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Energy Consumption and the Built Environment: A Social and Behavioural Analysis

Bill Randolph
and Patrick Troy

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TABLE OF CONTENTS

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EXECUTIVE SUMMARY

Approach and Method

The research on which this report is based seeks to explore the extent to which two key dimensions of Australian cities – their built form (in particular, dwelling type) and the socio-behavioural characteristics of households - influence the pattern of domestic energy (electricity and gas) consumption across the city. The approach and method of the research, and the layout of this report, follows closely that of a parallel study of the socio-behavioural aspects of domestic water consumption in Sydney published previously (Troy and Randolph, 2006)[1]. These interlinked projects, looking at water and energy consumption in different forms of residential built environment was funded by the NSW Environment Trust. This report and the research on which it is based, was the first systematic attempt to understand the behavioural aspects of the energy consumption of households in different kinds of dwellings in Sydney during the current period.

The research incorporates both quantitative and qualitative research methods. The former involved a large-scale telephone interview survey that generated detailed information about the water and energy consumption behaviour of a stratified random sample of 2,179 households, the dwellings they occupy, their socio-economic profile, and the range of equipment and facilities they use in their dwellings. The latter approach involved conducting 5 focus groups drawn broadly from the areas included in the survey which explored attitudes and behavioural aspects of the research in more depth. The research was undertaken during the period December 2004 and May 2005.

Summary of Quantitative Research Findings

The composition of households

Overall, respondents living in houses had larger households, they were older and were also likely to have higher household incomes than other households. They were more likely *not* to be in the labour force (i.e. at home or retired), but they had the lowest unemployment rate for those in the labour force. They were the least mobile and also much more likely to be home owners or buyers.

Respondents in low rise flats were the most likely to be working, but were also the most likely to be unemployed and to have lower incomes than households in other dwelling types. They included the largest proportion of single person households, which helps explain their lower income levels. They were generally younger than respondents in houses or semis, but compared with those in high rise flats, the proportion aged 35 to 55 was significantly larger.

Respondents in high rise flats were the youngest group but had relatively higher incomes, especially in relation to those in low rise flats. At the same time, the proportion over 55 years was higher than those in low rise flats. These findings

[1] Troy, P. and Randolph, B. (2006) *Water Consumption and the Built Environment: A Social and Behavioural Analysis* Research Paper No 5, City Futures Research Centre, Faculty of the Built Environment, University of New South Wales.

indicate both a large youthful market but also an older ‘empty nester’ and higher income market in this sector. They were also the most mobile, with 61% having moved into their current home within two years of the survey.

The profile of respondents living in semi-detached housing lay somewhere between those in houses and those in flats, suggesting a more diverse sector.

The characteristics of dwellings

Two out of three respondents (67%) owned or were buying their homes, while a quarter were renting privately and 5% were renting form a public landlord. While 81% of houses were owned or being bought, the proportion fell to 58% for semi-detached houses and to just 38% for flats. Over half the flats (55%) were rented privately.

Semis and high rise flats were generally the most recently constructed, with 26% of the former and 31% of the latter having being built since 1991.

Approximately one in eight respondents living in high rise flats were unable to recall either their electricity or gas supplier’s name.

Overall, 42% of respondents said they were connected to the gas mains. All respondents had electricity.

Respondents living in low rise flats were most likely to use electric stoves/cook tops as their main cooking method (60%) and were least likely to use gas (19%), reflecting a lower rate of connectivity to gas supplies for older low rise flat blocks.

Around one in ten residents of low rise flats reported not having the means to heat or cool their homes.

The most common forms of cooling were electric fans used by 56% of respondents and reverse cycle air conditioning (42%) and electric heaters (40%).

Electric heaters were the predominant form of heating used by 40% of respondents. This varied between 54% for flat dwellers to 36% for house dwellers. Only 25% used gas for heating purposes.

Air conditioning was much less prevalent in flats and semis than in houses. While almost two thirds of houses had some form of air conditioning, the proportion fell to 30% for semi-detached houses and to just 20% for all flats.

As many as 16% of respondents said they didn’t use any method to cool their home in hot weather.

15% of people in flats used a communal hot water system, a figure that rose to almost a quarter (24%) of high rise flat dwellers.

One in five (20%) of respondents said they own or have access to a swimming pool in their property, the vast majority of these being house dwellers and those in high

rise flats. While 20% of pools in houses were heated, the figure rises to 54% for high rise flats.

Attitudes to conservation

There was overwhelming confirmation of the importance in which energy conservation is viewed: 82% said it was very important and a further 14% rated it as somewhat important.

Respondents did not perceive key stakeholders as having a strong interest in conservation overall. The perception was that government was less interested in conservation issues than the utility companies themselves, and only 37% said they thought energy companies took conservation seriously. Few considered that local businesses took a serious interest in conservation.

Energy conservation in practice: How are households reducing energy use?

There was little evidence to suggest that energy reduction practices were widespread. Where they had been adopted, they generally involved only a minority of respondents. Actions to reduce energy were comparable across all dwelling types.

Beyond saying they turn off lights in unused rooms (58%), only around one in five respondents at most had taken other forms of action to reduce energy use. Reducing heating or cooling in unused rooms, turning off standby buttons and buying energy efficient light globes were reported by between 17% and 21% of respondents. Investing in energy efficient appliances was reported by one in eight.

With three quarters saying they intended to take some action to reduce energy use in the next 12 months, there was clearly a much higher potential for greater energy saving behaviour among respondents. Over 70% said they were prepared to reduce room heating and to purchase energy efficient appliances. Reduced room cooling in hot weather was the least favoured action, although a clear majority (60%) said they would consider this.

Attitudes to energy usage, pricing and conservation in the home

When asked whether they knew how much electricity or gas they used in a quarter, only around three in ten said they did: 33% of electricity users and 27% of gas users.

Flat dwellers were significantly more likely to say they knew how much energy they used than house dwellers (42% compared with 29%). This may well reflect the fact that this is the one utility cost that flat dwellers actually pay directly, and hence are more likely to be aware of this item of expenditure than households with multiple bill payments.

Most Sydneysiders think they use average or below average amounts of energy in their home, with just 12% saying they thought they used above the average amount of electricity and just 8% of gas consumers saying they used above average amounts of gas. On the other hand, 40% of electricity users said they used below average

amount of electricity, while 51% of gas users thought they used below average amounts.

Pricing policies were adjudged fair by two thirds of electricity users and three quarters of gas users. At present, therefore, there are relatively few complaints about current prices. But only a third though current prices encouraged conservation of energy in the home. On the other hand, there were clear majorities in favour of differential pricing for both heavier electricity and gas users. There was little variation in attitudes across the four dwelling categories for either gas or electricity users, indicating a broadly consistent level of support for differential pricing across the population.

But paradoxically, despite support for differential pricing, only a minority supported increasing prices to encourage lower electricity or gas use. This was consistent across all dwelling types. Of those who did support such a policy, roughly four in five thought an increase of between 1% and 10% would be sufficient. There was little support for major energy price increases to assist in reducing energy consumption or improved conservation policies and outcomes.

The potential for using energy saving devices and equipment in the home

Respondents were asked if they would be prepared to use energy saving devices under different levels of subsidy. The results show that support by government for such devices could be critical in promoting more general acceptance and take up. Potential uptake of energy saving devices increased substantially if the costs of buying or installing such products are at least half subsidised. Indeed, only a relatively marginal additional take-up appears to be achieved by fully subsidising such devices. Respondents seemed content to meet at least some of the cost of such devices themselves.

Summary of Qualitative Research Findings

Confirming the findings of the survey noted above, households generally had a highly inaccurate impression of their energy consumption. Flat dwellers believe that heating water is the most significant aspect of their energy consumption. House dwellers rate energy consumption for house heating and cooling as similar to hot water services. All households seem surprised to learn how little energy is used in lighting and cooking and they also question the high proportion of their consumption attributed to hot water services.

House dwellers believe that the greatest determinant of how much energy is used by a particular household is the size of their house and its structure, layout and aspect. In complete contrast, flat dwellers believe that energy consumption among flat dwellers varies with their level of awareness, attitudes, beliefs and behaviour. Regardless of their dwelling type, households with teenagers and children believe that their high consumption is due to the behaviour of the children and teenagers.

Socio-demographic and cultural factors were generally thought to be a greater influencer on how much energy is used in a household rather than dwelling type or household structure. Households comprising better educated people with greater understanding of the relationship between personal consumption and the short and

long term environmental impacts; a responsible, community focus, a caring attitude and a willingness and ability to change their ways were perceived to be more likely to use less energy than those with opposite qualities. However, this perception is largely not supported by other research. The relative lack of coverage of issues relating to non-renewable energy sources and the impact of greenhouse gas emissions in domestic energy consumption compared with the situation with water consumption means that householders are less likely to be aware of both the issues and the options open to them of effectively reducing energy use.

Participants generally had no idea of the price per kilowatt hour (kWh) of electricity or gas, although some have an idea of the cost of their quarterly electricity bill. The actual rate of between 9.7c and 9.9c per kWh for electricity and from 0.7c and 1.2c pr MJ for gas was meaningless to them. They had no sense of whether it offers value for money, but nevertheless most felt that it is reasonably priced and certainly too cheap to motivate saving. The only time the cost of electricity is even considered is when the bill arrives but it is soon forgotten once the bill is paid.

Because the unit of electricity measurement (kWhs) was meaningless to them, householders generally had no idea how much energy was used by the average person in Sydney per year. Their estimates of consumption range from 200– 51000 kWhs per year. The actual figures of 2600kWh per house dweller and 2050kWh per unit dweller were meaningless to participants. They were unable to even guess how much electricity or gas they used in their own home and certainly didn't recall the figure from their energy bills. All they were concerned with was the actual cost of the quarterly bill and then only when it is bill paying time.

Participants believed that the information provided on Energy Australia's, AGL's and Integral Energy's bills is as meaningful as it needs to be. Most are only interested in how much they actually have to pay which is clearly stated on the front page of their bill. They find that the 'daily use average' reported on the bill is useful as this enables them to compare consumption with previous bills - in contrast with consumption reported in kWhs.

While participants were familiar with a plethora of large and small scale energy saving initiatives, the propensity to implement them varies widely according to individual circumstances, including their awareness, understanding, beliefs and attitudes as well as their dwelling type and tenure.

Participants were more readily able to suggest energy saving initiatives that relate to water heating, home heating & cooling and lighting than they are to cooking or refrigeration. In each of the six main domestic energy using categories, the most popular initiatives to reduce energy use included:

- WATER HEATING: only using the dishwasher and washing machine when full, always making sure hot taps are turned off fully and only using hot water when it is really needed.

- HOME HEATING & COOLING: hanging heavy curtains & pelmets to keep the heat out, installing roof &/or wall insulation and wearing warm clothes instead of putting on the heater.

- REFRIGERATION: reducing frequency of opening fridge door; buying an energy efficient fridge with a top star rating and getting rid of the 2nd fridge if it is rarely used.

- LIGHTING: installation of energy saving light bulbs, putting sensors / timers on outside lights and positioning outside sensor lights so they are not unnecessarily activated by neighbours or wildlife.

- OTHER APPLIANCES: replacing old inefficient appliances with new ones with high energy star ratings, turning appliances off when not in use rather than leaving on standby and filling the dishwasher and washing machine to capacity before putting it on.

- COOKING: none emerged as significantly more popular than others.

The overlap in some categories illustrates the fact that some initiatives apply to more than one category and highlights the fact that only a small number of initiatives will actually be implemented, e.g. not putting washing machines and dishwashers on until they are full.

Increasing the price of energy is acknowledged as one means of encouraging more careful use of energy. However, participants deemed this unlikely to be effective due to difficulties in persuading non-bill paying members of the household to reduce their consumption. The desire for comfort and convenience tends to over-ride any motivation to be careful with energy consumption even if the price was increased. The link between using an electricity powered appliance and paying for it is often too tenuous to enable decisions over its use to be effectively made.

Price increases of between 25 -50% would be needed to lead to energy saving. The ability of any size of price increase to lead to energy saving behaviour seems likely to be determined by individual circumstances including amount of disposable income, attitudes towards the environment, ability to curtail the energy using behaviour of other members of the household and desired level of comfort and convenience.

While the ability of increased energy prices to curtail energy consumption was thought to be limited and bound to be unpopular, alternative ways of encouraging energy saving were more widely supported. These included:

- Much better education on how to save energy and how much money can be saved.

- Encouraging the purchase and installation of energy efficient appliances

- Enhancing overall concern on environmental matters

- Penalising heavy users with surcharges and other penalties, but ensuring that the poor and families were not unfairly penalised

- Government could set much better example in terms of energy saving policies

A series of barriers to achieving energy savings in the home were also identified, including:

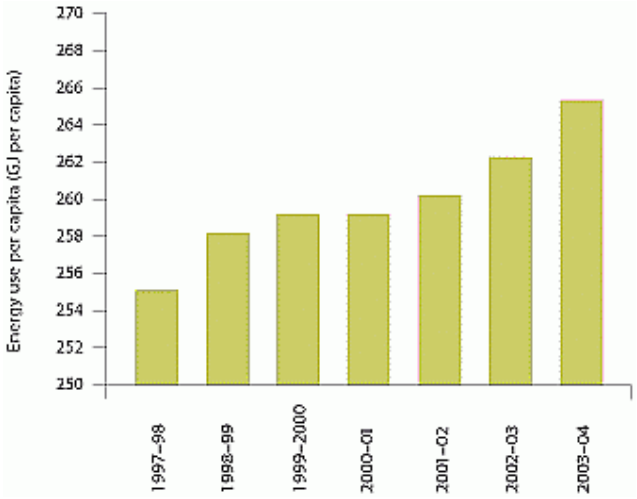
- Poor understanding of the costs and benefits of installing energy saving appliances or adopting energy saving behaviour.
- Saving energy is simply not a priority for many
- Energy saving alternatives are unappealing or impractical
- Lack of awareness of how to save energy
- Particular problems faced by renters and flat dwellers

PART 1: INTRODUCTION

1.1 Domestic energy demand and greenhouse emissions

There is increasing public concern over the ecological sustainability of Australian cities. Part of this concern is reflected in increasing attention being paid to issues of global climate change and to the way we exploit energy resources in our homes, particularly electricity. Electricity demand has grown consistently: in the quarter of a century to 2000, annual electricity generation grew by an average over 5% per annum across Australia and per capita consumption is expected to grow further (Jessup and Mercer, 2001). Overall, per capita energy consumption across Australia has increased in the last decade, and at an accelerating rate (see Figure 1.1)[2]

Figure 1.1: Energy use per capita, Australia, 1997-98 to 2003-04



Source: Australian State of the Environment Committee (2006)

While representing only part of the total energy consumption that takes place in urban areas, domestic energy use nevertheless accounts for a major component of the environmental impact of urban growth, not least because it reflects entrenched and complex attitudes to the use of energy within the broader society. In 2002 the residential sector in NSW was estimated to be responsible for 16.5 million tonnes of carbon dioxide (CO_2), the main greenhouse gas, emissions and consumed 23% of all electricity generated in the State (NSW Greenhouse Office, 2005). In terms of greenhouse gas emissions, given that electricity generation was itself 94% reliant on fossil fuels (Jessup and Mercer, 2001)[3], this domestic energy use can almost entirely be counted as having a direct impact on global greenhouse emissions (Lenzen, *et al*, 2004). Moreover, greenhouse gas emissions relating to energy use increased by 25% between 1990 and 2002, and accounted for almost half of all NSW CO_2 emissions

2 Australian State of the Environment Committee (2006) Australia State of the Environment 2006, Independent report to the Australian Government Minister for the Environment and Heritage, Canberra.

[3] Jessop, B. and Mercer, D,. (2001) Energy policy in Australia: a comparison of environmental considerations in New South Wales and Victoria, *Australian Geographer*, 32, 1, pp 7-28.

(NSW Greenhouse Office, 2005). Overall, the average Australian household is now responsible for about eight tonnes of CO_2, per year (NSW Greenhouse Plan, 2005)[4].

The growth in demand for energy is directly linked to increasing affluence. It is a commonplace now that households now consume more energy than those of two or three generations ago. Hot water services are now widely installed and used in showers compared with the average households of pre-1940 Sydney. Moreover, the convenience of the ubiquitous modern hot water system has meant daily showering is the norm rather than more restrictive periodic bathing practiced by populations of earlier periods, greatly increasing domestic energy consumption. The same generational changes have occurred with a wide range of domestic appliances. Home heating and cooling systems have become commonplace as have a plethora of kitchen appliances such as the electric toaster, mixers, juicers, sandwich makers, coffee makers, electric fry-pans and a wide range of home entertainment facilities such as radios, DVD and CD players, televisions, computers and play stations etc all of which have dramatically been 'taken up' by households and substantially increased the 'operational energy consumption' of dwellings. The dwellings themselves have changed and are built using more materials, fixtures and fittings manufactured or fabricated from elaborately transformed minerals that embody large amounts of energy. In this report we do not measure the embodied energy component of consumption (see Pullen, *et al*, 2006)[5], although we note that the increased use of materials such as glass and insulation may directly influence the level of operational energy consumption in a building.

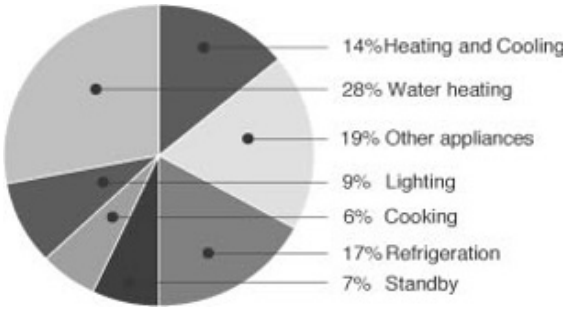
As a result, households have been increasing their use of energy substantially in recent decades, as the figures quoted above indicate. As Figures 1.2 and 1.3 shows, space heating and cooling and water heating account for two thirds of all household energy use and 42% of estimated greenhouse gas emissions generated in the home (Australian Greenhouse Office, 2005) [6].

[4] NSW Greenhouse Office (2005) *New South Wales Greenhouse Plan*. http://www.greenhouse.nsw.gov.au/climate_change_in_nsw/greenhouse_plan Downloaded 14 March 2007

[5] Pullen, S., Holloway, D., Randolph, B. and Troy, P. (2006) *Energy profiles of selected residential developments in Sydney with special reference to embodied energy*, Proceedings of Australian & New Zealand Architectural Science Association (ANZAScA) 2006 40th Annual Conference 'Challenges for architectural science in changing climates', 22-25 November 2006.

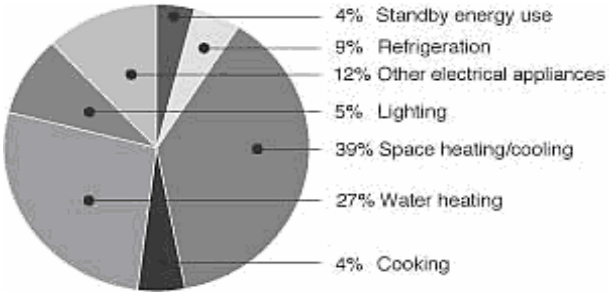
[6] Australian Greenhouse Office (2005), *Your Home Technical Manual, Third Edition*, Canberra. http://www.greenhouse.gov.au/yourhome/technical/index.htm, Downloaded 12.2.2007

Figure 1.2: Greenhouse gases from home energy use (1999)



Source: Australian Greenhouse Office (2005)

Figure 1.3: Energy use in the average Australian home (1999)



Source: Australian Greenhouse Office (2005)

1.2 The social drivers of energy demand: why behaviour matters

Much of the debate on energy demand management is focused on aggregate measures of energy consumption and of the technical or economic aspects of managing demand for these resources. While this is an essential level of debate when trying to negotiate international agreements or develop urban planning interventions, it has little purchase on the *actual* consumption behaviour of individuals and households that is the prime source of the stresses we create in the natural systems on which our cities depend. It also leads to demand management policies, such as broad brush pricing proposals, that overlook the complexity of household behaviour and attitudes that lie behind observed patterns of energy use in the home.

Despite the obvious importance that understanding the behavioural drivers of demand for energy might play in developing appropriate energy management policies, since the 1940s most of the focus of national energy policy has been on the supply side. That is, for over half a century governments have tended to accept the increasing demand for energy as though it was 'inevitable' and have sought to meet

predicted demand by increasing supply through the development of new power generating plants and larger capacity reticulation networks. The predominant management approach of responding to predicted increases in energy demand by simply adding more capacity means that demand management approaches have been underplayed. The current response to the challenge of reducing the greenhouse emissions associated with energy generation has predominantly focused on developing supply side 'technical fixes' such as measures to burn fossil fuels more efficiently or to find alternatives to fossil fuels for electricity generation[7], rather than to focus attention on how we might significantly reduce the overall consumption of, and therefore demand for, energy. At the national level at least, the preoccupation has remained with the 'technical fix' to maintain supply rather than the task of changing the behaviour and consumption patterns of consumers, be they households, businesses or governments. This is despite the efforts made within states to change consumption behaviour with consumer focused campaigns on greenhouse emission reduction and energy conservation policies, such as BASIX[8] and the Energy Smart[9] initiatives in NSW.

In recent years, research into the social and behavioural drivers of domestic resource consumption has attempted to unpack this issue with a view to informing more nuanced environmental policies that respond to the complex behavioural aspects of domestic energy demand. Gilg and Barr's (2006)[10] study of the attitudes and actions of households towards water and energy conservation in Devon, UK, showed that there were clear behavioural differences between distinctive groups of the population, defined by socio-demographic and attitudinal factors. Those more disposed towards conservation generally were much more likely to adopt practices in their own homes that reduced water and energy use. Age and socio-economic status were also deemed to be important – with older households, those with higher educational outcomes and home owners more likely to adopt conservation practices in the home. Renters were less likely to be committed to conservation behaviour.

Gilg and Barr found that three factors were critical in terms of policy making to encourage conservation practice: "*behavioural complexity*" factors whereby actions that were seen to be habits and therefore susceptible to change could be targeted in addition to factors that were beyond the household's capacity to affect, such as the landlord-tenant relationship; '*behavioural groupings*' where specific groups of the population could be identified whose attitudes to conservation behaviour could be changed by targeted campaigns; and "*lifestyle types*' where specific sub-groups such low income public housing tenants could be targeted for specific interventions to change their energy and water use behaviour. Policy makers therefore need to recognise the behavioural complexity with which households approach the issue of resource conservation and develop more sophisticated and segmented approaches to managing energy demand among domestic users.

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7 Department of the Prime Minister and Cabinet (2006) Uranium Mining, Processing and Nuclear Energy – Opportunities for Australia, Australian Government, Canberra. http://www.pmc.gov.au/umpner/docs/nuclear_report.doc. Downloaded 14 March 2007.

8 NSW Department of Planning Sustainability Unit. http://www.basix.nsw.gov.au/information/about.jsp Downloaded 18 March 2007

9 NSW Department of Energy, Utilities and Sustainability (2007) Energy Smart Homepage, http://www.energysmart.com.au/les/ Downloaded 18 March 2007.

10 Gilg, A. and Barr, S. (2006) Behavioural attitudes towards water saving? Evidence from a study of environmental actions, Ecological Economics, 57, pp 400-414.

In one of the few studies of the relationship between the social and spatial outcomes of the use of energy by Sydney's population, Lenzen *et al* (2004)[11] show that lifestyle, socio-demographic factors and the degree of 'urbanity' all have consequences for total energy use. They found that incorporating both the direct energy consumed by households in the home with indirect uses, such as travel and the energy embodied in the goods and services consumed by households, energy use per capita was higher in the inner, more density developed and more affluent areas of Sydney compared to the middle and outer areas. These findings are challenging in the context of urban growth management policies being pursued by the state governments across Australia that take it as a given that higher density urban renewal will deliver distinctive benefits in terms of environmental sustainability goals, an assumption mirrored by other metropolitan strategies[12]. Put crudely, higher density is deemed to be intrinsically more environmentally appropriate, primarily due to its impact on transport use, but also in terms of lower resource consumption by the smaller households deemed likely to live in this kind of accommodation.

1.3 Energy use and urban density

Much is therefore being assumed about the environmental benefits of a shift to higher density dwellings in current metropolitan planning proposals. However, conclusive research to substantiate these claims remains elusive. For example, Myors, *et al*¸ (2005)[13] have shown that *per capita* greenhouse emissions from high rise flats in NSW, at 5.4 tonnes of CO_2 per year, are significantly higher than those for other forms of housing and are substantially higher than the NSW average of 3.1 tonnes per year (Figure 1.4). While not specifically focusing on dwelling type *per se*, research by Foran (2006)[14] has show household greenhouse emissions in Canberra and Perth, based upon an assessment of total household energy consumption, is higher in inner city locations compared with suburban locations. This analysis includes both consumed energy for power and transport, but also embodied energy consumption in consumables and the buildings. Foran's analysis suggests strongly that urban density is positively related to total greenhouse gas emissions, with the implication that higher density areas *less* environmentally sustainable.

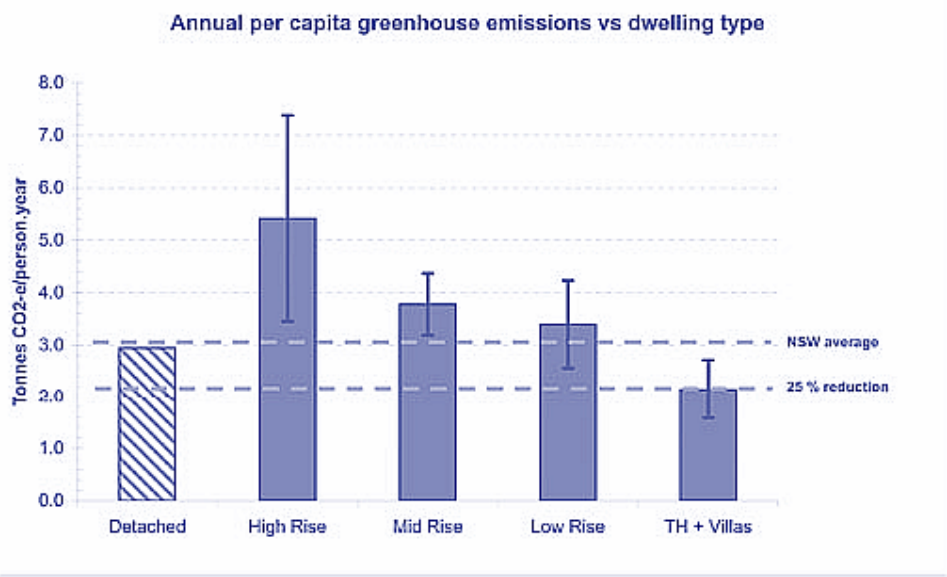
Figure 1.4: Annual per capita greenhouse emissions vs. dwelling type.

11 Lenzen, M., Dey, C. and Foran, B. (2004) Energy requirements of Sydney households, Ecological Economics, 49, pp 375-399.

12 For example: New South Wales Department of Planning (2005) City of Cities: a Plan for Sydney's Future, Department of Planning, Sydney; Queensland Office of Urban Management (2004) Draft South East Queensland Regional Plan. Queensland Government Office of Urban Management, Brisbane; Victoria Department of Infrastructure (2003) Melbourne 2030, Melbourne, Government of Victoria.

13 Myors, P., O'Leary, R. and Helstroom, R. (2005) 'Multi-Unit Residential Building Energy & Peak Demand Study', Energy News, 23(4), 113-16.

14 Foran, B (2005) The Footprint of Cities, Paper presented at the Urbanism, Environment and Health, Fenner Conference 2006, Canberra, 24-25 May 2006 http://nceph.anu.edu.au/Fenner2006/presentation_pdfs/Thursday/Foran%20Fenner%20May%202006.pdfDownloaded 7 March 2007



Source: Myors *et al*. (2005)

In a review of recent research on the relationship between residential density and non-transport energy use, Wright (2006)[15] summarises the general trends evidenced to date:

- Inner metropolitan medium density housing consumes less operational energy (i.e. energy consumed within the home on an on-going basis), than low density urban fringe development;
- High density, high rise development consumes more operational energy than medium or low rise development;
- Energy use in outer urban and lower density development is lower when measured on a per capita basis.

Therefore the evidence is growing that higher density does not *necessarily* lead to more environmentally sustainable outcomes on energy efficiency grounds, although the results of research depend on how the energy consumption is measured and at what scale. Pears (2005)[16] has suggested why this might be. Basing his conclusions on unreleased NSW Department of Planning research that showed that high rise flats generated significantly more greenhouse gas on a *per capita* basis than the residential average, he argues that high rise developments are much more likely to be dependent on electricity for all energy needs rather then the less polluting alternatives of natural gas, and that the communally provided services and amenities (such as lifts, swimming pools and other communal facilities) add considerably to the overall energy consumption of these developments. The targeting of much new high rise residential development in inner city locations at high income consumers also contributes to pushing up the energy using facilities associated with such developments. In an important point, he notes that that the surge of flat development in recent decades under weak or non-existing environmental standards will be a particularly challenge in achieving more energy efficient outcomes within

15 Wright, K. (2006) 'The Relationship Between Residential Density and Non-Transport Energy Use' Australian Planner, Vol 43, No 4, 12-13

16 Pears, A. (2005) 'Does Higher Density Really Reduce Household Energy Requirements? It Depends…' Urban Policy and Research, Vol 23, No 3, 367-369

the existing stock. The research reported here throws more light on this particular issue.

But while evidence is emerging about the performance of high and low density development in terms of energy consumption profiles, there has been little Australian research on what the contribution of social and behavioural factors play might play in determining these profiles. Research recently completed by the authors of this report into the life cycle energy consumption of dwellings in twelve residential estates in Sydney sheds some light on this issue[17]. This showed that *per capita* life cycle energy consumption of some inner suburban high density developments was higher than that of outer suburban areas comprising single storey detached houses. More importantly for this report, the analysis indicated that socio-economic factors were associated with energy consumption, with higher income low density suburbs (Glenhaven and West Pennant Hills) recording much higher *per capita* consumption than lower and moderate income low density suburbs (See Table 1.1). *Per capita* energy consumption for the four higher density estates included in the study was also highly variable. In other words, housing density *per se* did not appear to be the determining factor in explaining the differential energy use and estimated greenhouse gas emissions from these ten estates.

The present report extends this research on Sydney's energy consumption profile through an in-depth exploration of the critical, yet under-researched, issue of the impact that different socio-economic and behavioural factors have on energy consumption in different residential building types in Sydney, as well as the role dwelling density plays in shaping behaviour responses to domestic energy use. It forms part of a larger project which also looked at behavioural aspects of water consumption in Sydney. The research on water was the subject of a separate report (Troy and Randolph, 2006).

Energy demand management policy is often shaped on the notion that broad brush economic, technical or regulatory measures will be effective in reducing consumption. The objective of this research has been to go beyond the physical determinism embodied in contemporary urban development policies to explore the way energy consumption is shaped by the needs, attitudes and facilities used by different kinds of households in different types of dwellings in Sydney. The research also explored consumers' perceptions of their energy use and attitudes to conservation measures and sought also to understand better how energy demand management policies can be made more effective by a more nuanced understanding of the behavioural aspects of energy use.

[17] Pullen, S., Holloway, D., Randolph, B. and Troy, P. (2006) *Energy profiles of selected residential developments in Sydney with special reference to embodied energy*, Proceedings of Australian & New Zealand Architectural Science Association (ANZAScA)2006 40th Annual Conference 'Challenges for architectural science in changing climates', 22-25 November 2006.
Randolph, B. Holloway, D., Pullen, S. and Troy, P (2007 forthcoming) *Water and Energy Profiles of Selected Landcom Residential Developments*, Research Paper No. 7, City Futures Research Centre, Faculty of the Built Environment, University of New South Wales.

Table 1.1: Estimates of annual carbon dioxide equivalent emissions for ten case study suburbs, Sydney

Suburb and date of development	Annual CO_2-e emissions – electricity (per dwelling)	Annual CO_2-e emissions – gas (per dwelling)	Annual CO_2-e emissions - embodied energy (per dwelling)	Annual CO_2-e emissions - total (per dwelling)	Annual CO_2-e emissions - total (per capita)
Low Density Estates					
Late 1970s					
St Clair	25.4	1.9	3.1	30.4	8.8
Cambridge Gardens	28.6	1.8	3.1	33.5	10.6
Early 1980s					
St Andrews	24.8	2	3.3	30.1	8.8
Raby	26.4	2	2.8	31.2	9.4
Early 1990s					
Glenhaven	43	2.5	5.5	51	15
West Pennant Hills	39	2.4	5.6	47	13.1
Late 1990s					
Narellan Vale	20.7	1.9	3.9	26.5	8.3
Harrington Park	22.7	2.2	4.6	29.5	8.8
High Density Estates					
Kings Bay	12.3	1.6	1.7	15.6	7
Abbotsford	28.7	1.9	2.2	32.8	14.9
Cabarita	28	1.7	2.8	32.5	12.5
Liberty Grove	18	1.8	3.8	23.6	8.7

Source: Randolph, B, Holloway, D., Pullen, S. and Troy, P. (2007 forthcoming)

The findings aim to provide service providers and environmental planners with a substantially improved understanding of the role the built environment and consumer behaviour plays in determining energy use in people's homes and its contribution to environmental stress. This includes the kinds of changes in pricing, regulation or availability of services that may be needed to induce a further reduction of energy consumption by individuals living in different types of dwellings, different kinds of housing (particularly, renters *v* owners) and in different kinds of households.

1.4 Method

The essential questions the research aims to address are to what extent two key dimensions of urban structure - built form (in particular, dwelling type) and the socio-behavioural characteristics of households - influence the pattern of energy consumption across the city. The research has been undertaken by a methodology incorporating both quantitative and qualitative research methods. The former involved a large-scale telephone interview survey that generated detailed information about the energy consumption behaviour of sampled households, the dwellings they occupy, their socio-economic profile, and the range of equipment and facilities they use in their dwellings. Our previous research in this area has indicated the viability of such a method and also confirmed that both dwelling type and socio-demographic factors are both likely to have a critical influence on consumption behaviour (see, for example, Troy and Holloway, 2004). The qualitative aspects of the research took the form of 10 focus groups drawn broadly from the areas included in the survey.

The key major methodological advance of the research is that it has allowed, for the first time, detailed data on household characteristics, the characteristics of the dwellings they occupy and their water consumption behaviour and attitudes to be linked together.

Telephone Survey
The quantitative data for the research was obtained through a random quota telephone survey of 2,179 addresses in a random stratified sample of 140 CDs used for the earlier research project reported above (see Appendix 1 for a description of the method used to select the 140 sample CDs). A map of the location of these CDs is given in Figure 1.5 The survey was conducted between January and March 2005 and was undertaken for the researchers by AC Nielsen. The 140 CDs were stratified into four categories of 35 CDs:

- Areas of Wholly Separate Houses
- Areas of Predominantly Semi Detached Dwellings
- Areas of Predominantly Flats in a block of less than 4 storeys
- Areas of Predominantly Flats in a block of 4 or more storeys

Sample quotas were set on the proportion of dwellings in each dwelling type for each of the 140 CDs. The survey attempted to achieve interviews with approximately 500 households in each dwelling category. In the event, the response from residents in high rise flats and semi-detached dwellings was lower than for those in houses and low rise flats. This, in part, reflected the more limited number of CDs with very high proportions of semi-detached dwellings in the sample, and the difficulty in obtaining responses from occupants in high rise flats. The latter may reflect the high proportion of renters and younger households in this kind of property (Bunker, Holloway and Randolph, 2005) and the prevalence of mobile phone usage among this section of the population. After 75% of the overall sample had been achieved, it was decided to concentrate on the remaining medium and high rise component of the sample in order to bring sample numbers up towards the target. Also at this stage, in order to reduce questionnaire length to encourage a higher response, a range of questions were omitted. These largely related to questions of most relevance to respondents in houses. Consequently, some of the results reported below are based on a restricted sample of 1,808 cases.

The achieved response is shown in Table 1.2. The quota for houses was increased in order to achieve the overall target of 2,000 responses and to allow for more detailed analysis of houses if needed and to compensate to the reduced number of responses from high rise flats. In the event, a final total of 2,179 interviews were successfully completed. In the analysis presented in the following report the data have been weighted to reflect the distribution of dwelling types and dwelling tenure in Sydney as a whole. The unweighted and weighted counts are compared in Table 1.3. The results therefore can be viewed as a reflection of outcomes for households across Sydney. Note that is some cases, table bases reflect varying totals due to missing data.

Table 1.2: Telephone Survey: Achieved Response

Dwelling Type	Target quota	Achieved quota
Separate Houses	500	821
Semi Detached Dwellings	500	446
Flats in a block of less than 4 storeys	500	554
Flats in a block of 4 or more storeys	500	358
Total response	2,000	2,179

Table 1.3: Comparison Between Weighted and Unweighted Counts

Dwelling Type	Weighted		Unweighted	
Separate Houses	1,395	64.0%	821	37.7%
Semi Detached Dwellings	257	11.8%	446	20.5%
Flats in a block of less than 4 storeys	342	15.7%	554	25.4%
Flats in a block of 4 or more storeys	185	8.5%	358	16.4%
Total response	2,179	100.0%	2,179	100.0%

This survey represents a major benchmarking exercise in its own right and has provided a database that can be drawn upon for future comparative research by researchers and by service providers and planning authorities.

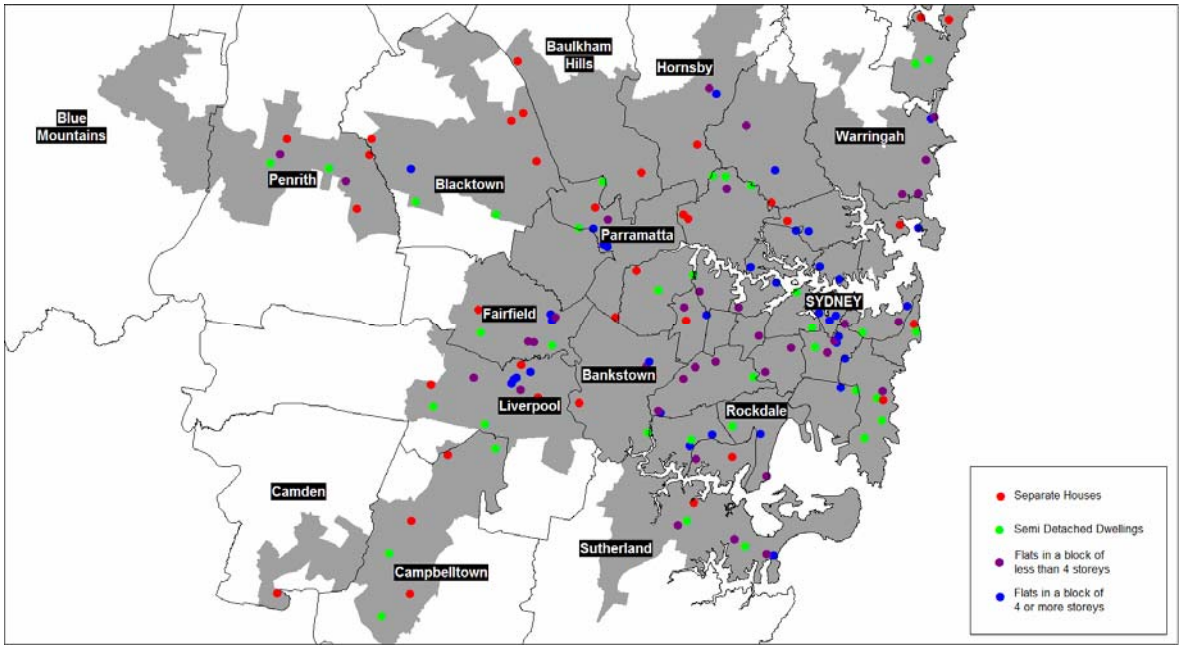
Focus Groups

The project also had an important qualitative component. This was undertaken through a series of five targeted focus groups that explored the behavioural aspects of energy consumption among key types of households, defined by occupancy of types of dwelling (separate houses, attached houses, and flats) and household/life stage type (e.g. families, young singles, older people). The focus groups were undertaken in April and May 2005. Participants were recruited by AC Nielsen by telephone and the groups were conducted by SMS Research for the research team. (A more detailed overview of the qualitative research methodology is given in Appendix 2.)

The aim of this qualitative component of the project was to explore the attitudes of consumers to their use of energy in much more detail, whether their residential position (location and type of dwelling) influences their consumption behaviour, whether they are aware of conservation policies, whether they are susceptible to more sustainable consumption practices, and their attitudes to more sustainable alternative practices. In addition, the focus groups allowed testing of attitudes to pricing strategies to assess attitudes to the kinds of measures that could to be employed to encourage households to reduce consumption of these resources. In

this way, the data recorded in the household survey can be better interpreted and more substantive conclusions drawn.

Figure 1.5: Distribution of sampled CDs in the Sydney Metropolitan Area



PART 2: QUANTITATIVE SURVEY

2.1 Introduction

This chapter describes the key findings from the survey of 2,179 households across Sydney on their energy consumption behaviour and attitudes to energy use and conservation. To simplify the descriptions, flats of four or more storeys are referred to as 'high rise' and flats in blocks up to three storeys are referred to as 'low rise'. Semi-detached and other attached row or terraced housing (including villas and town houses) are referred to generically as 'semi-detached' housing (or 'semis').

The first part of this section repeats the analysis presented in the earlier report on water consumption (Troy and Randolph, 2006). The profile of households and stock is included for completeness and to ensure each report for this project can be read independently. Section 2.2 sets out the basic characteristics of respondents, their households and the accommodation they occupy, using the weighted data, with specific attention to differences between dwelling type. The second part describes the facilities and characteristics of the dwellings in some detail. These data were collected to allow better understanding of the differences in attitudes and behaviour with respect to energy consumption. Clearly, the presence or absence of certain facilities in a home will greatly determine both the overall use of these services and attitudes towards them. Homes with multiple facilities are more likely to use more energy than those with few such facilities.

The third section focuses on energy use and attitudes. This includes discussion of the frequency of use of key energy using facilities in the home. Variations in other characteristics of the sample are discussed where these are considered relevant.

2.2 A profile of respondents and their households

Data were gathered on the respondents themselves, the households to which they belong and the property they occupy. This information is important in understanding the relationship between consumers, the homes they occupy and their energy consumption behaviour and attitudes. This section therefore provides the basic information for interpreting the main survey results as well as setting the socio-demographic context for the qualitative findings in Part 2 of this report. Data are summarised in Table 2.1. As we argue below, the differential socio-demographic profile of the dwelling sub-groups focused on in this report – the "compositional effect" – critically affects these outcomes.

2.2.1 Demographic characteristics

Number of People in Household

Two in five respondents' households (19%) were lone persons, while a third (33%) had two people in the dwelling. Three in ten had four or more people in the household. There was, however, a substantial difference between dwelling types in terms of household size. While 40% of households in separate houses had four or more persons, the proportion fell to just 10% for those in flats. Households in flats were most likely to only have only one person (39% of low rise flats and 32% of high rise flats). On average, households contained 2.59 persons, ranging from 2.86

persons for households in separate houses to 2.37 persons for those in semis and 1.97 persons for those in flats.

Age of Respondent
A quarter of respondents (25%) were aged between 18 and 34 while 41% were 35 – 54 years old and a third (34%) were older than 55 years. Two out of five (41%) respondents living in flats were 18 – 34 years (rising to 45% for those in high rise flats), compared with 18% of those in houses.

Gender of Respondent
There was a slight bias towards women in the profile of respondents, with 57% being female and 43% being male. This is likely to reflect the survey methodology whereby calls were made at a range of times during the day with women more likely than men to be at home during the day time.

Employment Status of Respondent
Approximately half of respondents in all dwellings worked full-time, with 5% unemployed and just over a quarter (26%) not in the labour force. The highest rate of full-time employment occurred in low rise flats, where three in five respondents worked full-time, compared with separate houses where only 46% of respondents were engaged in full-time employment. As a result, respondents in low rise flats have the lowest proportion not in the labour force (19%), but also the highest rate of unemployment 8%. Separate houses had the highest rate of respondents not in the labour force 29%, but the lowest rate of unemployment (4%).

Gross household annual income
Respondents were asked to asses their total gross household income. As many as 16% did not know or refused the question. Of those who answered, some 44% of households' incomes fell below $52,000 p.a. and 56% were above that figure. This is in line with known Sydney household income medians at this time.

Not surprisingly, household income was higher for households in separate houses compared with those in semis and flats, with 60% of the former having incomes over $52,000 compared with 52% and 49% of the latter two groups respectively.

- 17% of households in flats, 18% of those in semis and 12% of households in separate houses earned less than $20,800 annually (the average is 15%).
- 29% of respondents' households had incomes broadly in the middle of the income scale ($41,601 - $78,000). This did not vary greatly between houses (29%) and flats (30%), although the figure was lower for households in semis (23%).
- A fifth of households (21%) had household incomes above $104,000. This figure ranged from 25% of households in separate houses (25%) to 17% of households in semis and 15% of households in flats. The figure for high rise flats was 20%.

Table 2.1: Socio-demographic profiles of dwelling types

	Separate Houses	Semis	All Flats	Low rise flats	High rise flats	Total
Household size						
1	13%	20%	36%	39%	32%	19%
2	29%	40%	40%	38%	46%	33%
3	18%	21%	14%	15%	13%	17%
4 plus	40%	18%	10%	9%	9%	30%
Average size	2.86	2.37	1.97	**	**	2.59
Age of respondent						
18-34	18%	32%	41%	41%	45%	25%
35-54	44%	38%	32%	35%	24%	41%
Over 55	37%	39%	26%	24%	29%	34%
Employment status of respondent						
Employed full-time	46%	50%	56%	58%	54%	49%
Employed part-time	16%	17%	12%	12%	11%	15%
Unemployed	4%	5%	7%	8%	6%	5%
Not in labour force	29%	22%	21%	19%	24%	26%
Other	4%	6%	4%	3%	4%	4%
Household income						
Up to $31,200	18%	27%	24%	25%	22%	20%
$31,201 - $52,000	17%	16%	22%	24%	17%	17%
$52,001 to $78,000	16%	13%	15%	15%	16%	15%
$78,001 - $104,000	12%	19%	15%	16%	14%	14%
More than $104,001	20%	16%	13%	11%	17%	18%
Housing tenure						
Owned outright	49%	35%	25%	22%	26%	42%
Buyer	31%	23%	13%	14%	11%	25%
Private renter	12%	36%	55%	57%	54%	25%
Public renter	5%	5%	6%	5%	9%	5%
Other/Don't know	3%	2%	1%	2%	0%	2%
Year respondent moved in						
2004-5	6%	20%	26%	23%	32%	13%
2002-3	11%	24%	29%	29%	29%	17%
2001-2	16%	15%	14%	16%	11%	15%
1996-99	14%	12%	11%	12%	10%	13%
Pre-1996	51%	28%	20%	21%	18%	41%
Base (100%)	**1395**	**248**	**536**	**334**	**185**	**2179**

2.2.2 Summary

Overall, respondents living in houses had larger households, they were older and were also likely to have higher household incomes than other households. They were more likely *not* to be in the labour force (i.e. at home or retired), but they had the lowest unemployment rate for those in the labour force. They were the least mobile and also much more likely to be home owners or buyers.

Respondents in low rise flats were the most likely to be working, but were also the most likely to be unemployed and to have lower incomes than households in other dwelling types. They included the largest proportion of single person households, which helps explain their lower income levels. They were generally younger than respondents in houses or semis, but compared with those in high rise flats, the proportions aged 35 to 55 was significantly larger.

Respondents in high rise flats were the youngest group but have relatively higher incomes, especially in relation to those in low rise flats. At the same time, the proportion over 55 years was higher than those in low rise flats. These findings indicate both a large youthful market but also an older 'empty nester' and higher income market in this sector. They were also the most mobile, with 61% having moved into their current home within two years of the survey.

The profile of respondents living in semi-detached housing lay somewhere between those in houses and those in flats, suggesting a more diverse sector.

2.3 A Profile of Dwellings

2.3.1 Tenure, turnover, property age and type

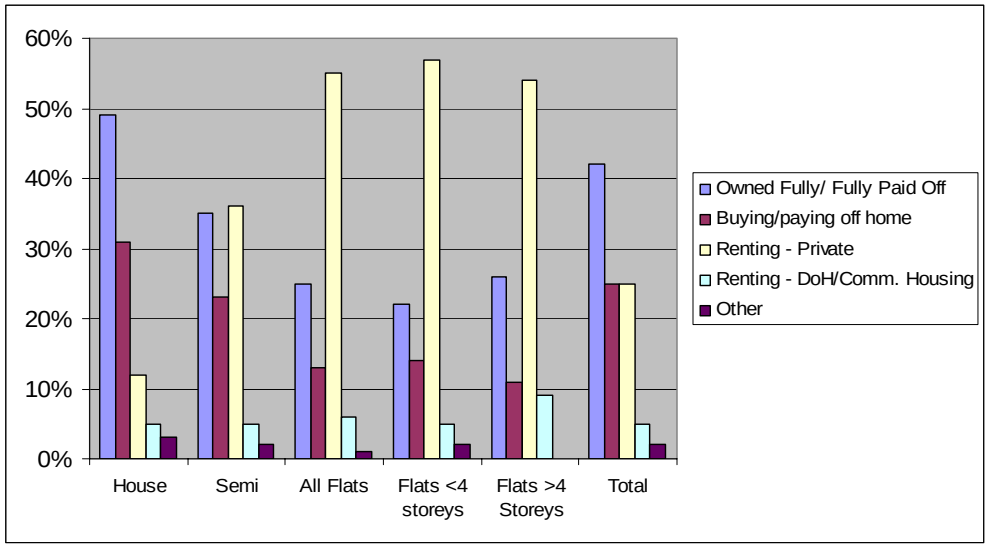
Overall, two out of five (42%) respondents were outright owners of their homes with a further 25% in the process paying off a mortgage (Figure 2.1). Another quarter were renting privately and five percent rented from the NSW Department of Housing.
The main difference between dwelling types was in the proportion of dwellings rented. While 81% of houses were owned or being bought, the proportion fell to 58% for semi-detached houses and to just 38% for flats. Over half the flats (55%) were rented privately.

Residential turnover rates reflected property type and tenure. Overall, two in five households had been living in their homes since before 1996, while 13% had moved within the year before the survey (i.e. during 2004) and 30% in the previous three years (2002 to 2004). While 17% of respondents living in houses had moved in the previous three years, the proportion increased to 44% for semi-detached houses and to 55% for all flats. As many as 61% of respondents in high rise flats had moved within the previous three years. At the other end of the scale, 51% of house dwellers had lived in their current home since before 1996, compared with 20% for flat dwellers.

Respondents were asked to assess the age of their home. While 10% said they did not know, the remaining 90% provided a date. While 17% of the dwellings were

constructed in the period between 1991 and 2005 (and just 3% were built after 2002),

Figure 2.1: Tenure of property by dwelling type



Base: 2179

12% pre-date 1945 and 13% were built between the Second World War and 1960. A third (35%) were built in the period 1961 to 1980. Semis and high rise flats were generally the most recently constructed, with 26% of the former and 31% of the latter having being built since 1991. Low rise flats were most likely to have been built between 1961 and 1980 (38%). Semis are more likely to have been built before 1945 or since 1980.

Turning to the type of construction, 54% of dwellings were full brick, while 25% were brick veneer. Approximately one in ten were fibro (9%) and 5% were weatherboard. A small minority were said to be built of concrete (4%) or some other or mixed materials (3%). Flats were predominantly built of brick (84%) or concrete (14%), with almost two in five high rise flats being of concrete construction and nine in ten low rise flats being built of full brick. On the other hand, well under half of all houses were full brick (40%), while 14% were of fibro construction, 7% of weatherboard and a third (34%) were brick veneer. Three quarters of semis were full brick.

2.3.2 Electricity Supplier

Sydney's electricity is delivered by three main utilities: Energy Australia, Integral Energy and AGL (Table 2.2a). The market share for these three suppliers reflects the areas they serve. Energy Australia, who supplied 51% of the sampled respondents, provides its coverage mainly to the eastern half of the city. The profile of dwellings served reflects this with higher proportions of flats and semis, which are concentrated in these suburbs. Integral Energy, with a 33% share of the market for these households, had a much greater focus on western Sydney. Its consumer profile was therefore skewed towards houses, the dominant dwelling for in this part of the city. AGL is a minority supplier, with just 8% of the market for these

respondents. Other suppliers and don't knows account for the remaining 9%. One in eight respondents living in high rise flats were unable to recall their electricity supplier's name.

2.3.3 Gas Supplier

Overall, 42% of respondents said they were connected to the gas mains. Here, AGL have the bulk of the gas market, supplying 71% of the market for these households. Energy Australia are the only other major provider, with a 16% share (Table 2.2b). As many as 15% of respondents in high rise flats could not recall the name of the gas supplier.

Table 2.2a: Who is the main electricity supplier to this dwelling?

	Energy Australia	AGL	Integral Energy	Don't Know	Other	TOTAL
Separate Houses	44%	8%	40%	5%	3%	1382
Semis	62%	6%	21%	7%	3%	246
All Flats	62%	8%	20%	9%	2%	528
Flats <4 storeys	64%	7%	21%	7%	2%	332
Flats >4 Storeys	58%	12%	15%	12%	3%	176
Total	**1093**	**169**	**705**	**134**	**55**	**2156**
%	51%	8%	33%	6%	3%	100%

Table 2.2b: What is the name of the main gas supplier to this dwelling?

	Energy Australia	AGL	Integral Energy	Don't Know	Other	TOTAL
Separate Houses	18%	69%	3%	7%	3%	639
Semis	12%	79%	1%	7%	2%	100
All Flats	10%	74%	1%	14%	0%	170
Flats <4 storeys	11%	75%	2%	11%	1%	82
Flats >4 Storeys	8%	75%	1%	15%	0%	84
Total	**142**	**647**	**22**	**75**	**23**	**909**
%	16%	71%	2%	8%	3%	100%

2.4 Energy use and equipment in the home

2.4.1 Main Cooking Method

Cooking and the preparation of meals accounts for a significant component of domestic energy use. Respondents were asked about their main cooking equipment. Almost half (46%) used and Electric Stove/Cook Tops, followed by 35% using Gas Stove/Cook Tops. These two cooking methods accounted for 80% of respondents. Relatively few used alternative methods: microwave use accounted for 10% of respondents and electric ovens by 4%.

But there were differences between dwelling types. Respondents living in low rise flats were most likely to use electric stoves/cook tops as their main cooking method (60%), and were least likely to use gas (19%). These use patterns reflect the lower rate of connectivity to gas for older low rise flat blocks (Table 2.3).

Table 2.3: Main cooking method by dwelling type

	Gas Stove/ Cook top	Elec Stove/ Cook top	Mixed Stove/ Cook top	Solid Fuel Stove/ Cook top	Gas Oven	Electric Oven	Microwave	Electric Frying Pan	TOTAL
Separate Houses	38%	43%	3%	0%	1%	3%	8%	4%	1393
Semis	31%	46%	2%	0%	2%	5%	9%	5%	251
All Flats	26%	55%	1%	0%	1%	5%	9%	3%	535
Flats <4 storeys	19%	60%	2%	0%	1%	5%	10%	3%	333
Flats >4 storeys	37%	46%	1%	0%	1%	7%	7%	1%	185
Total	**749**	**1005**	**61**	**3**	**25**	**83**	**181**	**72**	**2179**
%	34%	46%	3%	0%	1%	4%	8%	3%	100%

2.4.2 Heating and cooling

The vast majority of homes have some form of heating or cooling: only 4% said they did not have the means to heat or cool their homes, although this rose to 9% of residents of low rise flats (Table 2.4). The most common forms of heating and cooling were electric fans, used by 56% of respondents, reverse cycle air conditioning (A/C) (42%) and electric heaters (40%). Only 25% used gas for heating purposes. Electric air conditioning was used by one in ten (11%), with oil fired heating (9%) and solid fuel or wood stoves (8%), close behind.

Variations between dwelling types reflect the reliance on electricity by those in higher density housing. Electric heaters were the predominant form of heating for flat dwellers (54%), compared with only a third of house dwellers (36%). While few flat dwellers used gas for heating, one in eight (12%) used oil. Solid fuel and wood stoves were limited to those in houses and semis.

Air conditioning was much less prevalent in flats and semis than in houses. Overall, while almost two thirds of houses had some form of air conditioning, the proportion fell to 30% for semi-detached houses and to just 20% for all flats. Half (51%) of those in houses said they had reverse cycle A/C. But the proportion fell to only 10% for those in low rise flats, half the level recorded for high rise flat dwellers (21%)

and those in semis (22%). People in flats compensated for this by a somewhat greater use of electric fans in hot weather.

When asked what form of heating they used *most often* (Table 2.5), a quarter each said reverse cycle A/C (25%) or electric heaters (26%), and a fifth used gas heaters (21%). As noted above, reverse cycle A/C and gas heating were predominantly used by people in houses, while flat dwellers were much more reliant on electric heaters. The main variation to this pattern was the noticeably greater reliance on air conditioning by people in high rise flats compared with other flat dwellers, reflecting the higher amenity of many of more recently developed high rise flats. Other forms of heating were much less prominent.

Table 2.4: Type of heating and cooling used (all uses)

	Heating						Heat and Cool		Cooling			
	Elect Heater	Gas Heating	Oil Heating	Wood/ Solid Fuel Heating	Kerosene Heating	Other Heating	Ducted Air Heat and Cool	Reverse Cyc. A/C	Elect A/C	Elect Fans	Water Evap. Cool	No Heating or Cooling
Separate House	36%	29%	8%	11%	1%	5%	7%	51%	12%	54%	2%	3%
Semis	46%	27%	12%	3%	0%	0%	6%	22%	8%	58%	1%	6%
All Flats	54%	8%	12%	0%	0%	4%	1%	14%	6%	60%	1%	9%
Flats <4 storeys	57%	8%	13%	0%	0%	4%	1%	10%	6%	62%	1%	9%
Flats >4 storeys	47%	6%	9%	1%	0%	4%	2%	21%	6%	57%	0%	10%
Total	730	449	159	148	10	80	104	757	198	1005	34	80
%	40%	25%	9%	8%	1%	4%	6%	42%	11%	56%	2%	4%

Base = 1808

Perhaps surprisingly, 11% said they used no heating at all, but this figure varied significantly between houses (7%) and flats (21%) and the proportion rose to 25% for those in high rise flats.

Turning to the cooling method used *most often* (Table 2.6), electric fans (40%) and reverse cycle A/C (34%) were the clear favourites. As with heating, A/C was more common among house dwellers while flat dwellers were more likely to rely on electric fans. But as many as 16% said they didn't use any method to cool their home in hot weather. Again, as with those who did not heat their homes, the proportions was much greater among flat dwellers: 29% of those in low rise flats did not cool their home, compared with only 12% of those in separate houses. Overall, then people in high rise flats were more likely to either cool or heat their homes compared with those in low rise flats, although both were much less likely to cool or heat their homes that people in houses.

Table 2.5: Type of heating used most often

	Reverse Cyc. A/C	Elect Heater	Gas Heating	Oil Heating	Wood/ Solid Fuel Heating	Kerosene Heating	Ducted Air Heat and Cool	Other Heating	No Heating
Separate Houses	30%	19%	25%	4%	7%	0%	4%	2%	7%
Semis	16%	34%	24%	7%	1%	0%	3%	0%	14%
All Flats	11%	49%	7%	10%	0%	0%	1%	2%	21%
Flats <4 storeys	8%	51%	7%	11%	0%	0%	0%	2%	20%
Flats >4 storeys	17%	42%	5%	6%	0%	0%	2%	3%	25%
Total	**462**	**478**	**381**	**98**	**93**	**6**	**63**	**37**	**190**
%	25%	26%	21%	5%	5%	0%	3%	2%	11%

Base = 1808

Table 2.6: Type of cooling used most often

	Reverse Cyc. A/C	Elect A/C	Ducted Air Heat and Cool	Elect Fans	Water Evap. Cooling	No Cooling
Separate Houses	42%	6%	5%	35%	1%	12%
Semis	18%	5%	2%	52%	0%	23%
All Flats	12%	4%	1%	55%	0%	27%
Flats <4 storeys	9%	3%	0%	58%	1%	29%
Flats >4 storeys	19%	4%	2%	52%	0%	24%
Total	**616**	**99**	**75**	**724**	**12**	**282**
%	34%	5%	4%	40%	1%	16%

Base = 1808

2.4.3 Roof insulation

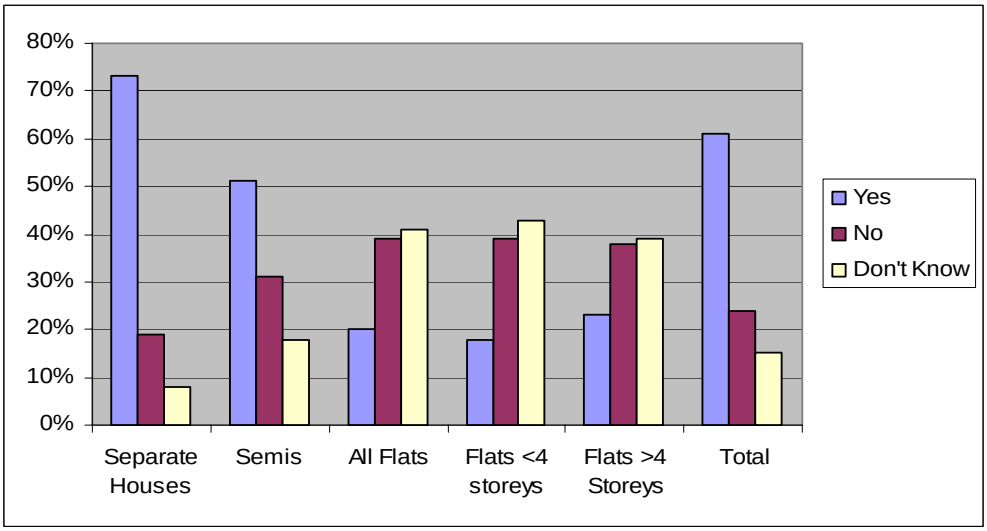
An important aspect of energy conservation is the level of roof insulation is fitted to the building. The findings suggest there is some way to go before all properties are insulated. While the survey did not enquire as to the level of insulation, it appears that the clear majority of separate houses do have some degree of roof insulation (73%). The level of insulation fell to 51% for those in semi-detached homes and to just 20% for all flats. Flat dwellers, however, were equally split between those who said their building did not have insulation (39%) and those who did not know (41%). Nevertheless, almost two in five said they did not think their property had roof insulation (Table 2.7).

Table 2.7: Does your building have roof insulation

	Yes	No	Don't Know	TOTAL
Separate Houses	73%	19%	8%	1318
Semis	51%	31%	18%	124
All Flats	20%	39%	41%	366
Flats <4 storeys	18%	39%	43%	264
Flats >4 Storeys	23%	38%	39%	89
Total	**1098**	**431**	**280**	**1808**
%	61%	24%	15%	100%

Base = 1808

Figure 2.2: Whether building has roof insulation by dwelling type



Base = 1808

2.4.4 Hot water heating

Water heating is the most significant domestic energy use. An individual's capacity to control water heating (as opposed to water use) is, in large part, determined by the degree of control they have over the operation of the system. The survey showed that while the vast majority of householders have their own water tank or instant gas system, 15% of people in flats used a communal hot water system, a figure that rose to almost a quarter (24%) of high rise flat dwellers (Table 2.8). Again, there was much lower usage of gas for water heating among flat dwellers.

Table 2.8: Type of Hot Water System

	Your own hot water tank	Your own instant (gas)	Communal	Other	No/Don't know	TOTAL
Separate Houses	68%	26%	0%	6%	1%	1314
Semis	65%	28%	3%	3%	2%	124
All Flats	70%	10%	15%	2%	4%	347
Flats <4 storeys	74%	10%	12%	1%	3%	254
Flats >4 Storeys	58%	11%	24%	2%	4%	79
Total	**1210**	**404**	**57**	**85**	**29**	**1785**
%	68%	23%	3%	5%	2%	100%

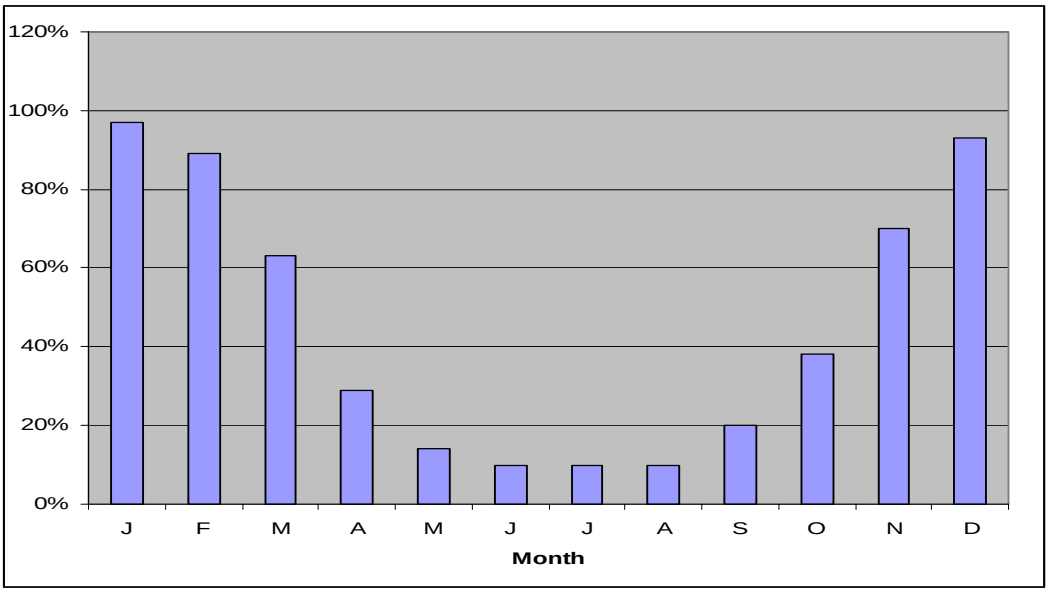
Base = 1808

2.4.5 Heated swimming pools and outdoor spas

One in five (20%) of respondents said they own or have access to a swimming pool in their property, the vast majority of these being house dwellers and those in high rise flats. Pool use was, not surprisingly, highly seasonal. The percentage of pool owners/users who said they use their pool reaches 98% in January but falls to 10% from June to August (Figure 2.3). One in ten (9%) said they use their pool all year round. The main variation was in the number of respondents in semi-detached houses and flats who said they used their pool in the winter (27% and 33%)

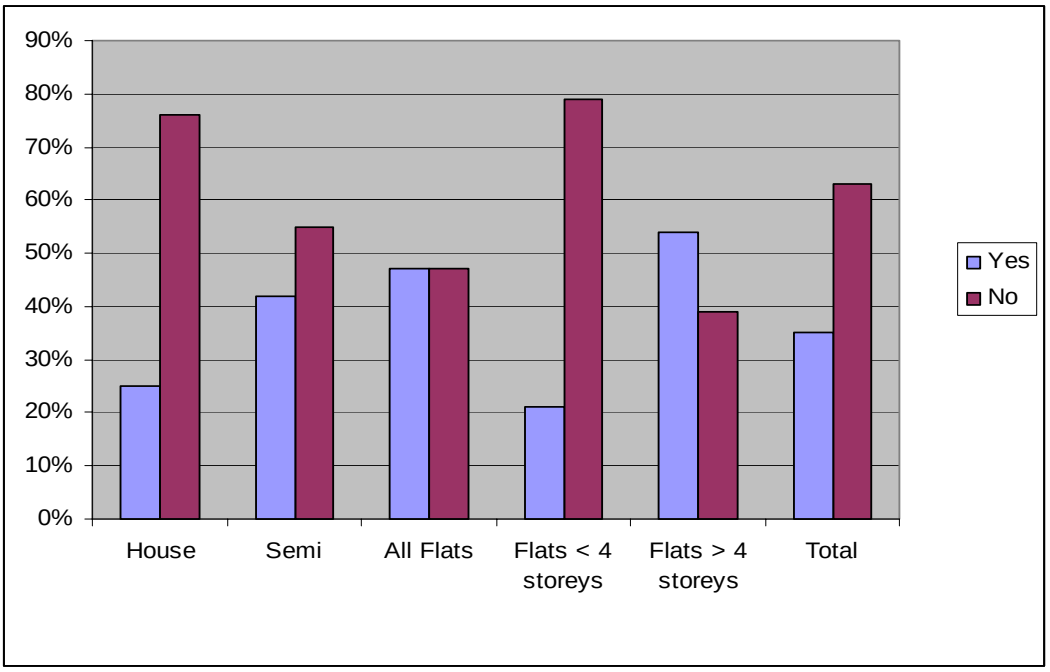
compared with those living in houses (4%). The difference can be attributed to the greater proportion of heated pools in the semis and flats. While 20% of pools in houses and 21% of pools in low rise flats were heated, the figure for semi-detached housing was 42% and for high rise flats 54% (the figure for all respondents with pools is 29%: Figure 2.4). Clearly, all-year pool use will have a significant implication for energy use in residential complexes with heated pools.

Figure 2.3: Proportion of pool owners/users using their pool by month



Base = 430

Figure 2.4: Is your pool heated?



Base = 430

2.5 General Attitudes to Conservation

2.5.1 Introduction

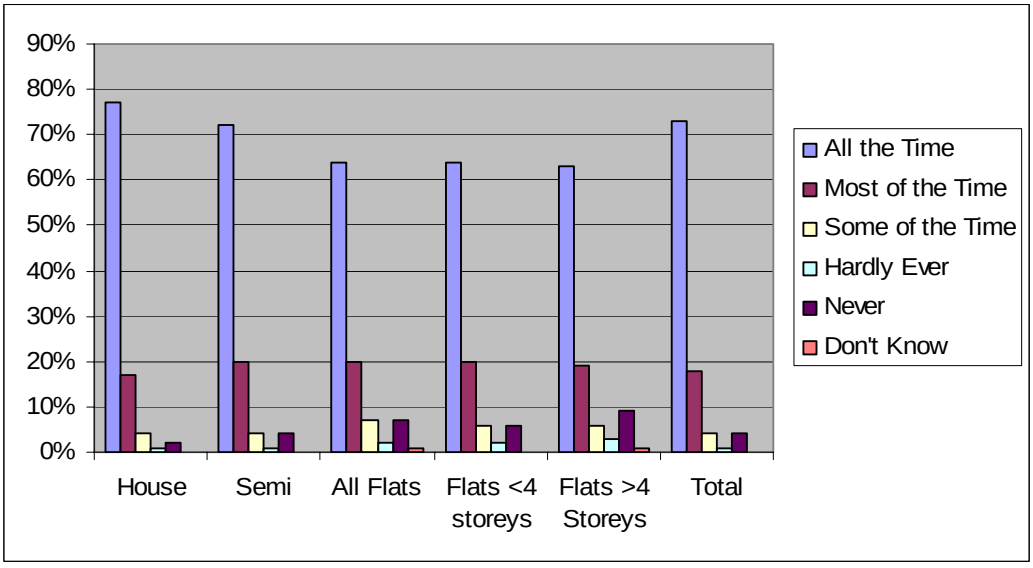
One of the objectives of the survey was to explore the attitudes of respondents towards conservation and environmental issues in general as attitudes to these general issues may influence water use. The responses to a number of general questions on conservation attitudes suggest broad support for such sentiments. There were differences between respondents in different dwelling types. The findings on general attitudes usefully inform the interpretation of the discussion of attitudes toward water conservation that are the focus of the remainder of this paper of the report. They will also provide a context for interpreting the findings form the qualitative research reported in Part 2.

2.5.2 Do you generally recycle waste and rubbish?

When asked if they generally recycle waste and rubbish, three quarters (73%) of respondents said they do all the time, with another18% saying most of the time (Figure 2.5). Only 5% admitted to recycling hardly ever or never at all.

The highest percentages responding positively to this question were those living in separate houses (77%) and semis (72%), while a lower proportion of those in flats (64%) saying they flats generally recycle waste and rubbish. As many as 12% of respondents in high rise flats said they hardly ever or never recycle (compared with only 3% of house residents).

Figure 2.5: Attitudes to recycling of waste and rubbish by dwelling type

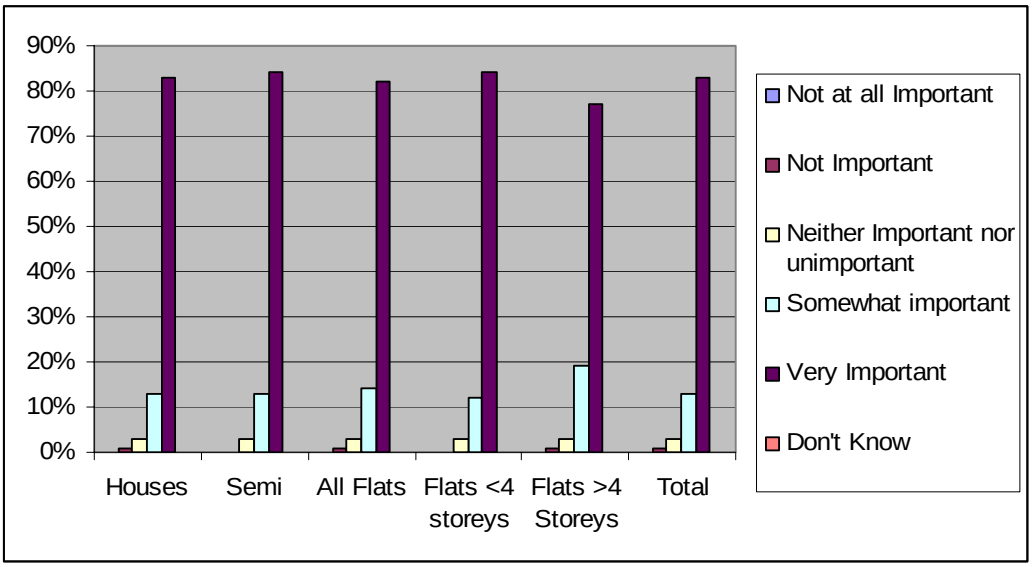


Base: 2179

2.5.3 How important do you think that it is to conserve water and energy?

Respondents were asked how important they rated the issue of conservation of energy and water resources on a five-point scale. There was overwhelming confirmation of the importance in which this issue is held. Some 82% said it was very important and a further 14% rated it as somewhat important (Figure 2.6). Only 1% of respondents said it was not important. While there was little overall difference between the main dwelling groupings, respondents living in high rise flats were marginally less likely to rate conservation as very important (77%) compared with those in low rise flats (84%). Disaggregating the data also shows that males, people aged under 34 and those on highest incomes were less likely to rate conservation as a *very* important issue, although in no cases does this rating fall below 75%.

Figure 2.6: How important is conservation rated by dwelling type



Base 2179

2.5.4 Do you think conservation is being taken seriously enough?

Respondents were asked whether they thought a range of key stakeholders, central to developing conservation policies, were considered to be seriously taking these issues seriously (Table 2.9, Figure 2.7). The response shows that respondents did not perceive these stakeholders as having a strong interest in conservation overall. The perception was that government was less interested in conservation issues than the utility companies themselves, and few considered that the private sector takes a serious interest in conservation.

- **Federal government**

Overall, only just over a quarter (27%) thought federal government took conservation seriously, with a clear majority saying it did not (63%) while 11% had no opinion (Figure 2.7).

- **State Government**

State government fared little better, with just 28% considering it took conservation seriously, and 61% saying it did not. (11% had no opinion).

- **Local Government**

Local government received a marginally higher recognition as having a serious regard for conservation issues, at 30%, although again, the majority thought it did not (56%). (17% had no opinion).

- **Local Business**

By far the worse rating for their attitude to conservation was local business, Just 19% considered this sector took conservation seriously, while 53% said it did not. However, many did not have a view on this, with 28% recording 'don't know' to this question.

- **Water Authority**

The best result was recorded by Sydney Water, with 45% saying the water authority took conservation seriously. Nevertheless, despite the heightened publicity and debate on water issues current at the time of the survey, as many as 39% believed that Sydney Water did not take conservation seriously (15% had no opinion).

- **Electricity Companies**

Marginally more respondents believed that electricity companies did not take conservation seriously than those who did, with 41% saying no and 37% saying yes. However, a fifth (22%) did not have an opinion.

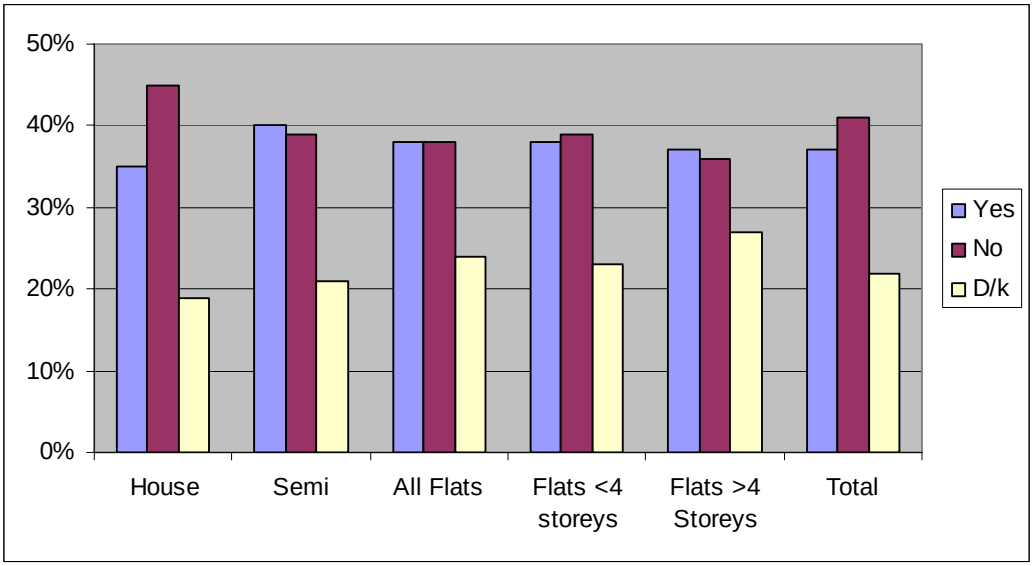
Generally speaking, respondents living in flats, particularly those in low rise flats, were more willing to trust these key actors in terms of their attitudes to conservation, with a consistently higher proportion of flat dwellers saying they think these six stakeholders took conservation of energy and water seriously. House dwellers were more sceptical of the behaviour of these stakeholders. On the other hand, younger respondents and those who are renting were also generally more likely to rate all these stakeholders as taking conservation seriously.

Table 2.9: Do key agencies take conservation seriously?

	Federal government	State government	Local government	Local business	Water authorities	Energy companies
Yes	27%	28%	30%	19%	46%	37%
No	63%	61%	54%	53%	39%	41%
Don't know	11%	11%	17%	28%	15%	22%

Base: 2179

Figure 2.7: Do energy companies take conservation seriously?



Base: 2172

2.5.5 Summary

Conservation is a widely supported sentiment in Sydney. Almost all respondents said this was a very important issue. There is no doubt that, at the time of the survey at least, most people in Sydney would be responsive to policies to encourage greater conservation in resource use. Most have adopted recycling as a common practice in their own home, assisted by council waste collection practices which now allow recycling in most areas. Without such support for this behaviour, however, it is possible many fewer would comply with recycling. A small minority, over-represented in flats, did not regularly recycle, however, this is possibly a reflection of the greater difficulty these households have in actually undertaking this activity.

Despite council recycling programs, water restrictions and the growing awareness of global warming, many households were sceptical about the attitude of government towards conservation issues. Only a minority think government at any level took conservation seriously. The figures were better for energy and water utilities, but even so, less than half responded positively to the suggestion for these two stakeholders. The best result is for Sydney Water, of whom almost half said they believe did take conservation seriously, noticeably more than the proportion who think it did not. Nevertheless, two in five did not think Sydney Water is serious on this issue. The same goes for the energy utilities, again despite the options to buy 'green' electricity. Clearly, the general population has significant reservations about how serious these key utilities take the task of delivering 'green' policies. Most tellingly, few thought local businesses took the idea of conservation seriously, an indictment of the failure of the local business community to engage in these debates.

2.6 Energy conservation in practice: How do households reduce energy

2.6.1 Actions taken to reduce energy use over the last year

Section 2.4 dealt with energy use in the home, as reported by respondents. We also wanted to find out whether respondents had changed their energy use in the recent past, particularly if they had taken steps to reduce consumption, and also whether they intended to change their use patterns in the future.

A number of questions were asked to establish whether respondents had taken actions to reduce energy consumption over the last year and a following set explored their likely change in energy use in the forthcoming year. These questions allow some indication of how energy consumption behaviour may change to be assessed. The answers suggest that there was along way to go before Sydney householders were fully behind the need to reduce energy consumption in the home in order to assist in the reduction in greenhouse emissions.

With the exception of turning off unused lights, there was little evidence that energy reduction practices were widespread. Where they had been adopted, they generally involved only a minority of respondents. When asked what measures respondents had taken it the past year to reduce energy consumption, the most common response, recorded by 58%, was to have turned lights off in unused rooms (Table 2.10). This is perhaps the easiest and most obvious action anyone can undertake, and it at least shows a willingness to consider cutting back consumption in this area. But beyond this, only around one in five respondents at most had taken other forms of action to reduce energy use. Reducing heating or cooling in unused rooms, turning off standby buttons and buying energy efficient light globes were reported by between 17% and 21% of respondents. Investing in energy efficient appliances was reported by one in eight.

Differences in the proportions of respondents from the four dwelling types saying they had undertaken energy saving actions were not significant, with all four groups reporting similar levels of action (or inaction). On the other hand, while 22% of respondents overall said they had not made any effort to reduce energy use, the figure for those not doing anything was highest for those living in high rise flats (27%).

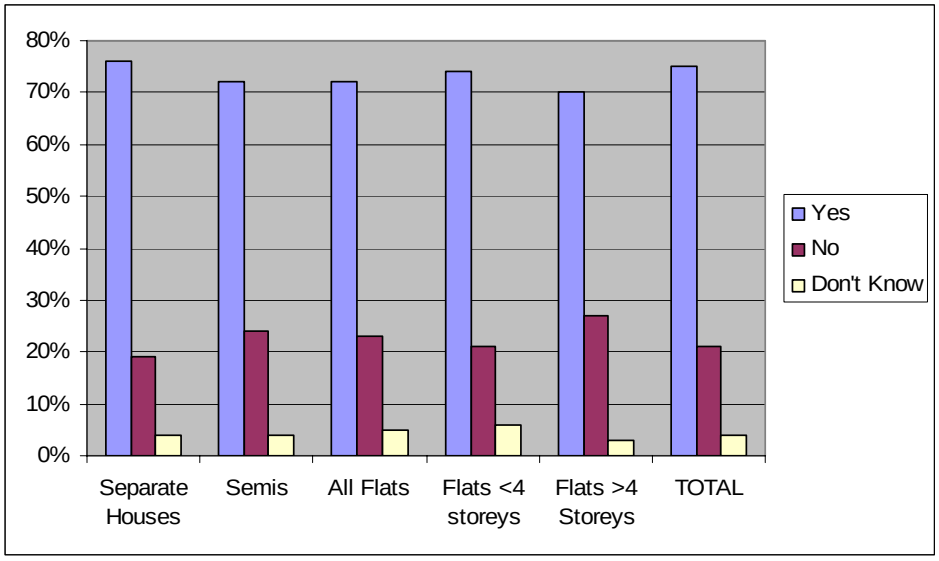
These figures contrast to the reported instances of action to reduce water consumption reported in the earlier report from this project (Troy and Randolph, 2006). Water reduction behaviour was more widespread and involved a wider range of activities and uses. Up to 87% of the same respondents said they have taken some form of action to reduce water use. Clearly, in the case of water, mandatory restrictions had had an impact on perceptions and behaviour. There has been no comparable level of behavioural ‘buy-in’ to energy conservation on the current voluntary basis.

Table 2.10: Actions taken to reduce energy use in the last year

	Turn Off Lights in Unused Rooms	Reduce Heating in Unused Rooms	Reduce Room Cooling	Turn off Stand-by buttons	Energy Efficient Globes	Purchase Energy Efficient Appliances	Other	No Action Taken
Separate Houses	59%	20%	19%	16%	17%	12%	20%	21%
Semis	60	22%	18%	20%	21%	12%	23%	20%
All Flats	55%	23%	15%	22%	15%	10%	20%	25%
Flats <4 storeys	55%	21%	14%	24%	18%	10%	22%	24%
Flats >4 Storeys	54%	26%	17%	17%	10%	9%	16%	27%
Total	**1262**	**459**	**398**	**389**	**369**	**251**	**450**	**476**
%	58%	21%	18%	18%	17%	12%	21%	22%

Base = 2179

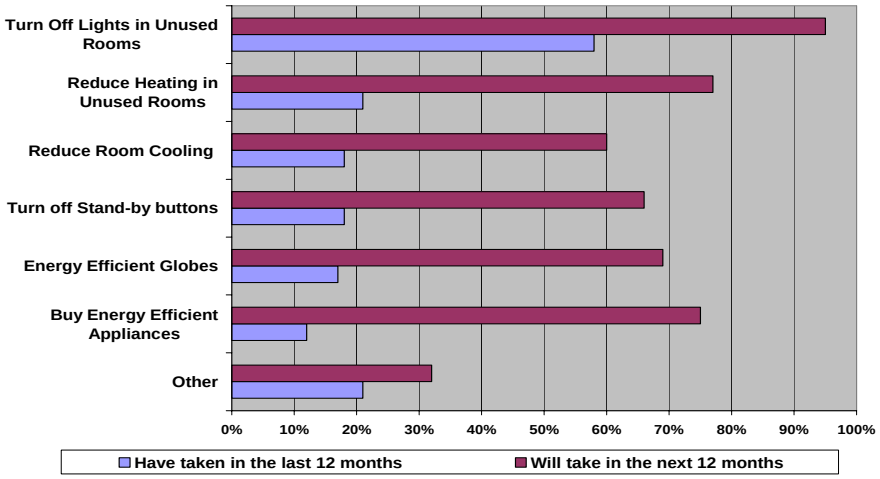
Figure 2.8: Action to reduce energy consumption in the home over the past year



2.6.2 Actions to reduce energy use likely in the next 12months?

When asked what actions they think they would take to reduce energy consumption in the next twelve months, a more encouraging picture emerges. With three quarters saying they intended to take some action, there was clearly a much higher potential for greater energy saving behaviour among the sample. Figure 2.9 compares the response to the question of what action respondents are likely to take to reduce energy consumption in the next twelve months with the actions taken in the last. Apart from the obvious level of good intention reflected in the response, the figures suggest a strong majority willing to consider doing more to reduce energy consumption across a range of uses. The least popular option was to reduce room cooling, a significant source of energy use in summer months. There was little difference between the four dwelling type groups in the level of positive response, although those living in high rise flats were somewhat more likely to say they would take *no* action (27%) compared with the others, particularly those in houses (19%).

Figure 2.9: Actions taken in last 12 months to reduce energy consumption and actions likely to take in the next 12 months to reduce energy consumption



2.7 Attitudes to energy usage, pricing and conservation in the home

A key element of the survey was to explore the awareness of energy use among respondents. This is a critical issue, for if consumers are unaware of the electricity and gas they are using, then attempting to manage demand by pricing signals is unlikely to be successful. Attitudes toward current and alternative pricing approaches were also the focus of a number of related questions. The aim here was to find out how much support there was for differential pricing and other conservations methods.

2.7.1 Do you know how much electricity or gas you use in a quarter?

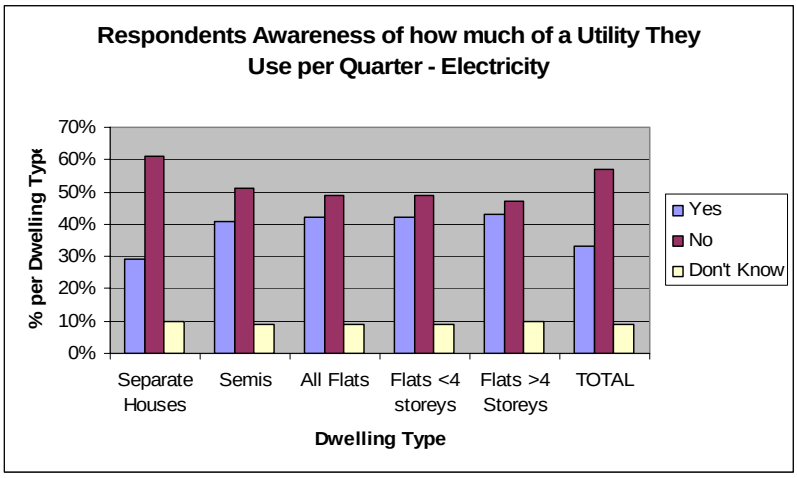
When asked whether they knew how much electricity or gas they used in a quarter, only around three in ten said they did: 33% of electricity users and 27% of gas users (Table 2.11). The remainder either said they didn't know or were not able to offer an answer. Respondents in houses were less likely to say they knew how much energy and gas they used compared with those in semis and flats, with those in flats most likely to know. This contrasts to the results for this question for water use (Troy and Randolph, 2006), where flat dwellers were much less likely to know the level of quarterly usage. This result may reflect the greater prevalence of individual energy metering in flats compared with water metering. That flat dwellers are more likely to say they know their electricity usage may well reflect the fact that this is the one utility cost that flat dwellers actually pay directly, and hence are more likely to be aware of this item of expenditure than households with multiple bill payments. Nevertheless, even with electricity usage, well under half of flat dwellers said they knew how much their bills were for.

Table 2.11: Do you know how much electricity or gas you use in a quarter?

	Electricity Yes [1]	Gas Yes	Water Yes[1]
Separate Houses	29%	25%	23%
Semis	41%	36%	21%
All Flats	42%	32%	7%
Flats <4 storeys	42%	28%	7%
Flats >4 Storeys	43%	37%	5%
Total	**723**	**248**	**360**
%	33%	27%	20%
Base	2160	910	2179

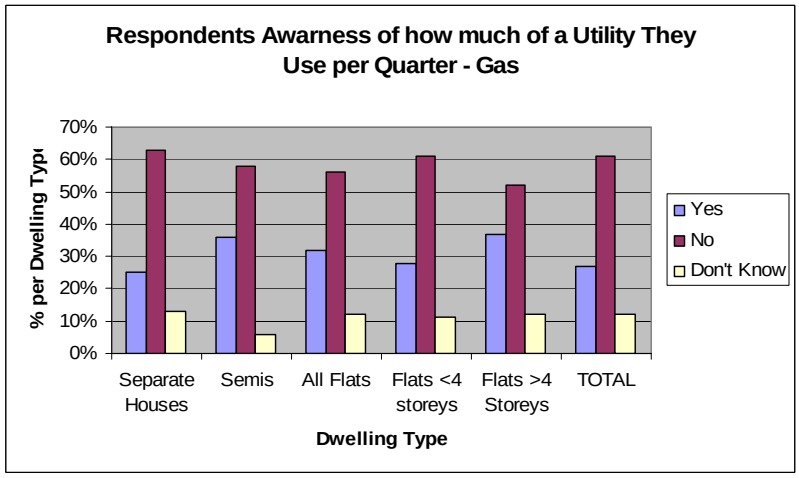
1. Significant at the 95% confidence level

Figure 2.10: Respondents awareness of the how much electricity they use in a quarter



Base = 2160

Figure 2.11: Respondents awareness of the how much gas they use in a quarter



Base = 910

2.7.2 How did respondents' energy usage compare to similar Sydney households?

Overall, 83% or respondents thought they used an average or below average amount of electricity compared with other Sydney households (Table 2.12). Among households with gas, the figure was 86%. Only 12% of electricity users and 8% of gas users thought they used above the average. Most of us therefore believe we are average or below average consumers of energy in the home, a statistical improbability, even allowing for a relatively broad definition of what an average amount might be.

While there was little difference between the perceived usage of gas between gas users in different dwelling types, the difference was significant for electricity use (Tables 2.13 and 2.14). Respondents in houses were less likely than those in higher density houses to say their households used below the average amounts of electricity compared with those in semis or flats. This in part reflects the composition of average household in the three dwelling groups. Nevertheless, even among house dwellers, only 13% thought they used above the average compared with similar households.

Table 2.12: How does your energy use compare with the Sydney average?

	Very Low	Low	Average	High	Very High	Can't Say	TOTAL
Electricity	9%	31%	43%	10%	2%	5%	2156
Gas	17%	34%	35%	7%	1%	6%	909

Significant at the 95% confidence level

Table 2.13: How does your electricity use compare with the Sydney average?

	Very Low	Low	Average	High	Very High	Can't Say	TOTAL
Separate Houses	7%	28%	46%	11%	2%	5%	**1384**
Semis	9%	30%	43%	10%	2%	6%	245
All Flats	13%	37%	35%	7%	2%	6%	527
Flats <4 storeys	14%	37%	35%	8%	1%	5%	332
Flats >4 Storeys	12%	37%	35%	7%	1%	7%	180
TOTAL	**192**	**660**	**934**	**212**	**41**	**117**	**2156**
%	9%	31%	43%	10%	2%	5%	100%

Significant at the 95% confidence level

Table 2.14: How does your gas use compare with the Sydney average type?

	Very Low	Low	Average	High	Very High	Can't Say	TOTAL
Separate Houses	16%	35%	36%	7%	1%	6%	639
Semis	18%	34%	37%	4%	1%	6%	99
All Flats	21%	32%	32%	6%	1%	8%	171
Flats <4 storeys	21%	34%	31%	6%	1%	7%	82
Flats >4 Storeys	19%	31%	35%	7%	0%	8%	84
TOTAL	**155**	**312**	**318**	**61**	**7**	**56**	**909**
%	17%	34%	35%	7%	1%	6%	100%

Significant at the 95% confidence level

2.7.3 Is the current pricing of electricity and gas is fair?

Although the majority of respondents were unaware of the price of energy they used and clearly under estimated the amount they used compared with others, most felt the price they paid for energy was fair. Around two thirds of respondents (64%) thought the price of electricity was fair and just under three quarters (73%) of gas users thought gas prices were fair.

While there was little difference in attitudes to the fairness of electricity pricing between dwelling types, there was a tendency for flat dwellers to be less positive about the fairness of gas prices compared with other users. Respondents in higher density housing were also more likely to have no opinion at all on this question, a possible reflection of the numbers of tenants in this type of property who may not pay energy bills directly.

Table 2.15: Do you feel that the current pricing of electricity or gas is fair?

	Electricity Yes	**Gas Yes**
Separate Houses	60%	75%
Semis	60%	72%
All Flats	62%	65%
Flats <4 storeys	62%	70%
Flats >4 Storeys	63%	58%
TOTAL	**1307**	**661**
%	64%	73%
BASE	2058	909

Table 2.16: Is the Current Pricing of Electricity Fair by Dwelling Type

	Yes	**No**	**Don't Know**	**TOTAL**
Separate Houses	60%	29%	11%	1283
Semis	60%	25%	16%	247
All Flats	62%	22%	16%	528
Flats <4 storeys	62%	24%	14%	331
Flats >4 Storeys	63%	17%	20%	179
TOTAL	**1307**	**474**	**277**	**2058**
%	64%	23%	13%	100%

Significant at the 95% confidence level

Table 2.17: Is the Current Pricing of Gas Fair by Dwelling Type

	Yes	**No**	**Don't Know**	**TOTAL**
Separate Houses	75%	14%	11%	639
Semis	72%	18%	9%	99
All Flats	65%	17%	18%	171
Flats <4 storeys	70%	13%	17%	83
Flats >4 Storeys	58%	22%	19%	84
TOTAL	**661**	**137**	**111**	**909**
%	73%	15%	12%	100%

Significant at the 95% confidence level

2.7.4 Does the current price of electricity and gas encourage conservation?

It is generally thought that attitudes to conservation are likely to be influenced by pricing. When asked if the price they paid for their energy encouraged them to conserve their use of electricity or gas, overall just over a third of respondents thought it did, while almost half thought it did not. But around one if six had no opinion on this issue. There was very little difference in the responses between electricity or gas. On balance, then, current energy pricing was thought not to encourage conservation (Table 2.18).

Table 2.18: Does the current price of energy (electricity or gas) encourage conservation?

	Yes	No	Don't Know	TOTAL
Electricity	37%	47%	16%	2158
Gas	35%	46%	19%	909

There was little difference between respondents living in different dwelling types in the proportion who thought the pricing of electricity did encourage conservation (Table 2.19). Respondents in higher density housing (semis and flats) were more likely not to have an opinion on this issue, again possibly reflecting the higher proportion of tenants in this form of housing who might not actually pay these bills themselves.

House dwellers were more likely to say they did not believe electricity prices encouraged conservation. This might be due to their greater average household energy use, and therefore greater sensitivity to the cost of their energy than flat dwellers.

There was no discernable difference between the dwelling groups in responses by to this question for gas users, other than the higher proportion of 'Don't knows' among flat dwellers (Table 2.20).

Table 2.19: Does the current price of electricity encourage conservation by dwelling type?

	Yes	No	Don't Know	TOTAL
Separate Houses	37%	50%	13%	1383
Semis	36%	43%	21%	247
All Flats	38%	40%	22%	528
Flats <4 storeys	39%	40%	21%	332
Flats >4 Storeys	39%	38%	23%	179
Electricity	37%	47%	16%	2158

Significant at the 95% confidence level

Table 2.20: Does the current price of gas encourage conservation by dwelling type?

	Yes	No	Don't Know	TOTAL
Separate Houses	36%	45%	18%	638
Semis	31%	49%	21%	100
All Flats	32%	46%	23%	171
Flats <4 storeys	32%	43%	24%	83
Flats >4 Storeys	32%	48%	21%	84
TOTAL	**316**	**416**	**177**	**909**
%	35%	46%	19%	100%

Significant at the 95% confidence level

2.7.5 Should people who use well above average amounts of electricity or gas have to pay additional fee?

Is there support for differential pricing of energy for heavy energy users? When we asked this question in the parallel water study (Troy and Randolph 2006) the results showed three quarters of these same respondents supported the idea for water pricing. But when asked the same question for energy, the results were less positive. Under two thirds (63%) thought heavy electricity consumers should pay additional amounts and the figure dropped to 59% for gas users (Table 2.21). It may be that the higher level of public awareness of water as being in a crisis situation may mean the public is more inclined to agree that heavy users should be penalised. There was no equivalent campaign to reduce use of energy compared with that being targeted on water at the time of the survey. Nevertheless, there were clear majorities in favour of differential pricing for both heavier electricity and gas users. Moreover, there was little variation in attitudes across the four dwelling categories for either gas or electricity users, indicating a broadly consistent level of support for differential pricing across the population (Tables 2.22 and 2.23).

Table 2.21: Should consumers who use well above average amount of electricity or gas pay an additional fee?

	Yes	No	Don't Know	TOTAL
Electricity	63%	29%	8%	2158
Gas	59%	32%	9%	909

Significant at the 95% confidence level

Table 2.22: Should consumers who use well above average amount of electricity pay an additional fee by dwelling type?

	Yes	No	Don't Know	TOTAL
Separate Houses	62%	31%	7%	1382
Semis	69%	23%	8%	247
All Flats	65%	27%	9%	528
Flats <4 storeys	65%	27%	8%	331
Flats >4 Storeys	64%	26%	10%	179
TOTAL	**1368**	**623**	**166**	**2157**
%	63%	29%	8%	100%

Significant at the 95% confidence level

Table 2.23: Should consumers who use well above average amount of gas pay an additional fee by dwelling type?

	Yes	No	Don't Know	TOTAL
Separate Houses	59%	33%	8%	639
Semis	65%	28%	8%	100
All Flats	58%	32%	10%	171
Flats <4 storeys	59%	32%	9%	82
Flats >4 Storeys	57%	32%	11%	84
TOTAL	**538**	**294**	**78**	**910**
%	59%	32%	9%	100%

Significant at the 95% confidence level

2.7.6 Should people who use well below average amounts of energy pay a discounted fee or rate?

The converse of penalising heavy energy users was the proposition that those who use well below average amounts should paid discounted charges or fees. Almost similar proportions supported this idea as supported the proposal to penalise high users with extra charges (Table 2.24), with roughly two thirds agreeing and three in ten disagreeing. There was no statistically significant difference in response between the four dwelling groups for either electricity or gas users (Tables 2.25 and 2.26). So, again, these results indicate a general support for differential pricing of energy to encourage lower users across the entire sample.

Table 2.24: Should consumers who use well below average amount of electricity or gas pay a discounted fee?

	Yes	No	Don't Know	TOTAL
Electricity	66%	29%	4%	2157
Gas	61%	29%	9%	938

Table 2.25: Should consumers who use well below average amounts of electricity pay a discounted fee by dwelling type?

	Yes	No	Don't Know	TOTAL
Separate Houses	66%	30%	4%	1383
Semis	71%	25%	4%	246
All Flats	66%	28%	6%	528
Flats <4 storeys	66%	29%	6%	332
Flats >4 Storeys	66%	27%	7%	179
TOTAL	**1434**	**631**	**92**	**2157**
%	66%	29%	4%	100%

Significant at the 95% confidence level

Table 2.26: Should consumers who use well below average amounts of gas pay a discounted fee by dwelling type?

	Yes	No	Don't Know	TOTAL
Separate Houses	64%	31%	6%	669
Semis	67%	26%	7%	99
All Flats	61%	30%	9%	170
Flats <4 storeys	64%	27%	9%	82
Flats >4 Storeys	60%	33%	8%	84
TOTAL	**576**	**275**	**87**	**938**
%	61%	29%	9%	100%

Significant at the 95% confidence level

2.7.7 Do you think that price of energy should be increased to encourage people to use less?

Differential pricing to reward lower energy use and penalise higher energy use is one approach to managing demand for energy. Increasing prices generally is another. When asked if energy prices should be increased across the board to encourage lower use, a clear majority said no. Around seven out of ten respondents did not agree with this as an acceptable demand management approach, with only one in five (21%) of both electricity and gas users thinking this would be acceptable (Table 2.27). Fewer than one in ten did not have an opinion. So while respondents felt that encouragement for lower energy consumption should be given through a differential pricing regime, relatively few wanted to pay higher prices themselves.

Table 2.27: Do you think the price of energy should be increased to encourage people to use less?

	Yes	No	Don't Know	TOTAL
Electricity	21%	73%	7%	2156
Gas	21%	70%	9%	909

2.7.8 Increasing prices for electricity use

When asked whether price increases should be introduced to encourage greater savings in energy consumption, electricity users overwhelmingly rejected the idea. Almost three quarters (73%) said they did not support this proposition, with only 21% in favour. A relatively small proportion (7%) did not have a view on this (Table 2.28).

Rejection rates were high across all four dwelling types, although there was a discernable tendency for those in higher density homes to support the idea, with as many as 28% of high rise flat dwellers agreeing.

This result can be interpreted as indicating that most people do not think they should have to shoulder the financial burden of reducing energy demand or pay to address other peoples less responsible energy consumption behaviour, and ties in with the finding that most people perceive themselves to be average or below average energy consumers. On the other hand, flat dwellers, comprising largely of smaller households, may also perceive themselves to be relatively low users on a household basis, and therefore more likely to agree that prices could be used to restrain energy use in larger households who are most likely not to be live in flats.

Table 2.28: Should electricity prices be increased to encourage lower electricity use by dwelling type

	Yes	No	Don't Know	TOTAL
Separate Houses	19%	76%	5%	1382
Semis	22%	70%	7%	246
All Flats	25%	65%	10%	528
Flats <4 storeys	23%	67%	10%	332
Flats >4 Storeys	28%	62%	10%	179
TOTAL	**446**	**1569**	**141**	**2156**
%	21%	73%	7%	100%

Significant at the 95% confidence level

2.7.9 Increasing prices for gas use

There was a similar result when gas users were asked whether gas prices should rise to encourage lower use, with just 21% of gas users agreeing with that sentiment and 70% disagreeing (Table 2.29). In this case, there was little difference in the results between respondents in the four dwelling types.

Table 2.29: Should electricity prices be increased to encourage lower gas use by dwelling type

	Yes	No	Don't Know	TOTAL
Separate Houses	21%	71%	8%	639
Semis	25%	66%	10%	100
All Flats	21%	69%	11%	170
Flats <4 storeys	17%	73%	10%	83
Flats >4 Storeys	24%	66%	10%	83
TOTAL	**192**	**636**	**81**	**909**
%	21%	70%	9%	100%

Significant at the 95% confidence level

2.7.10 By how much should energy prices rise to encourage energy saving behaviour?

Those who thought prices rises should be used to encourage lower energy consumption where also asked how much such a price rise should be. The answer was by not much. Just under half of these respondent thought prices should increase by just 5%, and around a third thought a rise of between 5% and 10% would be enough (Table 2.30). Relatively few saw merit in higher price rises. There were no significant difference in the response to this answer between respondents in different dwelling type (2.31 and 2.32).

Table 2.30: How much should energy prices rise to encourage energy saving behaviour?

	5%	10%	15%	20%	Over 20%	TOTAL
Electricity	44%	35%	6%	8%	7%	445
Gas	46%	32%	9%	5%	7%	192

Table 2.31: How much should electricity prices rise to encourage energy saving behaviour?

	5%	10%	15%	20%	Over 20%	TOTAL
Separate Houses	44%	36%	6%	8%	6%	259
Semis	43%	34%	6%	7%	10%	54
All Flats	45%	32%	6%	9%	7%	132
Flats <4 storeys	44%	35%	5%	11%	5%	77
Flats >4 Storeys	50%	28%	4%	7%	11%	51
TOTAL	**197**	**154**	**26**	**37**	**31**	**445**
%	44%	35%	6%	8%	7%	100%

Table 2.32: How much should gas prices rise to encourage gas saving behaviour?

	5%	10%	15%	20%	Over 20%	TOTAL
Separate Houses	44%	33%	11%	5%	6%	132
Semis	58%	25%	2%	4%	11%	25
All Flats	48%	33%	4%	6%	8%	36
Flats <4 storeys	39%	44%	7%	5%	6%	14
Flats >4 Storeys	52%	29%	3%	7%	10%	21
TOTAL	**89**	**62**	**18**	**10**	**14**	**192**
%	46%	32%	9%	5%	7%	100%

2.7.11 Do you think prices should be increased generally to pay for improved conservation policies and practices?

While only a minority of respondents supported energy price rises to encourage energy conservation, what was their attitude to pricing to encourage wider conservation practices across a broader range of environmental issues? Perhaps surprisingly, a higher percentage were in favour of this idea – just under three in ten – than supported higher energy prices to stimulate lower consumption, but these respondents still represented a minority, with around six in ten rejecting this idea (Table 2.33). From this evidence support for pricing policies to address environmental issues is limited.

Table 2.33: Do you think the energy prices should increase generally to pay for improved conservation polices and practices?

	Yes	No	Don't Know	TOTAL
Electricity	29%	61%	9%	2158
Gas	27%	64%	9%	910

There was a much more varied response between the dwelling types. Once again, respondents living in flats reported the highest support for wider conservation pricing policies (Tables (2.34 and 2.35). Around two in five residents of high rise flats support wider pricing approaches, compared with only a quarter of those living in houses.

Table 2.34: Do electricity users think electricity prices should increase generally to pay for improved conservation polices and practices by dwelling type?

	Yes	No	Don't Know	TOTAL
Separate Houses	26%	66%	8%	1383
Semis	33%	56%	11%	247
All Flats	36%	52%	12%	528
Flats <4 storeys	35%	53%	12%	332
Flats >4 Storeys	38%	49%	12%	179
TOTAL	**634**	**1322**	**202**	**2158**
%	29%	61%	9%	100%

Table 2.35: Do gas users think the gas prices should increase generally to pay for improved conservation polices and practices by dwelling type?

	Yes	No	Don't Know	TOTAL
Separate Houses	24%	67%	9%	639
Semis	29%	61%	10%	100
All Flats	36%	53%	11%	171
Flats <4 storeys	33%	56%	11%	82
Flats >4 Storeys	39%	51%	10%	84
TOTAL	**246**	**580**	**84**	**910**
%	27%	64%	9%	100%

Figure 2.12: Do electricity users think electricity prices should increase generally to pay for improved conservation polices and practices by dwelling type?

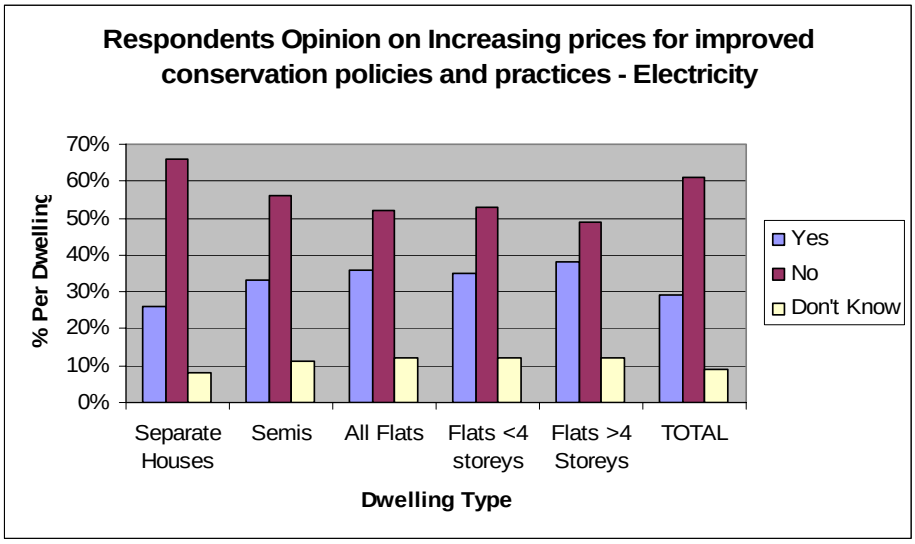
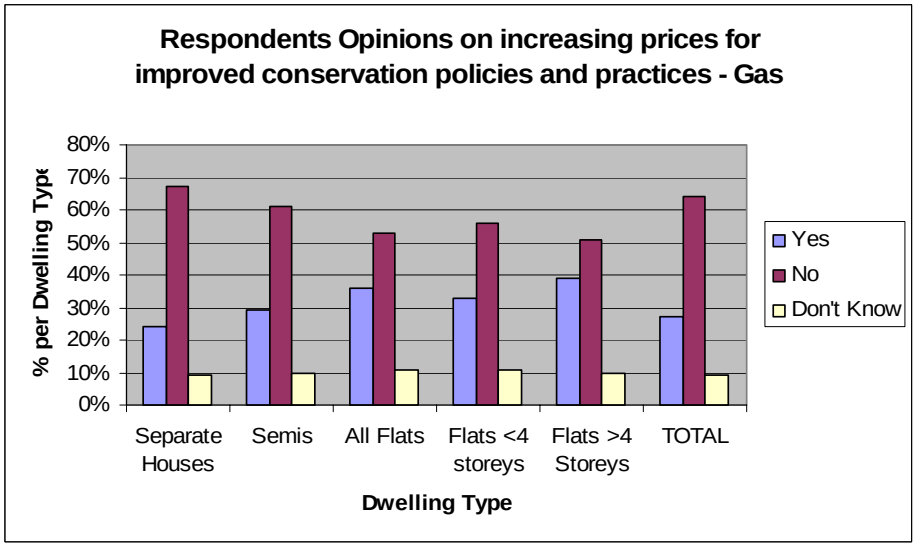


Figure 2.13: Do gas users think gas prices should increase generally to pay for improved conservation polices and practices by dwelling type?



When those who supported broader pricing policies to encourage conservation were asked by how much the prices should increase, once again, the amounts were relatively modest. Just over a half would be happy with a 5% increase and a further three in ten with a 10% rise. Only one in twenty would support rises over 20%. There was little difference between dwelling groups.

Table 2.36: By how much should prices be increased to encourage conservation?

	5%	10%	15%	20%	Over 20%	TOTAL
Electricity	57%	29%	4%	6%	5%	634
Gas	51%	33%	4%	6%	6%	247

2.7.12 Would you use more energy saving devices?

Finally, respondents were asked if they would be prepared to use energy saving devices under different levels of subsidy. The results show that support by government for such devices could be critical in promoting more general acceptance and take up.

To the question would you use more energy saving devices if you had to pay for them, 48% said yes and 42% said no and 10% didn't know (Table 2.37). This finding suggests that there is willingness for a sizeable minority to buy such devices regardless of whether they are subsidised. While we did not specify what kind of devices, this nevertheless indicates a broad support for adopting such innovations where possible.

If the energy devices were to be subsidised at half price, then many more would considered their take-up: 77% would use more of these devices and only 17% would still refuse. If they were provided for free, the support rises to 87%, with 10% rejecting the offer. There was no discernable difference between dwelling type groups in their answers to this question.

While the answers to this question offered no guide as to the type and cost of any water or energy conservation devices respondents might have been thinking of when answering it, the results show a strong latent support for conservation technologies in the home. This support increases substantially if the products are in part subsidised. Indeed, only a relatively marginal additional take-up appears to be achieved by fully subsidising such devices. Respondents seem content with paying for some or all of these devices themselves.

Table 2.37: Would you use more energy saving devices if they were subsidised?

	Yes	No	Don't Know	TOTAL
No subsidy	48%	42%	10%	2179
Half subsidy	77%	17%	6%	2179
Full Subsidy	87%	10%	4%	2179

Table 2.38: Would you use more energy saving devices if you had to pay for them by dwelling type

	Yes	No	Don't Know	TOTAL
Separate Houses	48%	42%	9%	1394
Semis	49%	39%	12%	248
All Flats	47%	41%	12%	536
Flats <4 storeys	49%	39%	12%	333
Flats >4 Storeys	43%	43%	14%	185
TOTAL	**1046**	**905**	**227**	**2178**
%	48%	42%	10%	100%

Table 2.39: Would you use more energy saving devices if they were subsidised at half price dwelling type

	Yes	No	Don't Know	TOTAL
Separate Houses	77%	17%	6%	1394
Semis	78%	16%	6%	248
All Flats	77%	16%	6%	536
Flats <4 storeys	79%	15%	6%	332
Flats >4 Storeys	75%	19%	6%	185
TOTAL	**1680**	**368**	**130**	**2178**
%	77%	17%	6%	100%

Table 2.40: Would you use more energy saving devices if they were provided free by dwelling type

	Yes	No	Don't Know	TOTAL
Separate Houses	87%	10%	4%	1395
Semis	87%	10%	3%	248
All Flats	86%	10%	4%	535
Flats <4 storeys	88%	9%	3%	333
Flats >4 Storeys	82%	13%	5%	186
TOTAL	**1888**	**212**	**78**	**2178**
%	87%	10%	4%	100%

PART 3: QUALITATIVE RESEARCH

3.1 Introduction

The primary aim of the qualitative research was to gain an understanding of consumer attitudes towards energy use and their perceptions of a range of energy saving initiatives. To fulfil this aim a number of secondary objectives were addressed:

- Identifying perceptions of energy use: What proportion of electricity and gas is perceived to be used in their own homes for water heating, home heating and cooling, refrigerator, cooking, lighting, and other appliances;
- Response to actual percentages of energy use for each of the above;
- Type of households perceived to be the biggest users of energy;
- Estimated amount of energy used by the average person in Sydney per year, using a range of amounts in kilowatt hours (kWhs) to assist;
- Level of meaning of quarterly volume and cost figures to consumers, as reported on electricity and gas bills;
- Ascertaining the perceived amount of energy consumers can save, in kWh/Milli Joules (MJ) and dollar terms by implementing various energy saving devices / means suggested by participants;
- Identifying consumer generated ways of saving energy at home;
- Source of awareness of these energy saving methods;
- Which, if any, energy saving methods participants have implemented in their homes;
- Energy saving methods most likely to be implemented in the next few years;
- Perceptions of the price of energy and its impact on energy saving;
- Response to actual price of both electricity and gas;
- Criteria for determining value for money of electricity and gas supplies;
- Perceived impact of increase in price of energy on motivation to conserve energy;
- Estimates of the extent by which energy charges would need to increase in order to motivate participants to seriously reduce their energy use;
- Response to the concept of high energy users being required to pay a surcharge for use above an amount deemed appropriate for a particular household type.

3.2 Qualitative Survey Findings

3.2.1 Single greatest perceived user of energy in individual households

As participants introduced themselves at the beginning of each group, they were asked to indicate what they considered to be the single biggest user of energy in their own household. The answers were recorded for each respondent on a short questionnaire. Table 3.1 indicates the incidence of each of the following uses being mentioned, i.e. 25% spontaneously mentioned water heating as the single biggest user of energy, etc.

Table 3.1: Single biggest use of energy in the home

ALL PARTICIPANTS	**%**
Water Heating	25
Home Heating & Cooling	23
Refrigerator	22
Cooking	8
Lighting	11
Other Appliances	11

The majority of participants perceive the hot water heater to be the single greatest user of energy in their households. This was particularly the case in households with teenagers. Although they did not articulate the connection between energy and water consumption, the perception of householders that water heating was the largest user of energy eloquently makes the point.

The second greatest single user of energy in the household was perceived to be home heating and cooling, i.e. heaters, air conditioners and fans. This was particularly the case in households with babies where it was deemed necessary to keep the house warm. While some make efforts to reduce the use of heaters by putting on extra clothes, others claim to live with people who insist on using the heater as the primary source of keeping warm. Coupled with this was a tendency to leave doors open or fail to switch heaters off when the room was not in use. This could be interpreted as energy prices being too low to encourage conservation.

Appliances that contribute to comfort levels were felt to be large users of energy. The more enhanced the comfort level (e.g. reverse cycle air conditioning) the greater the use of power.

> *"All the luxury items use the most don't they? Like the heating for the pool" (Group 11)*

The fact that the fridge was on permanently and that a number of households have a second, inefficient fridge leads many to assume that the fridge was a large user of energy. This reflects the fact that there was little understanding of the different amounts of kWh taken to power the full range of household electrical items.

A small minority identified the clothes dryer as a large user of energy in their `households as they are cognizant of the fact that dryers use a large amount of power. This was included in 'other appliances' which also includes computers and televisions which are heavily used in households with teenagers.

Cooking was not felt to consume large amounts of power relative to the other uses of power listed above. Dinner was generally the only meal that was cooked. Those with gas cookers or ovens felt them to be low power users. A number of participants frequently ate out or bought 'take away' meals.

3.2.2 Estimated proportions of energy use in own households

Having identified the main uses of energy in their own households, participants were then asked to estimate the proportion of energy use that would be accounted for by each use. Again the responses were recorded and are presented in Table 3.2. This was a difficult task for the majority of participants as most consumers have little, if any, concept of the amount of energy used for different energy consuming tasks in the household.

While water heating remained the main overall use of energy perceived by participants, the other uses were more evenly distributed. This suggests respondents were basically unable to differentiate between the different domestic energy uses in terms of actual energy used.

But there were difference between house and flat dwellers. Flat dwellers tended to attribute the greatest use of energy to be for water heating, whilst the groups of house dwellers nominated either heating and cooling or 'other appliances', as the biggest users. Flat dwellers in this sample comprised young singles and couples as well as families. Respondents with large numbers of children tended to made higher estimates of energy use for 'other appliances' due to the time children spent on computers or watching television.

Home heating and cooling was deemed the next biggest user of energy with heating rather than cooling being seen as the major energy user. This reflects the fact that while most heat their homes, few had air conditioning and alternative cooling systems such as fans aren't seen as high energy users. Heating and cooling is less likely to be seen as a big user of energy by flat than by house dwellers.

Table 3.2: Estimate of energy consumption by dwelling type

	FLAT DWELLERS	HOUSE DWELLERS	ALL PARTICIPANTS	AUSTRALIAN AVERAGE [18]
	%	%	%	%
Water Heating	30	20	23	27
Home Heating & Cooling	13	21	17	39
Refrigerator	17	14	15	9
Cooking	17	12	14	4
Lighting	15	15	16	5
Other appliances	10	18	15	16

3.3.3 Response to actual proportions of energy used by the Average Australian

Having estimated how energy use in their own households is spread over various uses, participants were then shown the average proportions of energy use by Australian households.

[18] See Figure 1.2 above

When the percentages of energy use were revealed, participants were extremely surprised, particularly by the low percentage for lighting and cooking given the propensity to leave multiple lights on unnecessarily and the perceived universality of cooking by some.

> *"I'm surprised cooking is so low because everyone cooks" (Group 11)*

> *"Most people don't turn off lights or have energy efficient bulbs. I was once shown this lump of coal and told it would take this to light a bulb for 4 hours and I thought 'that's a lot'." (Group1)*

While some questioned the credibility of the figures, some house dwellers expressed amazement that well over a third of domestic energy was spent heating water. Some responses suggested that people equated lower cost with lower energy – if their water is off peak, they pay less for it and this leads them to believe they must be using less energy.

3.2.4 Types of households perceived to be the biggest users of energy

Amongst house dwellers the size, structure, position and design of their house was deemed to be the greatest determinant of the amount of energy used. This highlighted the greater significance of heating and cooling for house compared with flat dwellers. The types of houses thought likely to use the greatest amounts of energy were described in the following terms:

- Large size
- Modern
- Single brick construction
- Poorly insulated
- Street facing
- No eaves
- Open plan living
- Large reverse cycle air conditioning unit
- Large number of large windows
- Swimming pools
- Large electric / instant (not-off peak) water heaters
- Fitted with luxury items such as heated towel rails

In contrast, flat dwellers placed great weight on the socio-cultural 'attitudes' and lifestyles of the occupants of a dwelling as the primary influence on energy use. High energy using house dwellers were likely to exhibit the following traits:

- Unaware of the amount of energy used by various appliances
- Ego centric
- Lack of environmental awareness
- Seek immediate gratification rather than considering the future
- House based:
    - work at home;
    - stay at home a lot with children rather than taking them out
    - 'couch potatoes'

Both house and flat dwellers identified households with children and teenagers as likely to consume more energy than households without children or teenagers. Participants felt that regardless of their age, the young (children and teens) do not think about energy consumption because:

- "it is not on their 'radar'."
- "they do not have responsibility for paying energy bills."

It was felt strongly that energy saving behaviour was learned so that children needed to be taught not to be wasteful in their use of lights and heaters. Those brought up in a household where energy conservation was not an issue were not likely to learn energy saving behaviour such as turning lights off when they leave a room.

Teenagers pose a greater problem when it comes to using energy: their increasing independence leads them to occupy additional rooms in the house, spend long periods on their computers and 'play stations' etc as well as taking long hot showers. Teenagers were thought to have a significant degree of control over their lives leading them to behaviour that increased energy consumption such as feeling free to help themselves to food and drinks stored in refrigerators or to watching TV in a different room from the rest of the household

Finally, wastefulness was recognised as a luxury typical of the wealthy rather than the poor. The more affluent a household was the less conscious it was likely to be in its use of energy. Also, there are those who prefer to spend their disposable income on holidays rather than replacing inefficient appliances with new energy efficient models.

3.2.5 Amount of energy used by average person in Sydney per year

Estimated

Estimating the average amount of energy consumed by a person per year in terms of kilowatt hours (kWhs) in Sydney proved to be a very difficult task for participants. When presented with a range from which to choose most found the task impossible and couldn't hazard a guess. This reflects the fact that people have no idea either of how much energy they use overall or of how much energy is used by particular devices. Energy use is all but invisible and this is exacerbated by the fact that kWhs is an unfamiliar and meaningless unit of measurement for most.

Amongst the minority prepared to hazard a guess, estimates ranged from 200 to 51000 kWhs per year for the average person living in Sydney.

It is clear that price charged for the energy consumed in a household is considerably more meaningful than the quantity of energy used. Indeed, energy consumption figures are not felt to make any sense unless put in dollar terms.

Actual

After being asked to estimate the annual amount of energy consumption for the average person in Sydney per year participants were shown the following:

	HOUSE	**UNIT**
Per Person	2600 kWh	2050 kWh
Per Dwelling	8970 kWh	5780 kWh

These figures lacked meaning for participants as they unfamiliar with kWh as a unit of measurement.

3.2.6 Estimated amount of energy used in participants own households

On being told that the average house dweller in Sydney uses 2600kWh per year and the average unit dweller uses 2050 kWh per year, participants were asked to estimate how much energy they used in their own households per quarter in terms of both volume and cost.

The overwhelming finding here was that most had no idea of how much energy they use per quarter and no confidence in trying to work it out. Those willing to estimate made wild guesses which ranged from 150 kWhs to 3000 kWhs per quarter.

The main reason estimating the amount of energy consumed was felt to be hard was that few participants ever looked at the amount consumed as they are primarily interested in how much they have to pay. While many were interested in comparing consumption levels with that of previous quarters, as shown by the graph on the bill, details such as number of kWhs were ignored in favour of whether any fluctuation had occurred and, if so, in what direction. They were more interested in how much energy they have used in relative rather than absolute terms.

When participants estimated how much they used in their own household in both kWh and dollar terms, some were accurate in the latter figure but wildly inaccurate with the former. Their ability to make an accurate estimate was further complicated by whether or not their household was connected to gas.

3.2.7 Perceived level of meaning of information presented on energy bills

Participants were asked to bring their energy bills with them to the groups. Energy bills were presented from Energy Australia, AGL and Integral Energy. The only information on these bills in which they had any interest was:

- how much this was going to cost the householder; and
- how much energy their household used since the last bill & compared with the corresponding quarter the previous year.

Some only refer to the figure they have to pay as the rest, including savings in kWhs, meant nothing to them.

The information on the bill was important to consumers with some using their bills as a means of checking that they are being fairly charged. Some sceptics felt that

they cannot be sure of the accuracy of their bills in terms of the number of kWhs used because, as far as they are concerned, they have no way of checking.

The provision of the 'daily use average' makes it possible for a householder to see how they are performing compared with the previous bill and is relatively easy to understand, which is a key strength of the bill's layout. Comparisons with running daily averages were felt to be important.

As well as rendering the amount of energy used more meaningful, comparisons with previous quarters have the benefit of demonstrating the benefit of energy saving behaviour such as replacing a multitude of light bulbs with energy efficient globes.

It appears that comparative information tends to be in the 'nice to know' category rather than triggering endeavours to reduce energy consumption if an increase has occurred.

Knowing that their energy use had decreased does not necessarily mean that energy consumption generally had become more efficient. Consumers look for further information to be provided on their bills to enable them to compare their household's energy use with that of the Sydney average. Such comparative information would enable householders to see how their use compared with the rest of their suburb for example.

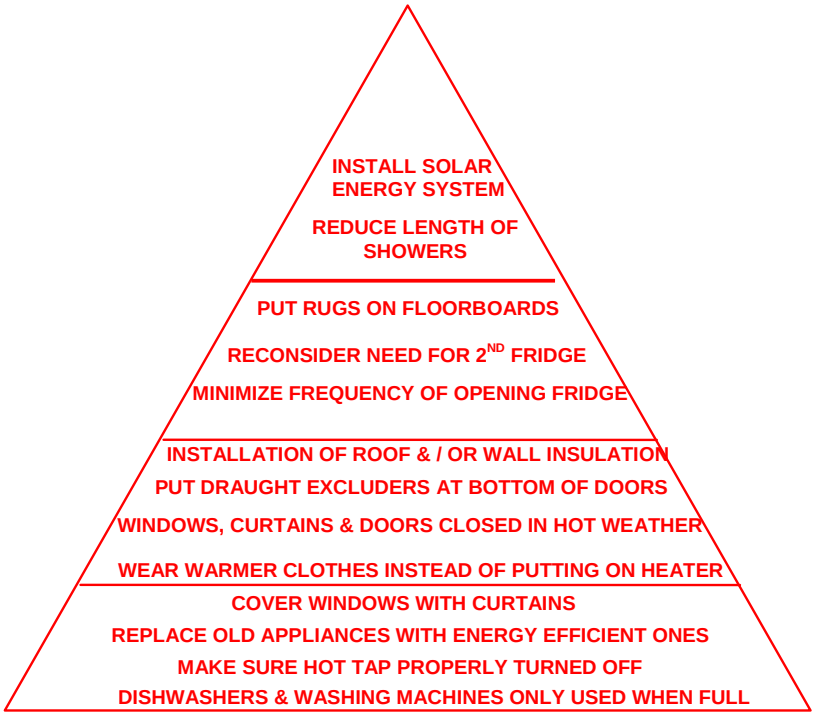
> *"Compared to everyone else I am using more or less, so you can try harder or feel good about what you're doing" (Group 1)*

3.2.8 Consumer generated ways of saving energy at home

When asked in what ways they could reduce energy use in the home, participants generated a plethora of proposed energy saving initiatives. Respondents were asked to indicate which initiatives they were already implementing, which they were likely to do in the next few years and which they were least likely to implement. Intention to implement each initiative varied enormously between participants. While some had already implemented a number of initiatives, others claimed that they would do so in the foreseeable future and still others had no intention of so doing. The wide range of initiatives mentioned and the small sample means the results presented here can only be indicative

Figure 3.1 summarises householders' propensity to implement a range of energy saving initiatives, with those likely to be implement by the majority towards the bottom and those likely to be implemented by the minority towards the top. It is significant that reducing the length of time showering was mentioned by relatively few participants. The use of the shower is clearly a strongly ingrained activity for many people. Few also suggested installing solar energy systems, clearly a reflection f the costs and trouble involved, but also reflecting lack of knowledge of the potential benefits of doing so. These responses extend the results of the quantitative survey discussed in Section 2 above with a much wider range of unprompted responses which reflect micro-level actions within the home that might all contribute to reduced energy consumption.

Figure 3.1: Proposed energy saving methods that participants suggest could be adopted (most frequently cited at bottom and least frequently cited at top)



3.2.9 Perceived amount saved by implementing energy saving initiatives

Few consumers had any concept of the amount of kWhs or dollars that could be saved by undertaking specific energy saving initiatives. Only the dollar saving appear to have the likelihood of creating incentives for the majority of householders to change their behaviour. This reflects the community wide lack of understanding of the connection between kWh and consumption of non-renewable resources or greenhouse gas emissions. It is not easy to obtain a tangible / immediate 'reward' for implementing energy saving initiatives, and this acts as a barrier to many putting them into action. It was not deemed worthwhile implementing energy saving initiatives unless the savings were significant:

> *"…a waste of bloody time" (Group 4)*

Some questioned the value of replacing old, inefficient fridges with new high star rated fridges, or getting rid of them altogether if they were a second, rarely used fridges, on the grounds that the effort was not worthwhile. Similarly, for some, claims that fluorescent lights were more energy efficient lacked credibility. A simple mental cost benefit analysis often worked against certain energy saving initiatives being implemented: For example, a household might save some kWhs and dollars by turning off their water heater when going on holiday but the inconvenience caused by not having immediate access to hot water on arriving home rendered it not worth doing.

What became apparent in the discussions was that the extent to which householders were prepared to implement energy saving behaviour was limited to those initiatives that did not reduce their comfort or convenience. The energy saving initiatives that were deemed most likely to save the most in terms of kWh and dollars were in minimising:

- the amount of water that is heated; and / or
- the use of heaters and air conditioners.

As both impact on the comfort levels and convenience of every member of the household it takes a very committed person to implement such initiatives.

In order to have some grasp of the amount of kWh and / or dollars saved by implementing energy saving initiatives, householders needed to have some understanding of the wide range of amounts of energy used by different appliances which was a function of the rate at which they used energy and duration of use. A lack of such understanding leads to polarised views on which initiatives are worth undertaking and which are not: While some thought that not using an electric blanket was a way to save energy because they use a lot of electricity, others felt that it was ok to use electric blankets because they were only on for a short time. Some felt that leaving mobile phones charging up over-night was a waste of electricity. Flat dwellers questioned the value of switching off stair and garage lights in their blocks to save energy on safety grounds when they were often fitted with fluorescent bulbs anyway.

Those who have implemented some energy saving initiatives do not feel that they have led to significant savings in kWh and, subsequently, dollars.

> *"We've put in low-flow shower heads in both bathrooms and I see no difference with the bill" (Group 3)*

In general, participants had little ability to estimate how much energy could be saved by reducing individual consumption. Those initiatives that lead to the most significant cost savings were often the ones that were least likely to be implemented:

- Some didn't have the money upfront;
- Others were unlikely to stay in the household long enough to recoup the benefits;
- If renting their home, then installing insulation and/or changing water heating arrangements such as installing off-peak heating was not feasible as the landlord would be most unlikely to do this for them.

Participants were basically half hearted about implementing the above initiatives – to do so would lead to some decrease in the level of comfort and/or convenience they currently enjoyed. Despite the best efforts of the bill-paying member of the household, it was thought that other members would be much less willing to comply with such initiatives.

3.2.10 Perceptions of the price of energy

The majority of participants had no idea of the price of either electricity or gas. Few had thought about it before and some clearly only did so when they received a bill. While most thought water was "ridiculously cheap", the price of energy elicited little response. Participants simply felt that it cost what it cost and that's the way it was. This illustrates an important distinction between perceptions of water use and conservation versus perceptions of energy use and conservation:

- **Water** is in the spotlight and has been so for some time as a result of the drought, media coverage and restrictions on householders' use of it. Water was viewed with emotion as well as pragmatically as it is essential and appears to be running out. The fact that different types of people have responded with differing levels of commitment and responsibility to the need to conserve water and that blame is apportioned to government's and water authorities made water difficult to discuss in terms of price.

- **Energy** has taken a back seat and was viewed more rationally than water. Householders acknowledged that it did not have the place in their minds that water had. Few who participated in the research had seen TV documentaries on greenhouse gas emissions and / or the dwindling nature of fossil fuels expressed any concern about the need to conserve energy[19]. Further probing on the issue of determining the level of value for money for electricity and gas revealed that, on the whole, they were considered cheap, particularly gas.

  > *"It's cheap as chips. I have seen some of the prices of what we sell it to China and Japan for and we pay a fraction of what they pay" (Group 3)*

Furthermore, it was deemed too cheap to motivate saving. The fact that energy is viewed as a necessity for modern life renders value for money "irrelevant" for some. Respondents felt they had no means of determining the value for money of energy:

- Many were unaware of any competition to their current energy supplier to enable them to compare the price of energy with anything in order to establish if electricity is reasonably priced;

- Those who had been approached to change supplier were motivated to do so on being told they would save money but then found that it was difficult in practice to effectively assess price differences being offered.

Some who had paid for their electricity via a contract tended not to feel that they obtained value for money.

> *"We worked out what everything was drawing on a meter and I believe we were losing out" (Group 11)*

[19] Note that this research was conducted before the recent increase in media interest in the outcomes of global worming and climate change.

3.2.11 Perceived impact of increasing in price of energy

With the price of electricity and gas described as too low to encourage reduced consumption, the concept of increasing the price of energy in order to encourage more careful use of it was seen as a logical step but not necessarily an effective one:

> *"If they did increase it, it would be a lot more noticeable to a lot of people" (Group 1)*

> *"We are trying our best to use less. If the price goes up I believe nothing will change" (Group 2)*

A key point was that many electricity consumers did not actually pay the bill so there was no motivation for them to reduce their use as a result of price increase. Attempts to discourage other household members from being wasteful were not seen as being practical or successful.

> *"It would just cause more arguments – the kids won't change and we will just nag to change it" (Group 2)*

Electricity was seen as a necessity as were most of the appliances it runs. It sustains the level of comfort and convenience to which households have become accustomed in modern life. Many householders saw little opportunity to decrease use of such appliances in an attempt to reduce their electricity bill. The perceived lack of impact of recent fuel price increases on people's transport habits was cited as an example of how people tend to wear price increases compared with modifying their behaviour.

> *"Petrol goes up but people still drive. It won't change" (Group 2)*

The link between using an electricity powered 'appliance' and paying for it was often too tenuous to enable it to be easily made.

So the price of electricity and gas was well 'below the radar' of the majority of participants. Specific pricing measures could, however, be implemented to modify energy using behaviour. For example, if the difference in price between off-peak and peak electricity was greater:

> *"…then there might be an incentive to stop using the pool cleaner during the day" (Group 3)*

Additionally, unusually high electricity bills have already encouraged some to modify their behaviour to keep energy costs down.

> *"When we left the heater on all night for the babies, our bill went up by a lot and we thought 'we can't keep going like this.' We now dress them warmer." (Group 11)*

There was support for some increase in the price of electricity and gas, but it would need to be substantial to make a difference to the lifestyle of many which in turn would penalize many low income households. For example: if the quarterly bill for

a young single reached $200 - $300, they might be encouraged to reconsider how frequently they use the clothes dryer.

Finally, similarities can be made with the perceived link between water use, conservation and price and those relating to energy:

- Counter-intuitive though it may seem, many claim to be considerably more motivated by a need to conserve energy than by a desire to save money paid for using it.
- The key trigger they need is not price increase but clear guidance on how to save energy.

"I don't get my bill and think 'I should save on this'. It's about being a good citizen. Do you sit in the dark or shower in cold water. It's not knowing how to do it." (Group 4)

3.2.12 Percentage by Which Energy Charges Would Have to Increase in Order to Motivate Energy Saving

Participants were asked by how much energy prices should rise to encourage energy saving. The wide range of percentage increases householders claimed would motivate energy saving supports the point raised by one young single flat dweller that the ability of any price increase to motivate energy saving was dependent on individual circumstances. While the estimated percentage increases needed to reduce consumption ranged from 10% to 100%, most were around the 25%-50%. Household size and income would have an impact on ability to afford significant increases to the household's energy bill. Low income households living in flats or houses nominated the lowest energy bill increases to motivating energy saving behaviour.

"An increase of $25 would be worrying" (Group 3)

The largest suggested increases of 75%-100% came from house dwelling families, who have more disposable income than some of their counterparts. Young singles tend to have more disposable income, no dependants, fewer financial responsibilities and smaller energy bills due to their lifestyle and reported having a greater ability to pay increases as a result.

"My bill is only $100 so to go to $150 is not so bad for me." (Group 1)

Some felt that large increases in energy bills would be more widely accepted if there was some kind of trade-off, i.e. that the revenue raised was spent for example on research into more sustainable energy sources. So, householders appeared likely to resent the notion of energy saving behaviour motivated by price increases leading to increased profits for energy suppliers.

3.2.13 Alternative ways to encourage energy saving

Subsequent to debating the notion of fostering more restrained use of energy by increasing its price, participants suggested a plethora of alternative ways to

encourage Sydney-siders to use less energy. These were grouped in the following categories and are presented in order according to how successful they were deemed likely to be or how important they were:

- Education on how to save energy and how much money could be saved
- Encouraging purchase of energy efficient appliances and installation of energy saving devices
- Concern for the environment
- Penalising heavy users with surcharges and other penalties
- Government must set a good example and target non-domestic users also

i) Education on how to save energy and how much money can be saved
According to participants by far the most necessary undertaking to encourage reduced energy consumption was the education of householders regarding the amount of energy used by different appliances in terms of cost. Essentially, they wanted to know how much money they could save by better managing their use of appliances. Without an awareness of how much energy members of the household consumes each time they switched on a light, turned up an air-conditioner or took an extra five minutes in the shower, it was almost impossible for even the most well intentioned householder to curb their energy consumption.

To have the desired impact, education on energy savings needs to cut through the "clutter" of other messages and therefore needs to take the form of mass media communication comprising electronic and print media, including:

- Sustained TV advertisement campaign to provide on-going reminders of the need to conserve energy.
- A testimonial approach was suggested in order to demonstrate the difference the efforts of householders can make to their bill, the environment, greenhouse gas emissions and so on.
- Pamphlets with lists of energy saving tips so householders are able to put advice into action easily and are encouraged to do so, e.g. 'by doing x you are able to save x amount on your bill'. Only a minority appeared to be aware of brochures containing energy saving tips supplied by Energy Australia.

Such awareness would enable householders to make informed choices – something respondents indicated they wanted to be able to do. While kWh and MJ mean little as units of measurements to most householders, it would be helpful for them to have some system for being able to identify the level of consumption of different appliances. For example, low, medium or high.

> *"We are motivated but we don't know what we are saving" (Group 11)*

> *"People don't know where they are using the most energy – they need to be educated" (Group 2)*

In addition to educating householders on the amount of energy used by different household appliances in a meaningful way (i.e. not kWh or MJ) and the subsequent cost saving, a segment of householders felt that a better understanding of the environmental benefits of reducing energy consumption was likely to trigger many to reduce household energy consumption. Only those who had watched some

convincing and alarming TV documentaries on the consequences of increased greenhouse gas emissions had much of a sense of environmental reasons to become conscious of household energy consumption.

While the general feeling was for positive environmental messages, i.e. how saving energy can help save the environment, some recognised the need for the stick as well as the carrot. They call for TV commercials that support statistics with visual depiction of the consequences of excessive use of finite resources and the production of greenhouse gas emissions. The impact of saving energy was clearly known to have immediate personal benefits (reduced bill) and longer term community benefits, but the issue was currently too remote to foster appropriate action to be taken by householders.

Finally, the need to 'teach the children in primary schools' emerged as a necessary route to follow in order to ensure that the next generation grows up practicing energy saving behaviour. The fact that it is today's children who stand to suffer the consequences if processes are not put in place now to curtail energy consumption, was felt to lend weight to this argument. Some clearly have more faith in the ability of the young to adopt energy saving behaviour than they had themselves in changing their bad habits!

> *"Maybe we are a lost cause, so the kids need to be taught instead" (Group 11)*

Some identified school based education on energy conservation as a prudent means of getting the message across to those from non-English Speaking Background as their children can bring the energy saving messages home to parents who still have difficulty speaking English.

ii) Encouraging the purchase and installation of energy efficient appliances

While there was widespread recognition that new appliances tend to be more energy efficient than their older counterparts, householders were unlikely to replace existing, inefficient appliances with new high star rating models until the old ones became defunct. Even when they replaced old models, financial constraints limited some from buying appliances with the highest star rating. This, coupled with the fact that suppliers profit from householders using appliances, leads some to believe that householders should be given a financial break to enhance their ability to use energy more efficiently; for example, by the replacement of old appliances with new, energy efficient ones or providing free energy efficient globes with the purchase of new light fittings.

It was thought that phasing out old appliances and buying new ones could be supported by subsidies in the same way as water conserving appliances have, e.g. Sydney Water supplying and fitting low-flow shower heads for $22. This confirms the finding that a high proportion of respondents to the survey would be willing to buy more efficient appliances if some subsidy was involved, as noted in Section 2 above.

Considerable encouragement was felt to be needed to get people to implement energy saving practices such as:

- installing dimmers with down lights;
- checking energy ratings on new appliances before they buy;

- making reverse cycle air-conditioning have the option of being set to different temperature for different rooms;
- ensuring high energy using appliances such as water heaters are chosen with energy efficiency rather than low cost in mind.

These all imply additional expense, hassle, and/or require changing lifetime habits, and participants stressed that changing these established practices needed encouragement.

iii) Concern for the environment
As indicated in section 3.1, the environmental impact of energy consumption was of sufficient concern to a number of householders to warrant it being one of a small number of issues to be addressed in public education campaigns designed to encourage energy conservation. Concern about the environment was such an emotive issue that householders expect it to be a focal point in attempts to encourage energy conservation.

The problem was that many people simply did know what the issues were in relation to the environmental impact of energy consumption, or, more importantly what they could do about it, yet much media coverage continues to assume a certain amount of knowledge and understanding particularly when covering issues relating to green house gas emissions. For example there were requests for visual depictions of the impact of greenhouse gas emissions in order to make it more tangible for people as well as making links between cost savings and positive environmental impact of householders' energy efficient behaviour.

> *"If you save 10% on your next bill, you'll also save x amount of greenhouse gas emissions" (Group 11)*

While financial savings to householders represent a rational reason to conserve energy, environmental benefits tend to be categorised as an emotional case for domestic conservation. Some felt that there was a need to tap into peoples' consciences to encourage the purchase of energy efficient appliances and enable them to feel good about themselves for making an energy efficient choice.

iv) Penalising heavy users with surcharges and other penalties
There was considerable support for applying surcharges to the bills of high energy using households on the condition that large households such as those occupied by big families were not unfairly penalised. Flat dwellers identified price increases in the form of surcharges as the most effective means of encouraging high energy using unit dwellers to save energy – there was some feeling that not all energy use in a block of units can be attributed to specific units and that it can be difficult to identify excessive users in particular units.

Participants felt strongly that it was unfair to penalise high energy using households when commercial use was so overtly wasteful. So, as well as trying to encourage those responsible for office buildings to make sure lights were not left on all night, heavy energy users such as hotels should be charged a surcharge for their excessive use.

Some, particularly flat dwellers, endorsed the need to discourage those who were not careful in their use of energy by hitting their hip pocket on the condition that this was balanced by a system of rewarding low users. This appeared to illustrate the prevailing attitude that while those doing the right thing expect a carrot, those doing the wrong thing need a big stick. There was recognition that most householders were not as careful as they could be when it came to energy conservation. This was probably because, to date, there has been little incentive to be careful.

v) Government must set a good example and also target non-domestic users
Unless all levels of government can be seen to practice and promote energy saving behaviour, householders felt that their efforts were being undermined leading to resentment. For example:

- **Local government** could enforce more energy efficient devices being installed in residential areas;
- **State government** could support household action by putting pressure on businesses and the building industry to, for example, install double glazing, switching off unused computers and turning air conditioning down. Ministers for Energy, it was felt, should set a good example and encourage others to follow suit;
- **Federal Government** needs to explore the potential of renewable energy resources and make them affordable for domestic use, by, for example, paying a rebate for householders who outlay money to install solar panels. Energy sources that enable energy to be pumped back into the grid warrant significant government support.

There was also some feeling that governments could benefit from employing energy planners and advisors.[20]

3.2.14 Recognition of long term benefit of investing in energy efficient appliances

Householders revealed a preparedness to commit to careful use of energy in their willingness to pay the price for energy efficient appliances.

Some needed the issue to be communicated in a more meaningful way than via the star rating which tends to assume pre-existing knowledge of the amount of energy and money saved on a use-by-use basis by a 4-star rated appliance versus its 2-star counterpart. Although rating stickers were acknowledged as a good reminder to ask about the energy efficiency of an appliance being considered for purchase, this meant that the running an efficient household needs to be clarified at the point of purchase.

Providing information on energy usage on the packaging of energy using appliances and devices, while helpful to consumers, was currently limited to light globes.

> *"If you buy a globe you can see what you are saving. You can see all that on the packaging." (Group 1)*

[20] At the time the research was undertaken, the NSW Government's BASIX scheme to increase the energy and water efficiency of new and substantially renovated residential buildings was only just being introduced. Consequently there was little knowledge of this system among participants.

3.2.15 Barriers to encouraging reduced energy consumption

One of the main barriers to encouraging reduced energy consumption was the vague, uninformed cost benefit analyses being undertaken by some householders which leads them to the conclusion that it was simply not worth implementing some energy saving initiatives simply because the inconvenience caused was not sufficiently financially rewarding over the period they were likely to live in their homes. Some felt that implementing many energy efficient initiatives did not lead to a significant saving.

> *"These ideas are good, but then you think 'how much am I actually going to save?'" (Group 1)*

> *"We know if we left everything on while we are on holidays we would know that it is wasting and it will cost us more money but we don't really know what it will cost." (Group 11)*

The set up costs for solar energy were prohibitive for many and as it took a long time to recoup the cost. Some felt that it took such a long time to recoup the cost, if at all, of replacing an old inefficient appliance with a new energy efficient one that it was not worth the effort. Many felt that it was only worth investing in energy saving initiatives if the cost savings are significant. Also, it was not deemed worth the cost saving to turn off appliances such as heaters and TVs every time a room was left and some felt that it is more expensive to turn such appliances on and off upon leaving and entering rooms, not to mention too inconvenient. Being penalised for making environmentally friendly choices such as opting for eco-energy was also seen as a disincentive.

A further financial issue that was raised was that of reporting average electricity use on bills. Most are interested in such information and claimed that if they found that their household was using significantly more energy than similar households they would make efforts to reduce their energy consumption. A minority, however, stated that finding that their use was at or below average consumption would work as a disincentive to conserve energy particularly if they felt that they had endeavoured to reduce their energy consumption.
While some of the things currently making it difficult for householders to reduce energy consumption are easily addressed some are less so. These are described below.

i) Saving energy is simply not a priority
In all households there was considerable evidence that a plethora of other things tend to be put before intention or actual endeavours to save energy. The desire for comfort and convenience are higher priorities than energy saving and this was felt to be 'normal'. People were concerned not to be seen as over zealous about energy saving: Those who are vigilant about saving energy tend not to be appealing to others!

> *'My grandma used to be a stickler for turning off power points at the switch. I used to think she was just being a cow" (Group 3)*

Also, there was some feeling that only the very keen would go to the effort of trying to establish why an energy bill was higher than usual.

Having one's comfort and/or convenience compromised as a result of implementing an energy saving initiative can lead to such behaviour being given much lower priority.

> *"After an overseas holiday I had a 30 hour journey home but I had turned my hot water off before I left and it took forever to heat up. I have never turned it off again!". (Group 4)*

Low flow showerheads, which can save both water and energy, came in for considerable criticism on the grounds of efficiency, comfort and, in one case, safety.

> *"They take too long to get clean because they burn you and it's too hard to get the soap off." (Group 2)*

Some used high energy using sources for indulgent forms of comfort and reward.

> *"My girlfriend says she gets chilled to the bone so she hops in the shower to warm up" (Group 1)*

> *"I work all day and get up at five in the morning so that [long shower with XL Tastic heater on full] is my reward" (Group 2)*

> *"I would die without my heater. I am a smoker and I go outside to smoke. I come back in and warm myself up all the time. I am trying to be better. I only put it on when I am going to be in the room all the time." (Group 1)*

Energy saving was thought to be of the lowest priority among some of the biggest wasters of energy, i.e. children and teenagers living at home – because they don't contribute to the bills. Behaviour, such as the tendency of children to go around the house switching the lights on but not switching them off again was deemed unlikely to change until they left home and had to pay their own energy bills.

Some of those for whom the environment was a priority demonstrated concern that old appliances may not get recycled as a reason not to replace such appliances with newer, more energy efficient ones. Technological progress has led to an increase in energy powered devices and appliances which have made peoples lives easier and more enjoyable. This included a trend for many households to have multiple appliances such as more than 1 TV per house as well as computers and mobiles charging up at all hours of the day. To some households serious efforts to save energy would lead to a step backwards which was not relished.

ii) Energy saving alternatives are unappealing or impractical

Householders often gave a 'reason' for not implementing specific energy saving initiatives in their home.

- Retrospective installation of insulation is not deemed feasible by many who rationalize this initiative away as something only done in new properties.
- Many are simply not prepared to have shorter showers.

- The trend is to have a lot of down lights per room when this form of lighting is installed.
- While some deem fluorescent lighting too unattractive for anywhere but the kitchen, others acknowledge the enhanced aesthetic appeal of the new compact globes but have found they regularly blow and are expensive to replace.
- Top loading washing machines are felt to be more appropriate for smaller laundries, even by those living in houses.
- Having one switch to operate multiple devices, e.g., fan & light in bathroom is often appropriate.
- Some feel the need to keep pools clean and filtered even when it is not in use in the winter.
- For some, the house is simply facing the wrong way to facilitate the running of an energy efficient household.
- Double glazing is identified as a double edged sword by some flat dwelling families: as the windows can't be opened air conditioning has to be installed.
- Second fridges, even if rarely used are not turned off for fear of dangerous gas escaping from them.

Difficulties in changing subconscious behaviour / the habits of a lifetime can impede the implementation of even the simplest energy and cost saving initiatives such as not using the microwave to defrost food and putting on extra clothes instead of the heater to keep warm.

iii) Lack of awareness of how to save energy

Some participants simply did not know about some energy saving initiatives such as turning off the water heater when away for a period of time, or how to establish whether an appliance was using too much energy or not.

There was also a lack of understanding amongst some as to why some types of appliance are more energy efficient, e.g. how energy lamps work, or that more energy efficient alternatives exist, e.g. that front loading washing machines are an energy efficient alternative to top loaders. So, even if they did establish that their appliances were using too much energy, they didn't know what could be done about it.

Some (house dwellers) did not know that gas was cheaper than electricity for cooking and heating. It was also thought that some older people were often misguided in their endeavours to save energy: they thought they were implementing energy saving initiatives but were oblivious to the fact that other practices within the household were wasting considerably more energy than was being saved elsewhere. For example, some thought they were being careful by turning the lights off when they left a room but they rarely updated their appliances or turned heaters off.

iv) Particular problems faced by renters and flat dwellers

Issues of tenure and housing type render some energy saving initiatives impossible to implement. For example, even if they were aware of the savings that could be made through insulation, renters cannot insulate pipes or change appliances and landlords would be highly unlikely to make major changes or invest in energy

saving fittings and appliances as it would offer them little financial benefit in return. Similarly, those renting have no choice about their source of power.

Flat dwellers were often precluded from choosing gas appliances as piped gas was not available in the blocks of units. Even if individual flat owners want to install energy saving initiatives they can be prohibited or delayed from doing by the owners corporations or other owners objecting to changes. Additionally, some owners simply do not think it is worth the cost and inconvenience to get something like solar energy installed in a flat. On the other hand, some higher income young professional flat dwellers felt that if they are willing and able to pay for it they should be allowed to use as much energy as they like. For them, having statistics on average use for similar households printed on their bills would be pointless.

The propensity for sharing households in the renting and flat markets means that bills are paid by contributions from all members of the household, each of whom may have different levels of awareness, attitudes and behaviour regarding energy use and conservation.

Other issues particularly pertinent to flat dwellers were explored earlier in this report:

- Heating and cooling is less likely to be seen as a big user of energy by flat dwellers than by house dwellers.
- Flat dwellings were much more likely to identify behavioural, life style and attitudinal factors as being important in understanding energy use, rather than the attributes of the dwelling itself. It is possible that this reflects the reduced ability to effect changes to energy services or appliances in flats, so the focus is much more on how people use energy.
- As well as endorsing the need to hit the hip pocket of the wasteful, flat dwellers are vociferous about the need to reward those who are making concerted efforts to conserve energy.

PART 4: CONCLUSIONS

This study has, for the first time, explored the socio-demographic and behavioural components that underpin domestic energy consumption in Sydney. It is one of the first studies to consider these issues in an Australian metropolitan context. Using data derived from a major household survey, backed by qualitative data from a series of targeted focus groups, the findings suggest that while there is certainly support for energy conservation, there is a significant gap between willingness to save energy and the ability or motivation to do so among the general population. The findings generally support previous research in this area, but add a layer of more detailed understanding of the social and behavioural drivers of energy consumption. We would argue that these are critical in understanding how potential policies and solutions to the implementation of domestic energy saving might be developed and implemented.

More specifically, we were concerned to explore two aspects which had hitherto been under-researched: namely the relationship between housing density, energy conservation and the socio-demographic drivers of energy demand. Given that previous research has shown, at best, an uncertain relationship between built form (i.e. residential density) and operational domestic energy consumption (i.e. the energy consumed in the course of occupying the dwelling), this research has attempted to develop a more nuanced understanding of how people who live in different dwelling types behave towards energy conservation both in the abstract and, more importantly, in reality. This is not an arcane issue. Given current metropolitan planning policy settings, higher densities will become the norm in terms of new housing production in the next quarter of century across metropolitan Australia. Understanding just what the real environmental benefits of this type of housing area, as opposed to the traditional single family dwelling which typified most urban development in the post-war period, is therefore critical to understanding whether these strategies will deliver truly sustainable outcomes. While other research, noted in the introduction, has looked at the levels of energy consumed, this research has attempted to go beyond the numbers and statistical modelling to provide an insight as to what lies behind household attitudes toward energy consumption and how that might relate to actual consumption outcomes.

It should be noted at this point that the research had hoped to link actual energy consumption data, obtained form the energy utilities, to the individual survey data. Unfortunately, data protection and privacy legislation meant that his could not be undertaken, despite the data being available and the technology for matching the two data sets together being eminently feasible. The negative impacts of tighter data protection laws and an excessive conservatism in interpreting those laws inhibit the use of data for research of this kind is something that requires review. Nevertheless, it has been possible to conclude a number of significant findings that should help to inform policy development in the area of energy policy.

In respect to better energy demand management policies, two points seem worth stressing in this conclusion. The first is the almost universal ignorance of the actual costs of using energy in the home. Both the survey respondents and the qualitative focus groups participants showed a lack of understanding of the quantity of energy they were using or how much specific uses might be costing them. This has

significant implications for polices that are based on pricing to reign in energy demand. It is clear that with such little relationship between energy use and an understanding of its cost, crude pricing signals will be virtually meaningless. Domestic energy is a sphere of consumption that is simply impervious to traditional economic based analyses or policy prescriptions. Moreover, the socio-demographic basis of demand at the household level, with larger households, predominantly families with children, using more energy than smaller ones, means the simple differential pricing where consumers with higher gross energy use would mean many families would be unfairly penalised. Any changes in pricing policy would need to take this into account.

The great reluctance shown by respondents to support increased pricing across the board as a way of encouraging greater energy savings confirms that such a policy would be very unpopular. With an almost universal lack of knowledge about energy use and cost, it might also be unlikely to achieve significant outcomes. The gap between what the minority who said they would support higher energy costs to reduce energy use would be willing to pay (relatively few ventured more than 10%) and the amount focus group participants said would be needed to rein in demand (around 50%) was also highly instructive. There is much work to be done in promoting energy saving and also devising pricing mechanisms that would really stimulant energy savings, but clearly, in the contest of a consumer body largely ignorant of either the cost of energy or the amounts used for various activities, differential pricing approaches are unlikely to be ineffective in themselves. A much greater emphasis is needed in skilling up the general population to be able to understand how much energy they are using as well as its cost, and to provide clear information about how energy reductions can be achieved in the home and the cost and benefits of doing so.

Following on from this is the point raised by focus group participants, that a much greater focus on education around energy use in the home is needed to increase public awareness of the ways they can practically reduce their energy consumption. While most respondents were willing to adopt energy saving measures, it was clear that few actually had much idea of how to go about this. Few appear willing to do so if it means a reduction in amenity and which impinges on their preferred life styles or levels of personal comfort. In particular, consumers have a poor understanding of the costs and benefits of installing energy saving appliances or adopting energy saving behaviour. Saving energy is simply not a priority for most people and energy saving alternatives are often perceived as unappealing or impractical. The recently (March 2007) announced intention in an election year of the Federal Government to spend $52m sending a leaflet to every household to encourage better energy conservation in the home is s step in the right direction. But the implications of this research is that the education process needs to be ongoing and substantial, not just a one-off event. This would entail a continual high profile campaign aimed at consistently improving people’s understanding of the ways to save energy. Special attention should be given to NESB communities and others who comprise special groups with particular issues, such as the elderly or renters.

The research also strongly suggest that there is a clear role for providing subsidies to promote the take up of energy saving technologies in the home, with three quarters of survey respondents saying they would install such technologies if they were subsidised at half price. At present, with subsidies to fit energy saving

appliances set at fairly minimal levels, there is little financial incentive for consumers to adopt such technologies, given the long cost recovery periods and the fact that many households will move home long before the saving are achieved. What incentive is there to install energy saving improvements that will mainly benefit succeeding occupiers?

All this presupposes that households are able to fit such devices should they wish to do so. The problem is that not all are able to. This leads to the second main conclusion from this study, which relates to the barriers to better energy use outcomes that stem from the socio-demographic determinants of energy consumption and the impact that the built environment – particularly the difference between low and higher density development – has on energy consumption in the home. These two issues are interrelated, given the relationship between dwelling type, tenure and life cycle for Australian households. In particular the different types of household who inhabit houses as opposed to flats in Sydney at the present time reveal fundamental differences in how these groups relate to how energy is consumed as well as their ability to adapt behaviour and amenities to achieve energy savings.

On the one hand, the focus groups revealed that house owners were more likely to stress the design characteristics of dwellings as determining factors in energy use: layout, facilities, ability to install devices, and so on. In contrast, flat dwellers were much more likely to cite age, life style and income as important determinants of energy consumption behaviour. These differential responses underscore the basic point that physical adaptations and modifications may be an option for house owners, but they are not for most tenants or flat dwellers and savings depend here on behavioural and attitudinal change.

While house owners and buyers have a much greater degree of autonomy and control in terms of how they respond to the governmental encouragement to reduce energy consumption, tenants and those in flats are in a less control of their immediate accommodation and have much less capacity to effect a meaningful transition to lower energy use. This is significant point, given the current push to develop higher density housing as the majority housing form in inner urban areas. With 31% of households in Sydney renting their homes in 2001 (around 412,000 households) and an estimated 595,000 strata titled dwellings in 2006 (projected to increase to over 900,000 by 2025), this is a growing issue. These two characteristics of Sydney's residential structure are liked, of course, with 54% of privately owned flats being rented in 2001, a figure that is unlikely to have changed much in the last six years of investor driven flat development.

For both tenants and flat dwellers, a whole range of other key stakeholders determine how well their housing is or could be adapted to reduced energy consumption. For tenants, the landlord holds the key to improved energy efficiency. But there is no reason why landlords would want to upgrade their property to make long term energy savings for tenants. There are no tax incentives or subsidies to encourage such action. With falling capital gains at present, and a squeeze on rents to deliver returns, there is little incentive in the marketplace to spur landlords to invest in such adaptations or improvements.

For strata dwellers, a formidable array of powerful intervening stakeholders holds the key to residents' capacity to implement changes to their homes to reduce energy consumption. Of these, the owners' corporation is probably the most important, along with building managers who often have a major influence in some of the larger schemes. What encouragement or support is there for owners' corporations to engage in energy saving activity that might involve building modifications and additional costs? Of course, recent initiatives such as the much lauded BASIX system that, from 2004, has incrementally introduced more exacting energy targets for new dwellings in NSW, the picture has improved for newly build flats. But these changes are only at the margin of the high density housing stock, and the current period when flat building has slumped suggests little new energy efficient high density stock will be delivered for some time. Coupled with the decision of the State government to defer the introduction of more stringent BASIX energy targets for high rise flats in mid-2006, this otherwise valuable initiative will deliver only modest gains overall for many years to come. Flats and landlords therefore pose a particular problem for any policy aimed at changing energy use patterns in the home.

Given the current major emphasis in the media on climate change issues, this research on the drivers of demand for energy at the household level should assist in devising more sophisticated approaches to energy demand management. We would argue that an effective and properly funded energy demand management policy and long term strategy that focuses strongly on consumer education and effective behavioural change (including effective household subsidies to adopt energy saving technologies), rather than on policies that favour developing more energy supply, would go a considerable way towards reaching the goal of turning back the ever growing demand for energy in the household sector and thereby starting to make a significant inroad into greenhouse gas reductions. This could happen, moreover, much more rapidly that restructuring the Australian energy supply industry towards more sustainable energy production. The sustainable energy crisis demands nothing less that a battle for the hearts and minds of the Australian public to change the attitudes towards energy consumption in the home. Public interventions, including subsidies for households to convert to energy saving technologies *within* the home, offer the most obvious place to generate real reductions in energy demand.

APPENDICES

APPENDIX 1:
Selection of Case Study Collector Districts (CDs) for the Telephone Survey and Final Response Rate

Stage 1

A central aim of this research was to establish the socio-behavioural drivers of water and energy consumption of households in different types of dwellings and areas. A practical solution to ensuring sufficient samples of dwelling types were included in the analysis was achieved by targeting CDs with predominantly similar dwelling types.

Initially, all CDs in the Sydney Statistical Division (SD) were ranked by the proportion of dwellings in the 4 dwelling categories used by ABS to report the census of population and dwellings. These are:

- Areas of Wholly Separate Houses
- Areas of Predominantly Semi Detached Dwellings
- Areas of Predominantly Flats in a block of less than 4 storeys
- Areas of Predominantly Flats in a block of 4 or more storeys

Thresholds were set for CD selection in each of four strata to ensure sufficient numbers of CDs would be available to include in the subsequent analysis. CDs for the 'separate house' stratum were selected if 99 per cent or more of the dwellings were of this form. As the proportion of dwellings that are semi-detached is lower than for separate houses and they are more widely distributed than separate houses, the threshold for semi detached CDs in this stratum was set where at least 50 per cent or more of the dwellings in the CD were of this form. The thresholds for CDs in the stratum in which flats in a block of less than 4 storeys were the predominant form was 70 per cent, while the 'cut-off' point for CDs in the stratum where the predominant form of dwelling was in flats in a block or 4 or more storeys was 50 per cent. A total of 1,577 CDs were selected by these means.

Stage 2

The second stage of the selection process was undertaken to ensure that the choice of CDs for the study broadly reflected the socio-economic profile of the dwelling types across Sydney. A factor analysis was undertaken on each of the four sub-groups of CDs to identify factors that described the socio-economic composition within each sub-group. The analysis was based on a number of socio-economic variables from the 2001 Census. (For further information about the factor analysis see Troy, *et al*, 2005).

After the factor analysis was run on CDs in each of the four strata, 35 CDs from each were selected as case study areas on the basis of the proportion of variance explained by each factor and its geographical distribution. Five factors explained 60-70% of the variance within each dwelling type stratum. For the four strata, 9 CDs were selected that scored highly on Factor 1, 8 from Factor 2, 7 from Factor 3, 6 from factor 4, and 5 from Factor 5. These 35 CDs were also chosen to reflect the range of locations across the Metropolitan Sydney area. Consequently, the 35 selected CDs for each dwelling area stratum not only had high scores for each factor

within the sub-group, but were also distributed across four broad sub-regions (Inner Sydney, Northern Sydney, Inner West and Southern Sydney, and Western Sydney). In this way, the CDs selected for the analysis can be taken to reflect the main sub-market segments of each of the four dwelling type strata. It should be stressed at the outset that the 140 CDs are not a simple random sample but constitute a stratified sample drawn from the total for Sydney.

Table A1.1: Final Response Rate by Dwelling Type and Sydney Region

TYPE OF DWELLING	**TOTAL**	**REGION**	
		Eastern Sydney	**Western Sydney**
Separate house	821 38%	326 25%	495 56%
Dwelling/non-dwelling combined e.g., top-shop flats	7 0%	3 0%	4 0%
Semi-detached/terrace/house/villa/townhouse/Duplex	431 20%	289 22%	142 16%
Granny flat" (flat attached to larger house)"	8 0%	6 0%	2 0%
Flats or units in a building (1 or 2 storey)	199 9%	136 10%	63 7%
Flats or units in a building (3 storeys)	355 16%	242 19%	113 13%
Flats or units in a building (4 or more storeys)	358 16%	294 23%	64 7%
TOTAL RESPONDENTS	**2179 100%**	**1296 100%**	**883 100%**

APPENDIX 2:
Qualitative Methodology

Overview

The purpose of the qualitative stage was to establish an in-depth understanding of residents' perceptions of the use of water and energy as well as response to water and energy saving methods.

A total of ten discussion groups (comprising 5-8 respondents) plus 1 mini-group (comprising 3 respondents) were conducted to explore the rational considerations and the emotional variables affecting water and energy consumption. Due to the volume of issues to be discussed on both energy and water use and conservation, it was deemed necessary to split the sample so that half of the groups discussed energy and half discussed water. Each group lasted between 1.5 and 2 hours and was audio and DVD recorded for analysis purposes.

The fieldwork was conducted between 18 April and 5 May 2005 during which time Level 2 water restrictions were in place in Sydney.

Group discussions were the most appropriate qualitative technique for this research as it permitted dynamic discussion of both the relevant issues and of potential initiatives.

The group discussion technique had a number of benefits for the project:

- Participants were provided with a relaxed and friendly atmosphere, in which they were able discuss their attitudes and opinions in their own terms;
- It permitted the group moderator to focus the attention of participants on those specific areas of interest in the study objectives which required detailed probing;
- It also allowed them to reveal those aspects of water / energy use which were of interest and importance to them as well as coverage of the issues on the discussion guide;
- It permitted a deeper and more thorough exploration of attitudes and reactions than traditional question and answer techniques do; and
- Being an extremely flexible technique it allowed for the input of stimulus material, such as actual proportions of water and energy use, to be introduced in the most appropriate manner for each group.
- Using discussion guides developed for both the energy and water groups the majority of each group was spent discussing attitudes, experiences and beliefs regarding either water or energy use as per the research objectives.

Additionally, on a number of occasions throughout each group, participants were asked to record in writing what proportions they thought their household's energy or water consumption was in certain areas of the house, such as the laundry.

Having been asked to bring their energy or water bill (depending on which group they were attending) to the group, participants were instructed not to look at their bill until after they had recorded their written estimate of the volume of water or energy used in their household and the perceived cost of water or energy per unit.

In this context, the bills were used in a variety of ways in the groups, including:

- Being of interest during discussion of household consumption figures / averages – participants compared and contrasted each other's consumption figures and attempted to explain them;
- Identifying the most and least meaningful information presented on the bills;
- Illustrating discussion of pricing issues.

Important Caveat

Due to the nature of the study, participants were asked to undertake an unusually large number of numerically oriented tasks such as estimating what proportion of total water consumed in their household they attributed to specific devices etc. Their estimates were then compared with ABS statistics for average household use.

While participants' answers to this and other similar tasks have been averaged out and presented in tables throughout this document, it must be stressed that the figures must be treated with **extreme caution** due to the qualitative nature of the method particularly the small numbers involved. A total of 75 residents participated in the qualitative study.

Findings were generally consistent across all dwelling types and household structures. Where differences occurred, these are noted.

Table A2.1

	DISCUSSED WATER	DISCUSSED ENERGY	TOTAL
House dwellers	28	23	51
Flat Dwellers	14	11	25
TOTAL	42	34	76
Young Singles / Couples	8	6	14
Families	27	21	48
Empty Nesters	7	7	14
TOTAL	**42**	**34**	**76**

Recruitment

In accordance with the collection districts (CDs) used for the telephone survey, respondents were recruited from a number of different areas of Sydney (see Troy et al 2005 for a detailed list of the CDs). Recruitment was conducted by AC Nielsen.

Initially, it was assumed that all participants would be recruited from the list of those who had, at the end of the telephone survey, indicated their willingness to participate in subsequent stages of this research.

However, due to difficulties in achieving the sample size for the telephone survey, particularly flat dwellers; it became necessary to supplement this recruitment method with traditional methods of recruitment. Thus, two different recruitment methods were used as follows:

1. **Survey Respondents -** Participants in seven of the ten groups were respondents from the Energy & Water Use telephone survey conducted by AC Nielsen. Having agreed, at the end of the interview to participate in further stages of research on the topic, they were subsequently approached for participation in one of the focus groups according to their dwelling type, household structure and location. This method proved fruitful for house dwellers but there was a low response rate from flat dwellers. As a result the second recruitment method was implemented for the remaining three groups.

2. **Data Base Respondents -** People on AC Nielsen's data base of consumers were screened using a recruitment questionnaire to ensure that they met the criteria required for participation in the groups. In this way, in addition to the checklist of questions used to determine which group they should go into depending on household structure, dwelling type and location, potential respondents were screened to ensure that:

- Neither they, nor immediate members of their family worked for any energy or water authority or supplier.
- They were the person in the household responsible for paying the energy or water bill (home owners only).
- They had not participated in a market research group discussion in the last six months.

Once they had agreed to attend one of the groups, respondents were asked to bring their water / energy bill with them to the group and promised a small cash payment ($60) to cover any expenses incurred in attending the group such as babysitting and / or travel.

It was envisaged that participants in each group would be drawn from particular CDs clustered in a particular area and a geographical spread of venues in which to hold the groups was booked accordingly. It proved too difficult to find people who fitted the criteria for dwelling type, household structure and CD. The suburbs from which group participants were drawn for each group are shown in Table A2.2.

Sample Configuration

The groups were configured according to:

1. Dwelling type:
    - house (including free standing, semi's and townhouses);
    - flat (including low and high rise).
2. Household structure defined using AC Nielsen's definitions:
    - young singles and couples (maximum of 2 people living in the household both aged less than 35 years of age);
    - families (minimum of 3 people with at least 1 aged 17 years or less);
    - empty nesters (1 or 2 people aged 55 years or more).

The specification of the 11 groups is set out in Table A2.3.

Table A2.2:

GROUP	SUBURBS FROMWHICH RESPONDENTS WERE DRAWN
1	BANKSTOWN; DRUMMOYNE; SUMMER HILL; HARBORD; NORTH RYDE
2	MILLER; HORNINGSEA PARK; GLENFIELD; MILPERRA; WARWICK FARM
3	BANKSTOWN; NORTH STRATHFIELD; STANMORE; SUMMER HILL
4	KAREELA; SOTH COOGEE; NORTHMEAD; CHESTER HILL
5	ASQUITH; WEST RYDE; LINDFIELD; EAST LINDFIELD; NORTHBRIDGE; NAREMBURN; LANE COVE; BELROSE; BEROWRA
6	DUWICH HILL; MORTDALE; ARNCLIFFE; KOGARAH; PENSHURST; MIRANDA; LAKENBA; BEXLEY; CRONULLA
7	QUEENSCLIFFE; DOVER HEIGHTS; MILPERRA; EARLWOOD; BEXLEY; GLADESVILLE; MORTDALE; BALMAIN
8	NORTH SYDNEY; NAREMBURN; MCMAHONS POINT; CROWS NEST; BROOKVALE; ST LEONARDS; MCMAHONS POINT; GLADESVILLE; NORTH SYDNEY
9	GLENFIELD; ST ANDREWS; NORTHMEAD; MOOREBANK; MORTDALE; BOSSLEY PARK
10	NORTHMEAD; CAMDEN SOUTH; TREGEAR; KILLARA; PENNANT HILLS; MILLER; STANHOPE GARDENS
11	MANLY VALE; CHATSWOOK; PENRITH

Table A2.3:

GROUP	TOPIC	DWELLING TYPE	HOUSEHOLD STRUCTURE	TENURE	VENUE
1	Energy	Flat	Young singles / couples	N/A	Sydney CBD
2	Energy	House	Families	N/A	Liverpool
3	Energy	Flat	Families	N/A	Sydney CBD
4	Energy	House	Empty Nesters	N/A	Hurstville
5	Energy	House	Families	N/A	North Sydney
6	Water	Flat	Families	Owners/Purchasers	Hurstville
7	Water	House	Families	Owners/Purchasers	Sydney CBD
8	Water	Flat	Young singles / couples	Renters	North Sydney
9	Water	House	Families	Owners/Purchasers	Liverpool
10	Water	House	Empty Nesters	Owners/Purchasers	Parramatta
11 (mini Group)	Water	House	Families	N/A	North Sydney