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Australian Householders' Attitudes Towards Sustainability in the Home

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Sandy Bond, Ph.D., MBS, ANZIV,
Professor of Property Studies,
Faculty of Commerce
P.O. Box 84
Lincoln University
Lincoln 7647, Canterbury
New Zealand
Phone: + 64 3 321 8255
E-mail: dr_sandybond@yahoo.com

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Abstract:
The energy used by Australian buildings account for around 20% of Australia's greenhouse gas emissions, shared fairly evenly between homes and commercial buildings (DEWHA, 2009). According to McKinsey and Company (2007) improving energy efficiency of buildings and appliances is the most cost effective way of reducing greenhouse gas (GHG) emissions. A new *National Strategy on Energy Efficiency* released by the Council of Australian Governments in July 2009 aims to accelerate energy efficiency measures in buildings.

About three-quarters of spending on buildings, over the last five years, have been on dwellings which have a mean asset life of 88 years for brick homes, and 58 years for timber homes. The remaining 27% of spending on buildings has been for non-residential buildings. (DEH & AGO, 2006, p. 23). These figures show the importance of a focus on the residential sector due to the size of the spending and the longer life of these buildings compared to the non-residential sector.

This paper outlines the results of research carried out in Australia in 2009. A nation-wide survey was conducted of householders to identify their attitudes towards climate change and the drivers and barriers towards energy efficiency in the home. Part of this involved determining their lifestyle choice in terms of house size and location; the types and usage of electrical appliances selected; the motives behind these choices, and their user behavior as related to energy consumption. The results from this survey will help to identify methods that encourage behavior change and increase the uptake of sustainability practices to reduce greenhouse gas emissions in new and existing residential buildings.

1. Background and Literature Review

The Kyoto Protocol is an international environmental treaty intended to reduce greenhouse gas concentrations in the atmosphere to help tackle climate change. National limitations range from 0% reductions for New Zealand, to 8% for the European Union and permitted increases of 8% for Australia and 10% for Iceland. As of 2008, 183 parties have ratified the protocol, which entered into force on 16 February 2005.

According to McKinsey and Company (2007) improving energy efficiency of buildings and appliances is the most cost effective way of reducing greenhouse gas (GHG) emissions. A report by the United Nations' International Panel on Climate Change confirms earlier estimates that energy use in the building sector could be reduced by 30-50 percent.[1]

1.1 Greenhouse Gas Emissions from Buildings in Australia

Buildings in Australia account for 23% of Australia's greenhouse gas emissions, consume 40% of Australia's total energy output and the cost to the economy of poor indoor environmental quality is estimated at $12b annually" (Green Building Council Australia, 2007).[2] According to Foliente et al. (2009), while the building sector is not the largest contributor to greenhouse gas emissions, it is one of the fastest-

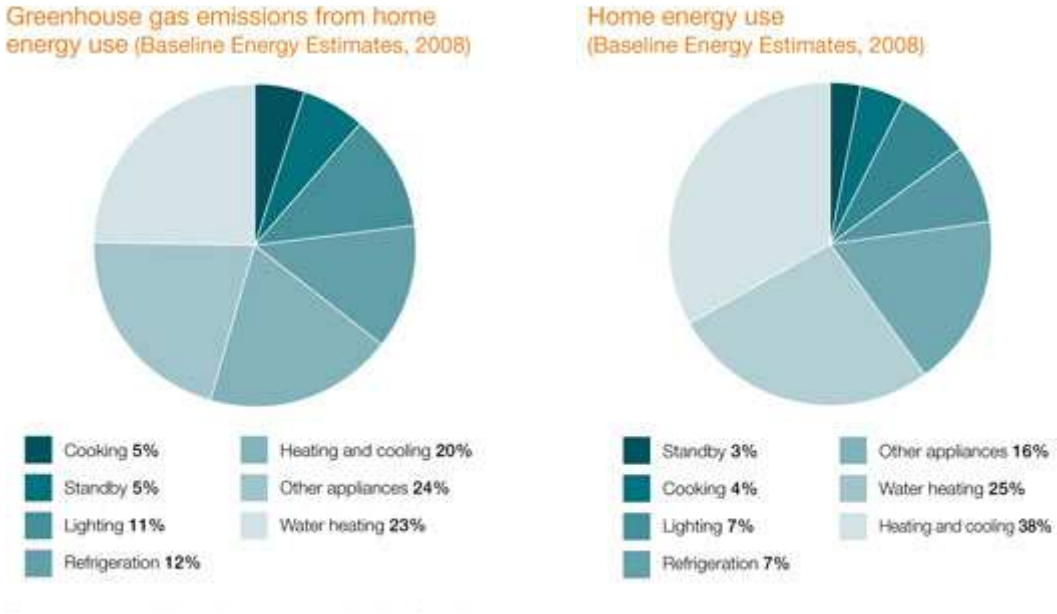
1 SL Nadel, M Rainer, M Shepard, M Suozzo, and J Thorne, (1998) *Emerging Energy-Saving Technologies and Practices for the Buildings Sector*, Washington, DC: American Council for an Energy-Efficient Economy. Report A985.

2 By comparison, US buildings account for 38% of America's GHG emissions, while the figure for the UK is around 42%.

growing sources. By 2010, emissions from buildings are estimated to increase by 48 percent over the 1990 level. Energy usage in residential buildings accounts for around 13% of total carbon dioxide (CO2) emissions from all sources in Australia.

In terms of *source* of greenhouse gas emissions in the residential sector, over half comes from *electrical appliances, including lighting, selected by residents or persons outside the building sector*, 23% comes from water heaters, and 20% comes from space heating and cooling (primarily by wood and natural gas). The Figure I below, shows both emissions and energy use in homes in 2008.

Figure I – Greenhouse gas emissions & energy use in homes



Source: Australian Greenhouse Office 2008, Your Home Technical Manual, Fourth edition. http://www.yourhome.gov.au/technical/pubs/fs61.pdf [accessed 5 June 2010].

It is not only the amount of energy used in homes that has an impact on the production greenhouse gas emissions but also the type of energy. Householders could reduce their carbon footprint by not only reducing the amount of energy they use in their homes but also by using energy from renewable and green sources. In 2006–07, electricity generated from renewable sources made up only 3.6% of electricity generated for industry and households with the majority coming from fossil fuels (e.g. coal, oil and gas), (ABS, 2010a). Table I below outlines the type of fuel used for electricity generation for industry and households from 2006-2007.

Table I - Fuels Used In Australian Electricity Generation For Industry And Households, 2006–07

	PJ	**Share %**
Thermal		
Black coal	1,379	56.4
Brown coal	671	27.4
Oil	25	1.0
Gas	284	11.6
Total thermal	**2,360**	**96.4**
Renewables		
Hydro	52	2.1
Wind and solar photovoltaic	23	0.9
Biomass	5	0.2
Biogas	7	0.3
Total renewables	**87**	**3.6**

Note: Figures are for energy input, not output.
Source: Australian Bureau of Agricultural and Resource Economics, 2009, *Energy in Australia 2009*.

According to ABS data (2010a), despite efforts to reduce energy consumption in homes, household electricity use per person rose 19% throughout the period 2001–02 to 2006–07. Larger dwelling sizes, decreasing average household size, more appliances and IT equipment per household as well as the increased use of heaters and coolers, have contributed to this increase.

1.2 Government Actions to Reduce Greenhouse Gas Emissions from Buildings

In recognition of the significant environmental impacts associated with buildings, in 2003 the Department of Environment & Heritage (DEH)[3] and others commissioned a scoping study "Sustainability and the Building Code of Australia" to investigate whether it was appropriate for sustainability requirements to be included in the Building Code of Australia (BCA). In June 2004 the Australian Building Code Board (ABCB) endorsed some of the key recommendations of the research and announced that sustainability should become a goal of the Building Code of Australia (alongside the existing BCA goals of health, safety and amenity).

In 2006, the DEH and the Australian Greenhouse Office (AGO) commissioned a study "to identify and quantify the range of environmental impacts, associated with the building fabric, using life cycle analysis; review the options for reducing these impacts; and identify a range of possible measures that could improve the sustainability of building materials across the life cycle/supply chain" (DEH & AGO, 2006, p. xii). The analysis is applied to materials, not to the buildings themselves and excluded operational aspects such as lighting, heating and cooling and appliances. Building materials included in the study were only responsible for 10% of the overall greenhouse impacts of buildings (the rest is from energy consumed for building operations that this project will focus on).

The findings from the above study show that the largest quantities of materials used in buildings occur in the *new residential construction sector*. The average size of new houses has grown significantly over the past twenty years to a current average of 258m2 while, at the same time, average household size has decreased to 2.6 persons per household in 2001. Thus, a reduction in the number and size of buildings led to the largest impact reductions of any single measure examined. Further, much of the environmental impact of buildings is determined at the design stage. It is therefore critical that environmental impacts be considered early in the design process. However, it can be difficult and costly to obtain good market information on building materials with credible environmental performance information. The development and use of tools allowing easy, accurate and quick quantification of environmental costs and benefits of design options was identified as a way to improve information flows.

According to the DEH and AGO 2006 study, the amount of new stock added annually to the residential sector comprises around 3.8% of the total stock.[4] The BCA also tends to focus on new works, including major renovations and refurbishments. Existing structures, that may not meet the new standards unless refurbishment is carried out, has been largely ignored. According to Cooper (2001) upgrading the existing stock is one of the most critical aspects of improving sustainability in the built environment.

About three-quarters of spending on buildings over the last five years have been on dwellings. About 55% of this involves construction of new dwellings and 45% involves alterations and additions to existing dwellings over $10,000. The mean asset life of a dwelling, as used by the Australian Bureau of Statistics, is 88 years for brick homes, and 58 years for timber homes. The remaining 27% of spending on buildings over the last five years has been for non-residential buildings (DEH & AGO, 2006, p. 23). These figures show the importance of a focus on the residential sector due to the size of the spending and the longer life of these buildings compared to the non-residential sector.

The barriers to reducing impacts on the environment highlighted in the DEH & AGO report include: lifestyle choice whereby people want large houses; a trend to smaller household sizes driving building demand for more dwellings, and resistance to urban densification and consolidation. In August 2004, the

3 Now the Department of the Environment, Water, Heritage and the Arts.

4 New stock added each year in the commercial sector is around 2-3% (Jones Lang LaSalle, 2005).

Ministerial Council on Energy announced a major advance nationally for energy efficiency, productivity and the environment, by agreeing a comprehensive set of measures comprising the first stage of the National Framework for Energy Efficiency (NFEE). The National Framework is a comprehensive package of measures covering the residential, commercial and industrial sectors, designed to overcome the barriers and challenges that prevent the market delivering the actual economic potential of energy efficiency.

At the Council of Australian Governments (COAG, 2009) meeting on April 30th 2009, the States and the Federal Government signed the National Strategy on Energy Efficiency 2009-2020 Memorandum of Understanding (MOU) and released a draft National Strategy on Energy Efficiency. Work commenced on five key measures to drive growth in the number of highly energy efficient homes and commercial buildings across Australia. Those relating to housing are as follows:

- Increasing energy efficiency requirements for new residential buildings to six stars, or equivalent, nationally in the 2010 update of the Building Code of Australia, as well as introducing new efficiency requirements for hot-water systems and lighting;
- Phasing in mandatory disclosure of residential building energy, greenhouse and water performance at the time of sale or lease, commencing with energy efficiency, from May 2011;
    - Vendors and landlords will need to have an energy-efficiency report when selling or renting a home
- Reforming current building energy efficiency standard and assessment processes to achieve consistency across the nation.

According to a report by Environment Victoria et al. (2009), "By 2010, emissions from buildings are estimated to increase by more than 48 percent above 1990 levels. Yet greenhouse gas emissions from the average home can be reduced by more than 75 percent with energy efficient design and appliances," p.4. The report states that as new homes will account for just 15 percent of Australia's housing stock by 2020, a focus solely on standards for new homes will not achieve the 'mass greening' of our housing stock we need, and a concerted program to upgrade the energy and water efficiency of the existing housing stock in needed as well. In recognizing this need the Government has introduced initiatives to improve the energy efficiency of homes as outlined in the following sections.

1.3 Government initiatives to improve the energy efficiency of homes

A method supported by the Australian government to reduce greenhouse gas emissions is the use of renewable energy, power produced from wind, water or solar sources. From an individual building perspective, solar energy can be used for the generation and provision of both electricity (photovoltaic systems) and hot water (solar hot water systems). Wind turbines can be placed on buildings for the production of power. Together these systems are known as micro-generation technology, "heat and/or electricity on a small-scale from a low carbon source".[5]

However, the uptake of these technologies has been slow. A study by Roberts and Sims (2007) suggests that the barriers to the adoption of micro-generation technology amongst residential developers in the UK were the initial costs, long payback periods, and the current market immaturity, reliability and liability of micro-generation products.[6] In Australia similar barriers to uptake have been identified in a report by Environment Victoria et al. (2009). These include: lack of consumer information at point of purchase or lease, or high degree of complexity or time commitment leading to inefficient choices; split incentives between builders and the householder where builders are not motivated to improve the energy efficiency of homes because they do not re-coup the benefits of lower energy bills or improved comfort that accrue to the householder; upfront capital costs of energy efficiency measures; and "bounded rationality" – householders may not understand the benefits to them of energy efficiency, or may not act due to other priorities.

5 Department of Trade and Industry (DTI) Micro-generation Strategy 2006.

6 The demand for micro-generation technology in the UK is been driven by the Code for Sustainable Homes that aims to achieve "zero-carbon status for new housing by 2016".

To address these barriers, and increase the uptake the Australian government developed a number of grants, funding and rebates. However, some of these were far from successful as outlined in sections 1.3.1 and 1.3.2, below.

1.3.1 The Home Insulation Program and revised Renewable Energy Bonus Scheme

Roof and ceiling insulation can save up to 45% on energy consumption for heating and cooling (DEWHA 2008). The proportion of insulated dwellings in Australia was 62% in 2008, up from just over half (52%) in 1994. Of those dwellings with insulation, 98% insulated the roof or ceiling. The most common type of insulation installed in the roof or ceiling was fibreglass, wool or polyester batts (55%) followed by sisalation or reflective foil (22%), (ABS, 2010a).

In February 2009, as part of its stimulus measures to prop up business in the face of the global financial crisis, the Labour Government undertook to provide rebates to insulate the ceilings of 2.7 million houses (up to $1,600 per household). As well as claiming that the scheme would create jobs, the government sought to boost its "green" credentials, insisting that home energy bills would be cut dramatically.

However, this $2.5 billion Home Insulation Program suffered intensive public criticism after four young installation workers were killed by electrocution or heat stroke, at least 87 roof fires and 1,000 homes being declared electrically "live".

Only a year after its commencement the Government announced the discontinuation of the Program on the Friday 19 2010. The government suspended the use of foil insulation and ordered safety checks in thousands of homes following industry warnings that the material can become electrified if wrongly installed. The government's Green Loans and solar hot water schemes for the installation of residential energy saving technology was also abolished, but with replacement schemes pledged to commence in June 2010, with tougher safety rules, few details were provided.

It was revealed that audits of homes had shown a risk of dangerous faults in up to 90,000 homes and that poor quality batts were fitted in 180,000 homes, out of the 1.1 million homes insulated. Some of the issues that arose were due to an inadequate accreditation process and the installation of insulation too close to electric cables, ceiling fans, lights and transformers.

A new Home Insulation Safety Program (HISP) has been introduced. A minimum of 150,000 safety inspections of homes that had non-foil insulation installed under the former Home Insulation Program will be carried out to provide a level of assurance to households that their properties have been inspected and are considered safe. The Australian Government's Foil Insulation Safety Program (FISP) is for the 50,000 households that had foil insulation installed between 3 February 2009 and 9 February 2010 under the discontinued Home Insulation Program.

The household Renewable Energy Bonus Scheme (REBS) due to commence on 1 June 2010 was to replace the Home Insulation Program and the Solar Hot Water Rebate but will no longer include an insulation program. Under REBS households will be able to receive a rebate for a solar hot water system ($1000AU) or a heat pump ($600AU).

1.3.2 The Green Loans Program

A Green Loans Program was launched in July 2009 allowing up to 960,000 homes to be put through the program. The GLP was intended to have three components aimed at assisting Australian households to improve their energy and water efficiency:

1. A free home sustainability assessment. A trained assessor visits the home and compiles an assessment report indicating what the householder might do to save energy and water, and to improve their sustainability.
2. A $50 Green Rewards Card for households who had participated in a home sustainability assessment. This was for the purchase of small items to improve efficiency, for example energy efficient light globes and the like.

3. Access to an interest free Green Loan, for amounts of up to $10,000 over a maximum period of four years through approved financial institutions.

However, upon review a number of issues arose with this program, as identified by Senator the Hon. Penny Wong, Minister for Climate Change, Energy Efficiency and Water (2010) including:

1. Sustainability assessment reports not being delivered to households in a timely fashion. As at 28 February 2010, 210, 864 home sustainability assessments had been completed but only around 84,000 reports produced had been sent out to households.

2. More assessors than required. Currently, there are around 4000 assessors contracted to the Department of the Environment, Water, Heritage and the Arts (DEHWA) to conduct home sustainability assessments under the Green Loans Program, with this to be capped at 5000 under the Government's changes to the Program on 19 February 2010. There are approximately 7500 people, including those already contracted, who have completed the required assessor training and been accredited with the Association of Building Sustainability Assessors (ABSA). ABSA figures estimate approximately a further 1800 people have completed training but have not been accredited.

3. Payment of assessors delayed. This delay is partially due to around 50 per cent of invoices received by DEWHA been incorrect or incomplete when first submitted.

4. No $50 Green Rewards Cards have been distributed to households to date.

5. Low uptake of loans. This was due the slowness with which assessment reports were made available to households, a potentially lower appetite to enter into debt in the latter half of last year given the Global Financial Crisis, and financial institutions stopping taking new applications for Green Loans.

To overcome some of the identified problems, the Green Loans Program is to be re-designed and extended, with new arrangements to apply to the end of 2010. A new cap of 5000 will put on assessors, allowing up to an extra 1200 trained assessors to contract with the DEWHAs; a weekly cap of 15,000 assessment bookings, and a daily and weekly cap per assessor of three and five respectively to ensure greater quality and a more even distribution of work for assessors right around the nation. A completely new Green Start Program will commence from 1 January 2011. The Program will remain directed at helping low income households and those most at need improve their energy and water efficiency and help tackle climate change.[7]

1.3.3 Other Energy and Water Conserving Initiatives

(i) The National Rainwater & Greywater Initiative

During the period 2000-01 to 2004-05, drought and water restrictions in many parts of Australia have focused attention on the need to conserve water. Introduced in 2008, the $250 million National Rainwater and Greywater Initiative, part of a $12.9 billion *Water for the Future* plan, is to help people use water wisely.[8] It offers households up to $500 towards a new rainwater tank or greywater treatment system purchased after 30 January 2009.

In addition to the above initiative, an increasing number of households have installed water conserving devices, including dual-flush toilets and reduced-flow shower heads. In 2007, 81% of households had at least one dual-flush toilet, up from 64% in 2001 (ABS, 2010b). Reduced-flow shower heads were used by 55% of all households (up from 35% in 2001). Further, nearly half of all households (46%) reported using one or more water conservation practices in 2004. The most popular measures adopted included using full loads when washing dishes and clothes, and taking shorter showers (18% of all households reported doing each of these), (ABS, 2008).

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[7] The Hon Peter Garrett MP, Minister for the Environment, Heritage and the Arts, "Significant changes to Commonwealth environmental programs", media release 19 February 2010, http://www.environment.gov.au/minister/garrett/2010/mr20100219.html [Accessed 20 May 2010].

8 Australia Government "National Rainwater and Greywater Initiative" http://www.environment.gov.au/water/publications/action/pubs/nrgi.pdf [accessed 21 May 2010].

(ii) Solar Hot Water Rebate Program

Solar energy was used by 7% of Australian households for heating water in 2008, nearly double the use in 2005 when 4% had solar hot water. A factor in this increase may be the introduction of State and Federal Government schemes offering rebates on the installation of solar hot water systems. The increase in use of solar water systems varies by state. For example the increase in Victoria was small (1% in 2005 to 3% in 2008), more than half the households in the Northern Territory (54% in 2008) use solar energy to heat water, up from 42% in 2005 (ABS, 2010a).

Various State and Federal Solar Hot Water Rebate Programs have been in operation since around 2006. The Federal solar hot water rebate program changed as at February 2010. Rebates of up to $1000 are now available to install solar hot water systems and up to $600 for heat pumps installed to replace electric storage hot water systems in existing privately owned homes. State Hot Water Rebate Programs offer between $300 to $1500 off the cost of a new solar hot water heater depending on the size of the system and the State.[9]

(iii) Solar Homes & Communities Plan

This program started in 2000 as the Photovoltaic Rebate Program offering $4,000 rebates to help Australian homes and communities reduce their energy use, help the environment and save on energy bills in 2000. Since November 2007, the program has provided rebates of up to $8,000 for the installation of solar photovoltaic systems. In May 2008, a means test was placed on the solar panel rebate to ensure support was provided to the homes that most needed it. This program has been hugely successful with the installation of more than 50,000 systems as at the end of September 2009 - a number which is increasing each week, and with 70,000 more installations expected to be completed under the program.

Unfortunately, despite the success of the Solar Homes and Communities Plan many of the above initiatives have not had the desired outcome in some instances, as noted above. Further, if notions of sustainability and energy efficiency are not priorities for homeowners, particularly when water and energy are still relatively cheap, uptake of these may not be as high as expected.[10] Further, as reported by Howden-Chapman et al. (2009), increased energy efficiency can be frustrated by the complexity of human behaviour including "take-back" whereby people take advantage of the better thermal properties of more energy efficient homes, by using heaters more.

(iv) Window protection

As windows can be the source of up to 40–60% of heat loss from a house, appropriate window treatments can improve household energy efficiency and reduce heating and cooling costs (SEDO 2008). In March 2008, more than one-third (35%) of all households did not have any type of window treatments to reduce heat loss or gain. This proportion was even higher for rented homes, where over half (54%) had no window treatments to reduce heat loss or gain (ABS, 2010a). Currently, there are no rebates available for the cost of adding window protection, but these statistics suggest that some kind of government initiative may be warranted to encourage the addition of some form of window protection: window coverings; outside awnings; tinted glass; or double glazing.

1.4 Attitudes Towards Sustainability in Homes

Connections Research (2007) surveyed 1700 households by email of water and energy conservation patterns and attitudes of Australian consumers towards sustainability and climate change. Public consciousness of global warming is now very high with 90% of respondents agreeing that "climate change is a major problem for the planet". Over 80% of homes have dual flush toilets, confirming the success of this water-saving innovation. More than half of the households surveyed have electric water heaters, which are increasingly being criticised for contributing to greenhouse gas emissions. They are also the largest

9 Energy matters (2010) *Australian solar hot water rebates, http://www.energymatters.com.au/renewable-energy/solar-power/solar-hot-water/solar-hot-water-rebates.php [accessed 6 June 2010]*.

10 A sustainable building, or green building is an outcome of a design which focuses on increasing the efficiency of resource use — energy, water, and materials — while reducing building impacts on human health and the environment during the building's lifecycle, through better siting, design, construction, operation, maintenance, and removal. Frej, Anne B., editor. *Green Office Buildings: A Practical Guide to Development*. Washington, D.C. The Urban Land Institute, 2005. pp 4–8.

single use of energy in the home. Solar water heaters and instantaneous gas water heaters are becoming common retrofits and replacements for electric water heaters. About half of households are willing to use loan or rebate schemes to make their homes more sustainable. Among homeowners, up to 20% are unwilling to undertake any sustainability improvements because of trouble or expense. Around 35% are willing to be persuaded if the savings, cost and ease of installation are attractive enough.

A survey by Connections Research (2008) of 7000 Australian households to determine their usage of digital technology, found that nearly 1300 were considering buying or building a new home in the next 12 months and this subset were asked questions about what sort of things they are looking for in a new home. They were asked their preferences from a list of over 40 attributes relating to technology, sustainability, building characteristics and security and how much extra they might be prepared to pay for these. The most desirable features have to do with energy efficiency and insulation from climatic extremes and noise. Respondents rated as “very important”: insulation (75.1%); energy-efficient lighting (55.2%), and rainwater tanks (53.6%). The only technology attribute in the same leagues was “ability to get broadband internet” with 63.9% of respondents rating this as “very important”. In terms of willingness to pay, a large number of respondents are willing to spend between $5000 to $10,000 or more, to add certain features to their new homes, mostly favouring solar water heating, rainwater tanks, better insulation, higher quality building materials and solar electricity.

A public attitudes survey by Gardiner and Ashworth (2007) assessed knowledge, beliefs and attitudes, as well as acceptance of distributed generation and demand management technology. Responses were received from 2022 people across Queensland, NSW, Victoria and South Australia. Overall 41% of the sample reported a strong intention to reduce household energy consumption, with a significant relationship between this response and the following demographic characteristics: people with lower electricity bills; people aged 30-39; and females. People from households with higher incomes ($150,000+ p.a.) were less likely to reduce consumption. In terms of preferred energy sources for distributed generation, solar was most preferred (88% of respondents), followed by wind (68%), bio-fuel (47%), and natural gas (44%).

According to the ABS (2006) in a range of household surveys conducted by the DEH & AGO (2000) every 2–3 years between 1992 and 2004, the environment has emerged as an issue of concern for large numbers of Australians. However, evidence suggests that adoption of environmentally friendly behaviours is greatest where it is convenient and where it does not require large investments of time or money. In 2005, 43% of households said they considered cost to be the main factor when buying a new white good, 44% nominated the energy star rating as a main consideration, and only 11% of households stated an environmental factor as their main consideration. Many households with insulation said their main reason for installing it was to achieve comfort (83%), rather than to save on energy bills (10%) or use less energy (4%). Also, it is possible that people may become complacent, feeling that they are "doing their bit" if they recycle, use unleaded petrol and buy the occasional energy efficient appliance. This complacency may be a barrier to further modifications of behaviour.

A report by United Nations Environment Programme (UNEP) (2007) confirms the ABS 2006 report stating that people do often not behave consistently with their level of concern about environmental problems. In fact, environmental considerations are probably only to a smaller extent determining human behaviour. As the report suggests, many other factors play a role, such as cost of in terms of time, money or effort, and people's ability to behave in certain way. People also have to be aware of the environmental effects of individual actors in order to behave in an environmentally-friendly way. It appears from various studies that individuals have misconceptions about power consumption of appliances, assuming, often incorrectly, that large appliances take more power than smaller ones, rather than also considering the energy rating of the appliance.

Other factors such as gender, socio-demographic differences and different building users can influence energy use in buildings. For example, in a study conducted in (Karjalainen 2006, as reported in UNEP 2007) it appeared that women are less satisfied with room temperatures than men, prefer higher room temperatures than men, and feel both uncomfortably cold and uncomfortably hot more often than men. Although women are more critical of their thermal environments, men use thermostats in households more often than women. Differences between socio-demographic groups are not always straightforward as

illustrated by results from a Dutch study by Steg (1999). Highly-educated people often use more heating energy, for instance, even though their home is likely to be better insulated. Young people have more wall and floor insulation in their homes, while middle-aged and elderly people take more small energy saving measures.

Stehlik et al. (2009) studied the perceptions and attitudes of householders to the issue of sustainable energy. Their study formed part of the Household Energy Audit Project (Energy Project), a City of South Perth community service and awareness campaign which involves energy audits of households. They used two survey instruments: a baseline survey to establish demographics, current energy use practices and community perceptions of participants, and a follow up instrument to measure behavioural change at the end of the project. They surveyed 149 residents in City of South Perth, Western Australia.

Respondent information on dwelling characteristics found that 80% of respondents indicated they had roof insulation in their homes, compared with 68.6% of people in the whole of Perth. The majority of respondents lived in homes made of double brick (89%), and 95% had some type of external shading, with 72% indicating they had eaves. This is an encouraging result as insulation, thermal mass, external shading and eaves are all known to improve not only thermal comfort but more importantly the energy efficiency credentials of homes.

In terms of energy use, all homes used mains electricity: 63% used mains electricity and mains gas. Overall 11% of 149 respondents indicated they had solar energy. The majority of respondent (90%) had an air conditioner or evaporative cooler. Over half of respondents had one air conditioner only, and the most popular form of cooler was the reverse cycle (60%). [11]

The most common form of heating used by respondents was gas, followed by a reverse cycle air conditioner. Nearly three quarters of respondents had gas hot water heating (71%). Of these, 44% had a storage tank, and 53% had instantaneous gas hot water heating. As solar water heater is the single best thing that can be done in the home to reduce energy costs this high adoption was encouraging. Hot water typically accounts for 30-35 per cent of the household energy bill and a solar hot water system will reduce that by up to 80 per cent.

Some more disappointing findings were that only 66% of respondents indicated that they had energy efficient light globes installed in their home. As switching to energy efficient globes is one of the cheapest, simplest actions a resident could take it is surprising not more are taking advantage of this option.

When asked about how often they switched off whitegoods and appliances, 56% of respondents indicated they "always" switched off the washing machine when not in use. The least common appliance for switching off when not in use was the microwave, with 64% indicating "never". This is concern given that appliances draw electrical power (3% of a home's energy use) if turned off or on stand by. Some of the largest drawers of energy are audio-visual equipment, VCRs, printers, and computer notebooks but this varies by country.[12]

While this study provides a baseline report on energy use and behavior it shows a mixed level of response to climate change issues by householders. The study reported here is to gather information at a national level of how well residents are adopting energy efficiency measures in their homes and how motivated they are to change behavior that will have a positive impact on energy use and ultimately carbon emissions form homes.

1.5 Efficiency measures to green the existing housing stock

There is limited information available to consumers about the costs and benefits of retrofitting to make homes more sustainable. Generally consumers want to know both the cost of installing a feature, the cost savings from having it and the associated payback period. For example, the cost to install a 1kWh photovoltaic system is about $12,000 but with the available rebate of $8,000 it would take 15 years to payback this feature and the consumer would save, on average, $250p.a. in energy costs and 1.83 tonnes of GHG emissions. Table II below provides indicative costs for retrofitting with the listed items, as provided by Environment Victoria et al. (2009) but the other helpful information identified above was not included. Lack of information has been identified by Environment Victoria et al. (2009) as a barrier to the uptake in sustainability practices in homes.

11 According to the ABS, in 2006 74% of homes in Perth used air conditioners, a figure which had almost doubled since 1992.
12 See http://standby.lbl.gov/summary-table.html [accessed 25 May 2010] and Mohanty (2001).

Table II - Efficiency measures and costs	
Retrofit activity	**Cost**
Audit	$200
Upgrade household with CFLs	$70
Weather sealing retrofit	$420
Ceiling insulation (do it yourself)	$1,153
Hot water – electric to solar	$3,500
Hot water – electric to heat pump	$4,000
High efficiency showerhead	$95
Dual flush toilet	$750
Tap flow controllers	$40
Fridge upgrade	$950
Average Cost per Dwelling	$2800

Source: Environment Victoria et al. (2009)

More information seems to be available on cost savings for energy saving activities when compared to retrofit activities. Table III, in Appendix I, provides an example of this information.

2. Research

The broad aims of our research are to (i) determine lifestyle choices of: size of home; location; density, and household size that impact on energy use (ii) examine the types and usage of electrical appliances selected by residential property owners/occupants together with the motives behind these choices; (iii) identify and explain user behaviour in residential buildings in relation to the energy consumed, and (iv) evaluate the incentives, barriers, costs, and benefits of sustainable development.

2.1 Methodology

A postal survey was adopted as the quickest and most cost effective way of surveying a large sample of householders across Australia. A covering letter describing the survey, the questionnaire, and a self-addressed prepaid envelope were mailed in September 2009 to 1250 randomly selected residents, 250 in each of the five largest Australian cities by population. As the questionnaires could be returned anonymously, no formal reminder strategy was able to be used to target individual non-responders. Instead an email was sent out as a reminder to respond if they had not yet done so. The responses were individually coded, entered into a computerised database, and analysed.

2.1.1 Database

Respondents were selected at random using the White Pages telephone directory for the five major capital cities by population: Perth, Adelaide, Sydney, Melbourne, and Brisbane (ABS, 2006 Census). Using the random number generator function in Microsoft Office Excel numbers were generated to help select the page number, column (on selected page), and row (in selected column, on selected page). The results created 250 selection markers for potential respondents per city. The markers were then used to select the listed surname and initial that corresponds to the randomly generated page, column, and row number in Excel. The surname and initial were then used to search the online version of the White Pages to check that the selected name was still listed. This method was selected to reduce potential typing errors and because the online version of the White Pages lists the full name and postcode of a suburb, whereas the paper based version of the White Pages did not.

2.1.2 Response Rate

A number of surveys were returned unopened with a stamped message that they were “undeliverable”. It was discovered that neither the hard copy White Pages nor the on-line version showed whether a property was a flat, unit or anything other than a detached home. Over one hundred surveys were returned, primarily from Sydney. When these were received, a new address would be located and the survey would be resent. Table IV below shows the number of returns and resends.

Table IV: Returns & Resends		
City	**Returns**	**Resends**
Sydney	37	18
Adelaide	10	9
Perth	22	9
Melbourne	25	25
Brisbane	22	22

Of the 1250 questionnaires mailed to residents 6.8% (85) were completed and returned. Due to this low response rate the survey is being repeated, but the latest results were not ready for inclusion in this paper.

2.2 Survey Instrument

The questionnaire commenced by asking respondents about the home they live in: size, number and types of rooms, and construction details, and the household composition. Next they were given a range of actions that have been identified as having a significant effect on household climate change emissions and asked to indicate the likelihood of them adopting the listed behaviours or actions in the next 12 months, together with reasons for not undertaking them, if they have not already done so. Respondents were asked to identify from a range of options what they consider to be the most important benefits of incorporating energy efficient features within a home.

To determine respondents' energy and water household consumption, we requested that they review their last three (3) electricity, gas and water bills and fill in a table to indicate units used, total cost and average daily consumption. This information was also used to help verify answers to earlier questions with regards to type and size of home they lived in and their reported behavior. Finally, demographic questions were included at the end of the survey.

3. SUMMARY OF CASE STUDY FINDINGS

When asked how motivated respondents are to reduce their personal climate change emissions, the majority (81%) said they were moderately (49%) to highly (32%) motivated. The majority of respondents (93%) were homeowners.

3.1 Size of home and household composition

Over two-thirds of the respondent's homes had either three of four bedrooms (35% in each group), while over a half of all homes had two bathrooms (52%) and two living rooms (52%). This number of rooms appears to be in line with ABS data that shows that the average home has grown to 258m2. In terms of household size, 43.5% of respondents have two persons, 20% comprise 3 persons and 16.5% have just one person. These figures are in line with the national average of 2.6 persons per household. According to the report by the Department of Environment & Heritage (DEH) and the Australian Greenhouse Office (AGO) (2006) this trend to smaller household sizes and larger homes presents a barrier to reducing impacts on the environment.

3.2 House construction

The majority (88%) of the homes were constructed of either double brick (53%) or brick veneer (35%), over half (56.5%) were on a concrete slab foundation and 46% were on brick or stone footings. Over two-thirds (73%) have air-conditioning in their homes with the most common type being either a wall mounted split system or a ducted evaporative system. Only 12% of the homes have a swimming pool.

3.3 Likelihood of adopting no to low cost energy efficient behaviours

From a range of *no/low cost* actions that have been identified as having a significant effect on household greenhouse gas emissions respondents were asked to indicate the likelihood of them adopting the listed behaviours or actions in the next 12 months. Table V below summarizes the results. Note that it does not show the "neither likely or unlikely" or "not applicable" options for space reasons.

Table V – Likelihood of adopting no/low cost behaviours that reduce greenhouse gas emissions			
Actions	**Already doing**	**Likely/Highly likely**	**Unlikely to adopt**
Turn off all my appliances at the wall when not in use	40%	**30%**	**23%**
Insulate my hot water pipes coming out of my water heater	40%	21%	**19%**
Reduce my showering time to less than 4 minutes	62%	20%	8%
Turn off the extra fridge until needed	38%	11%	17%
Install a water efficient shower head if I have a storage hot water system (to save hot water)	57%	10.7%	12%
Install water efficient tap fittings	53%	15%	12.5%
Avoid halogen down-lights or replace with LED/compact fluorescent/lower wattage globes	44%	**29%**	7.4%
Wash clothes in washing machine using cold water	76%	7%	12%
Turn lights off when not in the room and use natural light where possible	**89.4%**	8%	1%
Seal around external doors and windows with sealing strips to reduce draughts	43%	27.4%	**15.5%**
Use a warmer blanket while sleeping rather than warming the whole room/house	**88%**	8.3%	1%
Dress appropriately rather than cooling/warming the whole room/house	**86%**	12%	1%
Replace 10 of the most used light bulbs with LED or compact fluorescent globes	58%	**31.4%**	5%
Use the washing machine or dishwasher only when full	**82.4%**	12%	3.5%
Dry clothes on a clothesline rather than in an electric clothes dryer	**85%**	10.6%	1%
Turn down hot water heater setting to 50-60^{o}C	58%	14%	12%
Set the air conditioner thermostat to 18-20^{o}C in winter and 24-26^{o}C in summer (if needed)	46%	11%	3.6%
Install timers on appliances to turn them off when not in use	10.6%	16.5%	**38%**

Many of the respondents were already taking many of the listed *no/low cost* actions: more than 50% of respondents were taking action on eleven out of the eighteen listed. The most common actions taken were: turning lights off when not in the room and using natural light where possible; using a warmer blanket while sleeping rather than warming the whole room/house, and dressing appropriately rather than cooling/warming the whole room/house, and drying clothes on a clothesline rather than in an electric clothes dryer.

The *no/low cost* actions respondents were most likely to take included: replacing ten of the most used light bulbs with LED or compact fluorescent globes; turning off all appliances at the wall when not in use, and avoiding halogen down-lights or replace with LED/compact fluorescent/lower wattage globes. The actions they were most unlikely to take were: installing timers on appliances to turn them off when not in use; turning off all appliances at the wall when not in use, and insulating hot water pipes coming out of the water heater. Given that all the listed actions are low or no cost it was surprising that more people would not take these actions.

3.4 Reasons for not taking no to low cost actions

To determine the reasons why they may not take action, a table was included listing various potential reasons for this, including an "other" option. Table VI below outlines the most common reasons for not acting for each of the actions.

Table VI – Reasons for not taking action

Actions	Reasons
Turn off all my appliances at the wall when not in use	Inconvenient/no time/too busy
Insulate my hot water pipes coming out of my water heater	Lack of information/do not know how
Reduce my showering time to less than 4 minutes	Other; Forget/too lazy/not in the habit
Turn off the extra fridge until needed	Other; Inconvenient/no time/too busy
Install a water efficient shower head if I have a storage hot water system (to save hot water)	Other; Inconvenient/no time/too busy
Install water efficient tap fittings	Depends on savings
Avoid halogen down-lights or replace with LED/compact fluorescent/lower wattage globes	Other; Cost too much
Wash clothes in washing machine using cold water	Other; Inconvenient/no time/too busy
Turn lights off when not in the room and use natural light where possible	Forget/too lazy/not in the habit
Seal around external doors and windows with sealing strips to reduce draughts	Inconvenient/no time/too busy
Use a warmer blanket while sleeping rather than warming the whole room/house	Other; Forget/too lazy/not in the habit
Dress appropriately rather than cooling/warming the whole room/house	Forget/too lazy/not in the habit
Replace 10 of the most used light bulbs with LED or compact fluorescent globes	Cost too much
Use the washing machine or dishwasher only when full	Inconvenient/no time/too busy
Dry clothes on a clothesline rather than in an electric clothes dryer	Inconvenient/no time/too busy
Turn down hot water heater setting to 50-60^{o}C	Other; Inconvenient/no time/too busy
Set the air conditioner thermostat to 18-20^{o}C in winter and 24-26^{o}C in summer (if needed)	Other: Inconvenient/no time/too busy
Install timers on appliances to turn them off when not in use	Cost too much

Given that so many of these actions will help to reduce energy and water use in homes it is disappointing that one of the most common reasons given for respondents not to act was due to inconvenience, or that they forgot, or were too lazy. This information can provide useful clues of what is needed to help people act, such as automating some actions where possible or making actions mandatory, such as requiring homes to have water efficient shower heads.

3.5 Likelihood of adopting low to medium cost energy efficient behaviours

Next respondents were asked to indicate the likelihood of them adopting behaviours or actions in the next 12 months from a range of *low to medium cost* actions that have been identified as reducing greenhouse gas emissions produced by households. Table VII below summarizes the results. Note that it does not show the "neither likely or unlikely" or "not applicable" options for space reasons.

Table VII – Likelihood of adopting low/medium cost behaviours

Actions	Already doing	Likely/Highly likely	Unlikely to adopt
Have an energy audit/ assessment completed on my home	13%	11%	48%

Install ceiling fans to reduce use of or need for air conditioning	51%	8%	31%
Install a 1kW or larger Photovoltaic (PV) system on the roof	12%	11%	**57%**
Replace the old fridge (10 years or more) with a 5-6 Star Energy Rated fridge	42%	**21%**	18%
Replace the old washing machine (10 years or more) with a more energy and water efficient washing machine	45%	**19%**	19%
Replace the old dishwasher (10 years or more) with a more energy and water efficient dishwasher	24%	11%	8%
Install a 5 Star instant gas; heat pump; or solar hot water heater	38%	13%	32%
Install or top up insulation in ceilings	**63%**	**18%**	11%
Replace single flush toilet with water-saving dual system	**82%**	11%	5%
Externally shade any exposed western or eastern windows	**62%**	13%	11%
Install double glazing to windows	2%	5%	**69%**
Install a roof ventilator to help remove hot air from the roof cavity	27%	13%	36%
Switch household power supply to "Green Power" (100% renewable energy)	11%	**18%**	**53%**
Install evaporative air conditioning instead of a split refrigerate system	21%	2%	49%
Install a "Smart Meter" or similar device to find out where and how much energy is being used in the house and act on the results (reduce high energy usage areas)	10%	13%	**53%**
Install a rainwater tank or rainwater harvesting system	51%	17%	21%
Install a greywater system	17%	11%	51%

Not surprisingly fewer of the respondents were already taking action on the *low/medium cost* listed items compared to the *no/low cost* actions: more than 50% of respondents were taking action on only five out of the seventeen listed. The most common actions already taken were: replacing single flush toilet with dual system; installing or topping-up ceiling insulation, and externally shading any exposed western or eastern windows. Given that 42% of heat escapes through the roof and tat heating and cooling consume the most amount of energy in a home (38% as shown in Figure I) installing or topping up insulation is one of the more cost-effective ways of reducing energy consumption in homes and saving money. It is surprising with rebates available for installing insulation that the take up of these has not been higher, given the advantages of doing so. Similarly, water heating uses 25% of energy in homes but consumes the most greenhouse gas emissions and installing instantaneous gas or solar hot water heater is another cost-effective way of reducing both energy consumption and greenhouse gas emissions while saving money.

The *low/medium cost* actions respondents were most likely to take included: replacing both the old fridge and old washing machine with a more energy (and water) efficient one; installing or topping-up ceiling insulation, and switching the household power supply to "Green Power". The actions they were most unlikely to take were: installing double glazing; installing a photovoltaic system; switching to "Green Power", and installing a smart meter.

3.6 Reasons for not taking low to medium cost actions

Table V, in Appendix II, outlines the most common reasons for not acting on the various listed options, and this was predominantly due to the cost of the item/s. Given that there are rebates available in many States for some of these items such as photovoltaic panels, insulation, solar hot water systems, and rain water tanks, it would seem from these results that either the respondents were not aware of the rebates or are not informed about the benefits of many of these actions particularly in terms of overall savings in energy costs, where payback periods can be quite short for some items.

The response to installing smart meters indicates that more information is needed about these features. Smart Meters, also known as Advanced Metering Infrastructure, detail a consumer's energy use on a real-time basis. The progressive rollout of smart meters across Australia began in 2007 to help government regulators better match electricity consumption with generation by providing an economical way of measuring when the energy is consumed, allowing price setting agencies to introduce demand based tariffs. Electricity pricing usually peaks at certain predictable times of the day and the season. When consumers can see where, how and when they use energy they are better informed of how to adjust their consumption habits to be more responsive to market prices in order to save money on power bills.

There are products on the market that act like smart meters and can be purchased by consumers for their own use prior to the rollout of government mandated smart meters. These commonly receive information wirelessly at regular intervals from a transmitter placed in the meter box, keeping consumers informed about how much power they are using and how much it is costing, in real-time. In addition these can be connected to numerous transmitters or Individual Appliance Monitors (IAMs) at once, enabling different circuits or appliances to be monitored for energy consumption so it can be seen at a glance which appliance is using the most energy and at what times.[13]

3.7 Benefits for acting environmentally

It is recognised that many of the energy and water saving features in homes cost money so respondents were asked to rank from a list of financial and non-financial benefits what they considered to be the most important and that might motivate them to act. Cost savings greater than $1000 per annum were considered the most important, followed by: doing the right thing; achieving healthy indoor air quality; increased property value; decreased obsolescence , and "other" ranked last. Certainly it is the cost savings benefits that are reported most widely in the media in relation to acting in a more energy conserving way. "Doing the right thing" is a social construct and is based on a sense of moral obligation. How people perceive the risks from, and threats of, climate change are partly the result of cultural and social processes when these events are communicated to others (social amplification) and the results of such communication. With so much media-attention to the need to combat climate change this has no doubt raised awareness amongst the public for the need to act to help solve the world's environmental woes.

3.8 Energy and water use

To determine if respondents were acting in a way that they had reported in earlier questions that they were, they were asked to provide their daily electricity, gas and water consumption over three billing periods and to report of the cost of this. Tables VIII-X below shows these results.

Table VIII – Electricity daily volume consumed

Volume (kWh)	Period 1	Period 2	Period 3
0 – 5	12%	13%	7%
5 – 10	**18%**	**26%**	**26%**
10 – 15	**20%**	15%	**21%**
15 – 20	16%	**24%**	16%
20 – 25	12%	9%	9%
25 – 30	8%	2%	0
More than 30	12%	11%	21%

According to ABS total household electricity consumption is approximately 150-200 PJ per year and average energy consumption per person per year of approximately 20-21 GJ.

13 See for example the Current Cost ENVI http://www.smartnow.com.au/.

The survey responses indicate that energy consumed varied between periods, presumably taking account of seasonal changes. In all three periods, the majority of respondents consumed between 5-20 kWh per day, but nearly a fifth consumed 20kWh or more over period one, which is considered to be quite high, given that the ideal consumption is reported to be around 8 kWh per day.

Table IX – Gas daily volume consumed			
Volume	**Period 1**	**Period 2**	**Period 3**
0 – 15	60%	64%	53%
15 – 30	8%	3%	12%
30 – 45	0	6%	6%
45 – 60	5%	0	3%
60 – 75	5%	0	6%
75 – 90	3%	0	3%
More than 90	19%	28%	18%

Australian household gas consumption is approximately 125-150 PJ per year (ABS). Table IX shows that respondents mostly consume between 0-15 kJ per day which is below the national average but may be due to not all households having reticulated gas or using this form of energy.

Table X – Water daily volume consumed			
Volume (litres)	**Period 1**	**Period 2**	**Period 3**
0 – 50	0%	0.0	0.0
50 – 100	4%	4.3	2.5
100 – 150	0%	4.3	2.5
150 – 200	7%	6.5	0.0
200 – 250	8.9	2.2	5.0
250 – 300	8.9	21.7	25.0
More than 300	71.1	60.9	65.0

According to ABS total household average household water consumption is approximately 150-250 KL per year, or 426 litres-710 litres per day. The figures below in Table X indicate that two-thirds of respondents consume more than 300 litres per day in line with the national average statistics. But it is pleasing to see that one-fifth to one-quarter of respondents in periods two and three consume between 250-300 litres, well below that National daily average.

Lastly, demographic questions revealed that 62% of respondents were male and 61% were over 60 years of age. Comparing these figures to the Australian Census data (ABS, 2009) that shows the proportion of the population over 65 years of age was only 13.5% so the survey responses are not likely to be representative of the population as a whole. In terms of household income 28% earned under $30,000 per annum, 26.5% earned between $30,000 and $60,000 and 24% earned between $100,000 and $200,000. Respondents from the five states surveyed were dispersed as follows: 28% were from South Australia, 24% from Western Australia, 20% from New South Wales, 15.5% from Victoria, and 13% from Queensland.

Sub-group analysis revealed no statistically significant or important differences in the pattern motivation towards reducing personal climate change emissions across gender, age or income level.

4. Limitations

As with many postal surveys, respondents who are retired or working part-time have more time to answer surveys and are often over-represented. Thus, the respondent group is unlikely to be representative of the overall population. Further, the response rate was very low due to the discovery that neither the hard copy White Pages nor the on-line version showed whether a property was a flat or unit and surveys sent to homes that were anything other than a detached home were returned unopened with a stamped message that they were "undeliverable". To increase the response rate and representativeness of the responses of the population as a whole the survey is to be repeated. These results will be the focus of a separate paper.

5. Summary and conclusion

This paper outlines the results of a nation-wide Australian study of householders in 2009 to identify their attitudes towards climate change and the drivers and barriers towards energy efficiency in the home. Barriers to energy efficiency in homes are larger homes and smaller households, initial costs and long payback periods of sustainable features (Roberts and Sims, 2007), and lack of consumer information at point of purchase or lease; split incentives between builders and the householder, and upfront capital costs of energy efficiency measures; (Environment Victoria et al. 2009). The same barriers were indicated by respondents to this survey, particularly those relating to cost and lack of consumer information about benefits and savings from incorporating energy efficient and water saving devices and features.

This survey indicates the most common reasons people are not acting in more sustainable ways is due to inconvenience, or laziness. This tends to mirror the results of earlier surveys by Connection Research, 2008 and others. This information can provide useful clues of what is needed to help people act, such as automating some actions where possible or making actions mandatory, such as requiring homes to have water efficient shower heads.

Given that water heating and heating and cooling of homes use the most energy and produce the most greenhouse gas emissions these areas should be focused on. The greater uptake of rebates for ceiling insulation and gas water heating would aid in the fight to reduce greenhouse gas emissions.

According to Steiner, UN Under-Secretary General and United Nations Environment Programme (UNEP) Executive Director (2007), "by some conservative estimates, the building sector world-wide could deliver emission reductions of 1.8 billion tones of CO2". Further, Steiner notes that several countries, including Australia, are looking to phase out or ban the traditional incandescent light bulb and the International Energy Agency estimates that a total global switch to compact fluorescent bulbs would, by 2010 (from 2007) deliver CO2 savings of 470 million tones or slightly over half of the Kyoto reductions!

As outlined in a report by the UNEP Sustainable Construction and Building Initiative (2007) the right mix of appropriate government regulation, greater use of energy saving technologies and behavioural change can substantially reduce CO2 emissions from the building sector.

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Appendix I- Savings Information to Aid Consumers

Table III - Efficiency activities and cost savings		
Energy saving activity	**Cost Saving p.a.**	**CO2 saved (kg)**
Switch off the bar fridge	$40 -170	280
Upgrade from a 1 star to 5 star fridge model	$50	350
Wash clothes in cold water instead of hot	Electric water heater: $85 Gas water heater: $48	520 142
Replace old water heater with gas-boosted solar water heater	Electric water heater: $566 Gas water heater: $398	4020 1110
Take a 4 minute shower instead of an 8 minute shower	Electric water heater: $98 Gas water heater: $55	602 165
Switching off all appliances at the wall rather than leaving them on standby	$112	

Source: Department of Environment and Conservation & Dept. of Planning & Infrastructure "Living Smart" information pamphlets; Alinta (2009), *Advantages: Energising the WA Community newsletter, Winter.*

Appendix II- Reasons for not taking action

Table V – Reasons for not taking action	
Actions	**Reasons**
Have an energy audit/ assessment completed on my home	Inconvenient/no time/too busy
Install ceiling fans to reduce use of or need for air conditioning	Other; Cost too much
Install a photovoltaic system on the roof	Cost too much
Replace the old fridge with a 5-6 Star Energy Rated one	Cost too much
Replace old washing machine with a more energy and water efficient washing machine	Cost too much
Replace old dishwasher with a more energy and water efficient one	Other; Cost too much
Install a 5 Star instant gas; heat pump; or solar hot water heater	Cost too much
Install or top up insulation in ceilings	Cost too much
Replace single flush toilet with water-saving dual system	Other; Cost too much; Depends on Saving
Externally shade any exposed western or eastern windows	Other; Cost too much; Depends on Saving
Install double glazing to windows	Cost too much
Install a roof ventilator to help remove hot air from the roof cavity	Other; Cost too much
Switch household power supply to “Green Power”	Cost too much
Install evaporative air conditioning instead of a split refrigerate system	Other; Cost too much
Install a “Smart Meter” or similar device	Lack of information
Install a rainwater tank or rainwater harvesting system	Cost too much
Install a grey water system	Cost too much