INTEGRAL energy

The power is in your hands

Submission to the Legislative Standing Committee On Public Works

Inquiry into Energy Consumption In Residential Buildings

August 2003

Introduction

This report has been prepared by Integral Energy as input into the Legislative Assembly Standing Committee on Public Works Inquiry into Energy Consumption in Residential Buildings.

The Terms of Reference of the Inquiry into Energy Consumption in Residential Buildings require the examination of:

1. Changes in annual energy consumption patterns of electricity, gas and solar;
2. Implications for capital works programs of energy providers of any increases or projected increases in energy consumption;
3. Factors contributing to any increase in energy use (such as, take up of appliances, such as air conditioners; current design practices; growth in size of houses; subdivision design);
4. The application of current government and industry policies and initiatives (such as, the operation of rating tools, energy efficient appliances).

Specifically, this report responds to a letter from the Committee Manager requesting information regarding *"Integral Energy's activities and research in demand management and related residential issues.."*

The contents of this report have been drawn from the documents listed as attachements.

Integral Energy

Integral's network serves 2.1 million people across 24,500 square kilometres. In terms of customer connections, this involves the provision of electricity to 729,000 residential customers and 72,000 commercial/industrial customers.
Integral's network is made up of 25,000 transmission, zone and distribution substations, 370,000 power poles and 150,000 streetlights bound together by 33,000 kilometres of underground and overground cable.
Key load centres within Integral's supply area include: Parramatta, Penrith, Wollongong, Campbelltown, Blacktown and Liverpool.

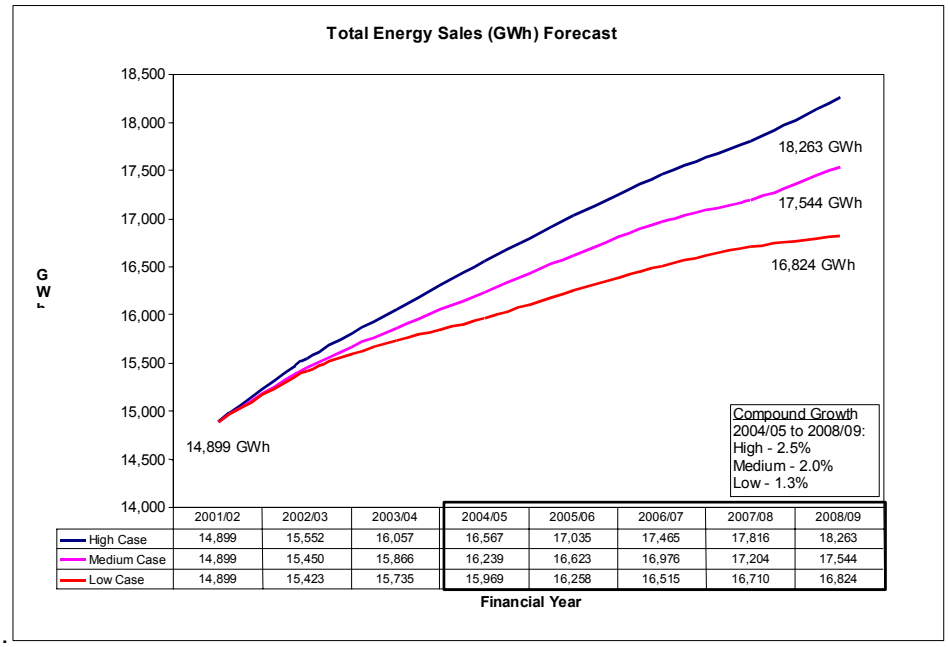
Figure 1

Electricity consumption – energy versus demand

Electricity consumption is driven mainly by weather patterns and the connection of large numbers of new appliances. Maximum demand occurs when a large number of customers seek to consume electricity simultaneously, for example, the heavy usage of air conditioning on a hot summer day. **It is the combined customer maximum demand, as opposed simply to growth in energy consumption and customer numbers, which drives the need to augment or extend the electricity network.**

Energy Consumption

Total energy actual and forecast results for the years ending 30 June 2002 and 30 June 2003 to 2009 respectively are shown in figure 2 below.



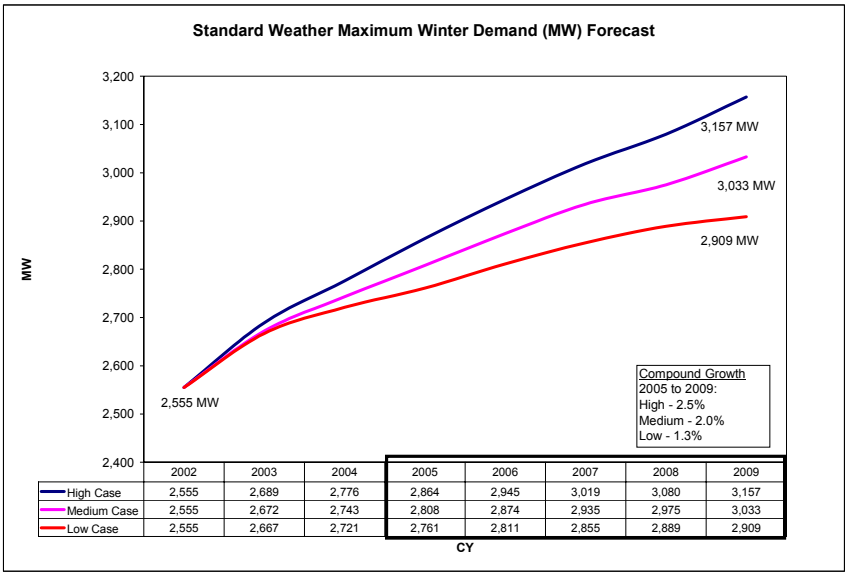
	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
High Case	14,899	15,552	16,057	16,567	17,035	17,465	17,816	18,263
Medium Case	14,899	15,450	15,866	16,239	16,623	16,976	17,204	17,544
Low Case	14,899	15,423	15,735	15,969	16,258	16,515	16,710	16,824

Figure 2 - Total Energy Sales forecast[1]

[1] The total energy sales forecast has been prepared consistent with the definition of sales in the regulatory accounts; off-peak inter-distributor energy transfers are excluded.

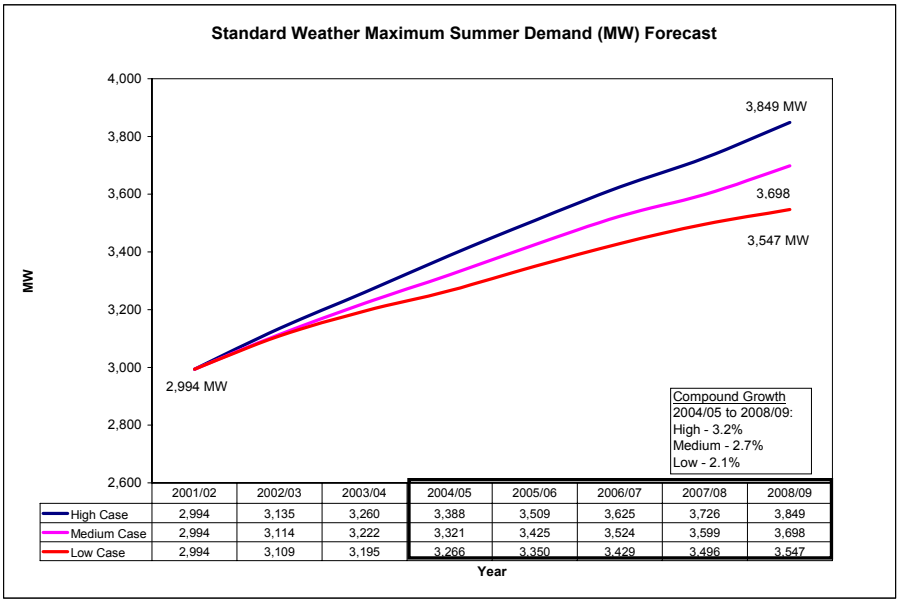
Standard Weather Maximum Demand forecasts

Actual and forecast Standard Weather Maximum Demand for winter over the calendar years 2002 and 2003 to 2009 respectively, and actual and forecast summer demands for the financial years 30 June 2002 and 30 June 2003 to 2009 are set out below in figures 3 and 4.



	2002	2003	2004	2005	2006	2007	2008	2009
High Case	2,555	2,689	2,776	2,864	2,945	3,019	3,080	3,157
Medium Case	2,555	2,672	2,743	2,808	2,874	2,935	2,975	3,033
Low Case	2,555	2,667	2,721	2,761	2,811	2,855	2,889	2,909

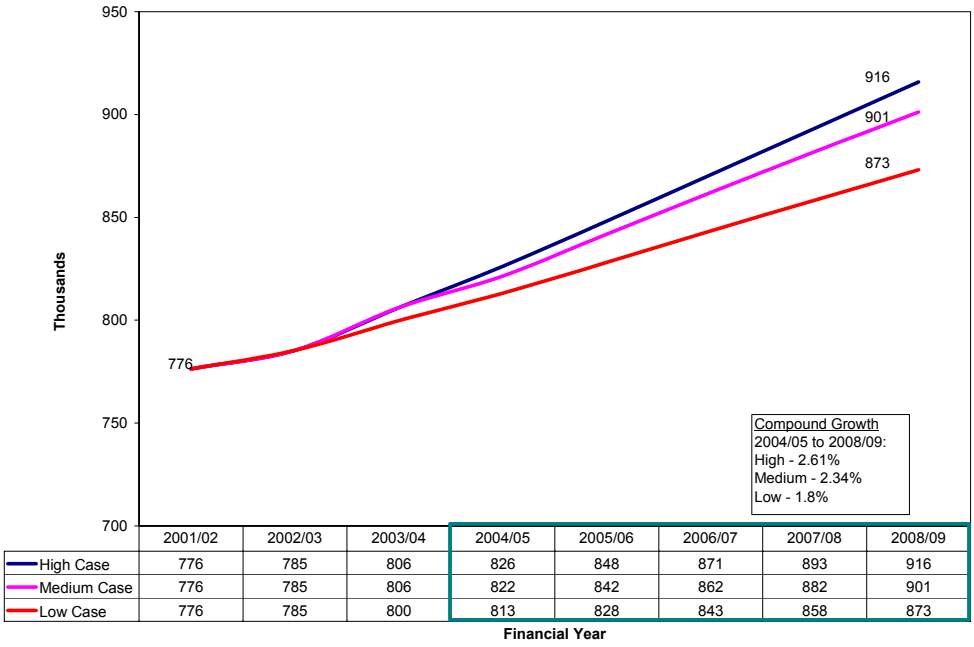
Figure 3 – SWMD Winter Forecast



	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
High Case	2,994	3,135	3,260	3,388	3,509	3,625	3,726	3,849
Medium Case	2,994	3,114	3,222	3,321	3,425	3,524	3,599	3,698
Low Case	2,994	3,109	3,195	3,266	3,350	3,429	3,496	3,547

Figure 4 – SWMD Summer Forecast

Customer number forecasts
Customer numbers actual and forecasts for the years ending 30 June 2002 and 30 June 2003 to 2009 are shown below in figure 5.



	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
High Case	776	785	806	826	848	871	893	916
Medium Case	776	785	806	822	842	862	882	901
Low Case	776	785	800	813	828	843	858	873

Figure 5 – Customer number forecast

Recent Changes in Customer Behaviour

Recent significant changes in key factors affecting Integral's network include:

- High growth rate in Integral's supply area and changing network characteristics, due to increased urban consolidation;
- High growth in electricity demand especially during peak periods;

Integral's customer base is growing strongly and some of Australia's fastest developing areas are in Integral's supply area and over half of Sydney's growth is occurring in Western Sydney.

The growth in peak demand is mainly driven by air conditioners, creating a huge strain on the network during summer months. Ten years ago, about 25% of households had air conditioning compared to 50% today. This figure is expected to grow.

Air conditioning places a huge strain on Integral's electricity network during summer months. A characteristic of air conditioning in the Western Sydney climate is that the appliances are usually required on a relatively small number of days. **Air conditioners therefore have contributed to a significant growth in peak demand while total energy consumption growth has been slightly more modest.**

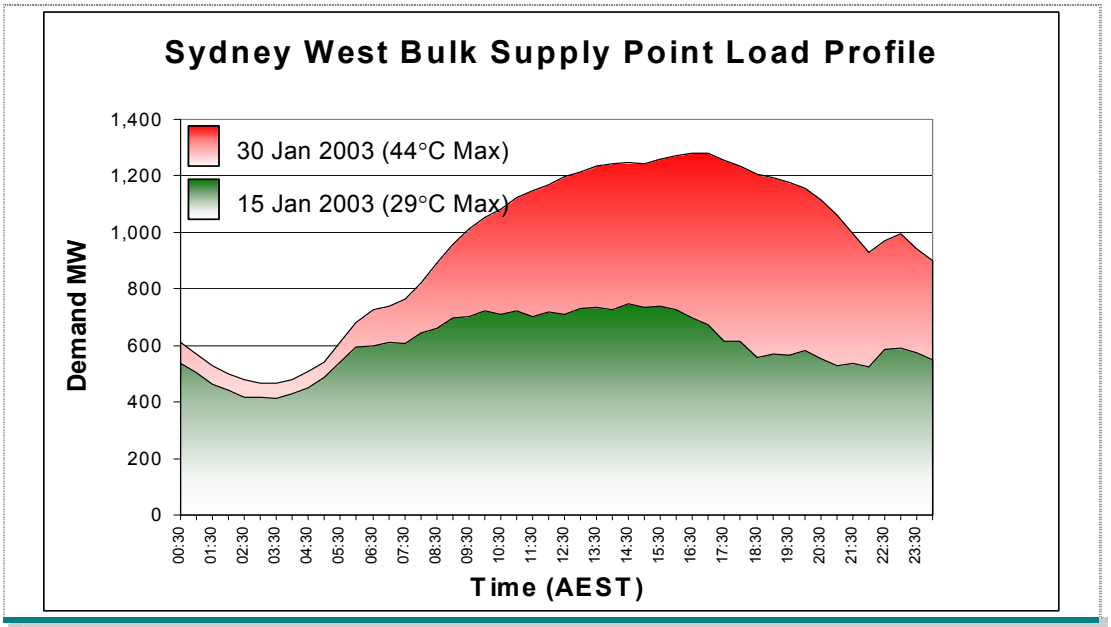


Figure 6 - Variation of load with temperature at the Sydney West Bulk Supply point

Figure 6 above shows the significant increase in electricity system demand that occurs on hot summer days, by comparing the demand on a 29°C to the demand on a 44°C day in January 2003.

During hot summers, 11% or 383 MW of capacity is required for 24 hours in a 12 month period, as illustrated in the figure below. The reason for the peaky demand is that air conditioners tend to run continuously during periods of very high temperatures.

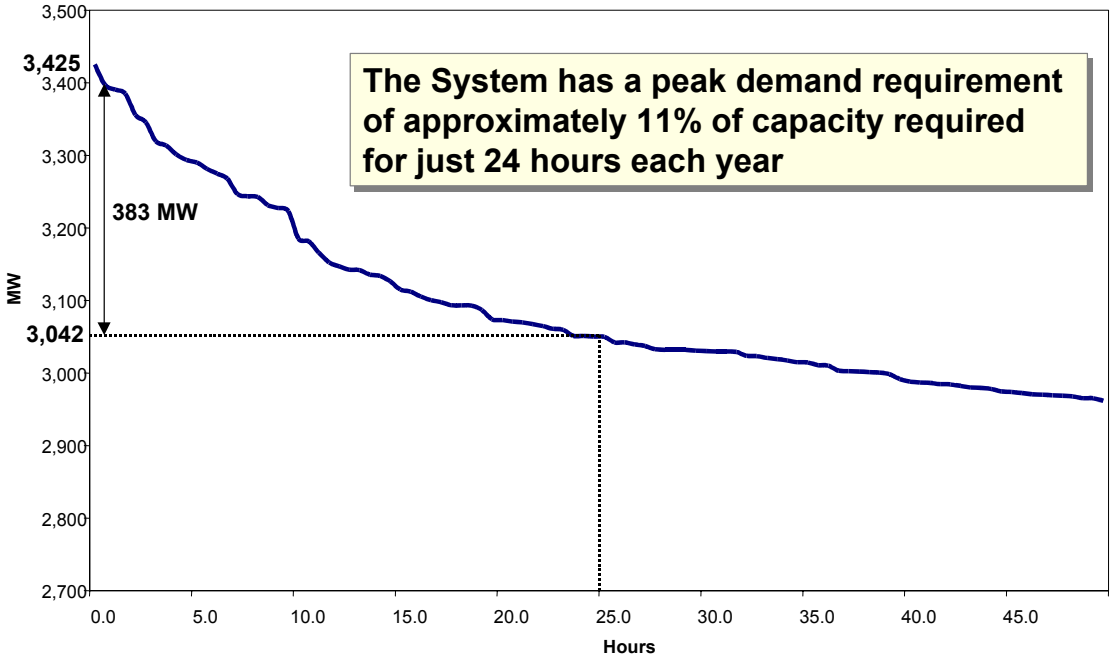


Figure 7 – Demand/Duration curve for total network

Further, the majority of this peak demand is caused by residential and commercial electricity customers, as illustrated below:

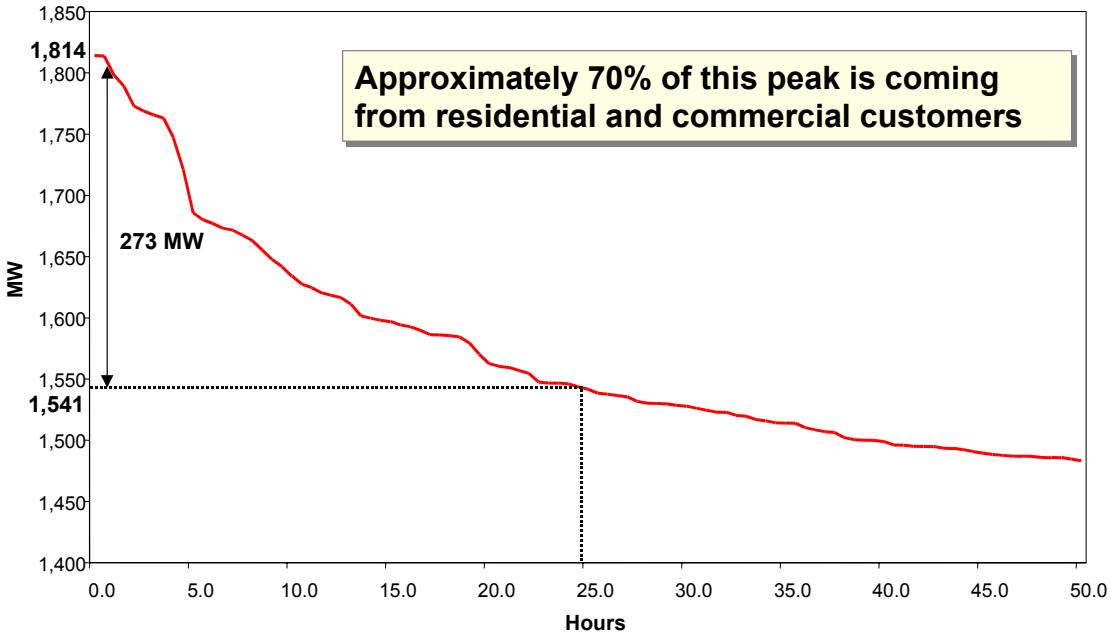


Figure 8 – Demand/Duration curve for residential and commercial customers

Growth in customer electricity demand is not only reflected in the number of new customers connecting to the network, but also in the increase in demand that existing customers place on the network. One way of measuring this is to review the After Diversity Maximum Demand (ADMD) for various customer classes. ADMD is a measure of the impact of customers (by class) on the network, taking account of the coincidence of peak use. It is used by network planning and design staff when developing plans for the network.

Table 1 below shows typical changes to the ADMD design criteria that have been applied because of the measured increase in demand within Integral's network. In areas where rapid growth has occurred the network is now inadequate to supply customers' demand for electricity in accordance with Integral's planning standards, eg Glenmore Park.

Area	Network Design Criteria	
	Pre 2000 KVA per lot	Post 2000 KVA per lot
Western Sydney	3.5 – 4.0	6.0 - 7.5
South Coast	3.5 – 4.0	5.0 - 6.5
Sth Highlands, Blue Mountains	3.5 – 4.0	5.5 – 7.0

Table 1 - Typical Changes in After Diversity Maximum Demand for Medium House (large villa, town house, apartment)

The culmination of these issues manifests in significant ways, for example, Integral's total system peak demand achieved a new all time high of approximately 3,425 MW on 30 January 2003. This was approximately 360MW above Integral's previous system peak. This event, which occurred on a hot day for Western Sydney, led to load–related power supply interruptions to approximately 40,000 of Integral's customers, and resulted in significant parts of Integral's network enduring loads at or in excess of their normal maximum rating capability.

Demand Management Responses

Demand Management initiatives can generally be defined in terms of the following key drivers :

- Environmentally driven - focus on reducing overall energy consumption and/or greenhouse gas emissions;
- Network driven - focus on solving network capacity constraints in ways that are more cost-effective (and often have lower environmental impacts) than network augmentation;
- Retail market driven - focus on improving costs to end-users and reducing an electricity retailer's exposure to high pool prices for wholesale electricity, by encouraging end-users to reduce energy consumption in times of peak demand when pool prices tend to be higher.

Integral is an industry leader in seeking out and applying demand management initiatives to its growth-related capital planning process.

- Integral convened and led the Demand Management Code of Practice Working Group, inaugurated in 1998, and has taken a leadership role in continuing to develop the existing Code in conjunction with key stakeholders.

- Integral has been pro-active in encouraging Demand Management initiatives to assist with the capacity of the network where constraints exist.

- Integral has used both market-based and traditional network planning approaches.

- According to the Ministry of Energy and Utilities, Integral has achieved the greatest benefits from Demand Management where it has encouraged customers to use energy more efficiently, reducing energy consumption, and better managing peak consumption periods.

- Integral has been able to defer during 1999/2000 nearly $29 million of spending on additional network extensions – for a cost of $1.2 million.

Past and Current Demand Management Programs

Embracing Demand Management opportunities has been fundamental to Integral's network investment planning considerations. Integral has been pro-active in encouraging Demand Management initiatives to assist with the capacity of the network where constraints exist.

Domestic Hot Water

- Integral currently has 1,556 MW connected reducing peak demand by 390 MW. 355,000 customers have selected this tariff option.

Air Conditioning Cycling Program – Load Cycling

In the summer of 2001 , Integral conducted an air conditioner interruption rebate trial. This trial found:

- Demand reduction of approximately 200kVA from 70 customers (just under 3kW/customer) was possible on a 35^0C day;
- Almost 80% of customers considered they were not inconvenienced by six half-hour interruptions over a nine week period;
- Most customers would be willing to sign-up to ongoing air-conditioning control in exchange for a regular rebate, although there were wide variations in the levels of compensation expected.

The study was successful in that a significant reduction in demand was detected immediately after the switching commands were issued. The graph below shows the accumulated participant load profile for 9 February 2001. **When the air conditioners under control were switched off, the maximum demand reduced to a level equal to that of a 25^0C day.**

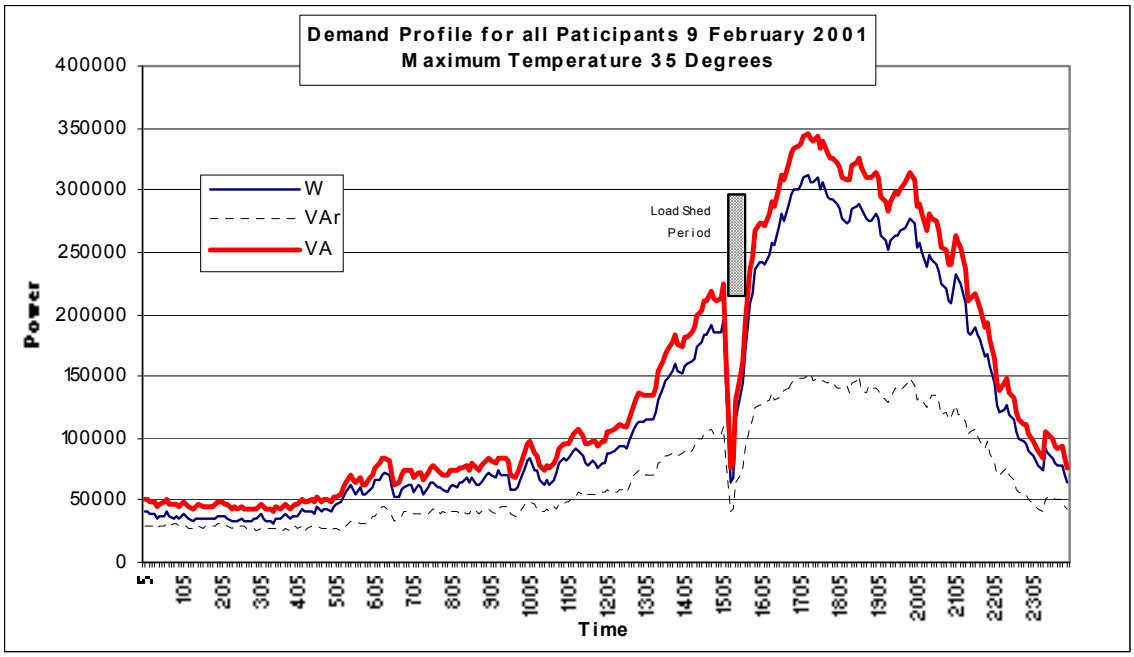


Figure 9 - Accumulated Participant Load Profile for 9 February 2001

Seven Hills – Load Curtailment

The Seven Hills Demand Management program was undertaken to defer a $1.7 million network augmentation project from 1998 to 2003. The Seven Hills program has since been further extended by two years to 2005.

Katoomba – Energy Efficiency
An energy efficiency program that was launched in the Katoomba area in 1998, focussing on energy efficiency in the residential sector, has successfully deferred additional capital works in the area until 2006/07.

Tahmoor – Fuel Substitution
This program in the Southern Highlands region ran for three years from 1998 and promoted the use of bottled gas for cooking and space heating as a means for controlling winter evening peak electricity demand growth.

Automated Meter Reading – New technology
Integral has recently completed an Automated Meter Reading (AMR) trial. The objective of the program was to investigate the half-hourly, remote reading of meters. AMR was deployed using the low voltage network to carry a meter signal to a substation where the signals were concentrated, radioed to a central database, and made available for viewing on line. In this particular project, only data interrogation and communication techniques were investigated. The system deployed could also allow real-time pricing, however its implementation would be costly.

Wetherill Park – Load Shedding
The Wetherill Park Industrial area is one of the largest industrial areas in Sydney's outer west, and as such has experienced high demand and significant demand growth. Large industrial customers have previously been signed up for load shedding on extreme hot summer days and for a program of power factor correction. Under the load shedding program customers are typically given 24 hours notice to reduce their loads during the system's peak period.

Marayong ZS 33kV Feeder – Power factor Correction
Investigations carried out by Integral – including public solicitation through the advertising of an Expression of Interest and consultations with major customers in the Blacktown industrial area – determined that power factor correction represented a cost-effective Demand Management opportunity in this area. Integral implemented a power factor correction program, which achieved its goals and deferred construction works from 2000 until 2006.

Parramatta CBD
The local council has reviewed the guidelines specifying the limits on building heights in the CBD area. This has the potential to result in rapid demand growth that could quickly exceed existing network capabilities. Integral is cooperating with SEDA in an initiative seeking to develop a Commercial Building Greenhouse Gas Rating Scheme for the area. As part of this study, Integral has funded and conducted a major survey to identify and establish the opportunities for Demand Management in the Parramatta CBD. Study results indicate that sufficient Demand Management opportunities exist to possibly defer the need for supply-side augmentation. Integral has begun making offers to building owners/managers for the implementation of appropriate Demand Management initiatives. Integral is planning to issue an RFP that will extend the Demand Management program with the aim of deferring any network augmentation in the area until June 2006. This would constitute a two-year deferral of the supply-side asset. Some of the specific Demand Management options that are being considered include the installation of power factor correction equipment and the use of existing back-up generators to allow interruption of mains electricity without loss of amenity to specific customers in time of system stress.

Castle Hill Demand Management Project
An innovative program that Integral Energy has recently implemented is the Castle Hill Demand Management Program. Integral has signed an agreement with SEDA to use its current programs and negotiate with major commercial customers in the Castle Hill area for the implementation of demand reducing initiatives. SEDA have identified a number of cost-effective initiatives and are now organising their implementation. SEDA will be paid on demand reduction targets being achieved. Programs such as efficient air conditioning upgrades, efficient lighting and efficient motor drives are an example. **This Demand Management program is seen to be the first of its kind in Australia.**

Request For Proposals (RFP) issued for Blacktown and Liverpool CBD
Demand Management initiatives are being sought through the RFP process for the Blacktown commercial centre and Liverpool CBD areas. It is anticipated that these activities will allow construction works to be deferred until June 2006.

Integral's network tariff objectives

Integral's network tariff strategy is based on improving the cost reflectivity of network tariffs available to customers. This will ensure that network costs are recovered in the most equitable manner possible and reflect the economic cost of providing for the network capacity needs of Integral's customers. Further, Integral believes that efficiency and equity outcomes for small customers will be improved if customers have tariff choice.
Integral's potential package of network tariffs is summarised in the following table.

Customer Type	Standard network tariff	Voluntary network tariff options
Residential	Current or Increasing Block Tariff	ToU Energy Controlled Air Conditioning Controlled Hot Water
LV Non-residential <160MWh	Current or Increasing Block Tariff	ToU Energy LV Demand ToU Controlled Air Conditioning
LV Non-residential >160MWh	LV Demand ToU	Potential Demand Side Management options
HV Non-residential <10MW	HV Demand ToU	
HV Non-residential >10MW or >40GWh	Individually Calculated	

Integral's potential package of network tariffs

In summary, Integral's objectives for network tariff reform are to:

- Improve efficiency and fairness of network tariffs by reducing the cross subsidy and deadweight loss that currently exists;
- Ensure that its network tariffs recover sufficient revenue at an acceptable level of risk.

From a tariff design perspective, Integral's aim is to have network tariffs that:

- Signal the future cost of network investment (improve dynamic efficiency);
- Promote more efficient utilisation of the existing network;
- Are as simple as practicable (to ensure that price signals are easily communicated to customers);

- Consider customer equity (equity as to consumption choices, historic pricing practices, customers' expectations, not impose unduly rapid price changes, etc);

- Consider the volatility, sufficiency and risk of network business revenue;

- Consider implementation issues.

These objectives are central to Integral's analysis and decision on the network tariffs that are implemented in the 2004 regulatory period.

Renewable energy obligations – New South Wales Greenhouse Abatement Certificates (NGACs)

The implementation of Demand Management initiatives may lead to a reduction in energy consumption and the possibility of generating NGAC credits. Integral Energy will seek to use these credits as additional financial incentive for customers to implement the demand reducing initiative. Integral is attempting to use this strategy in the Castle Hill Demand Management Program.

Generally, the generation and trading of NGACS is a Retail function. Energy trading are actively trading in these credits as Integral have a surplus of NGACS through its agreements to purchase greenhouse friendly energy.

Energy Efficiency and Demand Management Challenges

- A key to the successful implementation of these Demand Management initiatives is having adequate economic drivers to facilitate their adoption. In this respect Integral is strongly supportive of initiatives to create the correct economic incentive for customers to manage their consumption patterns to reduce peak demand on the electrical network.

- Given the different drivers of Demand Management responses, Demand Management initiatives should consider all of these drivers and not be the sole responsibility of the DNSPs. All players in the supply chain, that is, generation, transmission, distribution, retail and end-use customers, have a role to play in the provision of Demand Management responses as they can all potentially benefit from the introduction of Demand Management initiatives.

- Greater certainty for cost recovery of demand management investment from the NSW Electricity Regulator (The Independent Pricing And Regulatory Tribunal) would facilitate broader implementation of many new and existing Demand Management initiatives.

- The inconsistent application of standardised energy efficient building codes, coupled to the desire for increased density of new housing, has created an environment where new residential development creates greater electricity infrastructure demands than necessary. Examples of this are the absence of eaves and mandatory insulation on new homes. In the Western Sydney area, this means that new homes are fitted with large air conditioners upon construction, in order for them to be sufficiently attractive to the market.

- The existing National Home Energy Rating Scheme (NatHERS) star rating system has been a positive initiative, however its implementation has highlighted some short comings. Integral Energy supports the implementation of the Building Sustainability Index (BASIX) system, which takes a more holistic view of energy efficient planning.

- The existing National Home Energy Rating Scheme (NatHERS) star rating system discourages the use of off-peak storage hot water systems, even though these systems have been a successful Demand Management program for many years. The NatHERS system does not discourage the use of domestic air conditioning.

- Integral Energy is also supportive of energy buy-back schemes for customer energy efficiency through embedded generation, such as solar panel installation.

Attachments:

1. 2004 Electricity Network Review Submission to the Independent Pricing and Regulatory Tribunal, 10 April 2003

2. 2004 Electricity Network Review Supplementary Submission to the Independent Pricing and Regulatory Tribunal, 14 August 2003

3. Impact of Air Conditioning on Integral Energy's Network, Charles River Associates, May 2003.

4. Integral Energy Network 2013, Section 1

5. Integral Energy Demand Side Management Programs, Charles River Associates, May 2003.

6. Integral Energy Interruptible Air Conditioning Rebate Project - Final Report (special report no. s047)