DEMAND SIDE MANAGEMENT PROGRAMS IN THE WESTERN SYDNEY AREAS

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ABSTRACT

This paper presents Demand Side Management practice in Western Sydney Areas. Regulatory environment, sustainable network development and climate change issues in relation to Demand Side Management are discussed. Following the discussion of strategies and approaches to obtain customer participation, experience and lessons on past programs are presented. A case study is also presented to demonstrate a successful Demand Side Management program.

INTRODUCTION

Integral Energy's network serves more than 2.1 million people across 24,500 square kilometres in New South Wales (NSW), Australia. The network is made up of approximately 28,000 transmission, zone and distribution substations and 315,000 power poles bound together by 33,000 kilometres of underground and over head cable. Figure 1 shows the network area of Integral Energy.

Figure 1 Map of Integral Energy's network supply area

In recent years, Western Sydney has experienced rapid development due to new release areas and the booming economy. An ongoing trend within Integral Energy's supply area is the transformation of the network from a rural or semi-rural to one that is capable of supplying a more densely populated urban network. As a result, summer peak demand has been growing quickly, primarily driven by air conditioning. The summer demand forecasts are shown in Figure 2.

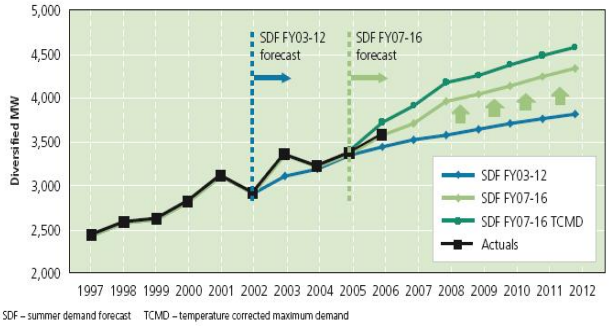

Figure 2 Summer demand forecasts

In general, the loads can be classified into three categories.

Residential

The new development and the penetration of air conditioning in the residential buildings contribute significantly to summer peak demand growth. The penetration of air conditioning has been particularly evident in new residential development, with many housing developers often including air conditioners as part of the new housing package to attract customers.

Commercial

These are typically office buildings and shopping areas, which have a high air conditioning and lighting component.

Industrial

Generally the production process and motors are the greatest energy consumers where lighting and air-conditioning loads are minor.
The rapid demand growth has been a great challenge to the network reliability and sustainable development.

THE CHALLENGE AND THE POTENTIAL

In Western Sydney, all areas experience demand growth at different rates. While network augmentation is planned to ensure system reliability, efficiency management of electricity supply by using demand side management (DSM) and other energy efficiency measures has been pursued as alternatives to supply-side solutions.
The challenge is to manage the changing consumer behaviour, to develop a suite of demand management (DM) initiatives and to manage the implementation of these initiatives over time. This will require a concerted effort by the industry, regulators and government to manage consumer acceptance of these initiatives and to change consumer attitude to electricity consumption.

The established residential areas where the demand growth is predominantly driven by AC growth, presents certain challenges in managing this appliance as sufficient control measures are not available.

Commercial areas, which have a high air conditioning component, are not as volatile as residential areas but still offer opportunities in efficiency improvement of the AC systems and also in lighting. There are also mechanical loads such as motors where more energy efficient alternatives exist. The difficulty in this load type is that generally, the owners of commercial buildings have no incentive to reduce energy consumption as these costs are passed onto the tenants.

Industrial areas generally have the least amount of air conditioning load but offer the greatest opportunity for cost effective energy and demand reduction. There is generally a high level of electrical energy consumed and relatively high levels of inefficiencies. Integral Energy has obtained the greatest success rate of demand and energy reduction in industrial areas.

While the three load types have different drivers they all have similar peak times during summer. The industrial summer profile may reach its maximum around 10 am, but will remain fairly flat until 3 to 4 pm when it commences to reduce. This is similar to the commercial load profile although it may peak around 2 pm.

The residential summer profile is slightly different. It will commence to increase around 1pm and may reach its maximum around 4 to 5 pm before reducing. During extremely hot periods, particularly on the third hot day in a row, the residential profile will stay high well into the evening. This poses a great challenge for electricity network companies.

REGULATORY ENVIRONMENT

The NSW Electricity Supply Act 1995 stipulates that Distribution Network Service Providers (DNSP) must investigate non-network alternatives prior to proceeding with the network enhancement option. The penalty being, not having the capital expenditure regarded as "prudent" and rolled into the network asset base. The NSW Code of Practice Demand Management for Electricity Distributors also details when and how non-network alternatives are to be investigated and implemented and is currently used by the regulator to determine if the appropriate level of investigation for non-network alternatives was conducted. The Code also details the calculation of the 'Avoided Distribution Cost' used to determine the budget for funding DM Programs.

The current regulatory rules, which began in July 2004, allows for demand management cost recovery via the 'D' Factor mechanism. Actual DM expenditure as well as revenue foregone is allowed to be recovered. This has resulted in an increase in the number of DM programs implemented by Integral Energy and other Network Distributors in NSW. To date, Integral Energy has implemented ten network-driven DM Programs in the current (2004 to 2009) regulatory period.

The current cost recovery mechanism incorporates a two year lag before moneys spent and revenue forgone can be fully recovered. Consequently, the future national energy regulator has provided assurance that cost recovery will be allowed in the first two years of the next regulatory period (2009 to 2014) but has given no assurance that the current cost recovery mechanism will be continued.

The DM Programs implemented by Integral Energy tend to be two or three years in duration as demand reduction takes time to implement. The programs are structured to remove or minimise load at risk until the network enhancement project is commissioned. Consequently, programs implemented during 2007 onwards will move into the next regulatory period and run the risk of not having expenditure fully recovered

INTEGRAL ENERGY'S DSM APPROACH

The concept behind DSM is to reduce peak demands below the network capacity limits in the parts of the network (localised programs) where required in order to defer or avoid capital expenditure as compared to augmenting the network in a cost effective manner. These peak demands may occur relatively infrequently, however, still pose a substantial risk in the network not being able to supply the demand under emergency situation. The network must have sufficient capacity to reliably and safely supply the peak demand. Distributors are developing demand management programs to primarily clip summer peak demands and defer capital investment in the network at the transmission and sub-transmission levels.

Electricity distributors in NSW operate under the NSW electricity Supply Act 1995, which includes a licence requirement to investigate demand management alternatives to network augmentation for specific capital expenditure projects. The NSW Code of Practice – Demand Management for Electricity Distributors, May 2004 (DM Code) requires electricity distributors to seek input to the planning process from the public and other stakeholders.

Integral Energy's approach can be summarised as below.

Long term planning statement

Integral Energy publishes a ten-year planning statement and a system development review annually. The planning procedure seeks input to both the supply and demand side options, and engages customers, stakeholders and the community on issues relating to system reliability and sustainability.

Working with customers on DSM programs

The majority of the DSM programs that Integral Energy has in place are working with industrial and commercial customers to reduce or displace the consumption of electricity from peak periods. These programs tend to be localised, focusing on peak demand in a particular part of the network and not large scale energy reduction programs.

If an area is developing and has a high growth rate DSM is generally not a viable option due to the time involved in

implementing programs. However, if the growth rate is moderate and the demand level exceeding the capacity limitation is within the scope of DSM programs and customers willingness to participate, then DSM is a viable option. This means that established areas are the prime candidates for DSM programs.

DM as part of the network planning process

Integral Energy incorporates Demand Management investigations as part of the normal planning process. DM programs are investigated together with supply side options. The most cost-effective option or combination of options is selected for implementation. This is not only a regulatory requirement but also good business practice. Investigations are team based with planning personnel investigating network and non-network options in tandem.

Integral Energy passes each capital investment project through the 'Reasonableness Test' as stipulated in the DM Code. Each project that passes the test is put to the market via a Request for Proposal for DM services for that area.

Market-based approach

The current DM Code requires a more market based approach to be used in investigating demand management options. This provides its own set of challenges in developing the skills both internally and externally in managing this process. Integral Energy have always used a market based approach to investigate demand management options and has changed processes to accommodate the new requirements of the DM Code.

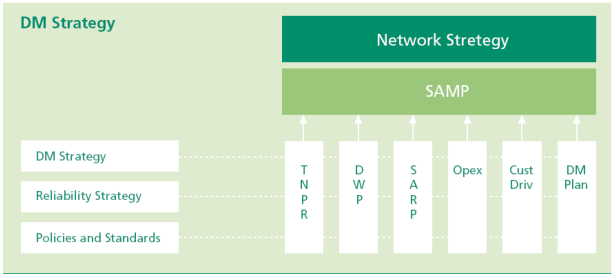

Figure 3 Integral Energy's DM Strategy
TNPR: Transmission Network Planning Review
DWP: Distribution Works Program
SARP: Strategic Asset Renewal Plan
SAMP: Strategic Asset Management Plan
DM: Demand Management

In certain circumstances direct negotiations with major customers has identified sufficient demand reduction to avoid a capacity constraint and defer a planned capital expenditure. The vast majority of programs currently in place today deal directly with the peak demand and attacking the causes of the peak. These programs are made up of energy efficiency (permanent demand reduction), peak clipping (using customers' back-up generation) peak shifting (deferring the use of energy) or just paying customers not to use electricity in certain times of the day. These types of programs can only be implemented with larger consumers.

OUTCOMES AND LESSONS LEARNED

Integral has mainly implemented network driven DM Programs in industrial and commercial areas. This is due to the fact the there are more opportunities in working with several large customers. Also, the current regulatory regime in NSW requires evidence of a network capital expenditure item being deferred as a result of the DM Program. This forces programs to be localised concentrating on only the customers supplied from the constrained part of the network. Integral has achieved a higher success rate in industrial areas. Comparing to industrial areas, commercial areas often have the barrier of owner versus tenant, where industrial areas tend to have the owner of the business also owning the facility. The benefits of reducing energy and demand flow directly to the investor of the initiative.

DM programs in residential areas that achieve the desired level of demand reduction have been difficult to develop. While some efficient lighting opportunities have been explored, there is currently no effective measures to control the peaky air-conditioning load.

One of the main drivers for electricity network expansion is the requirement to service increasing levels of customer demand and changing customer usage patterns. The challenge therefore is in the opposite direction, to encourage customers to respond positively to requests for demand management. Further challenges to customer demand management participation are offered by:

- Electricity being an "invisible" input into their process or business;
- The savings from demand management programs may not be easily identified;
- Energy efficiency is often not a core business function;
- Many demand and energy reduction initiatives require up front investment in order to deliver future benefits;
- Electricity being a relatively low input cost for many households and businesses.

These issues need to be addressed if customer driven demand management is to succeed.

CASE STUDY – WETHERILL PARK INDUSTRIAL AREA DEMAND MANAGEMENT PROGRAM

The Wetherill Park industrial area had been experiencing steady growth and the Wetherill Park Zone Substation supplying the industrial and surrounding residential area was approaching its transformer capacity limit. The overall demand growth rate was 1.7% per annum and the demand reduction required to defer the construction of a new zone substation for three years was 5,400 kVA.

As there are many large electricity consuming customers in the industrial area and the growth rate and target demand reduction was within scope, this project passed the reasonableness test. An RFP was issued to identify a service provider to implement the Demand Management Program.
Parsons Brinckerhoff (PB) was selected as the preferred service provider to implement the Demand Management Program in Wetherill Park Industrial Area. PB approached customers with Integral Energy and conducted level one audits and prepare reports listing all energy and demand reducing initiatives prioritised. Following the site audits, PB co-ordinated the implementation and the program progress. At the same time, customers were also able to approach Integral with projects they wished to implement to obtain the financial assistance on offer. Integral Energy offered financial incentives to assist implement the identified initiatives. The program ran for three years and was successful in achieving the target demand reduction. The key results for the program are listed below:

- 30 Customers participated in the program.
- 47 initiatives were identified
- 6,647 kVA of demand reduction was identified
- 27 initiatives were implemented
- 5,546 kVA of demand reduction was implemented
- 202 MWh per annum of energy reduction was achieved
- 260 tonnes per annum of CO2 gases reduction was achieved

Listed below is the graph of Wetherill Park Zone Substation recorded summer peak demands. It indicates the summer peak demands post DM program implementation. Note that the 2003/04 summer was hotter than normal and achieved a higher than normal peak demand.

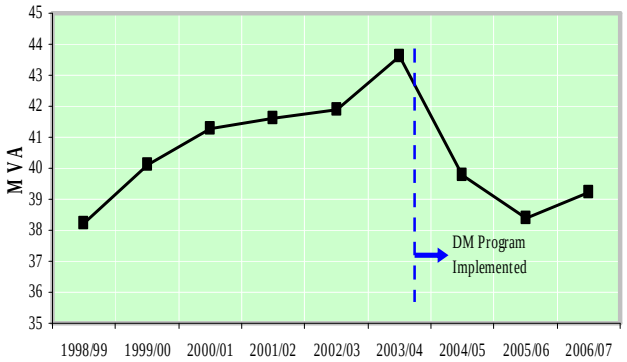

Figure 4 Wetherill Park demand management program

CONCLUSION – PROSPECTIVE

Integral Energy supports the DM Code of practice as an effective means for distribution companies to investigate and implement DM Programs. Integral also supports the current regulatory D-Factor cost-recovery mechanism for DM Programs. This mechanism has seen an increase in successful DM Programs being implemented. While the number of demand reducing initiatives has increased, more support is required to improve the cost-effectiveness of energy efficiency programs.
Energy efficiency can potentially significantly contribute to DSM, should the Carbon Trading Scheme be introduced in the near future. The recent increase in electricity prices and regulations such as Energy Efficiency Opportunities has seen some effects on the up-taking of energy efficiency initiatives. The Wetherill Park program implemented prior to this regulation.
A concept that is achieving some success is the Australian Building Greenhouse Rating (ABGR) scheme. Economic benefits to participating organisations result from having government and other environmentally focussed tenants wishing to occupy commercial space with a high 'greenhouse gas' star rating. Recent moves towards "triple bottom line" reporting should see this trend continue. Thus there is a significant role for all levels of government and industry to be involved in demand management program participation. This concept is particularly beneficial for energy efficiency and demand management in commercial areas.
As described above, Integral Energy's DSM has been concentrated on targeted (constrained local network) programs due to regulatory issues. This approach has identified more opportunities and program costs and benefits are more easily identified.
Less clear however and equally as important from a whole society perspective, is how to efficiently implement global demand management program. The efficient investment in global demand management programs therefore poses some real challenges, and over the medium term requires a "social benefits" type of philosophy from all stakeholders, as opposed to a detailed cost/benefit assessment applied to individual local constraints.

REFERENCES

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