

**Environmental  
sustainability in  
residential housing:  
understanding attitudes  
and behaviour towards  
waste, water, and energy  
consumption and  
conservation among  
Australian households**

authored by

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# EXECUTIVE SUMMARY

## Purpose

The current paper addresses a number of key questions relating to the sustainability of Australian households. It explores:

1. What are household waste/water/energy attitudes and practices?
2. How waste/water/energy attitudes and practices have changed over time.
3. What factors have driven changes in household waste/water/energy attitudes and practices?
4. The relationship between householders' waste/water/energy attitudes and practices (i.e., behaviour) and whether the relationship varies according to SES, household type, tenure or behavioural domain.
5. The most effective ways of shaping positive change in household waste/water/energy perceptions and behaviour and what are the costs and benefits of these approaches for stakeholders?

As the first phase of the research project, the positioning paper assesses the existing Commonwealth, state, and local policies in relation to household energy and water use and waste management (waste/water/energy) with a particular emphasis on Queensland and Victoria (as they are the sites for empirical data collection). The paper also provides a comprehensive desktop review of the scholarly literature relating to social, psychological and demographic determinants of these household practices. In addition, the review assesses behavioural interventions designed to impact positively on these household practices.

It is expected that the research will provide the following policy-relevant information:

- The key psycho-social and socio-demographic influences on household waste/water/energy practices.
- Identification of the drivers of change in household waste/water/energy practices.
- Acceptability of policy/behavioural interventions relating to household waste/water/energy practices.
- An understanding of how waste/water/energy attitudes and practices may vary across socio-demographic groups.

The findings of the surveys and interviews and their implications for household sustainability policy development in Australia will be discussed in the final report of this project. The report will also discuss the ways in which the research findings extend existing theory and literature.

### *Household trends in practices related to energy, water and waste*

The review of the scholarly literature provides some insight into the profile of households that conserve energy and water and recycle their waste, although the review highlights that households do not respond consistently in each of these domains. Energy conservation is more likely in small dwellings with fewer inhabitants who are less focused on comfort. A variety of factors motivate energy conservation including self-interest, altruism, and social concerns. Socio-demographically, past research suggests that more affluent households use more energy, although there is also evidence that they have greater capacity to engage in green energy programs.

The profile of a water conserving household is less clear, although, it appears that less affluent households at later life stages, with less people conserve more water. It is also likely that high water using households have habits that contribute to their water use such as doing more washing loads and taking more showers.

Now that recycling has become widespread and normative in developing countries around the world, it is psycho-social rather than demographic variables that are the major determinants of households' recycling efforts. Householders that engage in higher levels of recycling have more positive attitudes to recycling, perceive greater normative support for the practice, and judge that they can easily engage in recycling. Moreover, recyclers have more knowledge about recycling and feel a greater sense of obligation to recycle, perhaps because they care about their community or would feel negative emotions if they did not recycle.

### *Behavioural intervention strategies*

The review of behavioural interventions also highlights that the efficacy of strategies depends on whether the focus is on waste, water, or energy. Effective strategies for promoting long-term energy conservation include raising levels of commitment, providing goals and frequent feedback, and information programs that provide tailored information and raise awareness of social norms. Technological interventions have been shown to be effective at facilitating household water conservation, however, they may work best if combined with behavioural interventions. Although there is currently only limited research on behavioural interventions targeted to decrease water use, the research that exists suggests that prompts at point of water use and programs that target overall household sustainability may be effective. In terms of promoting household recycling, commitment strategies and information that raises awareness, communicates normative expectations, and provides reminders can also be effective.

### *Limitations of previous research*

The review highlights a number of limitations of the current research in this area and suggests directions for future studies. The limitations include the lack of objective measures of energy and water consumption and levels of recycling. Many studies rely on self reports or policy acceptance as measures of behaviour which is problematic as the determinants of self-reported behaviour and policy acceptance may be different to actual behaviour and consumption. The review also highlights that there is a dearth of theoretically grounded research on the psychological determinants of energy and water conservation. A third limitation of the existing research is that although many studies have examined the impact of demographic variables on waste/water/energy practices, there does not appear to be any systematic investigation of the effects of household tenure and household composition on household sustainability practices. Finally, given the substantial literature on the determinants of household recycling, there needs to be a greater focus on other waste minimisation practices such as composting, reuse, and reduced consumption of waste-producing products.

### *The theory of planned behaviour*

The research approach adopted by the project will help to address many of the limitations of previous research identified by the review. Following on from the desktop review, qualitative in-depth household interviews and surveys will be conducted. An expanded theory of planned behaviour model provides the theoretical framework for identifying the beliefs, attitudes, norms, facilitators and barriers associated with household waste/water/energy practices. Interviews and surveys will also explore the drivers of change in household waste/water/energy practices and the acceptability of policy mechanisms aimed at achieving positive change in these areas. This methodology will yield data of household waste, water, and energy attitudes and

practices that is theoretically grounded, systematic and rigorous. The coverage of energy and water conservation, the inclusion of objective measures of these two practices, and the systematic examination of household tenure and composition will help expand our understanding of household energy and water conservation specifically, and household sustainability more generally.



# 1 INTRODUCTION

## 1.1 Background

A major challenge currently facing societies around the world is the promotion of sustainable policy and practices. Meeting that challenge requires changes at the institutional, household, and individual levels. Strategies are needed across these levels to facilitate more efficient use of resources and support environmentally sustainable practices (Stern, 2000). The recent Garnaut climate change review (2008) highlights the need for all Australians to adapt to future climate change. Furthermore, the impacts on households are highlighted in the review, with recognition that certain household sectors, such as those on low incomes, may be disproportionately impacted by climate change mitigation and adaptation measures. These conclusions highlight the need for research to identify how best to support the development of household sustainability, in general, and from the perspective of specific household sectors.

Effective policy in this area will benefit from an understanding of current sustainability practices in Australian households and of what households can achieve in terms of changed lifestyle. Key questions that need to be answered are: What is the profile of an environmentally sustainable household in Australia at present? What prevents some households from being more environmentally sustainable?

In the current research we aim to address these overarching questions in order to provide critical information to policy makers seeking to promote household sustainability. Current Australian policy approaches in this area include a range of financial, structural and informational solutions, and while these are likely to be beneficial, the literature suggests that behaviour change and the adoption of sustainable technologies requires more than these approaches (Bamberg & Moser, 2007; Steg & Vlek, in press). The goal of this research, therefore, is to gain a comprehensive understanding of the socio-demographic and psycho-social factors underpinning householders' sustainability decisions to provide evidence to underpin effective policy. Clearly, achieving household sustainability in Australia will require a broad approach incorporating pricing and regulatory mechanisms and public education. The current research can help to complement these other approaches.

## 1.2 Research questions

In light of these considerations, this project has four aims: 1) to understand householder waste, water and energy (henceforth 'waste/water/energy') attitudes and practices and key influences on these; 2) to understand changes in these attitudes and practices over time and the drivers of change; 3) to identify and assess strategies for effecting positive changes in household waste/water/energy; and 4) to understand the influence of socio-economic status, household tenure and household type on these issues. These broad aims will be addressed with research speaking to the following specific questions:

1. What are Australian householders' waste/water/energy attitudes and practices?
2. Are there differences in these across socio-economic groups and according to tenure (owners vs renters) and household type (e.g., single person vs couple with children)?
3. How have waste/water/energy attitudes and practices changed over time?
4. What factors have driven changes in household waste/water/energy attitudes and practices?

5. What is the relationship between householders' waste/water/energy attitudes and practices (i.e., behaviour) and does this relationship vary according to SES, household type, tenure or behavioural domain?
6. What are the most effective ways of shaping positive change in household waste/water/energy perceptions and behaviour and what are the costs and benefits of these approaches for stakeholders?

### **1.3 Structure of the positioning paper**

In Chapter 2 we provide an overview of local government, state and Commonwealth policies aimed at addressing household energy and water use, and domestic recycling. There is a particular focus on Queensland and Victorian policies in the review as these are the locations for data collection. In Chapter 3 we provide a comprehensive review of the scholarly literature on determinants of household energy and water conservation and recycling as well as reviewing the interventions that aim to positively impact on these practices. Because the focus of the project is to understand the determinants of environmental practices and how these change, the project draws on the social and environmental psychology literatures, as these issues are central to both disciplinary domains. Chapter 4 outlines the research approach, describing the theoretical model adopted in the research and the methodology for the studies. Finally, Chapter 5 summaries the approach of the research project, the policy-relevant information that it will provide and the ways in which the current research extends the existing literature.

## **2 POLICY CONTEXT**

### **2.1 Introduction**

There is growing international recognition of the need to reduce carbon emissions and implement sustainable development principles. In the Australian context, recent policy developments (e.g., proposed carbon trading, Kyoto) are clear signals that environmental sustainability is high on the national agenda. Achieving environmentally sustainable development will require changes in policy and actions across many levels, from individuals to international institutions (Australian Department of Environment and Water Resources, 2007). Australian households exhibit some of the highest levels of energy and water use and waste output in the developed world. Thus, the household in its discrete dwelling setting is one significant site for action. An important focus for policy makers is to develop strategies that achieve sustainability at this level.

To develop effective policy responses, policy makers must have a comprehensive understanding of Australian households' environmental attitudes and decision making and what strategies will bring about positive change. Recent research has shown that across 26 countries, individuals' attitudes towards climate change are related to lowered greenhouse gas emissions at the national level (Tjernstrom and Tietenberg, 2008). This finding highlights the importance of understanding the complex set of factors that drive householder's environmental attitudes and practices.

The present chapter provides an overview of Commonwealth, state and territory, and local government policy and program responses addressing energy and water conservation and waste management at the household level. The Commonwealth's recently introduced housing initiatives are outlined, along with the sustainability objectives that underpin them. In addition, the chapter reviews the roles of state and territory housing authorities, the not-for-profit sector, and the private rental sector in affecting household sustainability practices. Finally the policy implications are briefly discussed.

### **2.2 Current household environmental sustainability policy and program responses**

Current policy measures to encourage more environmentally sustainable household practices encompass a combination of approaches including incentives (e.g., rebates for solar hot water, water tanks), regulation (e.g., mandatory energy ratings on appliances), and persuasive campaigns (e.g., Queensland Water Commission's *Target 140 litres per person per day* campaign). These measures will have differential appeal, relevance and impacts on Australian households depending on their SES and tenure. Moreover, household composition may also impact on preferences for and efficacy of policy measures.

#### *2.2.1 Energy*

The focus on energy efficiency has been driven by the climate change imperative and the effect of greenhouse gas emissions on the climate. One of the most cost-effective means of reducing greenhouse gas emissions and energy is through energy efficiency. Efficiency measures provide an effective and immediate means of meeting energy needs sustainably, i.e., reducing demand while maintaining or enhancing function. Policies adopted at the Commonwealth level are reflected in state and territory strategies and plans. In turn, a range of initiatives at a household level have been implemented to improve energy efficiency through information and targeting

behaviour, the installation of energy efficient technology in the home, and cost incentives to replace less efficient appliances with energy efficient appliances.

### *Commonwealth*

The *National Framework for Energy Efficiency (NFEET)* has, since 2004, provided the national policy framework for energy efficiency in Australia in industrial, commercial and domestic energy sectors. The Ministerial Council on Energy aims to identify and address barriers and challenges to the uptake of energy efficient solutions and has recently implemented Stage 2 of the national framework that includes a further five energy efficiency measures. The Council has also established implementation committees to facilitate the implementation of the framework and its goals.

A number of Commonwealth programs have been established to support energy efficiency at the household level including rebates (Insulation rebate; Photovoltaic Rebate Program; Solar and Heat Pump Hot Water System Rebate); loans (Green Loans Program), trials (Solar Cities Program); joint initiatives (Energy Star); schemes (Nationwide House Energy Rating Scheme) and initiatives targeting remote or off-grid areas (Renewable Remote Power Generation Program). Management of domestic appliance energy performance is being monitored through the National Appliance and Equipment Energy Efficiency Program (NAEEEP) with the use of energy rating labels and minimum energy performance standards. This program is being progressively introduced to all states and territories.

A major initiative of the Commonwealth is the Solar Cities Program. Led by the Department of the Environment, Water, Heritage and the Arts and receiving funding of \$94 million, Solar Cities targets both homes and businesses and is designed to trial new sustainable models for electricity supply and use in seven selected areas across Australia. Data will be collected until 2013 and used to inform future energy efficient measures that will reduce energy consumption and support 'wise' energy use into the future.

### *State and territories*

States and territories have developed sustainable energy and energy efficiency policies strongly tied to the Commonwealth's *National Framework for Energy Efficiency (NFEET)*. States and territories are working through various national structures such as the Ministerial Council on Energy and the National Emissions Trading Taskforce to increase the use of energy efficiency and reduce greenhouse emissions.

Some states and territories are developing sustainability objectives within their state or territory plan (e.g., SA). Other states and territories have established a separate agency to deliver the government's sustainable energy policy such as the Sustainable Energy Development Office (SEDO) in Western Australia, the Office of Clean Energy in Queensland, and Sustainability Victoria.

A range of regulations govern the provision, delivery and management of gas and electricity in states and territories. These regulations relate to licensing, operation and regulation, contracting, marketing, and tariff setting in relation to gas and electricity.

A number of states and territories operate programs and schemes relating to housing energy use and efficiency including household audits (Climate Smart Living - Qld), kits (Home Energy Wise - Qld), checklists (Take the Energy Challenge Checklist - WA); rebate schemes (converting to gas, solar); and public awareness campaigns. States and territories also deliver state based and specific programs such as the newly introduced fridge replacement scheme in Western Australia where householders in financial difficulty can exchange their older appliances with a new one, and the 'Big

Light Switch' where the Queensland government in November 2008 gave away one million energy saving light bulbs. Victoria undertook a similar initiative 'Change the Globe' distributing 500,000 energy saving light bulbs during 2007/2008 [http://www.sustainability.vic.gov.au/resources/documents/SV\\_BusinessPlan\\_0809\\_page1\\_to\\_292.pdf](http://www.sustainability.vic.gov.au/resources/documents/SV_BusinessPlan_0809_page1_to_292.pdf) (p.10).

Government websites provide a variety of consumer information, including fact sheets, tools for householders as means of promoting best practice, and increasing consumer awareness in an effort to improve household energy efficiency.

e.g. <http://www.saveenergy.vic.gov.au/>; <http://climatesmart.qld.gov.au/>;  
<http://www.resourcesmart.vic.gov.au/>.

### *Queensland*

The Queensland Government's energy policy and regulatory frameworks for the state's energy sectors are developed and managed by the Department of Mines and Energy. The Queensland Government developed its *Climate Smart 2050* policy in 2007 following the Council of Australian Government's (COAG) development of an emissions trading scheme. This policy provides the framework to invest in and develop new technologies to increase household energy conservation. The initiatives contained in *Climate Smart 2050* build on the achievements of the *Queensland Energy Policy - A Cleaner Energy Strategy* released in 2000.

The Queensland Government has branded its strategy aimed at householders 'Climate Smart Living' <http://www.climatesmart.qld.gov.au/>. As part of this promotion, householders can purchase for a small fee, an energy audit conducted by a qualified tradesperson who can provide advice and install various energy saving devices such as a household energy monitor, a water efficient showerhead, and compact fluorescent light globes.

Aside from Commonwealth programs and rebates, Queensland provides a Gas Installation Rebate Scheme to householders offering a \$300 rebate on gas hot water systems and a \$200 rebate on other gas appliances.

### *Victoria*

Sustainability Victoria is the Victorian Government Statutory Authority established in 2005, with primary responsibility for implementing the Victorian Government's environmental policies and initiatives. Energy policy in Victoria is embedded in a number of policy and strategy documents covering climate change, environmental sustainability, and greenhouse emissions. These include *Growing Victoria Together* (2001, 2004); *Our Environment Our Future: Victoria's Environmental Sustainability Framework* (2005); *Our Environment Our Future Sustainability Action Statement* (2006); *Renewable Energy and Energy Efficiency Action Plans* (2006); *Victoria's Greenhouse Strategy* (2002, 2005); and *Victoria's Greenhouse Challenge for Energy* (2004).

Victoria provides a range of programs and information to the householder to assist households to reduce their energy use. Sustainability Victoria's website [http://www.resourcesmart.vic.gov.au/for\\_households/energy.html](http://www.resourcesmart.vic.gov.au/for_households/energy.html) offers a range of information on sustainable solutions in the home, rebate programs and other initiatives directed at the householder. These initiatives include Green Power, tools to measure household energy and water use, and the Resource Smart Retail Program whereby households can access an accredited assessor who will conduct an audit and provide advice.

### 2.2.2 Waste

Government policy relating to waste management essentially aims to promote the reduction of the amount of waste sent to landfill and encourage recycling, reuse or reduction of the waste that is generated. National waste strategies were agreed to by the Australian, state and territory governments as a result of increasing concern with protecting the environment and promoting resource sustainability.

Waste management comprises a number of sectors – municipal, commercial and industrial (CandI), and construction and demolition (CandD). Household waste, and specifically waste collected through kerbside recycling programs, falls under the municipal sector. Household waste management extends to the recycling of other waste items recognized as nationally significant (Hyder Consulting 2008). These include e-waste (computers, mobiles, TVs, etc.); bulky items (e.g., white goods); other electrical equipment such as lights; and toxic household products (batteries, tyres, etc.).

Policy and strategy associated with waste management has been given policy emphasis as a result of the climate change imperative. Renewed interest in this area is also being driven following the findings of a national study which found that waste production (including household, commercial and industrial) has increased by 28 per cent between 2003 and 2007 (Hyder Consulting 2008). This increase is despite the implementation of various waste management strategies at the household level, including the popular kerbside recycling programs.

New waste minimization strategies have been introduced by most states and territories. While these strategies are diverse, most have a similar objective of 'zero waste' to landfill, and adopt quite stringent landfill diversion targets. Many of the policy frameworks adopt a waste hierarchy model and focus on encouraging industry and community responsibility to manage the waste disposal and diversion process.

Local government also has an important role in enacting national, and state and territory policy as it has the primary service delivery role in managing and disposing of waste through kerbside collection and land fill/transfer stations.

Current practice around kerbside recycling services allows for the separation of recyclable material from general household waste. However there are now very few strategies in place at a state or local level to separate kitchen and garden waste from general waste. Much kitchen and garden waste is compostable, and potentially able to be diverted from landfill. While some councils have initiated green waste collection as a best practice option, other councils are trialling collections, and others are still considering the best way to provide this option. Inner urban settings where access and space are limited can present significant feasibility issues to the extension of kerbside recycling to green (garden and kitchen) waste.

#### *Commonwealth*

At the Commonwealth level, Commonwealth and state governments are in the process of developing a new national waste policy to update the now outdated *National Waste and Recycling Minimisation* Strategy developed as part of the National Strategy for Ecologically Sustainable Development by the Council of Australian Governments (COAG) in 1992. The Environment Protection and Heritage Council of Australia and New Zealand, an intergovernmental council of environment ministers established in 2001 by COAG, has responsibility for the development of the new national waste policy.

## States and territories

State and territory policy responses have to date reflected the two key policy responses of the Commonwealth: the *National Waste Minimisation and Recycling Strategy* and the *National Kerbside Recycling Strategy*. The former policy is currently under review. Several states and territories are currently in the process of reviewing or redrafting policies. In each jurisdiction a number of government agencies are responsible for waste management and resource recovery covering policy, regulation, and planning.

The key state and territory policy frameworks are outlined below in Table 1. Key strategies underpinning the state and territory policy frameworks include similar features such as the:

- Setting of targets such as reduction in the diversion of waste from landfill or overall waste generation.
- Introduction of landfill levies.
- Introduction of a range of product specific programs addressing various household waste streams (chemicals, paints, and rechargeable batteries).

**Table 1: Key state and territory waste management frameworks**

<i>State</i>	<i>Key policy and strategy document</i>	<i>Stage of development</i>
QLD	Lets Not Waste Our Future	Draft discussion paper was released in October 2007 for public comment. Policy and strategy still being developed.
VIC	Towards Zero Waste Strategy (TZW)	Launched in 2005.
NSW	Waste Avoidance and Resource Recovery Strategy	Developed in 2003 and revised in 2007.
SA	Waste Strategy 2005-2010	Released in 2005.
WA	Statement of Strategic Direction for Waste Management in Western Australia	Released in 2004.
NT	Re-thinking Waste Disposal Behaviour and Resource Efficiency Interim Action Plan	Interim strategy drafted in 2007.
ACT	No Waste by 2010 Strategy	Released in 1996.
TAS	Draft Waste Management Strategy	Prepared in 2007.

States and territories have also developed or are in the process of developing city based strategies such as the *Draft Metropolitan Waste and Resource Recovery Strategic Plan* for Melbourne and the *Integrated Waste Strategy for Adelaide 1996-2015*.

Specific to household waste and kerbside collection, several state initiatives are underway. South Australia has plans to conduct a six-month pilot scheme across 10 council areas to collect food wastes and garden organics as a prelude to establishing kerbside recycling programs for food waste collection. Queensland raised the

potential for a third kerbside bin for household green wastes and organic materials in the 2007 Discussion Paper. The Northern Territory refers to implementing strategies to target locations where there is poor participation in kerbside recycling. Finally, Western Australia has developed a 'Buy Recycled Guide' to inform consumers of products containing recyclable materials.

### *Local government*

Local government also has an important role in the area of waste management alongside their service provider role in the disposal of MSW waste. Local governments across Australia have been responsible for establishing or trialling a range of initiatives to improve waste management. These include both education programs and innovative recycling programs (e.g. Toowoomba City Council kerbside green waste collection).

### *Queensland*

Queensland is in the process of developing a new waste strategy due for release in the near future. This strategy follows the release, in late 2007, of the *Let's Not Waste Our Future Queensland Waste Strategy Discussion Paper*. The new strategy is intended as an effective policy framework for future action on waste management across all of Queensland and will continue to be based on the waste hierarchy model. The new strategy is also intended to be closely linked to other policy frameworks such as the *Smart Queensland: Smart State Strategy 2005-2015* and the *South East Queensland Regional Plan 2005-2026*.

Currently policy and regulatory frameworks fall under the *Environmental Protection (Waste Management) Policy 2000* and the *Environmental Protection (Waste Management) Regulation 2000 (Qld)*. Prior to 2000 waste management was governed by a range of legislation including the *Litter Act 1971 (Qld)* and the *Environmental Protection (Interim Waste) Regulation 1996 (Qld)*. Current policy operates on the principles of the waste management hierarchy that encompasses avoidance; recovery for reuse, recycling or energy; management of residuals; and principles of polluter pays, user pays, and product stewardship.

Local governments in Queensland provide kerbside collection services to 99.6% of the state's population (EPA 2008). The EPA (2008) also found that 85% of households that had a waste collection service also had a kerbside recycling service. The Cairns based Bedminster facility is an example of alternative waste technology in operation. All kerbside collection material collected in the Cairns Douglas and Mareeba council areas can be processed at the Bedminster facility. Here, non-organic material is able to be separated from organic material and non-compostable material removed, and the remains are then gradually processed into a commercial grade compost (EPA 2008). Approximately 80% of waste normally sent to landfill is reduced though this facility (<http://www.sita.com.au/our-services/post-collections/sita-cairns-bedminster-composting-plant.aspx>).

The Environmental Protection Agency, as Queensland's lead agency to promote best practice kerbside recycling programs throughout the state, implemented a Best Practice Kerbside Recycling Scheme based on the scheme developed by EcoRecycle Victoria. The scheme is an initiative under the National Packaging Covenant and provides grants to local government councils who provide kerbside services based on best practice criteria such as providing specific recycling bin configurations to households. Criteria for funding are based on councils adopting 'Best Value Service' levels for kerbside collection and include the provision of:

→ Mobile bin systems (split or co-mingled).



- 2 x 60 litre crate system or equivalent.
- A drop-off centre  
[http://www.epa.qld.gov.au/publications/p00808aa.pdf/Best Practice Kerbside Recycling Program Funding Scheme 200204.pdf](http://www.epa.qld.gov.au/publications/p00808aa.pdf/Best_Practice_Kerbside_Recycling_Program_Funding_Scheme_200204.pdf).

### *Victoria*

Victoria is in its fourth year of the 10 year *Towards Zero Waste Strategy*, the state's primary initiative for addressing waste management issues. The key focus is on minimizing waste, maximizing recovery and reducing environmental impacts resulting from waste generation. The strategy is governed by the *Environmental Protection Act (1970)*.

The state has just released its *Metropolitan Waste and Resource Recovery Strategic Plan for the City of Melbourne* that recognizes Melbourne's place in the states overall waste production and recovery levels. The Plan is strongly tied to the *Towards Zero Waste Strategy*.

The Victorian best practice kerbside system promotes the option for a three bin system that includes kerbside collection of recyclables, organics and residuals. Currently the organics kerbside collection is optional, however it is envisaged that as waste collection and disposal contracts are renewed most metropolitan councils will take up the best practice system. Currently all outer suburban councils in Victoria provide the three bin option to households, while inner urban councils provide the two bin option primarily due to access restrictions and home storage issues.

The Shire of Nillumbik in Victoria has trialled a green waste collection service providing a weekly kerbside collection for food (including meat and bone) and garden materials. Initial results have shown that the scheme has been successful in reducing the amount of green waste sent to land-fill.

### *2.2.3 Water*

Increasing concern and experience of climate change and its impacts has led governments to make some significant changes to current policy on water management. Securing water sources for the future and improving household water conservation have dominated policy in the recent past and will continue to into the future. Managing water involves a range of legislation, initiatives and cooperative arrangements across the Commonwealth and state and territory governments.

### *Commonwealth*

The Australian Government has embarked on a major water reform program over the past two decades. The 1994 Council of Australian Governments (COAG) *Water Reform Framework* has provided the basis for the development of the *National Water Initiative* (NWI) which was agreed to in 2004 by COAG. *Water for the Future* is the Commonwealth's overarching strategy addressing the management of the long-term water supply across Australia. Government has committed \$12.9 billion to this strategy which is underpinned by *The Water Act 2007* and which includes the NWI.

Components of this national framework directed at the household level include the National Rainwater and Greywater Initiative and the Water Efficiency Labelling and Standards scheme (WELS). The former program provides funding to households to install water tanks and greywater systems in order to preserve drinking water, while the latter involves labelling household products for their water efficiency in an effort to assist individuals to choose the most water efficient products for their homes.

## *States and territories*

State and territory jurisdictions are primarily responsible for implementing national policy relating to water conservation and efficiency and administering the Commonwealth programs such as the National Rainwater and Greywater Initiative and WELS. States and territories have undertaken major structural and regulatory reforms into water management efficiency to ensure water supply into the future. This reform has included establishing structures such as water commissions or new portfolios; reviewing and renewing policy frameworks; and developing and implementing a range of initiatives to specifically address water management and its use in each jurisdiction.

States and territories have developed various policy frameworks specifically focusing on water such as the *Queensland Water Commission Strategic Plan 2008-2012* and the *Water Forever: Directions for Water Future (WA)*; encapsulated water policies within broader state or territory plans (*NSW State Plan*), or developed a suite of policies covering strategic and management objectives (*SA Water*). Branding and catch phases form part of the Government promotion and IT information gateways such as the *NSW Water for Life* and Western Australia's *Water Forever*.

States and territories have introduced 'waterwise' initiatives comprising a range of water efficiency programs and measures aimed at households and the broader community level that include:

- Water efficiency labelling.
- Technological improvements to make fittings and equipment more water efficient.
- Community awareness and education.
- Social marketing.
- Regulation and legislation.
- Research and development.
- 'Waterwise' accreditation.
- Trials of new initiatives.

In response to threats posed by drought, particularly in capital cities and country towns, state government in conjunction with local councils have implemented significant water restrictions on households along with promoting a range of programs for improved water use and efficiency.

## *Queensland*

The Queensland Water Commission was established in 2006 in response to increasing concerns about the impact of climate change, and in particular the drought conditions experienced in south-east Queensland. The Commission is the lead agency for water conservation in Queensland. In relation to household water use, the Commission in conjunction with local governments is responsible for improving water use efficiency through the imposition of water restrictions and water efficiency programs.

The Queensland Government has implemented a Climate Smart Home Service aimed at reducing household greenhouse gas emissions which includes providing households with a customised energy and water efficiency management plan. This program follows on from the Home WaterWise Service that provided advice and installation of water efficient devices to households to improve household water efficiency. The Brisbane City Council initiative, Target 170 (previously Target 140), is

currently in operation across a number of south east Queensland regional councils in response to low dam levels. The target provides households with the goal of limiting household water use to 170 litres per person per day. This initiative is accompanied by a range of water saving advice and information promoting improved household water efficiency.

### *Victoria*

Sustainability Victoria has responsibility for enacting the state's policy in relation to water conservation. Current policy driving action in Victoria stems from two key documents: *Tackling Climate Change and Water: Making Every Drop Count* (developed in 2006) and *Our Water Our Future* (2004). Victoria has in place a similar initiative to Queensland's 'Home WaterWise Service' labeled 'Water wise' that offers households a free water audit and repair or replacement of inefficient water fittings. Water wise is a joint initiative between the Department of Human Services and local water corporations.

## **2.3 Commonwealth housing initiatives and household sustainability**

While state and territory housing departments are increasingly concerned with energy and water efficiency, housing authorities are faced with a number of challenges to implementing change, not least that much of the public housing stock is aged and in need of significant upgrade. The Commonwealth's Social Housing Stimulus Package provides some funds to assist housing authorities with their upgrade programs and includes in its guidelines the requirement for housing to incorporate environmentally sustainable design features that will contribute to household reduction of energy and water use. The recently announced National Affordable Housing Agreement (NAHA) includes a requirement for all new housing built through NAHA funds to conform to a six star Energy Efficiency Rating where possible in an effort to reduce the environmental impact of homes and reduce the costs of energy for low income households. Similarly all states and territories have established affordable housing design guidelines since the early 2000s applicable to all new housing construction that incorporate design principles of environmental sustainability with a focus on resource efficiency in waste, water and energy.

## **2.4 State and territory housing authorities and household sustainability**

Some housing authorities have undertaken or are planning to undertake significant measures to improve the efficiency of social housing properties, in line with their commitment to national priorities and the central agency policies of each state and territory in relation to environmental conservation and sustainability. Some state and territory housing authorities have conducted household audits and/or implemented schemes to retrofit or upgrade water and energy appliances of social housing stock (NSW Office of Housing Annual Report 2007-2008; Queensland Department of Housing Annual Report 2007-2008). The NSW Office of Housing has introduced a range of water efficiency programs, improved water maintenance and introduced for the first time water usage charges for Housing NSW residents of public housing, while Housing Tasmania has plans to retrofit public housing properties to include energy efficiency features, such as better insulation, dual flush toilets, natural gas or solar hot water units, new glazing and draft proofing). Routine maintenance of public housing authorities in some jurisdictions includes energy efficient improvements such as replacing electric with gas heating, and installing water efficient appliances.

All state and territory housing authorities are required to build all new properties in accordance with strict environmental standards.

## **2.5 The not-for-profit housing sector and household sustainability**

While state and territory housing authorities are implementing significant upgrades and retrofitting of public housing properties, the same initiative has not been targeted for the not-for-profit community housing sector. There is also little evidence of community and affordable housing organisations providing educational or promotional material on household sustainable practices.

## **2.6 The private rental sector and household sustainability**

While there is little evidence to date of policy initiatives on environmental sustainability directed to private rental housing stock, private rental households can access any of the information found on government and other internet portals on sustainable living and practice. Private rental households are restricted in their ability to achieve greater household efficiencies in relation to energy and water use by landlord practices, particularly when there is a cost involved.

### *2.6.1 Low income private rental households and sustainability*

Although the private rental sector has always played a role in housing low-income and other households, it is now considered the *de facto* main provider of rental housing for lower-income households across Australia (Seelig *et al.* 2005). The majority of households in receipt of income support payments are renting privately. Moreover, households in receipt of Commonwealth Rent Assistance number just under one million, representing well over half of all private renters (SCRGSP 2007). The role of the private rental sector in housing low income households gained prominence as a result of a number of important shifts in the broader housing system. In particular, the decline in housing affordability has led to a decline in home purchase among low-income earners. At the same time, the increased targeting of public housing and decrease in public housing supply has forced more and more households to rely on the private rental sector. State and territories have begun to consider the ramifications of their energy and water policy responses on low income households. Less emphasis has been placed on waste minimisation of low income households as many of the current initiatives associated with waste reduction at the household level have to date been cost neutral, relying on behaviour change as the primary means of achieving waste minimization targets. However, unlike waste minimisation, there are a number of factors impacting the capacity for low income households to greater energy and water efficiency including the:

- Inability of low income households to make adjustments to their location, many of whom live in areas more affected by climate change.
- Capacity of low income households to implement changes due to the costs.
- Recognition that low income households already spend a greater proportion of their income on energy and water than other wealthier households (ACF, ACOSS and CHOICE 2008).

Without adequate consideration, current and future policy responses may negatively impact low income households, including those in social housing.

There are several schemes currently in place that focus on low income households. In January 2009, South Australia commenced the Residential Energy Efficiency Scheme (REES) that requires electricity and gas retailers with more than 5,000 residential

customers to provide energy audits to households in an effort to lower household energy costs and reduce greenhouse emissions. The scheme has the added objective of preparing households for future cost increases resulting from the implementation of the Commonwealth's Pollution Reduction Scheme expected to commence in 2010.

Similarly, the NSW Government has introduced a \$63 million Low Income Household Refit Program, where 220,000 households will receive an energy efficiency audit, refit kits that include water and energy saving devices and advice, and information on purchasing more efficient appliances.

Victoria will be continuing its scheme to provide low income households with energy and water retrofits following household audits. A further 8,000 homes are planned to be retrofitted by 2011 adding to the 4,700 homes completed since the schemes introduction in 2003 <http://www.sustainability.vic.gov.au/www/html/1464-energy-task-force.asp>, accessed 27/3/2009.

## **2.7 Policy relevance of the research**

The review of the policy context in relation to household waste, water and energy highlights a range of approaches adopted by government to promote waste minimization, and water and energy efficiency in Australian homes. Rebate schemes, low cost loans and low cost in-home audits help to overcome financial barriers associated with household sustainability. The provision of information through websites and energy and water efficiency appliance rating schemes can help households make informed decisions about household sustainability. Plans to implement a third bin aimed at kerbside collection of green waste offers a convenient structural solution to reducing household waste.

Although these financial, structural and informational solutions are likely to impact positively on household sustainability, past research and theory in this area suggest that behaviour change and technology adoption are underpinned by more than these considerations (Bamberg & Moser, 2007; Steg & Vlek, in press). Moreover, the factors that motivate adoption of household sustainability practices are likely to vary across socio-demographic groups. For example, financial barriers may be a greater consideration for low-income than high-income households and the structural constraints and lack of feedback (e.g., about water use) experienced by renters suggest the need for different avenues to promote household environmental sustainability.

The focus of the current research on the integration of a psycho-social understanding of household environmental attitudes and decisions with policy and housing perspectives will provide critical information to policy makers in the area of urban environmental sustainability. This approach will arm policy makers with a comprehensive understanding of predominant waste/water/energy attitudes and practices and the factors that underpin these. The research will also identify how and why these are changing and what strategies can take Australian households toward a sustainable future. Critically, the research will provide information around the policy responses that are likely to produce successful outcomes in relation to household waste/water/energy use. Such understandings will be presented in the context of their potential differential effects for households across socio-economic groups, household tenure and household types.

## 3 INTERNATIONAL AND NATIONAL RESEARCH

### 3.1 Introduction

Questions about existing household waste, water and energy practices in Australia can be addressed, at least in part, with data collected by the Australian Bureau of Statistics (ABS, 2005, 2006, 2007). Household *energy use* has almost doubled in the last thirty years and accounts for 12 percent of the total energy consumed in Australia (ABS, 2005). There have been significant increases in the number of households with energy using appliances such as air-conditioners (from 33% in 1994 to 60% in 2005) and computers (from 45% in 1999 to 68% in 2005). There is also evidence of increased energy conservation measures such as insulation and energy saving lighting, however the motivation for adopting these measures relates to comfort and convenience rather than energy conservation (ABS, 2007). Moreover, despite increased awareness of green power schemes (from 19% in 1999 to 29% in 2005), willingness to support the schemes dropped slightly from 26 percent in 2002 to 23 percent in 2005.

ABS data reveals evidence of positive attitudes toward *water conservation* in Australian households (ABS, 2007) with a majority of households reporting that they take steps to conserve water both inside and outside the house. Conservation measures included behavioural measures such as reusing grey water and structural changes such as installing water saving shower heads and dual flush toilets. The latter measure rose from 39 percent of houses with dual flush toilets in 1994 to 81 percent in 2007. Approximately half (49%) of Victorian households water gardens with buckets or watering cans and almost half (48%) of Brisbane households rely on rainfall to water their garden. Not surprisingly, households who pay for their own water were more likely to save water in the garden than those who do not pay water charges (75% vs 59%).

In terms of *waste management*, ABS findings suggest that the majority of Australian households currently engage in practices that address this issue with 99 percent of households recycling or reusing their waste (ABS, 2006). The data also sheds light on the motivators of household recycling: households are more likely to recycle if they generate sufficient recyclable materials, if there are convenient recycling facilities such as kerbside collection, and if there is interest in recycling. Evidence suggests that Australian households are increasing their recycling and reuse practices. Recycling of garden waste increased from 51 percent in 1996 to 66 percent in 2006, and reuse of waste materials (e.g., plastic bags, clothes and rags) increased from 37 percent in 1996 to 87 percent in 2006. On the other hand, rates of composting decreased slightly in the ten year period and the majority of households did not dispose of hazardous waste appropriately (e.g., batteries).

Although the ABS data provides information about current household sustainability practices in Australian households, it does not provide a full and comprehensive understanding of the psycho-social determinants that underpin these practices or the factors that might be motivating changes in attitudes and practices. This is especially the case for energy and water consumption and less entrenched waste management practices like composting where there is evidence of declining participation. An understanding of the psycho-social factors (e.g., attitudes, norms, beliefs) along with the socio-demographic differences that impact on household sustainability practices can provide a firm platform from which to launch policy and interventions aimed at promoting greater environmental sustainability in Australian households.

To guide this literature review we draw on existing categorisations that exist in the environmental psychology literature. According to Stern (2000), the predictors of environmentally significant behaviours can be grouped into the categories of attitudinal factors, habits or routines, personal capabilities, and contextual forces. In the following review we group attitudes and habits under psycho-social predictors and personal capabilities and contextual forces under socio-demographic and contextual predictors. Personal capabilities include factors such as knowledge and skills required for particular actions, the availability of time to act, and personal resources such as literacy, money, and social status. According to Stern (2000), socio-demographics can be proxies for personal capabilities. Contextual factors relate to physical infrastructure and technology as well as the physical difficulty of specific actions (e.g., Steg and Vlek, in press; Stern, 2000).

Behavioural-based interventions that seek to increase environmentally responsible behaviour and decrease environmentally destructive behaviour can be categorised into two main approaches: antecedent and consequence strategies (De Young, 1993). Examples of antecedent strategies are commitment, goal setting, information, prompts and modelling. Consequence strategies include feedback and rewards. Antecedent strategies are proposed to change behaviour by influencing the determinants of behaviour. Thus, making a commitment to save water or energy would promote conservation by changing attitudes to energy and water conservation. Similarly, information may be effective by increasing residents' knowledge and raising awareness and self-efficacy in relation to water or energy conservation. Conversely, consequence strategies are proposed to influence determinants *after* the enactment of behaviour by linking (positive or negative) consequences with the outcome of the behaviour. For example, providing rewards for saving water may reinforce water conserving practices. Similarly, giving households feedback about the level of water consumption in their community can provide information about what is 'normative' and thus influence individuals' attitudes and behaviour. In this review we focus on behavioural interventions but where there is clear evidence relating to structural or technical interventions, we also highlight these findings.

Interventions can be further categorized into those that focus on efficiency and those that focus on curtailment behaviours (Gardner and Stern, 2002). Efficiency behaviours refer to one-off behaviours such as installing water-saving shower heads, installing compact fluorescent light bulbs or buying a compost bin. Curtailment behaviours refer to ongoing efforts such as only washing full loads of clothes, turning off appliances not in use, and recycling. An understanding of what motivates both of these types of behaviours will be important. Efficiency measures have the potential to bring about ongoing significant changes because they become part of the infrastructure of the home (Gardner and Stern, 2002). However, this may only be the case if householders do not then compensate for the efficient appliance by using more of the resource (e.g., water or power). Curtailment behaviours will also be important for many people who are renting or do not have the possibility of making changes to their household infrastructure. Moreover, it is likely that an identity as a sustainable household would go hand in hand with habitual sustainable behaviours.

We drew on the published, peer-reviewed literature that investigates (1) the predictors of household energy and water consumption and domestic recycling, and (2) interventions to increase energy and water conservation and household recycling. Note that energy and water conservation is operationalised differently across the studies as behavioural intentions, self-reported behaviour, actual consumption, and some studies also investigate policy acceptance. Recycling studies tend to focus on recycling intentions and self-reported behaviour, although some studies measure

actual levels of recycling. In the summary we draw comparisons between the findings of the literature review and relevant Australian data.

## **3.2 Socio-demographic and contextual predictors**

### *3.2.1 Water*

#### *Age*

Research by Gregory and Di Leo (2003), suggests that older householders consumed less water. Similar to the generational hypothesis advanced by Carlsson-Kanyama, Linden, and Eriksson (2005), Gregory and Di Leo suggest that older householders may have experience of relying on dams and tank water for their everyday water in their earlier lives and therefore they have been socialised to care more about water conservation.

#### *Income and education*

Higher income seems to be related to higher water consumption. A study by Gregory and Di Leo (2003) shows that low water users were older families with lower income and education levels. They conclude that the lower water users were at a different life stage 'empty nesters' compared to high water users who were more likely in the later stages of the 'full nest' stage. Similarly, De Oliver (1999) demonstrated a negative relationship between income, education and consumption, although this demographic responded well to conservation measures. In contrast, Lam (2006) found that income and education was positively related to intentions to install a dual flush controller.

#### *Dwelling*

Research focusing on water consumption in Melbourne by Aitken and colleagues (Aitken, Duncan, and McMahon, 1991; Aitken, McMahon, Wearing, and Finlayson, 1994) clearly indicates that higher property values are associated with higher water consumption.

#### *Number of occupants*

Past research has identified that the number and type of residents is an important contextual variable in assessing water consumption (Aitken et al., 1991; Aitken et al., 1994; Jeffrey and Gearey, 2006). Research by Aitken et al. of Melbourne household water consumption (Aitken et al., 1991; Aitken et al., 1994) demonstrates that the number of residents in a household accounts for a large proportion of household water use. It is worth noting, however, that increases in water use are often less than proportional to increase in household size (Hoeglund, 1999). This finding demonstrates that larger households are able to achieve economies of scale in water consumption. This finding also suggests a need to explore the role that household dynamics plays in water consumption as these dynamics may exert a degree of social control that impacts on household water patterns (Randolph and Troy, 2008).

#### *Price instruments*

The effect of pricing on water consumption is mixed. Randolph and Troy's (2008) research on water consumption in Sydney concludes that simple pricing solutions are unlikely to be effective. Research by van Vugt (2001) has shown however, that the relative importance of social and pricing variables depends on the context. Van Vugt's findings indicate that when householders were charged a fixed tariff, whereby charges were independent of consumption, their water use was influenced by community identification. Specifically, under a fixed tariff system individuals with higher levels of community identification used less water than those with low community identification.



In contrast, when the tariff was variable, community identification did not play a significant role in water consumption. Instead, pricing influenced water consumption.

### *3.2.2 Energy*

A review of energy studies between 1975 and 1988 was conducted by Guerin, Yust, and Coopet (2000). The review investigated the predictors of energy consumption behaviours such as taking part in an energy audit. It also investigated predictors of actual household energy consumption, that is, how much energy a household uses. The results of the review suggest that there are somewhat different predictors of energy consumption behaviours than actual energy consumption. Age, income, home ownership and education were the most frequent predictors of behaviour, and age, income, number of occupants and dwelling size were the most frequent predictors of actual consumption.

#### *Age*

The Guerin et al. (2000) review suggests that sometimes age is positively related to greater energy use. This finding is supported by a recent study on home energy use in American homes between 1987 and 1997, that also found a positive correlation between age and energy use (Yust, Guerin, and Coopet, 2002). Some studies suggest, however, that households in the middle life-cycle stage use more energy than younger or older households. Carlsson-Kanyama, Linden and Eriksson (2005), also found that older generations displayed more energy conserving behaviours. For example, older respondents reported less clothes washing and lower indoor temperatures than younger people. Carlsson-Kanyama and colleagues (2005) argue that differences between the generations arise because different generations have been socialised to different lifestyles and values, with older generations valuing frugality and conservation to a greater extent than younger generations.

#### *Income*

Past research on the relationship between income and energy is inconsistent, with some studies showing a positive relationship and some showing no relationship (Guerin et al. 2000; Poortinga, Steg and Vlek, 2004). A more recent study of energy use in Norwegian households suggests that although householders with higher education had higher environmental concern and awareness, they also had greater energy use (Anker-Nilssen, 2003). The strong correlation between education level and income level suggests that educated, high income families were higher energy users. Anker-Nilssen's interpretation of this is that affluent households experience a 'rationality conflict' (Anker-Nilssen, p. 192) whereby their perceived needs (e.g., to save time, acquire luxury goods) win out over their ideals. An explanation for the inconsistent findings relating to income and energy use comes from a study showing that it is not income per se that influences energy use, but rather the interaction between income and dwelling size, with income only associated with higher energy use for those with larger dwellings (Yust, et al., 2002).

#### *Education*

The findings that relate education to energy use seem clear, although those households with higher education report greater awareness of the need for energy conservation and more environmental awareness overall, this does not always result in greater energy conservation (Anker-Nilssen, 2003; Guerin et al., 2000). The partial overlap between education and income level may account for this finding and, like income, it may be that the effect of education is moderated by dwelling size.

### *Home ownership*

Not surprisingly, home ownership is strongly related to engaging in energy conserving behaviour (Guerin et al. 2000). For obvious reasons, home owners are more likely to install energy efficient appliances in their homes that increase the value of the property and potentially reduce energy consumption.

### *Number of occupants*

Similarly, increasing household occupancy is significantly related to increased energy consumption (Guerin et al. 2000; O'Neil and Chen, 2002; Poortinga et al. 2004; Yust et al., 2002). Apart from the obvious explanation—that there is greater energy use because there are more people to use appliances—it is also possible that increases in household size are related to decreases in the importance of the conservation ethic as a motivator of energy conservation (Gmelch and Dillman, 1988).

### *Dwelling size*

As outlined above, dwelling size is a significant predictor of energy consumption (Guerin et al. 2000; Poortinga et al. 2004; Yust et al., 2002) and potentially moderates the effect of income level (Yust et al. 2002) and education.

### *Pricing*

Anker-Nilssen's (2003) research on Norwegian households demonstrated that the influence of electricity pricing was dependent on income level: Low income households decreased their energy use in response to price increases whereas high income households did not react. The proportion of total income consumed by energy costs is greater for low income than high income households, hence, price elasticity is likely to have the greatest impact on those who can least afford it.

### *3.2.3 Waste*

Findings from the review of personal and situational influences on recycling behaviour by Schultz, Oskamp, and Mainieri (1995) suggest that the relationship between demographic factors and recycling is mixed. Gender was not related to recycling but higher income has been consistently linked to higher rates of recycling (see also Kurz, Linden, and Sheehey, 2007). The results of studies examining the effects of education and age on recycling are inconclusive. Some studies have shown positive relationships between age and recycling, some negative and some no relationship at all. Schultz et al. conclude that the lack of relationship between education and recycling in some studies may have resulted from the limited variability on this factor. Overall however, a meta-analysis of recycling studies conducted by Hornik, Cherian, Madansky and Narayana (1995) demonstrates that relative to other determinants, demographic factors were the weakest predictors of recycling, with none of the demographic factors demonstrating a strong link. They argue that as recycling becomes more widespread and accepted in communities, demographic factors will be less likely to differentiate those who recycle from those who do not.

### *Distance*

Not surprisingly, the research consistently shows that the closer participants are to a collection point the more likely they are to recycle (Schultz et al., 1995). This finding is pertinent to those objects that cannot be recycled through curbside collection schemes such as white goods, electronics, and mobile phones.

### *Collection method*

Folz (1991) found that communities with voluntary kerbside collection had almost twice the level of recycling participation of communities with drop-off collection.

### *Sorting*

A study of participation rates for a co-mingled kerbside recycling program compared to an earlier program that required separation showed that 90 percent of residents participated at least once in the co-mingled program compared to a participation rate of only 40 percent in the separated program (Gamba and Oskamp, 1994).

### *Type of housing*

The Hornik et al. (1995) meta-analysis showed a weak relationship between type of housing and recycling, suggesting that single family households show a somewhat higher tendency to recycle.

It should be noted that the Hornik et al. (1995) meta-analysis concluded that external facilitators such as frequency of collection and proximity of containers were poor predictors of recycling. In contrast, Derkson and Gartrell (1993) demonstrate that the most important facilitator of recycling is access to an established recycling program. Overall, the weight of evidence seems to be that the convenience of recycling is a key determinant of recycling participation (ABS, 2006; Barr and Gilg, 2005; Kipperberg, 2007; Martin, Williams and Clark, 2006; Perrin and Barton, 2001).

## **3.3 Psycho-social predictors**

### *3.3.1 Water*

Some studies investigating attitudinal determinants of water consumption have been framed by the theory of planned behaviour (Ajzen, 1991). Research guided by this framework has shown that the theory of planned behaviour factors are significant predictors of both efficiency and curtailment measures (Lam, 1999, 2006; Clark and Finley, 2007). The theory of planned behaviour factors are attitudes (perceiving recycling as good), perceived behavioural control (perceiving recycling as easier to do), and subjective norms (perceiving that significant others want or expect you to recycle). Research by Lam (1999, 2006), also highlights that there are different predictors of the two types of strategies. In his research attitudes and perceived behavioural control were significant determinants of both efficiency (intention to install water efficient appliances) and curtailment (intention to use less water) intentions, however normative beliefs were only a significant predictor of curtailment intentions. Moreover, Lam (1999) also showed that perceived water rights were a significant negative predictor of efficiency intentions but not curtailment intentions.

### *Beliefs*

The exploration of the relationship between beliefs and water conservation has largely taken place within the framework of the new ecological paradigm (NEP; Dunlap, Van Liere, Mertig and Jones, 2000). The NEP is conceptualised as a measure of general environmental beliefs and ecological worldview. Corral-Verdugo, Carrus, Bonnes, Moser and Sinha (2008) found that general environmental beliefs accounted for a significant amount of the variance in self-reported curtailment behaviours. Earlier work (Corral-Verdugo, Bechtel and Fraijo-Sing, 2003), however, demonstrated that these general beliefs were mediated by more specific beliefs about water. They found that utilitarian water beliefs (i.e., water is an unlimited resource) were negatively associated with water conservation behaviours whereas ecological beliefs were positively associated with conservation. The latter research highlights that beliefs

about specific environmental practices are usually more predictive of behaviour than general environmental attitudes (Fishbein and Ajzen, 1975).

### *Habits*

In contrast to the idea that individual decision making is a rational, reasoned process, recent research has acknowledged the role of habits and routines (Steg and Vlek, in press; Stern, 2000). Generally, the role of habit or routine is operationalised as the frequency of past behaviour, for example, the number of showers or loads of washing per week. The research investigating the role of this factor for water conservation has shown mixed results. In their study of water consumption in Melbourne, Aitken and colleagues (Aitken, Duncan and McMahon, 1991; Aitken, McMahon, Wearing, and Finlayson, 1994) did not find that habits were an important determinant of actual water consumption relative to contextual variables such as number of household residents or property value, although, in their later study, number of clothes washing machine loads per week was significantly associated with actual water consumption. In contrast, research by Gregory and Di Leo (2003) demonstrated that habits relating to showers and clothes washing significantly predicted actual water consumption, and Trumbo and O'Keefe's (2005) research also showed that self-reported water conservation behaviour in 1998 was a significant predictor of conservation intentions in the follow-up survey in 2000.

### *3.3.2 Energy*

Research investigating the relationship between values and general environmental attitudes (e.g., environmental concern) suggests that these factors are not strongly related to actual energy saving behaviour. For example, Poortinga, Steg and Vlek (2004) found that environmental concern predicted support for energy related policy and the acceptability of energy saving measures, however, neither concern or values were related to a measure of estimated energy use. Similarly, Poortinga, Steg and Vlek (2002) showed that environmental concern was positively associated with the acceptability of energy saving measures; in this study energy consumption behaviour or outcomes were not measured. Overall, these findings are consistent with the compatibility principle proposed by Fishbein and Ajzen (1975) that argues that specific attitudes will be more predictive of specific behaviours than general attitudes.

Clark, Kotchen and Moore (2003) explored the motivations of householders who were part of a green electricity program compared to those who were not. Their results showed that both psychological and demographic factors differentiated the two groups. Participants in the program had more altruistic and environmentally oriented attitudes and had fewer household occupants and higher income than those not part of the program. When asked about the motivations for the decision to buy green electricity, the predominant reasons related to environmental protection and health concerns.

In their review of energy studies between 1975 and 1998, Guerin, Yust, and Coopet (2000) investigated the predictors of energy consumption behaviours (e.g., taking part in an energy audit) and actual energy consumption (amount of energy used). They conclude that desire for comfort, health concerns, motivation to conserve, and to a lesser extent folk knowledge (simple, non-technical ways of thinking about energy), are the attitudinal variables most frequently associated with energy conserving behaviours. In terms of conservation motives, the four main motivators of energy conservation (in order of importance) were: (1) economic benefit (e.g., reducing energy bills), (2) conservation ethic (e.g., making a contribution by reducing usage), (3) personal benefit (maintaining comfort and home value), and (4) social conformity (e.g., peer pressure) (Gmelch and Dillman, 1988).

Qualitative research by Kurz, Donaghue, Rapley and Walker (2005) conducted in Perth provides insight into the way that energy use is construed by householders and thus, the beliefs that surround energy use. Energy was represented as an infinite resource that is largely related to the technology needed to produce it. Moreover, the householders interviewed saw themselves as 'users' rather than 'wasters' of energy, regardless of their actual energy consumption.

### 3.3.3 Waste

Findings from the review of personal and situational influences on recycling behaviour by Schultz, Oskamp and Mainieri (1995) are consistent with the principle that it is specific rather than general attitudes that predict behaviour. There is only a relatively weak relationship between recycling behaviour and general environmental concern, whereas more specific recycling attitudes (e.g., beliefs about convenience and effectiveness) were consistently and significantly related to recycling behaviour.

Studies conducted within the theory of planned behaviour (TPB) framework also confirm this finding. Specific attitudes about recycling are a consistent predictor of recycling intentions (e.g., Boldero, 1995; Chan, 1998; Cheung, Chan and Wong, 1999; Chu and Chiu, 2003; Taylor and Todd, 1995; Terry, Hogg and White, 1999; Tonglet, Phillips and Read, 2004; Mannetti, Pierro and Livi, 2004). Overall, these studies provide support for the TPB in that attitudes, perceptions of normative support (i.e., subjective norms) for recycling, and a sense that recycling is something that is within residents' control (i.e., perceived behavioural control) were all predictors of recycling intentions. Importantly, in those studies that measured behaviour, behavioural intentions predicted self-reported behaviour (e.g., Cheung et al., 1999; Terry et al., 1999).

TPB research suggests that a supportive normative context promotes recycling, a conclusion that is confirmed by Ewing (2001) who found that expectations of household members, friends and neighbours influenced recycling participation and amount of recycling. More broadly, a cross-national study by Guerin, Crete and Mercier (2001) showed that participation in environmental organisations at the national level was related to general community participation in recycling programs, suggesting that broad societal norms can influence more specific environmental practices such as recycling.

In addition to attitudes, norms and control, other psycho-social factors have also been linked to recycling intentions and behaviour. Self-identity (the sense of oneself as a person who recycles) was found by Manetti et al. (2004) and Terry et al. (1999) to predict recycling intentions. This finding is consistent with other literature linking identity to environmental behaviour (e.g., Sparks and Shepherd, 1992; Fielding, McDonald and Louis, 2008). The research suggests that individuals are more likely to engage in environmental actions that are internalised and become part of an individual's self-concept.

Recycling has also been linked positively with other factors, such as connection to the community (Kurz, Linden and Sheehy, 2007; Tonglet et al., 2004); negative anticipated emotions (Carrus et al., 2008); moral obligation (Chu and Chiu, 2003); recycling knowledge (De Young, 1988; Gamba and Oskamp, 1994; Tonglet et al., 2004); and specific beliefs that relate to recycling (e.g., need for less landfill, recycling saves resources and protects the environment, convenience of recycling) (Davis, Phillips, Read and Lida, 2006; Tonglet et al., 2004).

## *Habits*

Studies have established a consistent link between past recycling behaviour and future intentions and self-reported recycling behaviour. Studies drawing on TPB have revealed that past recycling behaviour is a significant predictor of recycling intentions (e.g., Carrus, Passafaro and Bonnes, 2008; Cheung et al., 1999; Knussen and Yule, 2008; Knussen, Yule, Mackenzie and Wells, 2004; Terry et al., 1999) and self-reported recycling behaviour (Cheung et al., 1999; Terry et al., 1999). Although habit has been predominantly operationalised as past behaviour, research by Knussen and colleagues (2004, 2008) showed that both past recycling behaviour and perceived habit of recycling independently predicted recycling intentions suggesting that past behaviour and habit may be somewhat different constructs.

## **3.4 Interventions**

### *3.4.1 Water*

It should be noted that there are few studies focused on assessing interventions to reduce household water use. An early study by Geller, Erickson and Buttram (1983) assessed the efficacy of information, feedback and installation of water saving devices. Households who received information were told about the problems resulting from wasteful water use, the relationship between water and energy consumption, and methods for saving water. Households in the feedback conditions received daily and weekly feedback about how much water they had used and how much they had increased or decreased their water use. Households in the water saving device condition received a range of devices aimed at reducing water use (e.g., toilet dam, flow control, aerator, shut-off shower control). Relative to baseline, only households who received the water saving devices significantly reduced their water use, although, to a much lesser degree than might have been expected. The researchers argue that a compensatory effect may have resulted whereby residents increased their water consumption in light of the information they received about the water saving potential of the devices.

Thompson and Stoutemyer (1991) draw on the commons dilemma to frame their water conservation intervention. Environmental issues are often conceptualised in terms of the 'tragedy of the commons' (Hardin, 1968), a metaphor that refers to the self-interested overuse of natural resources by individuals that ultimately harms the collective resource through its ultimate depletion and destruction. Thompson and Stoutemyer (1991) investigated whether providing information about the commons dilemma, including the long-term consequences of overuse of water and efficacy of personal action, was effective in reducing water use in Southern Californian households. Participants in this condition were provided with a range of information including a description of the commons dilemma, problems associated with overuse of water, water saving tips, information about the amount of water wasted by various activities (washing cars) and bumper stickers ('If water runs low, who cares? We all do!'). The findings of their research showed that residents who received this type of information used significantly less water than those who were given information about the economic benefits of saving water, or a control group (i.e., a group who were unaware that their water use was being monitored). This reduction, however, was only evident for low/middle socio-economic residents and not for high socio-economic residents. Moreover, although the pattern of differences was still evident in the post-study period, it was not significant. A limitation of the Thompson and Stoutemyer (1991) study is that residents received more than information about the commons dilemma or economic savings in those conditions. For example, both groups were also asked to sign and return a pledge to conserve water, thus, commitment was also

activated in these conditions. Most importantly, the lack of sustained change raises questions about the long-term efficacy of these strategies.

Other research by Kurz, Donaghue and Walker (2005) investigated the effectiveness of antecedent (i.e., information, prompts) and consequence (i.e., feedback) strategies for reducing residential water and energy use in Perth households (see antecedent intervention strategy above for description of the study). The results clearly showed that only the prompts significantly reduced household water use during the study and in the follow-up period. In fact, households who installed labels prompting water conservation reduced their water use by up to 23 percent during the intervention period. Information leaflets and feedback did not result in any significant reductions in water use. Interestingly, results also showed that initial water use (i.e., high, medium, low) did not influence the effectiveness of the interventions. The researchers argue that the prompts were effective because they 'attune' people to the impact of the household object or appliance (e.g., shower) at the site where people interact with the appliance.

There have also been evaluations of socially-interactive, community-based programs that aim to encourage householders to engage in more environmentally responsible behaviour, including sustainable water consumption. The EcoTeam Program, for example (Staats, Harland and Wilke, 2004), involves the provision of information and feedback with a focus on the environmental consequences of household behaviour in a socially interactive setting. Groups of 6 to 10 people meet monthly to follow a workbook focusing on six issues (i.e., garbage, gas, electricity, water, transport and consumer behaviour) and discuss experiences and achievements in relation to their environmental household behaviour (e.g., any reductions in water use and ways they achieved the reductions). The EcoTeams also received feedback about the performance of their team and all other EcoTeams around the world. In a three-year longitudinal evaluation of the program Staats et al. (2004), reported that participants had reduced their water use by approximately 3 percent during the intervention period and this increased to almost 7 percent two years after the completion of the program. The long-term sustained reduction in water use points to the possibility that information and feedback delivered in a socially supportive setting may be effective at achieving sustained household water use reductions.

In the Australian context, Lawrence and McManus (2008) have evaluated the effectiveness of two community sustainability programs for reducing water consumption. The aim of the Sustainability Street and the Australian Conservation Foundation's Green Home programs is to reduce waste, water and energy use in residential homes. Similar to the EcoTeam Program, households in the Sustainability Street program meet at least six times per year to learn about sustainability issues and share their knowledge and experiences. The results of the evaluation showed that compared to their previous behaviour and to non-participants in the program, participants made changes to their self-reported water-saving behaviour. These changes, however, did not translate into significant reductions in their water consumption compared to a control group. Lawrence and McManus (2008) argue that one reason for this may be that once minor technical changes have been made (e.g., installing low-flow showerheads) further substantial savings cannot be made without more radical changes to household infrastructure and major deviations from what is considered 'normal' ways of using water. Critical differences between these Australian programs and the EcoTeam Program which may explain the difference in results are the lack of focus on long-term consequences of actions and feedback about current behaviour.

### *Technical interventions*

As outlined above, early research by Geller, Erichson and Buttram (1983) revealed that retrofitting water saving devices resulted in significant reductions in water use, although savings were not as substantial as might be expected from the manufacturers' information. In a five year panel study of a conservation program in Delaware, USA, the installation of water saving devices and pricing signals significantly reduced residential water demand (Wang, Song, Byrne and Yun, 1999). A 15 to 20 percent reduction in water consumption was recorded for residents who received the water saving devices compared to those who did not, although, in real terms this only translated into a 2 percent saving when considering the small number of people who actually installed the devices. This latter finding highlights the need for widespread adoption of these devices. The 'Casa del Agua' is a specially designed residential water conservation facility in Arizona, that incorporated water saving devices, rainwater harvesting and a greywater system, demonstrated a 47 percent reduction in municipal water use over a thirteen year period (Karpiscak, France, DeCook, Brittain, Foster and Hopf, 2001).

### *3.4.2 Energy*

#### *Antecedent strategies*

The major antecedent strategies used in behavioural interventions include commitment (a public or private pledge to change behaviour), goal setting, information, and modelling (i.e., examples of recommended behaviour). There is evidence for the efficacy of antecedent strategies in energy usage interventions. For example, some studies have shown long-term reductions in energy use when households make a commitment (e.g., Pallak and Cummings, 1976). Goal setting seems to be most effective when it is combined with feedback, and modelling positively impacted on knowledge levels and energy conservation in one study (Abrahamse et al. 2005; Winnett, Leckliter, Chinn, Stahl, and Love, 1985). The effectiveness of information seems to relate largely to how it is delivered. There is little evidence for the effectiveness of mass delivered information, but when information is tailored, as in home energy audits, increased energy conservation behaviours and decreased energy consumption have been observed (e.g., Winnett, Love and Kidd 1982-1983; Gonzales, Aronson and Costanzo, 1988).

In more recent research conducted in Perth on antecedent strategies Kurz, Donaghue and Walker (2005), trialled prompts (e.g., reminding participants of the amount of greenhouse gases used to heat water and the amount of water used in an ordinary shower) either by themselves or in combination with comparative feedback although prompts positively impacted on water conservation, had no parallel effect on energy conservation. Kurz et al. argue that the social environment that attuned people to water conservation and the more visible nature of water as compared to energy may account for the differences in effects.

Nolan, Schultz, Cialdini, Goldstein and Griskevicius (2008) explored the effectiveness of a variety of information for promoting energy conservation. They delivered door hangers to a community in California that described ways to save energy around the home. Participants were assigned to one of five conditions that varied the reasons to save energy. The reasons included: self-interest (i.e., saving money), environmental protection, social responsibility (doing their part), descriptive norms (describing what other community members do in relation to conserving energy), and a control condition. Households in the descriptive norms condition saved more energy than the other conditions. Of interest is the finding that, although norms had the most impact on behaviour, participants were least aware of the impact of norms on their behaviour.



### *Consequence strategies*

Feedback and rewards are the two consequences strategies predominantly investigated in the social and environmental psychology literature. In general, feedback interventions have been effective in reducing household energy use, especially when the feedback is provided more frequently (Abrahamse et al. 2005). It is worth noting that some studies found differential impacts of feedback depending on whether households were high or low energy consumers (Brandon and Lewis, 1999; Bittle et al., 1979-1980; Van Houwelingen and Van Raaij, 1989). These studies found that low consumers increased their usage in the presence of feedback. Comparative feedback was not found to be more effective than individual feedback and there is no clear evidence from the Abrahamse et al. (2005) review about whether feedback about monetary or environmental costs is more effective. Overall, financial rewards seem to be an effective strategy for motivating energy conservation, however, there is evidence that the effects of rewards are not maintained beyond the intervention period (Abrahamse et al. 2005).

A study by Abrahamse, Steg, Vlek and Rothengatter (2007) investigated the combined effect of antecedent and consequence strategies. Participants in the experimental conditions were provided with tailored information, a 5 percent consumption reduction goal (either individual or group), and tailored feedback. The tailored information was based on responses to a questionnaire; participants in the experimental conditions were provided with information about what measures would best help them to reduce their direct and indirect energy consumption. On self-reported measures of direct energy use, participants in the experimental conditions met the 5 percent goal and saved more energy than the control condition. It was also evident that participants in the experimental conditions reported greater engagement in conservation behaviours and higher levels of energy related knowledge than those in the control conditions. As outlined in the water intervention section above, the EcoTeams Program (Staats et al., 2004) also encompassed a range of intervention strategies. The program resulted in an average reduction of 17 percent in natural gas use amongst participants over a two year period.

### *Policy acceptance*

In addition to research focusing on behaviour and actual or self-reported energy consumption, there is also recent research investigating the acceptability of energy related policies. Policies based on pull measures (i.e., incentives) are perceived to be more effective and acceptable than those based on push measures (i.e., disincentives) (Steg, Dreijerink and Abrahamse, 2006). Policies that target direct rather than indirect and efficiency/technical rather than behavioural/curtailment measures are also considered more effective and acceptable (Poortinga, Steg, Vlek and Wiersma, 2003; Steg et al. 2006). Poortinga et al. (2003) also found that high income households were more accepting of technical measures than medium or low income households, no doubt because high income households were better able to afford the initial investment required for technical measures.

### *3.4.3 Waste*

#### *Antecedent strategies*

As with the intervention research on energy and water, commitment has also been used as a strategy to improve recycling participation. Overall, the weight of evidence demonstrates the effectiveness of commitment strategies for increasing recycling in the short term (Burn and Oskamp, 1986; McCaul and Kopp, 1982; Pardini and Katzev, 1983-1984; Katzev and Pardini, 1987; Schultz et al. 1995). Hornik et al. (1995) also

found in their meta-analysis that commitment was strongly related to recycling. However, for most studies, it is open to question whether the effects are sustained over time. Wang and Katzev (1990), for example, showed that households in both individual and group pledge conditions recycled more paper than a control group, however, increased recycling was only maintained at a three week follow-up in the individual commitment condition. Similarly, research by Werner et al. (1995) showed that households who committed to recycling by signing a form participated at higher rates in a kerbside recycling program than those who only received information or contact by telephone or face-to-face about recycling. Verbal commitment was also successful in increasing participation in a kerbside recycling scheme in New Zealand (Bryce, Day and Olney, 1997). On the other hand, DeLeon and Fuqua (1995) found that public commitment was only successful at increasing the amount of paper recycled when it was combined with behavioural feedback. These researchers argue that the lack of significant effects for the commitment only condition may result from all participants signing a consent form, thus, in essence, all participants may have felt they made a commitment to recycling. Research has also shown that commitment often results in greater effects on recycling than other strategies such as prompting or rewards (Schultz et al. 1995).

Information in the form of prompts or normative expectations has also been shown to impact positively on recycling (Hornik, et al., 1995; Schultz et al., 1995). Prompts alone have increased recycling (e.g., Burn, 1991; Oskamp, 1986) but research seems to indicate that they may be most effective when combined with other strategies (e.g., Spaccarelli, Zolik and Jason, 1989-1990). Information communicated through school programs reduced recycling contamination levels and increased recycling participation intentions (Woollam, Griffiths and Williams, 2006). Door-to-door awareness campaigns have increased actual levels of household recycling (Robinson and Read, 2005; Read, 1999).

Research investigating the impact of block leaders on community recycling rates suggests that they can significantly increase participation in recycling (e.g., Burn, 1991; Hopper and Nielsen, 1991; Nielsen and Ellington, 1983). Overall, Hornik et al. (1995) concludes that social influence is moderately related to recycling. The success of social norms for promoting recycling behaviour is likely due to the visible nature of recycling. One question that has yet to be answered is whether community identification moderates the effects of normative information (Schultz et al., 1995). It could be argued that only those who really care about their community and feel part of it will be influenced by the local norms.

Schultz et al. (1995) highlight some limitations of the work conducted on antecedent strategies to improve recycling. These include questions about the long-term effectiveness of the strategies, whether they differentially impact on different types of recycling (e.g., amount, contamination), and whether respondent characteristics such as pre-existing attitudes moderate their effects. A recent study of an up-to-date kerbside recycling programs in regional Queensland by Fielding, McKenna, van Kasteren, and Louis (2009) addresses these limitations and shows that commitment positively impacts recycling and contamination levels for those householders who have initially positive attitudes to recycling. Encouragingly, these positive impacts were evident at the end of a five month intervention period and at a three month follow-up.

### *Consequence strategies*

Early research on the effects of feedback suggests mixed results, with some studies showing positive impacts of feedback (e.g., Katzev and Mishima, 1992) while others did not (e.g., De Young et al., 1995). Studies that have explored the impact of

economic strategies in the form of taxes or incentives generally show that these strategies can be effective. In a Canadian study, user fees on rubbish collection increased recycling levels of all materials except toxic chemicals (Ferrara and Missios, 2005). Incentives in the form of shopping vouchers increased recycling participation rates by 10 to 20 percent in a three month period (Harder and Woodard, 2007). Although research has shown that rewards and incentives can positively impact on recycling, the major drawback of these strategies is that they do not often result in lasting change (e.g., Schultz et al., 1995). Iyer and Kashyap (2007) assessed the relative merit of information and incentive interventions and conclude that both are effective but that information programs appear to have longer term effects than incentive programs. Moreover, Sterner and Bartelings (1999) conclude that although economic incentives can be influential, there are other important drivers of waste management practices.

### **3.5 Summary**

The above review suggests a somewhat different household profile depending on whether the focus is on waste, water or energy. Households who are energy conservers are more likely to be small dwellings inhabited by fewer occupants who are less focused on comfort and more focused on the health benefits of energy conservation. They are also likely to be motivated to conserve energy to save money, make a contribution, benefit themselves or fit in with their social group. Because of the overlap of income, education and dwelling size, it is difficult to disentangle the effects of these factors. What seems likely is that more affluent households use more energy, although there is also evidence that they have greater capacity to engage in green energy programs. Importantly, electricity pricing is likely to have the most impact on energy conservation for those who are most vulnerable to price increases, namely low income families. These findings largely accord with Australian data of energy and water use in Sydney and surrounding regions collected by the Independent Pricing and Regulatory Tribunal (IPART, 2007). That study also found that larger households with higher incomes use more energy, although, it is interesting to note that they also found that significant numbers of low income households were high energy users and vice versa for high income households.

The profile of water conserving households is less clear. It appears that less affluent (i.e., lower income and property value) households at later life stages, with less people conserve more water. Australian data collected through the IPART study (2007) and a report on domestic water consumption in Sydney by Troy, Holloway and Randolph (2005) also showed that socio-economic status impacted household water consumption. It is also likely that high water using households have habits that contribute to their water use such as doing more washing loads and taking more showers. The attitudinal profile of water conserving households is not at all clear suggesting a need for more research that relates psycho-social predictors to actual water consumption and behaviour in the home.

There is substantial literature that can inform the profile of households who engage in higher levels of recycling. Higher income households who have access to a convenient recycling service such as kerbside collection are likely to engage in more recycling. It is clear, however, that demographic variables are not key determinants of household recycling, probably because recycling has become normative and hence there are not great differences in recycling levels between sections of society. It is also worth noting that recycling is not a practice that has significant lifestyle implications in the way that energy and water conservation do. Psycho-socially, households who engage in higher levels of recycling have more positive attitudes to recycling, perceive greater normative support for the practice, and judge that they can

easily engage in recycling. Moreover, recyclers have more knowledge about recycling and feel a greater sense of obligation to recycle, perhaps because they care about their community or would feel negative emotions if they did not recycle. Indeed, to the extent that householders internalize a recycling identity, identity consistent behaviour (i.e., recycling) is assured because to do otherwise has negative psychological consequences.

The review of behavioural interventions also highlights that the efficacy of strategies depends on whether the focus is on waste, water or energy. Long-term household energy conservation may be promoted by raising levels of commitment, providing goals and frequent feedback. Information programs that provide tailored information and raise awareness of social norms are most likely to be successful. A number of studies point to the critical role of social norms for supporting energy conservation and conservation related interventions. The review also highlights the need to explore the moderators of intervention strategies (e.g., existing energy use, dwelling size) as past research suggests that strategies may not be uniformly effective across population groups (e.g., Brandon and Lewis, 1999). At a local level, a program that provided financial and structural strategies to low income households in South Australia to conserve energy was effective at reducing energy consumption and green house gas emissions (Spoehr, Davidson and Wilson, 2006). This latter finding suggests the need to think broadly about intervention strategies and to tailor the intervention to the population for maximum effect.

For water conservation, the review of intervention studies demonstrates the efficacy of technological interventions: installing water saving devices in households resulted in significant water savings. Despite these promising results, it should be acknowledged that the amount of water saved by households in the Geller et al. (1983) study was less than would be expected and Wang et al. (1999) argues that significant water savings can only be achieved if there is widespread uptake of these devices. This highlights two important points. First, there is the potential for householders to compensate for water saving devices by using more water, thus, resulting in lower overall water savings. This suggests the need for interventions involving water saving devices to be combined with other behavioural interventions that highlight the importance of conserving water. Secondly, it is important to develop interventions that will encourage widespread uptake of water saving devices.

The results from the studies focusing on behavioural intervention to promote water conservation are less clear. There were no strategies that consistently resulted in reduced household water use. One difficulty in drawing conclusions from this literature is that in many cases interventions involved a combination of strategies. The only strategies that resulted in substantial and sustained water reductions were prompts that provided information at the point of water use (Kurz et al. 2005) and programs that target overall household sustainability, such as the EcoTeam Program (Staats et al., 2004). The success of these interventions may relate to the 'normative climate' (i.e., whether social norms support water conservation). Strategies that are implemented in supportive contexts or those that foster normative support may be more likely to promote water conservation (cf. Nolan et al. 2008).

A number of intervention strategies have proved effective for increasing recycling participation and actual levels of recycling. The effectiveness of commitment, arguably a strategy that increases engagement with a behavioural practice, accords with the ABS research that interest in recycling is a key driver of recycling (ABS, 2006). Information that raises awareness, communicates normative expectations, and provides reminders can also be effective. Economic strategies may also be useful, however, it is clear that they should not be considered in isolation from behavioural

strategies. At this point it must be noted that although recycling is only one way that households can address waste management in their homes, the majority of the literature is focused on this practice. Research relating to composting, reuse or minimising consumption is relatively scarce. Moreover, the studies that have investigated determinants of recycling relative to other household waste management practices have shown that different determinants underpin the different practices (e.g., Barr, 2007; Ebreo and Vining, 2001).

One important factor to consider when drawing conclusions from the literature is that little of the published research has been conducted in Australia and therefore it is difficult to know whether the general findings from the review generalise to the Australian context, given the cultural, climatic and policy differences that exist across developed countries. In addition to the lack of published Australian data, the review highlights a number of limitations of the current research in this area and suggests directions for future studies.

1. It is clear that many studies do not measure actual energy or water consumption and instead rely on self-reports of consumption or behaviour, or policy acceptance. Similarly, the majority of recycling studies also focus on self-reported behaviour or behavioural intentions. This is an important limitation as the determinants of self-reported behaviour and policy acceptance may be different to actual behaviour and consumption (cf. Poortinga et al. 2004).
2. Research focusing on the psychological determinants of both energy and water conservation—especially as they relate to actual resource use—is limited and there is a need for further, theoretically grounded research on this topic.
3. Although there are many studies that explore the effects of socio-demographic predictors such as age, education and income, there does not appear to be any systematic investigation of the effects of household tenure and household composition on household sustainability practices.
4. The substantial literature on recycling and the relative dearth of literature on other household waste management strategies suggests a need for research to focus greater attention on measures such as composting, reuse and reduction in waste producing products.

## **4 RESEARCH FRAMEWORK**

### **4.1 Introduction**

The present study draws on the well established and extensively used theory of planned behaviour methodology that identifies the costs, benefits, barriers and salient influences underpinning waste/water/energy attitudes and practices at the household level. This research will comprise a comprehensive desk-based review of literature, up to twenty household interviews, and a telephone survey of 600 households across two states.

This multi-method approach is designed to ensure that appropriate data is collected to answer the research questions, and will deliver both quantitative and qualitative understandings of present and changing waste/water/energy attitudes and behaviour, and the drivers of change. Although existing ABS and other data provide a useful starting point, there are clear limitations and gaps in the existing literature that can be addressed with new survey and interview data. The current research represents a theoretically driven, rigorous study of the linkages between attitudes and behaviours and how these linkages can be disaggregated by tenure, household type and SES.

The analytical phases of the study will be informed by a review and assessment of policy/behavioural intervention measures aimed at positively influencing waste/water/energy attitudes and behaviour. The review will be based on existing data and literature and newly generated data, including householders' own evaluations of measures identified. Policy implications and proposals will be framed on the economic viability and efficacy of measures, in terms of their financial costs to householders and governments, benefits, barriers, latitude of acceptance, and perceived fairness to different socio-economic, tenure and household composition groups.

### **4.2 The theory of planned behaviour**

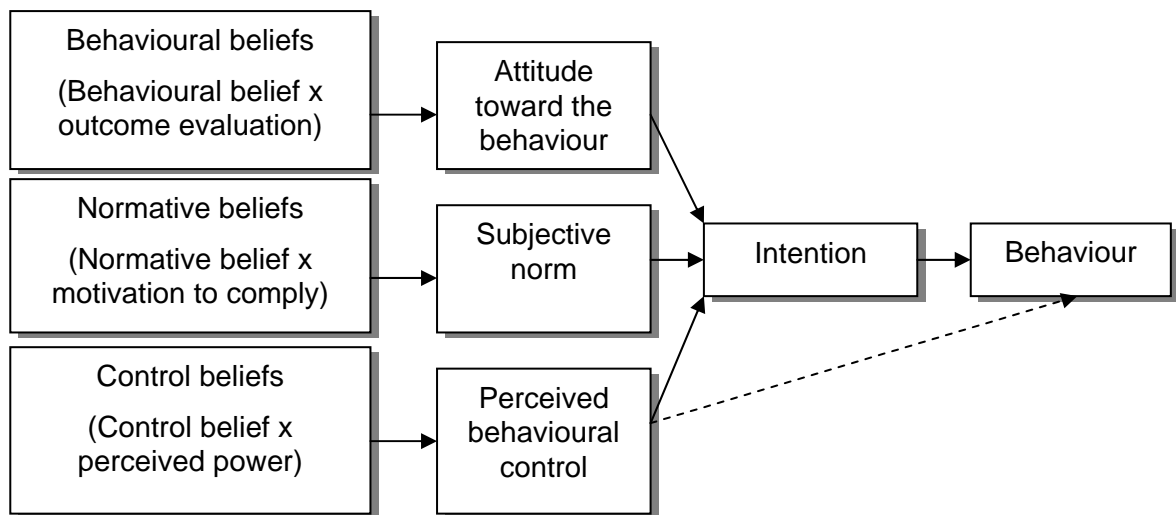
One model that provides a clear theoretical framework for understanding the relationship between attitudinal variables and behaviour and the factors that underpin these is the theory of planned behaviour (TPB; Ajzen, 1991). It is an extensively tested and well-supported model and reviews and meta-analyses conclude that there is broad support for TPB (Albarracin et al., 2001; Blue, 1995; Godin and Kok, 1996; Hagger et al., 2002). It is a parsimonious model with a well established methodology that allows accurate measurement of attitudinal and behavioural variables and the beliefs that underpin these. The elicitation of beliefs about the costs and benefits, barriers and salient influence sources (i.e., referents) that relate to waste/water/energy practices provides concrete information for policy makers striving to develop strategies to positively influence these practices. Note that the TPB has been successfully utilised to develop policy interventions relating to public health issues (e.g., Albarracin et al., 2001). Moreover, the parsimonious nature of the theory ensures scope to extend the model through the inclusion of additional factors to improve its explanatory power and to develop a comprehensive understanding of waste/water/energy attitudes and practices.

According to the TPB, the most proximal determinant of an individual's behaviour is his or her intentions to engage in the behaviour (see Figure 1). Behavioural intentions are in turn predicted by three main components: attitudes, subjective norms, and perceived behavioural control. Attitudes refer to the overall positive or negative evaluation of performing the behaviour. Subjective norms are based on individuals' perception of whether important other people in their life would want them to perform the behaviour, whereas perceived behavioural control reflects the extent to which

individuals perceive the behaviour to be under their volitional control. Thus, to the extent that individuals hold positive attitudes toward, think that there is normative support for, and perceive that they can easily perform, a behaviour, they should have strong intentions to engage in the behaviour.

An important aspect of the TPB is that it goes beyond merely identifying the direct determinants of intentions and behaviour by theorising about the factors that underpin these determinants. According to the TPB, our attitudes are formed via an expectancy value analysis whereby our beliefs that the behaviour will be associated with an outcome (behavioural beliefs) are weighted by an evaluation of the outcomes (outcome evaluations). Our perceptions of normative support (i.e., subjective norms) are thought to be a function of how much we perceive other referents think we should perform the behaviour (normative beliefs) weighted by our motivation to comply with the referents (motivation to comply). Finally, perceptions of behavioural control are proposed to be underpinned by our beliefs about the factors that facilitate or act as barriers to performing the behaviour (control beliefs) weighted by the expected impact that these factors would have if they were to be present (perceived power).

**Figure 1: Theory of planned behaviour model**

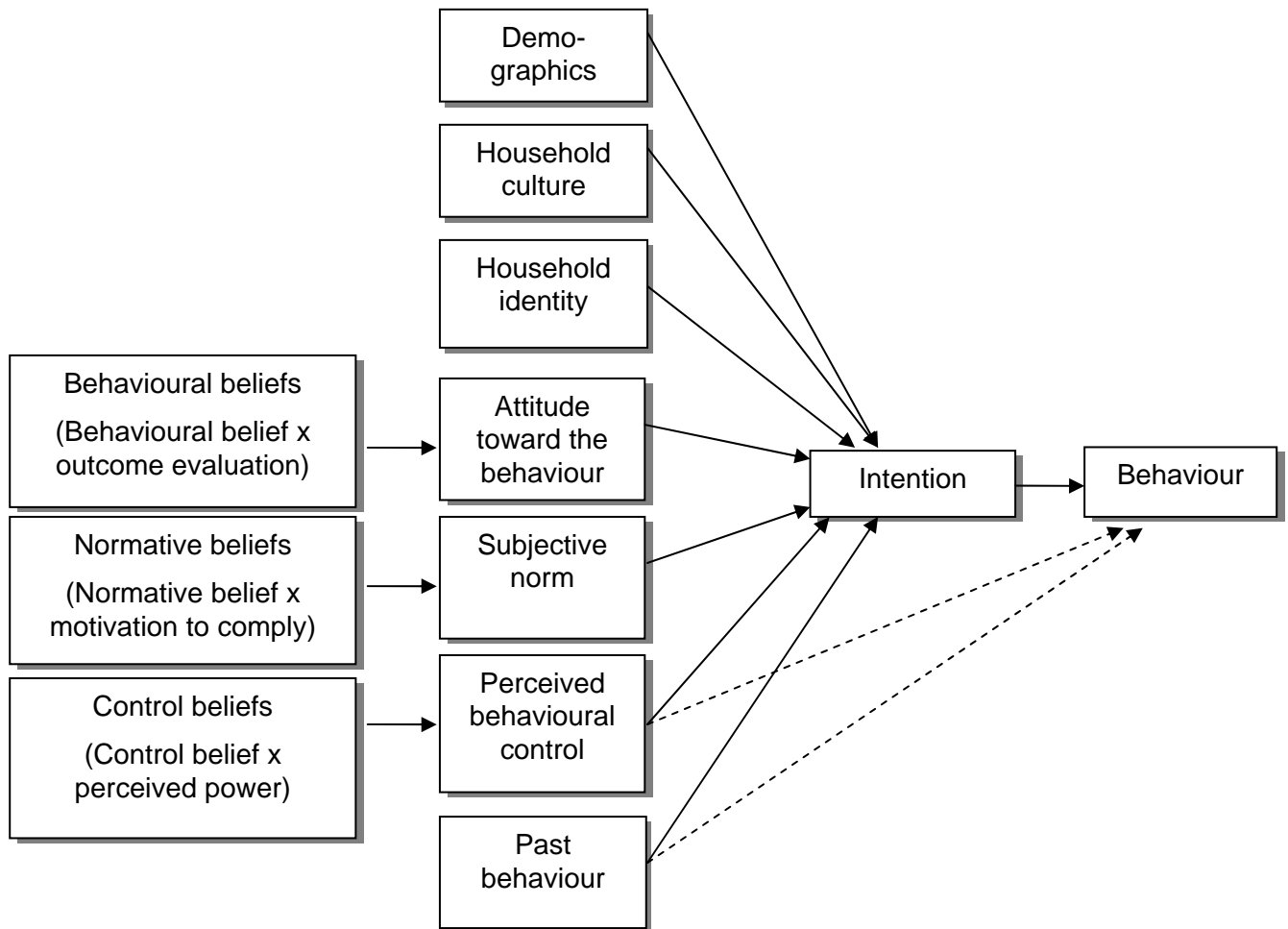


The literature review suggests the inclusion of additional variables to improve the explanatory power of the TPB model in relation to household waste/water/energy practices. Past research has demonstrated that habits, operationalised as past behaviour, predicts intentions and behaviour (e.g., Conner and Armitage, 1998; Ouellette and Wood, 1998). Similarly, the above literature review provided evidence that habits influence water consumption (Gregory and Di Leo, 2003) and recycling (e.g., Carrus, Passafaro and Bonnes, 2008; Cheung et al., 1999; Knussen and Yule, 2008; Knussen, Yule, Mackenzie and Wells, 2004; Terry et al., 1999). In the present study, habits will be measured as the extent of past engagement in household waste/water/energy practices.

As highlighted in the literature review, one of the limitations of the research in this area is that individual psycho-social variables are used to predict household level practices. The current research will seek to address this issue by extending the TPB in two ways. Past research suggests that identity may be an important addition to the TPB model (e.g., Conner and Armitage, 1998; Terry et al. 1999). TPB studies provide evidence that self-identity, for example, as a recycler, green consumer or environmental activist is a significant predictor of environmentally related actions (e.g., Fielding et al., 2008; Mannetti et al., 2004; Sparks and Shepherd, 1992). In the

present study we extend on this research by investigating the role that household identity (e.g., as an environmentally sustainable household) plays in predicting waste/water/energy practices. In addition, a measure of the extent to which there is consensus and cohesion, in other words a family culture, around waste/water/energy practices will also be included. These additional factors will assess the extent that household dynamics, in the form of identity and culture, play in household sustainability. Finally, demographic variables will also be included in the model to explore their contribution. The expanded TPB model is shown in Figure 2. The model depicts only the direct impact of the variables, but it is worth noting that according to the TPB indirect impacts (i.e., mediation) should also be observed. The survey data will facilitate analyses of indirect influence via mediation as well as direct/unique contributions.

**Figure 2: Expanded theory of planned behaviour model**



### 4.3 Research strategy

#### 4.3.1 Phase 1

In the first phase of the research a review of the most recent ABS surveys was conducted to identify current waste, water and energy practices in Australian households and how they have changed over time. In addition, a review of national and international scholarly literature was conducted to identify psycho-social and socio-demographic factors that influence waste, water and energy practices and behavioural interventions that have been used to change these practices. The review identifies factors that may be important drivers of household waste/water/energy attitudes and practices and interventions that may be effective for promoting more



sustainable practices. A consideration of the intervention literature in combination with the review of the policy context points to major behavioural and policy strategies that may be effective for promoting household sustainability. The literature review also highlights a number of theoretical and empirical gaps in the existing literature that can be addressed by the remaining phases of the research.

The review conducted in Phase 1 addresses Research Questions 1 to 4 and 6.

#### 4.3.2 Phase 2

The second phase of the project entails a survey of 600 households in Queensland and Victoria. The proposed sample size of 600 is not large enough to disaggregate across geographic regions (i.e., metropolitan, regional, rural), therefore, the surveys will be conducted in each state's major metropolitan centre: Brisbane and Melbourne. Queensland and Victoria were chosen as the sites for the research in an attempt to capture samples from two geographic and climatic locations, with potentially different policies to account for any differences that these variables may have. The sample will be stratified according to household tenure (renters vs owners), household composition (single person/couple vs families with children), and socio-economic status (high, medium, low), with three hundred households in Melbourne and 300 in Brisbane recruited into the sample.

The survey will be framed by the expanded TPB model and will therefore assess the following constructs in relation to energy conservation, water conservation, and waste management practices:

- Attitudes towards the practices.
- Subjective norms (i.e. perceived support from important others to engage in the practices).
- Perceived behavioural control.
- Behavioural Intentions.
- Self-reported past behaviour (to assess the role of habit).
- Household identity (i.e., as an environmentally sustainable household).
- Household culture relating to waste/water/energy.
- Socio-demographic information including age, gender, education level, household income, number of usual household occupants, household composition, household tenure, dwelling and garden size (subjectively rated by respondents as small, medium, or large).

Note that there are established guidelines for the measurement of TPB variables that will be followed as far as practicable to ensure the rigour of the research.

In addition to the TPB variables, the survey will also include:

- A set of questions that assess drivers of change of household waste/water/energy practices (as identified by the household interviews). Respondents will be asked to assess to what extent they think each factor has changed their attitudes and practices over the past 5 year period.
- A set of policy/behavioural intervention options (as identified by the desktop review) will be presented to respondents (e.g., low cost green loans, in home audits). Participants will be asked to indicate the favourability, level of acceptance and perceived fairness to societal groups (low income households, elderly, etc) of each option.

Finally, past and future water and energy usage data will be obtained through the relevant water authority and energy companies (Residents or landlords will provide consent for researchers to access this information). In both Queensland and Victoria renters pay for their water use, allowing us to access this data for all respondents regardless of their tenure. If respondents live in non-metered dwellings however, there is no way to accurately assess water use. For these respondents only behavioural intentions can be measured. Similarly, it will not be possible to collect behavioural data for waste management. For this domain, self-reported past behaviour and behavioural intentions will be used as the behavioural measures.

Data analysis will include t-tests and Analyses of Variance to compare socio-demographic groups (e.g., renters vs owners, low, medium, high SES) on all of the key variables (e.g., attitudes, change factors, policy acceptance). Multiple regression analyses will be conducted to assess the TPB model in relation to waste management, and energy and water use intentions and behaviour. The inclusion of the socio-demographic variables in the model will also reveal the extent of the relationship between these variables and waste/water/energy intentions and behaviour and whether any effects of the socio-demographics may be mediated by the psycho-social factors.

The data analyses will provide the following information:

- Whether there are any significant differences between socio-demographic groups on the psycho-social predictors of waste/water/energy intentions and behaviour.
- Whether there are any significant differences between socio-demographic groups in terms of waste/water/energy practices (e.g., actual consumption and self-reported behaviour).
- Whether the socio-demographic groups differ in their perceptions of the factors that drive changes in waste/water/energy practices.
- Whether there are any significant differences between socio-demographic groups in terms of the acceptability of policy/behavioural interventions.
- The relationship between the psycho-social predictors and intentions and behaviour (self-reported or actual).
- Whether there is a relationship between the socio-demographic predictors and intentions and behaviour (self-reported or actual).
- The relative importance of the socio-demographic and psycho-social predictors for waste/water/energy intentions and behaviour (self-report or actual).
- Whether there are differences between waste/water/energy in terms of the factors that predict intentions and behaviour (self-reported or actual).

Phase 2 of the research project addresses Research Questions 1 to 6.

### *4.3.3 Phase 3*

In the third phase of the project twenty four in-depth interviews will be conducted in Brisbane and Melbourne. The interviews will be conducted in-situ with all members of the household present. The sampling strategy will be to recruit twelve households in each city that vary in terms of tenure (renters and owners), socio-economic status (high, medium, low SES), and household composition (single person/couple households and households with children). This number of interviews allows us to explore whether beliefs, attitudes, and practices vary across socio-demographic groups. Households will be recruited from the survey (participants will indicate whether they would be interested in taking part in future research). Behavioural data

for the households will already be gathered in relation to the survey conducted in Phase 2.

A structured interview schedule will be used that draws on TPB recommendations for eliciting behavioural, normative and control beliefs. In relation to waste/water/energy practices, participating households will be asked about the advantages and disadvantages (i.e., costs and benefits), the people or groups who approve or disapprove (i.e., the salient referents) and the factors that facilitate or act as barriers (control beliefs). The interviews will also include questions that explore household dynamics around waste/water/energy practices (e.g., household culture and identity). In addition, householders will be asked about whether their practices have changed over time and what reasons there might be for changes (or lack of change).

Finally, the acceptability and fairness of policy and behavioural interventions will be assessed by presenting households with the policy/behavioural interventions that have been identified from the desktop review of scholarly literature and current policy approaches. Householders will be asked whether they think the interventions would help them to be more sustainable (why or why not) and whether they felt the interventions were fair to societal groups (and why or why not). There is also the potential for other questions to be included in the interviews that follow up on the findings of the survey.

The interviews will be recorded and transcribed. A thematic analysis will be conducted to identify the major themes emerging in response to each set of questions. Data from this phase helps to address Research Questions 1 to 6.

## 5 SUMMARY AND CONCLUSION

Governments around Australia are currently implementing a range of policies to promote household sustainability. These policies aim to minimize waste and promote household water and energy efficiency by providing information (e.g., websites), low cost tailored feedback (e.g., in home audits), convenient structural solutions (e.g., kerbside collection) and by mitigating financial costs associated with sustainability practices (e.g., rebates, low cost loans). Although these strategies are likely to impact positively on household sustainability, past research suggests that household sustainability practices are determined by a complex set of beliefs and attitudes, and a fuller understanding of these factors could help to optimize policy approaches. Moreover, research also suggests that policy and behavioural strategies aimed at promoting household sustainability are likely to be differentially effective across socio-demographic groups.

This project represents a comprehensive exploration of the waste, water and energy practices of Australian households. The present paper, encompassing a desktop review of relevant policy, ABS data, and scholarly national and international literature, is a first step in the research process. The policy review highlights the ways in which governments are currently striving to promote household sustainability. The ABS data provides information about the existing waste, water and energy practices of Australian households although, in the main it does not explore the psycho-social determinants of these practices or the factors that might be motivating change. The review of national and international literature goes some way to developing a preliminary understanding of the social, demographic and psychological determinants of household waste, water and energy practices and the behavioural interventions that might help to promote more sustainable practices in these areas.

Importantly, the desktop review has identified a number of limitations in the existing literature that the current project can help to address. There is a dearth of research examining the psycho-social determinants of household energy and water practices, and much of the research that exists has not linked the psycho-social data to objective measures of consumption. Although there are many studies exploring the impact of demographic variables, household tenure and household composition has received much less attention in the literature. Much of the research on waste has focused on recycling suggesting the need for a broader approach to waste minimisation. Moreover, much of the research conducted to date has not focused on the Australian context.

The current project will help to address the limitations identified by the desktop review. It draws on the well established theoretical framework of the theory of planned behaviour to investigate the beliefs (costs, benefits, facilitators, barriers, salient influences), psycho-social and socio-demographic factors that relate to household waste, water and energy practices. When it is possible, demographic and psycho-social factors will be linked to objective measures of household behaviour. The samples will be recruited to ensure that we are able to investigate the effect of household tenure and household composition. In addition, the project will explore the drivers of change in household practices and evaluate the acceptability of change strategies. Overall, the data will provide important information about how environmental sustainability can be achieved in households in a way that is perceived to be most acceptable and equitable to the community.

The project addresses the following research questions:

→ What are Australian householders' waste/water/energy attitudes and practices?

- Are there differences in these across socio-economic groups and according to tenure (owners vs renters) and household type (e.g., single person vs couple with children)?
- How have waste/water/energy attitudes and practices changed over time?
- What factors have driven changes in household waste/water/energy attitudes and practices?
- What is the relationship between householders' waste/water/energy attitudes and practices (i.e., behaviour) and does this relationship vary according to SES, household type, tenure or behavioural domain?
- What are the most effective ways of shaping positive change in household waste/water/energy perceptions and behaviour and what are the costs and benefits of these approaches for stakeholders?

The subsequent phases of the project—the quantitative survey and interviews—will help to address each of the above questions. The quantitative survey data will explore the link between attitudes and practices, the drivers of change, and the acceptability of policy interventions. It will also allow an examination of this data across demographic groups. The qualitative data will identify the important beliefs associated with waste, water and energy practices, and allow an in depth exploration of the impact of household culture and dynamics.

It is expected that the present research will provide the following policy relevant information:

- The key psycho-social and socio-demographic influences on household waste/water/energy practices.
- Identification of the drivers of change in household waste/water/energy practices.
- Acceptability of policy/behavioural interventions relating to household waste/water/energy practices.
- An understanding of how waste/water/energy attitudes and practices may vary across socio-demographic groups.

In so doing, the research will contribute to both understanding and improving the sustainability of household decision making around water, energy and waste in Australia.

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