NSW DEPARTMENT OF COMMERCE
GOVERNMENT ARCHITECT'S OFFICE

INQUIRY INTO ENERGY CONSUMPTION IN RESIDENTIAL BUILDINGS
CALL FOR SUBMISSIONS

BACKGROUND

The NSW Standing Committee on Public Works is to inquire into and report on energy consumption in residential buildings in New South Wales, and have invited submissions from the Government Architect's Office. Comments on the terms of reference are included in the following section.

COMMENT

5. Changes in annual energy consumption patterns of electricity, gas and solar:

Energy use in the residential sector is increasing at a high rate. Annual consumption in petajoules, for the residential sector are shown in the following table:

(Ministry of Energy and Utilities, NSW Energy Flows, 1998-99, 1999-2000 & 2000-2001):

Year	Electricity	Bagasse & Wood	Gas	Oil	Coal	Total
1998-99	66.7	30.2	17.5	4.4	0.1	118.9
1999-2000	67.6	30.2	18.5	4.4	0.1	120.8
2000-01	69.5	30.0	21.9	4.5	0.1	125.9

Off the four utilisation sectors, namely Transport, Commercial, Industrial and Residential, the residential sector percentage of all energy flows in NSW is growing with 11.4% in 1998-99, 11.7% in 1999-2000 and 12.2% in 2000-01.

The consumption of both electricity and gas is growing at a high rate.
The increase in gas consumption is mainly due to an increase in the market share of the hot water and cooking market. The increase in electricity is mainly due to the increase in reverse cycle air conditioning (Integral Energy, Network 2013).

The problem is both the level of consumption and the growth in peak demand. Electricity cannot be stored and therefore requires an almost instantaneous increase in generator output when additional electrical loads such as air conditioning are switched on. These demands may only exist for a short time, usually in winter on a cold day or in summer on a hot day. Increases in electricity demand may result in loss of supply and hence frustration of residents due to loss of supply, safety issues (loss of lighting in common areas, failure of lifts, failure of traffic lights) and loss of productivity. High demands can also result in failure of transmission and distribution assets resulting in disruption of supply or brown outs (low voltage can damage electrical equipment such as air conditions, refrigerators, freezers, swimming pool pumps).

Transmission and distribution systems as well as generators are placed under strain during periods of maximum demand. Transmission and distribution systems are also under strain in high temperatures as their capacities are lower at elevated temperatures.

6. Implications for Capital Works programs of energy providers of any increases or potential increases in energy consumption.

From the early 1960's to 1994 there has been a regular increasing capacity in NSW electricity generation. In the mid 1990's capacity exceeded demand by a considerable margin. There has been little growth in generation capacity since the mid 1990's while energy consumption and demand continued to grow. The maximum demand in NSW during 1998-99 was 11,424 megawatts (MW), an increase of 428 MW on the previous year. The installed capacity of the principal generating plants in NSW totals approximately 12,695 MW. All of this capacity may not be available at the time of maximum demand due to planned maintenance, unplanned outages, lack of storage water or high temperatures limiting output.

Major transmission upgrading since the mid 1990's has also been minimal with the exception of a high voltage connections to Queensland. These connections have enabled generation in New South Wales and Queensland to compete for load in either state in the deregulated market. The main interconnection has at times operated at very high loads. Further construction of generation facilities in Queensland may result in this interconnection becoming overloaded and restricting the flow of power between the two states.

Generation, transmission and distribution systems must be rated to supply the maximum demand to all areas; otherwise load shedding will take place. Load shedding interrupts power to non-essential supplies, such as residential loads, to maintain the network in a stable condition. Without load shedding at times when demand exceeds supply, the system could become unstable and shutdown. The time to fully restore the complete generation, transmission and distribution systems could be up to three days.

Generation, transmission and distribution systems need to be augmented to meet the growing load. If demand exceeds supply, load shedding will occur that could lead to thousands of households without power for extended periods. The only recent coordinated load shedding occurred in New South Wales when several generator failures occurred at Liddell Power Station in the late 1970's. This caused industry to shut down for hours at a time, resulting in large financial losses due to loss in productivity.

7. Factors contributing to any increase in energy use.

Integral Energy's Network 2013 (Annual Planning Statement 2003) states, "The uptake of air conditioning particularly within Western Sydney (in addition to rapid development) is also straining Integral's network. Ten years ago, about one in four households within Integral's supply area had air conditioning. Today, one in two households are air-conditioned and indications are that this figure will continue to grow".

Clearly the growth of residential development and the uptake of reverse cycle air conditioning systems have caused an increase in electricity consumption and maximum demand.

The uptake of mechanical air cooling is directly linked to poor climate appropriate design standards for residential buildings and marketing strategies encouraging people to use

energy to maintain indoor thermal comfort rather then passive/natural temperature control strategies.

The majority of new residential buildings are designed with inadequately passive solar heating and cooling capacities such as the simple inclusion of shading to direct solar heat gain in the summer. The result is indoor air temperatures that regularly exceed human comfort levels. In response to these situations most home occupiers are forced to rely on mechanical air conditioning to maintain a comfortable living environment.

In addition many older residential buildings may lack suitable cross ventilation preventing the ability of occupants to effectively cool internal temperature by opening windows.

Heat loads on built surfaces such as roofs, walls and pavements are exacerbated by the lack of shade in the environment such as trees and shrubs. Shade trees and appropriate landscaping cool hard, heat-adsorbing surfaces by blocking direct sunlight and via the cooling effect of transpiration. The ability of plants to reduce the urban heat island effect has been well documented and has lead to legislative standards for minimum landscaping requirements in cities such as Tokyo. The use of shade trees and other landscape features to mitigate external temperatures around residential dwellings (especially the new estates in Western Sydney) is hindered by the lack of incentive and adequate space allocated to landscaping.

Current subdivision design reflects the lack of consideration for achieving climate responsive residential development. Subdivision layouts lack appropriate consideration for climate, topography and context. Orientation of lots should ensure all dwelling can receive adequate sunlight, cooling breezes, ventilation and shading. Lot sizes and street layout should allow for adequate landscaping.

High density housing does not necessarily result in lower energy consumption than low density housing. High density housing developments may require energy consuming facilities such as clothes dryers, lifts, common area lighting, security lighting and ventilation of bathrooms and car parks. Older high density housing may have poor cross ventilation and hence require the operation of air conditioning for longer periods than low density housing. Clothes dryers in high density housing are believed to have high energy consumption, as there is usually no option for natural drying.

8. The application of current government and industry policies and initiatives.

There are a number of existing initiates to produce energy efficient homes, such as:

- Nationwide House Energy Rating Software (NatHERS),
- Electrical appliance energy star rating label program,
- Energy Star international standard for energy efficient appliances such as computers, printers, TVs, VCRs and audio players.

All these initiatives assist to minimise energy consumption.

The NatHERS program, which is the basis for energy efficiency in relation to the performance of the building envelope, has been under review. Criticism of the software includes its inability to adequately addressing thermal comfort performance. The ability for occupants to natural cool buildings is one of the critical issues. If NatHERS is to

continue to be used as the basis for the energy-rating scheme it needs to include thermal comfort as a performance indicator.

Considerations:

4. Strategies to address increasing energy consumption and to improve the sustainability of residential buildings.

a) It is important that any strategies developed to address energy consumption in the residential sector are undertaken in a holistic way. The sustainability index BASIX currently being developed by the Department of Infrastructure, Planning and Natural Resources is the first integrated planning tool aimed at raising the standard of performance across a range of indicators including energy efficiency, landscaping, water consumption and indoor amenity amongst others. It is recommended that the Standing Committee support this initiative by recommending that BASIX becomes a mandatory requirement for all residential development approvals.

b) Ultimately, the home occupier must be educated in the importance of reducing energy consumption and how to manage their built environment including modify their behaviour to remain comfortable without having to rely on mechanical heating and cooling.

Increased energy awareness to existing home occupiers will require a highly visible education program in all medias. The benefits of reducing energy consumption needs to be simply and clearly promoted.

5. Implementation of such strategies.

Consumer awareness and education in operational practices in conjunction with implementation of the BASIX planning tool to improve current design standards and performance of the built environment, will most likely have the greatest short term effect in reducing energy consumption in the residential sector.

6. Any related matter.

a) Market incentives could be introduced to promote the demand for residential buildings that have good thermal performance and therefore the ability to be energy efficient. Such a scheme could link the thermal comfort rating system to stamp duty via a sliding scale based on performance. Residential buildings that are energy efficient could receive a stamp duty rebate similar to the first homebuyers' scheme. Retrofitting existing residential buildings to improve the energy efficiency will also be effected by the introduction of stamp duty reductions based on a thermal performance rating system. Market incentives need to be accompanied by an education campaign to assist in changing user behaviour.

b) To reduce electrical maximum demands, an incentive scheme could be introduced by electricity retailers to allow load shedding of non-essential loads in periods of high demands. Such a scheme exists in Energy Australia's network area for interruptible pumping loads in the Business Sector.

Domestic loads could be split into essential and non-essential loads, as follows:

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Domestic Essential Loads	Domestic Non-essential Loads
Lighting	Air Conditioning
Refrigeration including freezers	Swimming pool pumps and accessories
Computers	Clothes Dryers
General Power to TVs, clocks etc	Washing machines
Microwaves	Instantaneous Hot Water Systems
	Cooking ranges, cooktops and ovens

Such a scheme would require additional metering, control equipment and segregation of electrical circuits within the home. While initial uptake would be slow, the long term benefits of not having to design generation, transmission and distribution systems to meet a short term maximum demand, would have significant financial and environmental benefits by increasing the utilisation of existing and new assets.

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