the energy sector.

The previous (2001) strategy did not target the primary production sector. This version of the strategy now specifically promotes initiatives for a wide range of land-based agricultural, horticultural and forestry enterprises. Off-site processing of primary produce (such as dairy factories, fish processing and sawmills) has already been covered earlier in this chapter.

The fishing sector is an intensive user of energy and is vulnerable to rising diesel prices. Support is currently available through the Emprove and EIB programmes. Further action in this area will progress as the opportunities become better understood.

The primary sector faces similar barriers as other businesses to adopting energy efficiency and conservation measures and renewable energy. For example, a number of farms are tenanted or have share-milkers meaning those responsible for investing in efficiency improvements don't directly get the benefit of lower running costs.

The primary sector also faces a unique set of challenges as a result of anticipated higher global energy prices and climate change. Consumers, particularly in Europe, have become more concerned about the carbon footprint of food production and distribution. Security of energy supply is also a critical issue for rural communities and businesses.

New Zealand's primary production sector has the opportunity to better manage on-farm energy costs and related emissions, by adopting energy efficiency and conservation measures as well as by increasing its use of renewable energy.

Government announced a Sustainable Land Management and Climate Change Plan of Action in September 2007. The Plan of Action will see the agriculture and forestry sectors, local government and Maori working in partnership with government to develop a comprehensive package to tackle climate change issues in the land management sector. A technology transfer programme is part of the plan of action and the energy efficiency and renewable energy actions in this section will inform and complement this programme.

[37] Derived from direct emissions and indirect electricity emissions from *New Zealand Energy Greenhouse Gas Emissions 1990–2005*, MED, 2006.

3.2.1 On-farm energy systems

Dairy sheds and irrigation systems are some of the most electricity-intensive parts of New Zealand farming. Studies[38] show that energy costs typically make up around 6.5 per cent of farm cash expenditure for non-irrigated dairy, and eight per cent for irrigated dairy.

Experience gained from demonstration farms shows that there is significant scope to make cost effective efficiency improvements in hot water and vacuum systems. Similar opportunities exist to make efficiency and emissions savings through investing in heating and cooling systems (including cold storage), lighting and motor-driven processing equipment. Such savings can help improve the competitiveness of vineyards and fruit growers that rely on storage, and help contribute towards meeting sustainability related marketing goals.

An energy efficiency study by Meridian Energy noted that cost effective energy savings of around 27 per cent could be realised on a typical dairy farm.[39]

Further work will be undertaken to determine the potential for cost effective measures to be rolled out across the sector and the best way to go about doing so.

On-farm energy efficiency

A New Zealand Centre for Advanced Engineering study covering 15 Southland farms has concluded that most dairy sheds could reduce electricity costs by $3,000 to $5,000 per year through limited capital expenditure on efficiency measures, with a payback period of less than five years.[40]

The study found the biggest savings are to be made from heat exchangers used to recover heat from the milk vat chiller to heat water. A system with a four-year payback could save around $2,200 per year. When variable speed drives are fitted to vacuum pumps, the combined energy savings for these two initiatives could total around 30 per cent of energy use.

Photo courtesy of New Zealand Centre for Advanced Engineering.

[38] *Energy Use and Efficiency Measures for the New Zealand Dairy Farming Industry*, EECA 2005.

[39] Meridian Energy, Dairy farmers receive practical energy efficiency pack from Meridian Energy, 2005.

[40] Dairy farm energy efficiency study for Venture Southland, New Zealand Centre for Advanced Engineering, 2007.

3.2.2 On-farm renewable energy

The rural sector has a role to play in the achievement of the renewable electricity target set in the NZES, especially through the development of innovative local energy systems.

Not all renewable electricity projects need to be large scale. There are opportunities for individual or groups of farmers to develop local energy systems that generate electricity for their use. Surplus power could also be sold to produce a revenue stream.

The combination of energy efficiency, renewable energy and enhanced demand management will support the development of more resilient and secure electricity supplies for rural communities. Refer to New Zealand's efficient and renewable electricity system (page 61) for further detail.

A rural renewable energy system

A joint project between Industrial Research Limited (IRL), Massey University and a group of farmers in Manawatu's Totara Valley has resulted in the development of a scheme comprising three solar photovoltaic systems, a solar hot water system, a heat pump hot water system, a micro-hydro generator and a biodiesel generator to meet the power needs of three farms.[41]

The scheme also includes an innovative wind turbine-powered hydrogen system. The wind turbine powers a hydrogen production unit. The hydrogen is then stored and utilised in a fuel cell to produce electricity when needed.

The objectives of the project are to gain experience in using a combination of renewable technologies to provide a system that is cost effective and meets the power needs of the local community.

The participants are already reporting that their day-to-day energy costs are lower as a result of the project. The scheme's backers envisage that such projects will have a wider application, outside of isolated communities, within the next decade.

Steve Broome, left, Research Engineer, and Alister Gardiner, Hydrogen and Distributed Energy Platform Manager, from IRL, stand on a hill in front of the Hylink water electrolyser which produces hydrogen fuel gas which is then pumped to a fuel cell and water heater at the farm below. Photo courtesy of IRL.

3.2.3 Carbon footprint management

Issues around greenhouse gas emissions such as food miles and the carbon footprints of products are becoming increasingly important for the sector. The ability to accurately measure emissions and manage them, can make a significant difference to the competitiveness and market position of producers. This requires focusing on energy efficiency, renewable energy and offsetting, and having high-quality accreditation.

[41] http://www.irl.cri.nz/scienceandtechnology/ourexpertise/energy-gen-dist/distributed-energy-systems/integrated-distributed-energy-systems.aspx

CarboNZero

The New Zealand Wine Company, responsible for the Grove Mill brand, was the first winemaker to achieve carboNZero status in the world. This was achieved by targeting electricity and fossil fuel use and making efficiency improvements across its production and distribution systems. Investments have been made in insulation and innovative cooling and heat recovery systems.

Grove Mill states that it took this course to deliver benefits to the bottom line from energy savings and to overcome emissions-related consumer issues. In doing so the firm has realised a unique international marketing benefit.

Photo courtesy of Grove Mill.

Taking action (3.2 Primary production – agriculture, horticulture, forestry and fishing)

Energy-efficient technologies deployment programme – Quantify the potential for sector-wide gains available from current energy efficiency technologies prior to developing, by the end of 2008, an industry-led programme to facilitate their uptake. The actions in this area will inform and complement the technology transfer programme, as part of the Sustainable Land Management and Climate Change Plan of Action, as well as existing Energywise Business programmes.

Investigate, and subsequently demonstrate, leading edge energy efficiency and renewable energy technologies through model farms – Begin a project to demonstrate leading edge energy efficiency and renewable energy technologies in real-world situations, providing technical performance and productivity data for new technologies and alternative energy systems. At least two demonstrations to be established by 2010.

Enhance the capability and capacity of rural sector energy advisors – Establish programmes to enhance the knowledge and skills of those providing energy efficiency and renewable energy advice to rural businesses and communities by the end of 2008. This will also include advice on biofuel production.

Encourage energy efficiency and renewable energy in glasshouse production of protected crops – Provide grants through the EIB programme to increase the uptake of energy efficiency and renewable energy actions in glasshouse production of protected crops.

Rural energy project grants – Better coordinate information on the availability and application of a range of existing government grant programmes. Examples of funds available include the Sustainable Farming Fund, EIB grants, the Low Carbon Energy Technology Fund and the Marine Energy Development Fund. For an overview of related funding mechanisms, see Annex 1.

Encourage the uptake of biodiesel in farm and forestry machinery – Most diesel-powered farm and forestry machinery is capable of being run on biodiesel blends of 5 per cent or greater. A report with recommendations on how to increase the uptake of such machinery that is capable of running on higher blend levels is to be produced by the end of 2009.

Primary production sector energy end-use research – Research and report on the energy end-use trends in the agriculture and forestry sectors with recommendations on how to better realise the potential for cost effective energy efficiency, conservation and renewable energy gains by the end of 2008.

Greenhouse gas footprinting strategy for the primary sector – Implement a strategy to allow primary producers to measure and verify energy-related greenhouse gas emissions associated with their production from late 2007.

See also, for additional actions on renewable energy, transport biofuels and electricity generation, Energywise Transport (page 47) and New Zealand's efficient and renewable electricity system (page 61).

3.3 Tourism

Tourism is a large and growing part of New Zealand's economy. It relies heavily upon the natural environment, both as the basis for many of its tourism products and to underpin New Zealand's image in international markets.

Delivering on the 100% Pure brand promise is fundamentally important to the sector. Travel, accommodation and activity-related energy use and greenhouse gas emissions are prominent issues as the sector seeks to serve increasingly climate-conscious travellers.

A recent international survey found that the majority of respondents were worried about emissions from flying and 93 per cent said they would, or might, participate in more environmentally friendly travel in the future.[42]

In acknowledging New Zealand's distance from many key source markets, the sector needs to ensure that New Zealand is serviced by more fuel-efficient aircraft. Air New Zealand is already investing to ensure that it will have one of the world's most fuel-efficient international fleets from 2010. It has also announced plans to test biofuel in one of its aircraft. Steps are also being taken to improve flight plans and routes to reduce fuel consumption (see page 56). Encouraging the uptake of similar measures by other airlines is an ongoing challenge. Increasing fuel costs and policies to address greenhouse gas emissions will help to drive this.

New Zealand can also offer real opportunities for tourists to reduce their energy use and emissions once they arrive here. Energy use in the tourism sector is dominated by transport and accommodation activities. Significant scope exists for increasing the uptake of biodiesel for bus travel in line with the ability of fuel providers to supply it, to move to long-distance passenger rail and to accelerate the uptake of more efficient buses. Actions addressing these opportunities are covered under Energywise Transport (page 47).

Carbon neutral transport for tourists

InterCity Group, New Zealand's largest transport and tourism operator, has set itself the goal of becoming the world's first carbon neutral public transport operator by achieving carboNZero status for all its operations by 2010.

It has already achieved this status for its corporate operations by improving energy efficiency in its offices. One project has cut electricity use by computer systems by 70 per cent. The firm has also spent over $20 million upgrading its vehicles to meet stringent emissions performance standards.

The first of four mega-coaches being built by InterCity Group. Photo courtesy of InterCity Group.

[42] Lonely Planet's annual *Travellers' Pulse* survey, 2007.

Tourism operators are also realising that to be competitive they need to tell their clients an accurate story about the environmental footprint of their business and the measures they have in place to reduce that footprint. Energy efficiency and conservation is a key part of that story and will be included in the future marketing of businesses and the sector as a whole.

Government will look to the sector to provide continued leadership in accelerating the uptake of energy efficiency and conservation measures and renewable energy. This may involve the sharing of best practice and experience of energy savings that have been realised by others through efficiency improvements made to tourist transport and accommodation.

There are many examples of accommodation that is already energy efficient. However, there is still significant scope to adopt energy efficiency and conservation measures and renewable energy more widely across the accommodation sector. For example, there is significant scope to increase the use of solar hot water systems, low-flow shower heads and energy-efficient lighting in the sector.

Sustainable accommodation

In 2007, the Youth Hostel Association's Wellington hostel was named Best in Oceania by Hostelworld.com. It was refurbished in 2005 with energy efficiency in mind. Features include a solar hot water system, an innovative shower heat recovery system, upgrades of room heating and cooling systems and double glazing.

Then Manager Hamish Allardice said: "The recognition from the award lets other organisations know that sustainability is good for business and good for the environment. It's just common sense. If you cut down on the resources you use, you save money."

The Hostel also won a Trailblazer award in the Sustainable Business Network's September 2007 Get Sustainable Awards.

Guests enjoy free bagel breakfast Mondays in the Atrium dining room at YHA Wellington City. Photo: Masa Udagawa

Taking action (3.3 Tourism)

Increase tourism industry participation in energy saving programmes – Identify opportunities to encourage the tourism sector to participate in the Emprove programme. A plan of action, including estimated savings, is to be produced by the end of 2010.

Improve the energy efficiency of tourism accommodation – Work with accommodation providers to increase the uptake of energy-efficient technologies such as solar water heating, low-flow showerheads and more efficient lighting. To be delivered through existing buildings initiatives.

Sustainability tourism charters – Refine the charters programme, including energy use measures, to allow for an extension beyond the current six pilot regions.

Qualmark – Include energy efficiency and conservation criteria in the Qualmark programme by the end of 2008.

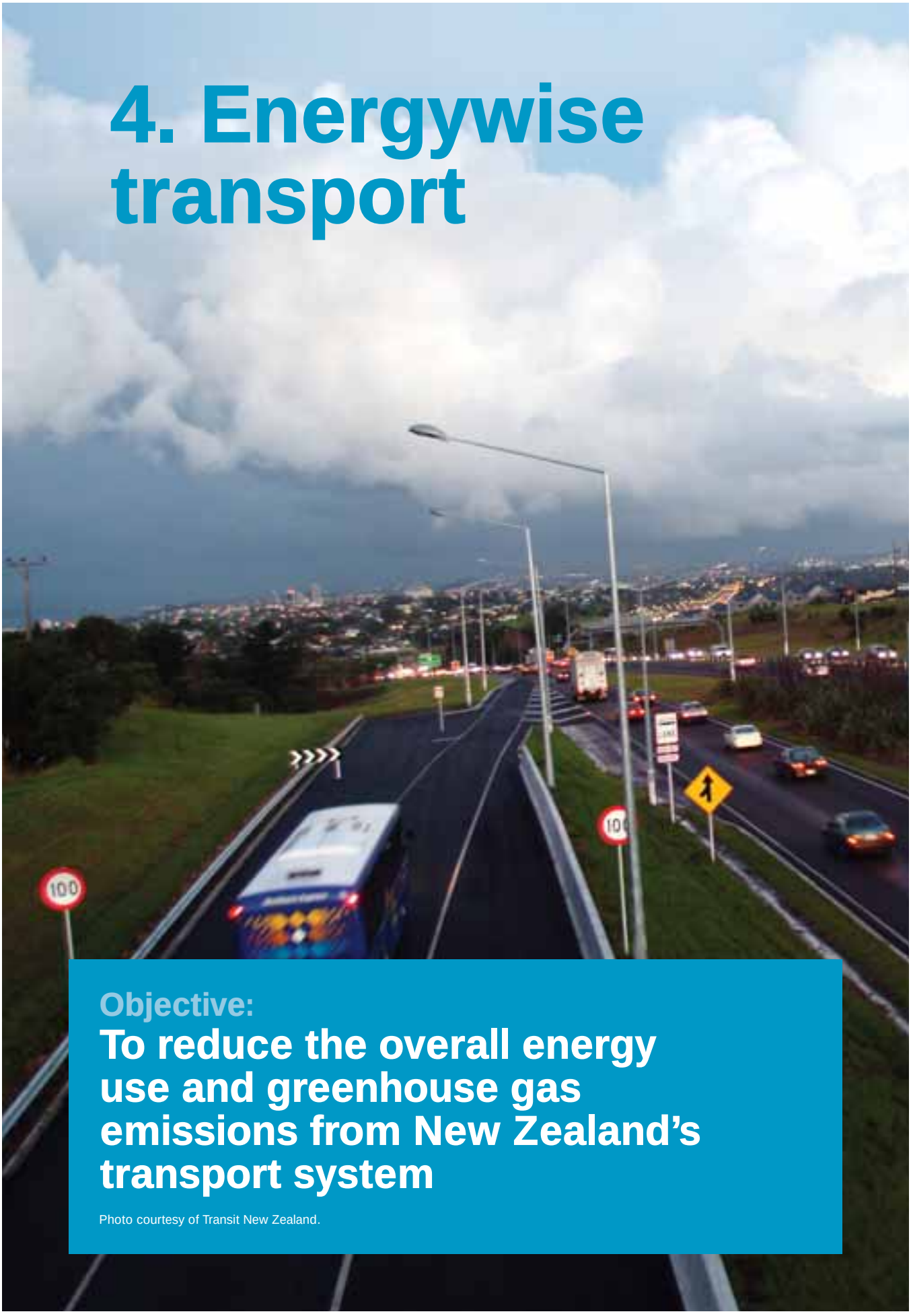
Recognition of best practice – Establish environmental excellence awards and include a sustainable energy category, by the end of 2008.

Sustainable tourism information – Provide sustainable tourism information, including energy use indicators, to the industry from sources such as the sustainable tourism website, published sustainability guides and intelligence from key markets.

See also the Energywise homes chapter, for more on energy efficiency, conservation and renewable energy in buildings and accommodation (page 17).

For more on biofuels and improving the efficiency of air and domestic land transport see Energywise Transport (page 47).

4. Energywise transport



Objective:

To reduce the overall energy use and greenhouse gas emissions from New Zealand's transport system

Photo courtesy of Transit New Zealand.

Energywise transport – Summary of actions

Action	Outcome	Delivery
4.1 Managing demand for travel		
Work with local government to promote travel demand management planning	Reduction in vehicle kilometres travelled (VKTs), energy use and emissions	Land Transport NZ (Funded)
Support businesses to put travel plans in place	Reduced VKTs, emissions and congestion	Land Transport NZ (Funded)
Support schools to put travel plans in place	Increased walking (including walking school buses) and cycling	Land Transport NZ (Funded)
4.2 More efficient transport modes		
Review funding policies to encourage greater provision of public transport, walking and cycling	Recommendations by the end of 2008	MoT (Funded)
Regional public transport planning	Targets set in Regional Land Transport Strategies by the end of 2012	Regional Authorities (Funded)
Complete Auckland rail electrification with the rolling replacement of diesel trains with electric units	Capacity and patronage increases	Ontrack and ARTA (Funded)
Complete the Wellington rail upgrade	Estimated double peak time capacity	Ontrack, GWRC and Land Transport NZ (Funded)
Support efficient bus use	Complete passage of Public Transport Management Bill by the end of 2007	MoT (Funded)
Bus infrastructure improvements including completion of the Northern Busway in Auckland	Save 1,000 tonnes CO_2 pa in first stage	ARTA and local councils (Funded)
Implement the Walking and Cycling Strategy and fund the Bikewise programme	Reduce VKT	MoT/Land Transport NZ (Funded)
Support development of Neighbourhood Accessibility Plans to encourage mode shift	Emissions reductions and health benefits	Land Transport NZ (Funded)
Active living programme	Encouragement for mode shift from cars to walking and cycling	SPARC (Funded)
Collect data on freight movements	Inform policy development by the end of 2009	MoT/MED (Funded)
Develop a New Zealand Domestic Sea Freight Strategy	Discussion document published in 2007	MoT (Funded)
Review heavy vehicle weight limits	Recommendations by the end of 2009, new land transport rule, if required, by the end of 2011	MoT (Funded)
Investigate options for improving the efficiency of the North Island main trunk line	Report with recommendations by the end of 2010	MoT (Under consideration)

Action	Outcome	Delivery
4.3 Improving the efficiency of the transport fleet		
Average fuel economy standards for new and used light vehicles entering the fleet	Decision by December 2007	MoT (Funded)
Introduce fuel economy labelling scheme for light vehicles by March 2008	$333m energy savings 0.98 Mt CO_2 cumulative by 2033	EECA (Funded)
Report on the potential for better tyres to improve vehicle fuel efficiency	Report by June 2008	EECA (Under consideration)
Collection of fuel economy data on vehicles entering the fleet	Rule in place by December 2008	MoT (Funded)
Continue the fuelsaver.govt.nz website and launch the rightcar.govt.nz website	Informed consumers	Land Transport NZ (Funded)
Develop a fleet commitment and driver training programme for heavy vehicle drivers	Savings of 0.011–0.014 Mt CO_2 pa	MoT (Funded)
Vehicle Fleet Strategy to promote optimal fuel economy, safety and air quality	Final strategy published by June 2008	MoT (Funded)
Work with the aviation industry to encourage the use of more fuel-efficient practices and aircraft	Improved aviation energy efficiency	MoT (Funded)
Vehicle retirement (scrappage) scheme	Extend trial to 2009	MoT (Under consideration)
4.4 Developing and adopting renewable fuels		
Develop voluntary sustainability consumer information for biofuels	Publish by the end of 2009	EECA (Funded)
Establish an Advisory Group to look at future vehicle technologies, such as biofuel and electric vehicles, and barriers to their early adoption	Establish by December 2007	MoT (Funded)
Introduce the Biofuel Sales Obligation and review the post-2012 obligation levels in 2010	Savings of 1.08–1.12 Mt CO_2 cumulative by 2012	MED (Funded)
Funding support for new low carbon energy research and development	Implement fund by the end of 2008	MoRST/FRST (Funded)
Accelerate the uptake of plug-in hybrid and electric vehicles	Establish work programme by the end of 2008	MoT (Funded)

National transport consumes 219.5 PJ (44 per cent) of energy used nationally. Freight modes account for approximately 43 per cent of New Zealand transport energy use, and passenger modes 57 per cent. In 2006 transport was responsible for 14.5 Mt of greenhouse gas emissions or 43 per cent of New Zealand's annual greenhouse gas emissions from the energy sector.

Unless action is taken, emissions from this sector are set to grow by 35 per cent by 2030. Such an outcome is economically and environmentally unacceptable.

New Zealanders have a strong desire for travel and mobility, yet they face unique issues in terms of physical geography and distance from global markets.

New Zealand is also primarily a technology taker with respect to vehicle and fuel systems. These circumstances create challenges that need to be met if the issue of climate change is to be dealt with successfully. Improvements in fuel efficiency and reductions in greenhouse gas emissions will depend upon:

- the extent to which New Zealanders are prepared to modify their travel behaviour
- the extent to which behaviour change is supported and encouraged by central and local government policies and programmes, such as through funding policies, urban planning and the promotion of active modes like walking and cycling
- the speed and extent to which fuel efficiency improvements are incorporated into vehicles from source markets
- the potential for consumer preferences to dilute gains from efficiency improvements and the changing nature of these preferences
- the rate of fleet turnover and the extent to which the second-hand market impacts on the benefits of technological advances
- the availability of biofuels and vehicles compatible with high biofuel blend levels.

Since 1990, emissions from the transport sector have been growing at a rate of 3.1 per cent each year with some reduction in the rate of growth between 2005 and 2006. This reduction corresponds to higher fuel prices. While the price of fuel will continue to impact on emissions from transport, it cannot be relied on to arrest growth in greenhouse gas emissions.

The government has a number of other strategies in which its objectives for an efficient transport sector are also reflected. In particular, the New Zealand Transport Strategy (NZTS) has an objective of ensuring environmental sustainability. An implementation document is currently being developed for the NZTS which will provide clearer guidelines for investment and strategic decision making by transport and local government agencies.

The NZES also sets out a low carbon transport future scenario to 2050. Actions here, and in the 'Resilient, low carbon transport' chapter of the NZES, will support the transition to a low carbon and efficient transport system.

Achieving significant gains from alternative fuels will depend on the realisation of second generation biofuels and the emergence of high volumes of plug-in hybrids, full electric vehicles and fuel cell and hydrogen vehicles.

It is reasonable to set targets for transport, though it is not yet possible to forecast the contribution of specific technologies.

The targets which will be used to assess progress include:

- to reduce per capita greenhouse gas emissions from the transport sector by 50 per cent from those in 2007 by 2040
- to position New Zealand to be one of the first countries, if not the first, to widely deploy electric vehicles
- reduce the kilometres travelled by single occupancy vehicles, in major urban areas on weekdays, by 10 per cent per capita by 2015 (compared to 2007)
- review regional passenger transport mode share targets by the end of 2012 through scheduled reviews of Regional Land Transport Strategies, and subsequent Regional Passenger Transport Plans
- reduce the rated CO_2 emissions per kilometre of the combined average of new and used vehicles entering the fleet to 170 grams CO_2 per kilometre by 2015 (approximately 7 l/100 km). The current average is in the region of 220 grams CO_2 per kilometre (between 9.5 and 10 l/100 km). This will equate to average fuel consumption figures of 7.4 l/100 km for petrol vehicles and 6.5 l/100 km for diesel vehicles
- by 2015, 2.1 million vehicles (80 per cent of the fleet) to be capable of using at least a 10 per cent blend of bioethanol or biodiesel, or electric powered
- by June 2009, the government will establish baseline data for the volume of freight, and the CO_2 emissions per tonne kilometre of freight moved domestically by different modes.

The potential savings from the transport targets are:

- up to 110 million litres of fuel, 3.7 PJ of energy, and a reduction of 0.26 Mt CO_2 emissions through reducing single occupancy vehicle trips by 10 per cent by 2015
- cumulative savings of 441 million litres of fuel, (16.2 PJ of energy) and 1.10 Mt CO_2 emissions over an eight-year period by reducing carbon dioxide emissions from vehicles entering the light vehicle fleet to 170 g CO_2 /km by 2015
- the gains to 2025 are estimated as 4,826 million litres (175.1 PJ of energy) and 11.8 Mt of CO_2 emissions. This outcome is based on vehicles travelling slightly less due to the Emissions Trading Scheme and fleet entry and exit remaining at the 2006 level. An underlying efficiency gain of 1 per cent per annum for newer vehicles has been assumed, as there will be gains not directly attributable to this initiative.

This chapter is presented as follows:

The 'Resilient, low carbon transport' chapter of the NZES contains additional information on these four topics.

4.1 Managing demand for travel

The urban environment has a significant impact on the need for transport services and the connectivity and social cohesion of communities. Issues relating to urban form are discussed more fully in the Government leading the way chapter of this strategy.

In addition to improving urban design, the most effective demand measures are: pricing, then mode quality improvements (better services, networks and facilities), then social marketing to promote behaviour change.

Travel demand management measures can also spread demand across modes and across time as a means of reducing peak demand, congestion, and its energy use and emissions impacts. For example, flexibility around working times can ease peak demand as can the scheduling of freight movements.

Telecommunications infrastructure, such as broadband, can serve to manage demand by replacing the need for travel through video conferencing or remote working, where this is practical and appropriate.

Travel behaviour change in Auckland

Auckland Regional Council studies show that traffic flows over the Auckland Harbour Bridge at peak times have fallen slightly in recent years. This trend has coincided with an increase in the provision of public transport, with many more buses now crossing the bridge as work on the new North Shore Busway project has progressed. There is also evidence of behaviour change among drivers as they have changed their times of travel.

Photo courtesy of Transit New Zealand.

Improving the overall quality of the vehicle fleet will reduce tailpipe emissions that are harmful to health. Also, effecting mode shift away from private cars to walking, cycling and passenger transport is particularly relevant to the aim of reducing the number of single occupancy vehicle kilometres travelled in urban areas at peak times.

Taking action (4.1 Managing demand for travel)

Working with local government – Central government agencies will work with local councils to develop travel demand management strategies that may incorporate urban design, investment planning and behaviour change tools.

Workplace travel plans – Assist workplaces in formulating and implementing workplace travel plans to reduce car and fuel use. This work contributes to congestion targets in Regional Land Transport Strategies.

School travel plans – Ongoing support for the implementation of school travel plans, walk to school week and walking school buses.

Government funding for the above plans has increased to 75 per cent of the overall cost since July 2007.

Car pooling is one simple activity that can reduce vehicle trips and can be promoted through these programmes.

4.2 More efficient transport modes

4.2.1 Personal travel

Moving to more efficient transport modes, across both passenger and freight transport, provides an opportunity to realise efficiency gains and reduce overall emissions.

Much household travel comprises short trips. One-third of all car journeys are less than two kilometres. The provision of walking and cycling infrastructure can assist with mode shift away from private cars.

Public transport also has a growing role to play, especially for commuting. Between 1999 and 2006, public transport use is estimated to have gone up by 68 per cent in Christchurch, 43 per cent in Auckland and 23 per cent in Wellington, saving an estimated 49 million car trips. This issue is also highlighted in the NZES.

As part of *Implementing the New Zealand Transport Strategy* the government is developing objectives for passenger transport in New Zealand. The NZES points out that there has been an historic under-investment in public transport. Much has been done to correct this since 1999. Funding in this area has increased ten-fold between 1999 and 2007. Additional funding of $650 million was announced in Budget 2007 for national rail improvements and for the upgrade of Wellington and Auckland commuter rail services. These recent developments are reflected in funding priorities and the development of targets for public transport.

A number of local authorities have already made good progress and set targets in promoting alternative modes of transport. These targets include:

- Auckland Regional Transport Authority aims to increase public transport patronage to 60 boardings per person per year by 2016
- Greater Wellington Regional Council has set a target to increase public transport use for journeys to work by 21 per cent by 2016
- Environment Canterbury has set a target for the proportion of all trips (excluding walking) in Christchurch being made by public transport to rise to six per cent by 2011
- Otago Regional Council plans that 4.5 per cent of all trips in the region will be made by public passenger transport by 2014.

Central government intends to engage with and support local authorities as they review their transport strategies and develop their targets.

Public transport in the regions

Public transport funding has increased and public transport operators are showing leadership in the adoption of renewable fuels.

In the Auckland region, major projects include the new North Shore Busway and a $600 million investment programme in commuter rail. It is estimated that the busway saved 3.9 million kilometres of vehicle travel during the 2006/07 year.

In Wellington, the commuter rail network is now undergoing a $500 million upgrade. A contract has also been let to upgrade the city's fleet of 60 electric trolley buses. This will increase capacity and provide more attractive services to the public.

In Christchurch, passenger transport operators are currently trialling biodiesel at 5 to 20 per cent blend levels.

Prototype of the new Wellington trolley bus.
Photo courtesy of Greater Wellington Regional Council.

Taking action (4.2.1 Personal travel)

Funding policy review – In line with the NZES, complete a funding policy review to encourage greater provision of public transport, walking and cycling and make recommendations to government by the end of 2008.

Regional public transport targets – Regional passenger transport mode share targets are to be set by the end of 2012 through scheduled reviews of Regional Land Transport Strategies.

Auckland rail electrification – Complete the electrification of the Auckland passenger rail system by the end of 2013.

Wellington rail upgrade – Complete the $500 million Wellington regional rail upgrade by the end of 2013. Depending on timetabling and train lengths, the upgrade could double peak time capacity.

Support efficient bus use – A programme to increase the uptake of low carbon and fuel-efficient buses (including hybrid and electric buses) used by passenger transport contracted to councils. The Public Transport Management Bill 2007 will enable regional councils and the Auckland Regional Transport Authority to set standards for, and impose controls on, commercial scheduled urban public transport services, while still allowing operators to register such services on a commercial basis. Controls regional councils may impose include requiring participation in integrated ticketing schemes and the use of low emissions buses. The passage of the Bill is to be completed by the end of 2007.

Bus infrastructure improvements – Complete the new North Shore Busway project by the end of 2008 and give higher priority to providing bus priority lanes, park and ride sites and bus shelters on the state highway network.

Getting there – on Foot, by Cycle (Walking and Cycling Strategy) – Implement the initiatives outlined in the Walking and Cycling Strategy's strategic implementation plan, including the walking and cycling model communities programme, the Long-distance Cycle Networks Investigation Project and the expansion of road user training and education related to pedestrians and cyclists.

Bikewise Week – Implement Bikewise week annually to promote cycling.

Neighbourhood accessibility plans – These are community-based programmes to improve safety and access at the community level. The objective is to develop resources and provide programme support to communities.

Active Living Programme – A SPARC programme[43] to encourage active travel modes such as walking and cycling to encourage less car use.

4.2.2 Land freight and maritime transport

A better understanding of the true costs of moving a tonne of freight by different modes, including environmental externalities, will help develop policies for efficient freight movement. Data from the United Kingdom has shown energy use for freight movement across different modes as follows: road transport 0.7 MJ (per tonne-km), rail 0.6 MJ, coastal tankers 0.3 MJ, and container ships 0.12 MJ.

New Zealand's circumstances are different from those in the United Kingdom, so there is a need to assess the levels of costs and fuel efficiency here. Such information can help guide the most efficient use of infrastructure, charging regimes and investment planning. The government proposes reviewing the Surface Transport Cost and Charges Study and is considering including maritime transport in it.

More information about land and marine freight movement is available in the 'Resilient, low carbon transport' chapter of the NZES.

Some businesses are already working together to make more efficient use of existing infrastructure to move freight, as the following case study illustrates.

[43] http://www.sparc.org.nz/partners-and-programmes/active-communities/active-friendly-environments/overview

Freight integration

Fonterra and Toll NZ are working together to make rail the primary transport mode for dairy products in the Waikato. They are taking around 45,000 truck movements off the road between the Waikato, Auckland and Tauranga, thus reducing carbon emissions by around 3,000 tonnes each year.

A hub has been established which is linked by rail to a number of manufacturing sites. The company is also using rail to transport milk from the Hawkes Bay, Manawatu and Wairarapa regions to Whareroa. This results in saving an extra 6,100 tonnes of carbon emissions each year.

In addition, the transfer of so many truck movements from the roads onto rail acts to reduce demand for roading and damage to it, improve safety, reduce congestion and reduce exhaust emissions that are harmful to health.

Fonterra's Crawford St site, a logistics hub acting as a distribution centre for Fonterra's Te Awamutu, Morrinsville, Waitoa, Hautapu, Waharoa, Lichfield and Tirau manufacturing sites. Photo courtesy of Fonterra and Toll NZ.

Taking action (4.2.2 Land freight and maritime transport)

Freight Efficiency Study – The government will establish baseline data for the volume of freight, and the CO_2 emissions per kilometre per tonne of freight moved domestically by different modes by the end of 2009.

The New Zealand Domestic Sea Freight Strategy – In line with the NZES, a work programme with the shipping industry, rail and road operators, to develop and publish a discussion document on a New Zealand Domestic Sea Freight Strategy by the end of 2007.

Heavy-vehicle weight limits – Study the costs, including the likelihood of increased damage to roads, and safety factors, and make recommendations on targeted changes to road freight weight and size limits by December 2009.

North Island main trunk line electrification – Conduct a desktop feasibility study into options, including electrification, for improving the efficiency of the North Island Main Trunk Line and report with recommendations by the end of 2010.

4.3 Improving the efficiency of the transport fleet

In addition to taking action to better manage travel demand and provide more efficient transport modes, action needs to be taken to increase the efficiency of vehicles in the transport fleet.

4.3.1 Commuter rail

The efficiency and environmental performance of commuter rail is being addressed through the electrification programme in Auckland. The majority of the commuter rail system in Wellington is already electrified and this is being extended on the Kapiti Coast.

4.3.2 Aviation

Government is working with the airline industry to improve flight plans and routes to optimise fuel efficiency. Modern commercial aircraft also offer further fuel efficiency gains. Further information is available in the NZES.

Airways New Zealand

Airways New Zealand, the national air navigation services provider, offers a range of measures to help airlines improve efficiency and reduce greenhouse gas emissions as they fly into and over New Zealand's airspace.

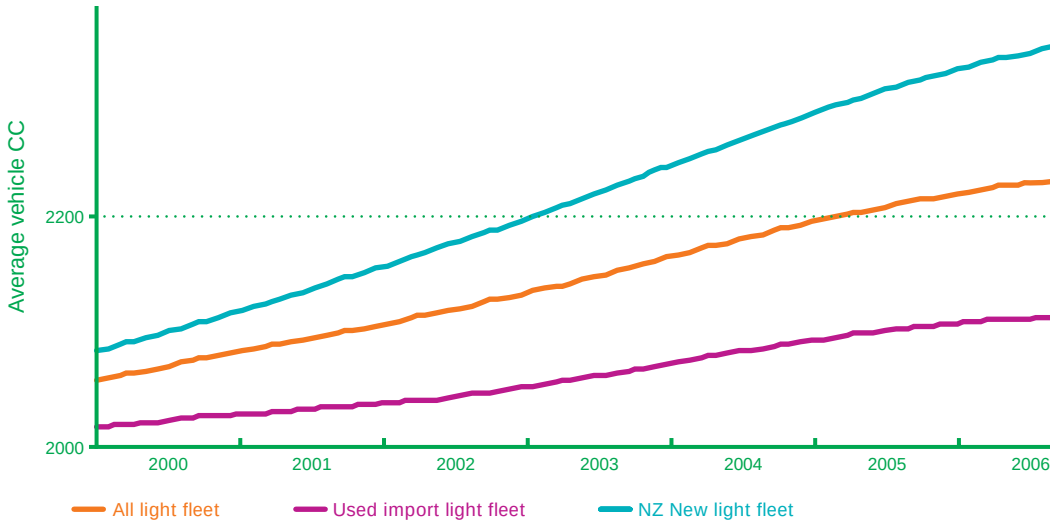
Initiatives include User Preferred Routing which allows pilots to alter their routes whilst airborne to take advantage of prevailing wind patterns, and an optimised arrival trial which enables landing aircraft to follow continuous descent approach procedures into Auckland Airport. Aircraft engines can be set at idle during these descents, significantly reducing fuel burn and greenhouse gas emissions.

Airways New Zealand estimates that its existing fuel saving programmes save the New Zealand airline industry approximately $20 million per year. This equates to savings of over 23 million litres of aviation fuel (0.73 PJ) and almost 0.06 Mt CO_2 emissions.

4.3.3 Private cars

The fuel efficiency of the light road vehicle fleet (primarily private cars) needs to improve. Better performance should reduce emissions of greenhouse gases as well as carbon monoxide, and fine particulates (PM_{10}s) which are harmful to human health.

Figure 6: Light fleet average engine capacity



Source: Ministry of Transport

Figure 6 shows the growth in the average engine size of New Zealand's light vehicle fleet. Engine size provides an approximate indicator of fuel economy, as a vehicle with a smaller engine size will, on average, use less fuel. However, as engine technology is improving, an increase in the average engine size of vehicles entering the fleet does not automatically imply an increase in average fuel consumption. Conversely, reduced average engine size of new or used vehicles entering the fleet implies improved average fuel economy.

Actual data on the fuel economy of the New Zealand light vehicle fleet has only been collected since March 2005. The data up to July 2007 shows no significant change in fuel consumption, despite a trend of increased engine size over this period.

The average light vehicle in the New Zealand fleet is over 12 years old and has a poor efficiency performance of around 10.2 l/100 km. Many modern petrol and diesel light vehicles (family cars) are already capable of around 4 to 5 l/100 km.

The average new import entering the fleet has a performance of 9.4 l/100 km and the average used import returns 8.5 l/100 km.[44] Government has agreed a target of reducing the rated CO_2 emissions per kilometre of combined average new and used vehicles entering the light vehicle fleet to 170 g CO_2 per kilometre (approximately 7 l/100 km) by 2015. The changes required for the fleet to achieve this target are set out in the 'Resilient, low carbon transport' chapter of the NZES.

A longer-term target has been set to reduce per capita emissions from the transport sector by 50 per cent by 2040. One of the key strategies to achieve this target is to position New Zealand to be one of the first countries, if not the first, to widely deploy electric vehicles.

Government will consider options for a sales-weighted fuel economy standard in November 2007. Options will include consideration of the timing, number and stringency of interim targets between 2008 and 2015, while noting the desirability of seeking some early savings.

Action will also be taken to accelerate the uptake of more efficient vehicles including the more widespread adoption of hybrids and early adoption of plug-in hybrids, all-electric and hydrogen-powered vehicles as they become available. The NZES contains detailed information on electric-powered vehicles and hydrogen.

Improving the choice and maintenance of tyres can also lead to lower fuel consumption.

[44] Petrol only and tested to the European standard.

4.3.4 Driver behaviour

Driver behaviour can have a significant impact on fuel economy.

Easy and safe ways to cut your fuel bill by 20 per cent

Keep your tyres inflated to the correct pressures and save up to 5 per cent

Don't speed – As well as being illegal, driving at 110 km/h uses around 13 per cent more fuel than driving at 100 km/h

Avoid short trips where you can – Cold engines can use up to 20 per cent more fuel

Drive smoothly – Accelerate smoothly and gradually. Use economy mode where fitted in automatics

Reduce idling time – If you are going to be stationary for more than 30 seconds, switch your engine off

Look ahead – Keep a good distance between you and the vehicle ahead to avoid lots of accelerating and braking

Look after your vehicle – A properly serviced car can be around 5 per cent more fuel efficient

Watch air conditioning – Switch it off when it's done its job and save up to 10 per cent

Keep your load down – Take unnecessary weight out of your car and take off roof racks etc when not in use

Photo courtesy of Land Transport New Zealand.

The tips in the box above apply drivers of private cars. The government has undertaken additional research into the potential for similar measures to be adopted across the heavy and light commercial fleet. It is estimated that up to 40 per cent of drivers could be expected to adopt similar measures, delivering a 10 per cent saving. If realised, this would save around 74 million litres of fuel per year and 0.19 Mt of carbon dioxide emissions.

Taking action (4.3 Improving the efficiency of the transport fleet)

Average fuel economy standards – Set a target to reduce the rated CO_2 emissions per kilometre of combined average new and used vehicles entering the light vehicle fleet to 170 g CO_2 /km by 2015. This will equate to average fuel consumption figures of 7.4 l/100 km for petrol vehicles and 6.5 l/100 km for diesel vehicles.

Vehicle fuel economy labelling – Introduce a point of sale vehicle fuel economy labelling scheme for new and used vehicles, by early 2008 to produce $333m and 0.98 Mt of savings by 2033.

Energy-efficient tyres – Investigate the potential for improving vehicle fleet efficiency by increasing the uptake of low-rolling resistance tyres and any complementary measures and make recommendations by June 2008.

Fuel economy data – Implement a rule by the end of 2008 to facilitate the collection of fuel economy data on vehicles entering the fleet.

fuelsaver.govt.nz – Continue to provide the fuel$aver website and update information on vehicle fuel economy in response to changing technologies.

rightcar.govt.nz – Launch the rightcar website by December 2007 to provide car buyers with safety and sustainability information.

Driver training – Develop a fleet driver behaviour training package to improve fuel economy, by the end of 2008.

Vehicle Fleet Strategy – Develop a strategy to enable the co-ordination and focus of policies promoting the purchase of more fuel-efficient vehicles by June 2008.

Aviation efficiency – An ongoing work programme identified in the NZES involving the New Zealand-based aviation industry and international forums, to encourage the use of more fuel-efficient practices and aircraft.

Vehicle retirement (scrappage) scheme – Building on the results of an Auckland pilot, extend the trial programme to two years and to other urban areas.

4.4 Developing and adopting renewable fuels

Another important step in reducing New Zealand's reliance on imported fossil fuels is by producing greater volumes of renewable fuels domestically. There is scope to do this through developing the supply of biofuels and encouraging the uptake of electric and plug-in electric vehicles. Other alternative fuelled vehicles such as fuel cell vehicles and those powered by hydrogen may also become available.

The uptake of renewable transport fuels, including electricity over the medium to long term, has the potential to transform the efficiency and emissions performance of the New Zealand vehicle fleet. This is dependent, however, upon the global car industry supplying compatible vehicles in sufficient numbers and consumers buying them. New Zealand will continue to be a technology taker for vehicles.

4.4.1 Biofuels

There are currently two main types of biofuel:

- bioethanol – in New Zealand principally made from whey (a by-product of the dairy industry)
- biodiesel – in New Zealand the single biggest source is tallow (a by-product of the meat processing industry). Biodiesel can also be made from used cooking oil and oil crops.

Research is underway into a number of second-generation and alternative biofuel production methods. This includes research into the conversion of woody biomass into ethanol, trials of willow (Salix) as an energy crop and biofuels from sewage algae. Scope also exists to use kiwifruit waste and straw to produce ethanol.

The government announced a Biofuels Sales Obligation in February 2007 to ensure that biofuels are used in the transport sector. It starts at a low level in 2008 (approximately 0.5 per cent) increasing to 3.4 per cent by 2012. More information on the sales obligation is available in the 'Resilient, low-carbon transport' chapter of the NZES.

Government programmes will investigate what actions can be taken to encourage vehicle compatibility with biofuels and will work towards the following target: by 2015, as much as 80 per cent of the fleet will be capable of using at least a 10 per cent blend of bioethanol or biodiesel, or be electric powered.

It is important to minimise conflict with food production, and not to contribute to the unsustainable production of biofuels in other countries that involve the clearance of native forests overseas. Hence a set of voluntary guidelines and consumer information will be developed and put in place around the supply of biofuels to the New Zealand market.

4.4.2 Electricity

The government has agreed in principle that New Zealand will be one of the first countries in the world to widely deploy electric vehicles. A number of high volume manufacturers are currently undertaking multi-billion dollar investment programmes to bring cost effective plug-in mass market electric vehicles to the market around the end of the decade. As New Zealand is a technology taker, the government will put policies in place to accelerate the uptake of such vehicles as the market makes them available.

Electric cars

Car manufacturers are developing a range of zero (tailpipe) emissions technologies aimed at the mass market with at least one manufacturer having a goal of launching a mass market small car in production from 2010.

Research is focusing on fuel cells, high performance batteries, highly efficient electric motors, regenerative braking systems and electrically driven air conditioning and vehicle charging systems.

Electric plug-in vehicles have downsized fuel tanks compared to fuel-only vehicles.

State-owned energy company Meridian Energy is trialling electric vehicles in New Zealand from 2008.

Left: The NZ Eco-UltraCommuter electric car which has been designed and built by engineering students at Waikato University. The NZ Eco project aims to demonstrate New Zealand's potential for sustainable battery electric commuter cars.
Photo courtesy of the project.

Right: Honda FCX Concept hydrogen fuel-cell car, a precursor to the production car coming in 2008 to the USA.
Photo courtesy of Honda New Zealand Limited.

Taking action (4.4 Developing and adopting renewable fuels)

Biofuels sustainability information – Publish voluntary sustainability guidelines and consumer information for biofuels in New Zealand by the end of 2009.

Research – Investigate renewable energy options for transport and make recommendations by the end of 2009.

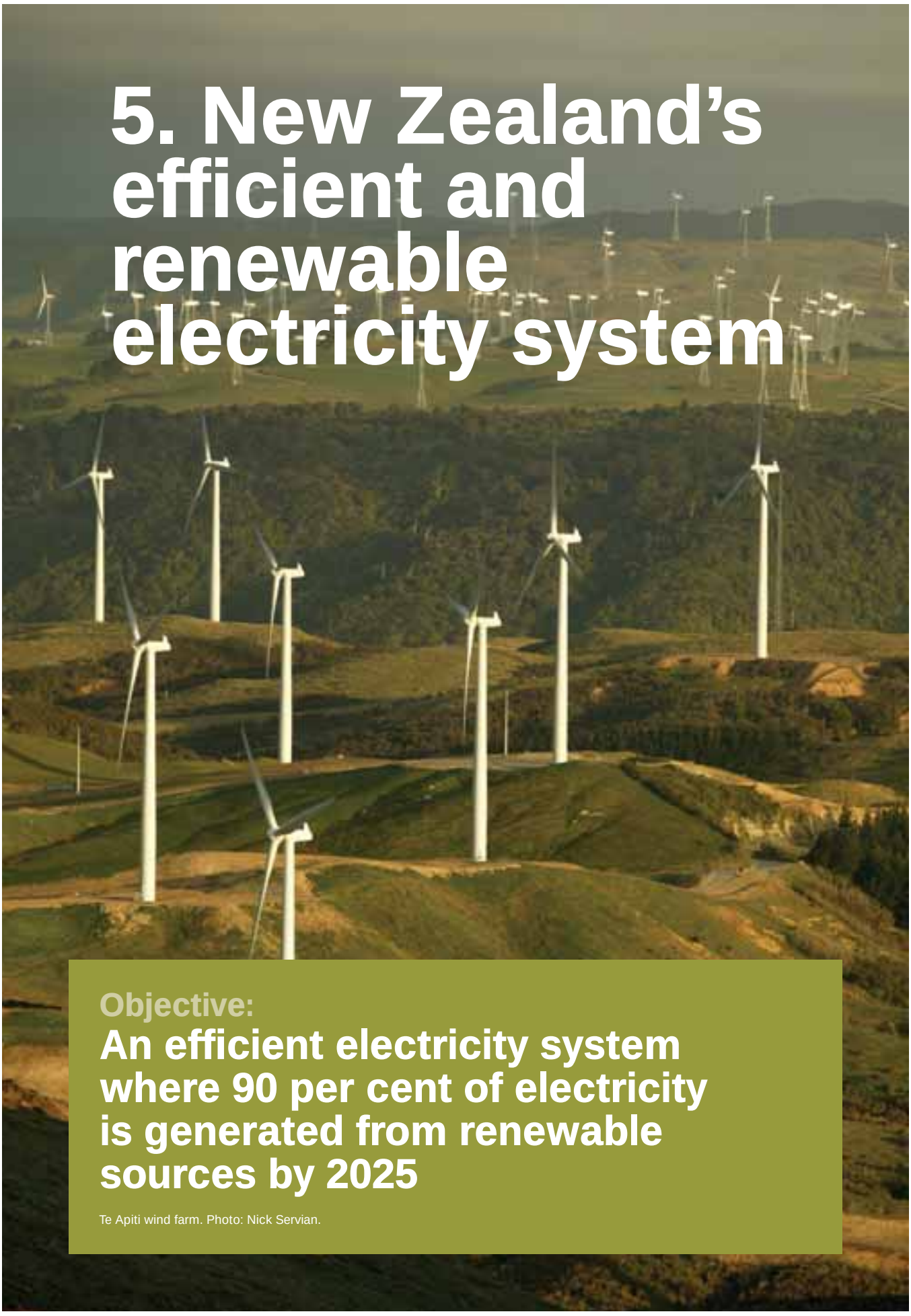
Advisory group on fuels and vehicles – In line with the NZES, establish an expert group to look a future vehicle and energy technologies such as biofuels and electric vehicles and barriers to their adoption, by December 2007.

Biofuel Sales Obligation – In line with the NZES, implement the Biofuel Sales Obligation, which requires 3.4 per cent (approximately 7.25 PJ per year) of petrol and diesel sales to be biofuels by 2012. Review the post-2012 obligation levels in 2010.

Low Carbon Energy Technologies Fund – Administer this fund to help bring forward the use of alternative energy sources such as liquid biofuels, biomass, solar, hydrogen, wind power, and low carbon fossil fuels. This fund is also discussed in the 'Sustainable energy technologies and innovation' chapter of the NZES.

Plug-in electric and hybrid electric acceleration – In line with the NZES, implement a programme to position New Zealand to be a leader in the deployment of plug-in hybrid electric and electric vehicles. Programme to include intergovernmental contact and be established in 2008.

5. New Zealand's efficient and renewable electricity system



Objective:

An efficient electricity system where 90 per cent of electricity is generated from renewable sources by 2025

Te Apiti wind farm. Photo: Nick Servian.

New Zealand's efficient and renewable electricity system – Summary of actions

Action	Outcome	Delivery
5.1 Promoting an efficient electricity system		
Smart meters	Guidelines published by the end of 2007 Decision on regulation by the end of 2009	EC (Funded)
Market design review	Recommendations by June 2008	EC (Funded)
Demand-side bidding and forecasting. New arrangements in place by June 2008	~8.5 MW of demand response from improved price forecasts[45]	EC (Funded)
Consumer participation potentials study	Published by the end of 2008	EECA (Under consideration)
Distribution network pricing	Published by December 2008	EC (Funded)
Supplier obligations to undertake energy efficiency	Recommendations by the end of 2007	MED (Funded)
Distribution network losses	Recommendations by June 2008	EC (Funded)
5.2 Promoting the uptake of renewable electricity		
National Policy Statement (NPS) for renewable energy	Complete by the end of 2008	MfE (Funded)
Provide information to local government to assist with planning processes for renewable energy	Ongoing information programmes	MfE / EECA (Funded)
Provide guidance to councils around consenting small-scale renewable energy systems	Ongoing support programme to help reduce compliance costs	EECA (Funded)
Identify changes to market arrangements to manage higher levels of wind generation in the future	Complete the Wind Integration project by June 2008	EC (Funded)
Relax some conditions around investment in renewable generation by lines companies	Introduce amendments to the Electricity Industry Reform Act 1998 by the end of 2007	MED (Funded)
Itemised billing arrangements for small-scale generation	Recommendations by the end of 2009	EC (Under consideration)
Raise awareness of distributed generation	Ongoing information programmes	EECA (Funded)

[45] Demand-side bidding and forecasting consultation paper, Electricity Commission, 2007.

Action	Outcome	Delivery
5.2 Promoting the uptake of renewable electricity (continued)		
Report on strategic implications of distributed generation on lines networks	Report completed by the end of 2009	MED (Funded)
Distributed generation capacity and capability building	Establish programmes by the end of 2009	EECA (Funded)
Technical guidelines for small-scale distributed generation programme	Publish guidelines by the end of 2009	EC (Under consideration)
Monitor the uptake of distributed generation of less than 10 MW	Report annually in Energy Data File from 2008	MED (Funded)
Consider options to further encourage additional uptake of distributed generation	Recommendations by the end of 2009	MED / EECA (Under consideration)
Improve rural security of electricity supply	Develop demonstration projects by the end of 2010	MAF / EECA (Under consideration)
New Zealand Marine Energy Deployment Fund	Administer fund from late 2007	EECA (Funded)
Marine energy atlas	Publish in 2009	EECA (Under consideration)
Marine energy technical and industry standards	Recommendations by the end of 2011	Standards NZ, EECA and EC (Under consideration)
Support for SEANZ, NZWEA, AWATEA and NZGA to promote renewable energy	Ongoing support	EECA (Funded)

There is significant scope to improve the operation of the electricity generation, transmission and distribution system to make it more efficient and increase the proportion of electricity generated from renewable energy resources.

This chapter is presented as follows:

5.1 Promoting an efficient electricity system

5.2 Promoting the uptake of renewable electricity

Further information on these areas is also available in the 'Security of electricity supply' and 'Low emissions power and heat' chapters in the NZES.

5.1 Promoting an efficient electricity system

The economically efficient management of New Zealand's electricity system can be promoted in a number of ways:

- improving consumer (or demand-side) participation, where consumers actively manage their use of electricity in response to signals[46] associated with high wholesale market prices or network constraints
- optimising the operation and management of transmission and distribution systems to minimise losses
- considering the potential to reduce peak demand when prioritising electricity efficiency investments or programmes
- increasing the uptake of distributed generation, particularly where it is located close to load or where it is able to reliably generate during periods of peak demand
- recognising the greater value of managing demand in winter versus summer when considering investments or programmes to more efficiently manage our electricity system.

An efficient electricity system can help reduce peak electricity demand. By relieving congestion on transmission and distribution networks, line losses can be reduced, system reliability improved (helping to increase security of supply), and the overall cost to consumers reduced. Over time, investment in new peaking generation, transmission and distribution assets (and their associated costs) may be delayed or avoided. Reducing peak demand can also reduce emissions from fossil fuelled generators that are currently required to provide power at peak times.

An efficient electricity system can also improve the ability of consumers to respond to wholesale prices. This helps temper market volatility and reduce potential abuse of market power when supply is tight. It may also raise consumers' awareness of their energy consumption and provide incentives for behaviour change around the uptake of energy efficiency, conservation and renewable energy.

5.1.1 Consumer participation

The potential for consumer participation to help manage electricity load in New Zealand is likely to be significant.[47] A survey of 222 businesses in 2004 identified at least 160 MW of consumer demand that could easily be used as a resource to manage peak demand or network constraints.[48] The potential for consumer participation is likely to grow in the future as enabling technologies, such as smart meters, become more widely used.

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[46] Which may be ripple signals (sent over power lines), radio frequency signals, or information sent via the internet or telecommunications networks (mobile or landline) depending on the application and type of consumer.

[47] The technical potential for consumer participation was estimated at between 250 and 900 MW by EECA in 2003. This potential *only* includes the top 300 industrial sites in New Zealand.

[48] A total of 438 MW of demand response capability was identified in the survey, which could be utilised with varying degrees of difficulty.

Large electricity consumers typically have direct exposure to the wholesale electricity market; they already have strong incentives to shift or shed demand when wholesale prices are high. There is scope to improve how this group of consumers participates in the market.

Many medium-sized consumers do not have time of use related tariffs and as such have little incentive to respond to real-time price signals. This situation varies from supplier to supplier and across distribution networks. More work is required to better understand the load profile of such consumers and quantify the potential for load shedding.

New Zealand residential demand has been managed for a long time, principally through regional control of water heating though ripple control. Recent studies have shown significant capacity to further shed residential demand at peak times.

The supply contracts that small users have with electricity retailers generally[49] offer the same flat rate for every unit of electricity consumed, regardless of whether wholesale prices are high or if there are network constraints. As a result there is little incentive for small users to respond to pricing signals, or for them to be aware of swings in wholesale pricing.

Smart meters, coupled with appropriate tariffs, can enable greater consumer participation in the market, particularly by domestic customers and small businesses.

Demand-side aggregation will be another key ingredient to unlock consumer participation from small- to medium-sized electricity consumers. This offers consumers a way of capturing the financial benefits that may accrue from participating in the market while avoiding the complexities of the electricity system. Existing electricity market rules and regulations may need to change to encourage greater demand-side aggregation.

Smart meters help manage usage

A Californian study introduced smart meters and tariffs to make peak price signals more transparent to 2500 domestic and small business consumers.[50] Tariffs were structured to reward consumers for reduced demand during peak periods.

Peak reductions of up to 27 per cent were achieved for some groups of consumers.[51, 52] The trial also found that most consumers were open to adopting smart metering technology and peak-related tariffs and that peak time response was maintained over days and years.

In many households in New Zealand, hot water cylinders are already remotely controlled by lines companies to control network demand. The California study demonstrated that smart meters and tariffs can motivate consumers to manage electricity consumption in other household appliances. A particularly effective approach is to automatically link smart meters to consumer goods, such as air conditioners or washing machines in the home. The appliance can be linked to the meter to, for example, delay the time at which the washing machine starts until a cheaper power rate is on offer, or to limit the power drawn by an air conditioner at peak times.

Smart meter. Photo courtesy of Arc Innovations.

[49] The remote control of domestic hot water cylinders by lines companies (using ripple signals) to manage local network demand is an important exception to this statement.

[50] *Impact Evaluation of the California Statewide Pricing Pilot*, Charles River Associates, 2005.

[51] The largest peak demand reductions occurred for a small number (for a given year) of critical days when demand on the electricity system was particularly high.

[52] *Dynamic Electricity Pricing in California, Do Customers Respond?* Matt Burgess (2006).

5.1.2 The role of network operators

Distribution and transmission network operators may use pricing (for network services) as a way of encouraging consumer participation to better manage network demand or constraints.

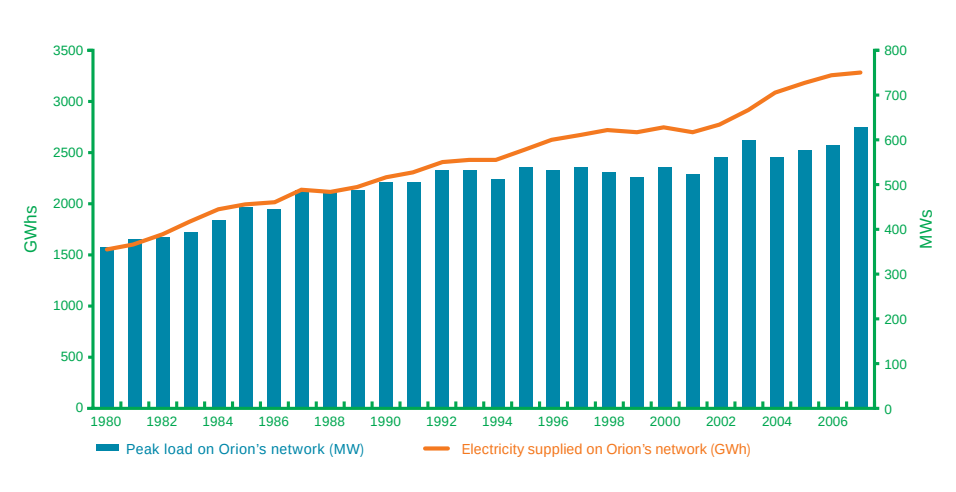
Lines companies have historically invested in electricity efficiency, distributed electricity generation and demand response only to manage demand on their networks, or to provide an additional revenue stream. Supporting the energy efficiency efforts of their customers has been less of a priority. The economic regulation of lines companies currently falls under the Commerce Act, and may discourage some lines companies from investing more widely in these areas.

Under the NZES, a review is underway of the regulatory control provisions relating to incentives for lines companies in the Commerce Act. The government is further considering the role of lines companies and retailers in delivering energy efficiency initiatives.

Managing peak demand success for Orion

Orion New Zealand Limited is a lines company in Christchurch. Confronted with growing demand peaks, in 1990 it instituted a range of energy efficiency and demand-response measures. Peak demand has been successfully decoupled from growth in energy demand. Orion attributes much of its success to peak load pricing, which has induced various consumers to undertake demand management activities.[53]

Figure 7: Managing electricity local peak demand



Source: Orion

5.1.3 The role of electricity suppliers

Energy efficiency programmes currently undertaken by the Electricity Commission and EECA involve partnerships with a range of organisations, including electricity suppliers. Such partnerships have proven to be an effective way to leverage government and levy funds and harness synergies that would prove difficult through normal commercial mechanisms.

An alternative approach is to place regulatory obligations on electricity suppliers, or more broadly energy suppliers, to deliver a specified level of energy efficiency improvements. Under this approach, electricity suppliers (retailers or lines companies) would be obliged to deliver a minimum volume (specified, for example in MWh) of pre-approved efficiency programmes, such as home insulation retrofits or the replacement of old refrigerators.

[53] *Alternating Currents or Counter-Revolution*, Evans & Meade, Victoria University Press, 2005.

Experience from overseas, for example the UK Energy Efficiency Commitment programme, shows that such an approach can be effective in increasing the uptake of energy efficiency measures.

5.1.4 Network losses

Transmission and distribution losses account for around 11 PJ or 7.5 per cent of electricity generation per year.[54] Transmission losses occur on the national grid; distribution losses occur as lines companies take power from the grid and deliver locally. They arise out of the design, operation and physical characteristics of distribution and transmissions systems and increase as the utilisation of (or load on) the system increases.

High-level incentives are already in place to better manage transmission losses. The management of distribution losses, though, is subject to a split incentive. Lines companies have few incentives to manage network losses as the cost of losses is borne by retailers. Several of the Electricity Commission's programmes listed below address aspects of this challenge and will enhance the energy efficiency of local networks over the life of this strategy.

Taking action (5.1 Promoting an efficient electricity system)

Smart meters – Publish voluntary technical guidelines for smart meters by the end of 2007. Investigate whether regulation is required to roll out smart meters, including the need for mandatory minimum technical standards should voluntary guidelines prove inadequate, and report with recommendations by the end of 2009.

Market design review – A work programme (part of a larger Market Design Review project) to improve electricity market rules and regulation to facilitate consumer participation. Work will focus on the extent to which consumers respond to variations in wholesale electricity prices, over the short term (for example price spikes) to the long term (as currently occurs in dry years). Recommendations to be made by June 2008.

Demand-side bidding and forecasting – A work programme (part of a larger demand-side initiatives project) to promote consumer participation in the wholesale electricity market by relaxing bidding requirements and improving the quality of information provided from the market. Implementation to be complete by June 2008.

Consumer participation potentials study – Publish a study by the end of 2008.

Distribution network pricing – Investigate barriers to demand-side participation as part of the development of the model distribution pricing methodologies project. Distribution pricing methodology to be published by December 2008.

Supplier obligations – An investigation into whether regulatory obligations on energy suppliers will deliver net benefits over current delivery mechanisms for energy efficiency is to be concluded, with recommendations, by the end of 2007.

Distribution network losses – A work programme to develop model approaches to improve distribution loss factor calculations and recommendations for the management, minimisation and allocation of distribution losses, reporting by June 2008.

[54] *New Zealand Energy Data File*, MED, June 2007, p 102.

5.2 Promoting the uptake of renewable electricity

It is in New Zealand's longer-term and environmental interests to meet increases in demand through an economic mix of renewable energy sources that will meet security of supply objectives. It is easier for New Zealand than almost any other country, to commit to a low emissions electricity system.

A renewable electricity target has been set in the NZES to increase the proportion of electricity generated from renewable resources to 90 per cent by 2025. This is a challenging target, but given New Zealand's wealth of renewable energy resources, it is considered achievable without the imposition of significant costs on the electricity sector. The resultant generation mix should ensure New Zealand's energy system is well placed to prosper in a low carbon economy. To achieve this outcome requires a very high rate of investment in renewable generation, lower utilisation of existing thermal plant and the decommissioning of older thermal plant.

Meeting the target will require generating electricity from a diverse range of renewable sources such as wind, geothermal, hydro and biomass. Emerging renewable technologies such as wave, tidal and solar photovoltaic, may also contribute to achieving the target. More distributed generation, including small-scale generation, could also make useful contributions to achieving the target.

Greater uptake of demand-side measures such as electricity efficiency and consumer participation (discussed on page 64) will also help meet the target.[55] Investment in electricity efficiency can lower the rate of growth in electricity demand, reducing the need for new generation capacity. Improved consumer participation can help the electricity system respond to changes in output from renewable forms of generation that are intermittent.

Communities living on islands or in very remote locations often rely on expensive diesel electricity generation. Encouraging more of their electricity to be generated from local renewable resources may help to reduce the cost of their electricity generation, increase security of supply and lower carbon emissions.

The review of lines companies' obligations to supply (Section 62 of the Electricity Act 1992) set out in the 'Security of electricity supply' chapter of the NZES will include an investigation of the benefits of distributed generation (including from renewable energy) where it is an economic alternative to supply by lines.

A number of barriers have been identified that are hindering the uptake of renewable electricity. They include:

- The lack of greenhouse gas emissions pricing – disadvantages renewable generation economically as fossil-fuel generation does not include the cost of greenhouse gas emissions. This is being addressed through the emissions trading work programme.
- Regulatory barriers – can discourage developers from investing in renewable generation. For example, some of the provisions in the Electricity Industry Reform Act 1998 can inhibit investment in renewable generation by lines companies. Other examples include the lack of national guidance on renewable energy which can make obtaining consents for large-scale renewable energy developments more difficult. For small generation, obtaining consents under the Resource Management Act (RMA) and Building Code can be a challenge.
- The market for small-scale renewable generation – is small and has not yet been able to take advantage of economies of scale to reduce costs. The capability and capacity of suppliers and installers to meet increases in demand will need to be improved.
- The lack of pre-commercial funding for emerging renewable technologies – some developers of emerging technologies do not have access to sufficient funding to allow for pre-commercial development of their technologies.
- The lack of information – industry, local government and consumers need to be well informed on the benefits and costs of renewable generation in order to help these sectors achieve the target.

[55] This is particularly so for demand-side measures that contribute to reducing or managing demand during winter when electricity supply is more likely to be tight.

Waiuku family are 100 per cent renewable

The Watts family of five from Waiuku has invested in a 100 per cent renewable home electricity system comprising a 480 W solar photovoltaic panel array, a 1 kW wind turbine and a battery bank that can store enough power to supply the house for five days. The family uses LPG for cooking and a wood-fired hot water system.

Compared to the average power bill of $1,600 per annum for a New Zealand home, the family's electricity system cost $21,000 and the only bills associated with it have been spending a few dollars on distilled water for the battery system. Over the past six years, the family has not experienced a power cut and estimates it has avoided emissions of around 12 tonnes of CO_2.

The cost of such systems needs to be considered against the cost of establishing new connections to the grid which are in the region of $18,000–$24,000 per km for lines.

The photovoltaic panel array and small wind turbine.
Photo courtesy of Charmaine A. Watts, Sustainable Electricity Association New Zealand.

5.2.1 Potential for distributed generation

Studies have shown that there is significant technical potential for renewable distributed generation to contribute to New Zealand's future energy supplies. However, the markets for distributed generation, in particular for small-scale generation less than 10 MW, are in the early stages of development due to their high costs when compared to conventional electricity supply.

Through future technological advancements, distributed generation costs are expected to reduce. As they do, some of the technical potential that has been identified will become realisable and more cost effective. The programmes set out below are designed to ensure that the right regulatory and market environments for distributed generation are developed in the first instance.

Taking action (5.2 Promoting the uptake of renewable electricity)

National Policy Statement (NPS) on renewable energy – Will provide high-level national guidance on renewable energy projects under the RMA. This action is discussed more fully in the NZES. It is expected to be finalised in 2008.

Renewable energy information for local government – Assist with RMA policy and plan making and local government energy strategy development. Programmes include expanding EECA's regional renewable energy assessment programme and updating The Quality Planning website (www.qp.org.nz) with a planning note on renewable energy in 2008.

Reducing compliance barriers – An ongoing work programme to provide guidance to councils of consenting issues around photovoltaic, micro wind and micro hydro systems so that they can reduce compliance costs.

Identify market arrangement changes to enable additional wind generation to be integrated into the electricity system – Identify options, including wind forecasting, to successfully integrate higher proportions of wind generation into the system over the next five to 10 years.

Taking action continued (5.2 Promoting the uptake of renewable electricity)

Relax restrictions on investing in renewable generation by lines companies – Introduce amendments to the Electricity Industry Reform Act to relax some of the restrictions on investing in renewable generation by lines companies, by the end of 2007. This will include allowing lines companies to trade in financial hedges and to manage the risks of selling electricity on the wholesale market. More details are provided in the NZES.

Itemised billing arrangements for small-scale generation – Review the case for itemised billing (showing imports and exports) for small-scale generation, by the end of 2009.

Raise awareness of the benefits and costs of distributed generation – A programme will be established to raise the awareness of the benefits of distributed generation, in particular small-scale generation, for end-use consumers and local government from late 2007. The programme will include providing information on potentials for distributed generation and advice to local government.

Report on strategic implications of distributed generation on lines networks – Investigate and report on the long term strategic impacts of distributed generation on distribution networks, by the end of 2009.

Distributed generation capability and capacity building – Establish a programme to support the suppliers and installers of distributed generation in order to meet increased demand, in particular for small-scale generation from the end of 2008.

Technical guidelines for small-scale distributed generation – Establish a work programme to develop technical guidelines or standards for domestic-scale distributed generation to reduce regulatory compliance costs and improve the safety of connecting to local networks, by the end of 2009.

Monitor the uptake of distributed generation – Establish a reporting programme through the Energy Data File that will provide information on the uptake of electricity generation of 10 MW and less, from 2008 onwards.

Consider options to further encourage additional uptake of distributed generation – Report on the progress of the uptake of distributed generation in the urban and primary production sectors, including forestry, under this strategy, by the end of 2009. Make recommendations on additional policies and programmes, including consideration of possible specific economic incentives for encouraging additional uptake of distributed generation, by the end of 2010.

Improve rural security of electricity supply – Develop demonstration projects, both on and off grid, to further identify potentials for distributed generation to contribute to security of supply in rural areas, by the end of 2010.

Marine Energy Development Fund – Administer a four-year, $8 million, contestable fund to bring forward the deployment of wave and tidal energy by facilitating the early adoption of the technology. The fund will be open for requests from late 2007. This action is also discussed in the 'Sustainable energy technologies and innovation' chapter of the NZES.

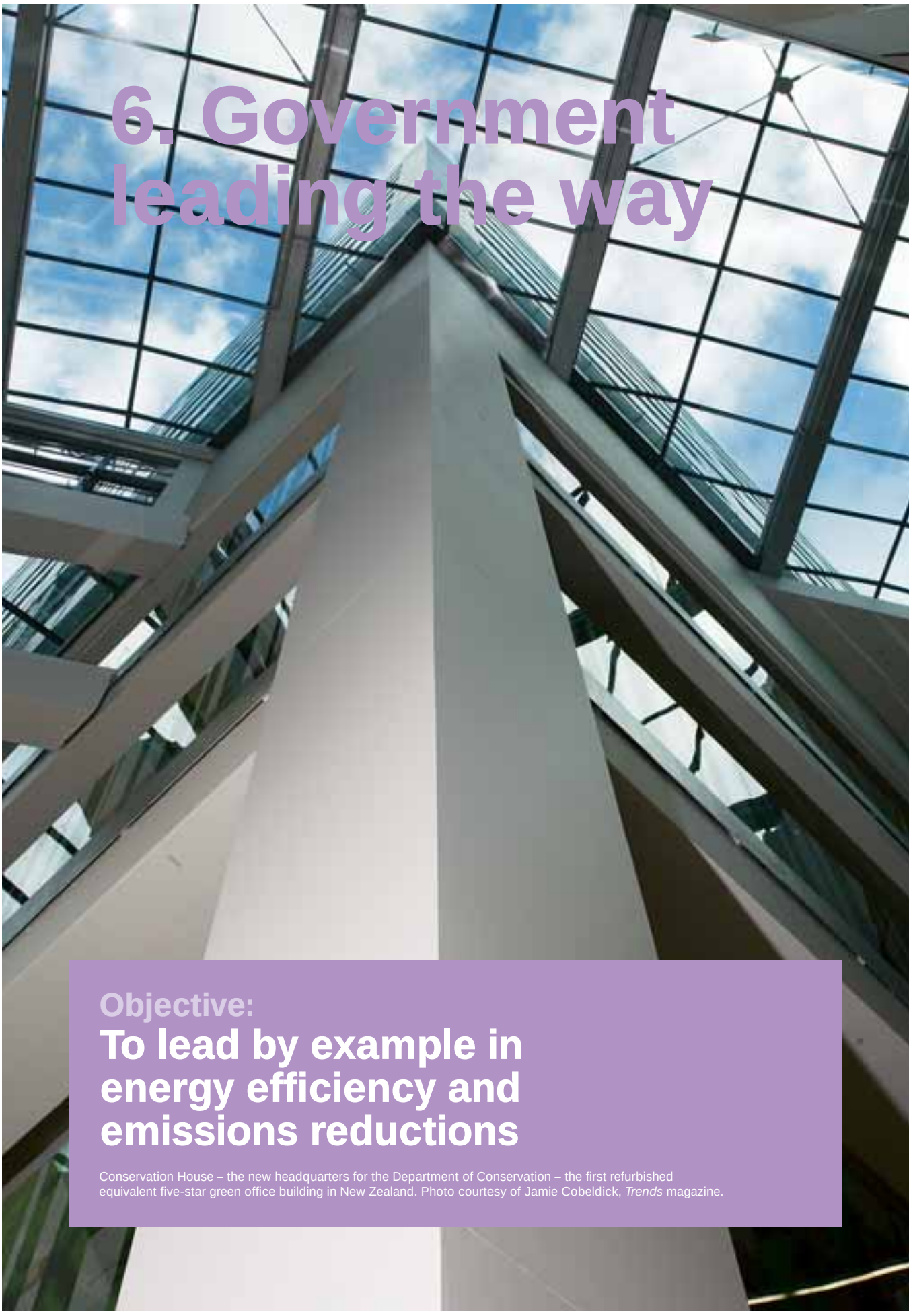
Marine energy atlas – Publish an atlas of New Zealand's wave and tidal current energy potential by the end of 2009.

Marine energy deployment standards – Establish a programme that will consider technical and industry standards for supporting the roll-out of marine energy systems from 2010.

Working with and supporting renewable electricity associations – Continue to support the Sustainable Electricity Association of New Zealand, the Aotearoa Wave and Tidal Energy Association, the New Zealand Wind Energy Association, and the New Zealand Geothermal Association, to promote the uptake of renewable energy.

See Annex 1 for an overview of the funding schemes to encourage the uptake of energy efficiency and renewable energy.

6. Government leading the way



Objective:

To lead by example in energy efficiency and emissions reductions

Conservation House – the new headquarters for the Department of Conservation – the first refurbished equivalent five-star green office building in New Zealand. Photo courtesy of Jamie Cobeldick, *Trends* magazine.

Government leading the way – Summary of actions

Action	Outcome	Delivery
6.1 Urban form and design		
New Zealand Urban Design Protocol implementation	11 case studies published in 2008; monitoring report by June 2009	MfE (Funded)
Integrated Approach to Planning project	Recommendations by the end of 2008	MoT (Funded)
Urban Design national guidance	Investigate the role for greater national guidance and make recommendations by November 2007	MfE (Funded)
Enhanced travel demand management planning	Enhanced planning capacity	Land Transport NZ (Funded)
Traffic system design and management tools	Recommendations for implementation by the end of 2009	EECA (Under consideration)
6.2 Central government		
Carbon neutral public service	Six lead core public service agencies to be carbon neutral by mid-2012. Remaining 28 public service departments to be on the path to carbon neutrality by mid-2012	MfE (Funded)
Public service procurement policies	Incorporate sustainability into a single procurement policy and make recommendations for the application to the wider state sector by November 2007	MED (Funded)
Departments to adopt a minimum five-star Green Star New Zealand rating for the construction of all new Grade A office buildings and refurbishments	Improved performance of public service accommodation	MfE (Funded)
Reduction in public sector energy use	10 per cent reduction in energy use, per full-time staff equivalent (FTE), by the end of 2012 compared with 2006/07	EECA (Under consideration)
Public service departments to have a workplace travel plan in place	15 per cent aggregate reduction in kilometres travelled by the end of 2010	MoT / Land Transport NZ (Funded)
Public service departments to reduce their average CO_2 emissions by 25 per cent per vehicle in their fleets by the end of 2012	0.20 PJ pa 13,000 tonnes CO_2 pa	MoT (Funded)
Public service departments to reduce their consumption of energy-intensive consumables such as paper	Reduction of 10 per cent by the end of 2010 from 2006 baseline	MfE (Funded)
Crown loans for government sector investment in sustainable energy	Provision of financial assistance	EECA (Funded)
Energy Domain Plan	A comprehensive database by December 2009	EECA (Under consideration)

Action	Outcome	Delivery
6.3 Local government		
The NZES/NZEECS engagement and partnership framework	Establish framework by the end of 2008	MED (Funded)
Support the development of energy strategies and RMA policy and plan making	Support programmes established by the end of 2008	EECA / MED (Under consideration)
Support local authorities to implement the Building Code energy efficiency amendments	Ongoing support	DBH/MfE (Funded)
Develop best practice tools and information for sustainable procurement for all agencies to use (including local government)	Tools and information available by December 2007	MED (Funded)
Advice and support on energy efficiency through the Sustainable Households Programme	Programme established in 2007	MfE (Funded)

The government has a responsibility to improve its own performance with regard to energy efficiency, conservation and the uptake of renewable energy. Doing so will form a key part of the government's programme for the core public service to help it become carbon neutral by 2012.

Local government has a key role to play in building more reliable, resilient and renewable energy systems. How local government manages energy issues will also have a major impact on the future use and development of these systems. Central to this will be the quality of urban form and design and how this influences the need for energy and transport services.

This chapter is presented as follows:

6.1 Urban form and design

There is an increasing awareness that quality urban form and design increases economic activity, improves community quality of life and reduces environmental impacts. These benefits can be achieved by planning for a more compact urban form, mixing land use, and ensuring greater connection within and between urban areas.

From a transport perspective, compact and mixed-use development helps ensure shorter travel distances to housing, shopping, offices and restaurants, thereby increasing accessibility to a variety of activities. Design of an integrated transport network aids this by providing easier access to numerous destinations through a range of different routes and modes of transport. A key aim is to encourage people to choose walking, cycling and public transport, rather than driving.

The New Zealand Urban Design Protocol recognises the wider benefits of good urban form and design. These include:

- enhancing community well-being by creating well-connected, inclusive places that support a mix of housing, uses and facilities
- emphasising a reduction in vehicle emissions and reduced fuel use through energy benefits
- providing environments that encourage people to become more physically active
- enhancing economic activity by providing easier access to people, goods and services
- achieving better environmental outcomes that include reduced greenhouse gas emissions and improved air quality
- encouraging innovative design that can include incorporating renewable energy sources and passive solar gain.

A number of regional and sub-regional strategies in New Zealand recognise the benefits of good urban form and design. A common feature of these strategies is an aim to integrate land use planning and transport investment decisions to reduce sprawl, increase access and reduce congestion. To help achieve this each strategy encourages an urban form and settlement pattern that focuses on intensifying key urban areas linked to transport corridors. The overall strategic intent is to increase economic competitiveness, enhance community well-being and protect the environment.

Taking action (6.1 Urban form and design)

New Zealand Urban Design Protocol implementation – Publish 11 case studies by the end of 2008 and complete a second monitoring report by June 2009. A key aim of the Protocol is to improve cross-sector commitment to quality urban design; including central and local government. The ability of the Protocol to make a difference to the quality of the urban environment depends on the implementation and success of its signatory action plans. Actions include continuing professional development workshops, establishing urban design panels and other initiatives that increase awareness of quality urban design and that demonstrate its value.

Integrating land use and transport – Complete the Integrated Approach to Planning project, and provide recommendations to central government and transport sector chief executives by the end of 2008. This project aims to promote better integration of land use, transport planning and funding. It will recommend actions to raise the capacity and capability of central and local government for making better decisions on the integration of transport and land use; for example, ways in which central government can provide guidance, and scope the development of guidelines, for integrating New Zealand's key land use and transport legislation so that any solutions are better integrated.

Urban Design national guidance – Government will decide on the desirability of providing national guidance on urban design by November 2007. This action is also discussed in the 'Resilient, low carbon transport' chapter of the NZES.

Enhanced travel demand management – Continue to work with local authorities to further develop their travel demand management planning capacity, that incorporates the use of urban design, investment planning and behaviour change tools.

Develop traffic system design and management tools for optimising traffic flows – Building on the results of a pilot study in the Auckland urban area, further investigate the use of traffic management and route optimisation as means of reducing energy use and emissions, and develop appropriate advice and tools, by the end of 2009.

6.2 Central government

Government will demonstrate sustainable outcomes in its vehicle fleet, its buildings, its purchase of equipment and consumables and the behaviour of public service employees. These will contribute to a carbon neutral public service.

Targets for central government include:

- Carbon neutral public service – Six lead core public service agencies to be carbon neutral by mid-2012. Remaining 28 public service departments to be on the path to carbon neutrality by mid-2012.
- Public service accommodation – Departments are to adopt a minimum five-star Green Star New Zealand rating for the construction of all new Grade A office buildings and refurbishments from 1 July 2007 and all new government buildings are to meet a minimum five-star rating from 2012.
- Energy use reductions – To achieve a 10 per cent reduction in energy use per FTE of premises occupied by public sector departments by the end of 2012, compared with 2006/2007.
- Workplace travel plans – Public service departments to have a workplace travel plans in place by the end of 2010 aiming for an aggregate 15 per cent reduction in kilometres travelled, including by air.
- Vehicle carbon emissions – Public service departments to reduce their average CO_2 emissions per vehicle in their fleets by 25 per cent by the end of 2012 based on a 2006/2007 baseline.

6.2.1 More sustainable government procurement

Collectively, the core government departments spend about $6 billion each year on goods and services. Sustainable procurement practices will use the government's purchasing power to grow the market for environmentally friendly services and products. This will help ensure government

departments purchase goods and services that are more energy efficient, emit less carbon, produce less waste, and are accredited or environmentally certified where possible. As a result New Zealand businesses can expect to benefit from the increased market provision of these goods and services.

6.2.2 Improving information

A lack of information around the potential to make cost effective savings still remains a barrier to the design of programmes in some sectors. A comprehensive programme, the New Zealand Energy Domain Plan, is proposed to identify and improve understanding of the potential to make gains and underpin the ongoing development and implementation of programmes in the NZEECS.

The Energy Domain Plan looks out five years and beyond to clarify:

- the enduring topic areas that need to be informed by official statistics
- data sources and information that currently inform these topic areas
- statistical challenges limiting our ability to get the information needed
- topic areas that most urgently need further information and research, and initiatives that could be undertaken.

The plan will be used to inform policy development and it will be a benchmark against which future versions of this strategy will be developed.

Taking action (6.2 Central government)

Carbon neutral public service – Six lead core public service agencies to be carbon neutral by mid-2012. Remaining 28 public service departments to be on the path to carbon neutrality by mid-2012.

Procurement policies – Public service departments to have incorporated sustainability into a single procurement policy, and recommendations made on applying sustainable procurement policies to the wider state sector, by November 2007.

Public service accommodation – Departments are to adopt a minimum five-star Green Star New Zealand rating for the construction of all new Grade A office buildings and refurbishments from 1 July 2007; all new government buildings are to meet a minimum five-star rating from 2012.

Reduction in public sector energy use – Departments to take action to achieve a 10 per cent reduction in energy use per FTE. Departments will also reduce the use of energy-intensive consumables such as paper by 10 per cent.

Workplace travel plans – Departments to have travel plans in place and take actions to reduce aggregate kilometres travelled by 15 per cent. The Ministry of Transport and Land Transport New Zealand will publish guidance on sustainable vehicle procurement and workplace travel planning by the end of 2008. Adoption of measures will be mandatory in 2012, as will their use by other government departments.

Improvements to the public sector vehicle fleet – Departments will make purchasing and leasing decisions that will reduce the average CO_2 emissions per vehicle.

Energy-intensive consumables – Public service departments will reduce their consumption of energy-intensive consumables such as paper by 10 per cent by the end of 2010.

Expand Crown Loans for government sector – Decisions on expanding the Crown Loan scheme to include loans for renewable energy are expected in 2008.

Energy Domain Plan – Create and maintain a comprehensive database on energy use in New Zealand by December 2009.

6.3 Local government

Local government has a key role to play in the successful implementation of this strategy and the NZES. It has indicated a strong willingness to assist central government in the implementation of both strategies.

A number of programmes in the preceding chapters have set out actions that involve local government. This section sets out some additional actions that will help to realise the objectives of both the NZES and NZEECS.

Local government has vital communications links with local householders, businesses and the energy industry that can be used to help implement many of this strategy's programmes and actions. It can also influence this strategy's objectives through its administration of the Resource Management Act, the Building Code, Regional Land Transport Strategies, responsibilities for public transport and travel demand management.

Local government, and its various subsidiaries, can be large users of energy; for example, when powering water treatment and supply systems. It has the opportunity to showcase best practice in sustainable energy technology and practices to its communities of interest. Many local authorities are already doing so and are leading the way through developing their own energy strategies and participating in the Communities for Climate Protection (CCP) programme.

Christchurch City Council

Christchurch City Council has produced a Sustainable Energy Strategy. The Council's long-term (2050) vision for the city's energy future is that:

- Christchurch's energy supplies are provided solely from renewable sources, and the city's energy systems are efficient and secure, ensuring sustainability and net zero impact on climate, local environment and public health
- Energy in Christchurch is affordable – so that all households are warm and dry, fuel poverty is eliminated and all cross sections of our community are able to afford to heat their homes to an acceptable and healthy standard
- Energy in Christchurch is affordable and secure – so that industry and commerce prosper and the city becomes attractive to more businesses and industries
- Christchurch is seen as a city that shows responsible leadership using the best sustainable energy practices and does its part in the global effort to reduce greenhouse gas emissions.

Sustainable Energy Strategy
for
Christchurch
2008 - 18

A strategy for our City to lead the community towards a more sustainable energy future

It has a target to reverse the upward trends of energy consumption and associated emissions within 10 years.

In addition, Environment Canterbury has a goal to make public passenger transport services in Christchurch carbon neutral.

The 2005 amendments to the RMA empowered regional councils with a measure of responsibility for planning for the strategic integration of electricity infrastructure and land use. This provides regional councils with a mandate to plan for their region's future renewable energy infrastructure requirements. Allowance for these new requirements can be made in second-generation Regional Policy Statements or, preferably earlier, through specific changes to plans.

Other examples of local government taking action include integrating travel demand management into transport strategies and helping government to deliver the Energywise home grants programme.

Community swimming pools

The government has granted a $920,000 Crown Loan to Dunedin City Council to improve the energy efficiency of its Moana Pool. The loan funded the installation of a new heat pump which recovered waste energy to heat pool water. In doing so it has displaced the need for around $135,000 worth of gas each year that would otherwise have been used. The system saves around 570 tonnes of carbon emissions each year.

From left, Moana Pool Manager Steve Prescott, DCC Energy Manager Neville Auton, Minister of Energy Hon David Parker, Dunedin Mayor Peter Chin, and ECCA Programme Manager Alastair Hines, 2006.

Taking action (6.3 Local government)

Establish the NZES/NZEECS framework for engagement and partnership – Promote co-operation and communication between central and local government in key areas of the energy strategies. The primary aim is to ensure local government input in designing programmes that fall within the regulatory, planning and delivery functions of local government.

Support energy strategy development and RMA policy and plan making – Provide support for local government initiatives to develop energy strategies and RMA policies and plans relating to energy matters.

Building Code amendments – Work with local government to assist them to implement the energy efficiency activities in the Building Code, with a particular focus on removing regulatory barriers and lowering compliance costs.

Develop best practice tools and information for sustainable procurement – For all agencies, including local government, to use, by December 2007.

Energy efficiency promotion – Through the Sustainable Households Programme, local government will be provided with advice and support to help promote energy efficiency and sustainability.

7. Accountabilities, monitoring and reporting

The success of this strategy depends on all New Zealanders contributing to the actions and targets – based on their own actions and responsibilities.

Most of the necessary investment in energy efficient and renewable technologies and processes will come from the private sector. New technologies will increasingly become available as the world responds to the need to reduce carbon emissions. Many of these smart technologies also improve economic efficiency and provide benefits such as health improvements.

As individuals, smarter everyday actions are necessary to reduce energy use in the home, in the workplace and in the way we travel. For example, by breaking past habits many individuals are already experiencing the benefits of smarter travel choices. Combining trips saves time and money, and using public transport avoids parking hassles. People also need to choose more energy-efficient and less intensive goods and services, as well as reduce wasteful consumption.

Central and local government need to play a role by making smarter choices easier for people to make. They must also lead from the front by demonstrating a high level of energy efficiency and uptake of renewable energy. This includes setting energy performance standards for buildings, products and vehicles they purchase or lease, and the way they manage those assets. Local government also has a major influence on future energy use by shaping community land-use patterns and transport systems.

This strategy also assigns formal accountabilities and responsibilities to government agencies. The Minister of Energy is accountable for the overall performance of the strategy.

The Ministry of Economic Development (MED) will report the progress made on implementing the NZES and the NZEECS to the Minister of Energy.

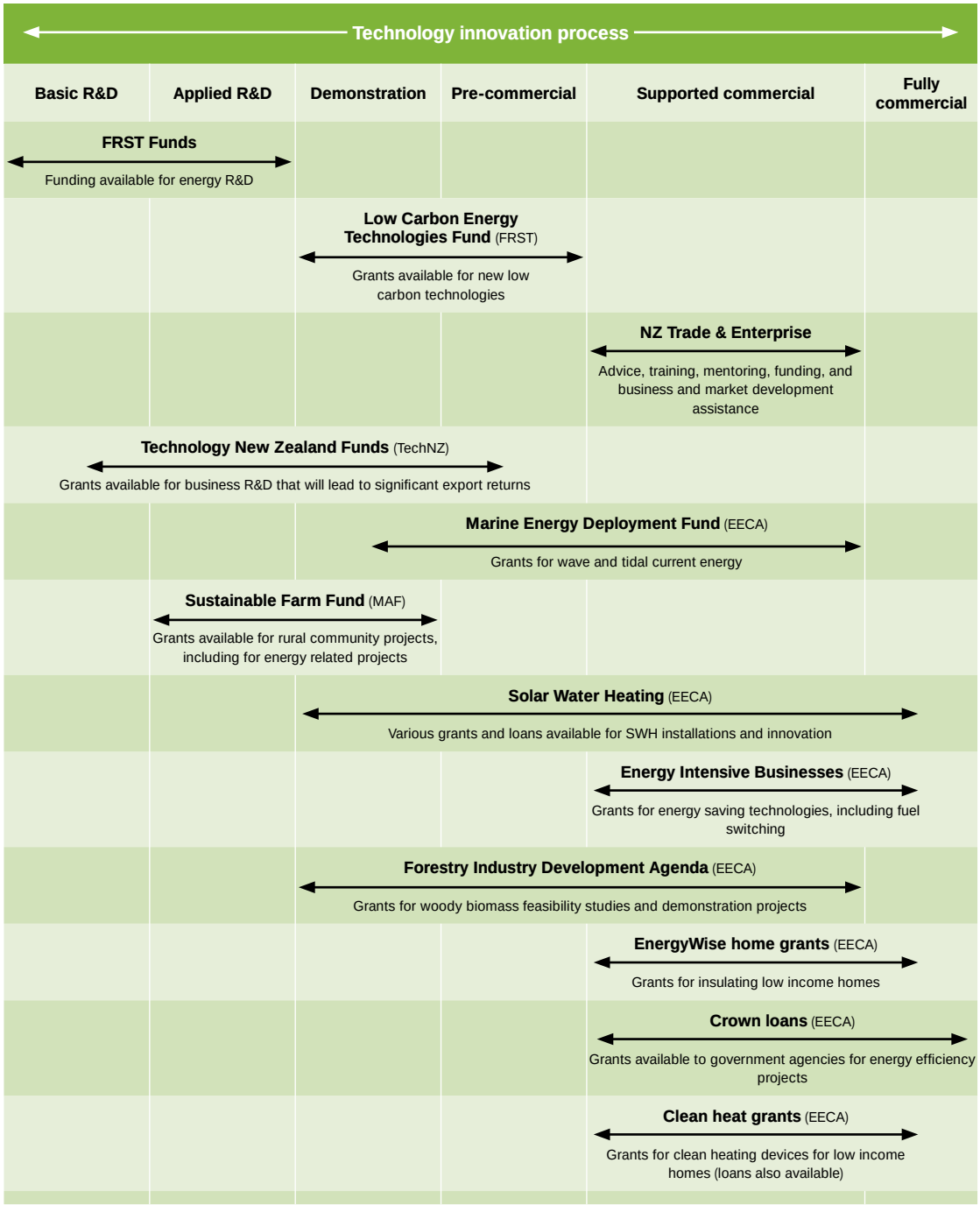
EECA has a role to play, over and above the delivery of its own programmes and actions, by monitoring sector level achievements.

MED will publish annual NZES/NZEECS progress reports. This will allow emerging problems and opportunities to be identified and actions to be taken. As a result the NZEECS will remain current and responsive to a dynamic energy policy environment over its five-year life.

The NZEECS identifies the agencies that are accountable for delivering each individual programme and meeting any targets. This includes monitoring and reporting to MED on the impact of a programme and how this contributes to the overall objective.

Annex 1: Energy efficiency and renewable energy funding programmes

Government funds available for encouraging the uptake of energy efficiency and renewable energy are set out below.



Annex 2: Glossary of terms

ARTA	Auckland Regional Transport Authority.
AWATEA	Aotearoa Wave and Tidal Energy Association.
BANZ	Bioenergy Association of New Zealand
BERS	Building Energy Rating Scheme – a system to rate the energy efficiency of non-residential buildings.
Biofuels 	Biofuels are any gaseous or liquid fuels produced from biomass that can be used as a fuel for engines. They are a renewable energy source. For the purposes of the Biofuels Sales Obligation, the term biofuels refers to those biofuels which are used as a direct replacement for petrol or diesel in petrol or diesel engines, such as biodiesel and bioethanol.
Biofuels Sales Obligation	The government has announced the Biofuels Sales Obligation which requires a percentage of total petrol and diesel sales to be biofuels, starting from 1 April 2008. More information is available at http://www.mot.govt.nz/biofuels-440-index/
Building Code	The New Zealand Building Code is the first schedule to the Building Regulations and sets out performance standards that building work must meet. All new building work in New Zealand must comply with the Building Code. Clause H1 specifies energy efficiency performance requirements.
CarboNZero	A carbon neutrality auditing and accreditation scheme run by Landcare.
CO_2	Carbon dioxide, a greenhouse gas.
Co-benefits	Sustainable energy programmes usually aim to maximise a primary benefit such as reductions in energy use or cost. These same measures may also reap additional benefits such as CO_2 reductions, improved health, and reduced lost work days.
DBH	The Department of Building and Housing.
Demand-side	The load that creates the demand for energy as opposed to supply side which refers to energy generation and supply systems. Demand-side is simply on the customer side of the meter.
Demand-side management	Measures which aim to reduce either energy consumption or peaks in demand. Most often used in relation to electricity, the term includes energy efficiency demand-response measures (such as shifting load to other times or cutting load during periods of peak demand).
Distributed generation	Also known as DG, it usually refers to electricity generation connected into either a distribution network or end-users system. DG can be effective in reducing transmission losses.
EC	Electricity Commission – a New Zealand Government Crown entity.
Economic potential	Economic potential is the fraction of overall technical potential that can theoretically be realised economically in the market assuming full uptake rates. See also Market potential, Realisable potential and Technical potential.
EECA	Energy Efficiency and Conservation Authority – a New Zealand Government Crown entity.
EIB	Energy Intensive Businesses – a business that uses a relatively large amount of energy to produce its output; generally applies to a whole industry sector. EECA's Energy Intensive Businesses programme was launched in 2005 to help energy intensive businesses reduce greenhouse gas emissions and improve energy efficiency.

ENERGY STAR® 	ENERGY STAR® is the global mark of energy efficiency, identifying the most energy-efficient products and appliances in a category. It is recognised and trusted in the US, Canada, Europe, Australia and Asia. In New Zealand, heat pumps, dishwashers, washing machines, TVs, DVD players, home theatre systems, computers and office equipment meeting the specification are available.
Electric hybrid vehicles	A hybrid car uses an internal combustion engine (such as petrol or diesel) alongside regenerative braking systems to provide power to the wheels while also charging a battery. An electric motor then uses the stored energy in the battery to move the vehicle at low speeds and while accelerating. This dual or hybrid drive train can use less fuel than a conventional car, sometimes only half as much.
Emprove	An EECA programme that supports the energy management initiatives of organisations that spend more than $500,000 per year on energy.
Energy efficiency	As defined by the Energy Efficiency and Conservation Act 2000, it means a change to energy use that results in an increase in net benefits per unit of energy used.
Environmental sustainability	A movement towards redesigning the ways society's needs and wants are met so that they can be accommodated within the long term carrying capacity of the environment.
FIDA	Forest Industry Development Agenda – aims to ensure the forest industry can make its optimal contribution to New Zealand's sustainable development.
FRST	Foundation of Research, Science & Technology
fuelsaver.govt.nz 	A Land Transport New Zealand website that provides information about fuel consumption of vehicles available on the New Zealand market.
Geothermal	Heat from the earth's interior made available by extraction of geothermal hot water or steam. New Zealand has a world-class geothermal energy resource due to its location on an active plate boundary.
Govt³	A Ministry for the Environment-led programme for government agencies to improve the sustainability of their activities. The 3 stands for three pillars of sustainability – environmental, social and economic.
Green building	Green, or sustainable, building is the practice of promoting healthier and more resource-efficient building construction, renovation, operation, maintenance and demolition.
Greenhouse gases (GHG)	Gases in the atmosphere that retain more energy from outgoing infra red radiation than from incoming solar radiation. They include carbon dioxide, methane and water vapour.
Green Star New Zealand	A comprehensive environmental rating system for buildings. Green Star evaluates building projects against eight environmental impact categories, plus innovation. Refer to www.nzgbc.org.nz for more detail.
GWh	Giga Watt hour. One million units of electricity or 106 kWh. GWh is the normally used unit of electricity energy supply. 278 GWh is equivalent to 1 petajoule (PJ).
GWRC	Greater Wellington Regional Council
HERS	Home Energy Rating Scheme – a proposed system to rate the energy performance of houses, for example, through a star rating similar to that used on whiteware sold in New Zealand.
HNZC	Housing New Zealand Corporation.
HVAC	Heating Ventilation and Air Conditioning.
INZTS	*Implementing the New Zealand Transport Strategy*.
LPG	Liquefied Petroleum Gas.
MAF	The Ministry of Agriculture and Forestry

Mandatory Energy Performance Labels (MEPL) 	Mandatory labels under the MEPS programme.
Market potential	Market potential is the fraction of overall technical and economic potential that can actually be realised in the market assuming business as usual. See also Economic potential, Realisable potential and Technical potential.
Megawatt (MW)	One million watts. It is a standard unit for electricity generation. One MW of capacity is enough to supply the peak electricity needs of about 500 households. The Huntly power station has a capacity of 1,000 MW.
Minimum Energy Performance Standards (MEPS)	Minimum Energy Performance Standards (MEPS) specify the minimum mandatory energy efficiency requirements for selected energy-using products.
MED	The Ministry of Economic Development.
MfE	The Ministry for the Environment.
MoRST	The Ministry of Research, Science and Technology.
MoT	The Ministry of Transport.
Next Steps	The name of a government review of the transport sector.
NPS	National Policy Statement.
NZES	*New Zealand Energy Strategy* – www.med.govt.nz
NZGA	New Zealand Geothermal Association
NZWEA	New Zealand Wind Energy Association.
Petajoule (PJ)	1015 joules – approximately the amount of electricity used by a city the size of Nelson each year.
Realisable potential	The fraction of overall technical and economic potential that can actually be realised in the market including the new expanded market potential that the strategy is expected to realise. See also Economic potential, Market potential and Technical potential.
rightcar.govt.nz	A website that will provide integrated safety and sustainability information for consumers.
Renewable energy	Renewable energy utilises natural resources such as sunlight, wind, tides and geothermal heat, which are naturally replenished. Renewable energy technologies range from solar power, wind power, marine energy and hydroelectricity to biomass and biofuels for transportation.
RMA	Resource Management Act 1991.
SEANZ	Sustainable Electricity Association New Zealand.
Second-generation biofuels	Generally refers to new methods of producing biofuels. Examples include the conversion of plant lignin and cellulose into fuels by enzymes and the gasification of biomass material followed by a gas-to-liquid Fischer-Tropsch process. Biomass that could be used in these processes includes all types of trees, grasses, agricultural plant wastes, straw and algae. Second-generation biofuels are not yet ready for commercial development but are the subject of extensive R&D both in New Zealand and internationally.
SIA	Solar Industries Association.
SPARC	Sport and Recreation Council.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission definition). Sustainable development must be based on the efficient and environmentally responsible use of all of society's scarce resources – natural, human and economic.
Sustainable energy	Sustainable energy resource use and supply is an important area of emphasis contributing to sustainable development.

Technical potential	The benefits from sustainable energy that could theoretically be gained if the best-performing technologies were taken up by all consumers in the market. In practice, this level of technology uptake will not normally be achievable. For example, the amount of energy that could be produced if all of New Zealand were covered with solar panels represents the technical potential for solar energy. Technical potential is always increasing with new and emerging technologies that improve energy efficiency and that enable new renewables. See also Economic potential, Market potential and Realisable potential.
TNZ	Tourism New Zealand.
Mt CO_2	Million tonnes of carbon dioxide. Generally this refers to the CO_2 equivalent of a mix of greenhouse gases.
Travel behaviour change programmes	These typically encourage voluntary changes in personal or private travel behaviour. Programmes often provide consumer information and encouragement for people to utilise energy-efficient and sustainable modes of travel (such as walking, cycling and public transport) and to reduce the requirement for travel (such as encouraging working from home). Includes travel awareness and travel planning.
Travel planning	As a form of travel behaviour change, it typically focuses on encouraging people to travel to specific destinations (schools, workplaces, etc) by modes other than the private vehicle (such as public transport, cycling, walking, etc). Travel planning is most commonly carried out in New Zealand in schools and workplaces.
Vehicle kilometres travelled (VKTs)	Sometimes abbreviated to VKT, it reflects the distance travelled by private vehicles over a particular period of time, Importantly, it does not capture the occupancy rate of those vehicles.

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