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Energy Cultures:
Implication for Policymakers

Barry Barton, Sally Blackwell, Gerry Carrington,
Rebecca Ford, Rob Lawson, Janet Stephenson,
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February 2013

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Contents

1. Executive Summary

The *Energy Cultures* research project (2009–2012)[1] was planned to help inform policy making related to residential energy use and energy efficiency in New Zealand. It sought, in part, to help address the difficulties faced by government agencies in achieving the economically viable potential for residential electricity savings.[2] In particular, the project set out to examine household energy behaviour in relation to space heating and hot water heating, which together account for around 60% of household electricity use.[3] The programme was designed as a number of discrete research projects, linked together by the *Energy Cultures* conceptual framework. This report presents the policy implications of the multiple findings of that research.

The most significant policy implications of *Energy Cultures* are as follows.

(i) Policy design should consider the triple role of norms, material culture (house structure and energy technologies) and energy practices in contributing to overall energy behaviour. The Energy Cultures framework draws attention to the three elements in energy behaviour. Each will respond differently to policy interventions. Policy design should consider which of the three elements to target for any given energy issue, while being aware that a change in any one element (e.g. material culture), is likely to lead to a change in others (e.g. practices and norms).

(ii) Households with the highest energy use tend to be those that pay little attention to improving the energy efficiency of their house, own many energy-using appliances, and have little regard to energy-efficient practices. This cluster of households (around 20% of the population) is generally wealthier and thus has fewer barriers than others to making efficiency improvements. This group represents a policy opportunity to achieve significant gains in energy efficiency and conservation.

(iii) The lowest energy users tend to have substandard housing and inefficient energy technologies, yet have very economical energy practices. This combination of circumstances tends to be aligned with cold, and often damp, housing. This cluster of households (around 25% of the population) has lower incomes and restricted choices, creating a substantial barrier to improving their energy situation. The WUNZ programme partially addresses their financial constraints to action, but it needs to be continued, and to include clean, efficient space and hot water heating, as well as other means to assist with financing (e.g. low-interest loans).

1 Funded by the Ministry of Business, Innovation and Employment. Project ID: Energy Cultures CONT-20051-ICE-UOO.

2 KEMA. (2007). *New Zealand Electric Energy-Efficiency Potential Study, Volume 1*. Wellington: Electricity Commission.

3 Isaacs, N., Camilleri, M., French, L., Pollard, A., Saville-Smith, K., Fraser, R., Rossouw, P. & Jowett, J. (2006) *Energy Use in New Zealand Households – HEEP Year 10 Report*. Porirua, NZ: BRANZ.

(iv) The particular energy-related problems and constraints faced by tenants were evident in many of the research streams. The proportion of people renting is growing, and the tenancy population has characteristics such as poor health that make it a particular priority for substantial policy action to address the lack of drivers for landlords to improve the energy standards of their rental properties.

(v) Achievement-related values – being capable and being intelligent – are strongly linked with energy efficient behaviour. Appeals to such values in energy efficiency social marketing can be expected to continue to be successful.

(vi) Making choices about energy-related changes in the home can be exceedingly complex, and a barrier to action. People value independent trustworthy information to help them in this process. This represents a policy opportunity to support the provision of independent home energy advice.

(vii) A person's family and friends are the key influences on household energy behaviour changes, more so than media, community action groups or other organisations such as councils, tradespeople or power companies. There are gains to be made by supporting the positive work of social networks.

(viii) Tradespeople and design professionals are, however, very influential in household energy decisions. There is a need for better training in energy efficient products and services, and better incentives to supply them.

(ix) Some of New Zealand's energy efficiency policies are lagging behind those of other similar OECD countries. Of these, introducing home energy rating and certification schemes and introducing a wider range of Minimum Energy Performance Standards on energy appliances would assist with policy challenges (ii), (iii) and (vi) above.

(x) New Zealand's energy policy framework should give a central place to energy efficiency. Data collection on energy use and behaviour should be improved in order to support the development and monitoring of energy efficiency policy.

2. Energy Efficiency: The Problem and its Significance

Getting energy policy right is important for several reasons. Firstly, energy is required to meet human economic and personal needs. New Zealand houses are often colder than international standards stipulate.[4] This leads to health problems, especially for the young, the old, and other vulnerable members of the population.[5] Secondly, production and consumption of energy have significant adverse effects on the environment, which may be controlled through policy measures. The third reason is a special case of environmental effects – climate change. Globally, the production and use of energy is the main source of greenhouse gas emissions.[6]

The potential impact of energy efficiency measures is more significant, and yet more within reach, than most measures on the energy supply side. In its *World Energy Outlook 2012*,[7] the International Energy Agency presents projections of energy trends to 2035 and insights into what they may mean. To do so it presents several different scenarios, differentiated mainly by their assumptions about government policies globally. The New Policies Scenario takes into account, in a cautious way, broad policy commitments and plans that have already been implemented, or have been announced. The Current Policies Scenario embodies the effects of only those policies that had been adopted in mid-2012. The 450 Scenario, in contrast, selects a pathway for actions that have a 50 per cent chance of meeting the goal of limiting the global increase in average temperature to 2°C. Energy efficiency accounts for about 70 per cent of the reduction in projected global energy demand from the Current Policies Scenario to the New Policies Scenario by 2035, and 74 per cent moving from there to the 450 Scenario by 2035. In the abatement of energy-related carbon dioxide emissions, from the New Policies Scenario to the 450 Scenario, energy efficiency is projected to provide much the greatest component; it produces 42 per cent of the total abatement by 2035, (71 per cent of it in the short-term of 2020). By contrast, the contribution of renewable energy technology to the abatement by 2035 is 23 per cent, biofuels 4 per cent, nuclear 8 per cent, and carbon capture and storage 17 per cent. It is striking how large a contribution that the IEA thinks energy efficiency measures will make globally, and how modest the contributions of renewables and other sectors.

The significance of energy efficiency is also affirmed by 'the McKinsey Curve'[8] – an estimation of the cost and effect of different methods of reducing greenhouse gas emissions. It ranks different technologies in accordance with the cost of abatement per ton of CO_2 equivalent. The most expensive options include carbon capture and storage, concentrated solar, photovoltaic solar, wind, and nuclear. But below them are measures and technologies such as fuel efficiency

4 Isaacs, N. et al. (2010). Energy in New Zealand Houses: Comfort, Physics and Consumption *Building Research & Information, 38,* 470–480.

5 Howden-Chapman, P. et al. (2012). Tackling Cold Housing and Fuel Poverty in New Zealand: A Review of Policies, Research and Health Impacts. *Energy Policy, 49*, 134–142.

6 The drivers of government energy efficiency policies have recently been summarised under the headings of: energy security, economic development and competitiveness, climate change, and public health. Pasquier, S. & Saussay, A. (2012). *Progress Implementing the IEA 25 Energy Efficiency Policy Recommendations: 2011 Evaluation*. In *IEA Insights Series 2012*. Paris: OECD/IEA. (p.13).

7 International Energy Agency. (2012). *World Energy Outlook 2012*. Paris: OECD/IEA. (pp 34, 252, 269, 282, 302, and 322).

8 Enkvist, P.A., Dinkel, J., Lin, C. (2010). *Impact of the Financial Crisis on Carbon Economics: Version 2.1 of the Global Greenhouse Gas Abatement Cost Curve*. McKinsey & Co.

in vehicles, water heating, air conditioning, appliances, lighting, and building insulation. These measures have "negative cost". That is, they more than pay for themselves. While the McKinsey Curve and the *World Energy Outlook* are at a high level of generality, their key message about the role of energy efficiency is very clear.[9]

Energy efficiency is a ratio of function (service) or value provided, to the energy converted to provide it. In other words, it is the amount of work done in relation to the energy used.[10] To increase energy efficiency is to increase the amount or quality of services gained from each unit of energy used. In many spheres of human activity, energy efficiency is gradually improving as newer technologies replace older ones. The challenge from a legal or policy point of view is how to accelerate this trend, particularly with technologies that are long-lived such as houses, cars and certain appliances.

Despite the theoretical potential of energy efficient technologies to provide better services for the same amount of energy (or the same service for less energy), people often fail to invest in them, even when the investment can be rationally justified on an economic basis. The phenomenon is persistent and widespread, and is known as the "energy efficiency gap".[11] A number of barriers to investment can be identified: information gaps, averseness to risk, and the presence of multiple gatekeepers whose approval or disapproval will influence an investment in energy-efficient technology. One of the more intransigent barriers is the "principal-agent" problem, which exists when incentives, costs and benefits are allocated or split in a way that discourages action, such as between landlords and tenants.

Over the years, governments worldwide have devised a number of policy measures to improve the uptake of energy efficiency, including:[12]

- Information and education campaigns.
- Minimum energy performance standards or MEPS (effectively eliminating the least efficient products from the marketplace).
- Labelling requirements for energy performance of a product or a vehicle, enabling purchasers to make informed decisions.
- Subsidies, encouraging and enabling people to invest in insulation or to replace obsolete appliances.
- Demand-side management programmes from energy companies, helping customers to reduce or modify their energy needs.
- Building codes.

9 A report for the New Zealand Government showed that investment in more energy-efficient homes and appliances can be more cost-effective than investment in new supply capacity. See: KEMA. (2007) above n 2.

10 Lovins, A.B. (2004). Energy Efficiency, Taxonomic Overview. In *Encyclopedia of Energy* (Vol. 2, p.383). Amsterdam: Elsevier; International Energy Association. (2009). *Implementing Energy Efficiency Policies: Are IEA Member Countries on Track?*. Paris: OECD/IEA. (p.19).

11 Sanstad, A.H., Hanemann, W.M, & Auffhammer, M. (2006). End-Use Energy Efficiency in a 'Post-Carbon' California Economy: Policy Issues and Research Frontiers. In Hanemann, W.M. & others, *Managing Greenhouse Gas Emissions in California*. Berkeley: California Climate Change Center at UC Berkeley. (pp.6–9, 6–17); International Energy Association. (2007). *Mind the Gap: Quantifying Principal-Agent Problems in Energy Efficiency*. Paris: OECD/IEA. (p.20).

12 Pasquier, S. & Saussay, A. (2012) above n 6; Ryan, L. & Campbell, N. (2012). *Spreading the Net: The Multiple Benefits of Energy Efficiency Improvements* (2d ed.). In *IEA Insights Series 2012*. Paris: OECD/IEA.

- Motor vehicle fleet performance standards.
- Energy price signals (but they are often not sufficient on their own; usually, non-price barriers must be addressed as well).

Energy efficiency policy measures are effective, but they need to be carefully designed.[13] It is widely accepted that there are significant difficulties in achieving changes to the energy behaviours of both firms and individuals, particularly at a system-wide level.[14] This is as true for New Zealand as elsewhere; at the time the *Energy Cultures* programme began, government targets for energy efficiency were not being achieved,[15] and New Zealand's rate of energy efficiency improvements was below the OECD average.[16]

In the New Zealand context, space heating and hot water heating, which together account for around 60% of household electricity use, offer great opportunities for energy efficiency.[17] An added complexity is that New Zealand houses as a whole have low indoor temperatures owing to persistent under-heating and poor thermal properties. A New Zealand study showed that only in living rooms on winter evenings will the temperature even come close to the World Health Organization's healthy indoor temperature range of 18–24°C.[18] An Expert Advisory Group on poverty believes that many poor families are by necessity endangering the health of their children by living in poor quality housing.[19]

The health dimension is perhaps the most pressing problem relating to residential energy use in New Zealand. Low indoor temperatures are associated with poor health and excess winter mortality, and both health and educational benefits result from improved home heating and insulation.[20]

A recent cost-benefit analysis of EECA's Warm Up New Zealand: Heat Smart (WUNZ) programme for residential insulation and clean heating showed a benefit to cost ratio of almost 5:1 with

13 Geller, H., Harrington, P., Rosenfeld, A., Tanishima, S. & Unander, F. (2006). Policies for Increasing Energy Efficiency: Thirty Years of Experience in OECD Countries. *Energy Policy, 34*(5), 556–573; International Energy Association. (2007). *Energy Use in the New Millennium: Trends in IEA Countries.* Paris: OECD/IEA. (p.139); IEA, *Implementing Energy Efficiency Policies* (2009), above n 10 (p.19); Energy Efficiency and Conservation Authority. (2009, November). *Energy Efficiency and Renewable Energy in New Zealand 2001 to 2008.* Wellington: EECA. (p.6).

14 Stern, N.H. (2007). The Economics of Climate Change: the Stern Review. Cambridge, UK: Cambridge University Press.

15 Energy Efficiency and Conservation Authority (2006). *Situation Assessment Report on the National Energy Efficiency and Conservation Strategy.* Wellington: EECA.

16 Energy Efficiency and Conservation Authority (2007), *New Zealand Energy Efficiency and Conservation Strategy.* Wellington: EECA. (p.13).

17 Isaacs, N., Camilleri, M., French, L., Pollard, A., Saville-Smith, K., Fraser, R., Rossouw, P. & Jowett, J. (2006) *Energy Use in New Zealand Households – HEEP Year 10 Report.* Porirua, NZ: BRANZ.

18 Isaacs, N. et al, (2010) above n 4.

19 Expert Advisory Group on Solutions to Child Poverty. (2012, August). *Solutions to Child Poverty in New Zealand: Issues and Options Paper for Consultation.* Wellington: Office of the Children's Commissioner. (p.29).

20 Howden-Chapman, P., Pierse, N., Nicholls, S., Gillespie-Bennett, J., Viggers, H., Cunningham, M., Phipps, R., Boulic, M., Fjällström, P., Free, S., Chapman, R., Lloyd, B., Wickens, K., Shields, D., Baker, M., Cunningham, C., Woodward, A., Bullen, C., Crane, J. (2008). Effects of improved home heating on asthma in community dwelling children: randomised controlled trial. *British Medical Journal, 337,* a1411; Howden-Chapman, P., Matheson, A., Crane, J., Viggers, H., Cunningham, M., Blakely, T., Cunningham, C., Woodward, A., Saville-Smith, K., O'Dea, D., Kennedy, M., Baker, M., Waipara, N., Chapman, R., Davie, G. (2007). Effect of insulating existing houses on health inequality: cluster randomised study in the community. *British Medical Journal*, 334–460.

99% of the benefits attributable to health benefits, rather than energy savings or employment.[21] It found that the programme could obtain additional benefits if it was better targeted at cool areas of the country, at displacing reticulated gas use, at providing insulation (rather than heating), and at the needs of the ill and low and middle income earners.

Rental properties are particularly problematic. Building quality is affected by the principal-agent problem noted above; the landlord has no incentive to make energy efficiency investments like insulation that he or she will not enjoy personally or see being reflected in higher rental income, while the tenant has no interest in making alterations that will only pay off over time. Rental properties are more likely to be colder than other dwellings. New Zealand dwellings rated with indoor temperatures below 16°C are more likely to be accommodating tenant households than owner-occupiers.[22] Rental properties also tend to house poor people. Around two-thirds (65%) all those aged under 65 who are in poverty live in rental accommodation.[23] More than 70% of all children in poverty live in rental accommodation. The percentage of households living in rental properties is increasing. Twenty years ago, it was 26%; in 2011 it was 33%.[24] If the rental part of the residential sector is difficult to influence in energy efficiency, then the performance of the sector as a whole is affected.

Presently there are no requirements for existing rental properties to be insulated or free from undue heat loss. (Only new dwellings are affected by the Building Act 2004.) The Housing Improvement Regulations 1947 require a dwelling to be free from dampness, but they say nothing about cold or heat loss. Nothing in the Residential Tenancies Act 1986 obliges landlords to ensure that their properties are warm or habitable. The Expert Advisory Group on Solutions to Child Poverty[25] and the Productivity Commission's Housing Affordability Enquiry[26] have recommended that the government reconsider the regulations concerning the performance of rental accommodation.

21 Grimes, A. et al. (2012). *Cost Benefit Analysis of the Warm Up New Zealand: Heat Smart Programme*. Wellington: Ministry of Economic Development. The clean heat subsidy has now ended except for people replacing open fires and other poor-performing heating in the worst-affected airsheds.

22 Isaacs, N. et al. (2006) above n 17 (p.28).

23 Perry, B., (2012, August). *Household Incomes in New Zealand: Trends in Indicators of Inequality and Hardship 1982 to 2011*. (pp.119, 125). Wellington: Ministry of Social Development. Also, Expert Advisory Group on Solutions to Child Poverty (2012) above n 19.

24 Department of Building and Housing, (2011, December). *Briefing for the Minister of Housing*. Wellington: Department of Building and Housing. (p.11).

25 Office of the Children's Commissioner (2012) above n 19.

26 Productivity Commission. (2012, March). *Housing Affordability Enquiry*. Wellington: The Productivity Commission.

3. New Zealand Policy Framework for Energy Efficiency

New Zealand has a substantial framework of policy, law and other measures aimed at improving New Zealand's energy efficiency performance.

The New Zealand Energy Strategy 2011–2026 (NZES) and the companion New Zealand Energy Efficiency and Conservation Strategy 2011–2016 (NZEECS) set the framework for residential energy efficiency policy. The strategies include objectives to improve homes, increase the uptake of energy efficient products and appliances, and to increase the proportion of electricity generated from renewable sources.[27] The Energy Efficiency and Conservation Authority (EECA) leads the implementation of the NZEECS and works closely with other policy agencies in the design and implementation of relevant programmes. The Ministry of Business, Innovation and Employment has overall responsibility for energy policy.

EECA's current priorities and work programmes are outlined in its statement of intent. Existing residential programmes focus on information provision and financial assistance.[28] In addition, Minimum Energy Performance Standards (MEPS) and appliance labelling programmes target residential consumers. EECA's flagship programme is Warm Up New Zealand: Heat Smart (WUNZ), which provides grants to homeowners and landlords to retrofit insulation in houses built before 2000.[29] Since 2009, more than 188,500 houses have been upgraded under the scheme.

New Zealand has a "strong legislative and institutional base" for energy efficiency in the Energy Efficiency and Conservation Act, 2000.[30] The purpose of the Act, set out in section 5 is to "encourage, promote, and support energy efficiency, energy conservation, and the use of renewable sources of energy". The Act also established EECA, the functions of which are stated in section 21 to include:

> promoting public awareness in New Zealand of the importance of energy efficiency and conservation, and the use of renewable sources of energy
>
> [and]
>
> promoting practices and technologies to further energy efficiency, energy conservation, and the use of renewable sources of energy

These functions give EECA a strong mandate for leading behaviour change. The *Energy Cultures* results provide insights to support these statutory requirements. Similarly, the results have implications for Ministerial responsibilities set out in section 7, specifically, "providing information and advice".

27 Ministry of Economic Development. (2011). *Developing our Energy Potential: The New Zealand Energy Strategy 2011–2021 and the New Zealand Energy Efficiency and Conservation Strategy 2011–2016.* Wellington: MED.

28 Energy Efficiency and Conservation Authority. (2012). *Statement of Intent 2012/13 – 2014/15.* Wellington: EECA. (p.22).

29 In some circumstances subsidies are also available for efficient heaters.

30 International Energy Agency. (2011). *Energy Policies of IEA Countries: New Zealand 2010 Review.* Paris: OECD/IEA. (p.41).

The Building Act 2004 controls the construction of new buildings and the alteration and demolition of existing buildings, and is therefore significant to material culture. The purpose of the Building Act, stated in section 3, is to ensure that "people who use buildings can do so safely and without endangering their health" and that "buildings are designed, constructed and able to be used in ways that promote sustainable development". The Act gives authority for the energy efficiency clause in the Building Code (Clause H1). The Building and Housing Group in MBIE is responsible for implementing the Building Act and ensuring consumers have access to information and education to support decision making in the building and housing market.

The Electricity Authority's Consumer 'Switching' Fund also impacts on residential energy behaviour by encouraging consumers to change energy retailers to get cheaper electricity. The objective of the fund is to promote competition in the electricity market.

Table 1 summarises the legal and policy frameworks for residential energy efficiency policy, current priorities, and responsible agencies.

Table 1: Existing frameworks for residential energy efficiency policy

Guiding Document or Strategy	Priorities and Policies	Key Agencies and Statutory Obligations
Developing our Energy Potential: New Zealand Energy Strategy 2011–2021 and the New Zealand Energy Efficiency and Conservation Strategy 2011–2016.	**Efficient Use of Energy** ▪ Warm, dry, energy efficient homes (p.10 NZES). ▪ Better consumer information to inform energy choices (p.11 NZES). **Secure and affordable energy** ▪ Competitive electricity markets (p.12 NZES). ▪ Reliable electricity supply (p.13 NZES).	MBIE, Economic Development Group Energy Efficiency and Conservation Authority Electricity Authority
Ministry of Economic Development, Statement of Intent 2012–2015.[31]	**Efficient, reliable and responsive infrastructure services** ▪ The energy sector provides more competitive and secure energy supplies. ▪ Improved energy intensity of the New Zealand economy (p.15). **An increase in the percentage of New Zealand's electricity that is generated from renewable resources.** ▪ Ensure regulations and barriers are not constraining use of renewables (p.15).	MBIE, Economic Development Group

31 The website of the new Ministry of Business, Innovation and Enterprise notes that the Statement of Intent was prepared largely before the intention to create the new Ministry was announced. The Ministry's strategy can be expected to change as its constituent agencies are integrated.

Guiding Document or Strategy	Priorities and Policies	Key Agencies and Statutory Obligations
Energy Efficiency and Conservation Authority, Statement of Intent 2012/13–2014/15.	Warm Up New Zealand: Heat Smart ▪ Grants for retrofitting insulation and installation of efficient heating devices[32] (Table p.22). Air quality grants and assistance ▪ Funding to decommission non-compliant and polluting home heating devices in designated pollution sensitive areas (Table p.22). Grants for community home repairs to enable insulation and clean heating devices to be installed (Table p.22). ENERGYWISE information campaign for consumers (Table p.22). Warm Up New Zealand: Heat Smart marketing campaign (Table p.22). Minimum energy performance standards and labelling standards (Table p.28). ENERGY STAR endorsement labelling (Table p.28).	Energy Efficiency and Conservation Authority Energy Efficiency and Conservation Act 2000
Department of Building and Housing, Statement of Intent 12/15.[33]	People participate with confidence in the building and housing market and resolve disputes in timely and cost-effective ways. ▪ Access to advice, information and education that support decision-making in the building and housing market (Table p.13).	MBIE, Building and Housing Group Building Act 2004

32 Subsidies for efficient heating have since been discontinued.

33 The Statement of Intent notes that it was largely prepared before the before the intention to create the new Ministry was announced. The strategy will change, as necessary, as the four agencies are integrated.

Guiding Document or Strategy	Priorities and Policies	Key Agencies and Statutory Obligations
Electricity Authority, Statement of Intent 1 July 2012 – 30 June 2015.	Output class 2: Promoting and facilitating consumer switching (p.25).	Electricity Authority Electricity Industry Act 2010

These specific policies play out against a wider background of government priorities and policies.

The government has a strong agenda for economic growth and has set four strategic priorities, as outlined below, to drive the policy agenda for the rest of the parliamentary term.[34] These priorities are likely to shape future developments in residential energy efficiency policy.

1. Responsibly managing the Government's finances.
2. Building a more productive and competitive economy.
3. Delivering better public services within tight financial constraints.
4. Rebuilding Christchurch.

The Business Growth Agenda (BGA) is a key vehicle for delivering the policy agenda above. Led by MBIE, it focuses on supporting business growth and job creation and will deliver "innovative initiatives and policy reforms".[35] The BGA is organised around six key business inputs and associated policy issues. One of them is Natural Resources (including energy and resources). Another one is Infrastructure (including building and construction).

Better Public Services (BPS) is another key initiative designed to achieve the four strategic priorities. It is concerned with better outcomes from the public sector and outlines 10 key targets to achieve this. Target three: *Increase infant immunisation rates and reduce the incidence of rheumatic fever* has the potential to influence residential energy efficiency programmes because of the strong link between housing and health. Targeted energy efficiency policies could have strong co-beneficial outcomes in terms of reaching this specific goal.

The government appointed a Green Growth Advisory Group in 2011 and asked it to report on topics fundamental to achieving greener and faster growth. The Group's report paid particular

34 English, B. & Joyce, S. (March, 2012). *The government's business growth agenda.* Paper presented to Cabinet Economic Growth and Infrastructure Committee, Wellington.

35 Ministry of Business Innovation and Employment. (2012). *The government's business growth agenda.* Retrieved from MBIE website: www.med.govt.nz/business/economic-development/the-governments-business-strategy.

attention to energy efficiency.[36] It recommended that the Government should establish an agency, based on a refocused EECA, committed to helping businesses, farms, and households to reduce their greenhouse gas emissions as well as improving their energy efficiency. There should be a particular emphasis on small and medium sized enterprises (SMEs). The Group also recommended that New Zealand have greater focus on demand side management to improve energy efficiency. The Group concluded that the electricity industry has a role to play in working with household and business customers, and that the Electricity Authority and the Commerce Commissions have important roles in dealing with the infrastructural and regulatory aspects of demand side management. However the Government has decided not to implement these recommendations.

Overall, New Zealand has many policy measures in place to improve energy efficiency performance in homes. However, there is room for improvement. In a recent review of New Zealand's progress implementing its 25 priority energy efficiency policies, the IEA expressed concern at the lack of policies in New Zealand to encourage energy efficiency in buildings beyond the requirements of the building code. It pointed specifically to the absence of home energy rating (HERs) and building certification schemes, and to the lack of promotion of passive and zero energy buildings.[37] This criticism is echoed by the Pure Advantage organisation[38] which emphasises New Zealand's lack of mandatory building performance standards in comparison to European countries, the UK and the US. The IEA also notes that New Zealand could achieve better outcomes through the expansion of its MEPS programme.

36 Green Growth Advisory Group (December 2011). *Greening New Zealand's Growth*. Ministry of Economic Development, Wellington, Recommendations 6 and 7. The Government responded in "Progress Update on Greening New Zealand's Growth Recommendations" attached to press release, Joyce, S, and Adams, A, Greening Growth in Business Growth Agenda, 11 December 2012, available www.beehive.govt.nz. The Update addresses Recommendation 6 by referring to existing EECA operations without indicating any new action. It addresses Recommendation 7 by referring to existing EECA operations, existing legislation, and letters (unspecified) from responsible ministers to relevant agencies. Also see New Zealand Government, "Building Natural Resources: The Business Growth Agenda Progress Reports" (Wellington, December 2012) p.14.

37 Pasquier and Saussay (2012) above n 6.

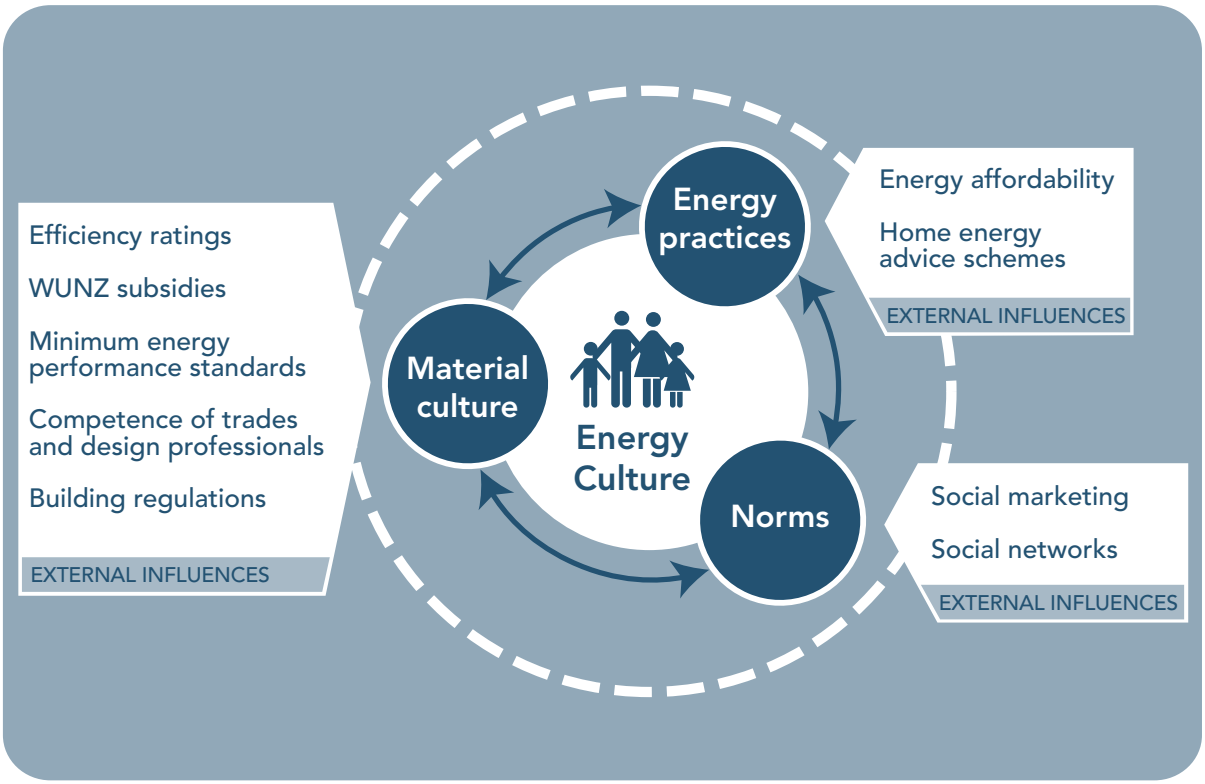
38 Pure Advantage. (2012, June 11). *New Zealand's Position in the Green Race*. Auckland: Pure Advantage.

4. The *Energy Cultures* Research Project

4.1 *Energy Cultures* Framework

The *Energy Cultures* Framework was developed by the research team to help understand the drivers of energy-related behaviours, and to help direct attention to the parts of the system that may benefit from change in order to influence energy behaviour in a desired way. The framework (Figure 1) depicts energy behaviour as primarily arising from the interactions between three components: norms (individual and shared expectations about what is 'normal behaviour'), material culture (physical aspects of a home including the form of the building and energy-related technologies) and energy practices (actions and processes).[39] These in turn are subject to broader influences that are largely outside of the individual's control, such as standards, subsidies, energy pricing and social marketing campaigns which directly shape householders' norms, material culture and energy practices.[40]

Figure 1: Energy Cultures Framework



39 Stephenson, J., Barton, B., Carrington, G., Gnoth, D., Lawson, R., Thorsnes, P. (2010). Energy Cultures: A Framework for Understanding Energy Behaviours. *Energy Policy, 38*, 6120–6129.

40 Note the Energy Efficiency and Conservation Act 2000 also refers (s 21) to EECA's functions as promoting 'practices and technologies' to further energy efficiency and conservation.

As an example, space-heating inefficiencies might be the result of ineffective heating technologies (material culture) and/or inappropriate heat settings (practices) and/or unrealistic expectations about warmth (norms). The combination of norms, material culture and energy practices can create self-reinforcing habitual patterns of energy behaviour. Achieving energy behaviour change involves altering one or more of these components, noting that a change in one (e.g. moving from an unflued gas heater to a heat pump) will almost inevitably lead to change in the others (e.g. different expectations of warmth, automated temperature settings).

From a policy perspective it is important to note that these components do not exist in a vacuum but are the result of many outside influences, of which policy settings form an important part. The framework is useful in directing consideration as to how different policy instruments can be utilised to influence norms, and/or the adoption of new material culture, and/or changes in energy practices. These will be discussed later in more detail in relevant sections.

4.2 Research Projects and Methods Used

The research programme was organised as a number of discrete research projects, linked together through the *Energy Cultures* conceptual framework. Experts from different disciplines had primary responsibility for each research project, although the approach was designed in collaboration with other team members, and the findings shared and discussed to develop an integrated understanding of the results. The main stages of the research are outlined in Table 2 and discussed in more detail in the following pages. The main publications and research outputs of the research programme are listed in the Appendix below.

Table 2: Research projects within the Energy Cultures research programme 2009–2012

Research project	Research aim	Research method/s
1. **Values and behaviour**	Examining the link between values and energy behaviours.	In-depth interviews with 100 householders using a 'laddering' technique.
2. **Energy behaviour of NZ households**	Collecting and interpreting data on norms, material culture and practices of households.	Survey of 2400 households; statistical analysis of the data.
3. **Energy Cultures clusters**	Segmentation of the NZ population according to energy culture characteristics.	Two-step cluster analysis.
4. **Understanding consumer choice**	Segmentation of the NZ population according to their preferred attributes of space and hot water heating.	Choice modelling across 2400 householders; clustering of responses.

Research project	Research aim	Research method/s
5. **Minimum Energy Performance Standards**	Comparing the range and level of New Zealand's MEPS with relevant countries internationally.	Desktop study.
6. **Energy behaviour change**	Exploring people's experiences of making an energy-related change in their home.	Focus groups in Auckland, Wellington and Dunedin.
7. **Influences on energy behaviour change**	Comparing the relative strength of different forms of influences on energy behaviour change.	Survey of residents of a Dunedin suburb; social network analysis.
8. **Intervention study**	Comparing relative impact of two different forms of energy advice on behaviour.	Standard individualised home energy audits, compared with providing advice through community networks.
9. **Hot water heating choices**	Understanding the non-adoption of energy efficient hot water heating systems in New Zealand.	Interviews with householders and tradespeople.
10. **Legal and regulatory research**	Investigating the legal framework for energy efficiency policy making in New Zealand.	Law and policy analysis. Comparative analysis.
11. **Policy report**	This present report.	

5. Research Results and Implications

5.1 Values and Behaviour

To obtain a better understanding of what guides energy efficient behaviour, the Foundation for Research Science and Technology issued a call for research to understand underlying personal values and their role in shaping demand. The first stage of the *Energy Cultures* project was therefore to investigate the relationship between a wide range of personal values and a selection of energy-related behaviours in the home. While there is extensive literature from many different perspectives on consumer behaviour and energy use,[41] there is a limited understanding of how energy consumption is related to underlying values.

To investigate in depth the way in which values may be related to energy saving behaviours, 'laddering' methods were used, which have been developed to identify means-ends chains.[42] In laddering only the relevant behaviours are predefined in the research and the values are uncovered by repeated questioning about why particular things are done or are seen to be important. The behaviour (i.e. the means to the end) is first described by the respondent who is then probed as to *why* they behave in that way. This normally uncovers some conscious rationalisation of the behaviour. This rationalisation is then probed as to why it is important to the individual. The underlying reasons, where a respondent can genuinely articulate them, can be associated with their fundamental underlying values.

Residents in three communities – Pakuranga, Cambridge and North-East Valley in Dunedin – were contacted by randomly selecting numbers from the telephone directory. Another survey was conducted in Thorndon and Wadestown, Wellington.[43] A handful of respondents were also recruited by recommendation from interviews on the basis that they would be interested in the study. The three locations were selected because of contrasting climates, housing stock and socio-economic criteria. For the discussions with respondents, the researchers selected twenty-two separate energy practices and/or material culture purchase options that could be undertaken to reduce energy consumption in the home.[44]

Research results show that the links between behaviour and rationalisations are generally much stronger than the links between behaviour and values. There are many instances where an underlying value for a behaviour cannot be identified. Often there is also no consistent relationship between values and energy behaviours; for example the same value related to capability was identified as underpinning both a willingness to install double glazing and a refusal to install double

41 Lutzenhiser, L. (1993). Social and Behavioral Aspects of Energy Use. *Annual Review of Energy and the Environment, 18,* 247–289; Wilson, C. & Dowlatabadi, H. (2007). Models of Decision Making and Residential Energy Use. *Annual Review of Environment and Resources, 32,* 169–203; Marechal, K. (2008). *An Evolutionary Perspective on the Economics of Energy Consumption: The Crucial Role of Habits.* Brussels: Sovalay Business School.

42 Reynolds, T.J. & Gutman, J. (2001). Laddering Theory, Methods Analysis and Interpretation. *Understanding Consumer Decision Making.* New Jersey: Lawrence Erlbaum Associates. (pp.25–62).

43 Mirosa, M., Gnoth, D., Lawson, R. & Stephenson, J. (2010, November). *Characteristics of Household Energy Behaviours* (Centre for the Study of Agriculture, Food and the Environment, University of Otago, unpublished report for EECA).

44 The list of behaviours was derived and modified from Barr, S. & Gilg, A. (2007). A Conceptual Framework for Understanding and Analysing Attitudes Towards Environmental Behaviour. *Geografiska Annaler, 89*, 361–379.

glazing. Different contexts and different rationalisations commonly result in weak and inconsistent relationships between values and behaviour. Different values can underlie the same behaviour; the same value can underlie different and opposing behaviours; and the same values can be connected to the same behaviours but for different reasons (as articulated in respondents' rationalisations).

Despite this finding, it is still useful to understand values in this context. Given the right set of circumstances, most people are likely to adjust their behaviour to act more consistently with their values. Furthermore, values are entrenched and difficult to change. If we want to change behaviour, it must be recognised that it is unreasonable to expect people to behave in ways they are opposed to. The main objective of this research has been to support policy makers in planning more targeted interventions to maximise uptake of smarter energy use by consumers. Thus, a number of specific recommendations for policy makers have been deduced from the findings.

Consistent with other studies that highlight a link between values and environmental behaviours,[45] the *Energy Cultures* study found the value of protecting the environment to be clearly related to energy behaviours and purchases. However, it also revealed that a much wider range of personal values exist, which influence energy use and purchases in the home.

Values relating to 'achievement' (being competent, intelligent, efficient) accounted for 38% of all of the responses.[46] Although the achievement value dimension has been previously linked to environmental concern in the literature,[47] the *Energy Cultures* study is the first to highlight the overwhelmingly dominant influence that this value has in driving and/or inhibiting energy-efficient behaviours and investments in the home. In particular, the study demonstrates that it is the individual values of being capable and intelligent that are most closely and consistently associated with energy-efficient behaviours. This simple premise is one that, to the knowledge of the researchers, has not often been exploited in social marketing efforts to increase energy efficient behaviour.

The use of this type of messaging in some of the current Energy Spot campaign is to be applauded. Social marketing efforts to change energy behaviours should consider appealing to achievement values, as simply linking to environmental values will miss out on a significant part of the population for whom this is not a key value. For example, a useful strategy could be a campaign promoting the message that certain energy-efficient behaviours (such as turning off appliances at the wall and installing energy-efficient light bulbs) are smart things to do that will make homes more comfortable and save them money. Likewise, reinforcing the idea that individuals are capable of making energy-efficient changes (i.e. that the changes are simple to make) will be a strong message to push in future communication campaigns promoting energy efficiency.

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45 See: Karp, D.G. (1996). Values and Their Effect on Pro-environmental Behaviour.*Environment and Behavior, 28,* 111–133; Poortinga, W., Steg, L. & Vlek, C. (2004). Values, Environmental Concern, and Environmental Behavior – A Study into Household Energy Use. *Environment and Behavior, 36*(1), 70–93; Stern, P. C., Dietz, T. & Guagnano, G.A. (1995). Values, Belief and Pro-environmental Action: Attitude Formation Towards Emergent Objects. *Journal of Applied Social Psychology, 25*(18), 1611–1636.

46 Lawson, R., Mirosa, M., Gnoth, D., & Hunter, A., (2010) Personal Values and Energy Efficiency. Presented at the annual conference of the Australia and New Zealand Academy of Marketing, Christchurch, December 2010, available http://anzmac2010.org.

47 Poortinga, W., Steg, L. & Vlek, C. (2004). Values, Environmental Concern, and Environmental Behavior – A Study into Household Energy Use. *Environment and Behaviour, 36,* 70–93.

Given that the findings have shown that the underlying values vary considerably for different energy behaviours (i.e. differ between heating, washing, lighting etc), it is recommend that interventions be designed on a behaviour-by-behaviour basis, on the basis of the most common value(s) supporting or in opposition to changing that behaviour. Identifying the most common value(s) for given behaviours will assist in crafting these behaviour-specific interventions. People's rationalisations for inefficient behaviours were most frequently linked to situational constraints, e.g. being a tenant, or being unable to get under the floor to insulate.[48] A problem with WUNZ is that it is applicable to only that portion of housing stock with no such constraints, so there is a need for policies to turn to addressing these more complex situations, particularly the landlord-tenant problem.

Finally, given that people's personal values tend to be relatively immutable, it makes sense not to try to change them, but to address the obstacles that prevent people from acting in energy-efficient ways that are consistent with their values. The *Energy Cultures* study confirms the findings of others in the energy field[49] that these obstacles can be motivational and contextual.

Table 3: Summary of research results and policy implications of values research

Key research findings	Implications for policy
The Achievement values (Being Capable, Being Intelligent) and to a lesser extent Environmental values (Protecting the Environment) are most strongly aligned with energy-efficient behaviours.	Campaigns (e.g. Energy Spot) aligned to these values are more likely to touch a chord.
Many behaviours have no identifiable value, and often different values underlie the same behaviour, and different behaviours arise from same value.	Design interventions on a behaviour-by-behaviour basis, linking to key values for each behaviour.
People's rationalisations for inefficient behaviours are often linked to situational constraints.	Policy should focus on motivating landlords to take action on insulation and clean heat for rental accommodation. Insulation schemes need to apply to a wider range of housing stock and household situations.

48 Mirosa, M., Lawson, R., & Gnoth, D. (2011) Linking Personal Values to Energy-Efficient Behaviors in the Home. *Environment and Behaviour* (27) 1–21; Mirosa, M., Gnoth, D., Lawson, R., & Stephenson, J., (2011, June) Rationalising Energy-Related Behaviour in the Home: Insights from a Value-Laddering Approach. European Council for an Energy-Efficient Economy Summer Study, France, pp 2109–2119.

49 Ibid.

5.2 Energy Behaviour Change

This section draws from the results of the household survey, focus groups and social network analysis[50] (research projects 2, 6 and 7 as listed in Table 2) and discusses the factors involved when households make a change to their space heating. In these parts of the research programme the research team was interested in people's reported experiences of the change process, particularly in relation to what had helped or hindered them in making the change.

It was evident from the household surveys (Project 2, Table 2) that there is already a great deal of heating-related change occurring in households. In the previous year, 16% had changed some aspect of insulation, and 12% reported that they had changed their main heating method (of these, 44% had changed to heat pumps). We did not analyse the causes for this change in the research, but the existence of WUNZ subsidies during this period is likely to be at least a partial influence.

Despite this level of change, there is still a long way to go to improve New Zealand's housing stock, and as the focus group participants (Project 6, Table 2) reported, change can be exceedingly complicated, expensive and often daunting. Reviewing the transcipts, the participants' experiences of the change process could be grouped into (a) the development of the desire to change, (b) choosing what to change to, and (c) implementing the change. These stages are described below.

The desire to change

The desire to change arose out of both drivers and attractors. Drivers included such things as technology breakdowns, health issues related to existing heating systems (e.g. asthma), high running costs, inefficiency, operational difficultues, and poor fit with aspirations (e.g. aesthetics, comfort). Attractors included such things as anticipated levels of warmth, dryness and comfort, preference for the practices relating to new heating system (e.g. press-button controls), better fit with values (e.g. using renewable resources), and anticipated return on investment through lower running costs or on later sale of house.

While each household had distinct circumstances that led to a change, some points of commonality included experiencing a house that had had a similar change and thus having a point of comparison, and/or having the encouragement of family or friends. Many participants had a good basic understanding of what constituted an energy-efficient heating system, some mentioning the Energy Spot campaign in this regard, but others referring to other sources of information including their own social networks.

Choosing what to change

Once a desire to change had been established, householders were then faced with the process of choosing what to change (insulation? heating system? glazing? curtains?), and then what to change to (what sort of heating system? what brand?). Considerations also needed to include

50 Stephenson, J. & Carswell, P. (2012, September 20–21). *Energy Cultures and Social Networks – influences on household energy behaviour*. Paper presented at the Energy Efficiency and Behaviour Conference, Helsinki, Finland.

cost, fit with the house, fit with current and future family needs, and (for some) whether their needs fitted with the WUNZ subsidy requirements.

For this stage, participants valued talking with trusted people (often family and friends); they valued independent objective information about options, and information crafted to their own circumstances; and they valued being able to trust the quality of the technology.

Implementing the change

Once a choice had been made, the householders were then faced with implementing the change. This process involved further choices as to supplier and tradespeople. It involved dealing with the stresses of financing the change, timing issues, and dealing with the physical disruptions. Decisions would have to be made on the fly, and some householders felt less compentent than others in making those decisions.

For this stage, finance was clearly all-important, and projects were either funded outright, through subsidy, or through a partial loan. (Interestingly, a number of participants reported that they had not taken up the WUNZ subsidy even though they were potentially eligible, for a variety of reasons including the restricted choice of installer, the inability to carry out the work themselves, and the fact that other firms offered essentially the same discount for doing the work.) In addition, householders needed to feel competent to make decisions, and to be able to trust the retailer and the tradespeople carrying out the work, and to be sure that the completed work would perform as promised. For many, having the ability to carry out at least some of the work themselves, or having family and friends who could help, was a crucial part of being able to realise the project.

In summary, energy behaviour change can usefully be seen as a 3-stage process – desire, choose, and implement – each of which has different influences. The 'desire' stage is largely about a shift in norms which can be driven by a variety of external influences but particularly family and friends; the choosing phase is supported by independent, objective and trustworthy advice from trusted people; and the implementation stage is supported by financial assistance, advice and trustworthy tradespeople. Significantly, family and friends played an important role in relation to all three stages. Independent advice was also crucial in both the choosing and implementing stages.

The finding of the importance of friends and family was strongly reinforced by the separate study on influences on energy-related changes in a Dunedin suburb (Project 7, Table 1). It revealed that people's friends and family members were overwhelmingly reported as the most helpful influences. Personal social networks were 2.9 times more influential than all media together (TV adverts, newspapers, Consumer magazine, internet), 3.6 times more influential than all local community groups, and 4.4 times more influential than all organisations listed (including EECA, power company, council, tradespeople and companies supplying energy-related goods). Approximately 25% reported family and friends as the ONLY influence on their change. Energy Spot (a TV energy campaign), tradespeople and EECA were next most influential, in that order. People desire information that they can trust.

The role of social networks was reinforced by data from the national survey (Project 2, Table 2) in which 7% of respondents reported that they talk to friends and neighbours about energy 'often' or 'very often'; 6% reported that they are 'often used as a source of advice'; and

4.5% reported that they 'give a great deal of information' in such exchanges. This presence and role of these 'energy mavens' suggests that there could be real benefit in supporting their activities and ensuring that the information they disseminate is sound.

Table 4: The key findings from the behaviour change research and implications for policy

Key research findings	Implications for policy
Three important stages of change have been identified: generating a **desire** to change; supporting people to **choose** what to change and ensuring they are in a position to **implement** the change.	Policy needs to be crafted to differentially support each stage. Of current policies, Energy Spot is likely to be most influential in the 'desire' and 'choose' stages, and WUNZ subsidies in the 'choose' stage (certified installers) and 'implement' stage (financial assistance). Much more could be achieved by supporting the role of social networks in all 3 stages, and in provision of independent trustworthy advice to support the 'choose' and 'implement' stages – see below for discussion.
There was a widely-expressed desire for independent trusted advice, crafted to householders' own circumstances.	This highlights the need for policies to support the dissemination of trustworthy advice from trusted people. This need could be met in different ways targeted to different segments of the population, such as: ▪ A nationwide home energy advice service, offering both home visits and telephone advice. ▪ An internet-based service more crafted to the preferences and circumstances of individual householders than current offerings such as Homestar.
WUNZ subsidy only applies to a limited range of household circumstances, and up-front costs are still a barrier to change for some.	Review the scope of WUNZ subsidies so that they apply to a wider range of physical circumstances. Develop low-interest loans and other financing options for low or fixed-income families.

Key research findings	Implications for policy
People's families and friends have an overwhelming influence on energy behaviour changes.	Place a greater focus on disseminating information and hands-on practical experience within existing social networks. Utilise existing energy mavens, and support existing networks to further stimulate change within their areas of influence.
There is a stark difference in tenants' ability to change compared to home owners.	Create motivations for landlords to improve insulation and heating within rental accommodation.

5.3 Energy Cultures or Clusters

The *Energy Cultures* framework explicitly acknowledges the existence of heterogeneity of consumers which results in differing cultural groupings (i.e. "energy cultures"). This section outlines the results of our research to identify different energy cultures in New Zealand.

In order to describe possible energy cultures, a comprehensive questionnaire was designed that covered all the dimensions in the *Energy Cultures* framework. Advice was received from an external panel of experts and the questionnaire evolved through four trial stages in different local communities before it was used for a national survey. The final survey comprised 205 questions.

The data was collected on-line by a commercial market research company which runs a panel designed to be nationally representative. The data available from the survey was then analysed in order to uncover underlying patterns that describe the different segments of the New Zealand population in regard to their use of energy in the home.[51] The analysis suggested a four cluster solution plus an outlier group of a further 6.3% of cases. The four clusters were analysed in terms of the three components described in the *Energy Cultures* model and also profiled by their demographic characteristics. The four clusters are described in Table 5 on the following page.

51 For a full explanation of the data analysis methodology, see Lawson, R. & Williams, J., (2012). Understanding Energy Cultures. Presented at the annual conference of the Australia and New Zealand Academy of Marketing, Adelaide, December 2012.

Table 5: Energy Cultures or Clusters

	Energy Economic	Energy Extravagant	Energy Efficient	Energy Easy
% of population	24%	19%	20%	31%
Demo-graphics	Younger, poorer and smaller households. Students and unemployed.	Families – dependent children aged under 50. Highest income.	Older – often empty nesters, part time work. Owner occupied Mostly in small centres/rural.	Middle-aged older Europeans. Few children. Second highest income, but many retired, Auckland and Wellington.
Norms	Environmentally aware. Confident in energy decisions.	Few distinctive features but appear less confident in energy decisions, value enjoyment and pleasure in life.	Value practicality.	Least concerned about environmental issues.
Material Culture	Often rented flats or apartments. Poor insulation. Fewest household appliances. Low sunshine hours. Portable electric and gas heaters.	Largest houses but not best insulated or improved. Energy efficient heating systems. High appliance ownership levels.	Separate freezers but lower ownership of many appliances, or own but not use. Well insulated houses and efficient heating systems.	Owner occupied – often debt free. High users of driers and often less efficient heaters. Insulation restricted.
Energy Practices	Lots of energy saving practices, e.g. drying laundry outside, switching off lights.	Less energy saving practices.	Lots of energy saving practices.	Heat throughout house and less energy saving practices.
Energy Usage	Smallest expenditure on energy.	Significantly higher energy spend than all other groups.	Medium level of household spend but lower than 'Energy Easy' on per capita basis.	Second highest consumption on a per capita basis.

Although some statistically significant differences exist between the segments in terms of norms, as noted above in Table 5, these differences are generally weak. The important differences between the groups lie in their material culture and energy practices. Portraying the groups in this way highlights areas that need addressing most from a policy perspective.

The highest energy users are the 'Energy Extravagent' cluster who are generally wealthier, have large houses, have little incentive to be efficient in their energy practices, and appear to pay little attention to the efficiency of their material culture. This cluster has the least financial constraint to using energy more efficiently and would appear to represent a significant policy opportunity for efficiency gains.

The lowest energy users are the 'Energy Economic' group, who live in poor quality housing, have inefficient heating technologies, yet who use energy-saving practices. Policy interventions to improve the situation of the Energy Economic households should primarily be aimed at improving their material culture. Since many are in rental accommodation this may also mean that the key initiatives have to be addressed to landlords or towards influencing the criteria tenants might use when choosing accommodation. If local authorities provided information on insulation standards of properties across their region, this could help tenants in choosing warmer and more energy efficient accommodation.

The Energy Efficient group has the second lowest spend on energy, and have achieved this through a combination of efficient material culture and efficient practices. This group is clearly motivated, and socialising their stories of change and the benefits they have accrued could be helpful in shifting the norms of other groups. They support the provision of better energy information such as minimum standards on appliances, star rating and home energy audits.

The Energy Easy group has the second highest spend on energy. Their energy use would be more efficient by paying attention to more efficient practices, and in some cases to improving the efficiency of their material culture. Given that this is the oldest group and yet relatively wealthy, this group could benefit from automated energy management systems and well as improved information as above.

Implications for policy in relation to the different clusters are outlined in Table 6 on the following page.

Table 6: The four energy culture clusters identified through the research and the policy implications arising from them

Key research findings (i.e. clusters)	Implications for policy
Energy Economic	Improve material culture, particularly heating and insulation. Extend WUNZ and provide more financial support. Incentivise landlords to improve housing quality. Establish a home energy certification program for tenants.
Energy Extravagant	Motivate to improve efficiency of their material culture and practices, and make change decisions easy. Apply time-variable energy prices, social marketing to change norms, encourage home energy management systems, extend MEPS and labelling schemes.
Energy Efficient	Support existing willingness to be efficient. Extend MEPS and labelling schemes. Establish a home energy audit program. Share success stories more widely.
Energy Easy	Make it easy to be efficient. Extend MEPS and labelling schemes, revise WUNZ criteria if a poor fit with this cluster, encourage home energy management systems.

5.4 Understanding Consumer Choice

Households can improve energy efficiency by investing in more energy-efficient technologies, such as insulation and energy-efficient appliances. Like most other goods and services, these appliances vary in their 'attributes', such as how much they cost to purchase and install, how well they work, and how they affect the aesthetics of the house. Households will vary in how they perceive the value of each of these attributes relative to others, which affects how willing they are to invest in energy-efficient appliances.

A choice survey was the method used to investigate this variation. The researchers asked each of 1396 home owners to make a series of choices involving hypothetical space heating or water heating appliances. Each choice required the respondent to trade off one attribute of appliances for another. The results show how each respondent values each attribute relative to others.

As expected, the results reveal considerable variation across respondents. To investigate patterns in the variation, standard techniques were used to identify groups, or clusters, of respondents with similar patterns in how they value attributes relative to others. In each resulting group, respondents tend to value one or more related attributes highly, compared to other attributes. The results varied in some instances between space heating and hot water heating. Five groups were identified, as shown in Table 7 below.

Price is Paramount group: one rather striking result is that upfront purchase and installation costs are of greatest concern to only about 15% of respondents. Another 35% are moderately concerned about upfront cost, although this is not the attribute they rank as most important.

Cost Recovery group: around 17% of the space heating respondents are relatively more concerned that they recoup most of the cost of their investment upon sale of their house.

Reliability group: for around 22% of all respondents, reliability of the appliance was the most important attribute. Reliability means that the improvement delivers the expected energy savings, works well, is easy to operate, and fits well with the house.

Aesthetics group: aesthetic issues were most important for 22% of space heating respondents and 35% of water heating respondents. Aesthetics refers to how the appliance would fit with the house, and also to concerns about noise or other disturbance to the household or neighbours.

Off-grid group: about 25% of all respondents felt as strongly about independence from the electricity transmission and distribution grid as about any other attribute, including purchase and installation cost. The size of this group was unexpected but consistent across both space and water heating.

These findings echo other parts of the research, that, for part of the population, their economic circumstances are the limiting factor. However the upfront cost is the overriding concern for only 15% of the population, and a moderate concern to another 35%. For around half of respondents the upfront cost is a relatively minor concern compared to issues like aesthetics and being off-grid. To support change to more efficient heating and hot water appliances, subsidies may help address barriers for the 'Price is Paramount' group and to some extent to the 'Cost Recovery' group, but are likely to be less motivating for the other half of the population for whom other drivers are more important.

Table 7: Key findings and policy implications from the choice modelling research

Key research findings	Implications for policy
Price is Paramount – about 15% of respondents are very concerned about up-front costs of both space and water heating. (A further 35% are moderately concerned about up-front cost, but this is not the most important attribute for them.)	Subsidies and other financial support measures will be attractive to these households.
Cost Recovery – about 17% of those responding (for space heating only) were willing to invest in more expensive heating if they could recover costs.	An energy rating scheme for houses would provide the market with information about energy efficiency investments, thus giving it a value. This could encourage this 'Cost Recovery' group to invest.

Key research findings	Implications for policy
Reliability – about 22% ranked reliability most highly.	This group wants assurance that the improvement will work as advertised. Policy tools include appliance rating schemes, MEPS, and making it easy for households to access trustworthy information and advice.
Aesthetics – about 22% of space heating respondents and 35% of water heating 20% of respondents were especially concerned about aesthetics and the fit with their house.	If policy instruments encourage particular products or behaviours, they must be flexible enough to accommodate aesthetics, fit with house, and effect on neighbours.
Off-grid – about 25% of respondents expressed preference for some grid independence.	Characteristics of this group require further exploration, but they may also be interested in other self-sufficiency investments, such as solar water heating or photovoltaics. This group has potential implications for the future management of the electricity system, e.g. supporting deferred investment in new large-scale generation.
Recoup on Resale – about 15% hope to recover investment costs upon sale of their house.	Prospective home buyers need trustworthy information about home energy-efficiency improvements.

5.5 Minimum Energy Performance Standards (MEPS) Research

Minimum Energy Performance Standards (MEPS) establish the minimum energy efficiency that products in the market must achieve under standard test procedures. The products that offer most promise in a MEPS programme are those where the energy efficiency is sensitive to the design, such as refrigerators, air-conditioners, dryers, lighting and consumer electronics. Because there may be an increase in manufacturing cost when the design of a product is modified to increase its energy efficiency, a MEPS scheme can be an effective tool for promoting these changes where appropriate. The New Zealand Energy Efficiency and Conservation Act 2000 provides a foundation for energy efficiency promotion in New Zealand by allowing the government to make energy labelling mandatory and to set MEPS for a range of products.

It was found that the number of MEPS implemented in New Zealand – 20 based on CLASP[52] categories – is lower than that in the other ten countries, with the strongest portfolios by approximately 25%. MEPS for compact fluorescent lamps and televisions have recently been added.

52 CLASP (2011). Global Standards & Label Information. Retrieved from CLASP website: http://clasponline.org/en/ResourcesTools/Tools/SL_Search.

On the whole, the products with implemented MEPS in New Zealand are well represented in the portfolios of the top ten countries. This suggests that the MEPS portfolio in New Zealand is well-aligned with best practice internationally, which is desirable because it helps New Zealand to reduce the risk of becoming a dumping-ground for low efficiency products.

Nevertheless, there is room to extend the portfolio further. *Energy Cultures* identified four products for which many other countries have implemented or pending MEPS, which have not yet had MEPS implemented in New Zealand. These are: clothes washers, dishwashers, incandescent lamps, and drink vending machines. Work is under way in EECA on some of these. It was noted that incandescent lamps are in the MEPS portfolio of Australia.

There are also reasons for considering clothes dryers, solar water heaters, heat pump water heaters, and domestic dehumidifiers as candidates for new MEPS. Solar and heat pump water heaters are at an early stage of market acceptance, which is an appropriate time to implement a performance standard for products with a service life of 10 to 20 years. Solar and heat pump water heaters are likely to become more important following Australia's decision to phase-out conventional electric water heaters in homes.[53] Clothes dryers and dehumidifiers are established products with significant markets in New Zealand.

Work on MEPS should continue to be aligned with that of Australia in the Equipment Energy Efficiency (E3) Program.

The key findings from this research and implications for policy are summarised in Table 8 below.

Table 8: Key findings and policy implications of research into MEPS

Key research findings	Implications for policy
The MEPS portfolio in New Zealand is well-aligned with best practice internationally.	
MEPS for clothes washers, dishwashers, incandescent lamps, and drink vending machines are common elsewhere.	Work should proceed on MEPS for these products in order to remain in line with major trading partners. (See NEECS p.24.)
Solar and heat pump water heaters are at an early stage of market acceptance and are likely to become more important in Australia. Clothes dryers and dehumidifiers are established products with significant markets.	MEPS for these products should be considered. Work on MEPS should continue to be aligned with that of Australia in the E3 program.

53 Australian Government Department of Climate Change and Energy Efficiency. (2011). Retrieved from Department of Climate Change and Energy Efficiency website: www.climatechange.gov.au.

5.6 Energy-Efficient Water Heating

Domestic hot water heating accounts for approximately 30% of household total electricity consumption.[54] EECA provides a lot of material on its website to support the uptake of more efficient hot water heating systems, especially solar and hot water heat pumps, which have attracted subsidies for installation. In research seeking to understand the reasons for slow uptake, in-depth interviews were undertaken to examine the decision processes of householders who were replacing existing hot water systems or building new homes. Trades people and professionals advising those households were also interviewed.[55]

Perhaps the most challenging barrier to overcome is that in order for a householder to adopt an alternative, they must drive the decision right from the start. If not, an electric hot water cylinder will be installed as the default option. Respondents had a real issue in finding information that they regarded as unbiased and relevant to their individual situation. There was a consistently-expressed uncertainty regarding available alternatives, what they were and how to evaluate them. Respondents commonly felt uncertain about payback periods in relation to up-front costs. From a tradesperson's perspective there were insufficient margins for them to bother with energy efficient systems. Landlords were not incentivised either; they did not perceive the installation of an energy efficient hot water system as a feature that might command a premium on the rent.

Table 9: Key findings and policy implications of research into hot water heating

Key research findings	Implications for policy
Standard hot water systems are the default option for tradespeople and designers, leading to widespread inertia.	Adopt regulations (as in some Australian states) requiring that all hot water cylinders installed in New Zealand are solar or heat pump ready.
Householders currently have to drive the decision to adopt EE hot water systems: undertake the process of searching for information, estimating performance and payback period, and evaluating the alternatives. This acts as a critical barrier in the adoption of alternatives.	Improve trade training and incentivise trades people and other advisors so that 'push strategies' are employed to bring the technologies to market.
Householders want independent advice from trusted people to move from idea to action.	Make available customised expert advice that would support the later stages of the adoption process, such as the options available, payback periods, solar potential for the particular location, advice on installers, and available subsidies.

54 NZ Energy Efficiency and Conservation Strategy (2007) above n 16.

55 Grieve. C., Lawson, R. & Henry, J. (2012). Understanding the non-adoption of energy efficient hot water heating systems in New Zealand. *Energy Policy, 48,* 369–373.

5.7 Legal and Regulatory Research

Energy efficiency requires a strong formally expressed place in the legal framework for energy policy.[56] The record of the Energy Efficiency and Conservation Act 2000 is mixed. It provides a good framework for strategy and policy action. What is desirable beyond its present form is for energy efficiency to be located at the heart of general energy policy, with energy efficiency policy connected to policies for the supply of energy.[57] California is an example of a jurisdiction where energy efficiency is so placed, as the preferred policy option, to be a governing factor in all energy-sector activity, in integrated energy planning, and in the evaluation of new generation of transmission options. California has produced considerable long-term success in energy efficiency.

Strategic planning in the National Energy Efficiency and Conservation Strategies (NEECS) is capable of considerable improvement. At present it is characterised by: weak targets, vagueness in the policy actions to be undertaken to meet a target or goal; no plans for implementation, no continuity or connection with previous NEECS, weak supporting data; and weak integration with EECA programmes and planning. An improved NEECS strategy framework could make a contribution to Government's high-level goals.

The allocation of responsibilities for energy efficiency among government agencies needs reconsideration. Agencies in fields such as transport or electricity have little or no responsibility to pursue energy efficiency. The result is a 'silo' problem. On the international scene, integrated government-wide approaches are generally thought to be required.

Best practice internationally for energy efficiency shows that conventional regulation and fiscal mechanisms continue to be important policy tools. Conventional regulation such as MEPS, building codes, and (in transport) vehicle and fleet performance measures are effective and efficient; so too are subsidy programmes such as Warm Up New Zealand: Heat Smart. The policy rationale for such action on energy efficiency is well established, and there are decades of experience in fine-tuning suitable regulatory instruments. Also effective are less conventional instruments, such as information disclosure requirements (e.g. labelling requirements, building energy efficiency certificates). Behavioural economics offers insights into methods of altering behaviour without undue intrusion. Many countries, but not yet New Zealand, produce energy efficiency improvements by using home audit or building energy efficiency ratings and certificates, and by using retailer demand-side management (DSM) programmes.

The four-cluster analysis showed that all groups were unenthusiastic about "banning" as a way of dealing with energy efficiency problems. The "Energy Economic" group was more receptive, and the "Energy Extravagant" group was less so. It was notable that low/no interest financing was well received, especially as it is little used at present, outside some local authorities with targeted rate systems.

56 Eusterfeldhaus, M., and Barton, B. (2012) Energy Efficiency: A Comparative Analysis of the New Zealand Legal Framework. *Journal of Energy and Natural Resources Law* 29:4 431–470.

57 Barton, B. (2012) The Denominator Problem: Energy Demand in a Sustainable Energy Policy. Policy Quarterly, in press.

Policy measures are available to improve the energy efficiency of rental accommodation.[58] The rental sector has been difficult to reach with the policy measures used thus far. It is an important sector because of its size and its relevance to poverty and health, especially child health, including rheumatic fever. Desirable measures are: fiscal and regulatory policy actions are designed so that they are available to tenants as much as to owner occupiers; action by Housing NZ to insulate and damp-proof its entire stock; reform of residential tenancies law and housing improvement legislation to ensure that rental accommodation is reasonably protected against heat loss and dampness; adoption of UK and Australian measures for information disclosure and home audit (building energy efficiency ratings and certificates); and encouragement of local initiatives to inform prospective tenants of the warmth and thermal characteristics of dwelling houses. (The Dunedin Student Tenancy Accommodation Rating Scheme is an example.)

The key findings from this research and implications for policy are outlined in Table 10 below.

Table 10: Key findings and policy implications from legal and regulatory research

Key research findings	Implications for policy
Energy efficiency requires a strong, formally expressed place in the legal framework for energy policy.	An integrated energy policy framework should give a central place to energy efficiency.
Strategic planning in NEECS is capable of considerable improvement.	Pending the next NEECS process, data collection and monitoring should be improved in order to support energy efficiency policy.
Comparative analysis shows that conventional regulation and fiscal mechanisms continue to be important policy tools.	MEPS, insulation subsidies, vehicle and fleet performance standards, etc, should continue to be used as policy instruments.
Low/no interest financing is liked as a policy instrument for energy efficiency.	Low/no interest financing of energy efficiency improvements should be explored further as a policy option.
Rental accommodation is affected by a generally-recognised principal-agent market failure.	Substantial policy action is required: action by Housing NZ; reform of residential tenancies law and housing improvement legislation; new information disclosure and home audit measures; and encouragement of local initiatives.

58 Barton, B. (2012). Energy Efficiency and Rental Accommodation: Dealing with Split Incentives. Hamilton, NZ: University of Waikato Centre for Environmental, Resources and Energy Law, unpublished paper.

6. Conclusions

New Zealand has several successful energy efficiency programmes in place, and the *Energy Cultures* findings confirm that initiatives such as WUNZ, MEPS and Energy Spot are addressing key barriers to change. However the *Energy Cultures* research has identified a number of areas in which energy policy could be strengthened to achieve some significant gains through positively influencing household energy behaviour. The *Energy Cultures* findings have identified a number of key barriers and pathways to behaviour change, particularly related to residential heating and hot water efficiency. These results provide useful insights for policy makers seeking to improve the energy efficiency performance of New Zealand homes.

The *Energy Cultures* research proceeded on the basis of a carefully-developed conceptual foundation. It was interdisciplinary in drawing together the perceptions and methods of several different modes of inquiry. It approached the difficult questions of individual behaviour in household energy use through several different research techniques. The different disciplinary perspectives and the different techniques employed often produced results that reinforced each other. That added to the cogency of the research results.

The most significant policy implications of the *Energy Cultures* research results are as follows.

(i) Policy design should consider the triple role of norms, material culture (house structure and energy technologies) and energy practices in contributing to overall energy behaviour. The Energy Cultures framework draws attention to the three elements in energy behaviour. Each will respond differently to policy interventions. Policy design should consider which of the three elements to target for any given energy issue, while being aware that a change in any one element (e.g. material culture), is likely to lead to a change in others (e.g. practices and norms).

(ii) Households with the highest energy use tend to be those that pay little attention to improving the energy efficiency of their house, own many energy-using appliances, and have little regard to energy-efficient practices. This cluster of households (around 20% of the population) is generally wealthier and thus has fewer barriers than others to making efficiency improvements. This group represents a policy opportunity to achieve significant gains in energy efficiency and conservation.

(iii) The lowest energy users tend to have substandard housing and inefficient energy technologies, yet have very economical energy practices. This combination of circumstances tends to be aligned with cold, and often damp, housing. This cluster of households (around 25% of the population) has lower incomes and restricted choices, creating a substantial barrier to improving their energy situation. The WUNZ programme partially addresses their financial constraints to action, but it needs to be continued, and to include clean, efficient space and hot water heating, as well as other means to assist with financing (e.g. low-interest loans).

(iv) The particular energy-related problems and constraints faced by tenants were evident in many of the research streams. The proportion of people renting is growing, and the tenancy population has characteristics such as poor health that make it a particular priority for substantial policy action to address the lack of drivers for landlords to improve the energy standards of their rental properties.

(v) Achievement-related values – being capable and being intelligent – are strongly linked with energy efficient behaviour. Appeals to such values in energy efficiency social marketing can be expected to continue to be successful.

(vi) Making choices about energy-related changes in the home can be exceedingly complex, and a barrier to action. People value independent trustworthy information to help them in this process. This represents a policy opportunity to support the provision of independent home energy advice.

(vii) A person's family and friends are the key influences on household energy behaviour changes, more so than media, community action groups or other organisations such as councils, tradespeople or power companies. There are gains to be made by supporting the positive work of social networks.

(viii) Tradespeople and design professionals are, however, very influential in household energy decisions. There is a need for better training in energy efficient products and services, and better incentives to supply them.

(ix) Some of New Zealand's energy efficiency policies are lagging behind other similar OECD countries. Of these, introducing home energy rating and certification schemes and introducing a wider range of Minimum Energy Performance Standards on energy appliances would assist with policy challenges (ii), (iii) and (vi) above.

(x) New Zealand's energy policy framework should give a central place to energy efficiency. Data collection on energy use and behaviour should be improved in order to support the development and monitoring of energy efficiency policy.

Appendix 1:

Energy Cultures Publications and other Research Outputs

Barton, B. (2012) The Denominator Problem: Energy Demand in a Sustainable Energy Policy. Policy Quarterly, in press.

Barton, B. (2012). Energy Efficiency and Rental Accommodation: Dealing with Split Incentives. Hamilton, NZ: University of Waikato Centre for Environmental, Resources and Energy Law, unpublished paper.

Eusterfeldhaus, M., & Barton, B. (2012) Energy Efficiency: A Comparative Analysis of the New Zealand Legal Framework. *Journal of Energy and Natural Resources Law* 29:4 431–470.

Grieve. C., Lawson, R. & Henry, J. (2012). Understanding the non-adoption of energy efficient hot water heating systems in New Zealand. *Energy Policy, 48,* 369–373.

Lawson, R., Mirosa, M., Gnoth, D., & Hunter, A. (2010, December) Personal Values and Energy Efficiency. Presented at the annual conference of the Australia and New Zealand Academy of Marketing, Christchurch, available http://anzmac2010.org.

Lawson, R. & Williams, J., (2012, December). Understanding Energy Cultures. Presented at the annual conference of the Australia and New Zealand Academy of Marketing, Adelaide.

Lawson, R. & Williams, J. (2012, December). The Nature of Fuel Poverty in New Zealand. Presented at the annual conference of the Australia and New Zealand Academy of Marketing, Adelaide.

Mirosa, M., Gnoth, D., Lawson, R. & Stephenson, J. (2010, November). *Characteristics of Household Energy Behaviours* (Centre for the Study of Agriculture, Food and the Environment, University of Otago, unpublished report for EECA).

Mirosa, M., Gnoth, D., Lawson, R., & Stephenson, J., (2011, June) Rationalising Energy-Related Behaviour in the Home: Insights from a Value-Laddering Approach. European Council for an Energy-Efficient Economy Summer Study, France, pp 2109–2119.

Mirosa, M., Lawson, R., & Gnoth, D. (2011) Linking Personal Values to Energy-Efficient Behaviors in the Home. *Environment and Behaviour* (27) 1–21;

Stephenson, J., Barton, B., Carrington, G., Gnoth, D., Lawson, R., & Thorsnes, P. (2010). Energy Cultures: A framework for understanding energy behaviours. *Energy Policy, 38,* 6120–6129.

Stephenson, J., Lawson, R., Carrington, G., Barton, B., Thorsnes, P., & Miranda, M. (2010). The Practice of Interdisciplinarity. International Journal of Interdisciplinary Social Sciences, 5:7, 271–282.

Stephenson, J. & Carswell, P. (2012, September 20–21). *Energy Cultures and Social Networks – influences on household energy behaviour.* Paper presented at the Energy Efficiency and Behaviour Conference, Helsinki, Finland.

Thorsnes, P. (2011, June) Household preferences for energy-efficient space and water heating systems. International Association for Energy Economics (IAEE) International Conference, Stockholm, Sweden.

van den Dungen, S., & Carrington, G. (2011). Minimum Energy Performance Standards: How does New Zealand Compare with Other Countries? CSAFE, University of Otago.

Appendix 2:

CSAFE and Biographical Details

Centre for Sustainability

The Centre for Sustainability is a research centre of the University of Otago, with a focus on sustainability challenges in agriculture, food, energy and environment. It specialises in interdisciplinary research to inform choices, adaptations and transformations in policy and practice. See www.csafe.org.nz. CSAFE has hosted the first and second phases of the interdisciplinary research project Energy Cultures. The second phase, Energy Cultures 2, analyses opportunities to stimulate energy behaviour change in households, businesses and transport. Both phases have been funded by the Ministry of Business, Innovation and Enterprise.

Biographical Notes

Barry Barton
Barry Barton is a Professor of Law in the University of Waikato, Hamilton, New Zealand, and is Director of the University's Centre for Environmental, Resources and Energy Law (CEREL). He specializes in energy law, mining and petroleum law, and environmental law. His recent work has concentrated on energy efficiency, energy infrastructure regulation by the Electricity Authority and Commerce Commission, carbon capture and storage, and oil and gas well safety. Barry is a member of the University of Waikato Council, and is a member of the Academic Advisory Group of the Section on Energy, Environment, Resources and Infrastructure Law (SEERIL) of the International Bar Association.

Sally Blackwell
Sally Blackwell is an independent consultant with broad experience in policy, programme design and social science research. She has a special interest in the social and behavioural aspects of household energy consumption and is passionate about translating research and best practice into effective programmes, and strategies, to create positive change. Sally has worked in the public and not-for-profit sectors and in academic settings, which affords her a broad view of the issues and opportunities associated with the performance of New Zealand homes. Sally has a master's degree in Environmental Studies from Victoria University of Wellington.

Gerry Carrington
Gerry is an Emeritus Professor at the University of Otago. From 1973 to 2008 he was a member of staff in the Physics Department, University of Otago, where his research focussed on technologies for improving consumer energy efficiency. He is author or co-author of 126 research papers, 65 consulting reports and six patents, and he wrote the textbook Basic Thermodynamics, published by Oxford University Press in 1993. At the University of Otago he helped to establish courses in energy management and he led the introduction of the Applied Science programme. Gerry's current activities include the Energy Cultures research project and occasional technology advising. He is a Fellow of the Royal Society of New Zealand and the Institution of Professional Engineers of New Zealand. He is a trustee of the National Energy Research Institute and the Blueskin Resilient Communities Trust.

Rebecca Ford

Dr Rebecca Ford is a Research Fellow in the Centre for Sustainability at the University of Otago. Her research is primarily focussed on the development of technological solutions to improve the way in which people use energy in their homes and transport. She is currently working on two interdisciplinary projects – Energy Cultures and Renewable Energy and the Smart Grid – which both identify and evaluate behavioural and technological opportunities to improve the efficiency in the home and in travel. Before moving to New Zealand, Rebecca completed a DPhil in the Engineering Department at the University of Oxford in the United Kingdom. She worked under the supervision of Dr Malcolm McCulloch in the Electrical Power Laboratory, on a research project "Reducing domestic energy consumption through behaviour modification." She also holds a Masters Degree in Engineering Science from Trinity College, Oxford.

Rob Lawson

Rob Lawson is Professor of Marketing at Otago University and has been an active researcher on aspects of consumer behaviour for over thirty years. Rob joined Otago in 1987, and was appointed Professor in 1995. He completed his first degree in geography at the University of Manchester and subsequently completed a MSc in Agricultural Marketing at the University of Newcastle-upon-Tyne, followed by a PhD at the University of Sheffield. Rob is the author of over 200 research publications, and his research is currently focused on household energy use and wider issues in sustainability and consumer ethics. Previously he has led major projects researching both aspects of tourist behaviour and the values and lifestyles of New Zealand consumers. He is co-leader of the Energy Cultures research programme.

Janet Stephenson

Dr Janet Stephenson is a social scientist with a particular interest in societal responses to environmental challenges. She is the Director of the Centre for Sustainability at the University of Otago, and co-leader of both phases of the Energy Cultures research programme. She has carried out research on the social acceptance of renewable electricity developments in New Zealand, and is a research team member on a project looking at the future management of the electricity grid. Janet's work also includes people's perceptions of landscapes, and is co-editor of two recent books on landscape and identity. Indigenous resource management is another ongoing research stream. She is a member of the Trust Board for the National Energy Research Institute.

Paul Thorsnes

Dr Paul Thorsnes is a Senior Lecturer in Economics at the University of Otago, Dunedin, New Zealand. He specializes in urban economics, environmental economics, and energy economics. Before joining the University of Otago, Paul taught at the University of Oregon (where he obtained his doctorate) and Grand Valley State University in Michigan. Recent energy-related research focuses on household demand for electricity and on the variation across households in preferences and willingness to pay for attributes of energy-efficiency improvements. In other recent research activity Paul has examined the effect on housing prices of environmental amenities, such as proximity to natural areas and the clean-up of industrial sites, and has analysed the mechanisms with which to allocate resources to the production of urban amenities.

John Williams

Dr John Williams is a lecturer in the Department of Marketing, University of Otago. He has taught marketing research methods and consumer behaviour for more than twenty years and has long-standing research interests in marketing theory, consumer behaviour and business ethics. Recently he has been involved in research into energy consumption and efficiency of households in New Zealand, including commercial projects with large energy retailers and generators. John has published in Energy Policy, Marketing Theory, the Journal of Business Ethics, Industrial Marketing Management, and the Journal of Business Research. He has degrees in Economics, Marketing and Statistics.