Managing Peak Load Demand

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By Michael Zammit, Managing Director, Energy Response

Introduction

The conversation around generation supplies can often get very confusing and also very political, after all do we want to see more coal fired generators or wind farms, can solar meet our needs or do we need to consider nuclear power? While the issue of the type of generation is important the reality is that Australia's most immediate issue is meeting peak demand, not the base demand (where we current use about 60% of the available base generation capacity).

As can be seen from the table below Australia's peak demand is growing at about 50% more than the base demand growth and in some areas up to four times the average.

	10-year Energy Growth Rate	10% POE Summer Maximum-Demand Growth Rate	10% POE Winter Maximum-Demand Growth Rate
Queensland	3.2%	3.9%	3.6%
New South Wales	1.9%	2.8%	2.3%
Victoria	1.1%	2.1%	1.8%
South Australia	1.5%	2.4%	2.1%
Tasmania	1.1%	1.5%	1.3%

Average Annual Energy and Demand Growth Rates, Source: NEMMCO's 2005 Statement of Opportunities

The demand peak is driven primarily by lifestyle changes such as more appliances in the home (particularly air conditioners), more computers, proportionally more but smaller households, etc.

The issues brought about by growth in peak demand manifest themselves in a number of ways:

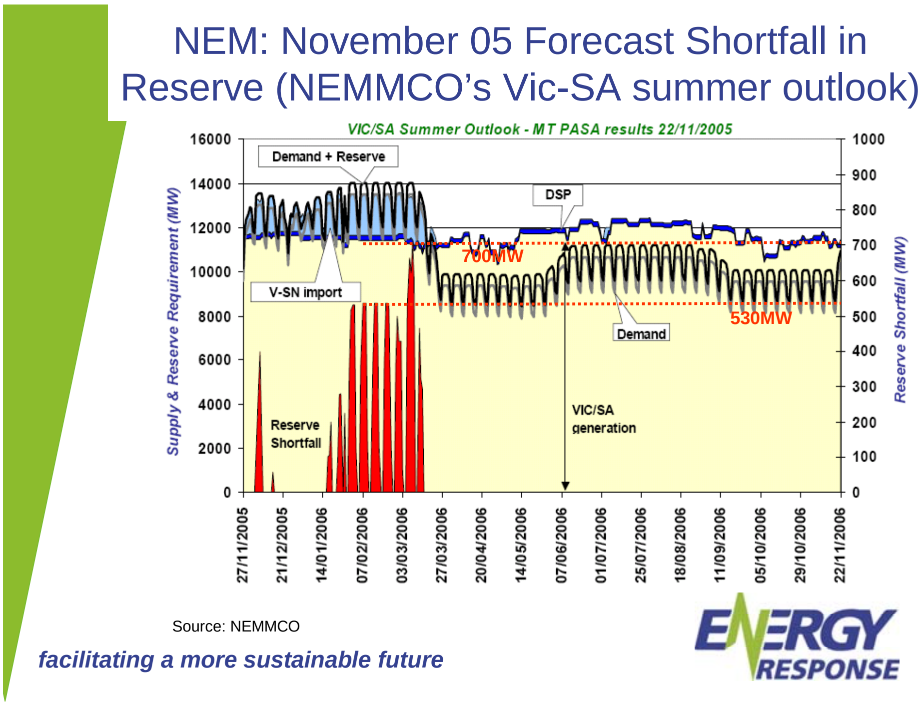
- as wholesale price peaks (the wholesale electricity price can rise from an average of around $34/MWh to a maximum of $10,000/MWh in any five minute period)
    - Wholesale price peaks are not necessarily linked to a demand peak (it may be a failure of plant or other supply side constraint that causes the wholesale price to peak), but generally higher demand causes an increase in the wholesale price

  - Some $1.5billion per annum is contained in these “price” peaks but less than 1% of the total energy consumed
- where demand in a network locality has stressed/overloaded the existing infrastructure, necessitating action by the Network Service Provider (NSP) such as augmentation
  - 10% of the capital spent by all NSPs goes to address the peaks that occur for less then 1% of the time
  - Almost 30% of all zone substations in the National Electricity Market (NEM) are currently overstressed to some degree during their demand peaks. The greater the stress, the greater is the potential for localized loss of supply
- rising peak demand means that NEMMCO must ensure there is sufficient reserve capacity available to the grid such that if the weather is severe (hot or cold) and/or a major item of plant was to fail an alternative supply could compensate for any shortfall

This paper mainly addresses the last of the three points above.

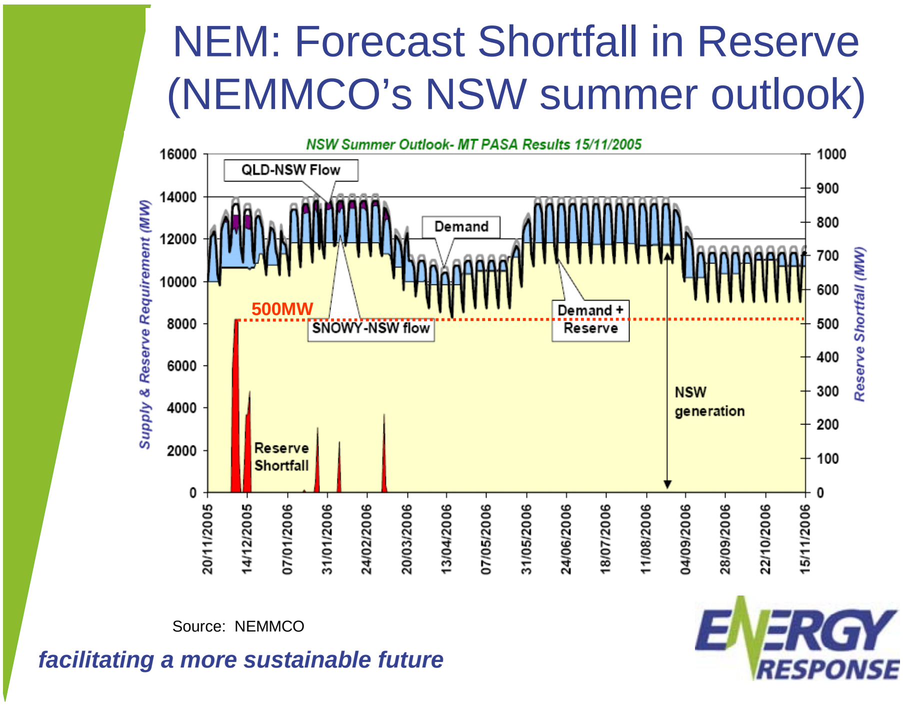
The Key Issue

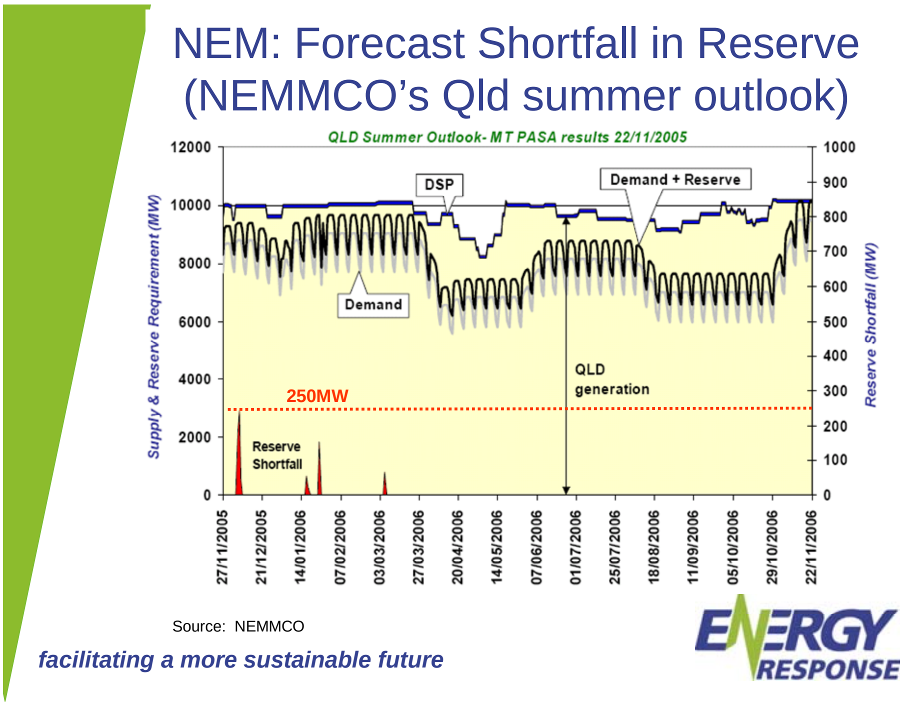
In the summer of 2005/06 Victoria and South Australia combined will be short of reserve capacity by up to 700MW (latest estimate at time of writing) as seen in the chart below.



This is almost four times more reserve shortfall for the same time last year and has been made worse by the issues that have delayed Basslink (the interconnector between Victoria and Tasmania) and delays in bringing on new gas generators. However, because the peak demand continues to grow at that considerable rate of around 3% per annum, Basslink (now with a lower capability than originally planned) and the known new generators are not likely to overcome the predicted shortfall in reserve for the ensuing summers.

Also, for the first time since the formation of the NEM the New South Wales grid is running short of reserve and to a lesser degree so is Queensland as shown below.





Resolution of the Issue

Building infrastructure is the traditional solution to meeting peak demands. However infrastructure is a costly and highly inefficient use of capital if only required for less than 1% of the year. Such infrastructure can be in the form of building a peaking generator/s or new interconnectors (or increasing the capacity of an existing interconnector) to take advantage of excess capacity in another state/s whenever possible.

The current cost of building gas peaking generators, the most popular form of peaking plant, is about $600,000/MW. Hydro generation is also well suited to meeting peaks, however our dry continent leaves little opportunity for further large or medium scale hydro generation developments. Further, large water storages often accompany hydro projects as reserve capacity but do we want to flood more precious land and pristine valleys for water storage? Recent history, like the Franklin River Dam protest, suggests that politically and environmentally such hydro options are highly unpalatable to the community. Other generator types are even more expensive, and some, such as wind generators, photo voltaic cells, brown and black coal generators are really not well suited to peak generation.

Increasing the capacity of the interconnectors or building new interconnectors, other than Basslink, would be counterproductive when New South Wales and Queensland are also short of reserve. Indeed it is yet to be seen if Tasmania (via Basslink), which is heavily dependent on hydro, will be a net exporter or importer of electricity. Ideally, Tasmania should be an importer at off-peak times and an exporter at peak times. Certainly if lower rainfall predictions across the continent are realised Tasmania will be a considerable importer of electricity.

Few amongst us would condone the building of more power plants and when Tasmania interconnects with the NEM in April 2006 we will further diminish water reserves in that state to meet the demand on the mainland. Water is actually a far more valuable resource than the price of water or the price of electricity generated from hydro plants would suggest.

Both gas and hydro generators are relatively Greenhouse Gas (GHG) friendly. However there are also "demand side" alternatives that we must fully explore that are even friendlier. After all is it not better to produce less electricity thereby saving more resources rather than using (wasting) more resources – both in terms of capital and energy?

Curtailing demand is a far better alternative than building more infrastructure; it's just that as a society we have been conditioned to think that if we use more energy then we need to build more power stations. That does not have to be that way and the NEM is large and dynamic enough for there to be considerable demand side potential.

Demand side options can be quite dramatic. For example, if an Aluminum smelter was to drop a pot line off supply for an hour there could be 200MW of demand come off the grid very quickly (about the size of one of the eight Hazlewood generators). NSPs can also shed load by switching whole feeders off or entire zone substations, blacking out entire suburbs. While this is a rare occurrence, it can even happen automatically if the power system frequency gets too low (which can happen if there is insufficient reserve capacity).

Demand Side Response (DSR) is a demand side option that is growing in popularity both in Australia and internationally. DSR is where an electricity consumer:

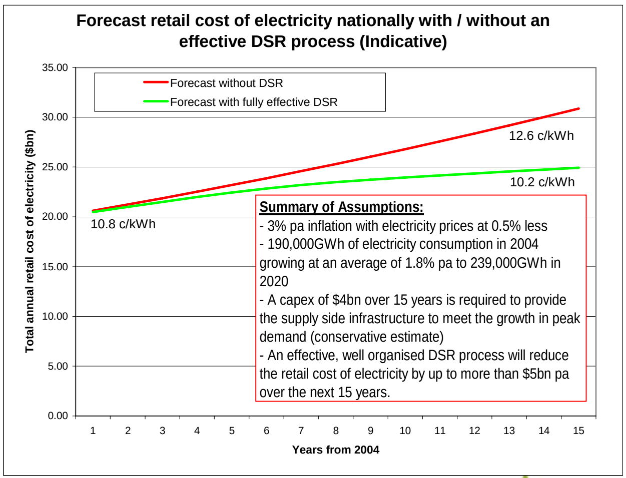
- Curtails load when asked to, and/or
- Shifts load to another time, and/or
- Switches their demand over to an on-site generator and/or where that generator can export electricity into the grid.

In all cases the electricity consumer supplying the DSR is paid for their effort where the DSR is an organized response to market signals. When DSR is aggregated such that collectively there might be 100's or event 1000's of Megawatts (MW) of DSR available then there are significant benefits:

- Reduces the cost of energy to business
  - Those that participate as DSR providers gain the most through payments for their participation[1]
- Pro-actively limits long term increases in electricity prices
  - ABARE, BCA, ESAA, EUAA and others are predicting that over the next 15 years $30-37billion must be spent on electricity infrastructure which would raise the price of electricity by 20%. 1000MW of DSR over that time, actively dispatched into the market would counter that price rise

[1] EUAA/AusIndustry Demand Side Response in the National Electricity Market Case Studies, End-Use Customer Awareness Program Report, April 2005

Forecast retail cost of electricity with / without DSR



facilitating a more sustainable future

ENERGY RESPONSE

- Affords Retailers more flexibility with their portfolios
  - Reduces risk and DSR is available at a lower cost than financial hedges
  - Retailer portfolios can be better balanced with DSR to reflect a change in risk management strategy
- Relieves stress on Electricity Networks at times of extreme peaks
  - Providing greater supply reliability
  - Strong business case (ie commercially viable) for NSPs to pursue DSR as an alternative to augmentation
- Defers costly and inefficient spending on under-utilised supply side capacity for Generators and Networks
  - Potential benefit to Networks (and ultimately consumers) of at least $0.5billion annually
- Reduces cost of reserve requirements by about $100million pa and releases generation capacity to supply energy rather than reserve, further deferring the need to build new generation (both peak and base load)
- Reduced GHG emissions
  - Peak lopping will reduce CO_2 production equivalent to the consumption of 300,000 households

Weighing up the options against a backdrop of rocketing peak demand do we really have a choice? Why burn more gas unnecessarily? Why build more infrastructure that will only be used for less than 1% of the year? It is imperative that as a society we start looking at alternatives that are far more efficient, more cost effective and friendlier to our environment. Also, for the benefit of Australian electricity consumers and our exporters, it is imperative that we claw back as much of the $2billion or so wasted in peaks as possible. This is the only way to prevent the price of electricity from rising significantly in real terms. Our manufacturing industry would be devastated by a 20% above inflation price hike and more jobs would almost certainly leave the country.

Our reserve shortages are not about to disappear in a hurry and at 3% per annum that peak demand is doubling in size every twenty years. Ultimately there will be an extremely hot week or two, actually we are overdue for such an event and a plant failure is always on the cards. What then?

Well organized DSR can provide all that is claimed in this paper. Ad hoc approaches as tried in the past have proved to be a waste of time and money.

This paper was presentation by Michael Zammit to the EUAA Peak Power & New Capacity Briefing, in Melbourne on Wednesday 7 December 2005.

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