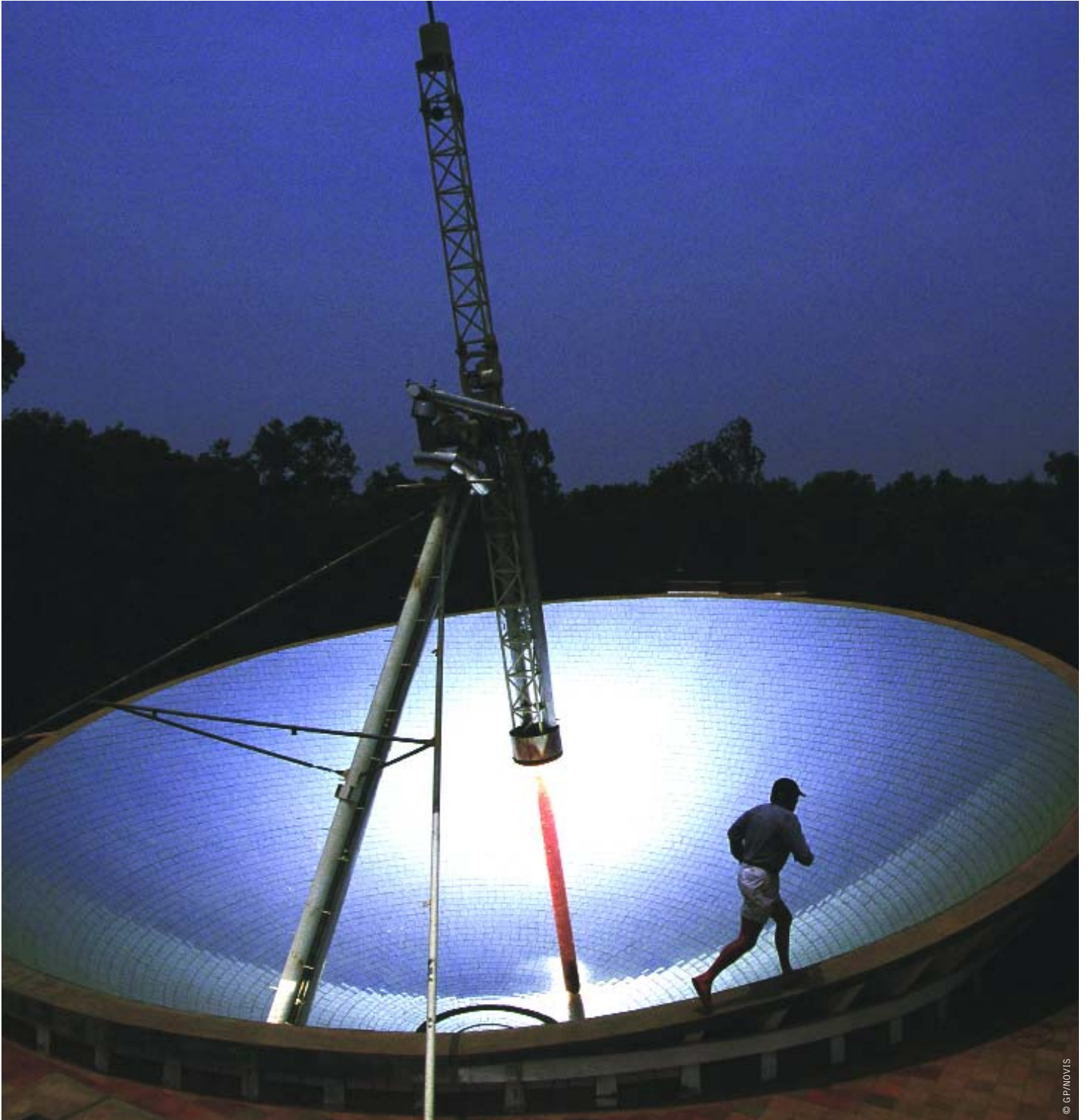


## executive summary

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"... NEW ZEALAND HAS VERY LITTLE TIME LEFT TO KICK-START THE SHIFT TO CLEAN ENERGY."



**image** MAN RUNNING ON THE RIM OF A SOLAR DISH WHICH IS ON TOP OF THE SOLAR KITCHEN AT AUROVILLE, TAMIL NADU, INDIA. THE SOLAR DISH CAPTURES ENOUGH SOLAR ENERGY TO GENERATE HEAT TO COOK FOR 2,000 PEOPLE PER DAY.

image GEOTHERMAL VENTS, ROTORUA,  
NEW ZEALAND.



## climate change – the imperative to act

Climate change is real and it is happening now. Humans have already warmed the planet by 0.6°C, and have experienced a range of serious impacts as a result. If we allow temperatures to rise more than 2°C we will cross a “dangerous” threshold - with dramatic and unmanageable consequences for our environment, society and economy. The latest update, in February 2007, from the world’s leading climate scientists at the Intergovernmental Panel on Climate Change (IPCC), warns that we may see up to 6.4°C warming this century if we do not dramatically reduce greenhouse pollution.

Our entire existence depends on a stable climate. If we don’t reduce our greenhouse pollution, climate change will lead to falls in global production of food staples (resulting in famine and food shortages), cause ecosystems to collapse (the Amazon could convert to grassland), increase extreme weather events (such as Hurricane Katrina in the United States and droughts and floods in New Zealand and Australia), and the loss of glaciers and the melting of the Arctic and Antarctic regions which could raise sea levels by metres. The Gulf Stream, which keeps most of Europe warm by bringing warmer surface waters from the south up along its coast, could shut down as melting Arctic waters stop the “pumps” which drive this deep ocean current. This would plunge Europe into a mini ice age.

The IPCC warns that the climate is much more sensitive to increases in greenhouse pollution than previously thought. This means, for every tonne of greenhouse pollution released, we will see greater and more rapid warming than expected. As these scientists learn more about the climate system it is now clear that when the climate changes, it often changes very rapidly. It is more like flipping a switch than turning a dial.

We can avoid climate disaster, but only through concerted and urgent action to reduce greenhouse pollution. We must shift to a clean, safe and secure energy system.

### new zealand - a lead role in the clean energy revolution:

There is a strong case for New Zealand to lead the world in clean energy and climate protection:

- We have vast renewable energy resources - including wind, hydro, biomass, geothermal, solar, wave and tidal energy, and we have experience in tapping them.
- We have huge potential energy savings and efficiency. Discovering that potential will reduce our energy expenditure, and result in a more productive economy.
- Clean energy will give New Zealand energy independence and security, by reducing our reliance on energy imports, and our susceptibility to rising oil and gas prices.<sup>1</sup>

- We have a responsibility to act. We are heavy greenhouse polluters, and since 1990 have allowed our levels of greenhouse pollution to increase by more than 21 per cent, and our carbon dioxide emissions by 38 per cent.

## how do we get there? the path to a clean energy future

Greenpeace commissioned this report from the Institute of Technical Thermodynamics Department of Systems Analysis and Technology Assessment of the German Aerospace Centre together with Dialogue Consultants, Wellington. The result is a pathway for a secure and environmentally sustainable New Zealand energy system. The Greenpeace Energy Revolution Scenario shows that we can achieve:

- 100 per cent renewable electricity by 2025.
- 72 per cent reductions in CO<sub>2</sub> emissions by 2050 through domestic action alone.

There will also be significant economic, environmental and social benefits through the use of clean, renewable energy sources such as solar and wind power, and a high level of energy efficiency.

This report is a subset of global modelling presented in Greenpeace and the European Renewable Energy Council’s report, Energy [R]evolution: A sustainable World Energy Outlook. That report demonstrated how global carbon dioxide emissions could be cut by almost 50% by 2050 whilst providing a secure and affordable energy supply and maintaining steady worldwide economic development. It can be downloaded at: [www.greenpeace.org/new-zealand/press/reports/global-energy-report](http://www.greenpeace.org/new-zealand/press/reports/global-energy-report)

## reduced reliance on fossil fuel imports

The scenario achieves a phase-out of fossil fuels in the electricity sector by 2025, comes close to a fossil fuels phase-out in heating by 2050, and achieves significant reductions in the transport sector. We can achieve this in a relatively short time-frame without relying on any major future technology breakthroughs. (Any such breakthrough, such as nanosolar technology, will be a bonus.)

## renewable energy will be cheaper in the long run

The Greenpeace Energy Revolution Scenario shows that in the long run, renewable energy will be cheaper than conventional energy sources and reduce New Zealand’s dependence on imported fossil fuels.

### reference

**1** DURING THE 2005/06 FINANCIAL YEAR, NEW ZEALAND SPENT \$4.94 BILLION ON PETROLEUM IMPORTS. EXPENDITURE ON PETROLEUM IMPORTS INCREASED 148% (FROM \$1.99 BILLION) IN JUST 6 YEARS. SOURCE: STATISTICS NEW ZEALAND, INFOS DATABASE. TOTAL FIGURE REPRESENTS THE SUM OF MERCHANDISE CATEGORIES 2709 TO 2715.

### two bad options –

#### nuclear energy and carbon capture and storage

Employing nuclear energy and carbon-capture and storage technology would divert attention and effort away from the real solutions to climate change – renewable energy, energy efficiency and conservation.

**nuclear energy** is often cited as a solution to climate change, but employing it would be simply swapping one environmental nightmare for another. Nuclear power is never safe. Not only is there no safe way of disposing of nuclear waste, but the nuclear power industry requires enormous government subsidies. Nuclear energy cannot compete on an open market; it costs at least 20 per cent more (and up to 10 times more per kilowatt hour) than renewable energy or energy efficiency.

Further, New Zealand does not have the infrastructure or expertise to deal with nuclear energy, and even the smallest commercially viable nuclear reactor would be too big to fit into New Zealand's electricity system.

**carbon capture and storage** (burying greenhouse pollution in the ground) is not viable either. It is very expensive, more expensive than a typical wind farm and the technology is unproven and therefore risky.

The Intergovernmental Panel on Climate Change says that there are still far too many questions about environmental risk, safety and costs for CCS to be deployed on a scale that would make it economically viable until at least the second half of the century, but we need to cut greenhouse gas emission by 50 per cent by 2050 and must take significant action in the next 10 years. Carbon capture and storage will not be ready in time to help us avoid catastrophic climate change.

New Zealand is geologically unstable and there is real risk of dangerous leakage and pollution from stored carbon gas. Monitoring the stored gas would be expensive and on-going, and there are questions about who would be responsible for this work and liable for any leakage.

### no time to waste!

The Greenpeace Energy Revolution Scenario proves that renewable energy sources, combined with energy efficiency and savings, can make the necessary cuts to our greenhouse emissions. The Scenario also shows that New Zealand has very little time left to kick-start the shift to clean energy. Delaying even a few years will make it impossible to achieve a smooth transition.

Globally, total emissions need to peak no later than 2020, with at least 50 per cent reductions in 2050. Wealthy countries like New Zealand and the United Kingdom (Annex 1, countries under the Kyoto Protocol) which collectively have been the main cause of the current levels of greenhouse pollution have a responsibility to act first. They need to aim for 20-30 per cent reductions on 1990 levels of emission by 2020, and 80 to 90 per cent reductions by 2050 if the planet is to have a good chance of avoiding very dangerous levels of climate change.

This report shows that New Zealand will struggle to meet these emission reductions in the energy sector, and will lag 10 years behind the target. By 2020, when we should have achieved 20-30 per cent reductions, we will be only stabilising emissions. We will reach 23 per cent reductions, but not until 2030. By 2050, our emissions will be 72 per cent below 1990 levels, or eight to 18 per cent of what is needed.

The position is further complicated by the fact that agricultural emissions comprise about half of New Zealand's total greenhouse gas pollution, yet may be more difficult and slower to reduce.

New Zealand, therefore, faces a great challenge. We are paying the cost for delaying action on climate change. We must learn the lesson that early action is vital. The costs of delay are enormous, both in terms of the severity of climate change impacts and in the difficulties posed by reducing greenhouse gas emissions rapidly enough to avoid severe climate impacts.

New Zealand could still meet a national target of 30 per cent reduction in total greenhouse gas emissions by 2020, and 90 per cent by 2050, by adopting the following strategies:

- Retiring carbon-intensive energy infrastructure before its due date (such as Huntly power station and Genesis' e3p). (The model assumes equipment is not retired early).
- Proposing more aggressive demands on the agricultural sector to also rapidly reduce its greenhouse emissions. This would involve a heavy commitment of funding to research and develop new techniques and implement existing knowledge, and might well require a shifting of agricultural practices from dairying to less greenhouse-gas intensive farming practices.
- A possible expansion of the use of biofuels in the transport sector, providing they can be produced sustainably. Any remaining emission reductions should be made up by purchasing credits on the international market, focusing on credits from projects under the Clean Development Mechanism, with emphasis on projects in Pacific Island nations.

Greenpeace calls for New Zealand politicians, policymakers and the New Zealand energy sector to invest in our future and take action now.

### political and policy leadership at a critical juncture

New Zealand needs clear and strong political and policy leadership if it is to make a smooth transition to clean energy.

The New Zealand Government is currently developing an Energy Strategy and a Climate Policy Package. These policies will largely determine whether we make the shift to clean energy and advance the global fight against dangerous climate change. Greenpeace has put forward a policy package that will provide the foundation for a clean energy future (see the Climate and energy policy section).

New Zealand's policies must be concrete and ambitious if we are to drive towards a clean energy future.



Policies must be practical and targeted, with a focus on measures that break down barriers to change (structural, financial and social) and create incentives for positive action.

Policies should ensure that vulnerable members of society are looked after during the process of change to a more climate friendly economy.

### framing the challenge - national greenhouse targets

New Zealand needs clear, overarching targets to frame the shift to clean energy. The targets must be consistent with keeping temperature rise below the 2°C "dangerous" threshold. New Zealand's minimum targets must be:

- a 30 per cent reduction in greenhouse pollution compared to 1990 levels by 2020;
- a 90 per cent reduction in greenhouse pollution compared to 1990s levels by 2050.

### a "price instrument" - the incentive to reduce greenhouse pollution

A polluter-pays "price instrument" forms the backbone of any suite of climate policies. This could be achieved either through a carbon charge or an emissions trading scheme. A price instrument must be implemented immediately and cannot be delayed.

- A broad-based carbon charge should be immediately implemented and remain in place until any alternative price instrument is established. Much of the policy work has already been done on this and could be reasonably implemented by 2008.
- Emissions trading should be implemented in the medium term (eg. from 2012) to allow time for policy development of this complex system.

### energy efficiency and savings

New Zealand has huge potential in energy efficiency and savings. Investment in energy efficiency and savings should be given priority over investment in new generation capacity, because it typically provides a better return on investment.

Policy recommendations include:

- Continuing programmes to boost solar water heating.
- Strengthening building codes to increase minimum levels of energy efficiency.
- Retro-fitting homes with insulation.
- Promoting Energy Star-branded appliances.

### the new NEECS

The new National Energy Efficiency and Conservation Strategy (NEECS) has the potential to deliver substantial reductions in greenhouse gas emissions, and a more productive economy. In order to be effective, the NEECS should:

- Adopt a 20 per cent reduction target for total energy consumption by 2020.<sup>2</sup> Interim and sectoral targets should be consistent with this overall target.
- Facilitate a major increase in investment in energy efficiency and conservation to at least \$300 million to \$400 million annually.
- Require the Energy Efficiency and Conservation Authority (EECA) to foster new businesses that deliver energy-efficient services.
- Include an Electricity Demand Management Fund<sup>3</sup> to generate significant funds for energy savings and efficiency.
- Ensure the rapid uptake of smart-metering so that consumers can monitor and more easily respond to national peak usage times by reducing their own usage.
- Require the Government to show a lead in practising energy efficiency and conservation.
- Decouple electricity profits from electricity sales.

### renewable energy

New Zealand can and should be a world leader in renewable energy. We have excellent renewable energy resources. We need strong Government policies to promote renewable energy. We are currently lagging behind European countries which have actively supported their renewable energy industries.

New Zealand can achieve a 100 per cent renewable electricity sector and a high proportion of renewable transport by:

- Promoting a diverse range of low-impact renewable technologies.
- Encouraging the development of a geographically dispersed, "distributed" renewable energy system.
- Increasing energy efficiency and conservation in order to lower demand.

Specific incentives for renewable energy are required in addition to a price on greenhouse pollution. Both carrot and stick measures are required to spark a rapid uptake in renewable energy.

### references

<sup>2</sup> FROM CURRENT LEVELS. THIS IS IN LINE WITH NUMEROUS STUDIES THAT HAVE SHOWN THAT THE EU COULD SAVE AT LEAST 30% OF ITS PRESENT ENERGY CONSUMPTION IN A COST-EFFECTIVE MANNER. SEE COMMISSION OF EUROPEAN COMMUNITIES, COM(2005) 265, GREEN PAPER ON ENERGY EFFICIENCY OR DOING MORE WITH LESS, AT PAGE 4.  
<sup>3</sup> THE FUND COULD BE A NEW INITIATIVE, OR A MAJOR INCREASE ON THE NZ\$2 TO \$6 MILLION/YEAR "EFFICIENCY LEVY" CURRENTLY RAISED BY THE ELECTRICITY COMMISSION.

### setting goals – renewable energy targets

New Zealand should adopt a legally binding renewable energy target of 100 per cent renewable electricity by 2025.

The Greenpeace Energy Revolution Scenario demonstrates that this is technically and economically achievable.

### measures to boost renewable electricity

A feed-in tariff, or guaranteed price system, should be established.

Based on international experience, this is the most effective means of supporting renewable energy. A feed-in tariff provides certainty to investors in renewable energy by providing a guaranteed sale price for electricity they generate over a specific period of time.

The tariff could be set at different levels, with targeted encouragement of particular types of renewable energy that deserve support such as:

- Community-owned wind development.
- Smaller (i.e. less than 20MW) wind developments.
- Newer renewable technologies, such as tidal energy, particularly for smaller pilot projects.

### micro generation

Micro-scale (i.e. household) generation deserves specific support.

A feed-in tariff and a net metering initiative are two specific measures that should be introduced.

Net metering protocols should be simplified and streamlined to ensure that micro generators can sell excess energy to the grid

### new zealand community wind

A programme to support small community-owned or local New Zealand-owned wind farms should be introduced.

### loading order

A variation of the Californian loading order should be adopted whereby electricity providers must first demonstrably consider energy efficiency options to meet demand, and secondly renewable energy.

Additional fossil fuel projects should be ruled out.

### resource management act

Climate change is a complex issue, requiring action at all levels – individual, local, regional, corporate, national and international.

The Resource Management Act (RMA) was amended in 2004 to remove regional councils' ability to directly manage and regulate greenhouse emissions.

- The Climate Protection Bill (Resource Management (Climate Protection) Amendment Bill 2006), proposed by the Green Party, should be adopted.

This bill would re-instate the ability of regional authorities to directly regulate greenhouse pollution, and is therefore the best available means of addressing the regulatory vacuum on greenhouse pollution. Once a price on carbon was implemented this could be re-assessed.

### end subsidies to fossil fuels

Fossil-fuel energy sources receive an estimated \$250 billion to \$300 billion in subsidies per year worldwide, heavily distorting markets.

Subsidies artificially reduce the price of fossil fuel energy and block the uptake of renewable energy out of the market place. Eliminating direct and indirect subsidies to fossil fuels would help to move us towards a level playing field across the energy sector.

### transport

#### domestic transport - reducing our dependence on roads

There is great potential to reduce greenhouse gas emissions from New Zealand's transport sector. Our per capita CO<sub>2</sub> emissions from transport are fourth highest in the world.<sup>4</sup>

Steps to reduce transport emissions should follow a hierarchy of action:

- Reduce the need to travel.
- Choose a low-impact means of travel.
- Choose a low-impact propulsion system.
- Improve the efficiency of propulsion.

Reduced transport emissions can be achieved by:

- Ensuring that urban planning processes allow reduced need for travel through more numerous centralised nodes.
- Encouraging information technology, such as video or web-based conferencing, which reduce the need for travel for meetings. Government departments should lead by example on this.
- Shifting urban journeys from road to public transport, walking and cycling.
- Boosting the proportion of the Land Transport Fund spent on public transport from the current 15 per cent to at least 50 per cent by 2010.
- Shifting longer-distance freight from road to rail and sea.
- Shifting domestic air transport to rail and sea-based systems.
- Introducing a mandatory percentage of biofuel to be mixed with regular petrol, starting from 5 per cent and increasing over time.
- Creating a major programme to encourage local production and usage of biofuels, including incentives for retailers to provide greater proportional mixes of biofuel in their petrol.



- Establishing a sustainability certification program for biofuels<sup>5</sup>.
- Introducing a range of measures to improve vehicle fleet efficiency and to encourage the uptake of electric plug-in hybrid vehicles. These would include:
  - the introduction of vehicle emissions standards and tests for all vehicles<sup>6</sup>;
  - fuel-efficiency standards for newly registered and re-registered vehicles equivalent to those prevailing in the country of manufacture;
  - a ban on the import of used vehicles more than seven years old;
  - a fuel-efficiency labelling scheme for all vehicles;
  - a differential registration or feebate scheme based on fuel efficiency.

### international transport

International transport (air and maritime) emissions are not covered in this scenario, but will have to be addressed by New Zealand.

New Zealand should respond proactively by:

- Switching exports by air to more efficient maritime transport.
- Developing sailing or hybrid cargo ships.
- Developing products that have a high value-to-weight ratio.
- Reducing emissions from all levels of production of our products as a response to the rising and inevitable concern about “food miles”.
- Encouraging the consumption of domestically produced products.
- The tourism sector should start planning for fewer, but longer and higher-value visits from international visitors, and actively encouraging New Zealanders to holiday domestically.

### energy revolution: a sustainable pathway to a clean energy future for new zealand

The Energy Revolution Scenario is a development pathway to a sustainable and secure New Zealand energy supply.

Renewable energy sources such as wind, solar, hydro and biomass account for about 18 per cent of New Zealand’s primary energy demand. Biomass (i.e. wood), which is used primarily for heating, is the main renewable energy source. The share of renewable energies for electricity generation was 57 per cent in 2006, with hydro power plants being the largest source. The contribution of renewable sources to heat supply is around 11 per cent. About 82 per cent of the New Zealand primary energy supply is from fossil fuels.

#### reference

**4** IN 2003, NEW ZEALAND WAS THE FOURTH HIGHEST EMITTER AMONGST ANNEX 1 PARTIES WITH RELIABLE DATA, WITH EMISSIONS 15 TO 40% HIGHER THAN THOSE ACHIEVED IN MOST COUNTRIES. NEW ZEALAND IS ALSO UNIQUE AMONGST ANNEX 1 PARTIES IN THAT TRANSPORT EMISSIONS ARE A GROWING SHARE OF ENERGY EMISSIONS, DESPITE RAPID GROWTH IN FOSSIL FUEL USE FOR ELECTRICITY GENERATION.

Exploitation of existing large energy efficiency potentials will reduce the current primary energy demand from 658PJ/a (2003) to 638PJ/a in 2050 while the population increases over the same period by more than 1 million people. This dramatic reduction in primary energy demand is a crucial prerequisite for achieving a significant share of renewable energy sources in the overall energy supply system, and for reducing the consumption of fossil fuels.

- The electricity sector will continue to be the forerunner of renewable energy utilisation. By 2025, 100 per cent of electricity will be produced from renewable energy sources (including hydro). A capacity of 14GW will produce 64TWh/a from renewable energy sources in 2050.
- In the heat supply sector, the contribution of renewable sources will continue to grow, reaching more than 82 per cent in 2050. In particular, biomass and geothermal energy will substitute conventional systems for direct heating and cooling.
- The priority in the transport sector is reducing the need to travel, switching to lower-impact travel methods (such as public transport), switching to more climate-friendly fuels and technologies (such as sustainably sourced biofuels and plug-in hybrid electric cars to store and use excess renewable energy from the grid - predominantly wind energy) and on improving efficiency. Because the use of biomass for CO<sub>2</sub> reduction in stationary applications is more cost effective, the use of biofuels is limited by the availability of biomass sustainably sourced within New Zealand.

By 2050, nearly three quarters of the primary energy demand will be covered by renewable energy sources. A balanced and timely mobilisation of all renewable energy technologies is vitally important to the attractive growth of renewable energy sources. This mobilisation depends on technical potentials, actual costs, cost reduction potentials, and technological maturity.

### development of CO<sub>2</sub> emissions

On our current track, New Zealand’s CO<sub>2</sub> emissions will more than double by 2050. If we follow the Energy Revolution path, CO<sub>2</sub> emissions will decrease by 72 per cent, from 31.17Mill. t in 2003 to 6.46Mill. t in 2050. Annual per capita emissions will drop from 8 tonnes/capita to 1.3 tonnes/capita. While today the electricity sector contributes about 19 per cent of CO<sub>2</sub> emissions, this will drop to zero by 2025.

#### references

**5** THERE IS A SIGNIFICANT GLOBAL RISK THAT LAND CLEARANCE FOR BIOFUEL PRODUCTION (EG SUGAR CANE AND PALM OIL PLANTATIONS) MAY GENERATE ADVERSE CLIMATE EFFECTS THROUGH LOSS OF CARBON SINKS, ENERGY INTENSIVE PRODUCTION METHODS, AND METHANE FROM ROTTING VEGETATION. THESE CAN OFFSET THE CLIMATE BENEFITS OF BIOFUEL USE. THIS IS IN ADDITION TO THE ECOLOGICAL AND SOCIAL IMPACTS OF INCREASED DEFORESTATION.

**6** EMISSIONS TESTING – WHILE NOT DIRECTLY RELATED TO FUEL-EFFICIENCY – WILL HELP REMOVE OLDER HEAVILY WORN VEHICLES FROM THE FLEET.

**costs**

Electricity generation costs under the Energy Revolution will steadily decrease, while those in the Reference Scenario continue to climb. By 2050, generation costs will be more than 40 per cent less than in the Reference Scenario. Due to growing demand, we face a significant increase in society’s expenditure on electricity supply. Under the Reference Scenario, the unchecked growth in demand, the increase in fossil fuel prices and the cost of CO<sub>2</sub> emissions result in total electricity supply costs rising from today’s 2.8 billion \$ per year to 7.3 billion \$ in 2050. However the Energy Revolution Scenario not only achieves significant reductions in CO<sub>2</sub> emissions, but also helps to stabilise energy costs and relieve the economic pressure on society. Increasing energy efficiency and shifting energy supply to renewable sources leads to a reduction of long term costs for electricity supply by more than 40 per cent than in the Reference Scenario. It becomes clear that following stringent environmental targets in the energy sector also pays off economically.

**effects on employment**

The rapid growth of renewable energy technologies described under the Energy Revolution Scenario will lead to large investment in new technologies. This dynamic market growth results in a shift of employment opportunities from conventional energy-related industries, like coal mining, to new occupational fields in, for example, the wind and solar industry. There are more jobs per kilowatt hour in electricity generated from renewable energy sources than in fossil fuels.

Under the Energy Revolution Scenario, an estimated 2600 to 6000 annual jobs are required to manufacture and install renewable energy electricity generation – a total of 122,000 to 282,000 job years through to 2050. This includes only the direct manufacturing jobs. If ongoing operational and maintenance jobs were included, the figures would be higher still, and a significant number of education and training positions would also be required to train these workers.

**to make the energy revolution real and to avoid dangerous climate change, new zealand must:**

- Set national greenhouse pollution targets
- Establish an economy-wide cost on carbon for 2008. Leaving it until 2012 will be too late.
- Achieve a 100 per cent renewable electricity supply by 2025, phasing out coal as a first priority and using gas as a transitional fuel until 2025.
- Invest in an effective public transport system.
- Move to a rail and sea-based freight system.

**figure 1: new zealand: development of primary energy consumption under the energy revolution scenario**  
(‘EFFICIENCY’ = REDUCTION COMPARED TO THE REFERENCE SCENARIO)

