energy cultures

POLICY BRIEFS

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UNIVERSITY *of* OTAGO
Te Whare Wānanga o Otāgo
NEW ZEALAND

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

SYNERGIA

Centre for Sustainability

Launched in 2012, the Energy Cultures Project is led by the Centre for Sustainability at the University of Otago and aims to develop knowledge and tools to achieve a sustainable energy transition across New Zealand. The Energy Cultures 2 Project focuses on efficiency transitions in three domains: households, businesses and transport systems.

For further information about Energy Cultures, please go to the Energy Culture's website:

http://www.energycultures.org

ENERGY CULTURES
OVERVIEW

Introduction

These policy briefs are an output of the Energy Cultures 2 research programme, funded 2012-2016 by the Ministry of Business, Innovation and Employment. The purpose of these briefs is to assist with the design of improved policies and practices to promote more efficient energy use in households, businesses and transport in New Zealand.

The research programme

The programme was led by the Centre for Sustainability at the University of Otago, and involved researchers from the Universities of Otago and Waikato, and the consultancy Synergia. The multidisciplinary team completed a number of work packages designed to answer two questions, as stated in the MBIE call for proposals:

1 Considering the current pattern of energy usage in New Zealand homes, small businesses and transport, where do the 'highest impact' opportunities lie for energy savings and how can these be cost effectively leveraged?

2 In transport, what is possible with new technologies and practices for energy efficiency and conservation and how can consumers be encouraged to adopt them and encourage markets to deliver them?

These policy briefs deliver a high-level overview of our answers to these questions, focusing on:

1. New Zealanders' aspirations for their energy futures
2. Helping households improve efficiency, warmth and comfort
3. Households in fuel poverty - the need to improve living standards
4. Improving energy efficiency and productivity in small-medium enterprises
5. Developing strategic capability in businesses through energy eco-innovation
6. Promoting electric vehicles
7. Improving driving efficiency
8. Urban freight: Improving energy efficiency and emissions
9. Generation Y and more widespread use of multi-modal transport
10. Interventions for a sustainable transport future

The findings have been reported in detail in a number of reports, academic papers and presentations, all of which are available to download from **http://energycultures.org/publications.**

Below: The energy cultures framework
(see overleaf for explanation)
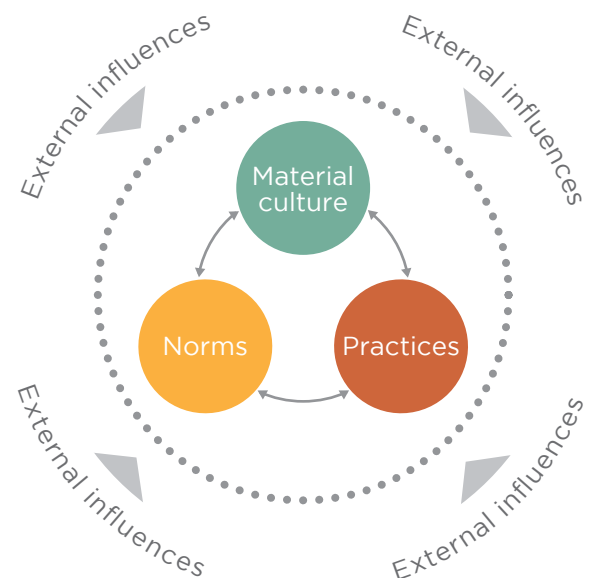
The energy cultures framework

The concept of 'energy culture' is another output of our research. This way of looking at energy behaviour helps reveal how people's energy-related practices are never isolated, but are strongly influenced by their norms (what they expect and aspire to) and their material culture (the physical assets they have). The interactions between practices, norms and material culture creates a distinctive 'energy culture'. This culture is also strongly shaped by external influences such as laws, infrastructure and policy.

In our research we have identified energy cultures at many scales – from individuals and households to businesses and societal groups. We have also used the same framework to investigate mobility cultures. The framework helps us to help design research, to analyse findings, and to identify interventions to achieve change.

Using the energy cultures framework in policy development

In developing policy options, we look first at the nature of the energy culture we are trying to change, and ask questions such as: What are the relevant norms, practices and material culture? Are people content with their energy culture or do they aspire to something different? Is the outcome desired by policy makers a good 'fit' with the culture? Is the culture changing already? What would be the knock-on effect of changing one aspect of the culture – would other aspects change too, and would that be beneficial?

We then look at the external influences and ask: What external influences are already driving change to this energy culture? What external influences are barriers to change? Are interventions needed to reduce these barriers? What kinds of interventions would be needed to have widespread beneficial outcomes?

Rima and George

On the following brief we tell the (fictional) story of Rima and George to illustrate the concept of energy (and mobility) culture, and show how energy cultures can change.

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Rima and George – a changing energy culture

When Rima and George first got together, they lived in a small rental flat, part of an old villa. The place had no insulation, and the sash windows rattled in the wind. To try and keep warm, Rima hung second-hand curtains in the main living room and they lit the portable gas heater in that room on cold nights. They didn't heat the rest of the house, and mostly they wore jerseys and woolly hats inside when it was cold. But at least they had an electric blanket on the bed. George wasn't too worried about the cold house, as it wasn't that different to the place they'd lived in when he was growing up, but Rima wasn't too impressed. They didn't earn much, and the landlord wasn't willing to insulate the house, so they were pretty much stuck with a cold house and getting ill a lot in winter.

George and Rima's energy culture: a feedback loop between material culture (poorly performing house, single inefficient heater, warm clothes, electric blanket), practices (only heating one room) and norms (acceptance of the situation as 'normal') has created a self-reinforcing situation with poor health outcomes.

Barriers to change include their low income and the landlord's lack of interest in improved insulation.

Another problem was that they had to have two cars, as their workplaces were in different directions and there was no public transport in easy reach. Their cars were pretty old and inefficient, and this added to the expense as well as producing a lot of greenhouse gas emissions. But they felt they had no options.

George and Rima's mobility culture: a feedback loop between material culture (two inefficient cars), practices (daily commuting in different directions) and norms (acceptance of commuting).

External influences reinforcing this situation include road infrastructure designed for commuting by car, no available public transport, locations of workplaces.

Then Rima got a new job, and she decided she'd had enough of cold damp places. They saved up a deposit on their first house, a small bungalow that had seen better days, but had potential. They had friends who had put in a heat pump and realised it made a big difference, and they knew there was a subsidy to help with insulation, so they made these their first changes soon after they moved in.

A changing energy culture, with both internal and external drivers of change:

Internal drivers of change include Rima's aspirations for a warmer home and their ability to save a deposit.

External influences of change include the influence of peers, and the subsidy to assist insulation.

Once the ceiling and floor insulation was in, and the heat pump installed in the living room, George and Rima found they very soon got used to a warmer living space. They set the thermostat warm enough so they didn't need to wear heavy jerseys and woolly hats inside. They tended to stay up later in the evenings as it was more comfortable to do so than in the old place. And for a change, they didn't get sick during the winter.
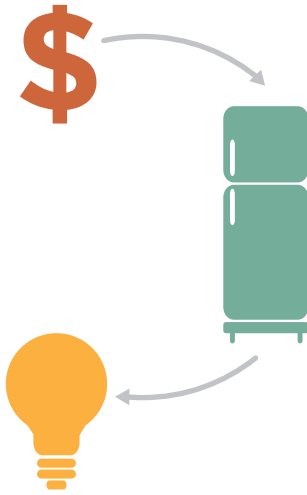
After a while they got an electric heater for the bedroom too, as it was a bit of a shock moving from the warm living room to a cold bedroom. They found the electricity bill getting rather high, so they got some thick curtains and made sure they closed them when it was getting dark. George started wondering about other ways to keep the power bills down, and his mate at work told him about LED lightbulbs, so he started gradually putting them in when the old incandescent bulbs blew. He got pretty interested in power consumption, changed their electricity supplier, and started watching their daily power use online to see when the electricity was being used. There seemed to be a lot disappearing when they were both at work, and he worked out it must be their old fridge, so they replaced it with a much more efficient one. And he fixed the hot water cylinder overflow, which had been leaking badly.

The move also meant that their travel patterns changed. There was a bus route nearby that George could take to work, and Rima was able to use the newly-constructed cycleway to get to her new job. They bought a couple of bikes and got rid of one of the cars. They only used the car in the weekends now, and started wondering if they should get rid of it altogether and join the local car-share scheme.

1. ENERGY FUTURES

New Zealanders' opportunities and aspirations for energy efficiency

WHY IS THIS IMPORTANT?

- Most New Zealanders live in houses that are less insulated than they should be, with heating that is less than ideal.
- Only 11% of the houses in our sample have double glazing plus ceiling, wall, and floor insulation.
- 41% of our sample did not have more than one type of insulation, or were unaware of the insulation status of their home.
- Our motor vehicle fleet is relatively old and increasing in age[1], and our driving practices are not focussed on efficiency either (see Policy Brief 7).
- There are clearly significant opportunities for households to improve their energy efficiency.

OUR RESEARCH:

The Energy Cultures 2016 third national household survey explored behaviours and attitudes towards energy and transport through a survey of 2,450 people which was representative of the NZ population by gender, age and geography. Here we share some of the results about New Zealanders' aspirations for energy change at the country-wide, Government, business, and personal level.

Opinions about New Zealand's overall energy use

- We should reduced the amount of energy that we use
- Don't know
- We should allow our energy use to continue to increase
- We should maintain our current levels of energy use

9.8% — 3.9% — 20.6%
65.7%
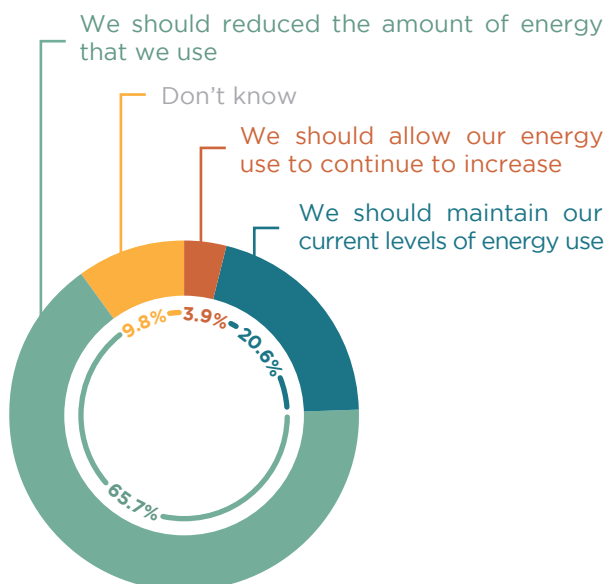
Which issues are most important for New Zealand?

26.9%
Affordable energy prices

23.1%
Changing the way we produce energy (being less reliant on coal, gas and oil)

13.7%
Helping to prevent climate change

12.2%
Energy independence for NZ (i.e. not having to rely on buying energy from other countries

10.4%
Reducing the amount of energy we use as a country

5.3%
Using the energy resources available in our country (coal, oil, gas)

4.6%
Don't know

3.8%
Avoiding blackouts and fuel shortages

GOVERNMENT

63% of the sample believe that the Government is responsible for changing the energy system in New Zealand, ahead of energy companies (14.7%) and individuals (11%).

[1] Ministry of Transport:
http://www.transport.govt.nz/assets/Uploads/Research/Documents/Fleet-reports/The-NZ-Vehicle-Fleet-2015-final.pdf

Which of the NZ Government energy priorities are seen as the most important?

Priority	
Warm, dry, energy efficient homes	▬▬▬▬▬▬▬▬▬▬▬
Develop renewable energy resouces	▬▬▬▬▬▬▬▬▬▬
Embrace new energy technologies	▬▬▬▬
An energy efficient transport system	▬▬▬
Reduce energy-related greenhouse gas emissions	▬▬▬
Competitive energy markets	▬▬▬
Reliable electricity supply	▬▬
Best practice in environmental management for energy projects	▬▬
Better consumer information to inform energy choices	▬
Develop petroleum and mineral fuel resources	▬
Enhance business competitiveness through energy efficiency	▪
Oil security and transport	▪

0   200   400   600   800   1000   1200   1400

BUSINESS
Only 21% of respondents felt that their employer is concerned or very concerned about energy use.
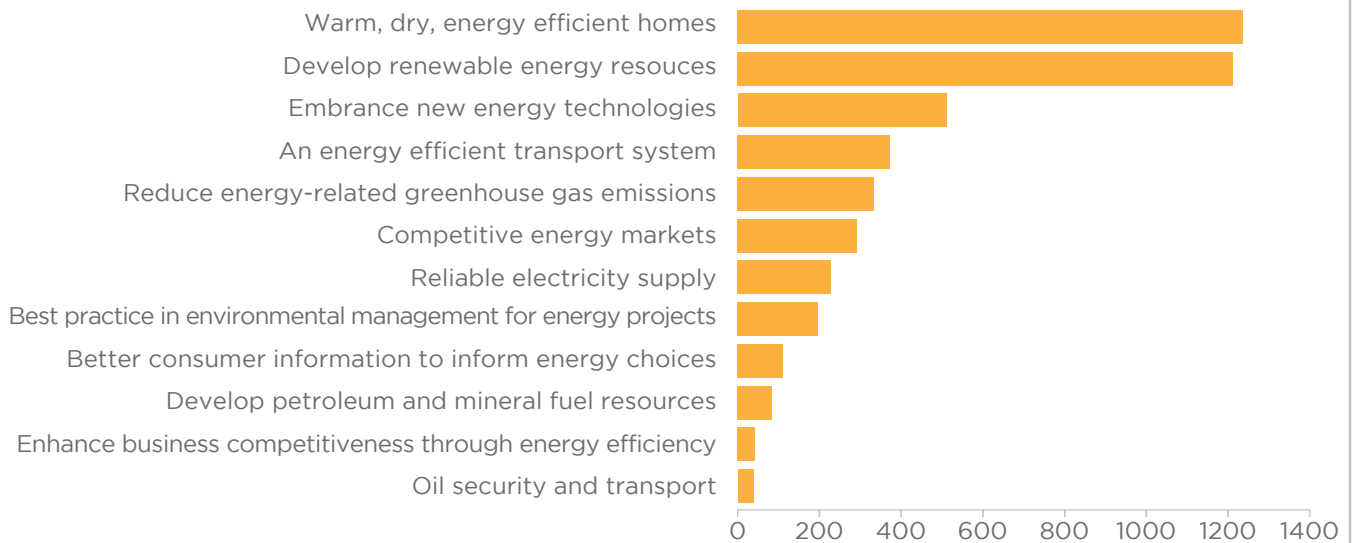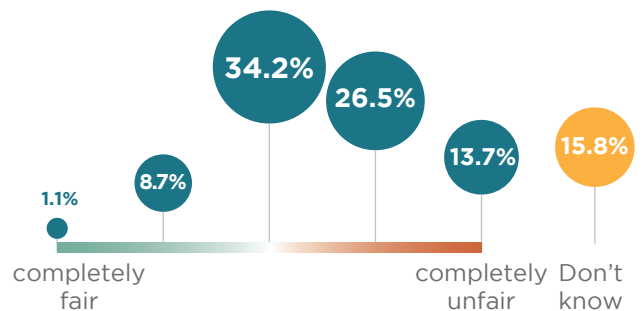**The electricity market in New Zealand is not seen as fair to consumers, and this finding is related to the desire to self-generate energy.**

INDIVIDUAL
When asked if they want to reduce their energy usage, more than 60% strongly agreed or agreed that they did.

To what extend, if any, do you think New Zealand's electricity market is fair?

1.1%   8.7%   **34.2%**   **26.5%**   13.7%   15.8%

completely fair — completely unfair — Don't know

Opinions about energy generation

- I am happy with electricity from electricity companies
- Don't know
- I would like to supplement my electricity with my own generation (e.g. Photovoltaic, micro wind generation, etc.) while staying attached to the national grid
- I would like to be independent of the national electricity grid and generate all my own power

9.5%   34.4%   35.5%   20.6%
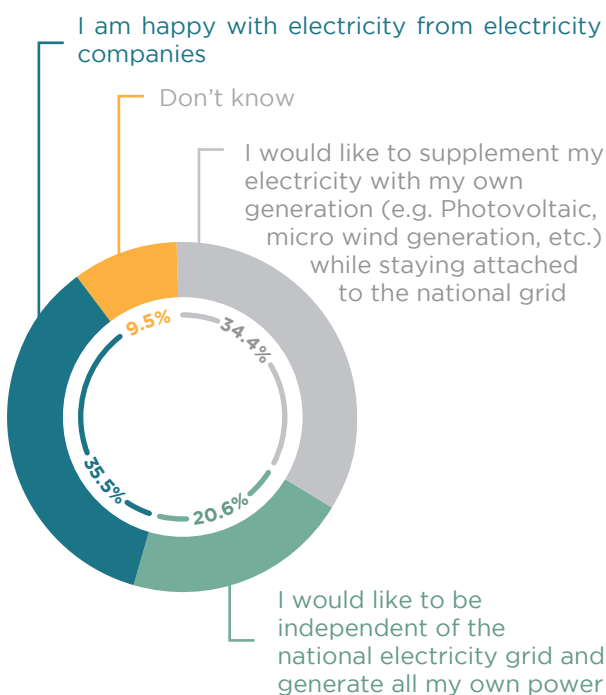
Policy options indicated by the research:

▸ When asked whether New Zealand needs to radically change how it produces and uses energy by 2050, 57% either agree or strongly agree.

▸ There is a clear appetite for change in New Zealand to be led by the Government. There is a desire for:
  • Warm, dry houses
  • Affordable energy
  • Sustainable/renewable energy.

Further information
Wooliscroft, B. (2016) *National Household Survey of Energy and Transportation: Energy Cultures Three. Centre for Sustainability*; University of Otago.

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2. HOME ENERGY ADVICE

Helping households improve efficiency, warmth and comfort

WHY IS THIS IMPORTANT?

Much of New Zealand's housing stock, particularly older houses, is of low thermal quality. Cold, damp houses are expensive to heat and can also be harmful to occupant's health and wellbeing.

"We had guests over and their noses had turned blue and we said right it's time to do something about this because this is embarrassing."

Householders can improve the efficiency, warmth and comfort of their homes by implementing simple inexpensive changes in everyday practices through to major investments in appliances or the house itself.

Many householders are not making energy changes, even when these are cost-effective.

Our research shows:

- People are often locked into unhealthy energy cultures, which can be difficult to change.
- Figure 1 portrays the energy culture of an older person living in a colder part of New Zealand, showing how norms, material culture and practices reinforce each other.
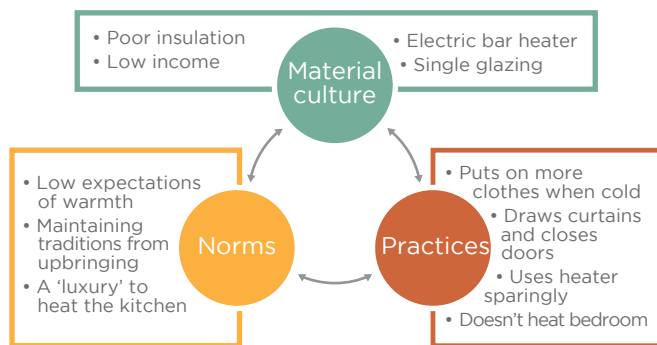

Figure 1: Example of energy culture

- Rental properties tend to have poorer energy performance, with tenants having little control to make improvements to the physical qualities of the home.

"We are absolutely desperate for insulation but obviously because we rent like what can you do? Ring your landlord and say 'Oi give me some insulation'?"

- As a result, people in rental properties often adopt very frugal energy practices. Cutting down on heating may have implications for their health and wellbeing.

- Home owners often don't know where to start making changes, and can feel unsupported.
- Householders may be wasteful with energy without realising it.

Our research examined how households of all types can become more knowledgeable and confident to make energy efficiency changes.

Eight points for action

Our research found that most people who made efficiency changes had experienced several or all of the following:

1. Experiencing another house that had made changes
2. Considering change to be 'normal' amongst people they know
3. Knowing changes will help personal or family wellbeing
4. Discussing changes with friends or family
5. Receiving independent and relevant information about options
6. Receiving financial support or assistance, and/or help from trusted friends or family
7. Being clear about what action they should take and in what order
8. Trusting the quality of technology and construction.

"I looked online and talked to friends and it was quite good because at playgroup there was different people had different things and a couple of them said come round and check out my heat pump and see what you think."

[1] Issues to do with rental housing quality are discussed in the policy brief on Fuel Poverty.

[2] See Policy Brief on Fuel Poverty for further details.

Intervention study

Energy Cultures research compared the effectiveness of two types of interventions (home energy audits and community energy events) to assist households with efficiency changes. The interventions involved three communities, with 71 people completing an initial survey, 20 audits conducted in two communities, and 3 energy events attended by 90 adults in the third community. Forty-one people completed the follow-up survey.

The community energy events were successful at changing norms and creating aspirations. They started conversations about energy efficiency, allowed people to share stories about energy changes, suggested simple changes to practices and to people's homes, and allowed people to experience some efficiency changes. Most people in the community made small inexpensive changes as a result.

Home energy audits were successful at providing householders with specific, relevant advice on material and practice changes, and in what order they should do them. Apart from households that had already made changes that they could afford, all households with audits made changes in their material culture and practices, some quite major. Figure 2 shows these changes.

Both are important. Community energy events are a good first step to build interest and develop knowledge and social norms, especially in communities with strong social ties. These events can build belief and trust that is essential for people to feel comfortable with the idea of energy audits.
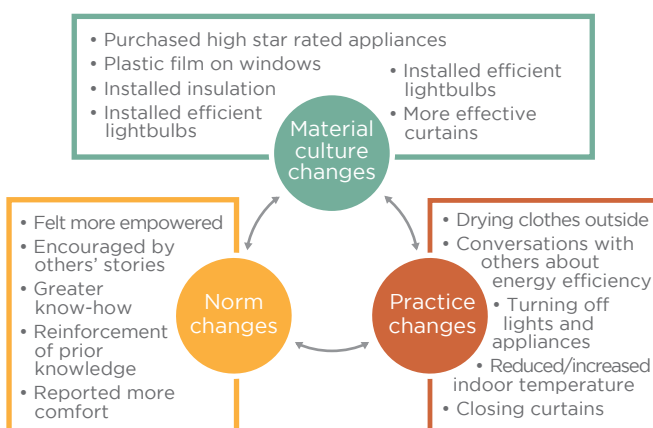

Figure 2: Energy changes implemented

Our research also found that:

▸ The greatest changes in material culture and practices came from homeowners in the medium income range. They had received personalised audits, and had financial ability and agency to invest in recommended changes.

▸ Financial concerns were reported as a significant barrier to change by low income households.

▸ None of the participants reported reverting back to earlier behaviours at a check-up six months later.

▸ Information about efficiency changes is important. Tailored information to suit each household's situation is needed for effective behaviour change.

▸ The way in which information is delivered or shared, and by whom, is also critical. Trust, and feeling supported by social networks, are important to engender belief and action.

"[I] made my decision by talking to people as much as anything as you sometimes wonder where the written information comes from and how biased it is."

▸ Information alone is insufficient. Many households are limited in ability to act due to house ownership status, their financial situation and their life stage.

Policy options indicated by the research:

▸ Use the 'eight points for action' to guide the design of energy efficiency programmes for households.

▸ Employ community energy events as a first step to build interest and motivation, working through trusted community members.

▸ Tailor the delivery of advice and information to suit the recipient community.

▸ Support the use of home energy audits as these are effective in stimulating change and giving householders a 'journey plan'. Where possible, offer subsidised audits, recognising the many co-benefits of greater energy efficiency.

▸ Employ software and technology to provide personalised advice on energy-efficiency practices.

▸ Develop an energy efficiency education scheme aimed specifically at landlords and rental property managers, as many physical efficiency changes cannot be made by tenants.

▸ Retain insulation subsidies for householders and landlords, and extend to cover work on non-standard houses.

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3. FUEL POVERTY Households in fuel poverty – the need to improve living standards

WHY IS THIS IMPORTANT?

- Much of New Zealand's older housing stock has poor energy performance.[1] When people live in inefficient, cold, damp homes, it costs more to stay warm and dry than in an efficient home. They are also more likely to suffer health impacts.[2]

- People on lower incomes can face relatively high costs to stay warm and dry, or suffer low temperatures, discomfort and sometimes ill effects if they don't spend at that level.

- Energy Cultures research interviewed householders who experienced fuel poverty (McKeague et al., 2016). Results show that fuel poverty affects people's participation in society and their quality of life. Quotes in this brief are from this study.

- Households are defined as being in 'energy poverty' when they spend over 10% of their income on fuel (Boardman 1991, 2010). However, this doesn't capture frugal energy users, or those who go without energy because they can't afford it.

- Our research also looked at another measure of fuel poverty: households that had gone without power during the year because it was unaffordable (Lawson et al., 2015).

- This was based on analysis of the nationally representative Energy Cultures household survey of 2,278 homes in 2014 (Wooliscroft, 2014).

> "It's very cold and damp in this house... ...you can actually feel the draught coming in through the windows... it takes a lot of heat to warm up this house...even then sometimes it feels like an icebox inside the house..."
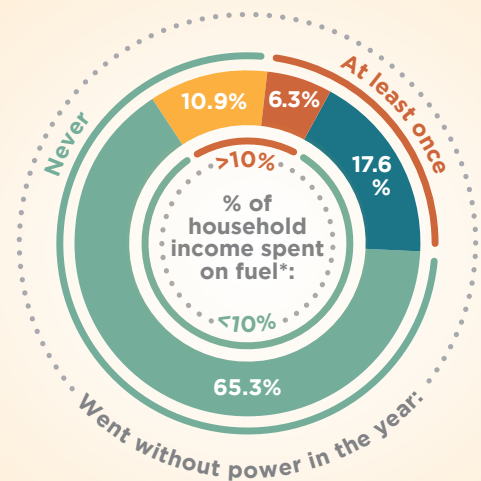> - Single father with three children

WHAT WE FOUND

We found 35% of households in the national survey had either gone without power, or spent more than 10% on fuel, or both.

*'Fuel' means all energy used in the home (electricity, gas, coal, wood etc) but didn't include fuel used for transport. 'Power' just refers to electricity, so we likely undercounted people who went without other fuels.

The first three groups – red, blue and yellow – all face challenges with the cost of energy. They are significantly different in their household makeup, housing, appliances, energy-saving practices and aspirations.

> "You feel deprived and you can't do anything...you are constantly going without...either it's without power or without food...and you are always cold."
> - Elderly man living alone

Never / At least once

10.9% 6.3%

>10%

17.6%

% of household income spent on fuel*:

<10%

65.3%

Went without power in the year:

6.3% spent more than 10% on fuel went without power at least once

This group had
- Lowest income per capita
- More solo parent families and elderly
- Spent more time at home (nearly 20 hours/day)
- Older houses, and more likely to be renting
- Homes less likely to be insulated

- Very economical with energy use – keeping heating low, putting on more clothes, washing clothes in cold water, taking short showers
- Fewer appliances – e.g. unlikely to have clothes driers, dish washers, laptops, electric blankets
- Aspire to reduce energy consumption to save money, or to increase it to be more comfortable.

This is the most vulnerable group. They are in straitened circumstances. They are trying to reduce expenditure on energy. Houses with poor energy efficiency are costlier to heat. As tenants they have little chance of improving the performance of the house. This group should be the highest priority for policy support.

[1] Isaacs et al., (2010). Energy Use in New Zealand Households: Final Report on the Household Energy End-use Project HEEP, BRANZ.

[2] Howden-Chapman et al. (2007). Effect of insulating existing houses on health inequality: cluster randomised study in the community. British Medical Journal 334(7591), 460.
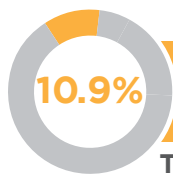
10.9% spent more than 10% on fuel never went without power

This group had
- Next lowest income per capita
- More retired couples and older singles
- Own house, debt free
- Main heating was wood burner
- Limited range of older appliances
- Made fewer efforts to save power (e.g. don't wait for full loads to run washing machine, wash in hot water).

This group spends more than 10% on energy bills so are in 'fuel poverty' by one definition. They may not be at risk from health impacts from lack of access 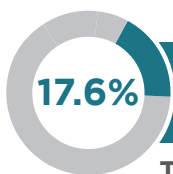to heating. However, given their low incomes, are they prioritising spending on energy and impoverished in other areas? Also, if there are other changes in life which means money currently spent on fuel has to be redirected to other needs, they could rapidly become vulnerable.

17.6% spent less than 10% on fuel went without power at least once

This group had
- Largest household size; pre-school children
- Higher income than the previous two groups but still modest
- Many in rental accommodation
- More likely to have inefficient heating – open fires, portable gas heaters, coal burners
- Very economical energy use – putting on extra clothes, only heating main living room, cold water washes, line drying laundry
- The most active interest in insulating and double glazing
- Would like to reduce consumption to save money.

This group's homes and heating devices have poor energy efficiency. Reported low level spending on energy could impact comfort and health. They have the largest family size and may be prioritising other needs over energy.

"I was ashamed of the way I was living...hiding in the cold...I rarely have people over because it's just too cold in the house." - Elderly woman

One third of New Zealand households are challenged by energy costs involved in running homes. Most are using energy frugally yet they are still paying unacceptable portions of their income, or are going without.

What are barriers to change?

Low-income households have few options available to invest in energy efficiency improvements. If they own their homes, they are often already stressed by mortgage repayments. If they are renting (and most are) they cannot make any substantial changes to the house, and have little power to bargain with their landlord about the state of the dwelling.

A package of initiatives is needed that sends the right signals to the market, helps prospective tenants make decisions that are better for them in financial and health terms, and ensures that all rental dwellings, not just new ones, have adequate energy performance. These initiatives should, between them, improve the physical housing stock, change the practices of tenants and landlords, and re-set expectations and aspirations for warm, dry, energy-efficient homes – creating a different 'culture' in the rental sector.

"My son doesn't spend any time in his room in winter because it's too cold there...when it gets really cold, we'd get dressed in layers...pile clothes on...stay in bed reading...trying not to think about the cold..."
- Single mother with one child

Research implications for policy:
- Improve information about housing performance in the rental housing market:
  - Require all rental dwellings to have a building energy efficiency certificate, obtained from an accredited appraiser. This may include an estimate of heating and lighting costs. A building owner may be required to hold a certificate for certain kinds of building, or before offering a building for sale.
  - Introduce warrants of fitness for all rental housing that include minimum energy performance standards.
  - Require all rental dwellings to provide visible information on the house's energy performance.
  - Encourage voluntary rating schemes: e.g. STAR Scheme (www.housingstars.co.nz) and Rate My Flat (http://ratemyflat.org.nz).
- Continue insulation subsidies for home owners and landlords, and extend to subsidise work on non-standard houses.
- Increase the provision of new purpose-built rental dwellings with good energy performance.
- Use social marketing to normalise the idea that rental houses should be warm, dry and mould-free.
- Review the Housing Improvement Regulations 1947 to ensure existing rental dwellings are have adequate levels of insulation and weatherproofing.
- Clarify the relationship of the Regulations with the Building Act 2004.

Further information

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4. SME ENERGY USE

Improving efficiency and productivity in small-medium enterprises

WHY IS THIS IMPORTANT?

Improved energy efficiency can generate significant savings and increase productivity for small-medium enterprises (SMEs). SMEs (businesses with less than 20 employees) are lagging in energy-efficiency changes, even though many changes pay for themselves in a short period.

What changes had SMEs made?

The 50% of SMEs who reported making efficiency changes had done so by adopting more efficient practices and/or changing technologies.

MORE EFFICIENT ENERGY PRACTICES

Most of the energy used by SMEs is in space heating and cooling (generally electricity) and transport (petrol and diesel). The most common changes were

- switching off (lights, computers etc)
- minimising travel
- planning to enable more efficient journeys
- using videoconferencing
- sourcing local products
- designing products that require less energy inputs
- changing packaging
- changing product/service mix

For many SMEs, changes in practice that cost nothing were the only way that they could improve efficiency.

MORE EFFICIENT TECHNOLOGIES

Apart from standard office equipment, business technologies varied greatly. Investments in new and more efficient technologies often occurred after plant had broken down. The most common changes were installing:

- efficient lighting (often LEDs)
- heat pumps
- insulation

Other changes included power factor corrections, improving server hardware, and installing heat recovery units.

However, for many SMEs, technology changes were seen as being beyond their financial capacity.

OUR SURVEY OF 180 BUSINESSES SHOWED THAT:

- Many SMEs lack interest in energy efficiency even though it could increase profitability.
- Other SMEs aspire to be more energy efficient but don't take any action.
- Half of the SMEs studied had already taken some action to save energy or use it more efficiently, but the change was usually minor.
- Micro-enterprises (less than 5 employees) tend to be frugal with resources anyway.
- International companies, companies with higher turnovers, and companies whose energy bills were a high percentage of operational costs were slightly more interested in changing than other companies.
- For larger businesses that had made a change, a frequent stimulus to efficiency was an energy audit and developing an energy strategy. However, this is considered unaffordable by many smaller businesses.

What are the main barriers to change?

- Energy is often seen as unimportant and peripheral to other demands on their time.
- SMEs lack knowledge about energy costs and potential savings, and how to achieve these.
- SMEs are so varied that there are few blanket solutions – they need individualised advice.
- SMEs have little to no control over the energy performance of rented and leased premises.

Top reasons given by SMEs for not having an energy management programme:

68%	18%	10%	4%

Not seen as a priority
No time to develop one
No money for one
No regulations to require one

NORMS

SMEs had very mixed perspectives on energy – some norms supported improved efficiency and some supported the status quo – and some SMEs expressed both at the same time.

Change-positive norms:

◗ Most think that their energy bills are significant expenses.

◗ Nearly half would consider changing the timing of energy use to save money.

◗ 83% were interested in new opportunities to save energy and/or profit from efficiency changes.

◗ Nearly 1/3 thought that their customers and clients were concerned about their environmental commitment.

◗ Many were interested in changing to EVs or biofuels if costs were the same or less, and they were reliable.

Change-negative norms:

◗ Nearly half thought that they had no control over how much electricity they used.

◗ Three-quarters thought society should reduce energy consumption, but only around half thought that they themselves or people they worked with need to do so.

◗ Energy changes were often not seen as a priority due to other conflicting demands of the business.

◗ Many felt they had no time or money to make changes.

◗ Many felt a lack of control over how energy is used in the business.

◗ Many felt they do enough by simply being frugal.

Poor building performance was an issue for many in rented and leased properties. Businesses felt they had very little leverage with their landlords to improve the energy performance of the premises.

Our analysis grouped SMEs into four energy cultures, depending of their level of interest and action on energy efficiency:

FOUR ENERGY CULTURES OF SMES:

"Be frugal"
Not interested in energy but use it carefully. Switch off to save costs. Don't see relationship between energy and core business.

"Do more with less"
Not interested in energy but don't overuse it. Developing ways to use energy more productively. Don't see relationship between energy and core business.

"Integrate"
Interested in energy consumption. Developing and investing in ways to use energy more productively. See a relationship between energy and their core business.

"Market it"
Being energy efficient is a core business value. Investing in ways to use energy more productively.

What trends are already supporting more efficient SMEs?

◗ Some efficiency changes are becoming less costly due to technology improvements.

◗ Some SMEs are aware that customers are increasingly interested in environmental credentials.

◗ Some SMEs are embedding sustainability and efficiency into the business as a whole as part of their identity.

◗ Existing advisory services are assisting some SMEs (e.g. EECA, council energy advisors, EMANZ).

◗ Many businesses aspire to change, even if they are not currently taking action.

Policy options indicated by the research

◗ Develop targeted approaches for the different SME energy cultures.

◗ Communicate the value of 'Integrate' and 'Market it' models for SME productivity and market share.

◗ Create social norms around efficiency by encouraging SMEs to share their stories of change, even where these are minor changes.

◗ Support widespread use of energy audits and business energy strategies.

◗ Encourage a whole-of-business strategic approach in which energy efficiency forms part of an overall goal of productivity and building market share.

◗ Position energy-saving in dollar terms. Provide estimates of costs of inefficiency and savings from efficiency changes.

◗ Target interventions at management to ensure organisational buy-in.

◗ Introduce minimum insulation standards for leased/rented commercial premises, particularly where spaces are used for office purposes.

◗ Enable low-interest loans for efficiency investments which offer rapid payback.

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5. ECO-INNOVATION

Developing strategic capability in businesses through energy eco-innovation

WHY IS THIS IMPORTANT?

- Businesses are under increasing pressure to think strategically about the sustainability of their production and consumption processes.
- Eco-innovation is the development and application of business models that incorporate sustainability throughout all parts of the business.
- By implementing eco-innovations, businesses can enhance their environmental performance and help build a resource-efficient economy.
- Eco-innovations can also increase the strategic capability of SMEs by transforming environmental challenges into new market opportunities.
- Strategic capability is the ability of a business use competitive strategies that allow it to survive and increase its value over time.

WHAT WE FOUND

- Our study analysed 142 small-medium enterprises (SMEs) across New Zealand.
- We studied how they have developed strategic capability through energy-related eco-innovations, including some that potentially create a competitive advantage.
- Examples included freight companies, bus companies, laundry services, tourist lodges, cafes, food manufacturers, wineries, piggeries, service stations, marine engineers and supermarkets.
- We found that these businesses typically started their 'journey' of eco-innovation in one of three ways. These three start-off points are shown using the energy cultures framework.
- This change often then had effects on other aspects of the firm's energy culture and sometimes on its strategic capability generally.

THREE TRIGGER POINTS OF CHANGE

TRIGGER 1. Change in material culture ▶

- Some business started with a change in material culture (e.g. machinery, buildings).
- The adoption of these new energy-efficient assets can act as a trigger point for further eco-innovation, such as uptake of more energy-efficient technology or renewable energy sources.
- Eco-innovation through technology change alone typically improves the efficiency of operations.
- However, it does not radically change a firm's operating systems.
- It does not necessarily develop new strategic capabilities and competencies.

TRIGGER POINT: Old equipment needs replacing

Change in assets

More efficient technology

Change in expectations
Cost reduction
Security of supply
Payback period

Change in practices
May fit with BAU operations
May improve E monitoring

Other insights

- For energy eco-innovation to become a strategic capability, businesses need to align all aspects of their energy culture – strategic intent, aspirations, values, practices and technologies, along with knowledge development to underpin ongoing innovation.
- Eco-innovation change must involve a whole-of-business alteration in energy culture, as opposed to an isolated incident, for sustained competitive advantage to result.
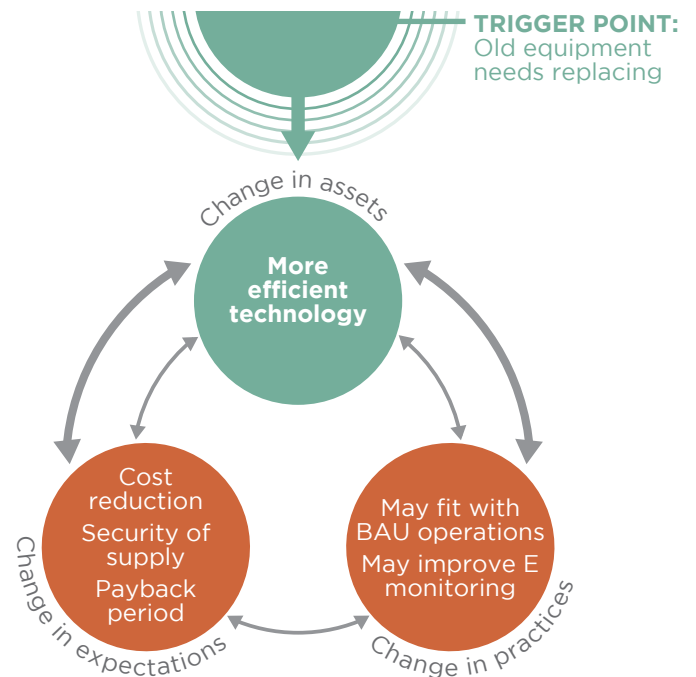
◗ This research looked at business that had succeeded in making changes. Many businesses are resource-constrained, which can inhibit them taking the first step of the journey in energy efficiency investments. See Policy Brief 4 on Energy Use in SMEs.
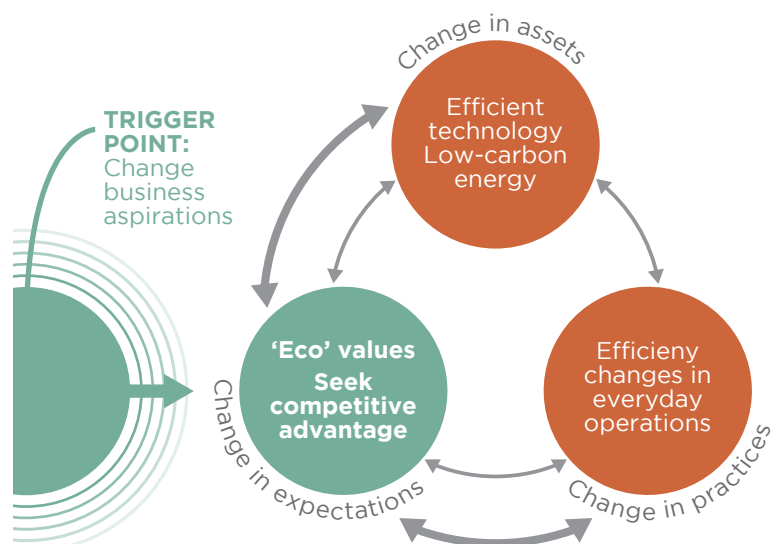
TRIGGER 2. Change in energy practices ▶

◗ For these businesses, the trigger point for change was to examine energy practices and processes throughout the organisation.

◗ The realisation that cost savings can be achieved through efficiency improvements sometimes led to organisational-wide shift in practices and norms, and improvements in technologies.

◗ To become embedded in the organisation there needs to be a close fit between organisational norms and practices.

◗ This process can further develop firm-level capabilities and competencies, such as adopting pro-environmental branding as part of the business model.

◗ In this instance, eco-innovation sometimes led to developments in strategic capability.
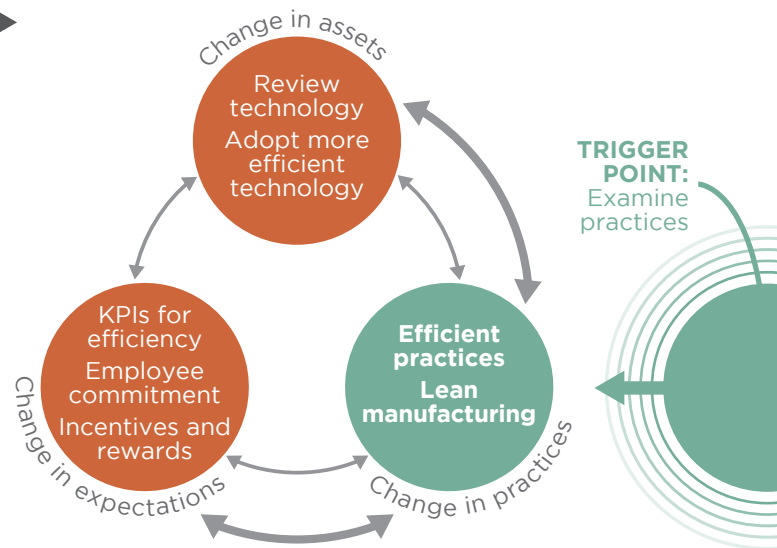
▼ TRIGGER 3.
Change in business aspirations

◗ A third group of businesses adopted energy eco-innovation as part of a wider strategy involving a re-evaluation of business values.

◗ Businesses saw competitive advantage in adopting sustainability as integral to their business model.

◗ This had flow-on effects in the adoption of efficient technologies and practices across the business to create an authentic offering.

◗ In this eco-innovation model, all links between the concepts are strong. Strategic capability was developed because of the organisation's ability to use its green credentials as a niche advantage in the marketplace.

Change in assets
Review technology
Adopt more efficient technology

TRIGGER POINT: Examine practices

KPIs for efficiency
Employee commitment
Incentives and rewards

Change in expectations

Efficient practices Lean manufacturing

Change in practices

TRIGGER POINT: Change business aspirations

Change in assets
Efficient technology Low-carbon energy

'Eco' values Seek competitive advantage

Change in expectations

Efficieny changes in everyday operations

Change in practices

Policy options indicated by the research

◗ Use the 'trigger points for change' model in communicating with businesses about energy innovations.

◗ Promote the competitive advantage of efficiency – both in terms of productivity and market discernment.

◗ Promote the value of whole-of-business energy innovation for developing strategic capability.

◗ Promote and incentivise energy audits and developing strategic energy plans.

◗ Target interventions at management to ensure organisational buy-in of energy efficiency recommendations.

◗ Focus on efficiency journeys: i.e. how change in one aspect of energy culture can lead to consequential changes in others.

◗ Target investment in energy efficiency at business 'life stages' (e.g. major equipment breakdowns, moving premises, and upsizing business).

◗ Encourage businesses to share knowledge, skills and successes in eco-innovations.

6. ELECTRIC VEHICLES
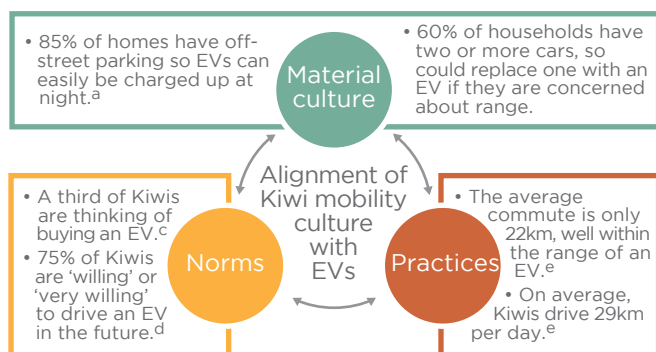
Promoting Electric Vehicles: Insights and implications

WHY IS THIS IMPORTANT?

- New Zealand's (NZ) road transport fleet is mid-range in efficiency compared to the rest of the OECD, and contributes 46% of NZ's energy-related greenhouse gas (GHG) emissions.

- Increasing the number of energy-efficient vehicles in the fleet is important to improve productivity and reduce emissions.

- Electric vehicles (EVs) are a highly efficient alternative to conventional internal combustion engine vehicles (ICVs). About 80% of NZ's electricity is generated from renewable sources with minimal GHG emissions. Co-benefits include energy security[1] and reductions in air pollution and noise[2].

- Energy security derives from switching from petrol or diesel to electricity, a 'home-made' fuel that is priced in NZ dollars.

- The NZ government has set a target of doubling the number of EVs every year to reach 64,000 by 2021, about 2% of New Zealand's current light vehicle fleet[3]. This may be hard to achieve without strong supportive policy environment. Public policy is a key driver that influences the uptake of EVs[4].

- The current policy package on EVs, 'Electric Vehicles: Driving an EV Future', is relatively modest by international EV policy standards.

Our research examined New Zealanders' interest in EVs and reviewed international policies to identify the characteristics of measures that would suit New Zealand.

A good fit with Kiwi mobility culture?

EVs are well aligned with some aspects of Kiwi's material culture, practices and norms:

- 85% of homes have off-street parking so EVs can easily be charged up at night.[a]
- 60% of households have two or more cars, so could replace one with an EV if they are concerned about range.

Material culture

Alignment of Kiwi mobility culture with EVs

- A third of Kiwis are thinking of buying an EV.[c]
- 75% of Kiwis are 'willing' or 'very willing' to drive an EV in the future.[d]

Norms

Practices

- The average commute is only 22km, well within the range of an EV.[e]
- On average, Kiwis drive 29km per day.[e]

Figure 1: Alignment of Kiwi mobility culture with EVs

What conditions support EV uptake in New Zealand?

- Technological advancements are increasing EV attractiveness in comparison to ICVs. Developments include lower maintenance costs, less interior noise, reduced vibration from power train, and better low-speed acceleration.

- Ongoing improvements in battery design are increasing the range of EVs.

- Installation of high speed charging stations by private sector and local government.

- New Zealand's electricity system is capable of supporting increased electricity demand. For example, if 80 per cent of the total light vehicle

a NZ Government (2016). Factsheet: Why EVs are well suited to New Zealand. Wellington: NZ Government.

b Ministry of Transport (MoT) (2014). Future Demand: NZ Transport and Society – trends and projections. Ministry of Transport: Wellington.

c Wooliscoft, B. (2016). Energy Cultures Household Survey 3. University of Otago: Centre for Sustainability.

d Ford, R., Stephenson, J., Scott, M., Williams, J., Rees, D., & Wooliscroft, B. (2015). Keen on EVs: Kiwi perspectives on electric vehicles, and opportunities to stimulate uptake (Working Paper). Centre for Sustainability, University of Otago. Retrieved from http://hdl.handle.net/10523/5730

e NZ Government 2016. Factsheet: Why EVs are well suited to New Zealand. Wellington: NZ Government.

1 Ministry for the Environment (2015). *New Zealand's Greenhouse Gas Inventory 1990-2013*. New Zealand: Ministry for the Environment.

2 Arup and Verdant Vision (2015). *Life Cycle Assessment of Electric Vehicles*. New Zealand: Energy Efficiency and Conservation Authority.

3 Ministry of Transport (2016). 'Electric Vehicles: Driving an EV Future'. Policy Announcement, 5th May 2016. New Zealand: Ministry of Transport.

4 Deloitte Touche Tohmatsu Ltd. (2011). Unplugged: Electric Vehicle Realities Versus Consumer Expectations. Available at: www.deloitte.com.

fleet consisted of EVs by 2040, EV charging would comprise approximately 8 per cent of total electricity demand[5].

- Charging EVs at home is straightforward. Most electricity retailers offer time-of-use pricing plans, which may be sufficient to manage peak demand without regulation. Home-based EV charging times can be managed as interruptible load using smart chargers, smart meters or ripple control.

What are the barriers to EV uptake[6]?

- Although prices are falling, EVs are more expensive to buy than ICVs.
- The total cost of EV lifetime ownership is less than ICVs. Higher up-front capital cost of EVs is a major barrier.
- Range limitations, charging times, and the absence of widespread charging infrastructure are concerns to prospective EVs purchasers.
- Lack of awareness of the direct and indirect benefits of EVs could be limiting some prospective purchasers.
- Kiwis tend to buy their cars second-hand, but there is still a limited range of second-hand EV imports. The main purchasers of new cars are owners of commercial vehicle fleets.
- The fuel efficiency of imported cars is not regulated in NZ, apart from labelling requirements. The market does not receive a signal that efficiency is important.
- There is little price pressure to use less hydrocarbons in transport through the Emissions Trading Scheme (ETS).
- The 2016 policy package to support EV uptake is unlikely to achieve the target of a doubling every year for 5 years unless stronger complementary measures are introduced to address the barriers to uptake[7].

Policy options indicated by the research[8]

- EV policy must be part of a comprehensive strategy to improve uptake of EVs, hybrids and ultra-efficient ICVs.
- Non-fiscal measures (e.g., parking and lane privileges, increased charging infrastructure) are important, but they are unlikely to create sufficient uptake momentum alone.
- Price signals, to be effective, must be immediate, substantial, applicable to the entire fleet, and directly linked to the problem they intend to solve. Current RUC exemptions for EVs are none of these and as a result, are unlikely to stimulate uptake at the desired rate.

In addition to the government's existing policy package, other effective policy measures might include:

- Strengthening ETS price pressure on hydrocarbon fuels use to a high level to raise awareness about vehicle choice and use. However, reliance on the use of ETS alone will not be sufficient.
- Introduce a 'feebate' scheme in which the prospective vehicle owner receives either a price benefit or a charge on the basis of its CO_2 emissions. The size of benefit or charge per unit of emissions would be set so as to provide a real influence on the selection of vehicles in the New Zealand market, and the pivot point would be re-set regularly to produce revenue neutrality across the scheme as a whole.
- Feebate policies should be applied both at the time of purchase or initial registration of a vehicle, and also throughout a vehicle's lifetime.
- Employ communicative measures to enhance public awareness of the many benefits of EVs and other highly efficient vehicles, and highlight the adverse characteristics of ICVs.
- Policy aimed at promoting EVs uptake must form part of a wider more holistic and comprehensive strategy for efficient, sustainable mobility. Aligned changes are needed in urban form, public and active transport, improved pedestrian and cyclist access, and other areas (see Policy Brief 10: Interventions for sustainable transport).

[5] Duncan, J., Halliburton T., Heffernan B., Watson N. and Coates G. (2010). Electric Vehicles – Impacts on New Zealand's Electricity System. Technical report. New Zealand: Centre of Advanced Engineering New Zealand (CAENZ), pp. 21. Available at: http://hdl.handle.net/10092/11575.

[6] Barton, B. and Schütte, P. (2015). Electric Vehicle Policy: New Zealand in a Comparative Context. Research Report. New Zealand: Centre for Environmental, Resources and Energy Law, pp. 24-26. Available to download: ISBN 978-0-473-34402-3.

[7] Rees, D. (2015) Modelling Transport. Transitions in New Zealand. Centre for Sustainability: University of Otago.

[8] Barton, B. and Schütte, P. (2016). Electric vehicles: promoting improvements in transport. New Zealand Law Journal, pp. 31-35.

7. EFFICIENT DRIVING

Improving driving efficiency: Insights and opportunities

WHY IS THIS IMPORTANT?

- Efficient driving can improve fuel economy by 20–45%[1] without increasing journey times considerably.
- Improved driving efficiency can also improve road safety.
- Efficient driving is a cost-effective way to lower GHG emissions and improve overall vehicle fleet efficiency.
- Use of the light vehicle fleet generates around 36% of New Zealand's energy-related greenhouse gas emissions.[2]
- The government has a heavy vehicle fuel efficiency programme but less focus on drivers in the light fleet.

Our research looked at how efficient NZ drivers are, what they think about efficient driving, and how they respond to information and smartphone apps.

'If other drivers were more considerate and slowed down in advance'

'The only thing preventing me is my personal driving abilities. Driving smoother will take more skill'

'City driving - especially in busier places than Dunedin, there's lots of stopping and starting'

What we found – an inefficient mobility culture

Results from our focus groups[3] revealed a 'mobility culture' of inefficient driving, caused by many factors.

People with in-car efficiency feedback were more likely to drive efficiently

Young drivers were less knowledgeable than older people

Few people considered the link between fuel use and GHG emissions

People said they drove more aggressively where this was the 'culture' of the road, e.g. in Auckland

People who drove efficiently tended to link efficiency to fuel cost savings

Young people felt they could not afford fuel-efficient tyres

Efficient driving is not part of the skills required for a driver's licence

Very few people engaged in fuel-efficient driving practices on a regular basis

Some knew how to drive efficiently but didn't apply the knowledge

Driving styles were mostly habitual

Parents didn't think to pass on efficient driving skills to their children when teaching them to drive

Mobility culture of efficient driving: Material culture — Norms — Practices
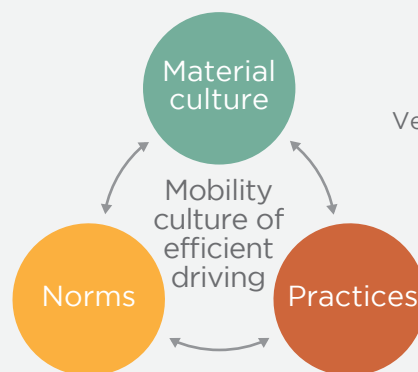
Why they said they didn't drive efficiently

- A lack of motivation to drive efficiently (e.g. savings were not compelling, no link to GHG emissions)
- For some, a lack of connecting knowledge to practice
- For some, especially younger people, a lack of skills, knowledge and experience in efficient driving
- A lack of real-time feedback
- Peer pressure from other road users
- For young drivers, the cost of fuel-efficient tyres and regular vehicle services.

[1] Sivak, M., & Schoettle, B. (2012). Eco-driving: Strategic, tactical, and operational decisions of the driver that influence vehicle fuel economy. *Transport Policy*, 22, 96-99.
[2] MBIE. (2014). Energy Greenhouse Gas Emissions; MoT. (2015). Annual Fleet Statistics.
[3] Fourteen focus groups were conducted with a total of 96 participants across New Zealand.

How bad is it?

Our national household survey[4] asked people to identify how many of the efficient driving behaviours listed below they always, or almost always, undertook.

Number of efficient driving behaviours undertaken

Percent of population

0   2   4   6   8   10   12   14
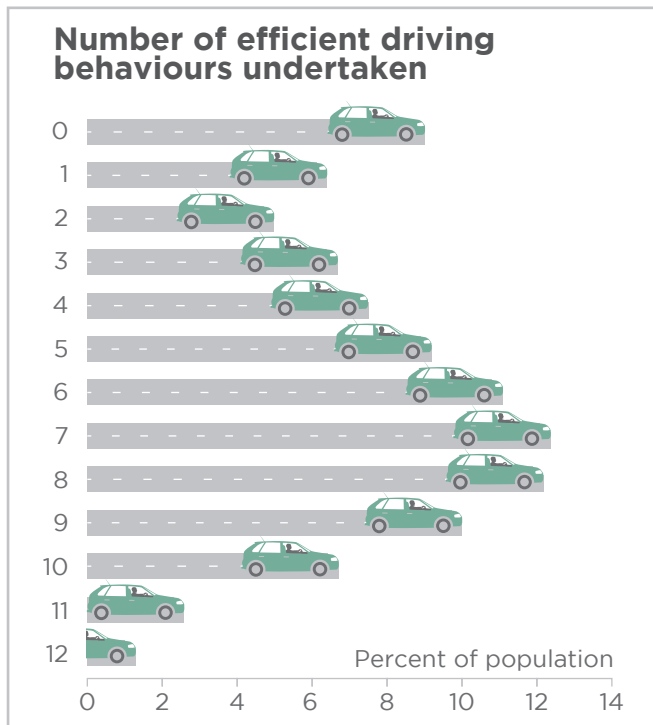
Nearly 10% of the population say they don't undertake any of these efficiency behaviours. Most people say they do some, but hardly anyone does most of them. There is much room for improvement.

What could be done to improve driving efficiency?

▶ We undertook two small trials using information videos[5] and driver feedback[6]. We found:

• Watching NZ-specific driving skill videos showed a statistically significant improvement in people's knowledge and intention to improve their driving practices. More research is needed to see if people implement this knowledge when they drive.

• Using smartphone applications with driving efficiency feedback was effective in changing the reported driving behaviour of about half of the drivers in our trial. The app with numerical feedback was more effective in changing behaviour than the app with simple visual feedback. To be more effective, apps need to be more accurate, trustworthy and user friendly.

[4] The national Energy Cultures Household Survey of 2500 households, undertaken July 2016. N=2455 for this question.

[5] A self-administered survey was conducted with 100 University of Otago students, who watched either a first-person or third-person educational driving video, and completed pre-and post- surveys about driving behaviours and fuel-efficiency.

[6] Two different smartphone apps with efficient driving feedback were trialled with twelve participants for two weeks.

[7] http://www.acc.co.nz/PRD_EXT_CSMP/groups/external_ip/documents/publications_promotion/wpc089713.pdf.

[8] https://www.energywise.govt.nz/on-the-road/driving-efficiently/

EFFICIENT DRIVING BEHAVIOURS

▶ Keep the vehicle properly serviced and well-tuned
▶ Don't fill the tank past the first click
▶ Make sure tyres are correctly inflated and wheels aligned
▶ Keep the windows closed to minimise drag
▶ Stop the engine whenever the car is stopped or held up
▶ Drive at a good distance from the car in front
▶ Keep in the most efficient rev zone
▶ Keep track of fuel economy
▶ Combine errands into one trip rather than several
▶ Avoid peak hour traffic
▶ Avoid short trips
▶ Travel at moderate, steady speeds

Policy options indicated by the research:

▶ Some information about fuel-efficient driving is provided by ACC[7] and EECA[8], but much more could be done.

▶ Include efficient driving in drivers licence testing, both in the theory and practical components, so as to develop efficient driving habits from when people first learn to drive.

▶ Develop social marketing campaigns that create motivations to change; e.g. highlight links between efficiency and safety, between efficiency and monetary savings, and between efficiency and reduced GHG emissions.

▶ Promote efficient driving, including through short educational videos and improved driver feedback apps.

▶ More widespread use of traffic calming measures to promote a culture of smooth, courteous driving.

▶ Promote and incentivise advanced driving skills training; e.g. for businesses where a high proportion of staff drive.

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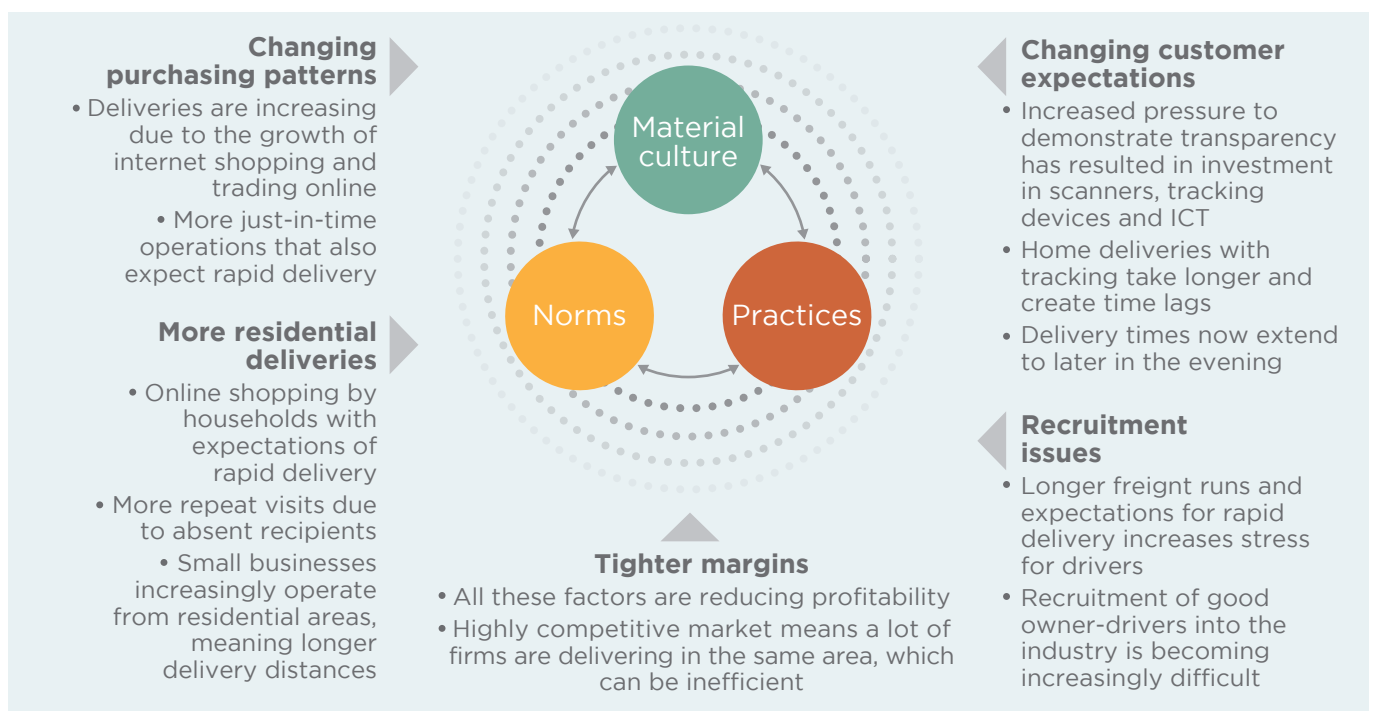# 8. URBAN FREIGHT
Improving energy efficiency and emissions

WHY IS THIS IMPORTANT?

- Freight movements nationally are predicted to increase by around 60% by 2042[1].
- Urban freight movements have a disproportionate impact on urban traffic movements, air quality and energy use due to most movements occurring in relatively congested areas.
- Urban freight movements are increasing due to more just-in-time deliveries to businesses, deliveries of online shopping to households, and returns of products bought online.
- Increasing demand for freight nationally is contributing to greenhouse gas emissions.
- Actions such as switching fuels, the adoption of efficient driving behaviours and the uptake of more efficient vehicles may offset some of the projected growth in freight emissions and increase energy efficiency.

OUR RESEARCH

- The characteristics of the urban freight sector are not well understood.
- We set out to understand the 'mobility cultures' of urban freight businesses, external influences that are shaping that culture, and their perceptions of the future.
- We conducted 25 semi-structured interviews with freight managers and drivers in four New Zealand cities.

What external influences are changing the energy culture of the urban freight sector?

Changing purchasing patterns
- Deliveries are increasing due to the growth of internet shopping and trading online
- More just-in-time operations that also expect rapid delivery

More residential deliveries
- Online shopping by households with expectations of rapid delivery
- More repeat visits due to absent recipients
- Small businesses increasingly operate from residential areas, meaning longer delivery distances

Material culture

Norms

Practices

Changing customer expectations
- Increased pressure to demonstrate transparency has resulted in investment in scanners, tracking devices and ICT
- Home deliveries with tracking take longer and create time lags
- Delivery times now extend to later in the evening

Recruitment issues
- Longer freight runs and expectations for rapid delivery increases stress for drivers
- Recruitment of good owner-drivers into the industry is becoming increasingly difficult

Tighter margins
- All these factors are reducing profitability
- Highly competitive market means a lot of firms are delivering in the same area, which can be inefficient

Together these influences are tending to increase urban freight movements, increase road congestion, and reduce profitability in the sector.

[1] National Freight Demand Study 2014

How do industry participants see the future?

▶ More delivery vehicles will be required to meet rising demand.
▶ Larger vehicles may be needed to cope with volume of deliveries.
▶ If unchecked, these will result in more emissions and increased congestion in urban spaces.

More vehicles + **Larger vehicles** = **More emissions** + **Increased urban congestion**

Industry barriers to improving efficiency

▶ Empty or below-capacity vehicle movements, inefficient driving, and idling.
▶ Drivers are often locked into unsustainable practices through company norms and customer expectations.
▶ Businesses have little spare capital to invest in efficiency improvements.
▶ Adopting more efficient driving practices is limited by industry expectations of speedy deliveries.
▶ Participants are confused about the capability of hybrids and EVs and micro-vehicles for freight tasks.
▶ Owner-drivers' decisions are mainly shaped by their company's requirements which rarely include adoption of more efficient and lower-carbon vehicles and practices.

External barriers to improving efficiency

▶ Parking spaces and loading bays for freight delivery are not optimally located for efficient movements.
▶ Road congestion makes urban freight deliveries less efficient.
▶ No incentives for companies or owner-operators to improve energy efficiency.
▶ Lack of collaboration between freight businesses in improving delivery efficiencies.
▶ Lack of collaboration between freight firms and governance agencies on actions to improve efficiency.

Policy options indicated by the research

▶ Carry out more empirical studies of urban freight efficiency to complement this qualitative study.
▶ Improve understanding amongst the urban freight sector about the capabilities of hybrid and EVs, and other types of low-emission vehicles.
▶ Improve supply chain of efficient vehicles suitable for urban freight deliveries.
▶ In collaboration with industry actors, improve design and location of loading bays and short term parking to allow for more efficient deliveries.
▶ Develop shared urban distribution centres and allow collaboration between freight providers to deliver more efficient deliver patterns.
▶ Improve consultation and collaboration between governing authorities and industry on actions to improve efficiency and reduce emissions.

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9. GENERATION Y A youth-led transition?
Supporting more widespread use of multi-modal transport

WHY IS THIS IMPORTANT?

- Compared to earlier generations, many young people born between 1980 and 2000 (Generation Y) are becoming less dependent on private cars.
- This trend is occurring in many developed nations as well as in New Zealand.
- In NZ, the distance driven per day for people aged 25-34 has been generally trending downwards since the 1990s. They spend less time as car drivers than older age groups of the working population, and the percentage with a full licence has fallen since the early 2000s.
- Similar trends are seen in 15–25 year olds although it is unclear whether this is partly due to changes in the licencing regime.[1]
- Our research shows that many of these young people are instead using multiple travel modes such as active transport, public transport and shared transport.
- There are many co-benefits of multi-modal transport including improved health and reduced greenhouse gas and particulate emissions.
- If these positive trends are not supported, Gen Y members are likely to revert to high levels of car ownership and use as they move through different life stages.
- Policies should support this emerging culture of multi-modality amongst Generation Y, and encourage more widespread uptake across the population, while addressing any negative repercussions.

TWO DIFFERENT MOBILITY CULTURES

Our research shows that many influences, both personal and external, are involved in young people adopting multi-modal mobility. We have shown the main influences below:
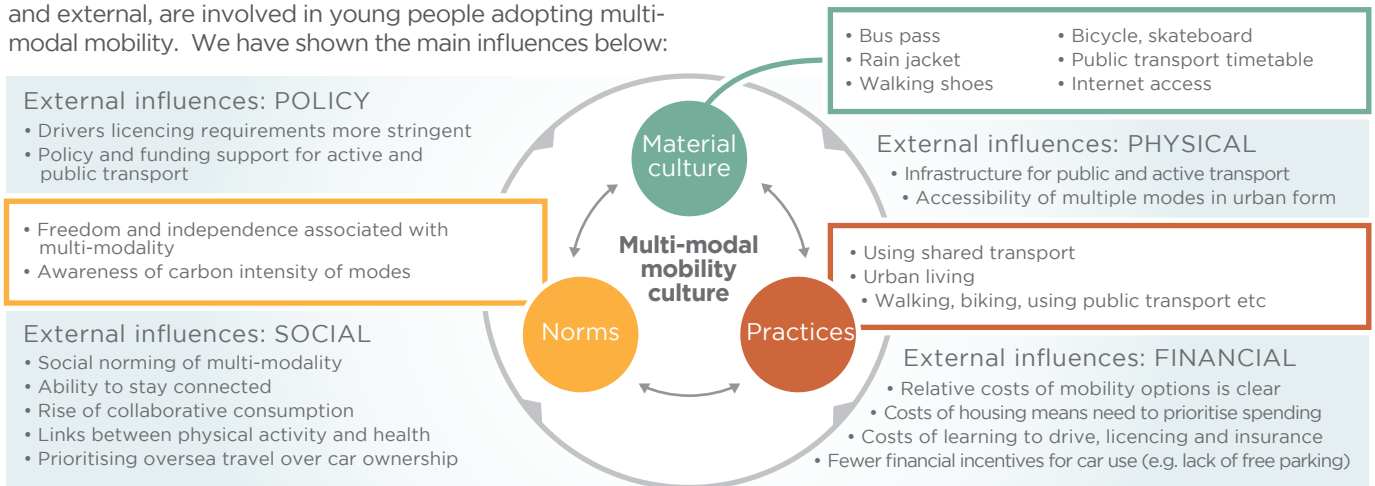
External influences: POLICY
- Drivers licencing requirements more stringent
- Policy and funding support for active and public transport

- Freedom and independence associated with multi-modality
- Awareness of carbon intensity of modes

External influences: SOCIAL
- Social norming of multi-modality
- Ability to stay connected
- Rise of collaborative consumption
- Links between physical activity and health
- Prioritising oversea travel over car ownership

- Bus pass
- Rain jacket
- Walking shoes
- Bicycle, skateboard
- Public transport timetable
- Internet access

External influences: PHYSICAL
- Infrastructure for public and active transport
- Accessibility of multiple modes in urban form

- Using shared transport
- Urban living
- Walking, biking, using public transport etc

External influences: FINANCIAL
- Relative costs of mobility options is clear
- Costs of housing means need to prioritise spending
- Costs of learning to drive, licencing and insurance
- Fewer financial incentives for car use (e.g. lack of free parking)

Material culture — Multi-modal mobility culture — Norms — Practices

Figure 1: Conditions inducing a multi-modal mobility culture.

Other combinations of influences mean many young people remain largely car-dependent:

External influences: POLICY
- Policy and funding schemes supporting dominance of road infrastructure investments
- Many negative externalities of car dominance not accounted for

- Perceptions of freedom and independence linked to car
- Negative perceptions of alternate modes

External influences: SOCIAL
- Widespread norms of car ownderhip and use
- Social status attached to car ownership

- Private vehicle ownership
- Drivers licence

External influences: PHYSICAL
- Built environment requiring car use
- Widespread availability of convenient parking
- Road infrastructure that prioritises car use

- Home location choices reinforcing car reliance
- Driving as default mobility option

External influences: FINANCIAL
- Car ownership messaging focusing on upfront cost

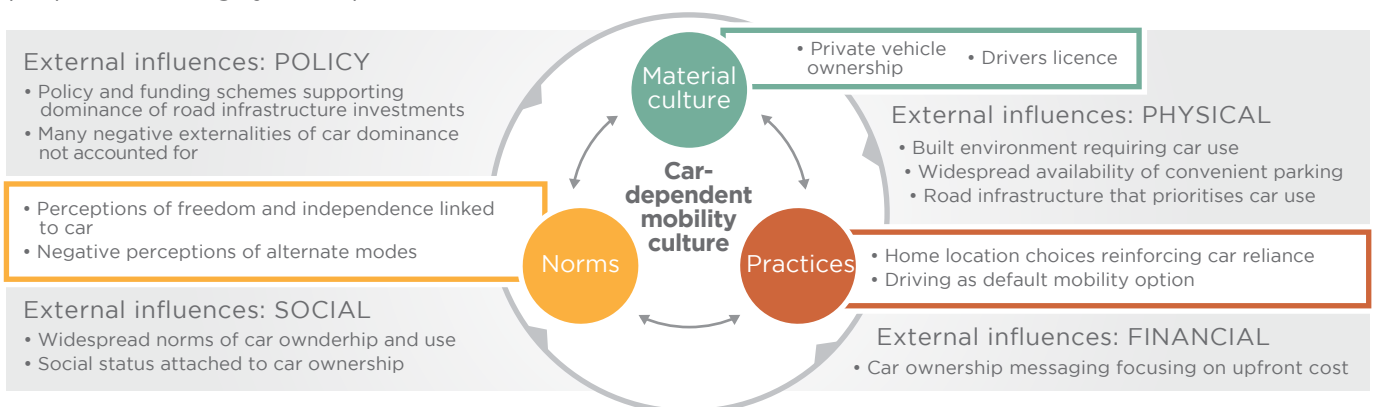Material culture — Car-dependent mobility culture — Norms — Practices

Figure 2: Conditions inducing a car-dependent mobility culture.

Reducing car-dependency achieves many policy goals including decreasing road congestion, improving emissions and improving health. In many cities internationally, using multiple transport modes is the norm, and it is not necessary to own a car. Multi-modality only becomes problematic if young people are unable to access work or socialise due to lack of transport options.

How can policy in New Zealand, particularly in larger cities, create an environment which:

1. builds on this serendipitous change in mobility culture, and supports young people in adopting and maintaining multi-modality?

2. ensures that young people who are considering their mobility path can choose multi-modality without harming their employment options?

3. creates an environment in which multi-modality is normalised for all ages?

What trends are already supporting multi-modality?

- Not owning a car is becoming an increasingly widespread social norm (influenced in part by people returning from OE who have experienced international cities with excellent public transport).
- Increasing investment in cycle and walking infrastructure in some NZ cities.
- Improvements in public transport.

What barriers do people face in choosing multi-modality?

- For young people, their (and others') perceptions that a drivers licence is essential for ID
- Employers' perceptions that their employees need a drivers licence even if their job doesn't require driving
- The absence of multi-modal transport options in most urban areas, e.g. poor public transport, lack of infrastructure for active transport, absence of car-share and bike-share schemes
- People's lack of understanding of the full financial costs of car ownership
- People's lack of understanding of the environmental consequences of car dependency
- Negative feedback loops, e.g. buses seen as unattractive can lead to a lack of patronage and subsequent loss of profitability. This can result in failure to maintain buses and as a result, public transport becomes more unattractive.

Policy options indicated by the research

Improve public awareness of:
- carbon and particulate emissions from car use
- full cost of car ownership
- 18+ as an alternate ID to drivers' licence.

Improve employer awareness of:
- multi-modal travel as a realistic option for travel to work.

Improve access to multi-modal mobility:
- Develop seamless multi-modal travel passes.
- Increase investment into infrastructure supporting active transport, with a focus on safety and continuity.
- Increase investment into high quality public transport especially for suburbs beyond active transport distance from key employment hubs.
- Real-time PT information online and at stops.
- Design and retrofit urban form to reduce need for private car ownership.
- Rethink implicit encouragement of car use, e.g. parking provisions.
- Introduce congestion pricing rather than invest in new road infrastructure.
- Build social norms around multi-modality through innovative use of media and association with high-profile Kiwis.
- Emphasise freedom and social engagement possible through use of multi-modality.
- Track experiences (positive, negative) of multi-modal travellers, and adaptively respond to barriers and negative feedback loops.
- Track the changing cultures of mobility in NZ, and target those population segments that have aspirations for change, e.g. Generation Y.

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Centre for Sustainability

10. TRANSPORT
Interventions for a sustainable transport future

energy cultures

WHY IS THIS IMPORTANT?

- New Zealand's current transport system is dominated by relatively inefficient motor vehicles that use fossil fuels. Negative outcomes include health issues (particulate emissions, road safety, noise, sedentary living), economic costs (e.g. of congestion), and being a significant contributor to New Zealand's greenhouse gas emissions.

- There are many cost-effective options for low-emissions transport, including alternative modes of travel such as walking, cycling, public transport and shared vehicles.

- Poorer communities tend to be less well served with active and public transport options, giving them little choice but to rely on cars.

How should New Zealand's transport system evolve to sustain a healthy economy, environment and society?

OUR RESEARCH

We undertook a 4-stage Delphi study involving 86 New Zealand transport experts.

Key findings

- The transport system is likely to face significant future challenges such as technology developments, volatile oil prices, and the need to radically reduce greenhouse gas emissions.

- There was a high level of agreement (80% or more) amongst the experts that a sustainable transport system for New Zealand would need to have the following features:

  - A collective, cross-party vision of NZ's future transport
  - Urban form and functioning reducing the need to travel
  - Integrated multi-modal transport systems in urban areas with over 100,000 people
  - Cross-modal ticketing systems for public transport
  - A range of mobility options for different length trips
  - Rural areas having access to information communication technologies to support travel substitution
  - Widespread understanding of the full cost (including externalities) of car ownership so that all transport modes are on a level playing field

How should NZ respond to these challenges and achieve a transport system that enables NZ to thrive?

- The experts considered that interventions are needed to achieve:

  - A cultural and structural shift in transport agencies to support investment in sustainable transport
  - Legislation and policies that prioritise sustainable transport across all laws that affect transport
  - A transport funding system that consistently reflects costs, benefits and long-term strategy
  - New options for transport revenue including congestion charging, road pricing, and the health budget (for active travel)

- Urban areas that support use of active and public transport
- Increased investment in public and active transport infrastructure
- Network design changes to support a wider range of road users
- Greater connectivity and integration across transport modes
- Improved safety for users of active transport and emerging transport technologies
- Increased use of rail for freight and passenger transport
- Widespread uptake of low-emission vehicles (see Policy Brief 6).

We concluded that substantial adjustments are required in order for New Zealand's transport system to support a thriving nation during a period of rapid adjustment to new constraints and opportunities.

These changes are needed in legislative and policy settings as well as in the culture of the agencies responsible for day-to-day transport decision-making.

CHANGES AT GOVERNMENT LEVEL

Diversify sources of funding for transport
Ensure sufficient price on carbon
Review rules of funding agencies

Establish cross-governmental working groups
Accelerate multi-modal investment
Ensure transport laws prioritise sustainability

Setting the scene for...

Norms that:
Focus on risk and resilience
Account for impacts and co-benefits
Prioritise sustainable and resilient transport

CHANGES TO THE CULTURE OF TRANSPORT AGENCIES

Infrastructure investments that:
Improve uptake of low emission vehicles
Enhance cycling safety
Expand passenger transport and light rail
Improve provision of public transport to suburbs
Enhance multi-modal connectivity and integration
Improve network design to support mode share
Improve links between industrial areas and rail

Practices that:
Re-allocate funding to improve mode share
Hasten uptake of low-emission vehicles
Improve cycling safety
Align policies for urban form and transport
Factor in risks e.g. energy prices, climate change
Consult with stakeholders for all modes
Improve education of engineers and planners
Communicate co-benefits to the public

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