

Submission to the Legislative Assembly Standing Committee on Public Works

Inquiry into Energy Consumption in Residential Buildings

August 2003

Introduction

The EnergyAustralia network covers a region of more than 22,000 square kilometres, extending from Waterfall in the south of Sydney to Nelson Bay north of Newcastle and north-west to Merriwa, Scone and Barry.



In 2001/02 the network distributed more than 26,500 GWh to the 1.5 million electricity customers located in the region.

The residential sector, which this submission concentrates on, makes a significant contribution to the overall operation of EnergyAustralia's network. In 2001/02:

- the 1.315 million residential customers represented 90% of overall customer numbers; and
- the 9,567 GWh of electricity consumed by residential customers represented 38% of overall electricity usage.

The comments in this submission are limited to the observed trends, projections, planning implications and initiatives with respect to electricity consumption within the EnergyAustralia network region. It should be noted that the analysis presented in this submission is not necessarily applicable to the State of NSW as a whole, as the EnergyAustralia region:

• experiences relatively milder climatic conditions than the State as a whole;

- has a relatively higher concentration of units, flats and semi-detached dwellings than the rest of the State; and
- may not be representative of the State with respect to access to alternative energy sources (notably natural gas and solar).

EnergyAustralia is committed to encouraging and promoting viable energy efficiency and demand management initiatives, and is devoting increased resources and attention to achieving this goal.

EnergyAustralia supports increasing Residential Building efficiency, and believes this has an important role to play in achieving a more efficient and sustainable energy sector, particularly over the longer term.

Current strategies to address increased energy efficiency and improve residential energy efficiency and the sustainability of residential buildings cover: Energy Rating Tools; Retro fit programs; customer and load research; and consumer awareness and education.

Energy Rating Tools

EnergyAustralia has supported the development of residential energy efficiency rating tools. EnergyAustralia is one of the key utility partners working closely with Planning NSW in the development of the BASIX sustainability assessment tool. We have provided comprehensive statistical data on appliance penetrations and average energy use for EA's residential customer base, based on our own monitoring studies. We have also assisted by providing technical input into the underlying algorithms and assumptions in the energy section of BASIX. EnergyAustralia has also had preliminary discussions with SEDA regarding their EnergySmart Home Rating Tool. Once this tool is developed (expected 2004) the option of linking this web-based home audit tool to the EA website will be considered.

Retro fit programs

We are currently in the planning stages of a larger program to make the REFIT service available to all customers at a subsidised cost. EnergyAustralia conducted the REFIT pilot program in the Hunter Region 2001/2002. This residential energy efficiency service included an energy/water audit, installation of AAA showerhead, 2 x compact fluorescent lamps, tap aerators, and toilet cistern weight. It was provided free of charge to almost 1,200 disadvantaged customers. We will continue to offer the service free of charge to customers experiencing hardship. While the pilot program demonstrated that significant savings in energy, greenhouse gases and water use are achievable, it also highlighted the importance of designing appropriate delivery mechanisms to minimise administration costs.

In 2000/2001 EnergyAustralia partnered with Newcastle City Council in carrying out a Residential Energy Monitoring Program – a comprehensive energy efficiency retro fit of six showcase households, and installed data loggers to monitor and compare before and after energy use. Results were analysed and reported to the Australian

Greenhouse Office (who partly funded the initiative). The program included community energy workshops and public promotion of the program results.

One issue with retro fit programs is that while they create NGACs for replacement of existing energy inefficient equipment, there is no incentive for the use of energy equipment in new dwellings. Unlike a retro fit program, under current policies installing energy efficient equipment in a new location does not create NGACs.

Customer and load research

EnergyAustralia conducts customer and load research to identify patterns and opportunities the usage of electricity. The findings from this research are the foundation for the majority of the information included in this submission.

Consumer awareness and education

EnergyAustralia has an ongoing energy efficiency promotion campaign including:

- TV, radio and print media advertisements;
- billing inserts (including a coupon booklet providing discounts on efficient appliances and services);
- education packages and programs for schools;
- information brochures for residential energy efficiency;
- web-based energy saving tips; and
- recorded messages providing energy saving tips for customers while on hold in the call centre telephone queue.

These programs are part of EnergyAustalia's overall consumer awareness and education promotion efforts, which have most recently involved an extensive campaign promoting awareness of electricity safety.

EnergyAustralia also complies with the requirements for the provision of greenhouse gas emissions data on energy bills, alerting our customers to the environmental impacts of their energy use, and prompting them to make informed decisions on ways to minimise their own greenhouse emissions.

EnergyAustralia maintains strong relationships and contributes to the work of major bodies and involved in sustainable energy issues such as SEDA and to the Australian Greenhouse Office through programs such as The National Appliance & Equipment Efficiency Program.

EnergyAustralia also maintains links with international bodies and is a silver sponsor of the 19th World Energy Congress and Exhibition will be held at Darling Harbour, Sydney in September 2004. The theme for the World Energy Congress is *"Delivering Sustainability: Opportunities and Challenges in Energy"*.

The remaining sections of this submission address specific issues raise in the Standing Committees terms of reference.

Term of Reference: Examine changes in energy consumption patterns of electricity, gas and solar

Residential sector electricity consumption in the EnergyAustralia network region in 2001/02 was 9,567 GWh. This was 32% above 1991/92 level of consumption (see Figure 1).



Figure 1 – EnergyAustralia Region - Residential Electricity Consumption Trend

This historical growth in residential electricity consumption has been a function of growth in both household numbers and average consumption per household (see Figures 2 and 3).



Figure 2 – EnergyAustralia Region - Residential Customer Number Trend





The estimated contributions by various appliances to electricity consumption in 2001/02 are shown in Figure 4.



Figure 4 – EnergyAustralia Region - Residential Electricity Consumption by Appliance

One-third of consumption is attributable to water heating, and one-fifth to refrigeration. Air conditioning is estimated to have contributed 7% to consumption but, as discussed later in this submission, it is the timing of use of air conditioning that has a far more significant impact on network system planning and augmentation.

The consumption breakdown shown in Figure 4 is a function of (a) the average consumption by each appliance and (b) the number of each appliance present in the network region.

Figures 5 and 6 and the accompanying tables respectively set out the 2001/02 estimates for average consumption by appliance and appliance penetration rates.



Figure 5 – EnergyAustralia Region - Estimated Average Consumption per Appliance, 2001/02

	L\A/b			
Appliance	p.a.	Source/Comments		
Off-Peak Water	3581	Known from billing records		
Peak Water	3050	Based on RES (2918 kWh pa)		
Pool Pump	1350	RES (1353 kWh pa). Comparison: AGO (1000 – 3000 kWh pa)		
Air Conditioning	1150	Based on EA Load Research 2000/01/02. Comparison: RES (Ducted 1026 kWh pa, Rev Cycle 698 kWh pa, Cool Only 216 kWh pa)		
Refrigerator	900	Based on RES (944 kWh pa, 2 nd fridge 828 kWh pa)		
Waterbed	780	RES (773 kWh pa). Comparison: AGO (> 1000 kWh pa)		
Space Heater	610	Based on RES (Room Heater 427 kWh pa, Ducted Heater 996 kWh pa)		
Freezer	600	RES (648 kWh pa)		
Lights	570	RES (566 kWh pa). Comparison: AGO (400 – 700 kWh pa)		
Cooking	500	Based on RES (Stove 363 kWh pa, Oven 233 kWh pa, Cooktop 187 kWh pa) and AGO (600-700 kWh pa). Estimate allows for non-stove cooking appliances.		
Dishwasher	250	Based on RES (227 kWh pa) and AGO (388 kWh pa)		
Computer	242	AGO 242 kWh pa		
Clothes Dryer	200	Based on RES (123 kWh pa) and AGO (240 kWh pa)		
тv	174	Based on RES (157 kWh pa) and AGO (108 kWh pa for 3 hours TV per day Allows for minor impact of cable TV penetration.		
Microwave	130	Based on RES (67 kWh pa). Allows for increased microwave usage		
Washing Machine	55	RES (55 kWh pa)		
Video	22	AGO (22 kWh pa)		
Other	340	Estimate to allow for iron, vacuum cleaner, portable tools, lamps, stereo, fish tanks etc.		

Abbreviations:

RES = 1993/94 Residential End-use Study AGO = Australian Greenhouse Office.

Water heaters, pool pumps, air conditioners, refrigeration, lighting, heating and cooking are the significant appliances in terms of average consumption.



Figure 6 – EnergyAustralia Region - Estimated Appliance Penetration Rates, 2001/02

Appliance	Percent of Households	Source/Comments				
Off-Peak Water	40%	Known from billing records				
Peak Water 32%		Extrapolated from ABS 85/86 (Sydney 40%, NSW 34%) & ABS 89 (Sydney 35%, NSW 30%). Allows for high proportion of home units in Sydney region				
Pool Pump	16%	Extrapolated from ABS 85/86 (Sydney 10%) & ABS 89 (Sydney 14%)				
Air Conditioning	43%	Based on EA market research 2000 (39% penetration) & confidential NIEIR air conditioning unit sales data				
Refrigerator	130%	ABS 1997: 30% of households have additional fridges				
Waterbed	15%	Extrapolated from RES (Sydney 13%, Other Metro 28%)				
Space Heater	65%	Extrapolated from RES (Sydney 75%, Other Metro 60%)				
Freezer	45%	Extrapolated from RES (Sydney 36%, Metro 64%) & ABS 1997: 44%				
Lights	100%					
Cooking	70%	Extrapolated from ABS 89 (75%) & RES				
Dishwasher	40%	Extrapolated from ABS 85/86 (19%), ABS 89 (24%) & RES (37%)				
Computer	50%	Estimate				
Clothes Dryer	70%	Extrapolated from ABS 85/86 (50%), ABS 89 (57%) & RES (66%)				
τν	200%	Estimate (average 2 TVs per house)				
Microwave	95%	Extrapolated from ABS 85/86 (34%), ABS 89 (56%) & RES (77%)				
Washing Machine	95%	Based on ABS 85/86 (92%) & RES (96%)				
Video	80%	Estimate				
Other	100%					

Abbreviations:

RES = 1993/94 Residential End-use Study ABS = Australian Bureau of Statistics.

In terms of penetration rates of the major electricity-consuming appliances, the significant appliances are refrigerators (with an estimated 30% of households having more than one appliance), lighting (100%), heating, cooking and water heating (all around 70%), and air conditioning (43% in 2001/02).

Term of Reference: Examine factors contributing to any increase in energy use

As pointed out previously, the growth in residential electricity consumption over the past decade has been a function of growth in both household numbers and average consumption per household.

Since 1991/92, residential customer number growth in the EnergyAustralia network region has averaged 1.5% p.a. Growth has been particularly strong at 1.7% p.a. since 1996/97. This growth has been significantly above long-term average growth, and has coincided with:

- rapid expansion of inner-Sydney apartment stocks;
- growth across the region resulting from urban consolidation of what were previously one-dwelling blocks of land; and
- generally strong dwelling building activity across the region, in response to low interest rates and initiatives such as the first home owner's grant.

Average consumption per household has grown at an average 1.3% p.a. over the past decade. This growth has occurred:

- despite the tendency towards smaller households (in terms of occupants per dwelling, due to demographics and the tendency towards medium-density housing).
- despite the recent rapid growth in new, potentially more energy efficient dwellings.
- despite the ongoing life cycle replacement of appliances with potentially more energy efficient models.
- despite the promotion of energy efficient appliances and alternative energy sources.
- in an environment of declining real electricity prices.

Clearly the growth in average residential customer consumption has been a result of the level of appliance holdings. Table 1 sets out the contributions to consumption growth of the various appliances.

	1991/92				2001/02		Change over Decade		
Appliance	Penetration Rate % of Cust's	Total Consumption GWh	Proportion % of GWh	Penetration Rate % of Cust's	Total Consumption GWh	Proportion % of GWh	Penetration Rate	Total Consumption	Proportion
Off-Peak Water	43%	1,669	23%	40%	1,904	20%	-3%	235	-3%
Refrigerator	125%	1,287	18%	130%	1,539	16%	5%	252	-2%
Peak Water	33%	1,109	15%	32%	1,287	13%	-1%	178	-2%
Lights	100%	645	9%	100%	750	8%	0%	105	-1%
Heating	70%	396	5%	65%	521	5%	-5%	125	0%
тv	200%	362	5%	200%	458	5%	0%	96	0%
Freezer	42%	304	4%	45%	355	4%	3%	51	0%
Air Conditioning	23%	292	4%	43%	653	7%	21%	361	3%
Cooking	70%	285	4%	70%	460	5%	0%	175	1%
Pool Pump	14%	212	3%	16%	280	3%	2%	67	0%
Other	100%	158	2%	100%	451	5%	0%	293	3%
Waterbed	14%	124	2%	15%	153	2%	1%	29	0%
Dishwasher	40%	113	2%	40%	131	1%	0%	18	0%
Washing Machine	98%	83	1%	98%	97	1%	0%	13	0%
Dryer	58%	82	1%	70%	184	2%	12%	102	1%
Microwave	94%	74	1%	95%	162	2%	1%	88	1%
Computer	18%	49	1%	50%	159	2%	32%	110	1%
Video	80%	20	0%	80%	23	0%	0%	3	0%
TOTAL		7,266			9,567			2,301	

Table 1 – EnergyAustralia Region – Appliance Penetration, Consumption and Contribution to Overall Consumption, 1991/92 and 2001/02

Home computers, air conditioning and clothes dryers have all experienced significant penetration increase, while the penetration rates of electric water and space heating have declined over the past decade.

The contribution to overall electricity consumption of the "lifestyle" and convenience appliances such as air conditioning, clothes dryers, home computers and other appliances has increased.

Term of Reference: Examine implications for capital works programs of any increases or projected increases in energy consumption

EnergyAustralia's overall capital works program necessarily addresses the following factors:

- Replacement of existing infrastructure as assets reach the end of their effective working lives;
- Regulatory compliance, duty of care and environmental considerations;
- System reliability;
- Franchise metering;
- Demand management program impacts and
- Network utilisation trends the level of new connections and levels and patterns of consumption and demand at the spatial level.

The Network utilisation and demand driven components of the capital program are of relevance in the context of this submission. It needs to be recognised that Network capital requirements are not driven by consumption and system wide growth but by peak demand at specific sites. Peak demand is driven by the usage pattern of customers, reflected in their load shape and the diversity of usage patterns amongst customers at any particular time. Growth in the aggregate level of consumption across the system is not a direct drier of capital investment requirements.

Planning to determine the need for, and timing of, demand-driven network augmentation is undertaken on a spatial basis. Forecasts of peak demand at each of 170 zone substations are carefully prepared and overlaid against the existing capacity at each substation, indicating the locations that require either network augmentation or an assessment of the potential for effective demand side management initiatives.

The key electricity measure in the demand-driven capital works planning process is the seasonal (winter and summer) peak demand in each zone, as against overall annual consumption. Spatial peak demands comprise a mixture of residential and non-residential loads. Estimates of future spatial peak demands take into account expected trends in both the levels and patterns of consumption.

Changing patterns of consumption within the residential sector are increasingly emerging as an important driver of capital expenditure. In recent years the system peak demand has grown at a considerably greater rate than annual energy consumption.

The remainder of this section presents:

- EnergyAustralia's residential sector forecasts for the period out to 2008/09; and
- Results of analysis of the changing patterns of consumption, with particular emphasis on the rapid growth being experienced in summer peak demand.

Residential Sector End-use Forecasting Methodology

Since the mid-1980's the NSW residential sector has been subject to considerable analysis and research at the end-use/appliance level. In particular the following research has provided insight into the energy consumption patterns of households:

- Household energy usage surveys conducted by the Australian Bureau of Statistics in 1984, 1985/86 and 1989;
- Time-of-use surveys conducted by the Electricity Supply Industry in 1986 and 1993/94. In particular, the 1993/94 Residential End-Use Study produced detailed consumption information down to the individual appliance level; and
- EnergyAustralia's current Load Research programme, commenced in 2000, is examining the electricity consumption patterns of a sample of some 230 households, including the collection of appliance consumption information in around 80 of the sample households.

The availability of such information is sufficient to facilitate a detailed forecasting approach, down to appliance level. The end-use forecasting approach disaggregates total residential electricity usage into individual appliances or appliance groupings. The overall residential forecast is given by:

GWh (year t) =	Σ (N ' * kWh ')
where GWh (year t) = N [/] =	Residential Sector electricity consumption in year t Number of appliance ^{<i>i</i>} in residential sector in year t (<i>i</i> = 18 appliances)
kWh ' =	Average annual consumption by appliance ⁱ in year t

The model is calibrated so that modelled historical consumption equates to actual known historical energy consumption levels. The estimates for each year of the average consumptions of the weather-dependent appliances (air conditioning, space heaters, water heaters and refrigerators) are made having regard to the weather effects on overall energy consumption.

Residential Customer Number Forecasts

The forecasting process requires sound projections of future customer numbers. These are obtained from the National Institute of Economic and Industry Research (NIEIR), using their "PopInfo" sociodemographic model and judgment as to future population and housing trends in the EnergyAustralia region. As shown in Figure 7, residential customer number growth of 1.0% p.a. is expected over the forecast period, with a possible range of growth between 0.7% and 1.2% p.a. The projected growth

suggests a return to more traditional long-term average growth, following the recent experience of prolonged strong building activity.



Figure 7 – EnergyAustralia Region – Residential Customer Number Forecast

Appliance Penetration Forecasts

Appliance penetration forecasts rely on judgement based on in-house experience and historical trends in penetration rates. Table 2 sets out the projections assumed for forecasting purposes.

With the exception of air conditioning, any change in penetration rates between 2002 and 2009 is assumed to occur linearly. Air conditioning penetration growth is expected to be stronger in the first four years of the forecast period before tapering off, reflecting a degree of saturation of penetration.

Table 2 – EnergyAustralia Region – Appliance Penetration Forecasts, 2008/09

	2001/02	2008/09 Low Case		2008/09 Ex	pected Case	2008/09 High Case		
Appliance	Penetration Rate % of Cust's	Penetration Rate % of Cust's	Change on 2001/02 % of Cust's	Penetration Rate % of Cust's	Change on 2001/02 % of Cust's	Penetration Rate % of Cust's	Change on 2001/02 % of Cust's	
Off-Peak Water	40%	39%	-2%	40%	-1%	41%	1%	
Refrigerator	130%	130%	0%	130%	0%	137%	7%	
Peak Water	32%	30%	-2%	31%	-1%	33%	1%	
Lights	100%	100%	0%	100%	0%	100%	0%	
Heating	65%	60%	-5%	62%	-4%	65%	0%	
тv	200%	200%	0%	200%	0%	207%	7%	
Freezer	45%	45%	0%	45%	0%	47%	2%	
Air Conditioning	43%	50%	7%	58%	15%	63%	20%	
Cooking	70%	65%	-5%	67%	-4%	70%	0%	
Pool Pump	16%	15%	0%	16%	0%	16%	1%	
Other	100%	100%	0%	100%	0%	100%	0%	
Waterbed	15%	15%	0%	15%	0%	17%	2%	
Dishwasher	40%	40%	0%	40%	0%	42%	2%	
Washing Machine	98%	98%	0%	98%	0%	98%	0%	
Dryer	70%	70%	0%	74%	4%	77%	7%	
Microwave	95%	95%	0%	95%	0%	95%	0%	
Computer	50%	54%	4%	64%	14%	71%	21%	
Video	80%	80%	0%	80%	0%	87%	7%	

Average Residential Customer Consumption Forecasts

The consumption per customer estimates that result from the assumed penetration rate trends are shown in Figure 8. As shown, EnergyAustralia expects that future consumption per customer will stabilise to a large degree.



Figure 8 – EnergyAustralia Region – Average Residential Electricity per Customer Forecast

The key assumptions behind the "Expected Case" outcome of gradually declining consumption per customer are set out below.

Factors that will tend to reduce average consumption per customer include:

- The penetration rate of electric water heating will decline from 73% in 2001/02 to 71% by 2008/09, due to increased penetration of natural gas and solar water heaters.
- The penetration rate of electric resistance space heating will decline from 65% in 2001/02 to 62% by 2008/09, due to increased penetration of natural gas, and the use of reverse cycle air conditioning as the primary heating source.
- The penetration rate of electric cooking will decline from 70% in 2001/02 to 67% by 2008/09, due to increased penetration of natural gas.
- Ongoing energy efficiency improvements in appliances such as water heaters (thermostat settings, insulation of tanks and pipes), air conditioning, refrigerators and freezers, lights, dishwashers and washing machines (see Table 3 below).

Offsetting factors that will tend to increase average consumption per customer include:

- The penetration rate of air conditioning will continue to increase, from 43% in 2001/02 to 58% by 2008/09.
- The penetration of other appliances, including home computers, dishwashers and waterbeds is expected to increase.

With regard to energy efficiency, the assumptions set out in Table 3 have been incorporated into the "expected case" forecast.

Appliance	Annual Efficiency Improvement	Source/Comments
Off-Peak Water	-9 kWh	AGO 1980-92 efficiency improvement – assumed to continue
Peak Water	-9 kWh	AGO 1980-92 efficiency improvement – assumed to continue
Air Conditioning	-1.0%	AGO 1980-92 efficiency improvement – assumed to continue
Refrigerator	-1.4%	AGO 1980-92 efficiency improvement – assumed to continue
Freezer	-0.2%	AGO 1980-92 efficiency improvement – assumed to continue
Lights	-0.3%	Assumed, impact of compact fluorescent lamps etc.
Dishwasher	-1.2%	AGO 1980-92 efficiency improvement – assumed to continue
Washing Machine	-0.5%	AGO 1980-92 efficiency improvement – assumed to continue

Table 3 – EnergyAustralia Region – Assumed Annual Energy Efficiency Improvement

Abbreviation: AGO = Australian Greenhouse Office. Estimates are based on the report "Strategic Study of Household Energy and Greenhouse Issues", prepared by Sustainable Solutions Pty Ltd for the Australian Greenhouse Office, June 1998

Changing Patterns of Residential Consumption

The dominant difference in residential sector consumption patterns now, as compared to a decade ago, has been the rapid penetration of air conditioning.

The number of air-conditioned residential premises in EnergyAustralia's region increased from 257,000 in 1991/92 to almost 570,000 in 2001/02. The air conditioning penetration rate has grown particularly strongly following the extremely hot summer of 1997/98. Ongoing penetration is expected to continue, although the recent rapid growth is expected to slow as penetration nears saturation levels and the level of new building activity returns to longer-term average rates. Figure 9 shows the recent and expected trends in new air conditioning appliances.



Figure 9 – EnergyAustralia Region – Estimated Additions to Air Conditioning Stocks

The rapid growth in residential air conditioning loads has had a significant impact on EnergyAustralia's network operations and capital expenditure planning.

The residential sector contribution to overall system summer peak demand has grown rapidly, in line with air conditioning penetration. Growth in summer peak demand has been considerably greater than overall energy consumption growth. In addition, the increasing contribution of the residential sector to summer peak demand has resulted in more prolonged daily peak durations, and consequently the network is becoming strained for longer periods of time.

Load research undertaken by EnergyAustralia indicates that residential air conditioning has a disproportionately severe impact on summer peak demand as compared to annual energy consumption. Air conditioners are used very intermittently, but it is the typical time of use of the appliance that is the key driver of peak demand. Figures 10, 11 and 12 illustrate the impact on the network of the average air conditioning unit.

Figure 10 shows the impact of air conditioning on customer load profiles. Customers with air conditioning generally tend to consume more electricity than non-air conditioned customers (compare the red and blue dotted line profiles), probably due to the tendency for air conditioning to be associated with larger households. What is most significant, however, is that on hot days the demand of the average customer with air conditioning doubles.

Figure 10 – EnergyAustralia Region – Profiles of Average Customers with without Air Conditioners



Figure 11 illustrates the daily peak load of the average air conditioning unit.



Figure 11 – EnergyAustralia Region – Average Daily Peak of Air Conditioners

The extreme "peakiness" of residential air conditioning loads is also demonstrated by the estimated load duration curve (LDC) in Figure 12.





The LDC indicates that air conditioners are virtually idle for 40% of the year, and for 95% of the hours in the year they operate at less than 36% of capacity. From a system augmentation point of view EnergyAustralia needs to have sufficient capacity

in place to supply the peak demand, which occurs for just one-half hour period throughout the year.

Prevailing temperatures have a profound impact on the demand on and the consequent operation of the network. The residential sector has traditionally been the prime contributor to winter weather sensitivity. As pointed out previously, due to the recent rapid penetration of air conditioning, the residential sector has had, and will in the future become, an increasingly larger contributor to summer peak demand.

Figure 13 illustrates the relationship between estimated residential peak demand and temperature in 2000/01. The slope of the relationship will steepen as air conditioning penetration continues to climb.





The problem of peak load and its impact on the electricity network has been encapsulated in the statement that "10% of capacity Network is used for only 1% of the time". This has then been translated into "\$1 billion investment used for 1% of the time" based upon an undepreciated ODRC value of EnergyAustralia's assets (the D in ODRC stands for depreciated). While this high level overview may be true on average for the system as a whole over the investment life of the assets (40 to 50 years), it can create a unrealistic expectation of the short term potential for DM over the next regulatory period.

Term of Reference: Consider strategies to address increasing energy consumption and to improve the sustainability of residential buildings

EnergyAustralia submits that strategies aimed at addressing sustainability issues in the residential sector be segregated into two distinct target groups:

- Future new dwellings; and
- Existing dwellings.

Future Dwellings

Clearly there is opportunity for addressing residential sustainability by ensuring that future dwellings are energy efficient.

EnergyAustralia is currently working closely with PlanningNSW in the development of the BASIX Building Sustainability Index. BASIX is being designed to encourage developers to focus on sustainability issues at the construction stage.

The potential benefits of schemes such as BASIX will include higher penetration of energy efficient appliances and a reduced need for heating and cooling energy consumption due to better dwelling design and construction.

Existing Dwellings

Strategies which address energy efficiency in existing residential dwellings include:

- Minimum star ratings on appliances;
- Elimination of energy inefficient imports;
- Customer education and energy efficiency/savings tips such as EA website hints (adjusting thermostats on heating/cooling appliances, standby energy reduction, payback periods for insulation, hours of operation for pool pumping etc);
- Consistent, thorough load research programs to monitor and evaluate effectiveness of programs. The Industry or government should invest in quality information, including analysis of the costs vs benefits of various initiatives;
- Builder/Developer/Renovator education to counter the tendency to install cheap, low efficiency appliance. Builders will need incentives or mandated measures to go for dearer efficient appliances; and this is not encompassed under the current rules for creation of NGACs.
- Retro fit programs such as EnergyAustralia's "Refit" program.

In looking at promoting energy efficiency in changing the stock of existing dwellings or appliances it is necessary to recognise that the substantial benefit of such programs are delivered over the long term. The diagram below in Figure 14 is a high level example of the impact of replacement and growth have on changing the energy efficiency of an existing stock of dwellings or appliances. The diagram illustrates that where even if all new stock and replacements of existing stock are required to be energy efficient, a significant proportion of old inefficient stock will remain in service for an extended period. For example with a growth rate of 5% and a replacement rate of 5% (equal to a 20 year life), it may take 8 years for more than 50% of the stock to be energy efficient. For items with a long life, such as dwellings, a growth rate of 2.5% and a replacement rate of 2.5% (equal to a 40 year life), will take 14 years before half of the stock became energy efficient. Appliances, which have an average life of around 10 years, have a higher potential for swift replacement by energy efficient alternatives.

Given the potentially long lags that can occur before changes in residential and appliance stocks increase in energy efficiency it is important to commence programs early to get benefits over the longer term and to consider means of addressing low replacement and growth issues where they occur.



Figure 14 – Example of inertia in changing stock – Scenarios of growth and replacement ranging from 1% to 10 %