

Demand Management Investigation Report

Terrey Hills

Summary

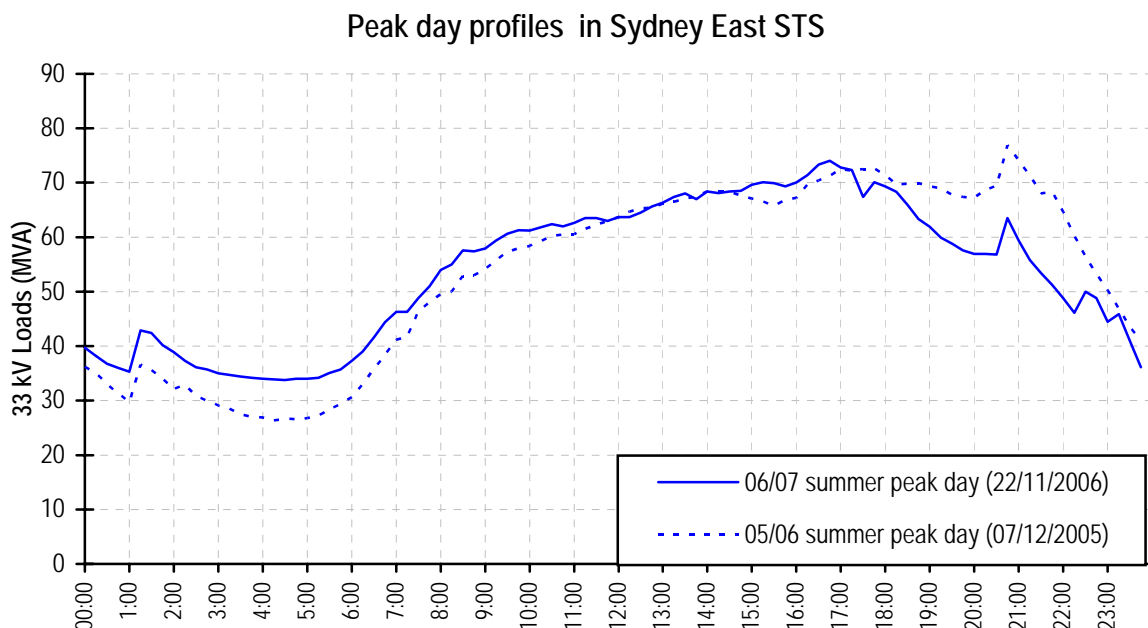
EnergyAustralia carried out an investigation of demand management (DM) options in the Terrey Hills, Narrabeen, Mona Vale, Careel Bay and Newport areas in 2007/08. The aim was to determine if there were cost effective demand management measures that could defer the need for a \$9m investment of building a new 33kV feeder from Sydney East STS to Terrey Hills zone substation, while maintaining network performance at the required level through the summer 2008/09. This report concludes that a sufficient demand reduction option is available.

Screening Test Outcomes

A DM screening test (DMST) completed in November 2007 concluded that to achieve a one year deferral of building a new 33kV feeder from Sydney East STS to Terrey Hills zone substation investment we would need to implement demand reductions totalling 3MVA before summer 2008/09. Based on the revised investment cost of \$9m, the savings from this deferral is estimated at \$720,000 or \$240/kVA.

Sydney East STS Peak Day Load Profiles

The following charts show the summer peak load profiles at Sydney East sub-transmission substation.



The load profiles suggest that commercial and residential loads dominate the summer daily peak demand. Any DM solution would need to be effective during weekday daytime between 2:00pm and 6:00pm. The load profiles of the top 10 days for summer in Appendix A show that the load profiles are quite consistent.

Demand Management Investigation

The overall investigation approach was to identify potential DM options, assess the likely size of the demand reduction and rank them based on their cost (\$/kVA) to EA. The most cost-effective options might result in a feasible project. We identified major customers based on their maximum monthly peak demand, visited the potential sites and collected information about their usage of energy and possible DM options. We also reviewed existing investigation reports from the Demand Management and Planning Project in the Sydney East STS area. Using all this information, we prepared a list of potential DM options for further investigation.

For each of the options we assessed the likely size of demand reduction that would result at the time of network peak at the zone substation. We also estimated the cost of implementing DM options to EnergyAustralia. Based on these estimates, we ranked the options and compared them to the potential savings from deferring the proposed supply side investment.

Identified DM options

- Power factor correction
- Relocatable generators
- Embedded generation
- Customer's standby diesel generators
- Commercial lighting upgrades and fixed dimming units
- HVAC upgrade

DM Options Analysis

Power factor correction

Where customer's loads exhibit poor power factor, peak demands on the network are higher than they would otherwise be. Based on actual electrical demand data from 2006, we identified that four customers had poor power factor in Terrey Hills area. The estimated potential demand reduction effective at subtransmission level is about 146kVA in summer. From our experience, the estimated cost of facilitating the program is about \$5,000 or \$36/kVA.

Relocatable generators

EnergyAustralia has used relocatable generators to provide reliable temporary load reductions in other areas. We identified several potentially suitable locations for installation of up to three 1MVA generators. The estimated cost to EnergyAustralia would be approximately \$700,000 - 790,000 or \$233 - \$263/kVA.

Embedded generation

A 0.9MW diesel generator at Pittwater RSL Club is available during network peak periods, which can shift 400kVA customer's summer peak load. We had a contractual arrangement with the customer over summer 2006/07 for five months. Our trial demonstrated the generator is reliable.

A new suitable network support agreement could be negotiated which would enable this generator to provide network support. We estimated a cost of \$60,000, or \$150/kVA.

Customer's standby diesel generator

A customer is willing to discuss using his on-site 800kVA standby diesel generator for load shifting. The summer peak load for this site was 480kVA in 2005. We undertook further investigation of the site and found that the standby generator is currently configured as a standard standby arrangement with no synchronising capability. Based on the customer's expressed reliability requirements, a SCTT connection would need to be installed. The demand reduction would be limited to the customer's own load - about 480kVA in summer daytime. The estimated cost to EnergyAustralia to establish and use this capability would be approximately \$175,000. This includes customer's main switchboard modifications, monitoring, dispatch equipment, project management, contracting and one year's operational cost. This translates to an average cost of about \$365/kVA.

Commercial lighting upgrades and fixed dimming units

From the survey, we identified some commercial customers who have the potential to upgrade their existing light fittings or install voltage reduction units (dimming devices) on their lighting systems. The proposed lighting upgrade option is to change the existing light fittings with an efficient lighting system consisting of a single triphosphor lamp, a reflector and electronic ballast. The estimated total demand reduction would be about 150kVA. The net cost to EnergyAustralia is estimated to be \$182,000 or \$1,213/kVA.

Heating, ventilation, and air conditioning (HVAC) upgrade

Improvements to HVAC systems can be achieved with control improvements, or equipment changes. Major equipment changes (to more efficient models) are generally only practical if replacement of plant is being considered for other reasons. We were unable to identify any significant improvements to HVAC systems at the sites we visited that would lead to a reduction in summer peak demand that did not involve replacement of major equipment.

Summary of Project Cost and Load Reduction

Based on our investigations, we have summarised below the estimated size and cost of each identified DM option:

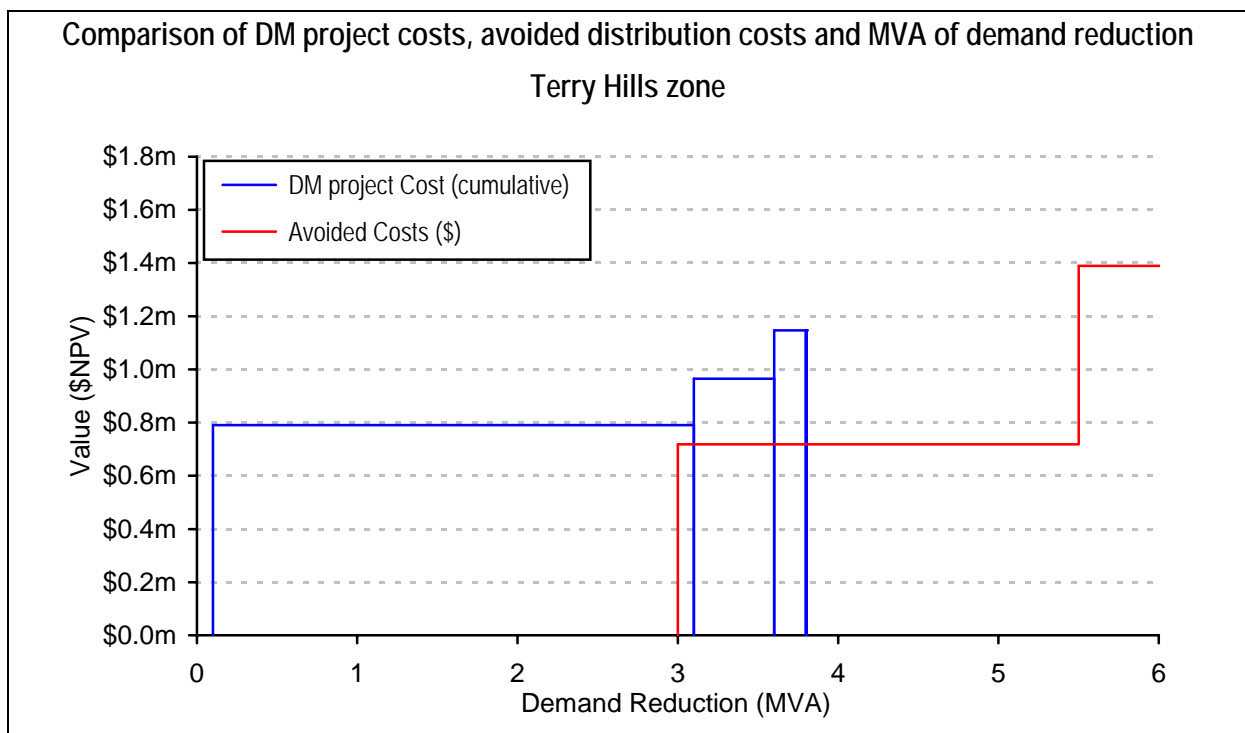
DM options	Summer Peak Load Reduction	Total Cost to EA (\$NPV)	Cost to EA (\$/kVA)	No. of Customers Involved	Time for Implementation
Power factor correction	0.14MVA	\$5,000	\$36	4	1 - 2 years
Pittwater RSL Club embedded generation	0.40MVA	\$60,000	\$150	1	1 year
Relocatable generators	3MVA	\$700,000 - \$790,000	\$233 - \$263	1	1 year
Standby diesel generator (SCTT connection)	0.48MVA	\$175,000	\$365	1	1 - 2 years
Commercial lighting upgrade and fixed dimming for lighting	0.15MVA	\$182,000	\$1,213	15	1 - 2 years

Analysis of Options

The following table shows the potential value of avoided distribution costs and required timeframe for various levels of demand reduction in two scenarios.

Avoided distribution cost (\$NPV)	Required demand reduction		Demand reduction time
	Terrey Hills zone or	Sydney East STS	
\$720,000	3.0MVA (\$240/kVA)	4.8MVA (\$150/kVA)	Before summer 2008/09
\$1,390,000	5.5MVA (\$223/kVA)	7.7MVA (\$181/kVA)	Before summer 2009/10

The chart below compares the cost and demand reduction impact of the identified options to the value of avoided distribution costs and DM requirements. Stacking the options from lowest relative cost to highest shows that there is a demand reduction measure very close to supply option to achieve a one year deferral.



Feasible Option

On the basis of this analysis, we found that a power factor program and relocatable generator options could achieve sufficient demand reductions and achieve one year deferral.

- **Customer power factor correction**

Based on our review of the load profiles of the customers and the resulting probability of coincidence, this should result in a reduction of peak demand at the zone of 140kVA. Total cost of EA to undertake such a program is estimated at \$5,000, including all project management, customer contact and direct costs.

- **Relocatable generators**

EnergyAustralia has used leased diesel generators in other areas as a successful DM option. Identification of a suitable site is a critical element of this option where generators can be installed temporarily. During our investigation, we identified several likely locations for the project, and assessed issues of ease of access, noise, exhaust stack installation, fuel refilling, earthing, generator control communication and distance to EA's 11kV substation. We have started to negotiate with one of the land occupiers who agreed in principle that we can use an area of spare space on his premises for installing generators. We are waiting for Warringah council's final approval.

The generator would be remotely controlled and monitored via a reliable communications link to the EA Control Room. The generators would start and run automatically with the ability to be controlled by the System operator (via SCADA). Then they will automatically synchronise and connect to EA network. The control and communications of gensets will be explored and developed further in next stage.

Based on our experiences from similar project, we found that this option is technically feasible and commercially viable. Estimated cost, based on our current contracts for generator leasing and experience with previous projects is \$700,000 to \$790,000 for a 3MVA installation.

- **Standby generator in RSL Club**

EnergyAustralia had a contract with RSL club's of using standby generator as DM option in past. This DM option can be re-established again. However, the generator is located in Mona Vale and is far from Terrey Hills feeder S22, it will have limited impact on helping peak load reduction in Terrey Hills area. This option will not be developed further.

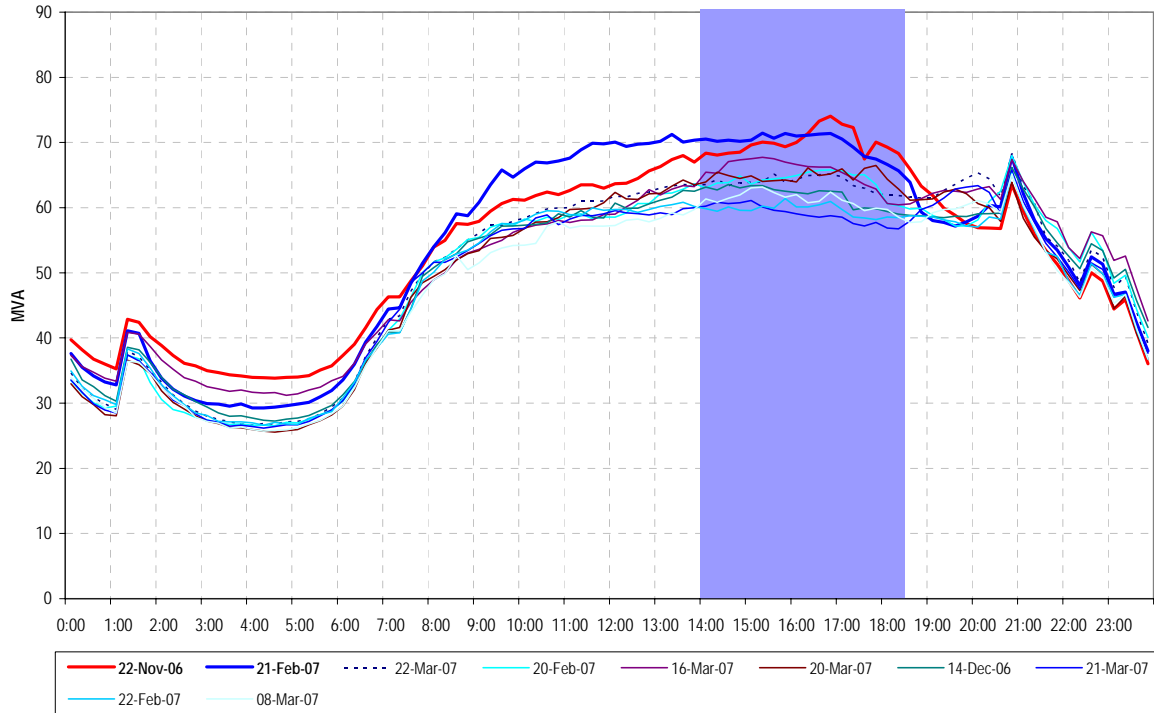
Conclusion

We identified a feasible DM option that is using three relocatable generators and PFC program to provide about 3MVA for summer late afternoon peak demand relief in Terry Hills area. The project is sufficiently large to enable one year deferral of the proposed investment.

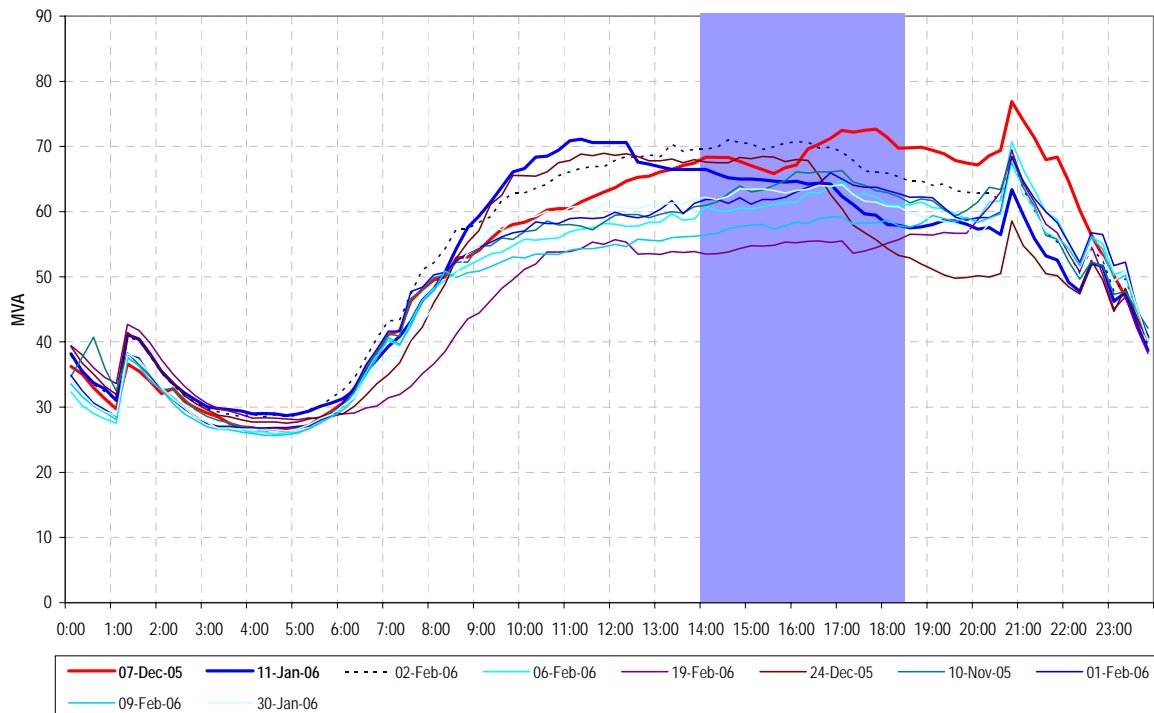
The option should be developed to a project offer to enable approval to be given for implementation in the middle of 2008.

Appendix A: Additional Data

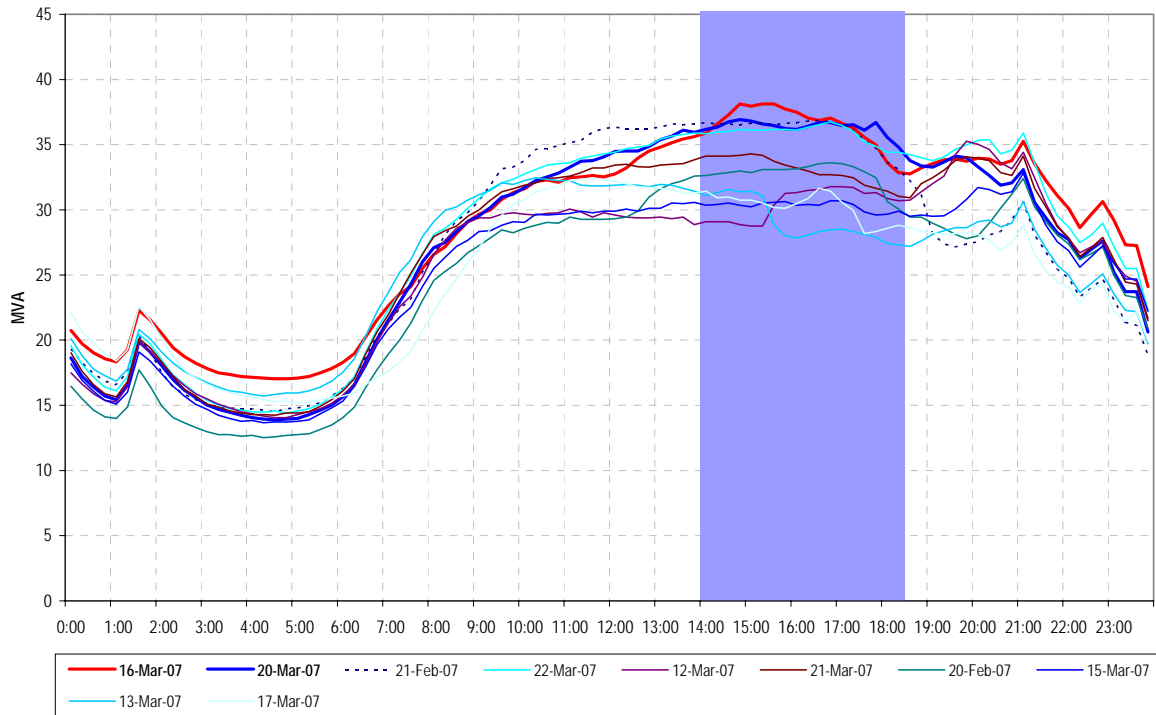
- Top 10 days summer 2006/07 daily load profiles on Sydney East STS total



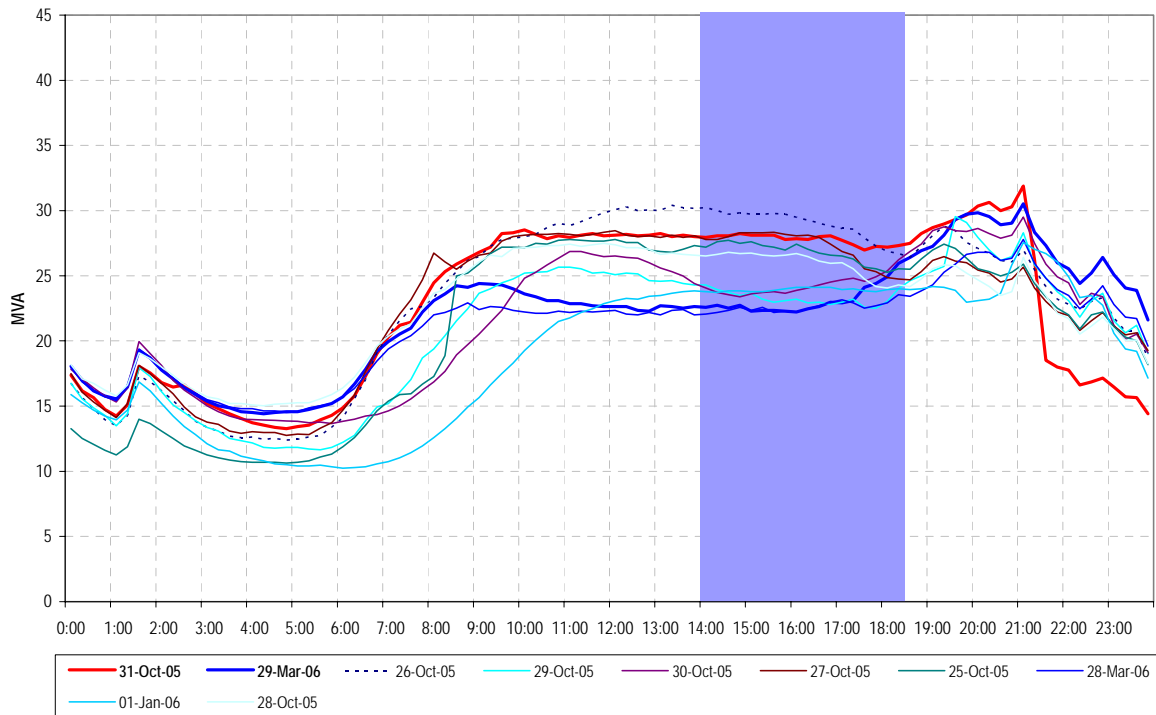
- Top 10 days summer 2005/06 daily load profiles on Sydney East STS total



- Top 10 days summer 2006/07 daily load profiles on Sydney East S22



- Top 10 days summer 2005/06 daily load profiles on Sydney East S22



Appendix B: Specific Site Investigations

As part of the scoping investigation, we visited and analysed opportunities at 23 following major customer sites connected to Sydney East STS. The purpose of the site survey was to identify any demand management opportunities that could help reduce the summer peak demand.

No.	Customers' Name
1	Wang Australia P/L
2	Mona Vale Hospital
3	Pittwater RSL Club
4	Unomedical Pty Ltd
5	Webforge Pty Ltd
6	Mona Vale Woolworths Supermarket
7	Austotel Management Pty Ltd
8	Royal Motor Yacht Club
9	GCS Systems & Services Pty Ltd
10	Narrabeen High School
11	Eureka Operations Pty Ltd
12	BBC Hardware Ltd
13	Mater Maria College
14	Wombat Enterprises
15	McConghy Industry
16	Minkara Retirement Resort
17	Solvents Australia
18	Moulding Services
19	Reef Funds Management Ltd
20	Avalon Beach RSL Club
21	Avalon Woolworths Ltd
22	RPA Yacht Club
23	Bayfield Hotel Wharf

Appendix C: DM Screening test

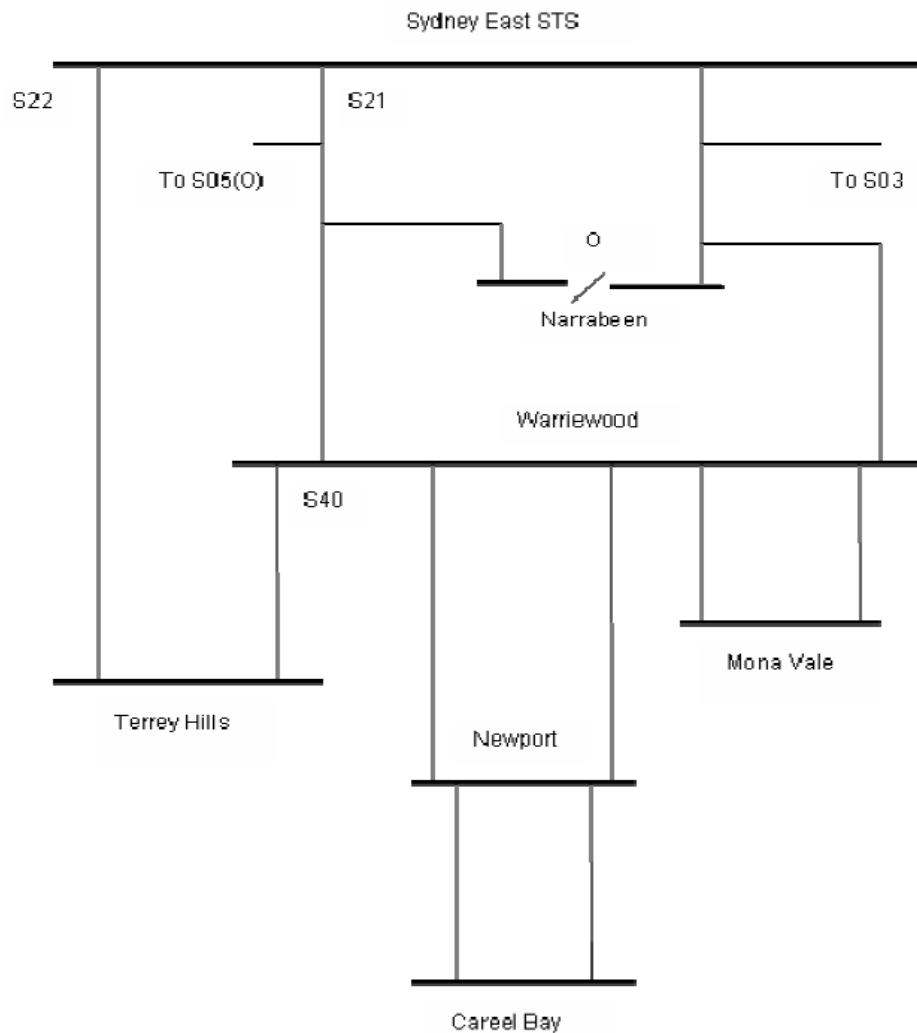
DEMAND MANAGEMENT SCREENING TEST

33kV feeders from Sydney East STS

Current Supply Arrangements

Sydney East subtransmission substation (STS) supplies a number of zone substations in the Pittwater municipality including Terrey Hills, Narrabeen, Mona Vale, Newport and Careel Bay.

The 33kV system supplying the zone substations listed above is shown schematically below.



Summer is the critical season for this system. Under the applicable design planning criteria, capacity is limited by the thermal rating of the 33kV feeders. We estimate that demand would exceed relevant capacity limits on feeders S21 and S22 in summer 2008/09 under certain conditions.

This system supplies a large area bounded by Terrey Hills in the west, Narrabeen in the south, Palm Beach in the north and the Pacific Ocean in the east.

Supply Capacity and Demand Forecast

The load on this 33kV system is a mix of residential and commercial. Some zone substations experience summer daytime peaks, and others have highest peaks in winter evening. However the system overall has highest peaks in summer afternoon.

Numerous outage scenarios have been considered to determine the capacity of this 33kV system to supply future demand growth. We have determined that the worst case scenario occurs during an outage of 33kV feeder S21. In this event, we forecast that demand would exceed the 50.6MVA limit of feeder S22 by 2.9MVA in summer 2008/09, rising to 10MVA by 2011/12. Capacity is sufficient to meet demand in winter for the foreseeable future.

Supply Strategy Option

The preferred supply side option is to build a new 33kV feeder from Sydney East STS to Terrey Hills zone substation. The proposed commissioning date is prior to summer 2008/09. The estimated cost is \$8m.

To meet this delivery date a decision on this investment must be made by February 2008.

Required Demand Management Characteristics

If demand reduction could be implemented across Terrey Hills, Narrabeen, Mona Vale, Careel Bay & Newport zone substations prior to November 2008 such that the load on feeder S22 is reduced by 2.9MVA (with S21 is out of service), then the investment in the new 33kV feeder could be deferred by one year.

Loadflow modelling has shown that the total amount of demand management at zone substation level to achieve this feeder reduction varies depending on where on the network it occurs. We have focussed on two scenarios as follows:

- i) The demand management is distributed evenly across all zones in proportion to their load share on the network
- ii) All the demand management occurs at Terrey Hills zone, which is the only zone directly connected to feeder S22

For the first case, a total demand reduction of 4.8MVA is required on the zone substations as shown below. This is around 5% of the total demand on these substations.

Zone	S2007/08	S2008/09	S2009/10	S2010/11	S2011/12
Terrey Hills	0.0	1.8	3.0	4.7	6.5
Narrabeen	0.0	0.5	0.8	1.3	1.8
Mona Vale/Careel Bay/Newport	0.0	2.5	3.8	6.0	8.3
Total	0.0	4.8	7.7	12.0	16.7

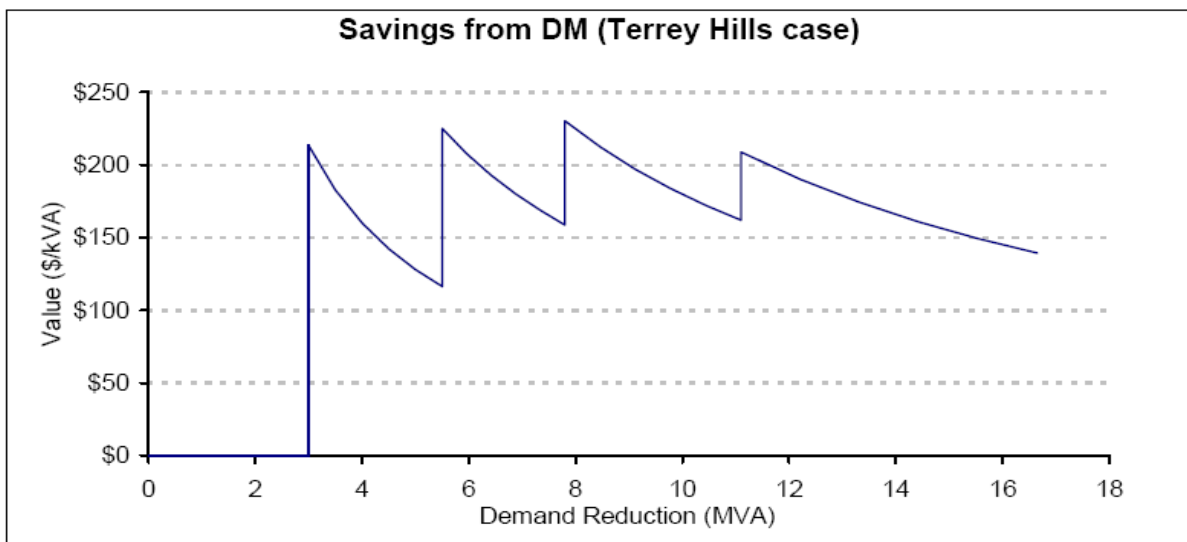
The saving from this deferral would be \$640,000 or \$133/kVA, which is moderate. The demand reduction would need to target the summer afternoon peak period.

If 7.7MVA of demand reduction on these zones could be achieved prior to summer 2009/10, then the project could be deferred by two years. The saving from this deferral would be \$1.24m or \$161/kVA, which is moderate.

As underlying demand is forecast to continue to grow, longer deferrals would require additional reductions.

For the second case, a total demand reduction of 3.0MVA is required at Terrey Hills zone substation to achieve a deferral. This is around 16% of the total demand on this substation.

The value of this deferral is still \$640,000, but because less demand reduction would be required, the relative value is \$213/kVA, which is higher. A two year deferral would require a reduction of 5.5MVA at Terrey Hills zone.



It is possible scenarios other than these two cases could result in sufficient demand reduction on feeder S22 to enable a deferral.

The required demand reduction is moderate in absolute terms, and as a proportion of the total demand in the local area. The relative value is moderate, but there is only two months before an investment decision must be made, and this period includes Christmas. It is possible that cost effective demand management options might be found by an investigation.

Recommendation

Based on this analysis it is considered reasonable to expect that it may be cost-effective to postpone the proposed supply-side solution by implementing demand management strategies. A demand management investigation will be undertaken, initially focussing on currently available information to enable a decision to be made in the necessary timeframe.