Description of integrated pilots/demonstrations/field tests/existing practices

1. Castle Hill Demand Management Project – Australia

2. What is integrated with DSM

DG	X
Energy storage	
Smart grid technologies	

3. What is the level of commercialization

Research project	X
Demonstration	
Field test	
Existing practice	X

4. Where to find more information?
   - IEA DSM, task XV, database
   - Charles River Associates (2003). DM Programs for Integral Energy. Melbourne, CRA.
   - Department of Energy Utilities and Sustainability (2005). Castle Hill Demand Management Project: Case Study. Sydney, DEUS.

5. Objectives of the case
   Castle Hill is a rapidly developing suburb located 32km north west of the Sydney central business district. The Castle Hill local electricity network has 5,320 residential customer connections and 679 business and community connections. Over the five years from 2000 to 2005, electricity consumption in Castle Hill increased by 32% and Integral Energy forecasts showed that this would grow by a further 54% over the subsequent 10 years.

   Increasing penetration and use of air conditioners in the Castle Hill commercial centre and surrounding residential areas would result in summer peak loads exceeding system capability. In 2003, Integral Energy forecast it would need to spend AUD 3.2 million to expand the Castle Hill zone substation by summer 2005 because of continued rapid development of the Castle Hill district.

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Integral Energy wished to examine whether it would be cheaper to assist local consumers be more efficient in their use of electricity rather than upgrade the electricity network. If not, the Castle Hill substation would be upgraded to ensure growth in energy demand was met.

6. Business rationale/model

7. Technologies used

8. Short description of the case

Peak demand in the Castle Hill area is primarily driven by use of domestic and commercial air-conditioning on hot summer days, particularly when there have been several days in a row with temperatures exceeding 35 degrees Celsius.

Initial Investigations

Despite the high levels of load growth, initial investigations by Integral Energy indicated that sufficient demand could be curtailed to defer the upgrade of the substation. Reductions in summer peak demand of 1 MVA initially, and further reductions of 0.5 MVA per annum were required to achieve deferral. A notional three-year deferral would provide a budget of sufficient value to warrant proceeding with a DSM option.

Integral Energy determined that a Request for Proposals for DSM strategies was warranted. However, this was supplanted by an offer from a New South Wales Government agency, the Sustainable Energy Development Authority (SEDA), to conduct a DSM program focussed on the commercial sector.

The Castle Hill Demand Management Project was developed via direct negotiation with SEDA. Integral Energy provided information on the level and timing of the required peak demand reduction and the level of financial support available.

Contractural Arrangements

SEDA was contracted by Integral Energy to work with electricity customers to relieve the peak summer electrical demand on the Castle Hill zone substation by 1,350kVA, approximately 4% of the peak electrical load on the local network, over a 3 year period.

The aim of the contract was to defer the need for the upgrade of the Castle Hill zone substation by reducing the demand for electricity during peak periods, namely from 1pm until 5pm on summer weekdays when the temperature reached or exceeded 35 degrees Celsius.

The overall contract target of 1,350 kVA was divided into three milestones of 450kVA of demand reduction to be achieved by the start of summer each year. The contract allowed for a budget of AUD150 per kVA of peak demand reduction, that is a total of AUD202,500 plus an ‘establishment fee’ of AUD50,000, bringing the overall project cost to AUD187/kVA.

However, using the framework for treatment of network utilities' DSM expenditure developed by the New South Wales electricity industry regulator, the value of deferring the capital upgrades to the Castle Hill zone substation was worth up to AUD566 per kVA (ie a total of AUD764,000). Consequently, if the contract target of 1,350kVA was exceeded, Integral Energy agreed to make payments of AUD135 per kVA for up to a further 352kVA reduction.

Program Objectives

The following objectives were set for the Castle Hill Demand Management Project:

- reduce the peak electricity load on Integral Energy’s Castle Hill zone substation by 1,350kVA by summer 2005/2006;

- increase the energy efficiency of participating businesses and residents and decrease energy bills;

- reduce greenhouse gas emissions through energy efficiency and/or fuel switching to other energy forms;

- increase investment in sustainable energy technologies and services;

- demonstrate that DSM can be a profitable alternative to supply side solutions for an electricity distribution network facing peak demand constraints.

DSM Strategies

Three DSM strategies were identified:

- Commercial/Industrial DSM: investigate using a modified version of SEDA’s award winning Energy Smart Business program to reduce peak demand by major commercial/ industrial customers, primarily through implementation of energy efficiency measures;

- Distributed Generation: investigate using existing or hired standby generators to relieve the network at peak times;

- Residential DSM: investigate the potential for energy efficiency, appliance interruption and load shifting in local residences.

Commercial/Industrial DSM

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Initial investigations into the top 20 energy users in the area served by the Castle Hill zone substation identified the Castle Towers Shopping Centre and its major retail tenants as potential targets for peak demand management initiatives. The top ten commercial energy users had a combined electrical load of greater than 10MVA. Consequently, 1.35MVA represented an average drop of 13% of their load.

Preliminary walk through energy audits of the shopping centre and the major retail tenants suggested good potential to improve the efficiency of lighting, ventilation and airconditioning systems. These systems account for an estimated 70% of commercial sector electricity demand during times of the peak summer load on the New South Wales network.

SEDA modified its existing Energy Smart Business program to assist these major energy consumers to identify and implement cost effective peak demand reduction projects.

Business forums and one-on-one meetings with major retail businesses were held during 2003 to recruit partners for the Castle Hill Demand Management Project. Free energy audits were offered to businesses to assess the potential for peak demand reduction and ongoing energy savings.

Following the energy audits, businesses were encouraged to make a public commitment to implement cost effective projects within 2 years. Businesses making this commitment became official “Partners” in the Castle Hill Demand Management Project and were provided with:

- a Partner Support Manager to give ongoing support and technical assistance to implement projects;

- participation in two advertising campaigns on local bus shelters and inside the Castle Towers Shopping Centre, as well as promotion in the project newsletter; and

- a $60/kVA bounty for measured and verified peak demand reductions.

The Project targeted interruptible loads, the installation of high efficiency air conditioning (and the upgrading of existing air conditioning systems), and the installation of efficient lighting and power factor correction equipment in new and replacement applications. The contracts with electricity customers were performance based, with payment on verification of demand reduction.

Distributed Generation

Although initial estimates of peak demand reduction available from commercial businesses looked favourable, it was considered prudent to also investigate distributed generation as a complementary peak demand reduction option.

Recruitment of standby diesel generators able to dispatch at times of peak demand was the main distributed generation option investigated. Other generation options such as gas generation, cogeneration and solar power systems were not pursued because of the time constraints for project implementation and budgetary considerations.

Initial investigations found four standby generators in the Castle Hill area, two tenants at the Castle Towers Shopping Centre and two businesses outside the shopping centre.

The business with the largest capacity of standby generation (250kW) was considered to offer the best potential for a standby generation option. Initial discussions were held with the asset owner and a pre-feasibility study was undertaken based on manual start-up and sychronised, remote start–up options. The pre-feasibility study indicated the net return to the asset owner for generating less than 1MW at peak times in the network and/or at times of high pool prices in the National Electricity Market was negligible and did not warrant the risk or administration required to implement the standby generation option.

Preliminary discussions were also held with Integral Energy about the possibility of using hired generators. Issues such as siting, fuel storage, cabling and grid connection were raised. A hired generator was not considered the ideal option but could be used to generate during peak periods over one summer. This would give energy efficiency options more time to be implemented and/or would make up for any shortfall in the peak demand reduction achieved through these options.

Residential DSM

Integral Energy, in conjunction with SEDA, had previously undertaken an interruptible residential air conditioning trial with 90 residents in western Sydney. Although this was successful in delivering a demand reduction, the trial raised a range of other issues that needed to be addressed before this option could be a reliable, market accepted solution for peak demand reduction over multiple years and with larger numbers of participants.

Further, as the demand peak in Castle Hill dropped off at close of business around 5pm, it was considered that interrupting residential air-conditioners might not be very effective in reducing the early afternoon component of the peak.

Castle Hill has a high penetration of domestic swimming pools. Therefore, a basic investigation into shifting pool pump loads (approximately 1kVA each) to outside peak times was undertaken, including interviews with local pool equipment suppliers and a limited survey of pool owners.

Overall it was considered to be not financially viable to undertake residential DSM initiatives in the Castle Hill Project, given the budget of $187/kVA and that the commercial DSM initiatives looked more promising for the size, length and timing of peak reduction required.

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9. Achieved/expected results (operational savings, CO_2, efficiency enhancement)
   Fifty-four possible DSM projects were identified with an estimated total load reduction of 5.2 MVA. To achieve the required 1.35 MVA peak load reduction, the top 20 projects were selected. Most of the peak demand reduction projects identified involved lighting, heating, ventilation and air-conditioning (HVAC) or optimisation of building management control systems.

   By June 2005, six project partners had been signed up and a total of 900 kVA peak load reduction had been achieved. The project was on track to achieve the target 1.35 MVA reduction by November 2005.

   Based on projects with funding approved and currently underway the following results are expected:

   - 1,350 kVA of peak demand reduction will be in place by summer 2005/06 at an average cost of $187/kVA;

   - around $370,000 in annual energy savings to businesses;

   - over $1 million worth of investment in sustainable energy equipment and expertise; and

   - over 7,000 tonnes of greenhouse gas reductions per annum.

10. Lessons learnt