



## **Healthy, wealthy, and wise**

A health impact assessment of  
*Future currents: Electricity scenarios*  
for New Zealand 2005–2050

November 2006

This report and other publications by the Parliamentary Commissioner for the Environment are available on the Commissioner's website: [www.pce.govt.nz](http://www.pce.govt.nz).

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## Preface

Human activity has transformed the planet's ecosystems over the last 100 years and the pressure is increasing. The complexity of the interactions is such that the outcomes are uncertain. Many of the changes have delivered great gains in terms of provision of food, water, and energy services. However, this has been achieved at some cost to ecosystem services, and resulted in growing inequities across groups in society and adverse impacts on human health.

Human health and well-being depend on the condition of the ecosystems of which we are a part. Despite huge advances in technology we depend on nature for the basics of life – the air we breathe, the water we drink, and the food we eat. Safeguarding these fundamentals is essential to our well-being and that of future generations.

This study explores the public health outcomes of two scenarios for New Zealand's electricity sector – business as usual and smart design (as outlined in *Future currents*, PCE 2005). It clearly demonstrates that the health benefits are greater under the smart design scenario, with its stronger focus on energy efficiency and small-scale generation. These benefits are on top of improved energy security and a reduction in greenhouse gases.

The use of health impact assessment (HIA) is a first for our office. Recommendations from previous PCE investigations have acknowledged the importance of health impacts and considered the effects on communities. The HIA approach and its tools have enhanced the effectiveness of such considerations.

Given the ongoing alteration of the planet's ecosystems, the links between community health and ecosystem function will be a high priority for the future.



**Helen Beaumont**  
**Assistant Parliamentary Commissioner for the Environment**

## Recommendations

Using energy more efficiently has a positive impact on health and well-being, especially at the household level. Increased support for targeted assistance programmes, such as the *Healthy Homes* initiative, would produce further cost-effective efficiency gains. So too would more programmes that offer targeted low-interest loans and grants for energy efficient investments in homes. People are more likely to commit to improving their home's energy efficiency if they have access to information, knowledge, and financial assistance. National promotional campaigns are another useful way of increasing public awareness of the benefits of being more energy efficient.

**Recommendation 1: The promotion of public health should be a key objective of any energy strategy. Thus the Minister of Energy should ensure that the forthcoming National Energy Strategy and the revised National Energy Efficiency and Conservation Strategy (NEECS) both contain meaningful objectives and measurable targets to protect and promote public health.**

Designing buildings to be energy efficient means that houses are more likely to be warm and dry. Good retrofitting can yield similar results. Although mandatory insulation of new homes has been beneficial, there is room in the Building Code for much stronger provisions for energy efficiency, particularly in terms of a building's thermal performance and its use of natural light. [Note: as this report went to press, the Government announced that it is considering a number of measures to improve the energy efficiency of buildings. A decision is due in April 2007.]

**Recommendation 2: That the Minister of Building and Housing amends the Building Code with significantly stronger provisions for energy efficiency to ensure that buildings are designed, built, and renovated in much more energy efficient ways.**

At the moment, New Zealand's electricity system is dominated by remote, large-scale generation. However, huge potential exists for local utilisation of energy resources to become more widespread. Benefits would include regional and local economic development, greater self-sufficiency in energy, and improved social connectedness within communities.

**Recommendation 3: That the Minister of Energy ensures that the National Energy Strategy contains provisions that give greater support to microgeneration technologies and energy efficiency initiatives.**

Central government support is needed to ensure that the potential for these technologies is realised. This means supporting industry training in emerging technologies, and assisting communities to build their capacity and capabilities to develop local energy resources and implement energy efficiency improvements.

**Recommendation 4: That the Ministers of Education and Tertiary Education respectively increase government funding for agencies such as the Tertiary Education Commission and the New Zealand Qualifications Authority to increase support for training courses and apprenticeships that cover energy efficiency and microgeneration technologies. This applies to architects, builders, building inspectors, plumbers, electricians, and real estate agents, among others.**

Investing money in energy efficiency can lead to lower energy and health costs over time. With changing demographics likely to increase pressure on the health service in the future, any measures that might improve long-term health and well-being should be carefully considered.

**Recommendation 5: That central government funding for energy efficiency should be substantially increased and cross-party agreement sought to guarantee ongoing support beyond the election cycle.**

After 2013 many rural communities may face either a huge increase in their distribution charges for electricity or disconnection from the grid. This is likely to have a negative impact on health and welfare in these communities.

**Recommendation 6:**

- (a) That the Minister of Energy ensures that EECA be given greater resources to help vulnerable communities to become more efficient and self-sufficient in their energy use**
- (b) That central government investigates and supports the best agency or agencies to plan and implement the necessary programmes that will ensure rural communities have a secure supply prior to this changeover.**

Many challenges will arise from more localised ownership and use of energy resources. These often involve new technologies as well as people taking a more active role in their energy use. There should be no barriers to the uptake of these technologies given their long-term benefits. It is essential that community development skills be increased in line with increased expectations to develop community-owned and -run energy resources.

**Recommendation 7: That the Minister of Economic Development investigates the potential business opportunities that will arise at the regional level from the development of distributed energy resources.**

The type of home heating is a key determinant of human health. Unflued gas heaters are detrimental to human health and expensive to run; yet approximately 40 percent of New Zealand households own one.

**Recommendation 8: That the Minister of Consumer Affairs introduces a regulation to promptly phase out the sale of unflued gas heaters in New Zealand. Furthermore, programmes should be targeted to encourage existing users to replace them with safer and healthier heating devices.**

## 1 Introduction

### 1.1 Project context

In 2005, the Parliamentary Commissioner for the Environment (the Commissioner) produced a report, entitled *Future currents: Electricity scenarios for New Zealand 2005–2050*.<sup>1</sup> The report explored future electricity demand and supply options using two fundamentally different scenarios (*Fuelling the future* and *Sparking new designs*) based on different sets of assumptions.

The project challenged established thinking by presenting two stories of the future as seen through the eyes of an urban woman (Robyn) and rural man (Shane) as they moved through their lives to the year 2050. The potential impact of the different energy pathways on their social and economic lives was described.

The report briefly touched on well-being and health, but the linkages were more implicit than explicit. A health impact assessment (HIA) of the two scenarios was thus identified as one way of making these energy and health linkages more explicit. Quigley and Watts Ltd was commissioned to undertake the work.

#### 1.1.1 Overview of the two scenarios

##### ***Fuelling the future***

The first scenario (*Fuelling the future*) assumes that there is a small investment in energy-efficiency measures in all sectors and that a growing demand for energy services continues to be provided for by increased, largely bulk-generation capacity. These assumptions are consistent with past experience and generally assume a business-as-usual approach.

##### ***Sparking new designs***

The second scenario (*Sparking new designs*) assumes a greater improvement in energy efficiency through smart design. Measures such as efficient lighting, air conditioning, and machinery see substantial investment. Moreover, in this scenario the residential sector embraces, to a greater extent, technologies such as solar hot-water heating and measures such as improved insulation and house design. Consequently, less electricity is required to provide the same level of comfort and services.

### 1.2 Report objectives

The purpose of this HIA report is to:

- introduce the scenarios in *Future currents*
- outline the concept of an HIA
- present the scope of the methodology used to conduct the HIA

- present the outcomes of the workshop
- provide evidence for the health impacts identified
- present the recommendations based on outcomes.

Quigley and Watts Ltd and the Commissioner worked with all stakeholder organisations to ensure the recommendations were relevant and achievable. This HIA makes some specific recommendations to relevant agencies. The aim is for decision makers to have more information at their disposal that can inform energy and health policy and to manage the two sectors in a more holistic manner.

### 1.3 What is a health impact assessment?

An HIA is defined as:

*A combination of procedures, methods and tools that systematically judges the potential and sometimes unintended, effects of a policy, plan, programme or project on both the health of a population and the distribution of those effects within the population. HIA identifies appropriate actions to manage those effects.<sup>2</sup>*

There is increasing interest that government policy decisions and proposals undergo an assessment of more than just their economic and environmental impacts. An HIA is one way of providing additional information about the direct and indirect consequences on population health and well-being that are likely to arise from government strategies, policies, programmes or proposals.

### 1.4 What underpins a health impact assessment?

Public health and well-being are not solely determined by the health sector, as many people assume. The health sector spends the majority of its budget on treating unwell people (making a significant contribution to population well-being), but only a very small amount (approximately 2 percent in direct funding channels) on trying to prevent illness. The majority of public sector spending is delivered across other sectors, such as energy, agriculture, industry, and transport.

These other sectors outstrip the health sector in their potential to affect, protect, and promote population health, because they have a considerably larger proportion of resources at their disposal. Their actions can also have a significant impact on environmental and social health. That is one reason HIAs largely focus on the proposals of the non-health sector.

For example, public health and well-being are not solely determined by individual lifestyle factors like smoking, fruit and vegetable intake, and/or obesity. These factors undoubtedly contribute to population health and well-being by influencing the risk of developing many diseases, but they are not recognised as the sole determinant.

The community in which people live, work, play, and study is where our illnesses and injuries develop and occur – so, for example, homes that are dry and warm, workplaces that are safe, and streets that promote walking and cycling are some of the places where community health and well-being are largely determined.

Overarching the individual and environmental factors are broader social and economic environments, for example, sound and reliable governance, unemployment rates, general economic conditions, and social support structures. Imagine countries where these things are not in place, and it is easy to see their impacts. All the factors mentioned above are important and are often intertwined and connected.

Appendix A lists the determinants of health (Appendices are available on the PCE's website). When these determinants are affected by a proposal, then health and well-being will also be affected, either directly or indirectly. An HIA helps to assess how the broader determinants of health are affected by a proposal.

## **1.5 Other information about health impact assessments**

An HIA can be carried out as an individual study, but is sometimes addressed as part of an integrated assessment with either environmental and/or social assessments. An HIA is best undertaken before a project is implemented so that measures can be recommended that will help increase the positive aspects of a project and minimise or avoid any negative impacts. Evidence is gathered in both quantitative and qualitative forms and may include literature, expert advice, and community participation. While environmental assessments do not typically identify the positive effects of a strategy, an HIA usually does. This is particularly helpful when trying to justify the adoption of strategies, or to seek funding.

HIA is widely used in many countries throughout the world (particularly in Europe and Canada) and is an established methodology encouraged by the World Health Organization (WHO) and the European Union. However, HIA is still in its infancy in New Zealand. This is rapidly changing thanks to a number of initiatives:

- the Public Health Advisory Committee has released its second edition of guidance on carrying out policy-level HIA within New Zealand<sup>3</sup>
- the draft Public Health Bill promotes HIA as a tool to improve health within New Zealand
- the New Zealand Health Strategy promotes the consideration of health in non-health sector decision making.

Furthermore, the Human Rights Commission recommends its use at the strategic level, and government legislation is placing public health higher on the agenda within the transport and local government settings.

## 2 Methodology

### 2.1 Setting the scope/boundaries of the health impact assessment

A scoping group (listed in the acknowledgements) was set up to determine the boundaries for the HIA. Group members were sent information before the half-day meeting, outlining issues to consider. At the meeting the group made the following recommendations about the HIA and its scope:

- identify the positive and negative public health outcomes of each scenario
- effectively communicate the public health impacts of using energy services
- build capacity within the Office of the Parliamentary Commissioner for the Environment
- use this HIA as a flagship HIA across the public sector
- raise the concept of public health within a sustainable development framework by:
  - developing political will of decision makers
  - changing the political will to make longer term strategic decisions
  - personalising the positive and negative impacts
  - raising awareness of the links between energy use and health, so people and communities are empowered to make better use of their energy resources.

### 2.2 Elements of the framework to be assessed

Several elements within *Future currents* were able to be assessed within the HIA, covering:

- both the *Fuelling the future* and *Sparking new designs* scenarios
- rural and urban contexts
- three timeframes for the two scenarios, from 2005–2015, 2015–2030 and 2030–2050.

The types of impacts over the respective time periods are likely to be similar (with substantial overlaps), but severity may increase over time, or the development of an impact may not occur until later time periods.

## 2.3 Populations affected

It is typical within an HIA to focus on population groups that will likely be affected. This HIA is interesting in that the 'population affected' consists of two fictional characters – Robyn and Shane.

- Robyn represents urban people. She is 21 years old in 2006, New Zealand European, university educated, and in a professional job, with three children to be born in the future.
- Shane represents rural people. He is 21 years old in 2006, Maori, educated, and working on his farm, with two boys to be born in the future.

This presents an easily digestible view of New Zealand in the future, ensuring that the scenarios are readable and understandable. However, it leaves little room for exploring inequalities in how the different scenarios will affect more vulnerable populations.

Normally, when policy options are implemented, the effects on 'mainstream' populations, who have multiple resources to fall back on, are less stark than the effects on vulnerable populations. Vulnerable populations are typically affected more severely by negative impacts and take longer to bounce back.

Therefore, it was considered useful to investigate these disparities by gently expanding the population groups within the HIA to include relatives of Shane and Robyn who have low incomes and/or are Maori:

- Shane (as he is) and his lower socio-economic/Maori relatives from the East Coast (rural)
- Robyn (as she is) and her low-income parents (urban).

## 2.4 Determinants of health and well-being affected

The brief was to present a rapid HIA; this required a focus on selected determinants of health. Those most prominent within *Future currents*, and those suggested at the scoping meeting (and in further discussions) to be covered in the HIA were:

- housing and buildings (new developments, planning rules, building codes, energy use, and indoor air pollution)
- economics (individual costs for energy, what the money is spent on, and local and regional business development)
- social connectedness (democracy, sense of control, and pride of community).

It was noted that some of the determinants not chosen as a focus would likely be touched on within the HIA anyway due to their overlapping nature. This includes some wider geographical determinants such as local and regional air and water quality.

## 2.5 Carrying out the appraisal

A half-day appraisal workshop was hosted by the Commissioner with the purpose of informing the HIA. It was the key opportunity for a broad representation of stakeholders to be involved in the HIA process. The workshop aimed to gather stakeholder views on the question **how will the scenario (either *Fuelling the future* or *Sparking new designs*) affect the determinants of health for the identified populations?** It then gathered suggestions for the scenarios to improve health and well-being, or to reduce any harmful impacts.

The people invited to the workshop (listed in the acknowledgements) were those who:

- were knowledgeable about energy issues
- had an interest in public health
- represented particular population groups of focus.

In preparation for the workshop, a considerable amount of data was collected and summarised for the participants to use. This included a description of the *Future currents* document and the two different scenarios (Appendix B); evidence about the link between relevant interventions and health impacts; and a brief profile of the populations being considered (see Appendix C on PCE's website). Data was sought from a variety of agencies.

The workshop split participants into three groups and each group was given one of the three determinants of health to work on in relation to each scenario (*Fuelling the future* and *Sparking new designs*). For both communities (urban and rural), the groups covered:

- *Fuelling the future* – housing and buildings
- *Fuelling the future* – economics
- *Fuelling the future* – social connectedness
- *Sparking new designs* – housing and buildings
- *Sparking new designs* – economics
- *Sparking new designs* – social connectedness.

The groups followed a set structure of work-group questions adapted from the Public Health Advisory Committee's (PHAC) HIA Guide (2005). The matrix included the following (for each determinant of health):

- How might each of the scenarios affect the determinants of health and/or well-being?

- Describe the potential direct or indirect health and well-being impact and the causal chain.
- What evidence (e.g. past experience, facts) is there for any answers given?
- List the populations potentially affected, and list populations who may be differentially affected (benefit/suffer most).
- Describe the key factors that may encourage or prevent the health and well-being impact.

After the group work, a workshop plenary session was used to appraise the entire *Future currents* document.

Following the workshop, the authors framed the results within the matrices of the PHAC's HIA guide to further test, integrate, and explore concepts and impacts. Please see Appendix D on the Commissioner's website for the full matrices.

### 3 Discussion

The three determinants of health that were the focus of the HIA (economics, housing, and social connectedness) have a number of linkages to health and well-being that are explored below.

#### 3.1 Economics

##### 3.1.1 The relationship between energy and economics

In 2003/04 New Zealand households spent an average of \$28 per week on domestic fuel and power, up 17.4 percent from 2000/01. The cost of obtaining energy services can be a significant proportion of a household's outgoings. Domestic fuel and power made up 25 percent of total household operations expenditure, and 3 percent of total household expenditure, which was the same as in 2000/01.<sup>4</sup> The cost of obtaining energy services depends on a number of factors, including the time of year, the characteristics of the building, the size and age composition of the household, household income, and the number and type of appliances in use.<sup>5</sup>

High housing costs, in part from higher fuel and power prices, contribute to considerable hardship for low-income families. Energy costs are rising rapidly and this will further increase the relative expenditure on domestic fuel and power.

The way electricity is priced in New Zealand does not generally encourage energy-efficient behaviour. Apart from a general day-night tariff option available to some consumers, there are few incentives for consumers to shift or shed their electricity load away from the peak periods in the morning and evening. This issue was also noted in a London-based HIA, which alluded to the 'perverse incentives' in electricity use, where higher users pay less per unit than those in disadvantaged groups.

A study in Thailand revealed that economic advantages can be gained from using alternative energy sources. The Power Development Plan study examined three energy creation options, comparing renewable sources against gas or coal sources.<sup>6</sup> Assessment of seven economic criteria showed that renewable sources had many economic advantages over the other options, including:

- creating more jobs
- requiring smaller investments that constantly yielded lower generation costs
- having lower import burdens
- having a higher GDP contribution to the economy
- being a more flexible and secure investment option.

London's experience also suggests that radical restructuring of the energy sector away from large-scale generation projects would create many opportunities for employment

and revitalization. This was perceived as an opportunity to promote local employment and training opportunities through apprenticeships in manufacturing, installing, and maintaining green technology.<sup>7</sup> Similarly, business and economic development was predicted to improve in London if economic development strategies supported energy conservation, double glazing, and efficient heating industries.<sup>8</sup>

The Economic Development Strategy in London noted that energy is a major cost across the economy. Improved energy management can yield significant gains across the business, voluntary, and government sectors. An example is integrating energy costs into a broader understanding of building design and management.<sup>9</sup>

### **3.1.2 The relationship between economics and health**

Many variables can represent 'economics', and different variables have been associated with potential health impacts through causal pathways. For example, both low-income and low-socio-economic backgrounds place people at greater risk of exposure to health hazards, reduce their access to services, and reduce their resilience to deal with such setbacks. As income decreases, rates of poor health increase, including chronic diseases and death. The effects of multiple disadvantages magnify these impacts:

*The strongest influences on people's health come from factors outside the health system. They include the social, cultural, physical and economic environments in which people live.*<sup>10</sup>

People on low incomes are also more likely to live in poor quality and/or crowded housing, and be unable to heat their houses to an appropriate level (which leads to health impacts).<sup>11</sup> This is acknowledged by the London Health Commission (2002: 8): "Those properties in the poorest condition are likely to be the most affordable to rent or buy, but also the most expensive to run, and particularly to heat."

For many low-income families, energy is just another cost that has to be balanced and sometimes traded off against other essentials such as food and health costs.<sup>12</sup> Food poverty is associated with a number of health outcomes including obesity (what little money people have is spent on high-energy, nutrient-poor foods). Inability to access health services due to lack of money is commonplace, resulting in complicated hospital admissions with more severe health outcomes that could have been anticipated and treated quickly and easily by a general practitioner (GP).

Poverty and lack of disposable income can contribute to social exclusion and isolation; for example, a person with little disposable income might be less able to participate in the community.<sup>13</sup> Social isolation and exclusion are associated with increased rates of premature death and poorer chances of survival after heart attack, lower immune function, higher neuroendocrine and cardiovascular activity, and reduced physical activity.<sup>14</sup>

Also, low-income households are more likely to have their power disconnected for non-payment. Paying a reconnection charge to get their power back on compounds their problems, further reducing funds for food, health care, and taking part in community activities.

A second variable often used to consider socio-economic disadvantage and health is the New Zealand Deprivation Index.<sup>15</sup> The index uses a broad range of socio-economic variables derived from census data, (such as income, access to a car, living space, home ownership, employment, qualifications, support, and access to a telephone) to generate an overall score of deprivation for a particular place. The deprivation level of the small geographical areas in which people live is a useful predictor of variation in health status and risk of disease, including obesity, diabetes, heart disease, and respiratory disease.<sup>16</sup>

Finally, economic factors are one of the major drivers of inequalities, as these factors are not equally available to different sectors of society. Inequalities affect health outcomes such as cardiovascular disease, cancer, diabetes, obesity, and the availability of food.

It is important to note that there is two-way traffic between health and economic development. Not only can economic development affect people's health, but also people's health can significantly affect economic development. Therefore, health is a mainstream issue for economic development and this should be reflected in any strategy.<sup>17</sup>

### **3.1.3 Energy interventions that work to improve economic factors and health**

There are several barriers to improving energy efficiency in households. For many, the main barrier is the upfront capital cost for things like insulation (e.g. of roofs and hot-water cylinders), efficient heaters, and dehumidifiers. Lack of awareness is another factor to consider. People may not be fully aware of the relative costs and benefits of investing in alternative ways of obtaining their energy services. Others may have neither the time nor the inclination to do so.

There is very little demand for energy efficiency specialists – this is particularly true for households. The Energy Efficiency Conservation Authority (EECA) and some other agencies do run small projects to conduct energy audits of household energy use. Some initiatives are targeted at vulnerable populations.

London's experience suggests that an energy strategy that ensures security of energy supply, and investment in energy efficiency and local generation, contributes to maintaining good health.<sup>18</sup>

## 3.2 Buildings and housing

The characteristics of the buildings we live and work in have a major influence on health and well-being; in particular, how the buildings are designed and built, and how they are heated and cooled. These characteristics vary quite markedly in the two scenarios in *Future currents*. The outcomes have significant implications for the health and well-being of both Robyn and Shane.

Building attributes that matter to human health and well-being include – air, light, thermal control, ergonomics, privacy and interaction, access to nature, land use, and mobility. Various studies support improving these attributes.

### 3.2.1 New Zealand's housing stock

Until relatively recently, New Zealand's houses have not been well designed for warmth and comfort. Many are cold, damp, draughty, and uninsulated, and don't fully utilise sunlight. An estimated one-quarter of New Zealand's homes are uninsulated.<sup>19</sup>

In 1996 the New Zealand Building Code was revised to require greater consideration of energy efficiency in new building design, domestic hot-water heating, and commercial lighting. The most significant change was the mandatory requirement for new houses to be insulated. A fully insulated house needs up to half the amount of energy to heat it as an uninsulated house.<sup>20</sup>

The *National Energy Efficiency and Conservation Strategy* (NEECS) is the main mechanism used to improve the building stock.<sup>21</sup> Its overall objectives are to:

- upgrade the performance of the existing building stock
- achieve best-practice design in new buildings
- improve appliance energy efficiency best practice.

Various means are used to promote these objectives, including information and education, incentives, standards, design briefs, and industry research.<sup>22</sup> A key NEECS<sup>23</sup> objective is to retrofit insulation into 100,000 homes by 2016, focusing in particular on low-income households.<sup>24</sup> This programme installs floor and ceiling insulation, wraps hot-water cylinders and lags pipes, and installs energy efficient light bulbs.

The *Healthy House Programme* is another initiative of note, jointly promoted by district health boards and Housing New Zealand. The programme upgrades insulation and ventilation as part of a wider range of measures aimed at reducing the effects of crowding. Evaluation of the programme has shown a 37 percent reduction in housing-related preventable hospital admissions as a result of improved housing conditions and interventions to reduce crowding.<sup>25</sup> Housing evaluations by Auckland Uniservices Ltd (2004) have found wider social and health impacts, including increases in overall well-being, increased perception of safety, and a sense of comfort, pride, and happiness in people's homes.

People on low incomes are more likely to live in crowded conditions in poorly insulated and cold houses. There is a strong correlation between these conditions and the incidence of respiratory illnesses:

*Living in a substandard house is an independent and additional source of stress; it also affects physical health through allergens, pest infestation, poorly functioning heaters or stoves and toxic chemical exposure. Long periods in poor housing during childhood have a negative effect on adult health.<sup>26</sup>*

Levels of stress and anxiety are, not surprisingly, closely linked to energy poverty. If people cannot afford to heat their houses and keep them dry, they have a less comfortable living environment and are more susceptible to illness.

Housing design has significant impacts on the risk of housing-related diseases, conditions, and injuries, such as respiratory diseases, rheumatic fever, meningitis, falls, burns, and driveway accidents. These lead to children taking more days off school, adults taking more days off work, more visits to GPs and more hospitalisations.<sup>27</sup> Housing design, indoor air quality, dampness, and mould growth all have strong associations with health outcomes. Intervention research has shown improved mental health and well-being with housing improvements.<sup>28</sup>

Poor housing increases the risk of injury from unflued gas heaters and exposed heating sources, faulty wiring or appliances, poor storage, flammable materials, and lack of functioning smoke alarms. Also, the longer people live in poor housing, the more it affects their mental and physical health; children are particularly vulnerable.<sup>29</sup>

The current *Housing, Insulation and Health Study* provided some useful data on how investing in insulation can reduce long-term health costs. Insulation was installed in 1400 households costing on average \$1800 per house. Follow-up studies found that people in these households visited the doctor less and took fewer sick days. These benefits were valued at more than \$3600 per household.<sup>30</sup> Assistance from this programme and others like it is essential, because low-income households cannot afford the capital costs of the insulation.

These measures have all achieved some useful results. However, given the magnitude of the problem and the relatively poor condition of the housing stock, they could be rolled out on a much wider scale. The Building Code could also be strengthened to further integrate energy efficiency into design and construction, and the types of appliances that are installed. Providing and promoting information is also important.

Investing in energy efficiency at the design and construction stages can add to the initial costs of the building, but will result in lower overall energy costs. Thus, orienting the building to take advantage of natural light and heat, and providing opportunities for shade and ventilation means less electricity will be needed to provide these energy services over time.<sup>31</sup> This is as true for households as it is for commercial buildings.<sup>32</sup>

There are also a number of private initiatives in energy efficient building design and construction. While some employ emerging technologies, others have demonstrated the possible efficiency gains from smarter use of existing technologies.<sup>33</sup>

### **3.2.2 Types of home heating**

The type of heating used in households is an important variable for energy efficiency, energy poverty, and human health. Many houses use inappropriate heating methods.

The average indoor temperature of many New Zealand homes (possibly up to one-third) is below the 18 degrees Celsius recommended by the WHO.<sup>34</sup> Many of these homes are occupied by low-income groups and by the elderly and children, who are particularly susceptible to the effects of cold, damp houses.

The *Household Energy End-Use Project* (HEEP) reported that of the 400 households covered in their survey, 11 percent had open fires and 44 percent had an LPG heater. Solid fuel burners were used in 52 percent of these households. HEEP data suggest that the use of solid fuel burners for space heating is more widespread than official statistics indicate, accounting for at least 15 percent of domestic energy use.<sup>35</sup>

Another salient conclusion from the most recent HEEP survey is the poor performance of electric hot-water cylinders, with many of the units operating at an unsafe temperature and/or being poorly lagged.

Unflued gas heaters are also widely used in New Zealand. Like many heaters, they are relatively cheap to buy, but more expensive to run. They emit carbon monoxide and water vapour, both of which contribute to unhealthy indoor air quality, dampness, and mould.<sup>36</sup> If the house is poorly ventilated these problems are compounded. The impacts can be particularly severe on children, pregnant women, elderly people, and those with asthma or heart conditions.

Rooms that contain unflued heaters should ideally be ventilated, but this seems counter-intuitive. Many people, perhaps unaware of the health risks, might wonder why you should have a heater on and a window open at the same time. Thus, providing education and information is also important. Labelling appliances is another way to raise awareness. Going a step further, appliance standards could also be used.

Open fires are particularly inefficient, as much of the heat is 'lost' up the chimney. Open fires are also a major source of air pollution in some urban areas, particularly where climatic conditions tend to trap the pollutants (e.g. in Christchurch in winter when inversion layers form). Solid fuel burners and, to a lesser extent, open fires are a significant source of space heating throughout the country.

### 3.2.3 Commercial buildings

Many commercial buildings use more energy than they really need, particularly for lighting and air conditioning. For new buildings, greater attention to energy efficiency at the design and construction stages can yield huge savings. Existing buildings can also be effectively retrofitted. Ongoing improvements in energy management techniques can prove worthwhile.<sup>37</sup>

EECA also promotes energy efficiency in commercial buildings through various schemes. These include *Energy Audit Grants*, which cover up to 50 percent of the cost of a firm's energy audit and the *Emprove* scheme aimed at medium and large energy users.<sup>38</sup>

The main benefits of improved energy efficiency in commercial buildings are reductions in total building energy use and in the peak demand for electricity.<sup>39</sup> Improving energy efficiency should ideally be used in tandem with pricing options that encourage users to more actively manage their demand. In other words, create economic incentives for firms to become more energy efficient and to have the flexibility to shift or shed their energy use away from peak times.

Quality lighting systems can reduce energy use by 27 to 88 percent depending on whether the focus is on improving lighting design and control systems or using higher quality fixtures.<sup>40</sup>

Improving lighting design can also improve worker productivity up to 23 percent. This represents huge savings to businesses. Natural lighting, shading, and use of high-quality task and ambient lighting fixtures can improve glare, heat, and energy costs. It can also improve health impacts on workers, such as decreasing the incidence of headaches.<sup>41</sup>

Increasing air quality through outdoor ventilation and natural ventilation significantly reduces respiratory illness, influenza, and absenteeism (9–20 percent). Individual temperature controls in a building can increase individual productivity by 2–3 percent and reduce energy use.<sup>42</sup>

## 3.3 Social connectedness and health

The two energy futures described in *Future currents* create different possible pathways for individuals, families, and communities. Each pathway has significant potential to impact on social connectedness in both positive and negative ways but, overall, *Sparkling new designs* has the greatest potential to protect and promote social connectedness.

Social connectedness means that:

*...people enjoy constructive relationships with others in their families, whanau, communities, iwi and workplaces. Families support and nurture those in need of care. New Zealand is an inclusive society where people are able to access information and support.*<sup>43</sup>

Social connectedness is valued differently by different communities, different stakeholders, and different decision makers. Decision makers need to recognise both the possible risks and the opportunities for social connectedness.

Many possible pathways link social connectedness (and similar concepts) and health.<sup>44</sup> Pathways relevant to this HIA include:

- sense of place
- sense of ownership
- access to services and the community (and inequalities in access)
- stress
- mental well-being.

### **3.3.1 Sense of place and ownership**

Sense of place and ownership are overarching concepts of interest to the health sector, where spaces are cared for and heritage respected, together with environments that are well designed, managed, and maintained. While these are common themes for planners and geographers, the level of study about why some places feel (and often are) better and healthier than others is limited,<sup>45</sup> partly due to the overarching nature of the themes. Other sub-themes such as access to services and access to the community are better studied, with linkages to neighbourhood and community functioning and resilience, social capital, and health outcomes.<sup>46</sup> Similar, but more tangible aspects that affect sense of place include safe environments, mixed land uses, and a reflection of diverse communities living in an area.

### **3.3.2 Access to social services and the community**

Access to social services and the community are important although they probably have less impact on health than an individual's socio-economic situation, such as their employment or educational level.<sup>47</sup> Certainly, services are often of lesser quality and more difficult to access in more deprived and rural areas.<sup>48</sup> Schools, in particular, act as important community focal points and facilities, so school closures can have far-reaching effects on local communities.<sup>49</sup>

Inequalities in access to health services have been researched extensively, although research has generally looked at socio-economic factors rather than urban design as such. Examples of inequalities include less access to health services for Maori and

Pacific people, people with mental health problems, immigrants, and people with disabilities. These inequalities generally relate to people's socio-economic situations, although neighbourhood factors also have an effect, including poor housing quality and tenure, high local unemployment, low community and political engagement, and fewer transport options both private and public.<sup>50</sup>

Friendship, good social relations, and strong supportive networks improve health at home, at work, and in the community. Belonging to a social network of communication and mutual obligation makes people feel cared for and valued. This has a powerful protective effect on health. When these are disrupted, negative health impacts occur.<sup>51</sup> Experiments suggest that good social relations can reduce the physiological response to stress.<sup>52</sup> Several studies have demonstrated links between social connectedness and the performance of the economy, as well as positive outcomes for individual health and well-being.<sup>53</sup>

Social isolation and exclusion are associated with increased rates of premature death, poorer chances of survival after heart attack,<sup>54</sup> lower immune function, increased stress, and higher death rates, whereas socially supportive interactions have the opposite effects.<sup>55</sup>

There are close linkages between social connectedness, community development, and ownership of energy resources. A local example of this is the *Bluff Healthy Homes Project* carried out by Awarua Research and Development.<sup>56</sup> The project, which aimed to insulate low income homes in Bluff, resulted in increased ownership, connectedness, and a greater understanding of personal and community benefits. Decision making was challenging, but a sense of community was strengthened as people had a neutral task to work on together. Supporting evidence shows that social connectedness is fostered when people have the skills and opportunities to make friends and to interact constructively with others, and when people feel safe and secure.<sup>57</sup>

## 4 Findings – *Fuelling the future*

### Local energy

In New Zealand most electricity is remotely generated well away from where it is used. The major electricity companies own most of the generation assets. Unlike some other countries, distributed generation is not widely used in New Zealand at present. These trends may or may not continue on a business-as-usual pathway in the future. *Fuelling the future* largely assumes that they do, based on the assumption that decision making in this scenario will mainly be based on proven technologies and established approaches.

After 2013, electricity line companies will no longer be required to supply electricity to all consumers. This could mean a sharp increase in distribution charges for some consumers, particularly those living in remote areas and, potentially, loss of access to the grid. Another driver will be a change in the availability of fuels for electricity generation.<sup>58</sup>

However, it is possible that the provision of energy services will become more dispersed and small scale, especially in rural areas, although not to nearly the same extent as in *Sparkling new designs*. This could create opportunities for local economic development and provide employment opportunities in the sector, plus innovations that might be exported to other markets. A lot depends on how energy and environmental policy evolves to meet these challenges, which is a key theme in the scenarios in *Future currents*. *Fuelling the future* teases out what might happen if this evolution of policy is lethargic.

### Energy efficiency

Under *Fuelling the future*, it is assumed that there is no significant strengthening of the Building Code or the Building Act 2004 to give greater effect to energy efficiency. The proportion of uninsulated houses drops incrementally throughout the scenario as the housing stock turns over. However, new buildings and subdivisions are still designed and built with insufficient regard to best-practice energy efficiency.

Research funding and policy responses remain dominated by large-scale supply-side solutions; this limits the funding and the extent to which the existing efficiency initiatives can be rolled out. Most households and businesses continue to have neither the knowledge nor the incentive to invest in energy efficiency improvements.

The demand for electricity keeps rising and pushes electricity prices up. As electricity costs rise, people are likely to keep fewer rooms in the house warm, especially if the house is difficult to heat anyway. Either that or they will heat their house sufficiently and cut back on spending in other areas.

## Energy poverty

A combination of higher living costs and higher birth rates among Maori and Pacific peoples creates more potential for overcrowding. Although many low-income homes are retrofitted under the existing initiatives, the additional pressures of overcrowding can swamp any gains. Overall indoor air quality does not improve significantly.

As energy poverty becomes more widespread, the overall health costs to the economy also rise. The numbers of days off work and school sick days are likely to be higher under *Fuelling the future*. Significant costs are therefore likely in both the energy and health sectors and these will be borne across civil society, the business sector, and the state.

Under the *Fuelling the future* scenario, market forces will be unlikely to encourage private rental owners to install energy efficiency measures in rental properties. Most energy efficiency will occur in private homes, such as Robyn's and Shane's, where affordability is higher. Robyn's parents and many of Shane's whanau, who are already on low incomes, will be the last to see any benefit. This could negatively affect both characters, because relatives living in cold and damp housing may need additional family care, social care, or institutional care. This will be a significant cause of stress and worry for the characters and their families.

### 4.1 *Fuelling the future* – Robyn's story

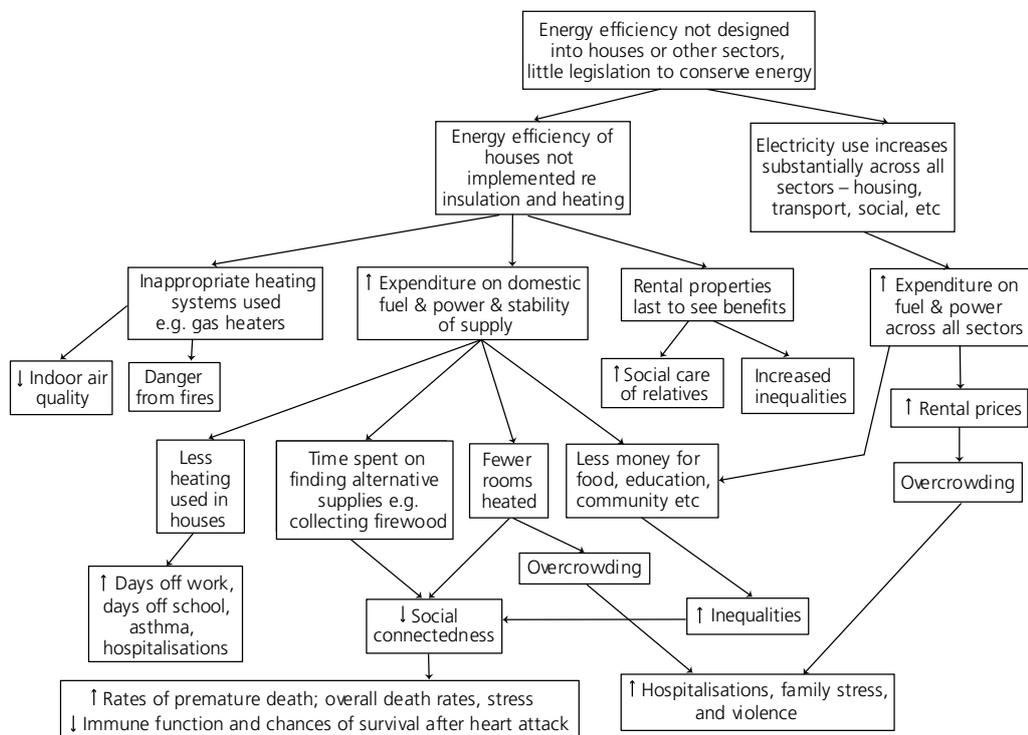
*Fuelling the future* continues a model of passive energy management for the New Zealand population. People continue to pay for their electricity with little or no thought to where it comes from and how it can be used more efficiently.

Robyn and her family live in Auckland and they have different energy costs and challenges to people living in smaller and rural areas.

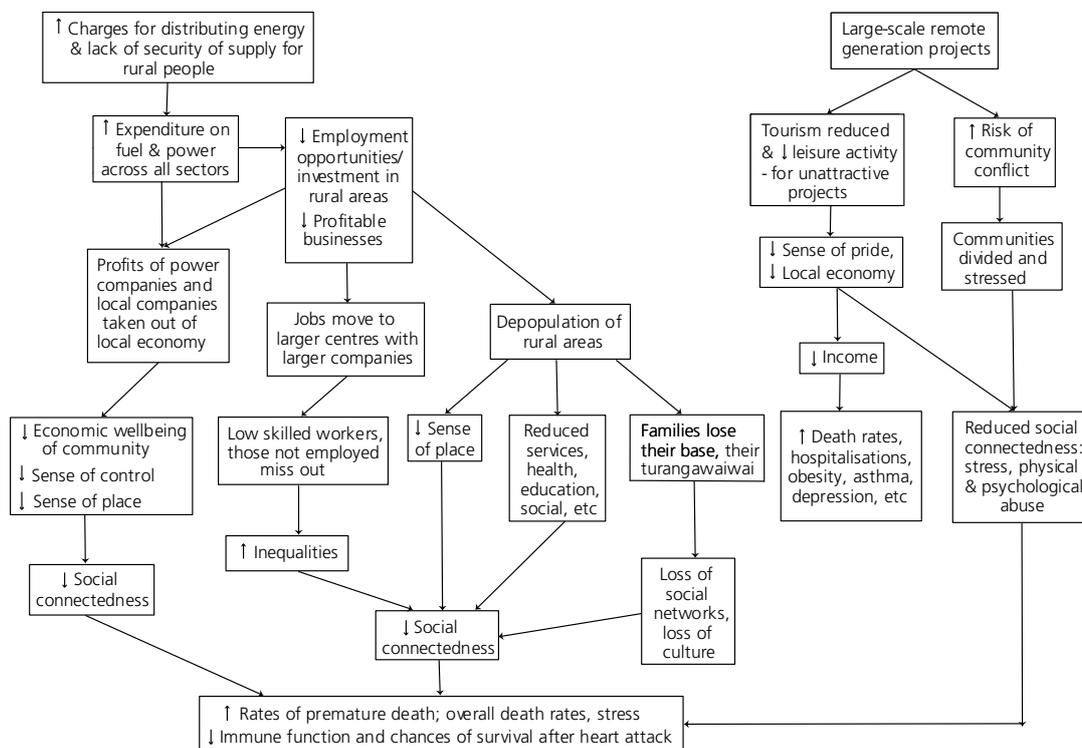
Under *Fuelling the future* Robyn and her family will face increasing expenditure on domestic fuel and power. This decrease in discretionary income will affect Robyn less as she is in a relatively high-income bracket and will be able to absorb the higher costs of electricity and other energy sources. She will be able to cope with the increased costs of transport and generally higher costs of living in terms of food and commodities prices.

### Energy costs for the elderly

Robyn's main concern in the early years of *Fuelling the future* is the rising cost of electricity, not so much for her as for her parents. Her parents still live in a poorly insulated, rented house and, as they retire and spend more time at home, heating becomes a major cost. The roof on their house begins to leak, but it is some time before the landlord can afford to fix it.



**Figure 1: Fuelling the future – model for potential negative impacts on health and wellbeing (1)**



**Figure 2: Fuelling the future – model for potential negative impacts on health and wellbeing (2)**

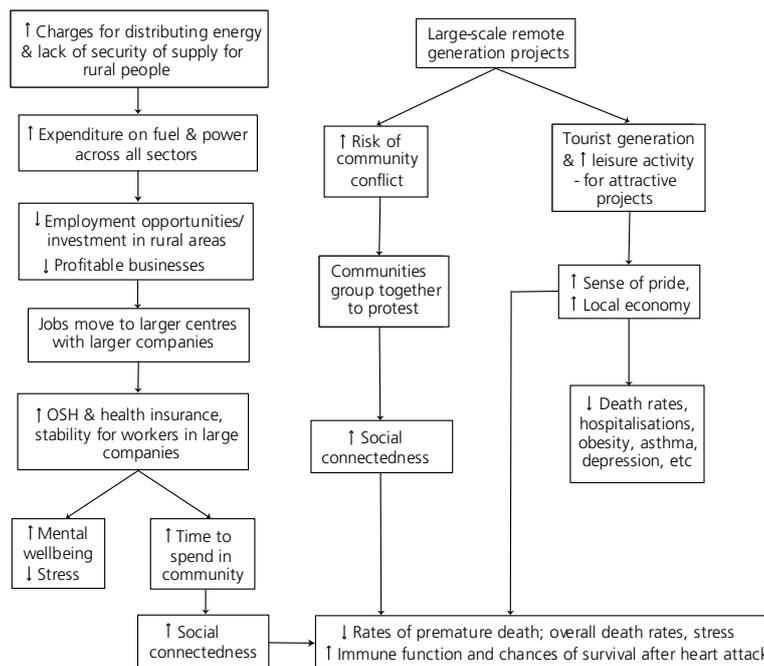
Robyn's parents were not always in a low-income bracket, but a lack of savings, low income from benefits, and the high cost of living have contributed to their current status. Although they are above the poverty line, they still do not have enough discretionary income for food, transport, entertainment, and clothing. These all strongly influence health.

Her parents begin to experience more health problems as they sacrifice some of their comfort to save money on power. Consequently, they end up spending more money on doctor's visits. Robyn helps out when she can.

This becomes a national issue as the demographics of the country's population change – there are a higher proportion of elderly and many live in substandard housing. As electricity costs rise in *Fuelling the future*, inequalities began to grow. More elderly people experience energy poverty, particularly those living alone.

**Employment opportunities**

Job opportunities in the larger cities are likely to remain high as larger companies (including offshore investors) continue to prosper with confidence in the security of their energy supply in the cities. Workplace health and safety improves as large companies are able to commit more resources to ensuring that all occupational safety and health (OSH) regulations are met. Centralised energy investment by government and large industry will mean centralised services providing jobs for people in those areas.



**Figure 3: Fuelling the future – model for potential positive impacts on health and wellbeing**

### **Health costs**

Health costs to the general population are likely to increase as future demand for health services increase. The cost of electricity for hospitals and other medical centres is also likely to rise and these overheads will inevitably be passed on to patients.

Many people continue to rely on unsuitable heating, such as unflued gas heaters. Standards on heating appliances remain generally lax so many consumers opt for options with a cheaper initial outlay rather than alternatives that have a higher initial outlay but are cheaper to run and less polluting.

Robyn has children and moves into a slightly more energy efficient new home. However, she uses a lot of extra electricity to keep it warm and dry, which is expensive. Consequently, she spends more money on energy to maintain her health and well-being and that of her children and her parents.

### **Social connectedness**

*Fuelling the future* increases the number of large companies in which people work. This has the potential to improve Robyn's social connectedness. Such companies provide job security, regular pay, and good OSH programmes, and her company is likely to offer health insurance. This could improve her and her family's mental well-being, reduce stress, and give her more time to focus on family and community activities. However, lower skilled workers are more likely to miss out on such benefits and those not in the workforce will completely miss out – for example, older people, students, and those unemployed. So while improving social connectedness for a portion of the population is possible, including Robyn, this is likely to increase inequalities in access to services and subsequent health outcomes between Robyn and other members of her community. Evidence also shows that inequality corrodes good social relations and that poverty can further contribute to social exclusion and isolation.

In contrast to the potential positive impacts offered by larger companies, they are also likely to remove money from local communities and deliver it to overseas shareholders. This net outflow may increase the risk of lower economic well-being and may negatively affect a community's sense of well-being and sense of control, including Robyn's. People are less likely to participate in an economically weak community and that will impact on many people's mental well-being. Again, those with the lowest level of cash resources will be most affected, further increasing inequalities.

## 4.2 *Fuelling the future – Shane's story*

Shane lives in two rural areas in his lifetime to 2050. Initially, he lives on his farm on the East Coast then moves to the Waikato region.

Although Shane is relatively well off because of his farm income, some of his whanau and others in the rural communities where he lives are not doing as well. As income decreases, rates of poor health increase.

### **Local energy**

Shane and his whanau are still expected to be relatively passive in managing their energy requirements. Rural line closures from 2013 mean that Shane and others in his community are forced to look at sources of energy other than electricity supplied by the national grid. This search is already occurring in places. The challenges to remote communities to find alternative local energy sources and increase energy self-sufficiency are currently being explored in a study led by the National Institute for Water and Atmospheric Research.<sup>59</sup>

This means that Shane's community is able to become more energy self-sufficient, but this will be expensive as there is not the support for change that exists in *Sparking new designs*.

### **Loss of local employment**

The problems of energy security and affordability in smaller and rural areas could mean a loss of local employment opportunities in those areas. Small businesses may be under pressure to sell to large corporate ventures/large businesses, which are better able to pay for electricity and maintain their supply in rural areas. Businesses that may have been able to succeed in more rural settings are likely to move closer to the national grid to ensure their energy supply.

Loss of jobs contributes to a lack of income to spend on energy as well as housing maintenance, particularly energy efficiency measures, thus leading to increased health problems including respiratory illness.

In rural areas, as elsewhere, the cost of housing is likely to increase, as is the cost of providing energy services in them. This can lead to a range of problems, including overcrowding. Among Shane's extended whanau more people are likely to be in shared housing compared with the total population.

### **Health problems**

Health problems for low-income and lower socio-economic families in rural areas increase as fewer doctors and other health workers choose to practise there. Lack of access to medical services exacerbates some of the already existing inequalities created by having less discretionary income to spend on basics such as food, clothing, transport, and entertainment.

### **Energy costs**

Shane's electricity costs rise even more significantly than Robyn's in *Fuelling the future*. This is because Shane's line company ramps up the cost of maintaining his power line, especially after it blew down during a storm. His opportunities to go off-grid are costly and difficult, so whichever options Shane chooses will result in a significant increase in his energy costs.

Fortunately, he can rely on firewood for space heating, as can his whanau. His district has a reasonable supply of firewood, but he has to spend more time and effort to collect it, especially for his parents. In many rural areas, people increasingly turn to wood for space heating, hot-water heating, and even cooking.

This creates stress for rural households and communities as they look for alternative energy sources. This is already a reality for many rural dwellers, who seem to be more independent and resilient against energy crises than urban dwellers. The health impacts are likely to be especially felt by low-income people who live in isolated areas with few alternative energy sources, such as firewood. These groups are likely to live in colder houses and may resort to unsafe energy practices such as using candles for lighting, especially if they are forced to go off-grid. The challenges to remote communities to find alternative local energy sources and increase energy self-sufficiency are currently being explored.

Electricity eventually becomes a significant running cost for Shane's farm and contributes to his decision to move to Waikato, where line charges are much lower. He pays particular attention to his energy needs when choosing his new house and farm. With few realistic alternatives available, Shane continues to rely on electricity to power his farm buildings and equipment. This becomes a significant cost in running his farm, which impacts adversely on his well-being.

### **Social connectedness**

The most significant social connectedness impact in *Fuelling the future* has the potential to have a major effect on Shane and his family. That is, rural costs of living are likely to rise due to increasing energy costs and insecurity of supply. This could lead to rural depopulation, with all the subsequent effects of 'missing demographics', such as certain age groups being under-represented in the community, leading to low

school rolls, workforce issues, and closure of services. Evidence suggests that services are often of lesser quality and more difficult to access in more deprived areas. It may also have a direct impact on mental and cultural well-being for Shane, affecting his ability to return to his turangawaewae (place to stand), to mentally recharge, and connect with his whanau.

Displacement of populations from housing is a significant predictor of well-being. Security and length of tenancy are related to multiple health outcomes, including minor psychiatric illness, stress, and an ability to socially invest/engage with a community. All household members, including children and the elderly, are affected by this lack of control over housing decisions. Flow-on effects include disrupted friendships, employment, and education. Housing relocation has also been associated with loss of community (particularly of a community's leaders and role models), uprooting of social networks, and unsatisfied social aspiration.

Large energy projects in rural areas, which are a feature of *Future currents*, have the potential to cause a significant amount of community conflict and protest. Such conflicts will have direct impacts on stress and social connectedness, and increase the potential for physical and psychological abuse for Shane and his whanau. Conversely, it has the potential to unite parts of the community (to fight a proposal), but at the same time to divide other parts.

However, community social connectedness could also be enhanced through the development of large energy projects that can attract tourism and provide leisure resources. Shane remembers reading about the benefits from the construction of Lake Karapiro and how it directly impacted on the local economy, improved the community's pride and sense of place, and provided more opportunities for physical activity. Attractive surroundings also affect people's likelihood of engaging in physical activity, with flow-on advantages for mental and physical well-being. Large energy projects that reduce the attractiveness of an area can create the reverse situation.

## 5 Findings – *Sparkling new designs*

### Workers and businesses

*Sparkling new designs* has the potential to increase business opportunities in both urban and rural areas, but particularly in rural areas. Good job opportunities mean better health outcomes across the board.

With a greater focus on energy management in *Sparkling new designs*, more businesses improve their working environments, energy efficiency, and therefore productivity. It is well recognised that sustainable, healthy, well-designed workplaces motivate people to reach their full potential. These attributes contribute to supporting human intellectual capital in innovative businesses.

Improving indoor environments (and in turn spending less money on electricity) leads to healthier workers and improved productivity. Businesses can focus on developing key areas and upskilling their workforce. There is the benefit of increased human capital and export opportunities from small business development.

Nationally there is likely to be less pressure on health services under *Sparkling new designs*. So, while there may be additional costs early on through bigger investment in energy efficiency, over time these costs are outweighed by the health benefits they help to generate. A more positive deterministic relationship between energy management and health results from this scenario.

### Energy efficiency

In *Sparkling new designs*, more effort goes into making buildings more energy efficient. This begins with greater government support for existing programmes, coupled with stronger partnerships with business and community groups to market the benefits.

Corresponding improvements in education and research add to the country's technical skill base. They enable knowledge of energy efficiency to permeate through the various skilled trades who design, construct, and maintain buildings. More local tradespeople become adept at installing energy efficient technologies and design concepts. This has a positive impact on the well-being of local communities

Incentives for smarter design of buildings and subdivisions flow through from amendments to the Building Act, the Building Code, and new provisions in district plans. New subdivisions and infill housing are increasingly designed and built to maximise local energy resources. The combined result of these incentives, promotions, and regulations is increased uptake of cost-effective energy efficiency investments in buildings.

Overall, in *Sparkling new designs* buildings become cheaper to heat and light. There are likely to be fewer cold and damp houses. This has positive implications for health and well-being.

## Local energy and social connectedness

A feature of *Sparking new designs* common to both Robyn and Shane is that the use of local energy resources increases. A range of locally owned schemes is possible – at the individual, household or community level. These schemes are likely to be installed and maintained by local tradespeople.

All these factors have a positive effect on social connectedness. Local people becoming more involved in decision-making processes that affect their future well-being can deliver positive impacts on mental health and reduce stress.

The increase in local generation that occurs under this scenario creates new social geographies of energy use. As with any form of social change there are positives and negatives. Most of the positives have been covered above. To facilitate positive outcomes, it is essential to ensure that a community has the capacity, skills, and resources to enable them to fully develop small-scale renewable energy resources.

Another challenge is to manage the potential for social disconnection. For example, some in the community could be opposed to certain local resources being developed. Communities could become polarised and people could feel pressured to conform to the majority view. In these situations, negative impacts on mental health and stress are likely, and even physical violence may occur.

### 5.1 *Sparking new designs* – Robyn's story

A feature of *Sparking new designs* is active energy management with greater individual and local community control. Robyn and her parents will spend less money on energy over time. This will be supported by individual and government-supported investment in energy efficiency measures in homes. *Sparking new designs* assumes more investment in energy efficiency and small-scale renewable energy resources.

#### Energy efficiency

Houses will be warmer and drier, which will improve health outcomes as well as educational and economic outcomes for families. Awareness of the benefits of energy efficient homes will also increase. Better energy efficiency in housing design means better return for money spent on electricity over the medium and long term.

Improvements in energy efficiency will in turn improve air quality. Healthier indoor air temperatures and moisture levels, along with better ventilation improve health outcomes for all, but in particular those on low incomes, children, elderly, and those with existing medical conditions such as asthma. This scenario has a positive impact on the health of Robyn's children and parents.

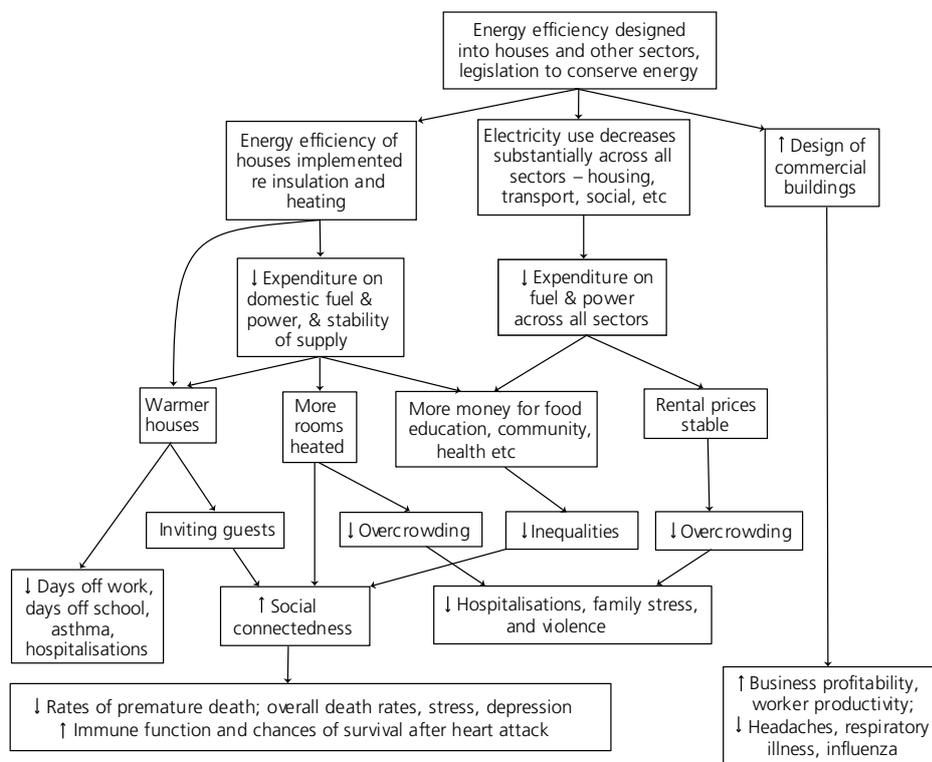


Figure 4: *Sparking new designs* – model for potential positive impacts on health and wellbeing (1)

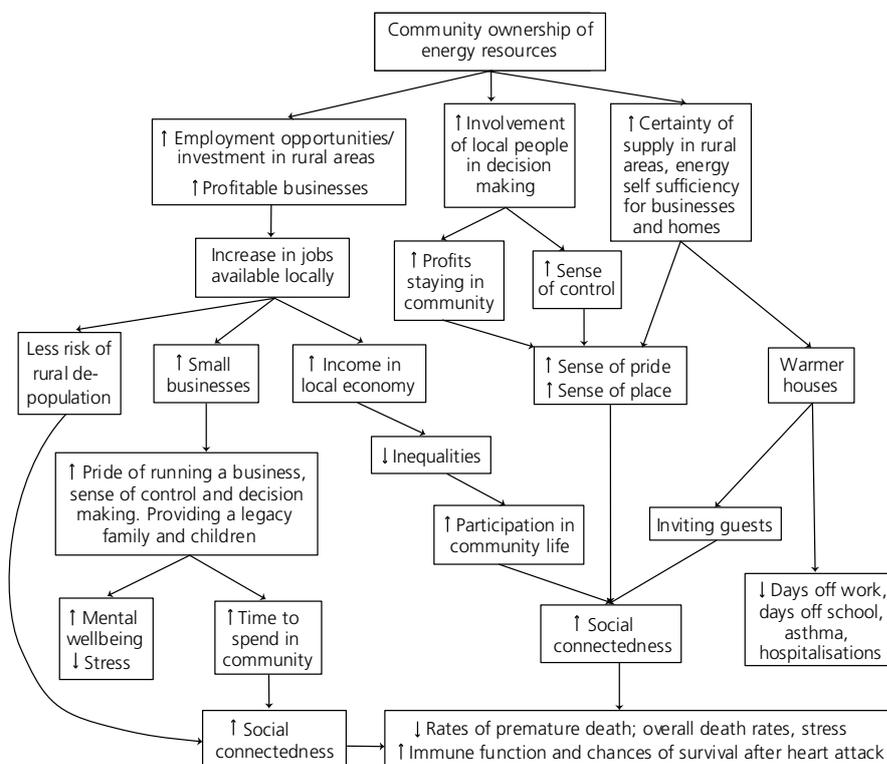


Figure 5: *Sparking new designs* – model for potential positive impacts on health and wellbeing (2)

### Business opportunities

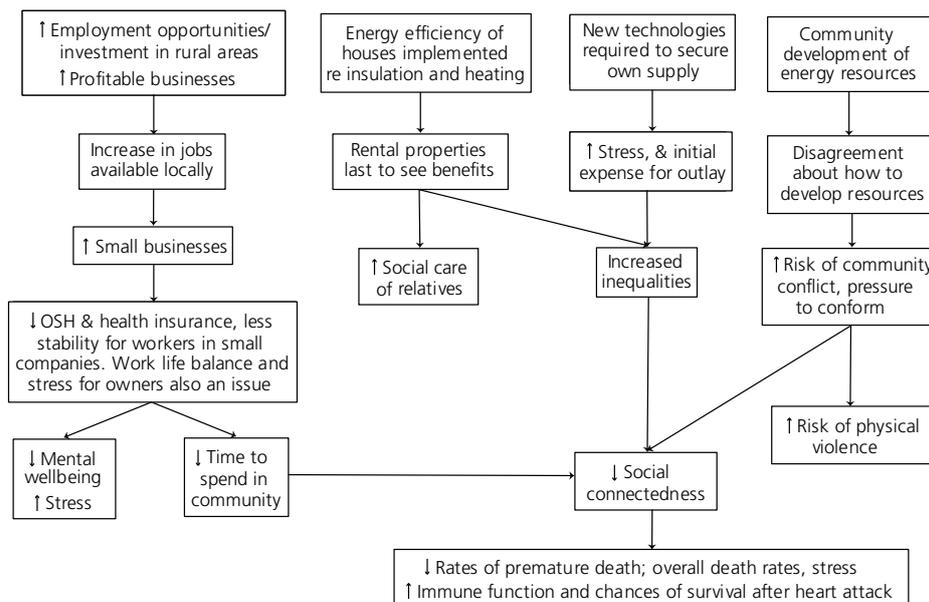
Jobs in small energy-related businesses will be more prevalent in Robyn’s world. Robyn gets work in the growing market for businesses offering energy efficiency advice, expertise, and products, and eventually sets up her own business in this area. The increase in small businesses also means that there is increased individual business risk. The downside is that smaller companies and family enterprises are carrying the stress of business outcomes that may impact negatively on individuals and their families.

As households and businesses move to increase their energy efficiency, the numbers of skilled tradespeople able to provide services and keep up with the technologies needs to increase. Where this is not possible, there is the potential for increased hazards to workers (OSH issues) and DIY homeowners. Again, *Sparking new designs* assumes that trade industry bodies have sufficient capacity to help provide these skills.

### Building improvements

The significant improvement in the energy efficiency of buildings has the greatest impact on health and well-being in *Sparking new designs*. This is particularly the case in the older and cheaper buildings occupied by predominately low-income groups.

Robyn has less worry with her parents after their house is retrofitted and the leaky roof fixed. She contributes to the costs and helps to install some of the technology, but she considers this is time and money well spent over the long term.



**Figure 6: *Sparking new designs* – model for potential negative impacts on health and wellbeing**

Robyn herself becomes skilled in energy efficiency management and thus, when she moves into a new home, she is able to install several new innovations that are now cost-effective. Again these are long-term investments that will soon be paid back. Robyn chooses a house that is already reasonably energy efficient. Her new house is warmer and drier overall, and not just in some of the rooms.

While crowding is still an issue under *Sparkling new designs*, it has less of an overall adverse health impact because households are spending less money on trying to keep their homes warm and dry. This not only makes it more affordable to have a healthy home, but it also frees up more money for health costs, as and when they are needed.

Tighter standards on appliances under *Sparkling new designs* eventually remove the less healthy forms of heating from the marketplace. This has positive effects on health and well-being as long as the cleaner appliances are affordable. Targeted assistance programmes could be usefully employed.

### **Social connectedness**

A greater personal and community sense of responsibility for energy supply and energy futures is a feature of *Sparkling new designs* shown by Robyn and her family. They use energy more efficiently and sustainably, and Robyn is more likely to consider local sources of energy and expertise.

*Sparkling new designs* leads to investment in local energy efficiency technologies that in turn inject money into local communities, particularly through small business growth, such as Robyn's. This can have a positive impact on community life and will impact on many people's mental well-being. Small business owners such as Robyn have the potential to develop pride in their business, control over what they and others do, and an ability to pass on skills and a 'legacy' to their children. Social connectedness also improves as homes become more comfortable and 'guest-friendly'.

Countering this improved social connectedness are negative impacts on work-life balance, stress, number of hours worked, feelings of responsibility, and annual leave for company owners. Support for setting up and running small businesses would be required to mitigate these impacts, as would national campaigns that inform consumers about correct products, suppliers, and expectations from energy efficiency upgrades.

### **Tackling inequalities**

Under *Sparkling new designs* the investments in energy efficiency installations may not be rolled out equitably. If left to market forces, middle income, pakeha, and/or owner-occupiers like Robyn are likely to get improvements first as they are more likely

to be able to afford them. But her parents, for example, are likely to get them last. This would have a direct impact on inequalities in health outcomes. This will be particularly hard felt in communities composed largely of neglected groups who could feel further marginalised.

Tempering this is the fact that many current government policies are targeted at vulnerable groups. It is essential that these sorts of schemes continue to be rolled out if inequalities are to be reduced. Other ways to mitigate any potential inequalities would be to develop appropriate criteria for entry of communities or households into schemes.

## 5.2 *Sparkling new designs* – Shane's story

*Sparkling new designs* means Shane and his whanau, along with many other rural communities, steadily achieve greater independence and control over their energy resources and energy use. As they spend less of their income on energy they have more discretionary income for food, clothing, transport, and entertainment.

Housing costs increase as requirements for incorporating energy efficiency into building design are rolled out. Over time though, these additional costs are recouped because less money is needed to keep houses warm and dry. The improved living conditions that result, such as healthier indoor air temperatures and moisture levels and improved ventilation, all contribute to healthier outcomes for families.

### **Business opportunities**

As in the urban areas, opportunities are created for rural small businesses offering energy efficiency advice, expertise, and products. Moreover, there is a wider range of businesses in rural areas, thereby increasing the job market and income potential for small centres and rural people. The increasing market for local energy investment means a more productive economy at the macro level. More of Shane's whanau are able to get jobs. On the downside, there may be increased risk of work-related accidents as smaller operators may be less likely to adhere to OSH requirements unless given assistance.

Under *Sparkling new designs*, greater effort is devoted to facilitating and assisting local and regional development of energy resources. As this is likely to create greater certainty and security for businesses and households in their energy use, there is likely to be less rural-to-urban drift.

The impacts for Shane are very similar to those for Robyn. Shane's community will also benefit from greater institutional support for distributed energy initiatives. However, he may experience additional stress because of the extra time and effort he devotes to energy resources for his family and his community.

### **Local energy**

The main difference for Shane under the *Sparking new designs* scenario is that by 2013 he has more options to consider when faced with a hike in his line charges. With greater government support and research into distributed energy solutions, Shane is eventually able to wean himself off-grid and become largely energy self-sufficient. This does create stress for Shane during the transition, but he is rewarded for his endeavours. Rural communities in general are affected more by reduced guarantees of security of electricity supply, so the incentives to find alternative solutions are greater.

### **Energy efficiency**

As under the *Fuelling the future* scenario, Shane has to help his whanau with their energy needs. He is, however, able to secure support for an energy efficiency retrofit of his parents' house, which makes the task much easier. The retrofit is carried out by a friend who has recently completed one of the new local training courses for tradespeople. The results are fewer health problems for his parents and less stress for Shane.

When Shane moves to Waikato he wants an energy efficient home and is pleasantly surprised by the selection on offer. It really does seem like uninsulated homes are a thing of the past. Targeted home insulation programmes become widespread in *Sparking new designs*.

*Sparking new designs* creates both challenges and opportunities for Shane. His progression to becoming more energy self-sufficient and efficient is expensive at times. It is also stressful, especially early on when he takes a few chances with some emerging energy technologies. Eventually, he reaps the rewards and has a warmer house for himself and his family, and an extremely energy efficient farm.

### **Social connectedness**

As Shane and others learn about new technologies and how to install them, the community's human capital grows as they upskill. A stronger sense of place emerges as local energy resources are developed and integrated and as the community works together.

Social connectedness also improves as homes become more comfortable and 'guest-friendly'.

Smaller energy projects occurring in rural areas, such as small-scale hydro, have less potential to cause significant community conflict and protest, but some level of discontent may occur. In small communities, this can potentially be highly disruptive to social connectedness.

## 6 Conclusions

The HIA of the scenarios in *Future currents* has shown clear differences in the potential health and well-being impacts for the population groups considered. These urban and rural, educated, low socio-economic, and different ethnic groups are affected in both positive and negative ways by the *Fuelling the future* and *Sparking new designs* scenarios. Using the matrices enables a clear focus for the collection of impacts and clearly shows the causal pathway for each. By taking this information and extending the scenarios for the characters – Robyn and Shane and their families/whanau – from the original document, this process has been able to demonstrate at a personal level just what these public health impacts will be.

While there are positives and negatives associated with each scenario, *Sparking new designs* clearly points to an overall approach that has many more positive health outcomes. This scenario primarily involves more community and personal responsibility for people's energy needs. The benefits clearly outweigh the negative impacts, which may be able to be mitigated by careful central and regional government management and guidance. Enabling small business development and workforce upskilling will assist the progress of either scenario but, in particular, this would benefit the more innovative scenario, *Sparking new designs*.

## Endnotes

- 1 Parliamentary Commissioner for the Environment, 2005.
- 2 Public Health Advisory Committee (PHAC), 2005: 7.
- 3 Public Health Advisory Committee (PHAC), 2005.
- 4 Statistics New Zealand, 2004.
- 5 Apart from the efficiency variables mentioned already, one of the hidden sources of wastage is standby power from various appliances. The HEEP study estimated that the average New Zealand household could be spending up to \$80 per year on standby power alone.
- 6 Sukkumnoed and Nuntavorakarn, 2006.
- 7 Anderson, 2002.
- 8 *ibid.*, 2002.
- 9 London Health Commission and the Environment Committee of the Assembly, 2001.
- 10 PHAC, 2004: 8.
- 11 *ibid.*, 2004.
- 12 *ibid.*, 2004.
- 13 World Health Organization, 2004.
- 14 *ibid.*, 2004; Seeman, 1996; Hawe and Shiell, 2000.
- 15 The NZDep2001 scale of deprivation from 1 to 10 divides New Zealand into tenths. For example, a score of 10 indicates that the meshblock (which on average contains 90 people) is in the most deprived 10 percent of areas in New Zealand, according to the NZDep2001 scores. A score of 1 indicates that the meshblock is in the least deprived 10 percent of areas in New Zealand (Salmond and Crampton, 2002).
- 16 PHAC, 2004.
- 17 London Health Commission and the Environment Committee of the Assembly, 2001.
- 18 Anderson, 2002.
- 19 Auckland Regional Public Health Service, 2005.
- 20 EECA, 2005.
- 21 EECA, 2001.
- 22 More information on these programmes can be found on these websites: <http://www.eeca.govt.nz>; <http://www.energywise.org.nz/homepage/index.aspx>; <http://www.eecabusiness.govt.nz/>.
- 23 The NEECS is presently under review.
- 24 EECA, 2001.
- 25 Jackson, 2006.
- 26 Auckland Regional Public Health Service, 2005: 5.
- 27 Thomson *et al.*, 2002; Howden-Chapman, 2004.
- 28 Thomson *et al.*, 2002.
- 29 Auckland Regional Public Health Service, 2005.
- 30 He Kainga Oranga/Housing and Health Research Programme, 2003.
- 31 BRANZ, 2005.
- 32 Waitakere City Council, 2006.
- 33 See [www.poweredliving.co.nz](http://www.poweredliving.co.nz); [www.nowhome.co.nz](http://www.nowhome.co.nz); [www.arhaus.co.nz](http://www.arhaus.co.nz).
- 34 Staley and Howden-Chapman, 2004.
- 35 BRANZ, 2006.
- 36 New South Wales Health and The Department of Human Services Victoria, (undated).
- 37 Centre for Advanced Engineering, 1996.
- 38 <http://www.emprove.org.nz/>.
- 39 Bannister and Guan, 1995.
- 40 Loftness, 2005.
- 41 *ibid.*, 2005.

- 42 *ibid.*, 2005.
- 43 Ministry of Social Development, 2005: 11.
- 44 Kawachi and Berkman, 2000.
- 45 Frumkin, 2003.
- 46 Dannenberg *et al.*, 2003.
- 47 Pickett and Pearl, 2001.
- 48 Galea and Vlahov, 2005.
- 49 Witten *et al.*, 2001.
- 50 Cummins *et al.*, 2003.
- 51 World Health Organization, 2004.
- 52 *ibid.*, 2004.
- 53 Ministry of Social Development, 2005.
- 54 World Health Organization, 2004.
- 55 Seeman, 1996; Hawe and Shiell, 2000.
- 56 EECA, 2005. Awarua Research and Development is a sub-branch of Te Runaka o Awarua Charitable Trust, an iwi-based organisation based in Bluff, Southland.
- 57 Ministry of Social Development, 2005.
- 58 There is current uncertainty over future gas supplies in New Zealand.
- 59 Penny, 2005.

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