

Understanding Energy Cultures

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Abstract

Despite the public knowledge of the need to reduce energy consumption, the increasing price of energy and the availability of energy-efficient technologies, household energy-saving behaviours and uptake of technology remains lower than would be expected, especially if one expects consumers to be economically rational. Many researchers have attempted to explain this fact, but single-discipline approaches to such a 'wicked' problem have largely resulted in unsatisfactory conclusions. This has prompted calls for multi-disciplinary approaches. One such approach, the 'Energy Cultures' research programme, has proposed a model of energy habits and other behaviours that are built up from three elements: material culture, cognitive norms and energy practices. The Energy Cultures research programme explicitly acknowledges the existence of heterogeneity of consumers which result in differing cultural groupings, i.e. Energy Cultures. While appealing theoretically, the challenge has been to find support for this paradigm empirically. In this paper we report one such attempt. Using data from a demographically representative sample of New Zealand households, and Two-Step clustering, we identified four distinct segments of energy cultures, which we name the Energy Economic, Energy Extravagant, Energy Efficient and the Energy Easy. Further analysis suggested a link between these cultures and family life cycle. Policy makers and energy businesses can use segment profiles to create and refine messages and products that are more likely to be accepted by the intended audience, in line with standard Marketing thinking on segmented markets.

Introduction

The adoption of energy efficient technologies has been regarded as slow for many years. Induction motors, heat pumps and solar heating systems are all examples of established and proven technologies that have been slow to gain market adoption. The McKinsey report on pathways to a low-carbon future (McKinsey 2009) concluded that adoption rates lag far behind that one would expect based on rational economic choice. In this they were echoing the major economic analysis of climate change published in 2007 when Lord Stern concluded that “It is difficult to explain low take up of energy efficiency as purely a rational response to investment under uncertainty” (Stern 2007). The problem of changing energy consumption behaviour to be more sustainable patterns of usage has been recognized by both policy makers and academics for a long time (e.g. Lutzenhiser 1992, 1993, 2008, Marachel 2008, Wilson and Dowlabadati 2007). This has led to calls to develop more broad based multidisciplinary understandings of energy behaviour in order to overcome the failings of single discipline studies (primarily from economics and psychology) to provide actionable guides to influence behaviour change. A key failing of single discipline studies, which usually focus on one experimental condition, is that they fail to deal with the heterogeneity in the marketplace or the range of complex interactions that occur in the consumption choice process. Even at the household level it is obvious that the demand for energy is derived demand arising from a multitude of needs: to keep warm, stay cool, move from A to B, be entertained and so on. Gary Becker was awarded the Nobel Prize in Economics in 1992 for his work on the Household Production Function modelling households in this way (Nobelprize.org 2012) but even this has not resulted in actionable understandings which can be used to influence change in energy behaviour.

In response to numerous calls for a more integrated and holist view of energy behaviour Stephenson et al (2010) published a paper entitled ‘Energy Cultures’ which draws on a wide range of literature on energy behaviour and attempts use a systems perspective. While the approach acknowledges an important sociological influence from practice theory it has strong links to lifestyle research in marketing. This paper describes a first attempt to operationalise the idea of energy cultures empirically. The research question is therefore “Do distinct ‘energy cultures’ exist in New Zealand, and if so what is their relative size and nature?”.

In the next section we briefly describe traditional lifestyle approaches and explain the theoretical developments and differences used in the Energy Cultures approach. Following this we review the analysis used to form clusters and describe the different energy cultures identified with examples about how they might inform market or policy initiatives that might affect the uptake of energy efficient technologies and behaviours.

Literature

Lifestyles were introduced to marketing research as systems concepts in the 1960s (Lazer, 1963), the idea having been originally attributed to Alfred Adler in the early part of the twentieth century (Adler, 1930). Arguably lifestyles and related ideas, such as psychographics, which were often not distinguished very well, reached a height of popularity in the marketing literature in the three decades from the 1970s (Lawson and Todd, 2002) but in the last ten years marketing has offered little that has been new on the subject. This is in contrast to other disciplines such as health where research profiling lifestyles has burgeoned as researchers have tried to come to

grips with the complex array of personal and environmental factors that influence patterns of behaviour manifested in things like dietary intake and levels of physical activity (e.g. National Health Service 2010). The profiling of health lifestyles is one of the examples that exists where researchers have used the concept of lifestyles in a domain-specific way as opposed to general consumer typologies. Other existing examples of domain specific lifestyles relate to food (Grunert et al, 1996) and tourism (Lawson et al, 1999). Both of those formulations were based on a theoretical framework based on means-end chains developed by Grunert et al for their study of European food lifestyles while Maibach et al's healthstyles project (1996) was built around the ideas from social cognitive theory (Bandura, 1986). The Energy Cultures approach developed by Stephenson et al has some interesting parallels to all these approaches and proposes that different integrated patterns of behaviour similar to lifestyles should be identifiable based on differences in material culture, cognitive norms and everyday practises. In that approach behaviour is seen as an amalgam of those three principle components which interact together to produce a self-reinforcing system that becomes characterised by strong habits. Figure 1 reproduces this model together with examples of each component that could be significant in describing energy behaviour in the context of household heating.

The research described in this paper is aimed at providing an understanding of energy cultures in New Zealand in such a way that they might be used to inform decisions regarding policy interventions to improve the uptake of more efficient behaviours and technologies. In order to describe possible energy cultures we devised a comprehensive questionnaire that covered all the dimensions in the model. 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. In line with the theoretical framework proposed in Energy Cultures that behaviour is the result of a complex system in which material culture, cognitive or belief elements and practices interact we then analyse the data available from the survey 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.

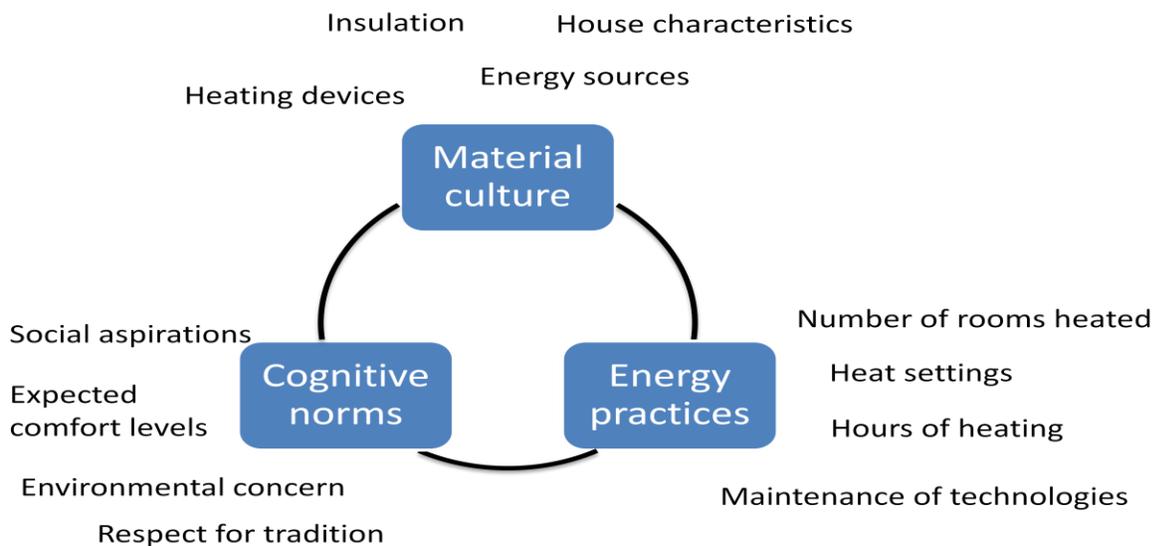


Figure 1: An Energy Cultures Framework: Source: Stephenson et al (2010) page 6124.

Methods

Questionnaire design evolved over four preliminary surveys that were designed to provide information about household energy use in different New Zealand communities in Auckland, Wellington, Dunedin and the rural community of Waitati. The final questionnaire comprised 247 questions covering the construction of the dwelling, heating and hot water options, appliances, energy use and expenditure, knowledge and attitudes concerning energy related issues, personal values and demographic characteristics. The data were collected on-line by a commercial market research company who run a panel designed to be nationally representative. A comparison with census statistics on income, location, age, sex and ethnicity only revealed an underrepresentation of Pacific Islanders. This is a regular bias in all kinds of survey work in New Zealand. We obtained 2,314 completed and usable responses.

The main method used to explore for different energy cultures was Two-Step cluster analysis in IBM SPSS v19. After initial examination of the data, three different approaches were tried for clustering. In the first case all relevant variables from the Energy Clusters model were included after the data had been cleaned and transformed to meet the requirements of the two-step method. This resulted in 66 variables being identified as potential inputs for the analysis. Attempts to profile groups on this base resulted in a single cluster always being the preferred solution. In the second approach we refined the clustering variables to 17, based on existing literature from economics, marketing, psychology and sociological studies of energy demand. A range of cluster solutions were produced from these variables but they all proved to be unstable, with poor silhouette scores. For example, clustering with 16 variables instead of 17 or reanalysing a subset of the sample gave distinctly different groupings. Further elimination of clustering variables from this set resulted in some very 'one-dimensional' clusters which were dominated by the single energy saving behaviours.

Since a requirement of a good clustering solution should be the ability to be able to predict differences in usage, we based a third approach on key variables that we had identified via logistic regression as differentiating between the top one third and the bottom third of energy spenders. These variables were the total number of rooms in the house, main method of heating, use of a separate freezer, use of a games console, use of a clothes drier, interest or installation of double glazing and turning off lights in unused rooms. Several of these variables are unlikely to have a direct impact themselves on the amount of energy consumed but are clearly representative of wider patterns of behaviour which do. For example, the games console is likely to represent the teenager spending long hours indoors in their bedroom operating separate heaters. These seven variables were used as inputs to a further clustering attempt and produced a stable four cluster solution with a silhouette score in the 'fair' range.

Results

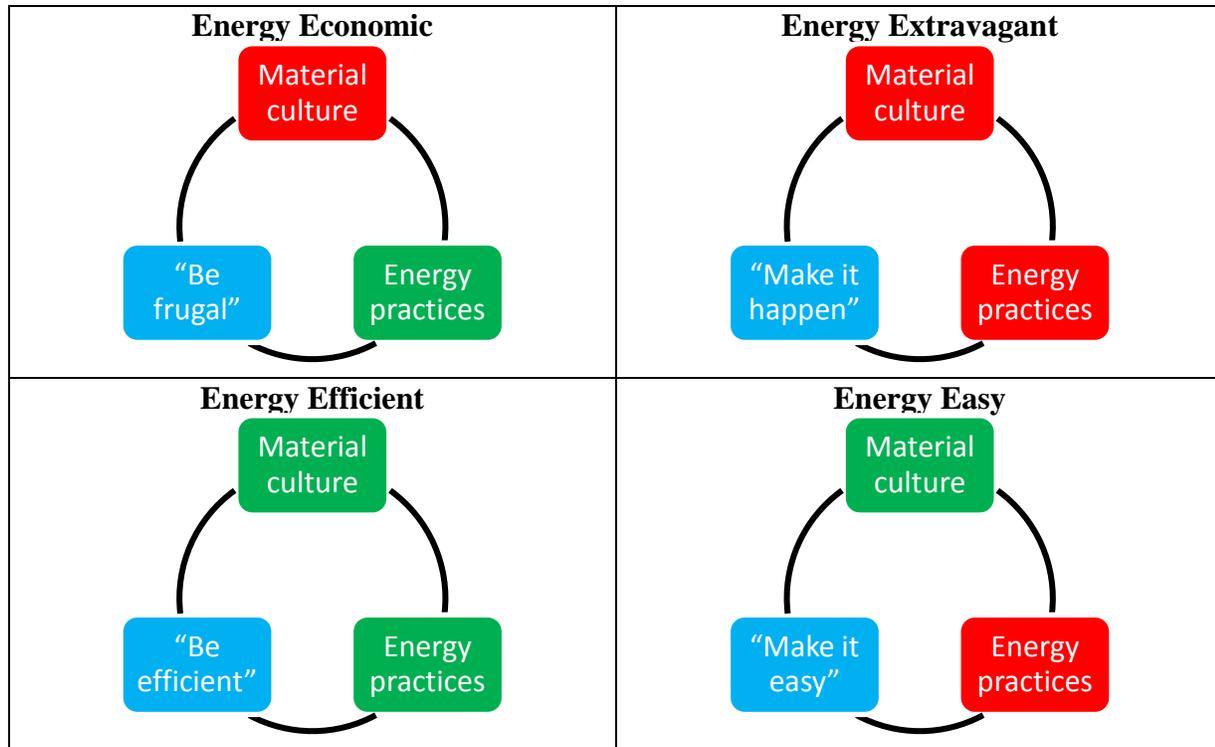
The analysis suggested a four cluster solution and an outlier group of a further 6.3% of cases. The four clusters were analysed in terms of the three component described in the 'Energy Cultures' model and also profiled by their demographic characteristics.

	Energy Economic 24%	Energy Extravagant 19%	Energy Efficient 20%	Energy Easy 31%
Demographics	Younger, poorer and smaller households; Students & unemployed	Families – dependent children aged under 50 Highest income	Older – often empty nesters, retired or part-time work. Owner occupied and most settled in smaller centres/rural	Middle aged/older Europeans – few children. 2 nd highest income but many retired, Auckland and Wellington
Cognitive Norms	Environmentally aware confident in energy decisions	Few distinctive features but appear less confident in energy decisions and value enjoyment and pleasure in life	Value practicality	Least concerned about environmental issues
Material Culture	Often flats or apartments, rented 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 Practises	Lots of ‘free’ energy saving behaviours	Less inclined to make an effort to save energy	Lots of ‘free’ energy saving behaviours	Heat throughout house and don’t appear to try to save energy
Energy Usage	Smallest expenditure on energy	Significantly higher energy spend than all other groups	Medium level of household spend but lower than ‘Comfort’ on per capita basis	Second highest consumption on a per capita basis

Discussion and Conclusions

The figures below attempt to summarise the clusters in terms of the three parts of the ‘Energy Cultures’ framework. For example, Energy Economic display good practices (green) in a poor material culture (red) with fairly neutral cognitive norms (blue). An interesting general finding is that although some statistically significant differences exist between the segments in terms of cognitive norms, they are generally weak, while the important differences between the groups lie in material culture and energy practices. This is a conclusion that is sympathetic to other literature in this area that has described weak links between general attitudes and behaviour (e.g. Lutzenhiser 2008) Portraying the groups in this way highlights areas which need addressing most from a policy perspective. Policy makers who wish to improve the Energy Economic situation can use our results by realising that any intervention has to address not only beliefs and attitudes, but also the material culture. For example, since many are in rental accommodation this may

mean that the key initiatives have to be addressed to landlords or towards influencing the criteria tenants might use when choosing accommodation. For example, local authorities might provide information on insulation standards of properties across their region.



Where energy practices need to change this might again be addressed by regulation in some form, as it has been to persuade people to wear seat belts or cycle helmets. Alternatively experiments offering feedback on power usage with normative components allowing for social comparisons has also suggested this might be a fairly direct route to achieving behaviour change (Schulz et al 2007). Energy businesses that offer feedback and automation systems could use our results to estimate the size of market and likely product appeals for their products and services.

Observing our groups after we had profiled them, it appeared as if there could be a connection to life stage or family life cycle. Accordingly we constructed a family life cycle variable following the categories and refinements suggested by Lawson (1989). Single parent families were merged back into the equivalent dual parent categories because of a lack of observations in the sample but cross tabulations show the groups to be more strongly related to the family life cycle than any other demographic or socioeconomic variable. Energy Economic fall mainly in the young single and newly married categories, Energy Extravagant are Full Nest I and II, Energy Efficient Full Nest III and Empty Nest I and Energy Easy are mainly Empty Nest II and Solitary Survivors. Descriptions of needs and resources across life cycle stages intuitively fits with the energy profiles we have developed in this segmentation study, so in further work we plan to test the effects of life cycle on sustainable practices in consumption more directly.

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