



**LOW CARBON LIVING
CRC**

The Australian household: Material consumption and the low carbon society



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EXECUTIVE SUMMARY

This report explores various aspects of household energy consumption in Australia, and is based on the premise of seeking to better inform policy development processes. The report outlines the numerous influences that have caused household energy usage to rise markedly. It considers how different academic disciplines structure competing explanations of household decision making in relation to environmental issues, including energy consumption. Drawing on insights from these disciplines, an integrated conceptual framework for understanding what drives household consumption of energy is developed. Finally, the literature from these disciplines is reviewed to provide some research evidence concerning the actual and potential impacts on households of policy interventions aiming to reduce energy consumption.

Household consumption involves energy use in two ways. Householders consume energy *directly*, by using electricity, gas or petrol in the dwellings in which they live and to power the motor vehicles they use.

Household energy consumption also occurs *indirectly*, through consuming goods and services which have energy embodied in their production: that is, energy is consumed in making a dwelling, motor vehicle, and appliances and in getting food into a household's pantry or refrigerator. The main focus of this report is on direct household energy consumption.

The scale of household consumption, and associated energy consumption, over the last twenty years has shown little sign of easing. This is perhaps not surprising because the drivers of household consumption are as powerful now as they were two decades ago, and in some cases are even stronger. Several of these influences on household consumption are shared with other equivalent countries, while some are more characteristically Australian. These drivers include a culture of consumption, household growth, rising real incomes and wealth, availability of credit, an economic imperative to consume given its role in economic growth and employment, the nature of the Australian urban form

and its energy environment, and a relative lack of environmental awareness.

Sitting behind household consumption, whether that is of a new air conditioner, television, car, etc., is a process of decision making. Household members collectively, by delegation to someone in the household, or individually, decide what to buy (type of car for example), where (notably important in housing decisions), how much (e.g. electricity, gas consumption) and when (e.g. television use, cooking, washing, etc.). Moreover the decision can be either highly deliberative or almost unconscious. For example when we watch TV, turn lights on and off, do the cooking etc, has implications for how much energy is consumed, although many households or individuals in the household would not think about that at the time of consumption.

The report discusses a whole range of policy levers which are available to manipulate/prompt/nudge/force households into behaviours that could reduce energy usage. These strategies include regulation, taxation, transfers, grants, pricing policy, capital expenditure, education and advocacy, and compliance. However the degree to which any one of these levers is effective, and the precise design of any policy instrument within these broad strategies, has to be grounded in a good understanding of what explains household decision making. But different disciplines offer different understandings, and in effect different policy advice.

The conceptual approaches that economics, psychology, sociology, urban studies, cultural studies and demography take to understanding household decision making are therefore reviewed, and these approaches are illustrated with examples from international and Australian literature. The conclusion drawn is that the main problem with these various theoretical or disciplinary frameworks is that they are discrete. Each approach offers explanations within a single framework, largely oblivious to the insights offered by the others and sometimes dismissive of them. If we are to adequately understand how to influence household behaviour in order to reduce carbon-based energy consumption, an integrated or interdisciplinary approach in both research

and policy interventions appears essential. To this end, a synthesising framework for understanding the large range of drivers of household consumption and decision making is presented and discussed.

The report concludes with an overview of the policy environment with respect to household energy consumption. It reconsiders the range of policy options, and reinforces the proposition that policy design is contingent on a sound understanding of all aspects of the processes of household decision making. It goes on to argue that appropriate policy instruments require two things. The first is a rich understanding of the problems or issues: this includes the scale and form of the problem, knowledge of the range of possible policy options, who will be affected by them, and to what degree, i.e. will they be equitable and efficient? The second even more fundamental requirement is that of social legitimation for the policy process, and for particular policy instruments: that is there must be broad acceptance of, and support for, the policy direction and its particular form.

Thus the capacity of policy makers to shape household decision making is highly constrained. As the varied examples canvassed in this report demonstrate, there is no 'one size fits all' model, but instead great need for reflective and nuanced policy.

INTRODUCTION

Energy use is integral to our lives as without it the standard of living Australians currently enjoy would be impossible. However this standard of living comes at a cost. Per capita levels of energy consumption in Australia are now some of the highest in the world (Energy Realities 2012) and have also experienced the largest growth among comparable OECD countries over the last two decades (see Figure 1).

This presents a major challenge when trying to shift towards a more sustainable low carbon lifestyle. Industry is the largest user of energy, and historically this sector has been the focus of most research and policy

interventions. But a sizeable percentage of consumption is by households, and thus a greater understanding of household decision making and choices around energy consumption is required.

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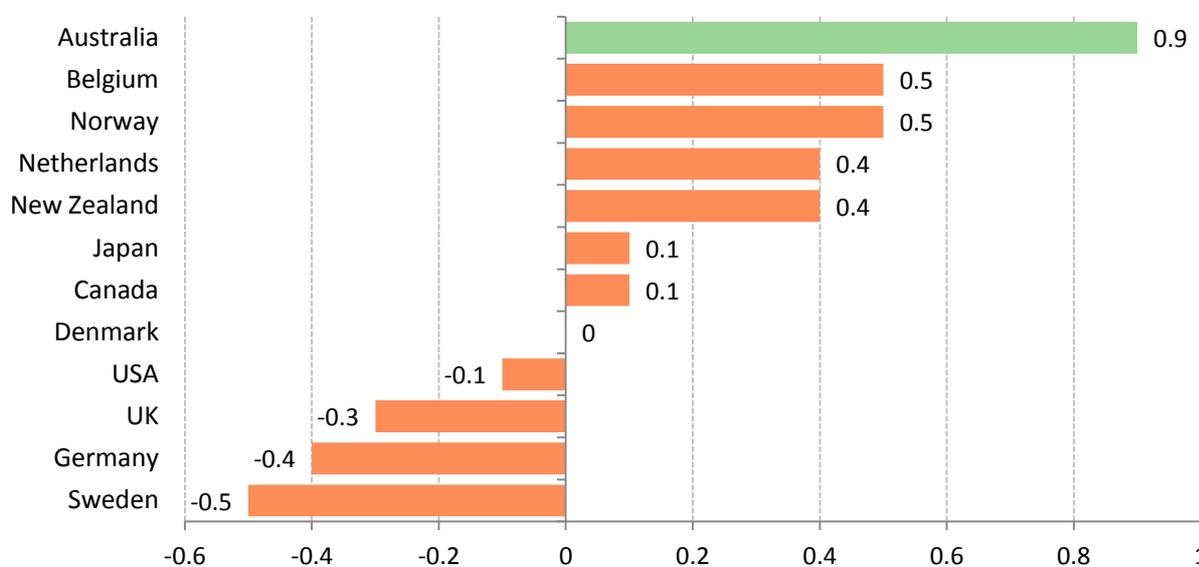


Figure 1: Change in per capita energy consumption, selected countries, tonnes of oil equivalent 1990-2010

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consumed, although many households or individuals in the household would not think about that at the time of consumption.

Analysis of trends in household energy consumption and costs, and identifying who those costs impact on, can be an important window into understanding consumer behaviour in relation to environmental outcomes. If we are to change household behaviour through appropriate policy interventions we need to have a better understanding of the scale and form of domestic usage, how consumption is changing, as well as how it varies

across different household arrangements – for instance according to housing type and tenure, age cohorts, income groups, and household types and their associated lifestyles.

Households rely on a variety of energy sources for heating and cooling, personal and household cleanliness, food preservation and preparation, entertainment, and personal mobility. In turn the type and amount of energy used by households affects the environment, as activities linked to household energy use directly impact on the amount of emissions generated and resources consumed. With Australia's population steadily increasing, and the bulk of its population residing in urban areas of a form which have a high carbon footprint (Newton and Meyer 2012), household energy consumption raises major sustainability challenges for Australia's future.

The report is not a technical one. Rather, it is exploratory, and can be read as an introduction to the topic – that is, it looks at ways of analysing the role of households in energy consumption, in order to better inform development of policies that might reign in that consumption. It begins in section 2 with an appraisal of the many drivers of consumer behaviour in relation to energy usage, several of which are common across similar countries and others of which are more characteristic of Australia. The different conceptual approaches to explaining household consumption behaviour that are inherent in the various academic disciplines are discussed in section 3. Drawing together the insights from each discipline, an overall framework for analysing energy consumption by households is then presented. This is followed, in section 4, by a selective review of the Australian literature, highlighting some of the research results that the different theoretical perspectives have yielded concerning the actual or potential impacts on households of policy interventions aimed at influencing their energy consumption.

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AUSTRALIAN HOUSEHOLDS: THE ENERGY AND RESOURCE CONTEXT

Residential consumption of energy accounts for around 30 per cent of total energy consumption (IEA 2014 Australia Table 3). Some of the energy used in other sectors (manufacturing for example) is also related to residential consumption in that the products or services of those other sectors can be for residential purposes, such as transport, food, clothing, furniture and fittings and actual housing construction – these represent embodied energy.

While many items within a household are consumed by individuals, clothing for example, the bulk of residential energy consumption is by or for the household unit. Hence the importance of the household as the focus of attention when considering policy aimed at curbing energy consumption. Prior to WWII household energy consumption was neither large scale nor widespread, reflecting more straitened economic conditions and, by today's standards, the relative dearth of consumer goods. Household consumption of energy accelerated after WWII, but with some exceptions (Galbraith's *The Affluent Society*, for example) there was initially little critical discourse as to the economic, social and environmental costs of such consumption.

By the 1970s a more critical view of consumption had begun to emerge in a variety of disciplines. Sociology and the cultural studies literature, heavily influenced by Bourdieu (1984), advanced the importance of consumption in societies making the transition from a Fordist to a post-Fordist world -- indeed the new forms of consumption were used as a delineating point in this historical transition (see Shove and Warde 2002). Political economists analysed its importance in the reproduction of capitalist economies (Harvey 1976, Meillassoux 1981) while neoclassical economists also looked at the importance of consumption to economic growth and stability but through the lens of consumer choice, rational individual behaviour and utility

maximisation (Lancaster 1966, Becker 1977, de Vries 2008). And in the same period a growing environmental movement argued, among other things, that excessive consumption and associated resource depletion was a threat to the environment of the planet.

Influences on Consumption

While the amount of academic literature on household consumption has greatly increased, with much of it critical or cautionary, awareness of the problems associated with consumerism has done little to temper its growth. Rates of household commodity consumption have continued to grow inexorably, only tempered by economic downturns. It is important to investigate why this is the case, as understanding the factors behind the growth in household consumption is a pre-requisite to confronting the challenges in trying to moderate or redirect such consumption for a low carbon future. Some of the factors are common across advanced industrial societies, and some are more characteristically Australian.

The Consumption Culture.

The last fifty years have seen an enormous growth in the range of products to consume, the marketing of these products, and the incorporation of product consumption into individual, group and societal identity. However this is not to imply that consumerism is a new phenomenon. There is now a substantial body of literature documenting the international drive to consume, and associated patterns of consumption tracing back some five hundred years (Veblen 1889, Smith 2002, Weatherill 1996, Roche 2000, de Vries 2008). The acquisitive instinct, whether driven by needs of security, status, personal identity or social alienation, is an incredibly powerful one.

There are of course enabling conditions, i.e. income and wealth increases, credit availability, etc, but these do not, by themselves, make households consume. More influential are social wants, norms and expectations, and these have changed to the extent that in contemporary

Australia we are largely defined by what we consume. Even into the 1960s we were likely to have been defined by class, religion, or occupation, but these have assumed less relevance since then, with cultural forces creating a context in which material consumption, and what and how we consume, are the key to how we see and define others and ourselves.

These cultural forces are myriad and include the more obvious ones such as the pervasive influence of television and advertising, the hundreds of print media magazines and books devoted to better material living i.e. all the decorating and lifestyle magazines, and the new social media built around smart phones and iPads. But these cultural forces also include the less visible ones of changing social norms and expectations, moulded by moves to a risk society in which people retreat into material consumption as a form of security and solace from an uncertain and insecure workplace, or the decline of religion and the need to create an alternative form of meaning.

Moreover the global financial crisis has highlighted the degree to which growth of household consumption is necessary for continued economic growth and

employment. Figure 2 shows the long term trend in household consumption expenditure as a percentage of Gross Domestic Product (GDP). It reveals that through the 1990s and the first half of the 2000s household consumption expenditure, at more than 58 per cent of GDP, was much higher than its long term trend (around 56 per cent of GDP). This would be a large part of the explanation for household energy consumption increases over this time period. However this percentage then slumped, around the time of the global financial crisis, to below 54 per cent, the lowest point it has been in fifty years, with implications for overall economic well-being. Collapse of this scale, and the need to return to more 'normal' consumption levels, would explain the back pedalling, including in terms of policy momentum, from what had previously been perceived as the need to reduce consumption in the interests of environmental sustainability.

Whatever the drivers or explanations of the consumption culture, there is no doubt that we are currently on a treadmill of consumption, with little direction as to how to get off it, and little explanation as to whether and why we should do so.

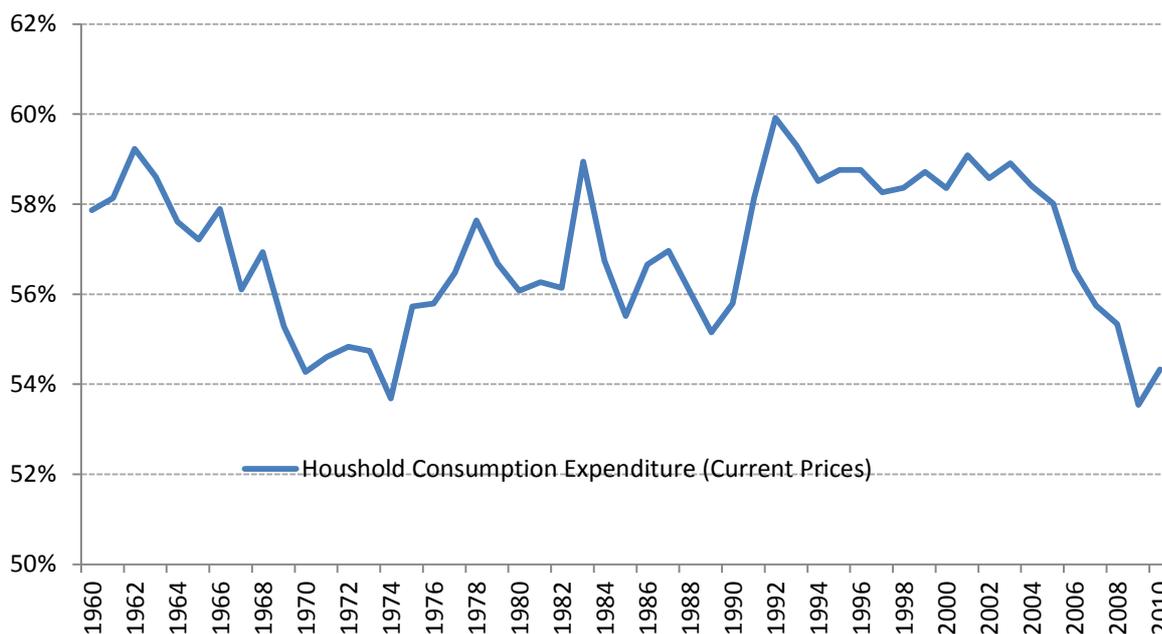


Figure 2: Household consumption expenditure as percentage of GDP, Australia, 1960-2010

Source. ABS (2014) Australian National Accounts: National Income, Expenditure and Product Cat. No 5206.0

Growth in Households

The more households there are, the greater consumption there is. A country with a high rate of household growth is likely to have a high rate of household consumption and that is the case in Australia. Over the period 1981-2010 Australia's annual rate of population growth was 1.4 per cent, one of the highest rates in the developed world (World Bank Development Indicators 2014) and this translated into an even faster rate of household growth, given that household size was falling over the same period. Most of this growth was fuelled by migration, with consumption boosted by immigrants who arrive with very little and subsequently build a lifestyle to typical Australian standards. This means consuming large houses, motor vehicles and all the things to go in and around the dwelling. Currently, in 2014, there is little evidence of a slowdown in the rate of household growth and therefore the consumption linked to it.

Rising Real Incomes and Wealth

Over the period 1989-2010 gross median real income for Australian households rose 32 per cent, indicating substantial capacity to transfer aspirations for consumption into reality (Greenville et al 2013). This compares with the USA where the real median household income increased by only 0.05 per cent for the same time period (US Census Bureau 2013). Overlaying the effect of rising incomes is that of the wealth effect, with wealth imparting the confidence to consume. While the degree to which consumption responds to wealth increases is contested, the overall upwards direction is not (Sousa 2009). This association occurs because households can leverage off their wealth to borrow, and thus consume more. Case et al (2011) found in the US context (looking at 20 years of data) that the wealth effect is an important determinant of consumption when asset values are rising but less important when they are falling. If this holds for Australia it is significant, given rising and sustained dwelling price increases here. Rising asset values are making us one

of the world's richest countries - in fact, in 2014, the level of median wealth per adult in Australia was the highest in the world (Credit Suisse 2014, p 57). Households are likely to consume more just by virtue of being rich. While many advanced industrial countries have seen their wealth and confidence in consumption fall since the GFC, Australia has not, and only at the end of 2014 were there any signs of fragility in Australia's economic confidence.

Availability of Credit

A good proportion of household consumption is financed not out of savings but from credit, the ability to borrow. In this respect the capacity of households to consume more has ratcheted up substantially in the decades following financial deregulation, which enabled households to borrow more and to access a whole range of new products to do so. What has been described as a democratisation of debt but also the instrument of a liquidity vortex (Berry 2014, p125), the process of households internationally seeking ever more debt has enabled consumption on an ever larger scale, but bringing with it risk and financial and economic instability as witnessed by the global financial crisis.

The 2008 GFC was the culmination of more than a decade and a half of growth in household debt, and associated consumption beyond sustainable levels, in many countries. The Australian Bureau of Statistics compared levels of household debt with assets between September 1990 and September 2013, and found the ratio of the former to the latter rose from 9 per cent to 19 per cent (ABS 2014). In Australia most of that increase in debt was to buy dwellings. This is significant because the purchase of a dwelling is a forerunner of other household consumption – and this is at a time when the dwelling is being furnished, decorated and landscaped on a scale and in a form that has no historical equivalent prior to the orgy of borrowing that followed financial deregulation. It is no coincidence that the very large two storey dwelling requiring ever greater amounts of energy use (the McMansion) emerged in this period.

The Economic Imperative

While the environment might have been ‘the greatest moral challenge of our time’ in 2007, it was regarded as such only for a short time. The GFC and the associated international contraction in economic growth have refocused political attention on the need to stimulate demand, with the consumer at the forefront of this revival in demand. Growth had ratcheted up in the 1990s and 2000s on the back of high household consumption, but the latter’s post-GFC collapse threatened the very foundation of economic and social sustainability, and made visible the economy’s dependence on household growth. In various countries the GFC saw Keynesian economic policies of demand stimulation unlocked from the cupboard of defunct economic theory, and various programs to maintain or stimulate employment and household demand were implemented. And six years on there is still an economic imperative to keep household consumption at high levels; environmental concerns resulting from consumption have largely been displaced by exhortations about its stimulatory role in creating employment.

Australian Urban Form

In a combination of historical accident and intent Australia has evolved an urban form which lends itself to high levels of household consumption and a problematic ecological footprint. The detached dwelling itself requires high levels of embodied energy by virtue of size, while the space and lifestyle facilitate both high levels of material acquisition of furniture and white goods with their embodied energy, and high levels of usage of water, gas and electricity in daily living. More indirectly the dominance of the detached house demands a low density urban form and car dependence, again with associated high carbon costs. And, despite probably a decade or more in which there has been a growing awareness of issues of sustainability, the urban form has only changed marginally, and not necessarily in ways where there is clear evidence of quality sustainability outcomes.

A few examples illustrate this point. The first is the growth of high rise dwellings as a response to more consolidated cities. Give the fit with the latter objective this trend may be seen as low carbon positive. On the other hand it is also problematic, because of the high embodied energy in such dwellings e.g. in the concrete construction, and because of continuing energy demand through lifts and underground car parks.

The second is the fact that, despite some consolidation, the bulk of new construction is still on the urban fringe, and the dwellings being built are larger than ever: during the 2000s Australia outpaced the USA in having the largest newly constructed dwellings in the world (James 2009). The dominance of the detached house means that renovating and additions can take place here on a scale few other countries can achieve: it is difficult to add a room to a fourth floor apartment, or to put in a pool or an outdoor kitchen. Although little researched this is an area where household consumption appears to have accelerated greatly, and with the environmental impacts little known.

The third, again related to the rapid urbanisation of Australian cities, is the fact that there has (a) been no effective provision of public transport in the outer urban areas and (b) employment growth has been increasingly concentrated in inner areas. The result has been sustained car dependence and longer commute journeys, in turn meaning more time actually using motor vehicles, even if vehicles have been getting more efficient.

In short Australia’s urban form is of a type that has dictated high levels of consumption, with typically large dwellings, appliances and motor vehicles that require energy usage at a rate greater than most other affluent societies. And the trend seems to be toward worse rather than better outcomes.

The Energy Environment

Countries differ in their capacity to provide energy for household use, and the mix of energy sources that are available, both largely related to the geological attributes

of the country. Thus the transition to energy rich economies began with the British industrial revolution, because of its abundant and reasonably accessible coal (Wrigley 2010). Some countries have the geography to generate hydro power (Iceland, Norway, Canada), some have gas reserves (Canada, Norway, Russia), others have coal (Australia, China, USA), and others petroleum (USA, Canada, the Middle East) (World Energy Council 2013). In the absence of these prime resources, countries have to either import their energy (e.g. gas from Russia for much of Europe) or to use expensive technology to harness nuclear power (eg France, Japan) or to capture solar power (e.g. Germany). Countries also differ in the way in which climate shapes household demand, with cold climates creating greater energy needs than milder climates. The availability and mix of energy resources, the technology required to convert it to electricity, and the demands placed upon it will affect the cost structure of energy between countries.

Figure 3 shows the costs of electricity for a number of advanced economies similar to Australia, expressed as

average electricity cost in US cents per KW and adjusted for purchase parity. This will of course not necessarily be the actual cost to Australian households as it is an average, and it will vary both as tariffs go up and down in relation to peak or non-peak use and from jurisdiction to jurisdiction. However the results are indicative of the general level of cost and it is interesting that Australia in 2011 (even after a period of rising prices) had some of the least expensive electricity of the countries shown. The figure also includes the average electricity consumption per electrified household.

There are some interesting patterns in Figure 3 which relate to points made above. Countries with a high proportion of detached housing and low density cities have much higher rates of consumption (Australia, USA, Canada), and countries with high electricity costs (Italy, Spain, and Germany) have few natural energy resources and need to rely on technology (solar) or imported energy. Perhaps the most interesting association revealed in Figure 3 is the almost direct relationship between cost and consumption.

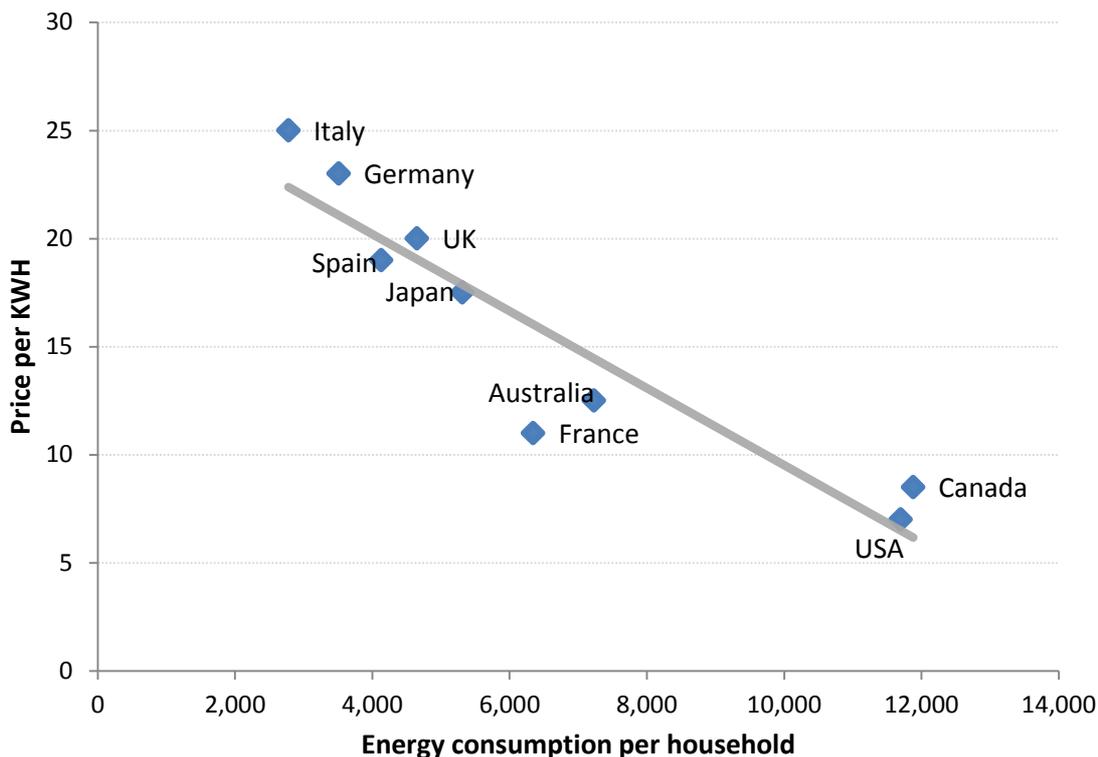


Figure 3: Electricity costs and consumption, selected countries, 2011

While for much of the last two decades Australian energy prices were low by international standards, they rose gradually over that time, as Figure 4 shows. For much of the last twenty years the rate of increase in energy prices was less than the rise in household income, although petrol prices traced a more unstable path and there were a few time peaks with increases in excess of incomes. After 2012 there were very large

increases in electricity and gas prices, taking their prices above the long term trend in incomes. Households tend to be less aware of the changes to their net income position than of the more visible increases in the cost of utilities. Thus the steady and regular increases in energy prices may have elicited appropriate behavioural adjustments on the part of households e.g. to change appliances, reduce appliance use, etc.

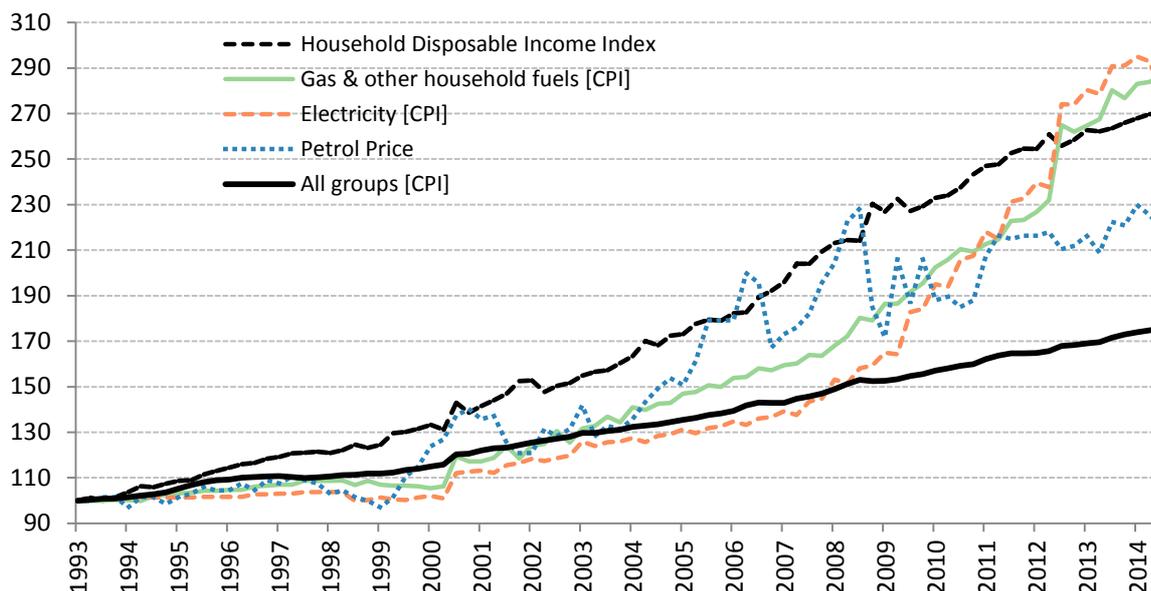


Figure 4: CPI Index of Energy Prices, Australia, 1993-2014

Source ABS Consumer Price Index Cat 6401.0

Environmental Awareness

The contextual influences on household energy consumption discussed above have been those which have tended to encourage greater consumption. One factor that might temper such consumption growth is awareness of the impacts of that consumption on the environment. But the limited evidence on whether this is the case is not strong.

Figure 5 charts, for the period from 1992 to 2012, the percentage of Australians who indicated that they were concerned about environmental problems. It shows a declining level of concern until the mid-2000s, a sharp increase in 2009, and thereafter concern decreased such that by 2012 the level was lower than it was in 2003. Part of the explanation for this trend could be the election in 1995 of a conservative (Liberal) government

which did not take any leadership role on the environment. But another reason could be that in the period from about 1993 to 2003 there was a relative absence of extreme weather events, nor a domestic environmental crisis to sharpen environmental consciousness. The drought that was to affect Australia in the 2000s and the water depletion of the Murray River basin did not really take hold and seize the public interest until the second half of that decade, which is when environmental awareness peaked at 82 per cent. Subsequent decline in concern could be put down to a combination of factors: the ending of the drought, a concerted political and media campaign by conservative interests to deny climate change and associated environmental problems, and the pushing aside of environmental issues by the GFC and the consequent need for economic stimulation - including by raising household consumption.

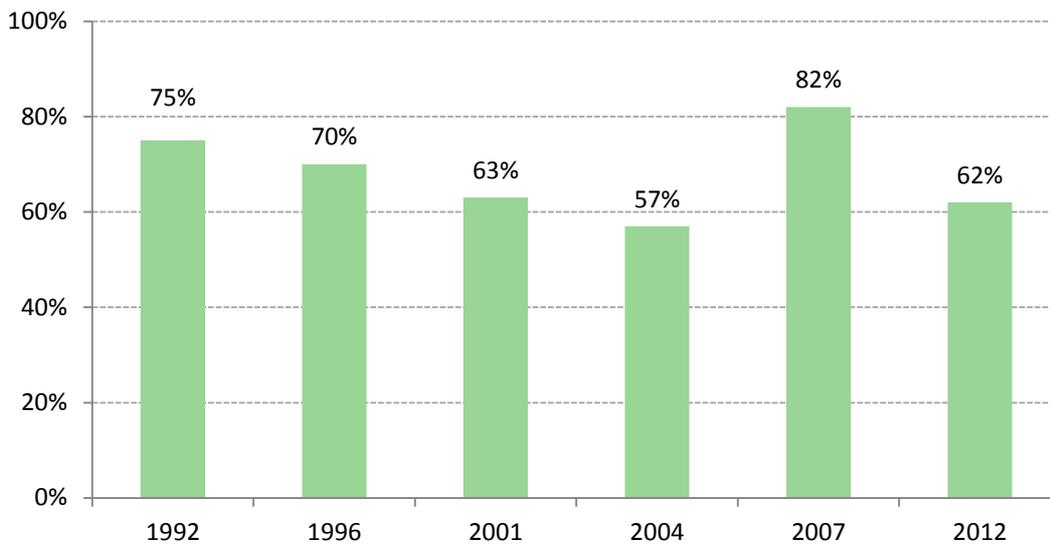


Figure 5: Environmental awareness: per cent of Australians concerned about environmental problems, 1992-2012

Source: ABS (2007) Environmental Issues: People's views and practices. Cat No. 4602.0; ABS (2012) Environmental Views and Behaviour, 2011-12. Cat No. 4626.0.55.001.

In terms of energy consumption the aforementioned factors have their effects in indirect rather than direct ways. To use the language of economists, the various forms of energy are 'complementary goods'. A complementary good is a product which shares a beneficial relationship with another product or service (core good) because it is used in conjunction with it, and where the complementary good may have little value in its own right i.e. when consumed alone. Thus petrol and electricity have little use in their own right but only derive their value, that is, the willingness of people to pay for them, because they make other products (such as cars, appliances, lighting, etc.) functional and attractive. The consumption culture factors noted above only affect energy consumption through the demand for the goods and services that energy powers. However this does not mean the demand for energy increases or decreases in some direct relationship to the core good, as the responsiveness of demand may be modified by either changes to the complementary good - in this case energy - or to the core goods to which energy relates. Such changes, discussed in more detail in the following section, include:

- Technological change: changes to the nature of the core good that makes them more energy efficient, such as more fuel efficient cars or appliances.
- Policy changes: changes to the energy consumption environment which mandate or encourage more efficient usage, such as prescriptive building standards for dwellings, energy star ratings for appliances, or water bans.
- Pricing: changes in the cost of energy to households can increase or decrease demand depending on the nature of the price change and the effect on the household budget.

CONCEPTUALISING HOUSEHOLD ENERGY CONSUMPTION

How we conceptualise household consumption behaviour has important implications for how we understand and interpret such consumption. The various fields of knowledge and their associated academic disciplines offer differing theoretical perspectives, and therefore different approaches to investigating the issue.

A review of approaches to explaining consumption

Historically it has been neoclassical economics that has provided the dominant framework for understanding consumer behaviour. In its most common and simplistic form this conceives (a) consumers as rational actors who are essentially price takers i.e. the consumption is driven by price signals and (b) their preferences are consistent, and their values are fixed and largely abstracted from any impacts of social structure or social relations. This conception lends itself to statistical analysis, as a person or household can be more readily 'measured' as an atomised individual actor or unit whose consumption decisions are internally generated, i.e. they reflect their self-interest and are price driven.

This understanding of household consumer behaviour is hampered because it (a) tends to downplay the role of societal or political processes in shaping behaviour and (b) tends to leave economics wanting in the explanation of relatively sudden shifts in consumer behaviour unrelated to price changes, such as the emergence of green consumerism.

However, despite these limitations, there is still more than enough substance in neoclassical economic analysis to offer an enormous contribution to the consumption literature. Not least are the universal principles of supply and demand, while concepts such as diminishing returns and elasticity of demand (i.e. the responsiveness of consumption to price signals) also have strong empirical validity and provide an important

base for policy interventions. The latter include, for instance, financial incentives which change relative prices and potential behaviour, or regulation and information provision which force households to build into their decision making awareness of the implications of what they may or may or not do (e.g. certain building regulations). The *Journal of Environmental Economics and Management* is probably the major academic outlet for research within this economic framework, with the bulk of the papers being in the form of econometric analyses of large, mainly secondary, data sets.

The growing view in recent decades, based on an empirically substantiated position that people do not always have consistent preferences, act rationally, or know their best interests or 'utility', has drawn attention to the limitations of such economics. The failure of economics to predict the global financial crisis (GFC) has often been used to illustrate this critique.

Psychology and behavioural economics offer a complementary approach to such problems without lapsing into the rational atomism of neoclassical economics. Much of the former literature is grounded in cognitive psychology, which is concerned with exploring and understanding the mental structures and processes which mediate between stimulus and response. This approach lends itself to the experimental method, where participants are exposed to certain tests under controlled or relatively controlled conditions, with the objective of observing how people respond and what are the strongest response stimuli. The approach can be very useful in suggesting appropriate interventions to change household energy behaviour, for instance by comparing a control group with a non-control group in an experiment involving the adjustment of thermostat settings in heating and cooling appliances. This is just one example, and a whole range of environmental behaviour interventions can be trialled in an experimental context. The *Journal of Environmental Psychology* is a rich source of studies of this form. For instance, Abrahamse et al (2005) provide a review and evaluation of thirty eight environmental psychology studies, with the objective of understanding to what

degree interventions resulted in household behaviour change, and what behaviour factors (such as existing attitudes towards the environment) affected how households responded.

While environmental psychology research is yielding insights into consumer behaviour and the cognitive factors behind such behaviours it also suffers from a tendency - as does virtually all psychology - to overlook the social context. Where do the values and attitudes of households come from: are they internal to the individual or shaped by their social relationships? In addition the problem with much of the psychological research is that it is almost always conducted in the laboratory rather than in the field or the real world, creating questions as to whether findings would translate to wider scale applied situations.

To better address the issues that both neoclassical and psychological frameworks largely ignore, sociology (notably economic sociology) has emerged, with its emphasis on the institutional context in which economic actors, including consumers, make decisions. This perspective recognises that the specific set of institutional arrangements (economic, social, and political) of a society or city can shape how people, including consumers, behave. Burke and Ralston (in Newton, ed 2011) illustrate one such approach in relation to Australian household consumption and use a 'structure of provision' framework to argue that the scale and form of household consumption in any society is a function of its distinctive structure of commodity provision: that is, its economic system, built environment, demographic structure, natural and policy environment, and the set of social values that have emerged in the population over time. This does not deny that consumers have considerable choice as individual actors, but points out that these choices will be guided by the specific institutional context. Thus for instance it is argued that the deregulated financial system that emerged in the late 1980s provided the means for Australian households to consume on a scale and of a form (much larger and more air conditioned houses, for

example) than may have occurred with a different financial system.

In terms of policy directions this recognition of the importance of context leads to efforts to change the institutional environment in which consumers (and for that matter, producers) operate. Thus interventions are less targeted at the consumer and more at the institutions that are believed to have impacts on the issue of consumption that is the policy concern. A recent (2013) example is regulating the media's ability to advertise live betting odds during television broadcasts, on the assumption this will in turn modify consumer behaviour.

However this approach also has its limitations in that it risks under emphasising individual behaviour and implying an almost mechanistic response to the set of institutional structures and levers, but without providing much insight into what specifically affects behaviour or explaining differences in behaviour between different actors. In recent years, the field of cultural studies has offered another approach to understanding consumer behaviour in relation to the environment. It includes some of the elements of institutional economics in that it attempts to examine the social forces shaping consumer behaviour. But the emphasis of cultural studies is different in that consumption is seen as a vehicle for social empowerment and identity formation. Cultural studies considers the role of consumption in shaping how we define ourselves and ourselves in relation to others, and for discussions of representation (for example, how movies, film and television represent consumption and the environment). Through such a perspective an understanding of consumption can be built which does not negate the importance of institutions as a shaping force but layers onto that a richer, more nuanced analysis. For example there are socially constructed notions of cleanliness, such as the Australian beliefs that you must have a shower every day, or that an item of clothing can be worn only once before it needs to be washed, which mean that water is consumed at a greater rate than is actually necessitated

by hygiene standards (Allon 2006, Allon and Sofoulis 2006).

The marketing literature also has its own take on consumption, unsurprising given the objective of the industry is to manipulate consumer behaviour through marketing messages. In some respects the marketing industry (and discipline) can be seen as one suffering cognitive dissonance i.e. the mental stress or discomfort experienced when one holds a number of contradictory beliefs, ideas, or values at the same time; it is an industry whose rationale is one largely created to mould household behaviour in the interests of consuming more. Yet the tools of the discipline can also be used to provide a better understanding of household consumer behaviours and to recommend appropriate marketing strategies in relation to reducing environmental impacts.

Early market research, in the 1970-80s, was largely focused on understanding the emerging environmentally conscious, or "green" consumer with a view to determining their viability as a market segment whose environmental concern might make them amenable to "green" product offerings (Kilbourne and Beckmann 1998, p516). In more recent years greater attention has been given to how marketing needs to accommodate to a more sustainable world and use marketing tools in new ways. An example is 'demarketing' i.e. reducing the demand for products that have social costs, exemplified in the Australian context by the plain packaging requirement on Australian cigarettes. Marketing practice can have a beneficial impact on household consumption through the marketing of products or services with sustainable characteristics i.e. if marketers will work with companies that develop and make sustainable products and services for the consumer market, and use marketing tools to encourage individual and households to become aware of and take up such products.

When applied to efforts to better explain how household behaviours might be changed in order to reduce carbon-based energy consumption, the main problem with these various theoretical or disciplinary frameworks is their discreteness. Each approach offers explanation within a single framework, largely oblivious to the insight offered

by the others (and sometimes dismissive of them). However, as an alternative, one suspects that better outcomes would result from research and policy interventions based on an integrated or interdisciplinary approach to understanding consumer behaviour in relation to the environment.

A synthesis

Figure 6 provides a synthesising framework for understanding the large range of drivers of household consumption and decision making. At the centre of the decision making environment are the individual and the household, recognising that all households are made up of individuals and that the decision making of a household comes from the attributes of the individuals in the household and the particular form of the household. The individual attributes focus on the cognitive factors that affect individual decision making, including memory, problem solving skills, thinking capacities, perceptions, awareness and knowledge. Two of these, i.e. awareness and behaviour, can be used to illustrate the ways in which research about environmental issues can be conducted. . Environmental awareness is typically elicited by asking people (via various survey methods) their views on a set of statements, measured on some form of likert scale e.g. 'to what degree do you think switching lights off helps the environment?' Behaviours are elicited either by similar surveys asking key questions (self-reported behaviours) or by analysis of relevant and available client data, e.g. electricity accounts (actual behaviours). The problem here is that there may be no consistency between actual and self-reported behaviours.

Within the household, decision making with respect to consumption will be different for an extended family compared to a nuclear family, and also different according to whether the latter is, for example, a couple, a sole parent family, or a couple with children. This inner core of the framework is the area of interest of environmental psychology and behavioural economics.

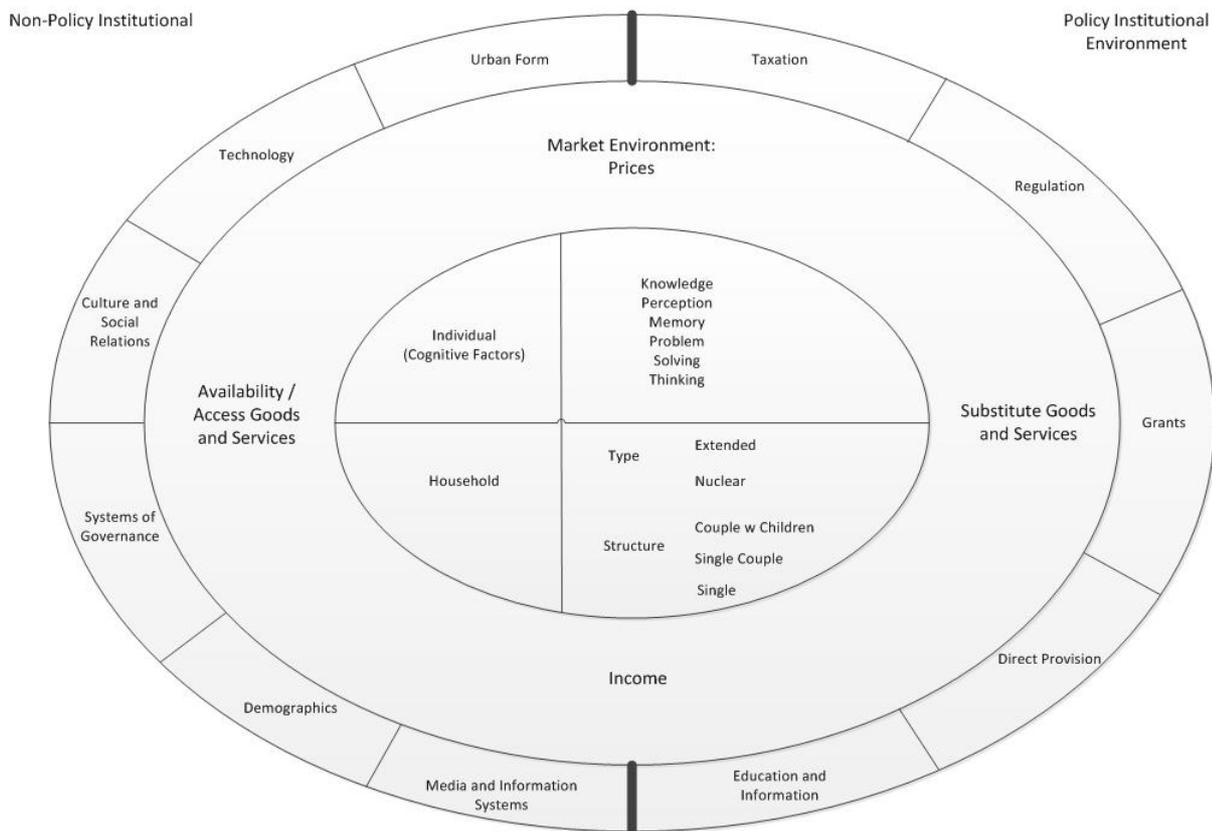


Figure 6: A framework for household consumption and decision making

The ring immediately around the individual/ household core is the market environment. This is the focus of neoclassical economic analysis with its emphasis on prices, incomes, and the availability of goods and services and of substitutes. This market environment is largely about a household's ability to translate the internally driven household factors into an actual consumption decision, given prices and budget constraints.

However this market environment will in turn be affected by a wider institutional environment (the outer ring) which is, in this case, broken into two parts: the policy environment and the non-policy environment. The former is concerned with all the policy instruments that can shape household decision making, either directly or indirectly, such as taxation and regulations. The other element of the institutional environment is the non-policy one (although there are connections) and includes the level and availability of technology, the urban form e.g. whether low density cities as in Australia, or higher

density ones as in much of Asia and Europe, and the political system and system of governance e.g. whether a Market Liberal federal system such as in Australia, or a Social Democrat unitary system such as in much of Northern Europe (Castles 1985, Esping-Andersen, 1990). The non-policy institutional environment also encompasses the demographic structure, including household growth, as well as the nature of cultural and social relations, and the nature and role of the media - for example, is the latter pro or anti climate change.

This household decision making framework can be used as a way of better comprehending all of the factors shaping decision making, and which therefore may have to be taken into account in both understanding household consumption and designing policy interventions.

HOUSEHOLD DECISION MAKING: A LITERATURE REVIEW

This section fleshes out the elements of the synthesised model of household decision making displayed in Figure 5, using it as a basis for providing a literature review of household resource consumption, mainly in Australia. The review is not meant to be exhaustive but merely indicative of the types of research studies being undertaken in various fields into household energy consumption, with particular reference to their implications for the further development of policy.

Urban Form

As indicated in Section 2.6 a country's urban form - ranging from issues of urban density, to housing type, tenure and form of construction - has enormous implications for household energy consumption. A simple example makes the point. In 2011 in Sydney, where residential density is high and there is a large public transport system, 63 per cent of journey to work trips were made by car; the comparable figure was 77 per cent in Adelaide because residential density is much lower and the public transport system more limited (Mees and Groenhart 2012). This means, all other factors constant, that motor vehicle carbon emissions will be greater in Adelaide than in Sydney, and with Australia having some of the world's lowest density cities, car usage and carbon emissions will be higher here than in most other countries (Newman 1982, Newman and Kenworthy 1989). The same is true with regard to housing form. In 2009 Australia achieved the status of producing the largest new houses in the world (James 2009). The result is that the heating and cooling requirements (and their carbon impacts) are therefore very likely to be greater in Australia than in societies that construct smaller dwellings.

These examples illustrate the importance of urban form, with an emergent body of work now being able to empirically document the scale of that importance and the causal elements involved. Randolph and Troy, in a

number of studies, have looked at various aspect of urban form, such as dwelling size, type, tenure, estate arrangements and residential density and their relationships with energy and water consumption, with mixed results (Randolph and Troy 2007, 2008). After controlling for factors such as floor size (per square metre) and attributes of occupants (income, household type), the authors found that it was difficult to determine the degree to which the building or urban form, as distinct from the behaviours of the occupants, had an independent affect. Newton and Meyer's study of household consumption and attitudes on six Melbourne estates representing inner, middle established and outer urban areas came to a similar conclusion: the location and dwelling context was much less important than the occupants' socio-economic context (Newton and Meyer 2012).

One finding was clear however, and related to tenure. Residential flat dwellers, because of the communal way in which properties are managed and the fact that many are rented, had a lower level of awareness of energy and water consumption than owner occupants of detached housing (Randolph and Troy 2008). This was reaffirmed by Gabriel's study of the environmental sustainability issues of Australia's private rental market, particularly for lower income renters (Gabriel et al 2010). The problem is one of dependence on a landlord to provide a dwelling form that it environmentally sustainable, and in the current policy environment there is little interest among landlords in such provision.

A different type of study (and one that could equally be reviewed under a technology heading) is that of Horne and Hayes (2008) which is an international comparison of the energy performance of housing, but particularly focusing on the USA and Australia where there are quite wide weather extremes. The study looked at over 50 housing designs, all of which had to be of the equivalent of an Australian five star rating or higher, and measured their environmental performance. Given that the Australian housing was new housing and at the high end of environment performance for Australia the conclusion was somewhat sobering; Australian homes built to 2006

energy efficiency requirements generally achieve much lower thermal energy performance than equivalent international samples, although generally, apartments and townhouses perform better than detached houses. Even though the lightweight construction on slab seen in current new Australian housing is also used in much of the USA, the more stringent building code requirements for building fabric (especially roofs and windows) in that country produce better environmental outcomes. This research would lead to the conclusion that the Australian housing form is generating long term problems for the households that occupy them at present and will occupy them in the future.

Adopting a different approach, but one which is comprehensive in its scope, is the book by Beatley and Newman (2009). While giving an overview of the form and scale of urban issues that Australia confronts in the environmental area, the authors cast a positive spin on the story by attempting to document the best practice in Australia in relation to urban environmental policy.

Technology

Poor environmental performance of technology on the one hand, and technological innovations on another, are seen as fundamental to creating the problems of, and opportunities for, a low carbon society. The research and literature on technology and energy usage is enormous, although most of it relates to industrial and commercial applications and issues rather than household usage. But there is a growing amount of the latter, particularly focussing on housing construction and materials or fixtures such as plumbing, heating, and cooling.

Illustrative of such research is a report (Willis et al 2010) on a study of water consumption of 151 households on the Gold Coast of Australia. A control group of 44 of the 151 households was established, each equipped with an alarmed visual display monitor which locked consumption at 40 L for bathroom showers, compared to no such controls on the other households. The report documented both the water savings (a 27 per cent reduction) and the cost savings to the households with

the alarmed system. The researchers estimate this produced a 1.65 year payback period for the installation of the new technology and pointed to the importance of innovations which enable households to take ownership of their water usage.

A different type of study is that of Wang et al (2010) which investigated the potential impact of climate change on the heating and cooling energy requirements of Australian residential houses in five very different regional climates. The study modelled for the five regional areas a typical detached housing design of 324 square metres and with three levels of energy rating (2, 5 and 7) and clearly showed the superior performance of the higher rated properties. But as modelling increased temperature scenarios the high energy rating dwellings appear to experience higher percentage changes in the total H/C energy requirement. The authors conclude 'that the high sensitivity to global warming may need to be considered in the planning of future energy requirement for energy efficient buildings' (Wang et al, 2010 p1681).

Research by Fay et al (2000) looked at home insulation and piloted a case study methodology (again of a typical Australian residential dwelling). The aim was to evaluate alternative design strategies for creating an energy efficient residential building over a 100 year life cycle, taking into account both embodied and recurrent energy. They found that 'the addition of higher levels of insulation in Australia paid back its initial embodied energy in life-cycle energy terms in around 12 years, although this saving only represented less than 6% of the total embodied energy and operational energy of the building over a 100-year life cycle' (Fay et al 2000, p39). The researchers' findings suggest that, before insulation, there may be other strategies worth pursuing - for example, more efficient planning and circulation within the home and better use of shading devices.

Interestingly they also suggest that renovation of an existing home with its embodied energy may be more effective than new construction. The problem of such life cycle analysis is that the household occupant is rarely concerned with the life time energy consumption and more interested in the recurrent. As it is with politicians,

the challenge is how to get households thinking long term!

Culture and Social Relations

The emphasis within sociology and cultural studies is on the household and the day to day practices of household living. The literature from this perspective recognises the considerable variability of these practices based on differences in lifestyle, cultural background, age, etc.

Strengers (2011) analyses the limitations of existing demand-management programmes for household energy use and water consumption, and puts forward an alternative resource management approach using social practice theory. The paper outlines the concepts, methodologies and strategies that the author believes central to this approach, and contrasts it with those of demand-management. Avenues for change include a focus on the 'intermediaries' of demand (showers, appliances, taps, etc.) and how these are used in day to day practice, with a second major focus being on co-managed resource systems. The latter means that provider and households take joint responsibility for a set of practices – some of which are described in the paper - that can lead to better resource use outcomes.

With a different emphasis is the chapter by Horne et al (2011) which explores, through interviews with households, the reuse or recycling of goods and materials in the home in relation to three areas of activity: food and beverage provision, home furnishing and home improvement and maintenance. The findings, according to Horne et al, reveal the limits of current policy approaches to reducing household waste and encouraging recycling, as they drew attention to the important role of networks of families and friends and other informal systems of provision in promoting second hand exchange.

Organo et al (2012) considered the gender implications of encouraging more environmentally sustainable policy. Using in depth interviews with six coupled households with young children, the researchers looked at sustainable practices by gender and found that women

practise them more often. Organo et al contend that, in the case study households, sustainability became a highly gendered practice because of the different roles in homemaking. The findings illustrated how gendered analyses can help identify both opportunities for, and constraints around, greater sustainability. The opportunities identified included 'the strong connections between both mothers' and fathers' understanding of good parenting and the importance they attach to household sustainability, with the constraints including the temporal challenges faced by households, and how these interact with wider structural and labour roles' (Organo et al 2012 p559).

Payne (2005) reported the findings from a study of environmental practices and values in self-nominated green homes, with the focus on children. Green homes, perhaps not surprisingly, proved to be a very effective mechanism for environmental education and sustainability practices. The study highlighted how environmental learning by children was closely associated with them *doing* practical things in the home, as well as the role of parents' environmental commitments. Other aspects of how the families functioned in relation to environmental practices were also considered, including social relations and conditions of the home, the school and community networks, and the prevailing cultural climate. The study demonstrates the importance of informal education practices and the need to develop environmental education curricula and learning strategies appropriate for different learning environments.

Another example of research in this cultural and social domain is a study of the sustainability implications of everyday decisions to fashion, consume, and share resources around the home, through the lens of extended family households (Klocker et al 2012). Through interviews with 17 members of 10 extended family households in Australia, the research team explored the potential for this households type (a more communal one) to reduce resource use, and thus improve sustainability outcomes. They found that the potential environmental and economic benefits of

resource sharing within larger households are shaped by, and partly negated by, wider society cultural values of privacy, space and independence. This illustrates the issue, described previously, that households consume within an external environment which is not particularly conducive to restraint, and hence even communal type families living under one roof duplicate household spaces and goods i.e. require multiple rooms, appliances, and resources.

Systems of Governance

Governance is not a sexy topic, and its relationship to household energy consumption is rarely commented on or researched. However the paper of Wear and Harrington (2002) – even if now a bit dated - illustrates the importance of the subject. That paper looked at Australia's then newly established National Appliance and Equipment Energy Efficiency Program, designed as a household appliance labelling and standards program with the objective of greenhouse savings of 81Mt of CO₂ equivalent between 2000 and 2015. The paper argued that the complexity of Australia's federal structure hampered the program's ability to achieve maximum impact, delaying implementation and resulting in confusion for industry. The net result was forgone greenhouse gas abatement opportunities, and lesser economic efficiencies than there might otherwise have been. The logical conclusion, it was argued, was the need for a more efficient federal system or the introduction of Commonwealth energy efficiency legislation.

Demographics

Demography takes in the study of population size, composition and distribution across place, with the processes through which populations change most immediately being death, birth and migration. There has been a longstanding but variable recognition of the relationship between population and environmental issues: most ancient civilisations had some consciousness of the need to balance population growth with the resource capacity of the environment, although

they lacked knowledge of what could be seen as a morally acceptable means of doing so (Diamond 2005, Ponting 2007). Malthus (1798) is arguably the father of demography in relation to the environment. He contended that population growth, without checks and balances, would reach the point that it would exceed the capacity of society to feed itself. Since then the demographic arguments have been continuously contested and debated, with much writing being polemical rather than research-grounded. Actual empirical research by demographers on environmental issues, apart from those concerned with natural resource constraints, is quite limited and this holds for Australia as much as anywhere else. However research within the cultural studies area crosses into the demographic when considering links between household composition and environmental practices and perceptions.

In one study Waitt et al (2012) explicitly focused on household composition, using a quantitative methodology, two-stage cluster analysis, to identify the types of households which are doing the most in terms of sustainable household behaviours. Drawing on data from a large-scale survey of Wollongong households the study reaffirmed the point made by those in the cultural studies tradition – that is, the importance of approaching household sustainability through everyday practices. The results highlighted the wide variation in participation in specific household sustainability practices, with women, suburban detached households and lower income segments of the population ultimately doing most of the work of being sustainable.

Media and Marketing

The mass media and the marketing industry are highly conflicted on issues of the environment. Both have a synergistic relationship in encouraging consumption, often of the least sustainable form. In some respect their activities can be seen as the antithesis of sustainability, whether it is advertising revenue for the print and visual media or billing for marketing firms. Much of their revenue is built around success in encouraging greater household consumption - witness the plethora of

decorating and home renovation magazines and television shows.

While the boundaries of the marketing and mass media industries are often blurred (i.e. the latter is a major vehicle for the former) it is still useful to distinguish between the two. Mass media embraces all forms of technology that are used to communicate to large or mass audiences, with radio, television and print the traditional forms, but now including the digital media. By shaping the nature of communication for audiences, media can affect the degree to which people are generally aware of environmental issues, which environmental issues they are aware of, and the public understanding of the causes and effects of different environmental issues. The media can also shape the extent to which people support or reject policy interventions, with probably the most visible environmental agenda-setting example in the Australian media being the consistent campaign by the Murdoch press to deny global warming.

There is not a great deal of literature on the role of the Australian media with respect to the environment, particularly as it might relate to households. But an interesting example is the analysis by McManus (2000) of reporting (or lack thereof) by the Australian media on the 1998 Buenos Aires conference on climate change, despite following closely on from the highly publicised Kyoto convention in 1997. He argues the negligible coverage was an example of '*embodiment*', or the uncritical acceptance of certain assumptions and practices, and '*distanciation*', which is defined as the separation of cause and effect in regard to an issue' (McManus 2000, p306).

On the other hand the media, because of its success in informing and persuading, can also be an important tool for shaping household decision making toward more sustainable consumption. Marketing research on the environment in its early years focused predominantly on the attributes of the 'green' consumer, the meaning of environmental consciousness, and on those consumer behaviours and values such as recycling, and pollution

which are explicitly environmental (Kilbourne and Beckmann 1998).

In marketing practice there are two obvious links to sustainability and reduced carbon emissions. One is the role of marketing in assisting companies to show their public commitment to sustainability, in an attempt to help to differentiate their product or service from those of other companies. To be effective this strategy has to be backed by some substance i.e. the delivery of services or products that reflect sustainability in their design, production or consumption. The other aspect of marketing that has implications for sustainability is the lessons to be learnt in providing appropriate information and communication programs, to guide households in making more informed decisions about sustainable practices.

Wheeler et al (2013) investigated consumer brand rejection of 'green' and non-green brands. Based on data covering three years (2009–2012) and around 1000 responses in three waves of research on 30 brands, they found that 'green' brands tend to be not considered in the consumption decision rather than being consciously rejected. Consumers do not think about these brands in a buying situation largely because they are unfamiliar with them, suggesting that their single 'green' message is not enough to make it into the shoppers' consideration set. The research also found that not being 'green' was not a reason for rejection of non-green brands, highlighting the importance of 'brand advertising to build multiple, relevant memory structures for any brand' as a way to increase the probability of being thought of in a consumption decision (Wheeler et al 2013, p108).

D'Souza et al (2006), using 155 telephone interviews of consumers, researched the green purchase intentions of customers in Australia with a view to identifying the factors that shape purchase decisions. A conceptual model of green purchase decision making was developed to inform the survey design. The model and survey enabled attributes of green products, such as product labels, packaging, and product ingredients, to be compared with more external factors such as corporate identity and perceptions of the extent to which

companies placed a higher priority on profitability than on environmental responsibility. The research showed that the latter appeared to influence customers' decision making and perceptions more than the former. The paper then pointed out the implications for companies of engaging with environmental issues.

Market Environment

This is the domain of the economists and is principally concerned with issues of the impact of pricing, income, availability and substitutability of alternative products on consumer choice and behaviour.

One of the major research areas in household economics - and the area of energy consumption is no exception to this - is that of the sensitivity (or elasticity) of household energy demands to pricing and/or income. Given that price levels can be an important policy instrument in shaping demand for energy it is easy to see the importance of knowing how sensitive consumers are to price.

Narayan and Smyth (2005) provide estimates of the long- and short-run elasticities of residential demand for electricity in Australia using econometric techniques. They find that, in the long run, income and price are the most important determinants of residential electricity demand, while temperature is significant some of the time and gas prices (i.e. the price of substitutes) are insignificant. Their estimates of long-run income elasticity and price elasticity of demand are consistent with previous studies, although theirs are towards the lower end of other existing estimates. Thus the income elasticity is 0.323 (model 1) and 0.408 (model 2) and the long run price elasticity of demand is -0.541 , while in the short run, it is -0.263 (Narayan and Smyth 2005, p471-472). The results reaffirm international research demonstrating that an increase in income will increase the use of electrical appliances and increase the demand for energy intensive goods and services, while price increases will reduce demand but not by the amount of change in price.

Fan and Hyndman (2011) also looked at the price elasticity of electricity demand but using South Australian data. The objective was to determine whether there was any variation in price sensitivity with the time of day, and to estimate the form of any such relationships that might exist in South Australia. Such research is important because household consumers are increasingly operating in an energy environment that includes both spot market pricing and smart meters, meaning that the era of paying a flat rate for the electricity consumed is over. The research found the overall price elasticity in South Australia, estimated using historical data, ranged from -0.363 to -0.428 , showing a moderate responsiveness of electricity consumption to changes in prices, results consistent with the findings of Narayan and Smyth (2005). However Fan and Hyndman (2011) also showed that responsiveness varied for different times of the day, with the strongest responsiveness being at peak times, thus affirming the industry belief that flexible pricing schemes are an effective way for dealing with peak demand (Fan and Hyndman 2011, p3717).

A much older and different type of study is that of Ironmonger et al (1995) which examined economies of scale in energy use and expenditure among adult-only households and across three adult-only household types. The research found that as household size increased the amount of energy used per person reduced, indicating that economies of scale did exist. This meant that smaller households, but particularly older ones who spend more time at home, suffered a double penalty of greater per person energy use and higher charge per unit of energy. The implication is that, given the trend towards smaller average household size which has been maintained since this 1995 study, the loss of economies of scale in energy consumption are undermining gains in energy efficiency obtained through other means. As discussed in section 2, good policy intent can be confronted by competing challenges from broader societal and economic processes.

Hoffmann et al (2006) used suburb-level quarterly data to model residential water demand in Brisbane,

Australia, from 1998 to 2003. In Brisbane, the method of charging for residential water consumption at that time was a fixed annual service fee with no water entitlement, plus a fixed volumetric charge per kilolitre. The measure of water demand in the study was the average quarterly household water consumption, and this was modelled against various demand characteristics including the marginal price of water, the number of rainy and warm days and household income and size. The results showed that residential water consumption is price and income inelastic. But in one of the few studies of any type to differentiate between tenure (rather than just housing type) the analysis found that the price and income elasticity of demand in owner-occupied households was higher than in rental households. This result backs up the more recent study by Gabriel et al (2010) who, although using a different methodology, concluded that tenants have less capacity to control energy use and therefore one could expect a lower income and price elasticity for this category of household.

These and many other economic studies could also have been discussed under the next heading of policy, given their direct policy importance. The following section canvasses some of those studies which were explicitly designed with policy intent.

Policy

A whole range of policy levers are available to manipulate/prompt/nudge/force households into behaviours to reduce their energy usage. As outlined in Table 1, these levers include regulation, taxation, transfers, grants, pricing policy, capital expenditure, education and advocacy and compliance, all of which can be adapted to the goal of cutting energy consumption. For instance, regulation can involve building controls (e.g. to promote high energy rating dwellings); grants can be used to encourage a switch to low energy use products (e.g. solar, water efficient taps and shower heads); pricing policies such as a peak electricity pricing can send signals to reduce demand at specific times; and education and advice programs can

result in more informed citizens. Taxation policy, of which a carbon tax is the major example, is also an important policy instrument although it tends to target commercial and industrial use, rather than aiming to have any direct impact on households. However taxation can in principle be applied at the household level, e.g. different property taxes or rates for environmentally higher performing dwellings, or different car registration fees to encourage individuals or households to purchase the cleanest models of cars. In addition to these types of policies, there is a further category of policy aimed at compliance, i.e. to ensure policy and programs are enforced and are monitored to guarantee planned outcomes are delivered. For example a six star energy efficiency rated dwelling program may operate within a weak or flawed compliance regime, which means intended energy performance may not be achieved (see Pitt and Sherry 2014, p88-100).

In developing policy to change household energy use, there are two domains of policy to consider: the context in which embodied energy is used, referring to the external environment in which household decision making occurs, and the internal decision making environment over which the household has direct control.

The external environment includes many of the influences on energy consumption discussed in section 2; these are the attributes of urban form, the physical geography of Australia and variations in local areas across it, the design quality and availability of household items (motor vehicles, appliances, food, clothing etc.) and, more abstractly, social values and belief systems (such as the importance of family, the dominance of the detached dwelling, and attitudes about home ownership and individual responsibility). The household is not entirely passive in this regard, as it can make choices within this context (for example, about where to live and in what type of dwelling, the choice of type of motor vehicle, etc.). But except through the slow process of changes in consumer preferences and associated signals to producers, households cannot have dramatic effect on these areas. Thus, if the goal is to more

effectively limit consumption of embodied energy, the policy focus needs to be on the providers of goods and services to households.

The internal decision making environment is about the decisions that can be made directly by households to modify or reduce energy use: that is, decisions about the quantity of goods and services to consume, in what form, for whom and when. Household decision making about resource usage largely relate to five areas: the dwelling, food, appliances, transport, and leisure and recreation. Within each of these five areas, choices can be made which have better or worse outcomes in terms of resource/energy use. Taking transport as an example, 'worse' compared with 'better' decisions in terms of usage can be summarised as ones of:

- Multiple vehicles per household vs. no motor vehicle;
- Car use vs. public transport, and better still walking or cycling;
- Use of high petrol consumption vehicle vs. low consumption;
- Use of high embodied energy vehicle vs. low embodied energy;
- Locating in areas which require car use vs. areas that allow for alternatives of public transport, cycling, walking;
- Use of vehicle in peak hour when congestion costs highest vs. off peak travel.

Table 1: Government policy levers for influencing household energy consumption

Broad Policy lever	Embodied energy consumption: External to household decision making	Direct energy consumption: Internal to household decision making
Regulation	Building regulations to encourage use of passive design material in new or established dwellings. Planning regulation to require potential for lower energy use of urban environment e.g. new residential housing estates.	Mandated smart meters.
Taxation	Carbon tax to raise the cost of resource/energy consumption and encourage behavioural change.	Tax credit for purchase of electric vehicle or low energy appliance. Motor vehicle emissions tax.
Transfer payments		Provision of pension or benefit supplements to compensate for higher energy costs.
Grants	Grants to/for builders, developers landlords, to insulate homes or to install energy saving appliances.	Grants to/for home owners, tenants to insulate home or to install energy saving appliances.
Pricing policy	Emissions trading scheme which raises costs of energy consuming activities.	Raising energy costs through different pricing to send behavioural change signals.
Education and advocacy	Industry focused environmental awareness programs.	Home energy audit programs to encourage energy conservation by providing homeowners with information about economically sustainable retrofit actions.
Compliance	Policy and programs, e.g. building regulations, should be properly enforced and changed for changing circumstances.	Policy and programs should be monitored and appropriately enforced e.g. are grants appropriately targeted?

Such trade-offs also exist for each of the other four areas of resource use that households engage in – that is, their dwellings, food, appliances, and leisure and recreation - and for each it is possible to design a range of policy instruments to influence where a household will line up in the trade-off between 'worse' and 'better' decisions.

Choosing the appropriate policy instruments requires two things. The first is a rich understanding of what the problems or issues are: the scale and form of the problem or issue, knowledge of the range of possible policy options, as well as who will be affected by each of them and to what degree, i.e. will the options be equitable and efficient? As illustrated by this discussion of the different approaches to explaining household decision making about energy use, and the related review of the literature, there are no simple one dimensional policy solutions. A range of policy responses are necessary and have to be targeted in very different ways.

The second requirement, and a more fundamental one if the policy is to be successful, is that of social legitimation for the policy process and particular policy instruments, ie there must be broad acceptance of, and support for, the policy direction and its particular form. This links directly to the belief system of a society and the public understanding of a problem and its causes. Policies are often difficult to implement and the carbon tax debate in Australia highlighted that if there is not sufficient public legitimation for the policy, or understanding of it, then the policy is unlikely to succeed. The nature of societal beliefs and how they are constructed or have evolved takes us into an enormous literature beyond the brief of this report.

In the Australian context, however, some broad generalisations about social values can be drawn out from the comparative public policy and intercultural management literature (Castles 1985, Esping-Andersen 1990, Van Kersbergen and Vis 2014, Korpi and Palme 2004). Among these generalisations are that Australia has, as a guiding social principle, high regard for individualism rather than collectivism; is more market

than government oriented, with associated values around the limited scale of government intervention including the role of welfare and taxation; and historically it is a country that has placed much greater emphasis on economic growth rather than environmental sustainability. These belief systems or values can place constraints on policy interventions, in terms of both the scale and type of intervention which Australian society and households will find acceptable.

There is a relatively large Australian literature on environmental policy. But not much of it has an emphasis on households, the major foci being rural water, land use, and marine management and conservation, and to a lesser extent industrial and urban pollution (Walker 2000, Conacher and Conacher 2000).

However in recent years there have been some evaluation studies of different energy saving policy initiatives. Peterkin (2009), for example, studied 34 randomly selected single storey houses in Perth from which a test group was created. The latter had strong passive solar design elements – that is, the homes were designed for energy performance, and did not rely on add-on (non-passive) design elements such as high performance glazing insulation and innovative shading strategies. Peterkin concluded that the key to improving the low carbon performance of Perth's future housing stock is less in the non-passive solar design but rather in the passive design elements of material, zoning, control of sun penetration and control of ventilation. He contended that five star building regulations should concentrate more on the passive than non-passive.

Clune et al (2012), in a similar type of study to that of Peterkin but with a different objective, developed a Residential Emissions Calculator to compare heating and cooling loads for 72 new Australian houses, based on star ratings, and compared these to a sample of historic Australian house sizes by state. The analysis illustrated that house size has significant impact on the capacity of residential building codes to reduce emissions, and suggested that the increase in house size is undermining the effectiveness of moving from a 5 star to 6 star rating. In the Victorian case study the

undermining affect was of the order of 38 per cent. These findings suggest that regulation (that is, star ratings) should also be related to house size, and that if this is not recognised in an integrated national emissions management policy then household energy performance goals might not be achieved.

The research by Peterkin (2009) and Clune et al (2012) was about regulation as a policy lever. Dowd et al (2012) focus instead on education and information provision. Recognising the importance of public awareness, the project aimed to test whether a process could be designed that would encourage individuals – from within their existing social networks – to facilitate energy reduction discussions that ultimately changed the way they consumed energy. The research focused on a process called “EnergyMark”, which was grounded in the idea that change is facilitated by factors that include the provision of tailored information, the availability of social support, encouragement to set goals, and access to feedback. The paper presents results from the first trials of the process, which showed an average emissions reduction of 20 per cent, based on a pre- and post-trial carbon calculator that incorporated a number of elements related to energy used in the home, as well as personal transport. The trial also found that participants of widely varying demographic backgrounds and dispositions responded positively to the program. This was seen as evidence that such purpose-designed information and support programs have useful household energy savings potential.

Not all programs to which evaluation research methods have been applied yield positive results. Macintosh and Wilkinson (2011) investigated the Australian Government’s Solar Homes and Communities Plan (SHCP) and its predecessor, the Photovoltaic Rebate Program (PVRP), and evaluated them on criteria of equity and cost effectiveness. The research found that the programs were ineffective (with limited take up) and costly: they reduced emissions by 0.09 MtCO₂-e/yr over the life of the rebated PV systems, at an average cost of between AU\$238 and AU\$282/tCO₂-e. In addition, the data suggest there were equity issues associated with

the program, with 66 per cent of all successful applicants residing in postal areas that were rated as medium-high to high on a socio-economic status (SES) scale.

An example of a study about the link between policy and the potential impacts of household energy consumption is the report by the federal Department of the Environment, Water, Heritage and the Arts (2008) on *Energy Use in the Private Residential sector*. This models projected construction of new dwellings and the take up of typical household appliances to 2020, on the assumptions that the dwellings built and appliances purchased are to mandated Australian energy standards.

Conclusion

The scale of household consumption, and associated energy consumption, over the last twenty years has shown little sign of easing. This is perhaps not surprising because the drivers of household consumption are as powerful now as they were two decades ago, and in some cases are even stronger.

Moving towards a low carbon environment in this social and economic context will be difficult. The challenge may be compounded by the multiple and occasionally conflicting understandings of household decision making provided by the different disciplines researching and analysing the topic. The problem with these various theoretical approaches is that they are discrete, and tend to only offer explanations within a single framework. This means each is largely oblivious to the insights offered by the others, and may sometimes be dismissive of them. However the argument presented in this report is that if we are to adequately understand how to influence household behaviour in order to reduce carbon-based energy consumption, an integrated or interdisciplinary approach is essential. To this end, a synthesising framework for understanding the large range of drivers of household consumption and decision making has been presented and discussed.

The discrete or distinct nature of the analysis undertaken within the different disciplines to explain consumer

behaviour can lead to one dimensional policy solutions, for instance the focus on pricing policy that comes from the discipline of economics. However, as summarised in Table 1, there are a whole range of policy levers which are available to, in various ways, influence – this might be to manipulate, prompt, nudge, or force - households into behaviours that could reduce energy usage. Regulation, taxation, grant programs, pricing levels, education initiatives, and appropriate compliance regimes are among such policy levers. But the precise design of policy instruments within any of these broad strategies must be grounded in a sound understanding of what explains household decision making. The multiplicity of behaviours around material consumption. and the varying nature of what drives such behaviours, mean there is no 'one size fits all' policy model, but instead a need for diverse, reflective and nuanced policy.

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