FINAL REPORT

Electricity Demand Side Management Study

Review of Issues and Options for Government

Submitted to

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DISCLAIMER

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1. EXECUTIVE SUMMARY

1.1. OBJECTIVE AND APPROACH OF THE STUDY

The overall objective of this project was to assist VENCorp in providing Government with:

- A definition of the relevant issues regarding the role and status of demand side participation in the electricity market in Victoria, and
- A range of practical options available to Government, consistent with the principles of the NEM, to facilitate the proper functioning of demand side participation, should it be found that significant barriers exist to market-driven solutions.

To address these objectives, the CRA project team considered the following four sets of issues:

- What is the nature of the problem, and how can demand response address this problem?
- What are the possible solutions to the problem and are they likely to be of significant enough value to warrant consideration?
- If so, why haven't market forces allowed these solutions to come forward? What are the barriers?
- Given the nature of any barriers identified, what can/should Government do to reduce these barriers?

1.2. ROLE OF DEMAND RESPONSE IN THE NEM

From its inception, the NEM has viewed demand response as an important contributor to efficient market function. The assumption was that price signals would let customers decide – on entirely individualised terms – as to when reducing their electricity consumption would be more strategically economical for them than continuing to consume. Such actions, in aggregate, can provide significant benefits for the overall functioning of the market, including:

- Act as a check on the market power of suppliers by reducing demand when customers find it more advantageous to reduce demand rather than pay the prices suppliers are asking for electricity.
- Reduce final prices to consumers, in the event that the amount of demand customers are willing to forego is sufficient to make the marginally priced generator unnecessary.

- Increase the security of supply by substituting voluntary load shedding for enforced load shedding, and thereby enhancing the continuity of supply to customers with fewer options.

- Reduce the threat of and/or need for Government intervention in the market to maintain power system reliability at politically and socially acceptable levels.

- Reduce the need for investment in very low duty peaking plant.

- Provide a more stable regulatory and market environment for new investment decisions regarding energy infrastructure.

Arguably, demand response is of particular importance in Victoria, where peak demand is characterised by sharp needle peaks caused by periods of hot weather and/or unforeseen loss of generation capacity. These short-lived periods of peak demand would be insufficient on their own to warrant investment in additional generation capacity, but nonetheless have potentially significant consequences for spot prices and the security of supply. It is unlikely that the drivers of Victoria's load shape will change in the foreseeable future.

Because of the needle-peak nature of Victoria's load profile, energy efficiency was not included in the definition of demand response strategies. Although these measures are valuable in their own right – they offer (a) attractive financial returns to users when compared to the operating costs of less efficient stock and equipment, (b) better environmental outcomes for society through reduced greenhouse gas emissions, and (c) greater economic efficiency for the State overall – they will neither (*i*) significantly reduce the magnitude of the difference between average load and peak load, nor (*ii*) change the duration or cause of the needle peaks. As a result, energy efficiency will not improve the functioning of the NEM during times of needle peak demand (which are forecast to characterise Victoria's load profile for the foreseeable future), and we have therefore omitted consideration of energy efficiency from the set of actions included in the term "demand response" for the purpose of this study.

A simple test was conducted to provide insight as to whether the magnitude of demand response likely to be available in Victoria could actually provide any of the impacts cited above. A total of five events were identified in which high prices persisted for 50 minutes or more. The bid stack associated with each event was examined to determine what level of reduction in price would have occurred at different levels of demand response. The analysis was static, whereas the process whereby prices are set in the NEM is quite dynamic. As a result, the analysis represents a vast oversimplification. However, results did mirror key features of observed results regarding the events analysed, giving some comfort that the results of the analysis are useful.

The analysis indicated that large levels of demand response could be expected to significantly reduce pool price. Demand response in the order of 1000MW were seen to produce reductions of over 90% in the pool price. This comports with experience in the market. The load restrictions imposed in February 2000 reduced load by about 1000MW, and reduced prices to very low levels.

As could be expected, correspondingly smaller load reductions had less impact on pool price. While a 100MW reduction tended to have impacts on price of 10% or less, 250MW reductions – which is about the amount of load reduction we believe currently exists in Victoria at present – were seen to provide price reductions ranging generally from as little as 15% to as much as 79%.

1.3. CURRENT STATUS OF DEMAND RESPONSE

NEMMCO's 2001 Statement of Opportunities (SOO) presented a conservative estimate of approximately 143 MW of demand reduction capacity in Victoria and South Australia. This is 50% of the 286 MW that NEMMCO initially identified via interviews with retailers, state planning agencies and customers. NEMMCO downgraded its initial estimate because it had some doubts about the reliability of the resource. Since then, it has further reduced the estimate to 110MW.

By contrast, a study conducted for the Victorian Government in December 2000 identified an additional 200 MW of demand-side capacity that could be expected to come on-line in the near-term.

Calls to licensed Victorian retailers undertaken within the project identified 87MW of demand response in programs offered by three retailers. Interestingly enough, no more than 15 customers are contributing this resource. Extrapolation to the remainder of the Victorian market reaches a level of 200 MW.

For a variety of reasons, we believe that the level of demand response achieved to date represents only low hanging fruit. Significant additions totalling at least a doubling of the current amount is likely to become available as the market matures, assuming that market signals are allowed to continue to function and that the barriers identified in this report are addressed.

Virtually the entire demand response-taking place anywhere in the NEM is a product of retailer sponsored off-market initiatives. Under this type of program, the utility monitors pool price movements and advises customers when it believes that a sustained period of high price will eventuate. Customers are generally free to set their own trigger points and to respond or not to any particular event. Income achieved from the arbitrage between the retailers contract stack and the pool price, are generally shared between the two parties.

By contrast, virtually no demand-side bidding has eventuated, and we believe that this path provides no benefit to would be providers of demand response. It does not provide any advantages that cannot be achieved via the retailer off-market programs, and it is much more intrusive and constraining than those programs. As a result, we have recommended that no further effort be expended in trying to make demand-side bidding work.

1.4. BARRIERS

A number of factors were identified that act as significant barriers to more demand response being active in the market. These were prioritised based on the following four criteria:

- The appropriateness of Government involvement in the area addressed by the barrier;
- The likely impact that removing or negating the barrier would have on enabling demand response;
- The likelihood that the barrier can be overcome; and
- The degree to which it is timely to address the barrier concerned (i.e., in some cases there are certain barriers do not need to be addressed unless other barriers have already be removed).

Based on these criteria the following high priority areas for Government initiatives to facilitate demand response were identified:

- Improving customers' awareness of the potential they may have for demand response actions, the ways in which demand response can be integrated with the customer's on-going business operations, the benefits demand response actions can provide to the customer, and the various means by which they can exercise their demand response within the NEM.
- Improving the quality of price signals to support demand response, including issues concerning non-interference with market price signals, extending the price signals of the NEM to the domestic sector, and exploring the potential to create a short term forward contract market and a long term market price signal for demand response
- Improving the ability of demand response aggregators to function in the market
- Reviewing the factors that may impinge on customers' ability to use their standby generators for demand response and ameliorating these wherever possible subject to other policy and regulatory settings

- Reviewing the factors that may impinge on NSPs' ability to encourage demand response and benefit from it and ameliorating these wherever possible subject to other policy and regulatory settings.

1.5. RECOMMENDED ACTIONS APPROPRIATE FOR GOVERNMENT TO FACILITATE DEVELOPMENT OF DEMAND RESPONSE

For demand response to make the type of contribution originally envisaged for it in the design of the NEM – namely, to provide a check on the market power of suppliers, and reduce the need for investment in low duty-cycle generation plant, thereby contributing to security of supply – it is likely that levels in the order of 500 MW will be required. Although it is impossible at the current time to quantify the impact that any Government policy initiative or program will have on the amount of demand response available in the market, the following initiatives are recommended as comprising sufficient facilitation to bring forward an effective amount of demand response:

1 Improve customer awareness by:

1.1 Providing relevant information to customers on demand response benefits and operation via seminars, brochures and other literature, and the use of demand response in Government facilities as demonstration sites and case studies.

1.2 Empowering customers with regard to demand response through training in demand response prospecting and training, and the development of sample clauses to be used in tenders to and contract with electricity retailers to facilitate the customer's use of and benefit from demand response.

2 Maintain market price signals by providing a clear policy statement of the Government's non-intervention in price signals in the electricity market.

3 Extend market price signals and consider demand response functionality in the design of FRC by:

3.1 Including the value of demand response to the market in the current ORG study of the benefits and costs of interval metering for domestic and other low consumption electricity customers.

3.2 Encouraging the ORG to consider including central switching equipment in the list of demand side options to be considered by DNSPs in their network planning.

3.3 Convening a working group of DNSPs, DNRE, the ORG, retailers, and possibly VENCorp to explore mutually acceptable operational and financial arrangements to support the use of centrally switched demand response at the smaller end of the market.

3.4 Monitoring the availability and cost of communications and monitoring systems required to support the use of centrally switched demand response at the smaller end of the market.

4 Facilitate market entry of demand response aggregators by:

4.1 Tendering out investigation and implementation of demand response potential in Government facilities.

4.2 Requiring retailers to offer retail contracts that allow customers to sell demand response to third parties.

5 Improve certainty for the use of standby generators by:

5.1 Convening a working group of EPA, VENCorp, DNRE, and the ORG to clarify the impact of current air quality regulations on the use of standby generators and recommend policies to co-optimise demand response and air quality.

5.2 Asking NECA and NEMMCO to clarify the market status of customers who break their connection with the grid in order to run standby generators.

5.3 Convening a working group of the DBs, VENCorp, DNRE, and the ORG to review DB interconnection requirements for standby generators and recommend a set of model requirements that provide adequate safety and fault protection without unduly disadvantaging the use of standby generation for demand response.

6 Enhance the role of NSPs in facilitating demand response by:

6.1 Supporting the ORG's decision to require DNSPs to plan and augment networks in ways that minimise costs to consumers, and request that ORG consider mandating that DNSPs demonstrate that they have given proper consideration to demand response and other demand side measures in their network planning processes.

6.2 Giving TNSPs more responsibility for ensuring delivery of demand side alternatives to network augmentation where they are cost-effective.

6.3 Requesting that VENCorp re-visit its planning criteria and procedures for the sole purpose of identifying additional measures that could be undertaken to provide increased facilitation of demand response and other appropriate demand-side measures.

7 Explore the potential for wholesale and retail contract market solutions by:

7.1 Recommending to the NEM Ministers Forum that (a) a detailed investigation be undertaken of any deficiencies in the current operation of the contract market, the potential impact of these deficiencies on achievement of the overall objectives of the NEM, and that (b) this investigation include a consideration of the desirability of exchange-based short-term forward trading as part of the overall "fix" of the contract market's problems, and an assessment of how market participants can be "encouraged" to develop such a trading mechanism.

7.2 Recommending to the NEM Ministers Forum that (a) a comprehensive review be undertaken of the market's ability to manage high pool price risk efficiently and the impacts of any apparent deficiencies on prices to consumers, and that (b) this review include a review of possible options for setting up of facilitating an insurance market. This could start with consensus from the jurisdictions that such a market would facilitate demand response (as well as firmer contracts, and hence assist the contestable retail market), and include encouraging the jurisdictions to create an environment to facilitate an insurance market and/or look into the possibility of mandating such insurance.

Second-stage recommendations were also developed which can serve as additional support for the recommendations above, should they be needed.

2. INTRODUCTION

Charles River Associates Asia Pacific Pty Ltd was engaged by VENCorp to provide assistance in defining the issues and developing a range of options for Government to consider regarding electricity demand side management in the National Electricity Market. This report sets out our final conclusions and recommendations in accordance with the final Scope of Work for the project, which is shown in Attachment 1.

There has been a growing recognition amongst government officials, regulators, NECA, retailers and key consumer groups of the potential importance of demand side participation in the market, and the emergence of a reasonable level of price elasticity of demand.

In December 2000, NECA submitted to the ACCC for approval, a range of Code changes designed to facilitate demand-side bidding in the NEM. At the time they were submitted, Stephen Kelly, in his capacity as Chairman of the Code Change Panel said:

> "These changes will make it easier and more attractive for end-use customers to bid directly into the market. They have been widely welcomed by customers. They are vital both to encouraging the sort of vigorous demand-side participation that is essential to ensure a genuine, two-sided market in which customers are not simply price-takers; and to enable customers actively to manage their demand during high-priced, peak periods."

As is discussed in some detail in this report, while we agree with Chairman Kelly that demand side response would enhance competition in the NEM, in our view, demand-side bidding is unlikely to be either the only – or even the best – way to achieve this. In fact, as is discussed in further detail later in the report, we believe there are other mechanisms that can provide better price signals, greater flexibility and better technical support for demand response – and, therefore, more demand response overall.

On 26 June 2001, the NEM Ministers in each of the participating jurisdictions at their inaugural NEM Ministers Forum meeting "requested that jurisdictional officials prepare a paper for the next meeting of the NEM Ministers Forum advising on options to address these demand side participation and demand side response issues".

In addition, IPART has even more recently released a discussion paper that marks the start of an inquiry called for by the Premier of New South Wales "into what role demand management should play in providing the state's energy services".

The terms of reference for the IPART inquiry ask the Tribunal to:

- *Explore the technical and economic potential of a wide range of demand management, options (including load management and distributed generation options);*

- *Assess whether greater use of these options is warranted;*
- *Assess procedures and identify barriers to demand management in the development of electricity networks and the pricing of network services; and*
- *Advise on other issues that may impede efficient application of demand management.*

New South Wales has initiated other measures as well, including:

- License requirements on electricity retailers to undertake activities that increase the energy efficiency of their customers' operations and reduce greenhouse gas emissions
- A DSM Code of Practice that requires the state's electricity distribution companies to explicitly solicit private sector and community involvement in developing and implementing demand-side alternatives to network augmentation, and provides guidelines for how they go about this.

The ORG in Victoria has taken steps in a similar direction with its recent decisions to require distributors to:

- Publish annual network planning reports
- Plan and augment their networks so as to minimise costs to consumers
- Pay a fair and reasonable share of avoided network costs to embedded generators and possibly to customers that manage their loads as well.

These developments reflect a growing recognition that Governments and regulators can and should play a strategic role in facilitating the emergence of an active demand side participation in the evolution of the NEM. This report discusses a range of options available to the Victorian Government to both reduce the barriers to demand side participation and provide some incentives to key stakeholders to accelerate its development.

3. THE ROLE OF DEMAND RESPONSE IN THE NEM

3.1. DEFINITION OF THE MARKET PROBLEM

The problem under investigation and the boundary of the solution set being considered must be specified in order to:

- Clearly delineate what aspects of the market the study addresses (and those it does not address), and
- Provide practical guidance to Government regarding those actions it can take to address the problem.

We consider that the market problem is constituted by sharp needle peaks in demand that are occasioned by periods of hot weather and/or unforeseen loss of generation capacity which, based on their aggregate duration, would be insufficient on their own to warrant investment in additional generation capacity, but which nonetheless have potentially significant consequences for spot prices and the security of supply. It is critical to recognise that this problem is likely to be endemic – or at least persistent – given the role of sustained periods of hot weather in the summer in driving electricity demand in Victoria.

A full exploration of the supply/demand balance in Victoria was not included in the scope of this study, and is addressed in other places, most notably NEMMCO's Statement of Opportunities. Attachment 2 provides a summary of the supply/demand situation from this and other sources.

3.2. THE THREE MARKETS OF THE NEM

There are three key markets for electricity in the National Electricity Market (NEM):

- Forward (contract) market;
- Near time (spot) market;
- Real time (ancillary services) market.

The forward market is not a market as such, but rather is made up of many different contracts entered into by market participants. The majority of these are financial hedges that operate around the spot market price.[1] These hedges are virtually always traded on a bi-lateral basis in the "over-the-counter" market, although they could (at least in theory) also be traded on an exchange. These

[1] Hedges will probably also begin to operate in the ancillary market in the near future, due to the recently announced changes in its operation.

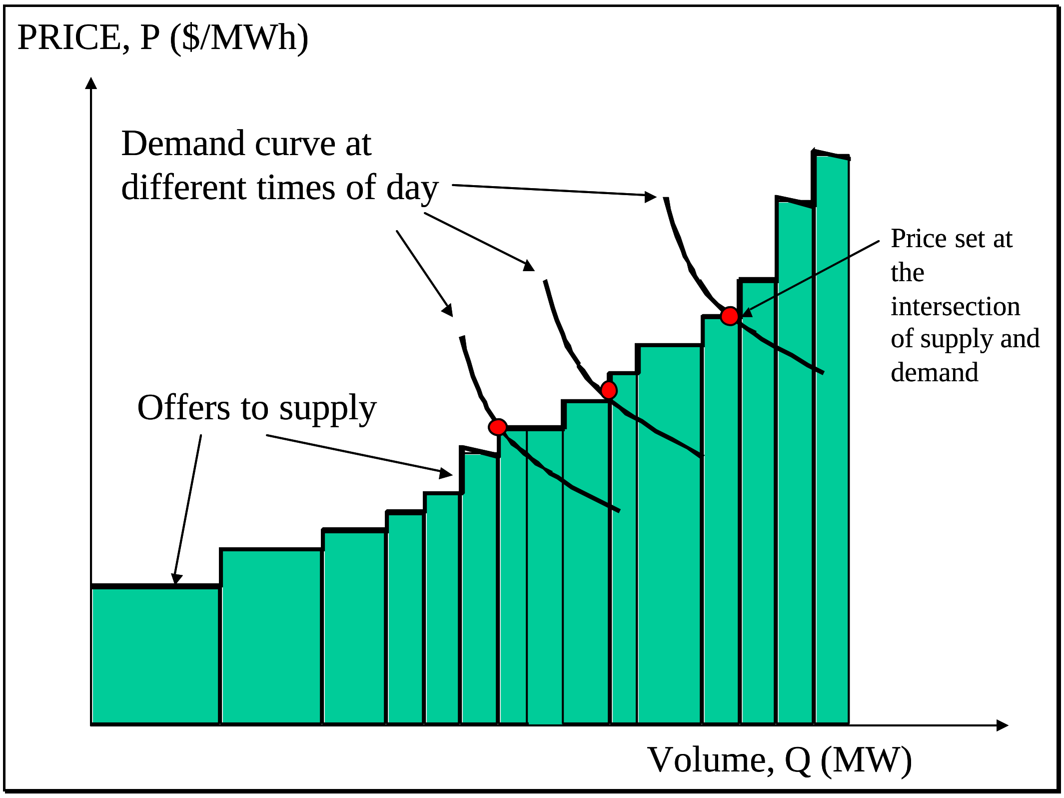
contracts allow participants to essentially fix the price of electricity for future periods and are the primary means by which price risk is managed b participants in the NEM. Most contracts focus on the mid-term future (i.e., from six months to the next few years). There is no reason why these contracts could not address the next several hours or the next day, but in practice, the market in short-term forward contracts has not developed as yet.

Both the near term (spot) market and the ancillary services market operate as part of the NEM.

The spot market in the NEM is designed to be as close as possible to a pure, real time electricity market. The NEM takes offers (from scheduled generators and loads) which indicate the amount of capacity each generator wishes to run in the market and the price at which they are willing to sell their electricity, and stacks these to meet real-time demand using the cheapest units first.

The pool price is then set at the price of the most expensive unit actually running at the time (with some exceptions due to constraints and other factors). Hence the NEM operates in textbook fashion – with price being set by the intersection of supply and demand in each five-minute period. This is shown diagrammatically below:

Figure 1 – Schematic Supply/Demand Curve for the NEM



Responsive loads can either bid, and be scheduled, in the NEM, or operate outside the scheduling system (to move the demand curve in real time).

3.3. THE ROLE OF DEMAND SIDE PARTICIPATION IN ADDRESSING THE MARKET PROBLEM

Demand curtailment at the point of consumer indifference regarding market price is a necessary feature of a two-way competitive market. Without it, the competitive forces in the market are limited to competition between suppliers only. Under such conditions, when supply is tight, there is no competition, and prices soar. Where very sharp peaks occur for only short durations in aggregate over the course of the year, there may also be shortages.

Demand-side participation (i.e., the voluntary reduction of demand in response to price signals[2]) is an expression of the price elasticity of demand, and exerts competitive pressure on suppliers.

Voluntary demand curtailment in real time can be used in a variety of ways, including:

- As a substitute for "regional" supply side contingency reserves (or involuntary demand curtailment) to maintain power system security within agreed standards.
- As an important element of special control schemes that can be applied under certain conditions to enhance the load carrying capacity of the network. Such special control schemes, in effect, provide additional contingency reserve that can be called upon in the event that a specific network outage condition occurs
- As a means for providing "local" network support, that is, to maintain the loading on critical network elements within design limits even when all elements of the network are not in service.

The two principal benefits of demand side participation are:

1. It adds an element of competition to the market when the supply/demand position is tight. Rather than relying on regulatory measures to peg prices under these conditions, demand-side participation provides a mechanism whereby the market can continue to function properly and find its own clearing price.
2. It maximises economic efficiency by providing a means whereby consumers can define and act on their point of price indifference.

[2] Note that these demand reductions can occur either dynamically in real time or on pre-determined schedules (based on locked in forward prices), as will be discussed later.

Compared to the situation where there is no demand side participation whatsoever, demand side participation should (at least in theory):

- Act as a check on the market power of suppliers by reducing demand when customers find it more advantageous to reduce demand rather than pay the prices suppliers are asking for electricity.
- Reduce final prices to consumers, in the event that the amount of demand customers are willing to forego is sufficient to make the marginally priced generator unnecessary.
- Increase the security of supply by substituting voluntary load shedding for enforced load shedding, and thereby enhancing the continuity of supply to customers with fewer options.
- Reduce the threat of and/or need for Government intervention in the market to maintain power system reliability at politically and socially acceptable levels.
- Reduce the need for investment in very low duty peaking plant.
- Provide a more stable regulatory and market environment for new investment decisions regarding energy infrastructure.

Other markets have also sought to capitalise on the capabilities of demand response. Examples include the ancillary service market in New Zealand; demand response exchanges, such as the Demand Exchange, in the US; and the UK's Triad demand reduction programs. In each case, the nature of the mechanisms used to organise demand response reflect the specific design features of the market in question.

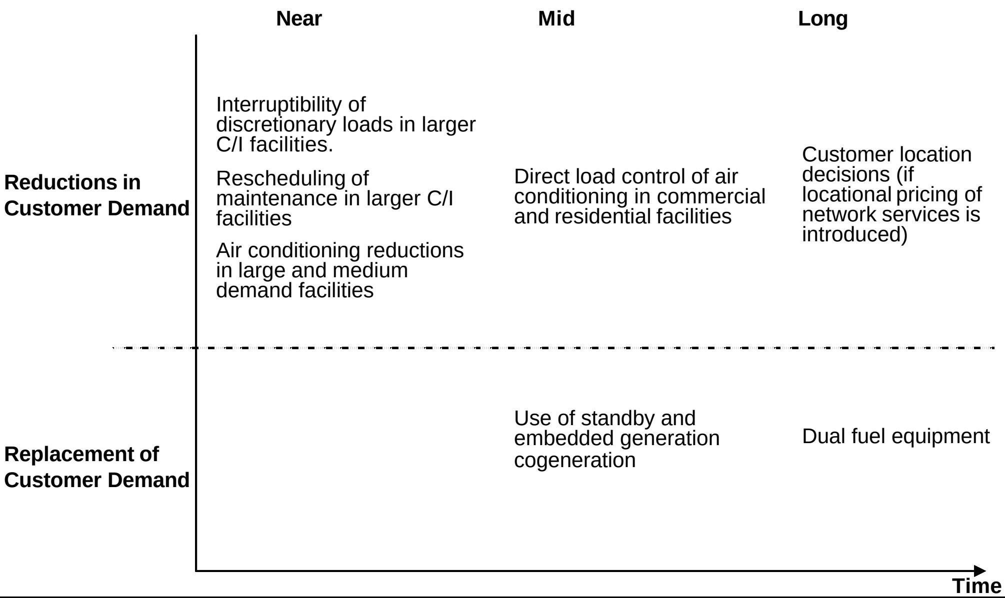
In the case of the NEM, as will be explored in detail in later sections of the report, the features that are most significant for the design of a demand response mechanism are ex-post pricing and the fact that the NEM is an energy-only market. These are not features that characterise the markets mentioned above (except for New Zealand, and there is a very good chance that demand response will perform as well in the NEM's new Ancillary Services Market as it does across the Tasman), and therefore it would be inappropriate to assume that we can simply adopt approaches that have worked well overseas for use here. Rather, we will need to fashion mechanisms that work with and preserve the unique characteristics and advantages of the NEM's design.

3.4. POTENTIAL SOLUTION SET

Based on the definition of the problem above, the range of possible solutions can, on the most basic level, be defined as those actions that can be taken to reduce demand during those times. Given the "needle peak" nature of Victoria's peak demand – that is, very sharp increases in peak demand for very short periods of time – the most appropriate demand-side actions, and those that will be included in the term "demand response" as used in this study will include those actions that can be undertaken to reduce demand specifically in response to the occurrence of higher peak demand and/or pool price.

Figure 2 on the following page provides a partial list of these possibilities, and further differentiates them according to: (a) whether they constitute a reduction in the customer's electricity demand solely, or rather a replacement of that demand by some other means, and (b) the timeframe it is likely to take to achieve significant contributions from each possibility (relative to its total potential). It should be noted that energy efficiency measures, such as better insulation in buildings or more efficient equipment such as air-conditioners and motors, are not included in the definition of demand response for this study. Although these measures are valuable in their own right – they offer (a) attractive financial returns to users when compared to the operating costs of less efficient stock and equipment, (b) better environmental outcomes for society through reduced greenhouse gas emissions, and (c) greater economic efficiency for the State overall – they will neither (*i*) significantly reduce the magnitude of the difference between average load and peak load, nor (*ii*) change the duration or cause of the needle peaks. As a result, energy efficiency will not improve the functioning of the NEM during times of needle peak demand (which are forecast to characterise Victoria's load profile for the foreseeable future), and we have therefore omitted consideration of energy efficiency from the set of actions included in the term "demand response".

Figure 2 – Illustrative Demand Response Actions, and Likely Timeframes for Significant Penetration



It should be noted that demand response actions can also be differentiated with regard to (a) the amount of notice that is required to bring them into play, (b) the certainty that the demand response will eventuate every time it is called upon (i.e., its firmness), (c) the duration of time in any given instance over which the demand reduction is likely to be able to be maintained, (d) the degree to which its output (i.e., the magnitude of the demand reduction itself) can be readily ascertained.

A full exploration of the technical options for demand response is beyond the scope of this study, but the options shown in Figure 3 can be briefly described as follows:

- Interruption of discretionary loads in larger commercial/industrial facilities – As an example, there is an abattoir that participates in a demand response scheme by turning off its bone crusher and allowing bones to pile up. After the demand response curtailment is over, the bone crusher is run extra time to catch up. There are many other processes in industrial facilities that can be operated in similar batch modes.

- Rescheduling of maintenance – Many larger commercial/industrial facilities have scheduled maintenance periods for their major equipment. Scheduling these to take place in the summer months when pool prices are likely to be highest, and to be able to be undertaken at short notice can provide demand response.

- Air conditioning and other reductions in larger facilities – Equipment such as air conditioning and lighting can be reduced during times when demand response is needed.

- Direct load control of air conditioning in smaller commercial facilities and homes – Air conditioning equipment in small commercial establishments and residences can be automatically cycled on and off when demand response is needed. The cycle interval is generally kept relatively short to reduce undue degradation of comfort. Examples might be 7.5 minutes off in every half hour or 15 minutes off in every hour.

- Use of standby generation, embedded generation, cogeneration, and dual fuel equipment – This type of equipment allows the customer to replace grid-supplied electricity with other energy forms.

Attachment 3 provides further detail on pertinent technical issues.

4. EXPERIENCE TO DATE

4.1. HISTORICAL DEVELOPMENT AND CURRENT STATUS

4.1.1. First Efforts: The VPX Capacity Support Program

The largest single DSM initiative in the NEM to date was the Victorian Power Exchange's (VPX) Capacity Support Program, which was implemented in 1997 to provide reserve capacity against a potential shortfall of some 700 MW across Victoria and South Australia. Prior to this time, both wholesale and retail prices had experienced significant reductions, and there had not been significant price volatility in the market. As a result, there had been virtually no interest shown in demand response. This changed in the summer of 1996-97, when sustained hot weather and forced outages created significant, though transient, imbalances in supply and demand. As a result, prices soared, and the security of supply was threatened.

The VPX Capacity Support Program used a competitive ITT process to obtain 500 MW of capacity from Victoria, and ETSA was to provide an additional 185 MW in South Australia in the form of new generation and voluntary load curtailment for the period December 1997 to March 1998, inclusive.

At the close of tenders in October 1997, approximately 150 MW of demand-side resource (of which 58 MW was considered firm load, the balance being 'non-firm') had been contracted for dispatch by VPX. The timeframe for this program was extremely tight and this undoubtedly limited the ability of customers to respond.

The Program was also intended to serve as a demonstration program that would hopefully result in more active involvement by retailers in demand-response. It made available three levels of payment:

1. Availability payments, which participants got for nominating a demand-side resource that they could make available;

2. Pre-notification payments, which participants received if the system operator told them to stand by; and

3. Dispatch payments, which participants got if they actually shed load in response to a request. Failure to deliver minimum amounts of load shed that had been bid resulted in financial penalties.

While several of the retailers that had participated in the program continued their offerings, participating capacity did not grow (and probably declined) due to the removal of the payment structure of the Capacity Support Program.

4.1.2. Current Status of Demand Response in the NEM

To date, very little demand has been scheduled in the NEM. Those loads that are regularly scheduled in some way include the pumped storage facilities associated with hydro powered generation stations and controlled hot water loads. These are already included in the demand profile, however, and therefore cannot be considered as being available to assist in further reducing peak demand. These resources amount to around 1,320MW in total, with pumped storage comprising the vast majority of this.

Within South Australia a number of load shedding initiatives have been recognised, including

- Retailer-exercised interruptibility agreements with customers, totalling somewhere in the range of 45 to 100MW, and
- Generator-exercised interruptibility agreements with customers, totalling another 30 to 40MW.

Similarly, both of the incumbent retailers in Queensland have developed and offered demand response programs:

- Energex offers "**energy**flex" which is described as a curtailable load product for business. It includes a negotiated participation fee, performance fee and a sharing arrangement based on the spot price.
- Ergon Energy (Solutions) is offering to develop a "Load Management Package" for businesses that is quite comprehensive and offers no risk financial returns. It is known that this package also includes sharing of spot price savings.

Specific data on the number of customers participating in these programs and the total amount of demand response signed up through them is not available.

4.1.3. Current Status of Demand Response in Victoria

Smelter loads in Victoria and NSW were traditionally used as spinning reserve prior to the commencement of competitive markets and therefore were expected to be demand side players in the NEM. However, since the start of the market, their demand side role has been all but replaced by supply side resources.

VIC Government Demand Side Capacity Investigation

In December 2000 the Victorian Government announced that it was anticipating up to 200 MW of demand-side capacity through load reductions by large customers, based on a series of interviews.

NEMMCO SOO

By way of comparison NEMMCO's 2001 Statement of Opportunities (SOO) presents a conservative estimate of least 143 MW of demand reduction capacity at times of high pool prices in Victoria and South Australia. This is 50% of 286 MW that NEMMCO identified, but was downgraded because NEMMCO had some doubts about the reliability of the resource. Since then, the estimate has been further reduced to 110MW.

NEMMCO also made the point in the SOO that other demand side responses may be occurring and already make up part of the demand curve. They have completed some simple modelling of demand response to pricing curves for Victoria and South Australia and found evidence that this is the case, and have stressed that their assessment of demand response is conservative.

Demand Response Available Through Electricity Retailers

The three Victorian incumbent retailers that responded to inquiries from the CRA consultant team as part of this study have, in aggregate, 87MW of off-market demand response capability[3]. It is interesting to note, however, that this capacity is being provided by a total of only about 15 customers. Based on anecdotal information, we believe that the total amount of signed-up off-market demand response capability in Victoria is currently about 200MW, and that there is significant potential for more load to be signed up.

4.2. MECHANISMS FOR DELIVERING DEMAND RESPONSE

4.2.1. Retailer Off-Market Demand Response Programs

Currently, demand response operates almost exclusively through retailers. Retailers have evinced increasing interest in these arrangements primarily as a result of two factors:

- The increased cost and decreased availability of contract cover at "reasonable" (i.e., past) prices.
- Increased demand from customers, which has been spurred by increasing retail prices, price volatility, concern about the adequacy of supply at times of peak demand, and the growing track record of demand response as a means for customers to gain substantial financial benefit.

These arrangements are typically set up as a contract between the customer and the retailer, which specifies:

- The type and amount of demand response the customer will undertake.

[3] Details of retailer off-market demand response programs are discussed in Section 4.2.1.

- The amount of notice the customer needs to deliver the demand response.
- The trigger price at which the customer is willing to be called upon to provide the demand response. It should be noted, however, that virtually all of the programs make responding to the call entirely voluntary for participating customers.
- The means by which the retailer and customer will agree on the amount of demand response that the customer has delivered. In most cases, the customer receives a portion (generally at least 50%) of the savings provided by the demand response for the retailer. In some cases, the retailer may pay the customer up front to enter into the contract and/or provide an availability payment.
- The procedures by which payment to the customer for the demand response delivered will be calculated and made.

Interest in these arrangements may be initiated by either the customer (perhaps at the instigation of an energy consultant) or the retailer, and may be negotiated separately from or as part of the electricity supply agreement. In the latter case, these negotiations form another aspect of the competition for the supply contract.

These contracts are considered to be off-market because the load reductions are voluntary rather than scheduled. The off-market nature of the arrangements provides other advantages as well, including the following

- It allows the retailer to maintain the confidentiality (and therefore competitive advantage) of the details of the deals it has struck with individual customers.
- It avoids tipping the retailer's hand with regard to deployment of its demand response resource, which can be of significant benefit in maximising the financial leverage achieved. (This may be particularly important as the amount of demand response controlled by the retailer approaches the amount required to set market price.)

As discussed above, it is estimated that retailer off-market demand response programs in Victoria currently have about 200MW at their disposal.

4.2.2. Demand-Side Bidding

From the beginning, the design of the market assumed demand-side participation, and demand side bidding was seen as a major source of this participation. Interestingly enough, virtually none of the demand response that has been realised has resulted from customers bidding their demand response resources directly into the market. Demand-side bidding has proven to be a non-event, and for relatively obvious reasons, when viewed from the customer rather than the market perspective.

Although the NEC has rules that allow demand side to participate in the market on an equal footing with supply side, they require that bidders must:

- Make offers into the wholesale market in a highly structured and systematic format
- Take full exposure to spot price (absent an allocation arrangement with retailer)
- Meet prudential requirements and pay market participant fees
- Allow NEMMCO to schedule and dispatch their load.

These requirements have made demand-side bidding a non-starter with customers due to the loss of control they perceive it entailing over their own operations. Although the customers can actually maintain total control over their operations by how they construct their demand-side bids, they do not recognise this and would need to "learn" complex market rules and devote management time to interacting with the electricity market. In addition, demand side bidding does not generate any cash revenues for the customer. It offers the potential for savings if the customer is willing to face the risk of exposure to pool price, which virtually no customers have been willing to undertake to date.

In addition, it is important to recognise that demand side bidding would actually reduce the ability of demand response to provide a check against the market power of suppliers because it requires that the nature and magnitude of demand response be declared beforehand, and respond to NEMMCO's dispatch requirements.

In short, we do not believe that demand-side bidding will ever constitute the preferred method for customers, retailers or aggregators to bring demand response to the market, and therefore do not believe that "fixing" the rules governing it is a worthwhile effort. As such, we have omitted the demand side bidding rules and requirements from our analysis or barriers.

4.2.3. Third-Party Aggregators

Aggregation refers to the development of new players whose sole role is to purchase demand side response from customers and sell it into the market, making money out of the arbitrage opportunities between spot and contract prices.

The key advantage these groups would offer is to aggregate the small customer contributions into one portfolio that can be traded. This benefits the customers in terms of the transactional costs that may be associated with trading their demand capability, and in valuing that capability in the market. It also adds value to the market in that the portfolio will benefit from supply diversity and deliver much greater confidence of being able to provide a relatively firm offering on an actuarial basis.

4.3. ESTIMATES OF POTENTIAL

4.3.1. VIC DB Study

A study conducted in 1999 for the Victorian Distribution Network Service Providers identified over 650 MW of technically attainable demand response. Significantly less than this had actually been realised at that time, however.[4] Table 1 presents an overview of the survey results.

Table 1 – Demand Response Potential in Victoria

MW of Demand Response Potential				
	Technical Potential	***Market Potential***	***Likely Market Potential***	***Price Condition***
Large C/I Load Shedding	499	253	190	≤ $1 per kW
Small Business DLC[5]	12	6	3	≤ 10% off summer bill
Residential DLC	156	45	23	≤ 10% off summer bill
Total	**667**	**304**	**216**	

The survey which, is probably the most comprehensive piece of work to date on the technical and market potential for DSM in Victoria, was based on a combination of in-person interviews and telephone interviews with over 250 large commercial and industrial business sector customers, (Tranche 1, 2 and 3), small business sector (Tranche 4) customers, and residential consumers.

The results were assumed to be a conservative estimate of the demand response potential for a number of reasons. The estimate of technical potential was thought to be conservative because:

- It was based on capacity available from "simple," readily identified actions that do not require capital investment.
- Control upgrades to standby generators, lighting and other technologies which were not taken into account could provide significant additional capacity

[4] Probably less than 150 MW of demand response had been achieved in Victoria at the time the VIC DB study was undertaken.

[5] Direct load control.

- Significant additional potential may exist in other areas that were not taken into account, for example power factor correction.[6]

Similarly, the estimate of market potential was thought to be conservative because:

- It was based on a price offer that is substantially less than the current level of VOLL. Increasing the offer to be more reflective of "top-end" pool prices would undoubtedly have increased market potential.
- The price offered also omitted the potential value of any T&D price signals that might be applicable.

4.3.2. NECA Survey

NECA's December 2000 survey of demand-side participation in the NEM indicated that a total of 817 MW of demand side response was available from programs offered by the retailers, TNSPs, DNSPs and Generators that had responded to the survey. In aggregate, these respondents represented a customer base of 2,154 MW in peak demand.

It should be noted that 800 MW of this demand response identified was contributed by only one customer. If this major customer is removed, the remaining load reduction equates to 1.3% of the total maximum demand from the surveyed firms, which represented sites with loads ranging from 1 MW through to almost 1000 MW.

4.4. SUMMARY OF THE STATUS OF DEMAND RESPONSE

Demand response lagged in the early years of the market due to falling wholesale and retail energy prices, easily available and relatively cheap contract cover (due to excess capacity), and a relatively low level of price volatility. As the supply/demand balance has grown tighter in recent years, several factors have combined to increase interest in demand response on the part of both customers and retailers, including the following:

- Increasing retail prices have focussed customers' attention on ways to reduce consumption, rather than just bargaining on per-unit prices, as an important way to control overall energy costs.
- Media reports about high wholesale market prices and incidents of supply interruption (or near-interruption) have heightened customers' interest in demand response as a means for protecting supply security and generating cash revenues.

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6 These could be substantial. For example, improving the power factor of the 1,570 MW used in the large C/I sector from a presumed value of 0.7 to 0.9 would reduce summer peak demand by approximately an additional 400 MW.

- Price volatility in the wholesale market coupled with reduced availability of contract cover at prices retailers felt were reasonable have led retailers to look for alternative risk management strategies, including demand response programs with their customers.

At this point, even if the contract market eases substantially, there is likely to continue to be interest in the demand side on the part of both customers and retailers. Many customers have learned that they have the potential to generate meaningful amounts of cash on an opportunistic basis through demand response arrangements. They are likely to want to continue these arrangements, and will put pressure on retailers to continue to offer them.

For their part, retailers are likely to continue to offer such arrangements if for no other reason than to meet the expressed desires of large commercial/industrial customers. It is possible, however, that retailers will become strictly reactive in providing these arrangements, and not exploit demand response to the extent that it could be.

Meanwhile, the total amount of demand response signed up by Victorian retailers is approximately equal to the level of market potential estimated in early resource assessment studies. However, these estimates were relatively conservative, and it is likely that potential exists for significantly more demand response to be arranged. In this sense, demand response is best seen in terms of extraction economics. Revision of resource potential estimates upwards is a common occurrence with regard to extraction industries such as fossil fuels: as the value of the resource increases, more reserves prove economically viable, and more innovation is applied to increasing the efficiency and capabilities of extraction techniques. In this light, it is not surprising that the estimate for available demand response would increase, given (a) rising awareness of the potential benefits of demand response to its providers, (b) increasing resource values, and (c) increasing risk from non-attention to risk management coupled with reduced availability of the traditional risk management resources.

5. POTENTIAL IMPACT OF DEMAND RESPONSE ON MARKET PRICE

This section looks at the potential price impact demand response could have had in the market had it been operating over the 2000-01 summer.

As highlighted in Section 3, price is set in the NEM at the intersection between demand and supply. As demand for electricity rises, so more expensive suppliers need to commit and generate to supply that electricity.

If, rather than rising, demand were to fall, then price should also fall. A demand side response in the market would result in a fall in demand. This section of the report looks at how much the price may have fallen as a result of different magnitudes of demand response on several specific occasions.

5.1. PERIODS UNDER REVIEW

Given the possible scope of such an analysis and the amount of data available in the NEM, it was important to limit the periods to be analysed.

Table 2 – Summary of Price Events, shows an analysis of the number of high priced events last summer, between 1 January 2001 and 30 June 2001. The table highlights the number of hours, days and events that occurred during that timeframe at various prices.

Table 2 – Summary of Price Events

Trigger prices	$500	$750	$1000	$1500	$2000
Total number of hours	19.75	16.1	14.5	11.5	11.4
Number of affected days	12	12	12	12	11
Number of events	46	51	52	43	42
Average length of event (hrs)	0.43	0.32	0.28	0.27	0.27

In order for demand to respond to high priced events, the events must have a minimum duration to allow the demand to respond. Table 3 – Duration of Price Events shows the number of events of specific durations at various price levels that occurred during the analysis period.

Table 3 – Duration of Price Events

Length of Event	Price Triggers				
	$500	**$750**	**$1000**	**$1500**	**$2000**
10 minutes or less	24	30.0	30	29	28.0
15-30 minutes	8	11	14	7	7
35-45 minutes	5	6	5	5	5
50-60 minutes	6	2	2	1	1
60 minutes or more	3	2	1	1	1

The analysis of price impacts looked at events that lasted at least 55 minutes, in order to ensure that the intervals analysed included sufficient duration to provide an amount of financial return likely to be of interest to participants. There were nine such events in the analysis period, of which four were subsequently removed from the analysis due to the fact that they included time periods in which price was set by South Australian generators (see Section 5.3 below).

5.2. METHOD OF ANALYSIS

The analysis involved taking the publicly available NEM bidding and availability data and for each five-minute period during the event, and stacking the available capacity in order of bid price until the stack reached the published demand for that dispatch interval. The stack was then reviewed to see how much price would have changed for various levels of demand response.

5.3. LIMITATIONS OF THE ANALYSIS

In reality, price setting in the NEM is much more complicated than the simple stack approach, with various network and plant constraints, co-optimisation of energy and ancillary services and so on. This analysis does not replicate that complexity and therefore our marginal stack did not replicate the prices actually seen in the NEM during the time periods analysed.

In addition, this analysis looked only at the combined Victoria-NSW market and treated South Australia as an additional demand on the system because of the problems with the size of the data set. This is a gross over-simplification of reality and was the reason that some of the periods gave anomalous results. These were subsequently excluded from the analysis.

However, with only a couple of exceptions, the stack did produce high prices at the times when pool prices were high and our "marginal" plant was fairly close in the stack to the actual marginal plant (as far as this can be estimated from the NEM data). While the analysis may not have been able to replicate the exact point on the supply curve for every event, the slope of the curve is the same as it was in the market at the time of each event and this gives some comfort that the answers are useful.

It must also be recognised that the analysis that was conducted is static, in the sense that it looks at historical bidding and interpolates what impact specific demand reductions would have had. In reality, generators can rebid into the market right up until the event and therefore would respond to demand reductions. The larger the demand response, the more likely it would be that generators would try to do so.

5.4. RESULTS

Table 4 gives an overview of the results of the analysis. For the five events in question, it shows the average pool price prevailing during the event and the impact (percent reduction) various levels of demand reduction might have on the price.

Due to the limitations discussed above, it would not be appropriate to indicate exact prices since our stack was not exactly the same as that which NEMMCO would have been using. However, it does give an indication of the magnitude of the impact that might be possible with different amounts of demand response.

The results highlight that 100MW of demand response has a small impact on price in most cases. In only a few events can 100MW of demand response have a significant impact. This occurs during events that have a very steep supply curve; when the demand has just risen above a discontinuity in the curve; or when the demand reduction would remove inflexibility in the market (such as over-constrained dispatch on one of the interconnectors).

As expected, larger demand response has a much bigger impact – with 1,000MW capable of reducing price spikes virtually in their entirety. This fits with some of the experience in the market to date – for example during the Victorian restrictions of February 2000, load restrictions were in the order of 1,000MW and reduced prices in Victoria to very low levels.

Table 4 – Results

	Event 1	Event 2	Event 3	Event 4	Event 5
Average pool price prevailing during event	$960.7	$1,770.8	$2,942.0	$703.5	$3,774.9
Impact of demand response of:					
100 MW	5.6%	5.3%	13.8%	7.6%	61.0%
250 MW	22.6%	30.3%	66.9%	15.1%	78.9%
500 MW	70.5%	86.4%	83.3%	32.5%	86.2%
1,000 MW	93.8%	96.2%	91.8%	88.9%	91.4%

In addition, results indicate that at levels of demand response that are currently available in the market, meaningfully large impacts on pool price may be possible.

5.5. CONCLUSIONS

As discussed above, this analysis constitutes only a preliminary investigation and its results must treated with caution. However, the results do indicate that:

- Dynamically responding supply and demand bids in the market – with customers making active decisions regarding the prices at which they are willing to re-schedule, shed, or shift to other energy sources some or all of their electricity consumption – is likely to facilitate true economic efficiency in the NEM, and
- Currently available levels of demand response appear to be approaching the levels required to make meaningful impacts on pool price.

It might be useful for the analysis that was conducted under this study to be continued at a higher level of sophistication in order to provide firmer resolution on the level of demand response required to produce different levels of impact on pool price. This could be useful in ascertaining the cost-beneficial level of Government involvement in facilitation of demand response as follows:

- Different levels of demand response will produce different reductions in pool price
- The level of impact plus the number of times the impact can be achieved (which is a product of how many price spikes there are and the degree of flexibility the demand side has in responding to all or only some of these spikes) will determine the impact of demand response on average pool price
- The product of the change in average pool price times total throughput quantifies the savings to all Victorian consumers due to demand response.

Although there are a number of other benefits from demand response (including, importantly, reduced reserve requirements) total consumer savings could be taken as an initial estimate of the value of bringing forward demand response, and could therefore serve as a conservative estimate for Government expenditures for demand response facilitation efforts.

6. MOTIVATIONS AND BARRIERS

This section describes the motivations for and barriers to demand response from four relevant perspectives: customers, retailers, aggregators and network operators.

6.1. CUSTOMERS

By definition, demand side activity is undertaken using the customer's ability to manage demand during peak periods. Therefore, barriers that relate to customers' understanding of and ability to participate in demand side activities are fundamental to the take up of demand side resources in the market. Conversely, the sole reason for customers to pursue demand response strategies is to save money or generate revenue.

The most important barriers that affect customers fall into the following categories, each of which is described in further detail below:

- Lack of awareness
- Low level of materiality of energy costs in operations and aversion to risk
- Absence of appropriate price signals
- Institutional barriers
- Technical barriers.

6.1.1. Lack of Awareness

To be able to undertake demand side response it is necessary that customers be aware of (a) when and how they use electricity and the technical options they have for altering this usage, and (b) the fact that there may be significant advantages for doing so.

Experience gained in the VPX Capacity Program, other interruptibility programs undertaken here and overseas (including the retailer off-market demand response programs that have been initiated to date) indicate that even most of the large and relatively sophisticated commercial and industrial customers are unaware of the technical potential within their energy-using equipment for load shifting or load shedding. Most customers have a production method or a way of doing business that is simply accepted as given. Except for the most energy intensive, technical and behavioural alternatives are generally only investigated if they relate to core concerns of the organisation. In most cases in the demand response programs undertaken to date, the technical opportunities for demand response have had to be introduced to the customer and "sold" within the customer organisation's management. An outside party, such as the electricity retailer or a consultant, has usually done this.

This lack of awareness stems from the fact that reducing electricity consumption, particularly in response to external signals, has not been strongly encouraged by most of the traditional electricity tariffs. Furthermore, the early years of the competitive market were characterised by falling retail prices and relatively low levels of price volatility, which meant that customers achieved significant bottom-line savings with minimal effort just through their supply negotiations.

More recently, rising prices, high levels of price volatility and threats to or actual failures of the adequacy of supply have made more customers aware of the existence of the problem. A proportion of the larger customers have been assisted in understanding their options and implementing demand response strategies. For most customers, however, knowledge about the means to address the situation, and the scale of benefits available for doing so, is still missing. And, this lack of awareness is exacerbated by several of the other barriers described below.

In sum, in all the cases in Australia where the opportunity has arisen to make a financial gain from deploying demand response, the customer has had to be first made aware of the potential and then assisted to take action. This is because they do not fully understand their demand response capability technically, and do not know how to value it properly. This will only be rectified with a concerted effort at increasing customer awareness of the potential for and benefits from demand response.

6.1.2. Low Level of Materiality of Energy Costs in Operations and Aversion to Risk

A customer's awareness of energy costs and use tends to vary with either the proportion of their total cost base that energy expenditures account for, and/or their absolute level of expenditure on energy.

Not surprisingly, customers with relatively low energy costs are less aware of the related issues and far less concerned about energy issues in general. It is simply not material to them. By contrast, industrial customers in energy intensive industries are far more sophisticated in how they manage their energy use and related costs, and often have dedicated staff for this task.

For most customers, however, energy costs represent a very small percentage of total operating costs – typically less than 2%. As a result, very few have significant levels of technical or operational knowledge regarding energy use, and energy is generally viewed as a low priority area of the operation. Because of its historically low impact on most companies' cost structures, it is very difficult for most customers to justify dedicating significant levels of internal resource or attention to energy issues. It then proves very difficult for them to quantify the reward for demand side actions; thereby further complicating decisions regarding capital investment and/or operational decisions that are in non-core areas, but could have impacts on core operations.

To illustrate, from the perspective of an industrial or commercial customer, the financial remuneration received from participation in a demand side initiative must offset any incurred costs plus provide a reasonable return. This essentially involves the customer calculating their individual value of lost load.

These costs can include:

- Increased labour to manage the demand side response – operationally and commercially;
- Increased maintenance costs;
- Capital costs;
- Additional fuel costs;
- Penalty rates if a shift change is required to accommodate the load shed;
- Potential for lost production and output.

The majority of large customers will also place some cost premium on the "hassle factor" associated with undertaking activities outside of their normal operating routine when they are unsure of what is actually involved.

Inexperience with undertaking demand side projects impedes the customer's ability to assess accurately the costs they might incur in their implementation, which in turn makes placing a total financial value on the resource very difficult (if not impossible). This often results in the customer either adding significant risk premiums to the demand side undertaking, or abandoning the calculation and decision process altogether. It is clear, however, that where customers are assisted to participate by advisors (or retailer staff skilled in this function) this barrier is far more likely to be overcome.

Even where these calculations are completed, the demand side action may need to compete for investment funds within the organisation. Investments on non-core projects usually face a much higher investment threshold than those that are applied to what are perceived to be core business areas that deliver growth, competitiveness, profit, etc. As a result, while customers may do simple demand management projects that have low upfront costs, the wider range of demand side projects is not exploited, as these often do not meet the investment threshold.

In addition, where changes in energy operations or scheduling are perceived as possibly interfering with core concerns such as maintenance of production schedules or quality standards in the case of industrial enterprises, or employee, customer, or client comfort in the case of commercial establishments, the customer is very likely to place large premiums on avoiding these risks.

Another aspect of this barrier that is related to both risk aversion and materiality is the fact in many large organisations where the demand response potential tends to be the greatest, internal management accountabilities are often organised in ways that discourage demand side actions. For example, the purchasing function is often centralised and not in touch with the technical potential that may be available for demand side management. The purchasing department may be solely focused on the supply agreements and may even believe that demand side issues will not be popular with the operational personnel.

Operations managers, on the other hand, are usually driven by minimising unit production cost and/or maximising production output. They may have no concern about energy costs and may not understand how they can influence these costs or increase profitability. In addition, it is often the case that revenue in-flows from demand side participation are not "credited" to the operations manager, leaving him with all the risk from the decision but no incentive/reward for taking that risk. Finally, in most cases there is also no easily definable downside risk for customers – or internal managers – who choose to **not** participate in demand response programs.

6.1.3. Absence of Appropriate Price Signals

Experience overseas and in the off-market demand response programs offered by Australian electricity retailers has shown that customers will respond to price signals. To function properly, these price signals must:

- Indicate the value of demand side activities as a function of time (i.e., as being responsive to changes in external factors);
- Provide a firm, known value for demand response that is to be undertaken in the near term, and sufficient notice for the actions to be initiated; and
- Provide a relatively firm value for actions to be undertaken in the future, in order to provide a revenue stream against which to consider investments that enable demand response capability.

None of these currently exist in the NEM.

Absence of a real-time price signal

The spot price of the wholesale market, or a real-time retail pricing mechanism, would be ideal for signalling the value of demand response as a function of time. However this signal rarely reaches consumers due to the highly averaged tariffs preferred by customers and therefore offered by retailers. These tariffs are very popular with customers as they remove complexity and uncertainty and mean that customers do not have to manage significant price risks on a day-to-day basis. In fact, this service in and of itself represents a significant portion of the value added by the retailer in the supply chain. It is also a service that customers actively seek and expect from their retailers. Some retailers have offered tariffs that do pass through some portion the wholesale price risk, but these arrangements have by-and-large been in response to lack of forward contract cover and have generally met with considerable resistance from customers.

While the demand response programs offered by many retailers provide an additional signal regarding the real time value of demand response, that signal is not readily available to all customers. A chicken and the egg problem results – customers want to avoid complexity and risk, and therefore seek flat unit-price electricity contracts. In such cases, retailers are likely to provide the pricing structure requested whenever they can, in order to meet customers' expressed needs. Customers then do not receive a price signal, so they have no reason to respond, and diffusion of knowledge about the applicability of demand response is retarded. By contrast, experience in the US and elsewhere has indicated that where customers actually experience demand side programs they tend to become less concerned about the risks, and tend to extend their participation.

In sum, while the averaging of electricity prices has cushioned customers from the price volatility (and risk) and, therefore been popular, it has come at the cost of gaining demand side response when required. Retailers are understandably not keen to offer customers products that are not popular or require customers to make operational changes (also unpopular) unless there are significant savings for the customers, or there is an unacceptable level of risk to the retailer.

Absence of a firm short term price for demand response

Similarly, the ex-post nature of the NEM settlement procedure prevents a clear, firm price signal about the value of demand response in the near term. The NEM is designed on an ex-post model, which relies on participants (both supply and demand) optimising their position over time right up to the point of dispatch. Supply participants (over 30 MW) must bid; it is voluntary for demand-side participants.

To enable the spot price to function as the real-time intersection of supply and demand, the market allows extensive rebidding. Spot prices are not determined until right up to (indeed, effectively after) the event.

These arrangements pose barriers to demand side participation for the following reasons:

- They tend to limit the demand-side resource that can respond to "fast-start" applications.
- Demand-side participants do not know the spot price that will actually eventuate at the time they bid or at the time that they dispatch the demand. Therefore, it is difficult for them to quantify the reward for their actions beforehand, thereby complicating decisions regarding capital investment and/or operating schedules that are essentially "non-core" for essentially all would-be demand-side participants.

- In fact, since the action of the demand side may reduce the market spot price, it is possible for the action of the demand-side participant to actually erode the projected benefits that prompted the action in the first place.

Retailers that have offered off-market demand response programs have generally included program services that attempt to address these issues. For example, the retailer is likely to provide advice to the customers regarding the likelihood that a projected price will in fact eventuate, and sometimes takes on some of the ex-post risk. Generally, however, in exchange for these service and risks, they reduce the share of the demand response benefit that goes to the customer. This lower realised price reduces the price signal for demand side activities, and ultimately the amount of demand response that is achieved.

Absence of a firm long term price for demand response

The need for demand response is a function of the supply/demand balance. To justify investments to enable demand response, some future value for the resource needs to be projected.

For example, conversion of an islanded standby generator to synchronous operation could require an investment of some $20,000 to $30,000 (or even hundreds of thousands of dollars, if complex fault protection equipment is required by the local DNSP). Recouping the investment will depend upon the number of hours the unit is run in future years, and the price obtained during the periods it is run.

At present neither of these factors can be easily predicted with satisfactory accuracy. Although there is publicly available information about the forward contract market, and this information can be analysed to identify the contribution of those hours characterised by high demand and high prices to contract prices, this analysis is not trivial, and will generally exceed the capabilities or resources available to most customers. Supply side participants use this information to make decisions about investment in generation plant, but these players are experts; such investments are their core business. The same cannot be said for customers.

The absence of this price signal in the market is not currently being addressed in any way that provides any practical assistance to customers. As a result, investment in demand response capabilities that might be quite rational and that might be undertaken if the information were available may be going unmade, with a consequent loss in the efficiency of the market.

6.1.4. Institutional Barriers

Three types of institutional barriers have been identified, each of which primarily relates to the use of standby generation.

Standby generation systems typically occur in two common configurations: break before make and synchronous. Compared with other mechanisms for demand response, such as interruptible loads in C/I facilities, standby generation has a key advantage in that it is relatively easy to monitor the time, duration and energy of its output. Further, building managers test backup generation equipment regularly, and hence are often positively disposed towards being paid to run the generators when they would have had to do so anyway. This is especially attractive if they can be run under load as this is often not possible for them in their current configurations and the units often fail when actually called on to carry load. As a result, standby generation represents a source of significant demand side potential that can be available in the near term and is relatively easy to monitor.

The three institutional barriers to its use that have been identified are as follow:

- Regulations regarding air quality may impact the use of standby generation capacity.
- NEC rules and requirements may impose unintended constraints or costs on standby generators.
- Network interconnection requirements may unduly restrict the use of standby generators.

Air quality regulations

Environmental regulations regarding the operation of diesel (and gas-fired) standby generators in densely populated areas may be a significant determining factor in the usability of standby generation as a demand-side resource.

Operating diesel standby generators produces additional air pollution. This may be of particular concern to air-quality regulators where the generators are located in urban areas and on the hot and humid summer days when peak demand and high pool prices are most likely to occur. Noise may be a secondary concern.

Local council or EPA approval may need to be sought or license conditions may have to be reviewed to determine the nature and frequency of diesel generation operation that can be permitted. This issue needs to be resolved at the Government level. One means for resolving this issue that has been discussed is to limit the number of hours units can run on a given day and/or other time periods.

NEC rules

According to NEMMCO personnel, market rules state that if a market participant breaks his connection to the grid, he is no longer in the market, and therefore cannot participate in the market settlement system. NEMMCO has received legal advice that this would preclude payments to standby generators that sought to operate as scheduled loads. NEMMCO has also stated that they do not believe that the intention of this rule was to preclude the operation of standby generators as scheduled loads, and would welcome an approach by a market participant to provide the opportunity to review this rule in greater detail, and remove unnecessary barriers, should they exist.

Network interconnection requirements

Local DNSPs have technical and safety requirements that must be met by equipment that interconnects with the local network. According to personnel from several DNSPs that were interviewed, the network operator often has stringent requirements for fault protection that apply to the interconnection of standby generators. These requirements are meant to protect the system from improper operation or integration of the standby generator. Meeting these requirements may cost several hundreds of thousands of dollars. In addition, the specific requirements may vary between networks, thereby adding complexity as well as expense for a would-be aggregator of standby generation capacity.In sum, the significant issues that will need to be addressed to determine whether and to what extent standby generation will be able to provide demand response include:

- whether the EPA's current regulations on emissions provide sufficient latitude for operation of these systems in demand response programs;
- whether EPA will impose new emissions controls for coincident operation of these machines within a confined area such as the CBD;
- whether the capital cost required to ready these systems for operation in demand response programs is worthwhile, particularly in light of the size and age of the existing stock of standby generators;
- whether the technical requirements of the DBs regarding the interconnection and operation of these systems impose unaffordable costs for harnessing this resource; and
- whether the owners of these systems will face significant potential legal liabilities associated with possible degradation of the quality of supply to tenants etc. in their premises when the machines are started up or are operating.

6.1.5. Technical Barriers

The only significant technical barrier that was identified concerned the possibility that the consumption of domestic customers will not be measured by interval meters but by load profiles. The profile method would dampen the ability to provide price signals for and reward demand response behaviour.

6.2. RETAILERS

Retailers have several motivations for getting involved in demand response. These include:

- Make money by avoiding high pool prices.
- Manage risk by reducing exposure to high pool prices and reducing the amount of load that requires more costly contract cover.
- Attract and/or keep customers by offering products and services that compete favourably with those of the retailer's competitors, and provide on-going reminders of the value the retailer provides the customer (through payments for the customer's demand response).
- Check generator market power in the pool by controlling demand response that can be brought into the market without advance warning to suppliers, thereby potentially reducing the retailer's position as a price taker.
- Possibly reduce pool price, if enough demand response can be delivered to the market (see Section 5 for a fuller discussion). This would provide significant benefits to all retailers, and ultimately to all customers.

However, there are also several significant barriers to retailer involvement in demand response activities, particularly at optimal levels. These include:

- The need to minimise marketing and transactions costs for all but the largest customers.
- The lack of integration between the perspectives and operations of the trading and account management functions within most retail organisations.
- Competing options that may appear equally or more attractive as compared to demand response owing to other market imperfections.

6.2.1. The Need to Minimise Marketing and Transaction Costs

Electricity retailing is a volume business. Margins are generally thin, and do not allow large amounts of time to be devoted to any but the largest customers for tailored solutions. As a result, retailers understandably try to minimise the transaction costs associated with obtaining each successful signing of a new retail consumer. In practice, this results in retailers offering standard deals and often being reactive to customers' needs, particularly in the case of larger customers, and progressively less responsive to customers' need as customer size decreases. Where flat per-unit contracts are desired by the customer and can be delivered, demand-side investigations may not come up. Even when demand response is offered or entered into at the customer's request, it is not seen as the main line of the retail business. As a result, it is unlikely to be exploited to its full potential.

6.2.2. The Lack of Integration Between Trading and Account Management Perspectives

The real value of demand response is realised by the hedging or trading desk of a retailer, however, most demand response programs have been developed and implemented by the sales and marketing part of the organisation. The latter is arguably better placed to identify demand response opportunities and work with the customer to implement them. However, the trading or hedging group of the utility is likely to be much better placed to understand the value of demand response and create innovative demand response offerings. To date, however, traders have not been highly involved in demand response program development. They have generally felt that demand response was too small in aggregate and too un-firm in nature to have much value. The lack of integration of these two functions within the retail organisation has almost certainly resulted in reduced development of the role that demand response could play in the retailer's portfolio. Without a clear indication of value to the company (and therefore sharable value to the customer), sales staff have probably also sub-optimised their efforts to recruit demand response.

6.2.3. Competing Options

Retailers have alternatives to demand response. The most important are contract cover and owned generation. Both of these can help the retailer manage risk. Owned generation offers other benefits as well including:

- The ability to earn revenues separate from the retail function without a proportional increase in overhead costs.
- The ability to act as a check on the market power of other players and confer market power on the retailer.
- Other benefits that reflect the specific situations of various retailers, and provide additional justification for the investment; for example:

- Providing options for other resources controlled by the retailer. This could be particularly true in the case of a retailer that has gas supply contracts or (even more so) that owns upstream gas (e.g., Origin Energy).

- Embedding a generator in a network and gaining support payments (e.g. AGL's Summerton plant).

The full range of alternatives that a retailer has when faced with a supply constraint in the energy market, include:

- Absorb the risk and/or attempt to pass or share it with the customer;

- Withdraw from the market until more contract cover becomes available;

- Pay high prices for any contract cover that is available;

- Build its own peaking generation plant (i.e., provide a supply-side physical hedge), or

- Deploy enough demand side load reduction to counter the risk.

The first two are seldom the preferred options, although they have been necessitated in some markets at some times. In theory, demand response could be thought of as an equally preferred alternative to the remaining two others. In fact it is not.

In general, forward contracts (or hedge) have historically been the preferred alternative, as they have been relatively easy to obtain and relatively attractively priced, due to the sufficiency of supply.

In markets where the peak demand growth is in line with average growth it is likely that major new generation will be built (base load or high efficiency gas), as peaking stations may not be economic over their lifetime. In this case, contracts (where available) are likely to remain the preferred approach, and demand response will be highly attractive until new plant is built to support the hedges. The situation in Queensland is an example of this sort of development.

However it is becoming clear that when supply tightens and/or becomes constrained in markets with "needle peaks" (as is the case in Victoria and South Australia) where peak demand is growing faster than total consumption, forward contracts from generators tend to first become very expensive and then almost impossible to procure. In this case, gas peaking stations tend to be the preferred supply-side addition.

In these markets, owned generation becomes the main competitor to demand response. The former is generally preferred for the reasons mentioned above as well as the fact that:

- The plant can be built to the size required, whereas achieving significant amounts of demand response can seem quite difficult.

- The plant can hedge the entire exposed load with certainty. This helps in a competitive sense as offers can reflect this certainty, and customers can be offered risk-free supply (for a price).

- The plant will operate as required and when required, as compared to demand response, which is often seen as providing a non-firm resource at best. The fact that it is a physical asset may also give comfort to market analysts of listed entities. The recent AGL incident in New Zealand shows the effect of over exposure to the spot price: AGL's NZ losses were less than A$200 million, but some $A1,800 million was wiped off the company's market value through share price movements in reaction to the news.

- The continued ownership of the plant by the retailer is assured, whereas customers may leave, taking their demand side resources with them.

It is our feeling that many of the ways in which the demand side resource seems second best as compared to the supply-side resource may be able to be addressed over time. However, in the near-term, retailer preference for owned generation is likely to:

- Further reduce the impetus for demand response, since the retailer with the owned generation will begin to have a vested interest in higher pool prices if he is operating during them.

- Extend the market power of the supply side in setting market price (the fact that it will reduce the degree to which the retailer is subject to that market power will not lessen the impact of this on the efficiency of the market).

These represent considerable barriers to demand response.

6.3. DEMAND SIDE AGGREGATORS

The limited amount of demand side response that has eventuated to date in the NEM has been driven by either:

- A few large customers with exposure to spot prices; or

- Retailers seeking load curtailments from selected retail customers to reduce the retailers' exposure to spot prices.

The current commercial arrangements that normally apply in the competitive retail market leave no room for third parties to have a role other than as an agent of either a retailer or the retail consumer.

In our view, the apparent inability of specialist demand side aggregators to enter and add value to the market by developing commercial opportunities for cost-effective demand side response is a major barrier that requires urgent attention. Energy retailing is essentially a high volume, low transaction cost business where gross profit margins are thin, customer loyalty is extremely low, and customer churn is high. Retail contracts are typically very short –term – 12 months to 2 years in duration, and therefore retailers simply cannot afford to spend considerable time and attention on negotiating complex retail contract arrangements with highly customised demand response provisions incorporated in them.

During crisis times when spot prices may climb to extraordinarily high levels for more than a few hours over a summer season, for example, retailers do indeed have the incentive to seek out some measure of demand side response from their largest customers, and they have been prepared to pay a high proportion of the benefit accruing in the spot market for such responses.

However, these arrangements tend to be rather ad hoc and temporary and may not survive beyond the period of the crisis. A sustained development of demand side response requires demand side aggregators who can work in partnership with retail consumers on a medium to long-term basis to develop and implement a cost-efficient demand response strategy.

The role of the demand side aggregator could include any or all of the following:

- Work with the retail consumer to identify the cost-effective demand response opportunities that are present in the customer's facility;
- Develop a mutually beneficial commercial basis on which the available demand response can be packaged commercially and "sold" in the NEM;
- Design the necessary load monitoring and control facilities needed to implement the demand response strategy;
- Finance and install the necessary facilities, and operate and maintain them in good working order; and
- Aggregate the non-firm demand response available across a portfolio of retail consumers to sell firm products and services based around load curtailment wherever there is a market for it (e.g., provide high price insurance in the energy market, contingency reserve in the ancillary service market, network support services etc.).

Aggregators' primary motivation for getting involved in demand response activities would be to make money. The main barriers to them playing the role described above would be:

- The inability of customers to negotiate their demand response capabilities separately from their supply contracts.

- The lack of a mechanism whereby the aggregator would get paid. To be able to function effectively and profitably, demand side aggregators need to be able to build long-term commercial relationships with their clients and foster a high degree of customer loyalty. This requires the NEM trading arrangements to provide for:

- The clear separation of the demand side response strategy from the day-to-day retail contractual arrangements for energy purchasing – Existing retail contracts that are in the form of variable volume or metered hedges completely insulate the retail consumer from any exposure to spot prices and therefore eliminate any customer incentive to respond to dynamic spot prices; and

- Open and transparent markets with a high degree of price discovery of both the real time and forward prices for the available range of demand response related products and services – The existing OTC market is quite complex and does not provide a ready market or efficient forward prices for highly customised, non-firm load curtailment options.

As is stated elsewhere in this report, this does not require demand curtailment to be bid directly into the energy spot market; however, to the extent that the demand side is competing with supply side options for the provision of contingency reserves in the ancillary services markets, this will need to be bid in on a daily basis.

Other barriers to the establishment of an independent demand side aggregator industry closely parallel the remaining barriers in the NEM to the emergence of a growing demand side response, in particular consumers' general lack of knowledge of and/or interest in the issue.

While the absence of demand side aggregators is in and of itself a major barrier to the development of demand side response, deficiencies in both the wholesale and retail NEM trading arrangements effectively prevent independent demand side aggregators from entering the market. Over the past twelve months or so, a number of Victorian-based firms that are not involved in energy retailing have been seriously considering the business opportunities in this area. However, until there is a marked improvement in the NEM trading environment, any concerted attempt by any of these firms to enter the market is likely to be deferred indefinitely.

Of course, it would be quite possible for existing energy retailers to establish their own demand side aggregation businesses at arms length from their normal standardised retail trading operations. Retailers would have some significant advantages over independent third parties in setting up such a business because:

- They have an extensive existing client base that they could use to grow the business;

- They have energy trading arms that are a ready market for any of the demand curtailment products that could be developed; and

- They are already very substantial organizations with a strong capital structure that could afford to carry the establishment costs of a new business venture such as this.

On the other hand, they also have a number of significant disadvantages:

- It would be very difficult for them to differentiate the energy sales and demand response services in the eyes of their clients and this could impede their ability to develop the necessary long-term commercial relationship needed by the aggregator with his customers;

- The demand side aggregation role would inevitably be involved in commercial arrangements with other retailers that could prove to be very uncomfortable for the retailers concerned. This could impede the retail customer's access to highly competitive energy rates.

While retailers should be entitled and in fact encouraged to set up their own demand side aggregator functions, from the consumers' perspective, it is important that there are competing, independent third-party aggregators in the market that can provide a high quality service that is completely unencumbered by relationship problems amongst competing retailers.

Assuming the existing barriers that are effectively preventing the establishment of an independent demand side aggregator industry can be overcome, it may also be necessary to ensure that the incumbent retailers do not use their current position in the market to create new barriers to entry for the independent aggregators. The existing provisions of the Trade Practices Act may already provide sufficient protection in this respect. However, if not, consideration could be given to strengthening the existing retail license obligations.

6.4. NSPs

Network system providers could use demand response to enhance the utilisation of their networks by deferring augmentation on low load factor assets. Current barriers to them doing so include the following:

- Current pricing mechanisms – Network revenues can become linked to energy flows and this can act as a barrier to any demand side resource that may limit energy flows in the network (i.e., the network experiences lost revenue). NSW has removed this link for these reasons and made revenue dependent on demand only. In addition, distribution pricing is not cost reflective of constraints and yet makes up the bulk of the NSP's charges to customers. This need not be the case as more cost reflective pricing regimes are available and have been instituted in countries such as New Zealand with great success in stimulating demand response. Such tariffs would marshal demand-side activities to better manage the capital expenditures of NSPs for system reinforcement and augmentation.

- Lack of understanding of demand response opportunities – NSPs have no contact with customers, and therefore little understanding of the practicalities of demand side opportunities. In addition, their culture tends to be driven by technical rather than market or commercial considerations. This is a significant barrier in many cases but is somewhat offset in Victoria by the private sector ownership of NSPs and the tight internal competition for capital that these NSPs can experience.

- Different planning horizon and time frame – The lead times for cultivating DSM are much longer than sourcing and installing equipment such as transformers. This is why some regulators are seeking longer lead times on declaring constraints and providing information that market proponents can use to assess the value of demand side response to overcome the constraints.

- Non-firm aspect of demand side – Demand side options normally cannot be compared directly with the conventional network investment option because they have a fundamentally different technical "reliability" and therefore the risk profiles of the two are very different. There is also a commercial risk on demand side options in that the regulator may not allow an asset to be included in the regulated asset base or only do so at a reduced asset value. NSPs are coming to grips with this need to balance technical concepts of risk with the commercial risk issues, but reaching a mature level will take time. Again, in Victoria private sector ownership and internal competition for capital will likely assist in this transition.

- In most instances, due to the lumpy nature of major network investments, the DSM option is not necessarily a complete substitute. It normally provides an option for investment deferral and becomes part of the tool kit for network planners seeking the least cost approach to integrated management of the network. This means that it is often transient, providing deferral for a few years and then being redundant once the supply side investment becomes commercially acceptable and is made (often called the saw tooth effect).

- Lack of cost recovery mechanism for investments – This concerns the ownership and cost-recovery of equipment that enables demand-side participation. For large commercial/industrial customers this is not likely to be a problem as the metering and communications equipment is likely to (a) need to be tailored to the equipment and operations of specific customers, (b) represent a relatively small proportion of the potential savings, and (c) offer significant additional benefits to the customer. However, the issue is likely to be significantly different in the mass market where (a) significant economies of scope and scale can be achieved by using a central communication infrastructure to operate switched loads that individually are quite small (and would therefore prove uneconomic to switch through decentralised technologies), (b) retailers are unlikely to make large investments against a limited term supply contract with customers with relatively small demand response capabilities, and (c) customers themselves are unlikely to make these investments. In such cases, an alternative source of funding for these investments could overcome significant transaction costs and potential stranded costs. Network operators would seem to be ideal candidates to fund the installation of these communications systems as enabling infrastructure that can be used to provide potential benefits to all network users. Operation of the communications systems could be undertaken by the network system operator on behalf of the retailer or customer on a fee-for-service basis.

7. PRIORITISING THE BARRIERS

7.1. CRITERIA FOR PRIORITISATION OF BARRIERS

In order to be able to prioritise the barriers to demand response, it is necessary to define suitable criteria. The following criteria were selected:

- The appropriateness of Government involvement in the area addressed by the barrier;
- The likely impact that removing or negating the barrier would have on enabling demand response;
- The likelihood that the barrier can be overcome; and
- The degree to which it is timely to address the barrier concerned (i.e., in some cases there are certain barriers do not need to be addressed unless other barriers have already be removed).

The application of these criteria was undertaken based on the experience of the CRA consultant team, and indications of the success and impact of some measures that have been gathered from previous work. Each of the criteria is discussed in further detail below.

7.1.1. Appropriateness of Government Involvement

This concerns whether the barrier is something that Government should play a role in addressing. Associated considerations are the degree and timing with which the barrier would be addressed in the absence of Government involvement, and the degree to which Government involvement can be undertaken in a manner that is consistent with NEM principles and other relevant policy settings.

7.1.2. Likely Impact of Removal of Barrier

This assessment was made based on the experience of the CRA consultant team using the following scale factors:

- High – this means that removal of this barrier is essential to enable meaningful levels of demand response;
- Medium – this means the removal of the barrier would be enabling but not essential;
- Low – this means that removal of the barrier would be of only limited efficacy in changing the level of demand response likely to be undertaken in the market.

7.1.3. Likelihood that the Barrier Can be Overcome

Applying this criterion involved looking at:

- The nature of the barrier itself and the specific processes that would be required to overcome it;
- The number, type and diversity of players that would need to be involved or addressed in overcoming the barrier;
- The order of magnitude of effort and cost that would be required in overcoming the barrier;
- The degree to which there are precedents and examples of similar barriers being addressed.

7.1.4. Timeliness of Addressing this Barrier

Certain barriers must be removed before removal of any other barriers can have any effect. For example, if there are barriers to customers seeing price signals, no amount of solving technical barriers will result in more demand response. Therefore, barriers must be prioritised with regard to order in which they become ripe to be solved.

7.2. APPLYING THE CRITERIA

Table 5 below applies the criteria described above to each of the barriers identified in the previous section.

7.3. PRIORITISATION OF THE BARRIERS

Based on the considerations presented in Table 5, Figure 3 plots the potential impact of the removal of each barrier against the relative difficulty of the barrier being overcome. Based on the results, the highest priority for Government attention should be placed on addressing the following areas:

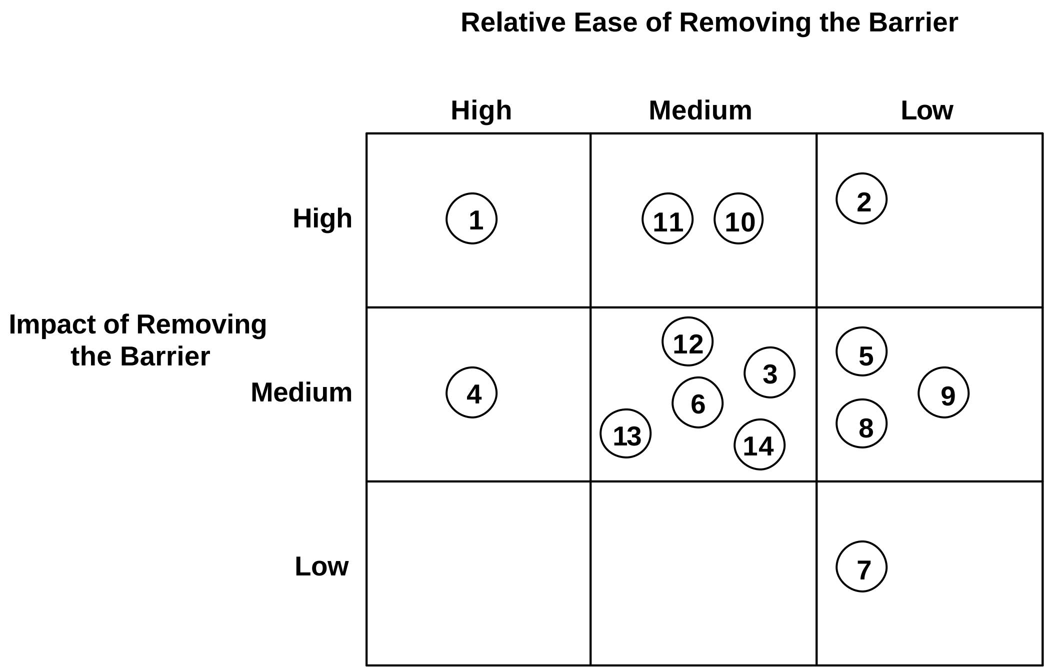
- Improving customers' awareness of the potential they may have for demand response actions, the ways in which demand response can be integrated with the customer's on-going business operations, the benefits demand response actions can provide to the customer, and the various means by which they can exercise their demand response within the NEM.
- Improving the quality of price signals to support demand response, including issues concerning non-interference with market price signals, extending the price signals of the NEM to the domestic sector, and exploring the potential to create a short term forward contract market and a long term market price signal for demand response

- Improving the ability of demand response aggregators to function in the market

- Reviewing the factors that may impinge on customers' ability to use their standby generators for demand response and ameliorating these wherever possible subject to other policy and regulatory settings

- Reviewing the factors that may impinge on NSPs' ability to encourage demand response and benefit from it and ameliorating these wherever possible subject to other policy and regulatory settings.

Figure 3 – Prioritisation of Barriers for Government Attention Given the Impact of Removing Each Barrier and the Relative Difficulty of Doing So



Note that (a) the numbers of the barriers correspond to those shown in Table 5, and that (b) it was not possible to determine whether the new Ancillary Services Market (Barrier 15) will pose a barrier to demand response.

Table 5 – Prioritisation of Barriers

No.	Barrier (for details refer to the sections noted)	Appropriateness of Government involvement (organisations likely to be involved)	Likely impact of removal of barrier	Likelihood that barrier can be overcome	Timeliness
1	Lack of customer awareness (6.1.1, 6.1.2)	Highly appropriate as provision of information is a common Government function, activity should centre on dissemination of market results, including Government experience (DNRE, VENCorp)	Moderate to high	Relatively likely	Fairly urgent
2	Lack of adequate pricing signals (6.1.3)	Appropriate for Government to be involved as provision of appropriate price signals is a primary requirement of markets, and original NEM design assumed price signals would reach customers (DNRE / NEM Ministers Forum)	Extremely high	Already being addressed by retailers for selected customers; will need to be extended to smaller customers. Superficially easy since no change in required – but requires discipline during difficult situations to be credible to the market.	Critically urgent

No.	Barrier (for details refer to the sections noted)	Appropriateness of Government involvement (organisations likely to be involved)	Likely impact of removal of barrier	Likelihood that barrier can be overcome	Timeliness
3	Air quality regulations (6.1.4)	Appropriate for Government to ensure that policy settings are consistent with Government al objectives (EPA)	Moderate	Not clear	Critical for use of standby generation in urbanised areas
4	NEC rules regarding market status of standby generators (6.1.4)	Very appropriate for Government to raise questions for clarification (DNRE)	Moderate	High	Important in near term
5	Network connection requirements for standby generators (6.1.4)	Very appropriate (VENCorp / ORG / DBs)	Moderate	Low to medium	Important in near term
6	Quality of price signal to be available to small customers under FRC	Very appropriate – design of FRC is a jurisdictional matter (DNRE and ORG are already working in this area)	Relatively high for domestic customers, but only moderate overall	Medium, as costs may be high, and customers may try to avoid the price signal	Important in near term
7	Retailers' need to minimise marketing and transactions costs (6.2.1)	Not appropriate fro Government to address directly, but provision of information for customer awareness addresses indirectly	NA	Low to impossible	NA

No.	Barrier (for details refer to the sections noted)	Appropriateness of Government involvement (organisations likely to be involved)	Likely impact of removal of barrier	Likelihood that barrier can be overcome	Timeliness
8	Lack of integration between trading and account management perspectives (6.2.2)	Not appropriate	Medium to high	Medium to high	Very timely
9	Availability of competing options (6.2.3)	Not appropriate for Government to address directly	NA	NA	NA
10	Inability of customers to negotiate their demand response capabilities separately from their supply contracts (6.3)	Appropriate for Government to provide information that increases customers' ability to exercise choice in the market (DNRE, ORG)	High	Medium	Very timely
11	Lack of a mechanism whereby the aggregator would get paid (6.3)	Appropriate; absent Government involvement it is unlikely that third party involvement will occur I the foreseeable future	High	Medium	Timely to start now, though solution is likely to take some time to eventuate
12	Current NSP pricing mechanisms (6.4)	Appropriate, as this is a jurisdictional issue (DNRE, VENCorp, ORG)	Moderate	Medium to high	Timely but not urgent

No.	Barrier (for details refer to the sections noted)	Appropriateness of Government involvement (organisations likely to be involved)	Likely impact of removal of barrier	Likelihood that barrier can be overcome	Timeliness
13	Lack of understanding of demand response by NSPs including integration of DS planning within NSP planning timeframes and practices (6.4)	Appropriate as they are government-regulated monopolies, though consistency with light-handed regulation should be maintained (DNRE, VENCorp, ORG)	Moderate	Medium	Timely but likely to take significant time to achieve
14	Lack of cost recovery mechanism for NSP investments in demand response capabilities (6.4)	Appropriate as they are government-regulated monopolies, though consistency with light-handed regulation should be maintained (DNRE, VENCorp, ORG)	Moderate	Medium to high	Timely but not urgent
15	Ancillary service market issues	Appropriate for jurisdictions to propose review of NEM functioning	Unclear whether a barrier exists; should be reviewed once market has been in operation for some time.	NA	NA

8. POTENTIAL SOLUTIONS

This section of the report identifies and discusses possible means for addressing those barriers that were identified in the previous section as being appropriate for Government involvement and susceptible of successful outcomes. After a discussion of what each solution would entail, a prioritised set of solutions is presented for consideration for implementation by Government.

8.1. IMPROVING CUSTOMER AWARENESS

Improving customers' awareness of and ability to enter into demand response arrangements, we believe, is the highest priority solution, and will require effort in the areas of education, empowerment, and (perhaps) incentives. While this effort should probably concentrate on larger commercial and industrial customers in the first instance, it should be expandable to address all customer classes. This will require customisation of the content and format of the awareness campaign to the needs of each customer class.

8.1.1. Educate Customers

Although awareness of and interest in demand response has increased among some larger customers, medium and smaller customers (and even quite a few of the larger customers are largely unaware of the potential they may have for demand response of the benefit it can provide. Our experience indicates that two factors drive interest in demand response: (a) rising energy prices and/or supply security problems, and (b) information about the magnitude of potential benefits. There has been a great deal of concern recently about increased prices and the potential for supply/demand imbalances in the coming summer. The currency of these concerns can serve as a rationale for Government to offer a variety of educational mechanisms for customers regarding demand response[7].

Specific educational approaches could include:

- Information seminars about demand response – While concern regarding current conditions may be the primary reason customers decide to attend, the content of the seminars should stress the benefit side of demand response. In this regard, the most successful approach is likely to be case studies. There are two ready sources of information on potential case studies: electricity retailers and consultants who have helped customers benefit from demand response, and who would therefore have a self-interest in promoting customers' understanding of and interest in demand response. These parties could help promote the seminars, however, presentations from customers

[7] Information on energy efficiency would also be relevant to current conditions.

themselves are likely to be most effective, as they will address the concerns other customers are most likely to have about demand response, namely, the ability to carry on business operations without undue disruption or negative impact, technical difficulties encountered and/or capital investment required, and the magnitude of the benefit provided. Seminars should also provide information about where customers can go to get technical assistance, as well as tips on appropriate commercial arrangements for demand response. This could include dissemination of information on key contractual features to look for, the use of a set of model contract clauses, and/or information about innovative electricity supply contracts that maximise the flexibility of the use of the demand response resource by the customer[8].

- Brochures and other literature – Brochures about demand response – particularly containing case studies and a referral to parties to approach for additional information and assistance – should be developed to provide additional takeaway resources from the seminars and to provide stand-alone resources to extend the reach of the seminar content to other customers. As in the case of the seminars, the content should focus on tangible benefits, but additional information other topics should also be included, such as: how to prospect your business for demand response opportunities, examples of alternative technologies that provide demand response capabilities as well as other benefits, and who to call for additional assistance in moving forward with demand response.

- Government involvement in demand response – Implementation of demand response in Government facilities would provide relevant case study material, demonstrate Government commitment to demand response, and contribute to the actual amount of demand response available in the market. It is important to recognise that the Government has considerable leverage and visibility as a buyer of electricity and related services; Government interest in demand response as part of its electricity purchasing – or interest in third-party services – is likely to be of significant importance. It could motivate more demand response activity on the part of retailers and/or provide assistance to demand response aggregators that are trying to launch commercial operations.

8.1.2. Empower Customers

Awareness and interest constitutes the first step toward making better use of the demand response resource that is present in many customers' facilities, but may not be sufficient on it own. Measures should also be undertaken to empower customers in their consideration of and negotiations regarding demand response. Of critical importance here are the following types of support:

[8] See section on Wholesale and Retail Contract Market Solutions for further information on innovative supply contracts.

- Training in demand response prospecting and operation for customers that want to do this on their own. This could constitute an additional and more technical set of seminars, or be provided on a customer-specific basis. The latter would best be organised on a fee for service basis, provided by professionals, perhaps with co-funding or promotional assistance by Government.

- Provision of sample tender document clauses, contract clauses, and negotiating tips for customers to use when negotiating demand response arrangements with their electricity suppliers.[9] These could be distributed at the seminars or on a stand-alone basis.

- Accreditation of demand response advisors/intermediaries might be considered, in the event that a large number of new players enter the market, and/or indications emerge that demand response advisors or service providers are engaging in deceptive or misleading conduct.

8.1.3. Provide Incentives

Several forms of incentive could be considered to increase customers' interest in investigating demand response. In order of increasing cost and complexity these might include:

- Removal from or improved positioning in the order in which mandatory electricity supply restrictions are imposed – Customers that enter into demand response arrangements could be given preferential treatment during times of mandatory electricity supply restrictions, in recognition of their assistance in avoiding such situations.

- Funding support for feasibility studies – Financial assistance could be provided to customers undertaking feasibility studies of demand response. It would be important to keep this assistance focused on applications where detailed feasibility studies really are required, rather than spawning an industry in feasibility studies. Consideration could be given to increasing the proportion of study costs that are funded for projects that are implemented.

- Demonstration projects – Funding could be provided for demonstrations of new or innovative demand response applications. These should be restricted to applications that (a) have not yet been undertaken, and (b) have high visibility and wide replicability. It would also be appropriate fro Government to recoup its funding through the revenue stream provided by exercise of the demand response.

[9] See Section 8.4.2 for a discussion of demand response contract design for allowing customers to exercise or trade demand response through third parties.

At present, it is not clear whether any of these incentives will be needed. We recommend that thought be given to their possible use, but that the impacts of the other two components of this solution be monitored prior to implementation of any incentives. Further investigation of the potential incremental impact of these incentives could also usefully be undertaken during the educational and empowerment activities.

8.2. MAINTAINING MARKET PRICE SIGNALS

As mentioned earlier, the presence of periods of very high pool prices is the factor that has been most responsible for driving forward the amount of demand response we have seen to date in Victoria. These high prices create opportunities for retailers, customers (and perhaps in the future, aggregators) to make money on demand response. Their interest in doing so, as also discussed earlier, can reduce market prices to all consumers, improve supply security, and result in an improved environment for infrastructure investments.

Without the high price signals, demand response will not eventuate.

While the intent is not to create periods of high pool prices, it is important for Government to recognise that actions it undertakes to dampen price signals will also dampen demand response. As such, it is recommended that Government recognise the impacts that the imposition of mandatory or voluntary load restrictions can have on market price signals, and therefore demand response, and exercise all possible restraint before exercising such measures. This will ensure the continuity of price signals to demand response customers, and reduce the risk of Government action stranding demand response assets or reducing returns on demand response activities.

8.3. EXTENDING MARKET PRICE SIGNALS AND DEMAND RESPONSE CAPABILITIES TO THE DOMESTIC SECTOR

While the highest priority for short term response is large and medium sized consumers, Victoria is currently at a critical decision point with respect to the implementation of full retail competition such that the metering/profiling debate may well define whether or not the medium to longer term potential of demand response down to the smallest consumers will be enabled.

The following recommendations are offered to ensure that the demand response potential of these customers can be harnessed in the market.

8.3.1. Review the Costs and Benefits of Metering to Enable Small Customers to Deliver Demand Response

Small customers can, in aggregate, deliver meaningful amounts of demand response through re-scheduling of end-uses like clothes and dishwashing, and reducing the use of other appliances such as lighting and air-conditioning. While interval metering is not a sufficient condition to promote demand response, it is a necessary one (for development of baseload and possibly verification load profiles).

The ORG is already undertaking a review of the potential benefits and costs of interval metering for customers with annual consumption below 40 MWh. It is important that the potential benefits of demand response to these customers and the market as a whole be included in this analysis.

8.3.2. Review the Opportunities and Cost Recovery Mechanisms for Central Switching

As discussed in Section 6, the economics of certain types of demand response – such as direct load control of air conditioning – are very sensitive to scale economies. Distributors are likely to be in the best position to install (and possibly operate) such equipment. There is, at present, however, little incentive for DNSPs to install such equipment, and virtually no means for them to recover its costs. The absence of this equipment essentially constitutes a lost opportunity.

As such, it is recommended that Government:

- Request the ORG to include central switching equipment in the list of demand side options to be considered by DNSPs in their network planning

- Convene a working group of DNSPs, DNRE, the ORG, retailers, and possibly VENCorp to explore (a) the means by which promotion of use of the switches would be undertaken, (b) how sufficient flexibility could be engineered into the system to allow separate exercise of different retailers' customers, (c) what rules would guide the priority of use of the shared demand response resource, and (d) how fair and equitable funding and pricing of the asset and associated services could be arranged between all relevant parties, including recovery of the initial asset cost by the DNSP, fees for service from the DNSP to the retailer (and potentially vice versa), and whether some portion of the fees for service to the DNSP should be used to defray costs passed through to the customer base.

8.3.3. Explore Initiatives to Enhance the Availability and Reduce the Marginal Costs of the Monitoring and Control Systems

Communications infrastructure and monitoring and control systems are needed to for certain demand response measures, particularly centrally switched demand response measures in smaller customers' facilities. The basic switching control systems have been widely used in Australia and are affordable for mass-market applications. Appropriate technology also exists for communications and monitoring, but has not been implemented in small facilities in Australia, and therefore may not have achieved sufficient economies of scale in production to reach affordable prices for the mass market.

Whether this is likely to pose a barrier to implementation of these demand response strategies remains to be seen. It is therefore recommended that the Government:

- Undertake further investigation of the availability and costs of these systems, and
- In the event that either of these factors seem likely to retard or preclude implementation of these demand response strategies, explore means for improving their availability and/or reducing their costs through initiatives such as bulk or forward purchasing.

8.4. FACILITATING THE ENTRY OF DEMAND RESPONSE AGGREGATORS

At present, customers have only one viable avenue for exercising their demand response potential: their electricity retailer[10]. It is our view that this amounts to an appropriation of a property or trading right from customers, and is likely to result in sub-optimal amounts of demand response in the market due to a variety of factors including: (a) constraints on retailers' resources (both technical and budgetary) for investigating demand response, which is not their core business, (b) the potential for other approaches to risk management to reduce or negate their interest in demand response. As a result, we believe that third-party demand response aggregators can provide a valuable service for customers and the market as a whole. Means for encouraging the entry of these players, listed in order of increasing cost and complexity, are discussed below.

[10] Technically, customers can also use demand-side bidding or arrangements with generators. The former, however, is likely to impose more risks and difficulties on the customer than benefits it provides as compared to the retailer route. The latter, to date, has proven to be a route open only to very large customers.

8.4.1. Use the Government's Demand Response Potential

Tendering out for investigation and implementation of the demand response potential of Government facilities, in conjunction with the other recommendations below, could provide significant business potential for one or more aggregators, particularly if Government facilities are currently supplied by more than one retailer. Such action would also demonstrate Government's commitment to demand response and provide input to the development of valuable case study material for the customer awareness effort described above.

8.4.2. Require Retailers to Offer Retail Contract Options That Allow the Customer to "Sell" Demand Response to Third Parties

As discussed earlier, variable-volume, fixed price contracts dominate the market because they provide customers with straightforward and effective risk management. However, they also preclude the customer's ability to exercise his demand response capabilities through any channel other than the serving retailer. As a result, a different contract structure will need to be available if third-party demand response aggregators are to function in the market.

Our proposed solution calls for the clear separation of a customer's retail energy purchasing from the commercial arrangements associated with the customer's potential demand side response at times of high prices in the wholesale market. These may merely be instances of high prices in the spot energy market, or they may extend to include periods of high prices in the various forward markets[11].

To achieve this clear separation, and to enable the customer to determine the merits or otherwise of active demand side response measures and receive the full market value of such actions, requires that the customer's contract with the retailer transfer full exposure to pool price at the margin from the retailer to the customer. The simplest way of achieving this outcome is for the retail contract to have the following features:

- For pool price levels below a contractually defined threshold level, the contract operates in the same way as any other normal retail contract – it is essentially a variable volume contract up to a contractually defined maximum pool price at a fixed per unit energy price. The purchase obligation of the customer in any trading interval would be determined by the physical metered quantities as measured at the customer's network off-take point. The contract price could include pass-through provisions associated with some or all of the unbundled fees for network services, NEMMCO pool fees etc.

[11] See Section 8.7 for a discussion of recommendations regarding forward contract markets for demand response.

- For pool price levels at or above the contractually defined threshold level, the contract would operate like the fixed volume swap contracts used in the wholesale market. That is, the customer would hedge a fixed component of his potential purchases during such times. The magnitude of the fixed volume commitment that the customer chooses to commit to would depend on the customer's own risk preferences and the degree of flexibility the customer has to reduce his demand under high pool price conditions.

These arrangements will allow the customer to decide what is the best strategy for maximising the value of his demand side response in the market. At one extreme, he could simply decide to exercise his demand response on an opportunistic "as available" basis and choose on each occasion as and when high pool prices occur whether or not to reduce his demand depending upon his own personal circumstances at the time.

At the other extreme, he could choose to sell a firm forward option in the contract market whereby he in effect would commit ahead of time to reduce demand whenever the option is exercised[12]. In reality, as the option is merely a financial instrument, he would still have the ability to choose not to reduce his own demand at the time but it would mean that he would need to purchase the equivalent amount of energy specified in the option contract at the prevailing high price in the spot market.

During the high-price trading interval (I), the amount owing by the retail customer to the retailer (C_I) would be defined as follows:

$$C_I = QC_I \times PC_I + PP_I \times (QA_I - QC_I)$$

Where:

QC_I = the threshold contract quantity in MWh for Trading Interval I;

PC_I = the contract purchase price in \$/MWh for Trading Interval I;

PP_I = the actual pool price adjusted for network losses in \$/MWh at the customer's purchase point in Trading Interval I; and

QA_I = the actual metered consumption at the customer's purchase point in Trading Interval I.

[12] Operating in this manner would require a short and/or long term forward contract market for demand response. Recommendations regarding the facilitation of these markets are discussed in Section 8.7.

To the extent that the customer reduces his consumption below the threshold quantity specified in the contract, the retailer will credit the customer's bill for that amount of energy at the prevailing pool price. This type of contract should prove to be attractive to retailers because it provides a greater degree of certainty about their level of "energy purchase commitment" at times of high pool prices. As this form of contract in effect transfers all of the volume and price risk at such times to the retail consumer, the risk premium demanded by retailers for such a contract in a truly competitive market environment should be considerably lower than for a standard variable volume contract.

At the same time, this form of contract provides the maximum level of incentive at the margin to the customer to reduce his demand in response to high pool prices quite independently of whether or not he has chosen to hedge the cost of any or all of his maximum potential physical energy requirements for those periods.

We are proposing that (a) some standard pro-forma retail contracts built around this two-tiered approach to retail energy purchasing be developed in collaboration with key industry and customer associations, and (b) retailers be required to make this contract available to customers upon request. It is likely that the most effective means for doing this will be to make the availability of these types of retail contracts a license requirement.

8.4.3. Providing Start-Up Funding for Aggregators

If the previous measures, in combination with the measures described in Section 8.7, are not sufficient to facilitate entry of demand response aggregators, and if start-up funding proves to be a barrier, Government could consider providing low-interest loans for demand response aggregator start-ups. Eligibility for such funding should be made contingent upon the presence of a suitable business plan, including proposed means for repaying the loans.

However, it is not clear at this time whether start-up funds are likely to be a barrier, and therefore we recommend only that monitoring be undertaken of the potential need for start-up funding.

8.4.4. Requiring Retailers to Pay Compensation for Non-Supply

At present, retailers do not have to compensate customers should they be unable to supply electricity. While retailers clearly should not bear the risk for non-supply due to the faults of others (e.g., distribution or transmission faults), they should be at risk for actions under their control. These would include inadequate hedging or contracting, should these lead to a decision by the retailer to curtail supply to customers against their will (absent an appropriate directive from NEMMCO or relevant state authorities). In such cases, the retailer should be liable to the customer for the value of lost production, business operation and/or amenity caused by the interruption of supply. This would probably need to be a license condition, and would therefore require that the current license requirements be amended.

Such a change would remove non-supply as a hedging strategy, though we hasten to add that there is no evidence at present to indicate that any retailers have seen (let alone used) non-supply as a price-risk hedging measure. Therefore, we recommend that this mechanism be held in reserve until such time as it is determined that non-supply is being used by retailers as a price risk hedging strategy.

8.5. IMPROVING CERTAINTY FOR THE USE OF STANDBY GENERATORS

The most significant barriers facing the use of standby generators for demand response include the following:

- Uncertainty regarding the impact of EPA emission requirements on the ability of customers to exercise their standby generators for demand response purposes
- Uncertainty regarding the market status of customers that need to break their physical connection to the grid prior to running their standby generator in either an islanded or synchronous configuration
- Differing and potentially overly complex requirements on the part of distribution companies for interconnection on the part of customers who wish to use their standby generators in parallel with the grid.

8.5.1. Clarifying the Impact of Clean Air Requirements

EPA emissions regulations and local government noise regulations can both serve to limit the availability of standby generator for demand response. As there is a significant magnitude of standby generation in the State's CBDs, these regulations are likely to have a material impact on the amount of demand response that can be developed in the State in both the near and longer term.

It is recommended that the Government convene a working group of officials from EPA, VENCorp, DNRE and the ORG to:

- Identify all EPA and local government regulations that may serve as constraints to the use of customers' standby generators for demand response
- Determine the amount by which current thresholds for emissions, noise and other factors would be exceeded by the expected exercise of the demand response capabilities of standby generation
- Quantify the value of exceeding those thresholds and compare that value with the value of the demand response that could be obtained
- Provide recommendations regarding the co-optimisation of demand response, air quality, and demand response.

8.5.2. Clarifying the Market Status of Customers Who Break Their Connection to the Grid to Run Standby Generation

According to NEMMCO officials, current provisions of the National Electricity Code (Code) may limit the direct participation of standby generation in the market, where that generation cannot be operated while connected to the main grid. While any application for registration with NEMMCO would be evaluated on its individual merits, this general issue could be a limiting factor for standby generation. If this part of the Code was found to be unreasonably limiting the emergence of demand side options in the market, then it may be appropriate to consider proposing changes to those provisions.

It is recommended that the Government more formally seek clarification of these Code provisions from NEMMCO and NECA.

Some other issues that might arise in registering standby plant for participation in the NEM include establishing acceptable metering arrangements, and possibly ensuring that the plant meets technical standards set out in the Code.

8.5.3. Ensuring that DB Interconnection Requirements Do Not Unduly Disadvantage the Use of Standby Generation for Demand Response

Local DNSPs often have stringent requirements for fault protection that apply to the interconnection of standby generators. These requirements are meant to protect the system from improper operation and/or integration of the standby generator, but meeting them can cost several hundreds of thousands of dollars. In addition, the specific requirements may vary between networks, adding further complexity for multi-site customers and aggregators.

It is recommended that the Government convene a working group of the DBs, VENCorp, DNRE and the ORG to:

- Review current interconnection requirements
- Identify significant differences in approaches between DBs
- Identify a recommended set of interconnection requirements that provide adequate safety and fault protection.

8.6. ENHANCING NSPS ROLE IN AND BENEFITS FROM DEMAND RESPONSE

Although NSPs can benefit from demand response and are in a position to provide key demand response functionality, there are a number of barriers to them doing so. Briefly, as described in Section 6 above, the most important of these include:

- Pricing mechanisms that are linked to energy flows and therefore reduce the NSPs interest in measures that reduce throughput;

- Lack of understanding of demand response opportunities;
- Planning timeframes that preclude development of demand response options;
- Lack of cost recovery mechanisms for investments in demand response;

As also noted in Section 6, the ORG has recently decided to require distributors to:

- Publish annual network planning reports
- Plan and augment their networks so as to minimise costs to consumers
- Pay a fair and reasonable share of avoided network costs to embedded generators and possibly to customers that manage their loads as well.

While these are good steps forward, we recommend that Government undertake the initiatives presented in the paragraphs below in order to enhance the involvement of both TNSPs and DNSPs in facilitating demand response and deriving benefits from it.

8.6.1. Make DNSP Planning Processes Transparent and Gives Proper Consideration to Demand Response

The ORG is already planning to require DNSPs to plan and augment their networks in ways that minimise costs to consumers. The Government should ensure that this requirement explicitly mandates that the planning process (a) be made as transparent as possible, and (b) requires DNSPs to demonstrate that they have given proper consideration to non-traditional investment options, especially demand response and other demand-side measures.

8.6.2. Give TNSPs More Responsibility for Ensuring Cost-Effective Demand-Side Alternatives to Network Investment Are Undertaken

Although the ACCC's regulatory test for new transmission network investment requires an assessment of demand side measures, it is not clear whether the regulatory requirement on the TNSP ends with the assessment or extends to "delivery" of cost-effective demand-side alternatives to new network investment.

Government should clarify the obligations of TNSPs with regard to cost-effective alternatives to new network investment and consider making TNSPs take greater responsibility for ensuring that such alternatives, including demand side options where relevant, are undertaken. This will require putting in place appropriate cost recovery (and possibly incentive) mechanisms.

8.6.3. Review VENCorp's Network Planning Procedures

Although VENCorp completed a review of its planning criteria and procedures earlier this year, it might be worthwhile for that exercise to be re-visited for the sole purpose of identifying additional measures that could be undertaken to provide increased facilitation of demand response and other appropriate demand-side measures.

8.7. PROVIDING WHOLESALE AND RETAIL CONTRACT MARKET SOLUTIONS

8.7.1. Standard Retail Contract for Demand Side Participation

The recommendation presented in Section 8.4.2 for the establishment of a retail contract for demand-side participation that replaces the current variable-volume fixed price contract structure with a variable volume contracts subject to a wholesale price cap is also required for customers to be able to trade their demand response potential in either the short term or long term forward markets, and is therefore considered a recommendation that is relevant to improving the functioning of the wholesale contract market.

8.7.2. Short-Term Trading Opportunities for Demand Side Participants

The original NEM market design called for the establishment of an exchange-based short-term forward market. The primary purpose of this market was intended to provide a liquid market with low transaction costs for participants to fine tune their contract position in the hours and days leading up to real time dispatch. Such a trading facility was perceived to be quite valuable particularly for physical market participants who needed to manage physical constraints associated with their generation or purchasing particularly where some amount of lead-time is required. This would apply for example to large baseload generators who must make plant commitment decisions up to a day or more ahead of real time dispatch.

It also applies to much of the potential demand side response where consumers need to modify production planning schedules, modify staff shift rosters, amend maintenance plans etc. By way of example, let us assume a retail customer has the capability to reduce his demand by 10 MW for a 4-hour period from 1pm to 5pm on 12 hours notice, and that it would be economic to do so provided that he would be paid at least $20,000 to do so. He would then offer to sell a 10 MW forward 2-way hedge contract in the day-ahead market for the nominated 4-hour period with a strike price of not less than $500 per MWh. On the vast majority of days, a standing offer in the market at that price would be rejected because it would be well above the prevailing forward price for that period.

However, if the expected supply demand position becomes very tight, when the forecast temperature for the next day is 40+ degrees Celsius, it is quite possible the day-ahead price could rise to $500 per MWh, in which case someone with exposure to pool price may opt to purchase the contract on offer. As soon as the forward contract is sold, the customer would set in train the necessary arrangements to curtail demand by 10MW during the 4-hour period.[13]

The combined effect of the customer's contract with his retailer and the forward hedge contract sold in the day-ahead market is that, regardless of the actual spot price on the day, the customer will receive his required $20,000 for the demand curtailment action.

The original proposal for NEMMCO to facilitate the establishment of such a market was dropped because of objections from a broad range of market participants who believed that it would develop naturally if in fact there were a demand for it. While there is some limited short-term contract trading occurring, it is in the form of over the counter (OTC) contracts and for contract quantities and durations that are generally not suitable for forward selling demand curtailment capability. Large baseload generators have learned to manage the trading risks associated with their plant inflexibilities without having access to an exchange-based short-term market. On the other hand, it has acted as a major barrier to the development of active demand side participation.

While a well-functioning, exchange-based liquid short-term forward market would provide considerable impetus to the development of demand side response and increased price elasticity in the market, we recognize that existing barriers that impede the development of such a market are formidable.

The existing structure of the industry with relatively few physical participants in some regions and the absence of an adequate regulatory regime to supervise market behaviour are major deterrents to short-term trading for other than the large physical players with lots of market trading experience.

In our view, there appears to be a range of deficiencies associated with the current operation of the contract market that should be of concern to the Government and which therefore warrant a quite detailed investigation as to the extent to which those deficiencies are jeopardizing the long term achievement of the NEM objectives. However, this issue is clearly beyond the terms of reference for this report.

[13] Because this is a contract mechanism, the customer would not actually have to reduce his demand. However, if he did not do so, he would have to have a contract in place for physical supply that he could exercise at that time time, and be prepared to pay the price required in that contract.

At the same time however, the lack of opportunities in the current contract market afforded to the demand side to forward trade demand curtailment opportunities on a short term basis would not be sufficient justification on their own to re-open consideration of the establishment a facilitated short-term forward market. This would suggest then that if Government decides for other reasons to undertake a much broader-based review of the operation of the wholesale contract market, then the potential merits of an exchange-based short term forward market should be considered as part of the potential package of solutions.

In the absence of such trading opportunities, the potential for demand side response in the market even in the long term will be essentially restricted to loads that can be curtailed with at best only a few minutes notice.

8.7.3. Efficient Pooling of High Pool Price Risk

The existing OTC market for trading and managing the risk of exposure to extremely high prices in the spot market is essentially limited to various forms of bilateral trading in options contracts. In addition, because of the limited availability and/or extra-ordinarily high contract prices for these products, anecdotal evidence would suggest that there has been a growing tendency towards self-insurance strategies on both sides of the market.

Generator companies with a portfolio of plant are tending towards a reduction in their overall contract quantities so that they carry their own physical reserve in the form of un-contracted generation. Retailers on the other hand are either building their own peaking plant or considering underwriting new peaking plant facilities to be constructed by others to ensure that the projects go ahead.

Arguably, this is the competitive marketplace at work with high pool prices and high prices for options contracts bringing on new investment when required. However, it could also be argued that this strong tendency towards self-insurance strategies on both sides of the market is symptomatic of inefficiencies in the options market where forward prices are rising to levels well beyond what should reasonably occur in a well-functioning forward market, and ultimately the cost of this inefficiency will flow through in the form of higher prices to retail consumers.

How material the inefficiencies are, and therefore their likely impact on retail prices to consumers is unknown, and it is well beyond the terms of reference for this report to consider this issue further. However, if market-based mechanisms could be developed to efficiently pool high or extreme pool price risk, these mechanisms would also provide strong forward price signals to those willing to invest in demand side measures that require up-front capital commitment. This could include such measures as:

- Additional working capital requirements on an ongoing basis to carrying higher stock levels that would enable production to be curtailed at relatively short notice for a limited period;

- Capital investment in switching and protection equipment as well as remote monitoring and control facilities that would enable a portfolio of standby generators to operate as a new form of reserve plant for the main power system;
- Capital investment in enhanced controls and/or increased production capability that provided greater flexibility for demand control by the customer; etc.

These forms of demand side response need to be considered like any other new investment opportunity, and they are unlikely to be developed unless the market can determine their value in the medium term and provide a forward commitment to purchase them for a sufficient length of time to justify the investment.

A highly efficient high pool price insurance market would be able to accurately determine the true market value of any non-firm supply side or demand side physical options that can be offered into the market and pool these non-firm options to create efficiently priced firm high-price financial insurance products to on-sell to traders in the market. This is very difficult to do through a bilateral market because it requires multiple customized bilateral contracts associated with any particular resource in order to pool the risks effectively.

For example, a demand reduction of 100 MW capability of two hours duration that could be called on without notice could be sold any number of times in the form of forward options contracts to multiple buyers on the grounds that most of the time, no 2 parties would exercise their call option at the same time. However, the seller of these options contracts would be potentially exposed to such multiple claims, and would therefore look at ways and means of managing that risk. He in turn may therefore opt to buy one or a number of even more limited options contracts with peak generators or others with similar demand reduction capability to cover of that risk.

Trading multiple limited call options contracts in this way on a bilateral basis does in theory provide a basis for financially pooling and trading high pool price risk, but the efficiency and price discovery associated with it are highly questionable. In addition, the options would need to be exercised ahead of time to enable the seller to initiate the necessary dispatch actions, and the transaction costs associated with short-term trading and settling of such contracts would be high.

The alternative being suggested would entail competing market-makers in the provision of standardised short and long term firm one-way options contracts purchasing a range of non-firm financial products from participants with physical hedge capability (peaking generators, customers with demand reduction capability etc.). The market maker would generally be buying on a long-term non-firm basis and selling on a medium to short-term firm basis.

As with the short-term forward market, the lack of opportunities in the current options market for forward pricing highly customised and potentially non-firm demand side response opportunities would not be sufficient justification on its own to justify major changes to the existing market. However, the Government should consider this issue further as part of a much broader-based review of the market's ability to manage high pool price risk efficiently and the impacts if any of any apparent deficiencies in this area on delivered prices to consumers.

Again, in the absence of such trading opportunities, the potential for any demand side response in the market involving an up-front investment will be very limited.

8.8. REVIEW OF THE ANCILLARY SERVICES MARKET

The new daily frequency control ancillary services markets are due to commence operation on 30 September 2001. Based on the New Zealand experience, these new, more flexible markets could greatly facilitate demand side participation in the provision of these services. Provided the demand side participation is strong, this is likely to significantly enhance the level of competition, particularly in the provision of contingency reserves, and result in a substantial downward pressure on reserve prices.

While there continue to be difficulties in the contract market that act as a significant barrier to the emergence of demand side aggregators, the establishment of the new ancillary services market could provide a major impetus to the creation of this new category of market participant that will be critically important in the overall development of demand side participation in the NEM.

It is important therefore that the rate of progress in the emergence of demand side participation in the ancillary services market and its effect on the emergence of demand side aggregators over the next six to twelve months is closely monitored. For this reason, we are proposing that, after the initial six months of operation, the extent of demand side participation in the new ancillary services market be critically reviewed, and any steps be taken to remove any unnecessary barriers that are impeding the growth in their participation.

9. SUMMARY AND PRIORITISATION OF RECOMMENDED SOLUTIONS

9.1. RECOMMENDED AND STAGE 2 SOLUTIONS

Table 6 summarises the recommendations presented in this Section 8 and prioritises them for consideration for implementation by Government.

While it is impossible at the current time to quantify the impact that any recommendation will have on the amount of demand response available in the market, the recommended set of initiatives reflects the consultant team's judgement as those initiatives that will, in aggregate, be required to provide a level of demand response capable of making a contribution in the areas originally envisaged in the design of the NEM, namely, to provide a check on the market power of suppliers, and reduce the need for investment in low duty-cycle generation plant, thereby contributing to security of supply. As such they were selected with regard to the following three factors:

- Their likely level of impact on the amount of demand response available in the market
- The likelihood that they can be achieved
- Their cost and complexity.

Table 6 – Recommended Solutions

Solution Set Recommended for Immediate Implementation by Government

Barrier (for details refer to the sections noted)	Solutions (for details refer to the sections noted)
Lack of customer awareness (6.1.1, 6.1.2)	Improve customer awareness by: ▪ Providing relevant information to customers on demand response benefits and operation via seminars, brochures and other literature, and the use of demand response in Government facilities as demonstration sites and case studies. (8.1.1) ▪ Empowering customers with regard to demand response through training in demand response prospecting and training, and the development of sample clauses to be used in tenders to and contract with electricity retailers to facilitate the customer's use of and benefit from demand response. (8.1.2)
Lack of adequate pricing signals (6.1.3, 6.3)	Maintain market price signals by: ▪ Being aware of the impacts that the imposition of mandatory or voluntary load restrictions have on market price signals, and therefore demand response, and exercising all possible restraint before exercising such measures. (8.2)

Barrier (for details refer to the sections noted)	Solutions (for details refer to the sections noted)
Potential lack of price signals in the domestic sector (6.1.5)	Extend market price signals and consider demand response functionality in the design of FRC by: ▪ Ensuring that the value of demand response to the market is included in the current ORG study of the benefits and costs of interval metering for domestic and other low consumption electricity customers. (8.3.1 ▪ Encouraging the ORG to consider including central switching equipment in the list of demand side options to be considered by DNSPs in their network planning. (8.3.2) ▪ Convene a working group of DNSPs, DNRE, VENCorp, the ORG and retailers to explore mutually acceptable operational and financial arrangements to support the use of centrally switched demand response at the smaller end of the market. (8.3.2) ▪ Monitor the availability and cost of communications and monitoring systems required to support the use of centrally switched demand response at the smaller end of the market. (8.3.3)
Lack of third-party demand response aggregators (6.3)	Facilitate market entry of demand response aggregators by: ▪ Tendering out investigation and implementation of demand response potential in Government facilities. (8.4.1) ▪ Requiring retailers to offer retail contracts that allow customers to sell demand response to third parties. (8.4.2)

Barrier (for details refer to the sections noted)	Solutions (for details refer to the sections noted)
Barriers to the use of standby generation for demand response (6.1.4)	Improve certainty for the use of standby generators by: ▪ Convening a working group of EPA, VENCorp, DNRE, and the ORG to clarify the impact of current air quality regulations on the use of standby generators and recommend policies to co-optimise demand response and air quality. (8.5.1) ▪ Formally requesting NEMMCO and NECA to clarify Code provisions regarding the market status of standby generators that cannot operate while connected to the grid. (8.5.2) ▪ Convening a working group of the DBs, VENCorp, DNRE, and the ORG to review DB interconnection requirements for standby generators and recommend a set of model requirements that provide adequate safety and fault protection without unduly disadvantaging the use of standby generation for demand response. (8.5.3)
Barriers to the use of demand response in networks (6.4)	Enhance the role of NSPs in and benefits from demand response by: ▪ Supporting the ORG's decision to require DNSPs to plan and augment networks in ways that minimise costs to consumers, and request that ORG consider mandating that DNSPs demonstrate that they have given proper consideration to demand response and other demand side measures in their network planning processes. (8.6.1) ▪ Giving TNSPs more responsibility for ensuring delivery of demand side alternatives to network augmentation where they are cost-effective. (8.6.2) ▪ Requesting that VENCorp re-visit its planning criteria and procedures for the sole purpose of identifying additional measures that could be undertaken to provide increased facilitation of demand response and other appropriate demand-side measures. (8.6.3)

Barrier (for details refer to the sections noted)	Solutions (for details refer to the sections noted)
Lack of contract mechanisms to provide forward price signals for demand response (6.1.3)	Explore the potential for wholesale and retail contract market solutions by: ▪ Suggesting that the NEM Ministers Forum consider undertaking an investigation of whether there are significant deficiencies in the current operation of the contract market, and if so, to also investigate (a) the potential impact of these deficiencies on achievement of the overall objectives of the NEM, including the ability of demand response to function in the market, and (b) the desirability of an exchange-based short-term forward trading as part of the overall "fix" of the contract market's problems, and an assessment of how market participants can be "encouraged" to develop such a trading mechanism. (8.7.2) ▪ Recommending to the NEM Ministers Forum that (a) a comprehensive review be undertaken of the market's ability to manage high pool price risk efficiently and the impacts of any apparent deficiencies on prices to consumers, and that (b) this review include a review of possible options for setting up of facilitating an insurance market. This could start with consensus from the jurisdictions that such a market would facilitate demand response (as well as firmer contracts, and hence assist the contestable retail market), and include encouraging the jurisdictions to create an environment to facilitate an insurance market and/or look into the possibility of mandating such insurance. (8.7.3)

Solution Set Recommended for Stage 2 Implementation by Government

These solutions would be implemented in light of the outcomes of the solutions described above. As such, they (a) would not be undertaken earlier than six months from the implementation of the first set of solutions, and (b) if needed, would all be implemented within two years of the first set of solutions.

Barrier (for details refer to the sections noted)	Solutions (for details refer to the sections noted)
Lack of customer awareness (6.1.1, 6.1.2)	▪ Providing or encouraging the development of an accreditation scheme for demand response advisors/intermediaries, in the event that a large number of new players enter the market, and/or indications emerge that demand response advisors or service providers are engaging in deceptive or misleading conduct. (8.1.2) ▪ Providing incentives for demand response which could include (a) preferential treatment for demand response customers during periods of mandatory electricity supply restrictions, and/or (b) funding for demand response feasibility studies, and/or demonstration projects (in both case with recapture of the incentive funding through subsequent demand response revenues). (8.1.3)
Potential lack of price signals in the domestic sector (6.1.5)	▪ If necessary, considering the use of measures such as bulk or forward purchasing to overcome barriers posed by the availability and/or cost of communications and monitoring systems required to support the use of centrally switched demand response at the smaller end of the market. (8.3.3)
Lack of third-party demand response aggregators (6.3)	▪ Providing start-up funding for demand response aggregators (8.4.3) ▪ Requiring retailers to compensate customers for non-supply in certain instances (8.4.4)
Potential barriers in the new Ancillary Services Market	▪ Recommending that NEMMCO and NECA review the operation of the new Ancillary Services Market after six months of operation to (a) see where (if at all) it can be enhanced to maximise cost efficient demand side participation, and, if required, (b) explore appropriate rule changes to enhance demand side participation. (8.8)

9.2. FUNDING STRATEGY

Three options exist for funding the recommended initiatives:

- Consolidated revenue – Although this source is available and entirely under the control of the Government, it is assumed that it is not the preferred source for funding the recommended demand response initiatives.
- A levy on the market – VENCorp already has the power to do impose a levy, and it should be considered as the preferred approach. If this approach is undertaken, it is recommended that a modest amount (in the order of $1 million) be budgeted for implementation of the recommended initiatives in 2001/02. This effort should include the development of a more definitive action program for subsequent years, including funding requirements. The VENCorp Board should be responsible for the overall program, and should (a) report regularly to Government on ongoing results, and (b) seek Government endorsement for the program and budget on an annual basis.
- NEM-wide funding – The NEM Ministers Forum may investigate demand response issues. If so, it is possible that the investigation would be funded through special NEM fees.

ATTACHMENT 1: SCOPE OF WORK

ELECTRICITY DEMAND SIDE MANAGEMENT – SCOPING STUDY

Background

Recent amendments to the Electricity Industry Act (s79A and s79B) have extended VENCorp's statutory role to facilitate the development of arrangements relating to the management of electricity demand ("demand side management" or "DSM"). The Act also allows VENCorp to enter into agreements and arrangements relating to the development of DSM proposals, and to recover associated costs for its activities in this regard from retailers and/or electricity market customers subject to approval of the Office of the Regulator-General.

The initial step in the development of any DSM program would be to better define the objectives of the program and therefore VENCorp proposes to develop the framework for and oversee the conduct of an initial scoping study.

Scoping Study

VENCorp is seeking expressions of interest from consultants (or other parties) to assist with the development of an appropriate scoping study and to undertake stakeholder interviews and analysis along the following lines:

(a) What is the current market problem that is sought to be addressed?

(b) What are the potential solutions and scope for success in addressing the defined problem?

(c) What are the existing barriers/constraints that prevent these solutions being implemented by the market (focusing primarily here on DSM options)?

(d) What can be done to resolve these constraints?

The output from the scoping study would be a VENCorp paper to Government defining the issues and putting forward a range of possible options for Government to consider – perhaps ranging from information dissemination at one extreme, to formation of a specialist aggregation/retailer function at the other – with a discussion of the advantages/disadvantages of the options and a recommended approach.

Next Steps

VENCorp has publicly advertised for expressions of interest to offer services to assist in the development of the scope of the proposed study, setting out their knowledge/expertise, their proposed approach and indicative costs/fee structures.

Following receipt and assessment of the expressions of interest, VENCorp would submit a recommendation to Government on a preferred consultant, along with a detailed terms of reference and cost estimate for the proposed scoping study.

An indicative timetable is as follows:

(a)	Advertisement calling for expressions of interest-	18 May 2001
(b)	Expressions of Interest due by	1 June 2001
(c)	VENCorp recommendation to Government on preferred consultant and detailed terms of Reference	end June 2001
(d)	Scoping Study completed (2 month duration) and consultant's report delivered	end August 2001
(e)	VENCorp recommendations to Government-	September 2001

ATTACHMENT 2: VICTORIA'S SUPPLY/DEMAND SITUATION

The Statement of Opportunities

NEMMCO's most recent Statement of Opportunities 2001 (SOO 2001) highlights a predicted shortfall of 81 MW below the minimum required level of 760 MW for peak loads in the summer 2001/02 for the integrated Victorian/South Australian grid. Over the longer term the reserve forecast for Victoria and South Australia is forecast to diminish in proportion to increases in the demand for electricity, in the absence of any new supply- or demand-side capacity. Details of the forecast reserve situation for Victoria and South Australia on peak summer days based on the SOO are presented below.

Table 1: Victorian and South Australia Forecast Reserve Margins

Regional Reserves With 143 MW of Demand Side Participation			
	Victoria	Vic->SA Transfer	South Australia
2001/02	447	177	232
2002/03	224	157	117
2003/04	102	0	-144
2004/05	-201	0	-456
2005/06	-472	0	-553
2006/07	-731	0	-644
2007/08	-976	0	-728
2008/09	-1233	0	-812
2009/10	-1520	0	-913
2010/11	-1768	0	-1024

Source: NEMMCO 2001 Statement of Opportunities

As illustrated, this forecast indicates that:

- In Victoria, the summer 2001/02 reserve level is just under the required 500 MW, on peak hot summer days.
- By the summer of 2001/02 South Australia reserves fall below the minimum reserve level of 260 MW. As for Victoria, the situation deteriorates rapidly, exacerbated in part by continuous reductions in the transfers from Victoria

- Victoria does not have adequate reserve for 2001/02 to provide sufficient transfers to South Australia to maintain the South Australian reserve requirement of 260 MW. Transfers further decline from 2001/02 to 2003/04.

As noted by NEMMCO at the time of publication of the SOO, there are no known or generation reserves and committed projects which can be expected to address the critical near term shortfall; hence new investment in the form of additional supply-side options, demand side participation or transmission interconnects will be needed to satisfy the combined reserve requirements in Victoria and South Australia for 2001/02.

In the longer term, NEMMCO has noted that there a number of are a number of new committed or advanced supply-side projects which could relieve the reserve shortfalls post 2001/02. Table 2 presents an overview of the more significant of these projects.

Table 2: Potential New Supply-side Options for Victoria and South Australia

Proponent	Project	Expected Commissioning
AGL	150 MW gas turbine in Victoria	December 2001
Origin Energy	50 MW gas turbine in Victoria	December 2001
Origin Energy	50 MW gas turbine in South Australia	December 2001
Murraylink	200 MW interconnector between South Australia and Victoria allowing access to 25 MW of additional reserves	January 2001
Edison Mission	320 MW gas turbine in Victoria	January 2002
Basslink	480 MW (nominal) interconnector between Tasmania and Victoria	Early 2003
SNI	250 MW interconnector between South Australia and Victoria allowing access to 65 to 250 MW of additional reserves	Not Approved
Thomas Playford	210 MW resulting from extension of power station's environmental licence	April 2004

Source: NEMMCO 2001 Statement of Opportunities

NEMMCO has committed to undertaking an investigation of 250 MW of supply-side potential offered by AGL and Origin, with a view to confirming the size of the plants and their commissioning dates. Should the full 250 MW be available by the end of December 2001, reserve levels in 2001/02 would be expected to exceed the minimum requirements.

As noted by NEMMCO, there is also scope for increasing the level of demand side participation in the market.

Addendum to the SOO

Following discussions with relevant jurisdictions, NEMMCO established a working group to review the load forecasts, generation project schedules and expected levels of DSP for the 2001/02 summer period. The working group comprised representatives from:

- NEMMCO
- Victorian Energy Networks Corporation (VENCorp), and
- The South Australian Electricity Supply Industry Planning Council (ESIPC)

The establishment of this group is in accordance with a program of work outlined in Section 8 of the SOO.

The key findings of the working group, to date, have been published in an addendum to the SOO[14]. An overview of the these findings follows.

- The 10 percentile maximum demand forecasts in Victoria and South Australia have been revised upward by 58 MW and 74 MW respectively to reflect higher than predicted demand growth – largely attributed to air conditioner sales. This revision results in the following peak demand forecasts:
  - Victoria – 8867 MW, and
  - South Australia – 3058 MW.
- The 10 percentile maximum demands in Victoria and South Australia prior to Christmas 2001 are expected to be at least 300 MW lower than over the peak summer period in January and February due to lower average temperature conditions.
- The current level of DSP for the coming summer has been revised downwards to 225 MW. Using a prudent estimate that 50% of this capacity be considered in the supply/demand assessment, the level of available DSP is now considered to be 10 MW. The approach of downgrading the capacity of the DSP resource by 50% is consistent with that used to derive the 143 MW of DSP presented in the SOO 2001 (50% of 286 MW).

14 NEMMCO, *2001 Statement of Opportunities Addendum 1*, June 2001,

- Based on information received from a number of proponents of new generation capacity who had publicly announced commissioning dates for prior to or during the coming summer the monthly profile for new generation in the coming summer has been revised. The new forecast is presented in Table 3.

Table 3: New Generation Capacity in Victoria and South Australia

Plant	Nov	Dec	Jan	Feb	Mar
Victoria	0	250	450	600	600
SA	0	50	150	150	150
Total	**0**	**300**	**600**	**750**	**750**

Details of the individual projects underlying the revised forecast are provided in Table 4.

Table 4: Summary of New Generation Capacity in Victoria and South Australia

Proponent	Project
Australian National Power (ANP)	Is working towards a target date of 1 December 2001 for the installation of an extra 65 MW at Snuggery and Mintaro in SA.
Valley Power	Expects to commission a 300 MW plant at the Loy Yang B site in Victoria by 1 February 2002.
Duke	Is planning to install a second unit with a capacity of 43 MW (31 MW during hot weather conditions) by 1 February 2002 at Bairnsdale, Victoria.
AGL	Is expecting to commission a 150 MW plant at Somerton in Victoria by 1 December 2001.
Origin	Expects to have commissioned its 95 MW plant by 15 January 2002 at Quarantine in South Australia.
AES Golden Plains	Its project plan for a 370 – 500 MW plant in Victoria will enable 129 MW of this capacity to be commissioned by 1 February 2002, should all necessary permits be granted by 1 August 2001

The revised supply/demand assessment for the summer of 2001/02 as presented in the Addendum is outlined in Table 5.

Table 5: Supply/Demand Assessment for Victoria and South Australia

	Nov	Dec	Jan	Feb	Mar
Existing Generation in SOO	10829	10829	10829	10829	10829
New Generation	0	300	600	750	750
Load Forecasts in SA	2897	2946	3058	3058	3058
Load Forecasts in Victoria	8341	8571	8867	8867	8505
DSP	110	110	110	110	110
Flow into Combined Region from Snowy	1500	1500	1500	1500	1500
Reserve Trigger Level	760	760	760	760	760
Reserve Margin With No New Generation	1201	922	514	514	876
Reserve Margin With New Generation	**1201**	**1222**	**1114**	**1264**	**1626**

ATTACHMENT 3: TECHNICAL OPTIONS FOR DEMAND RESPONSE

DSM resources could be captured via the implementation of three generic mechanisms:

- load shedding through interruptible loads and/or standby generation;
- load shifting by substituting other fuels for electricity or by time-of-use tariffs; or
- strategic energy efficiency improvements.

Although all of these mechanisms would impact on peak demand excursions on Victoria's electricity system, there are important distinctions between the three. These distinctions lie in three criteria, as summarised in Table 1 below, and discussed at greater length in the paragraphs that follow.

Table 1: Key Characteristics of Demand-side Response

Demand-side Response	Level of Demand-side Investment Required	Lead Time To Gain Capability	Short-term Response to Peak Conditions
Load shedding via interruptibility	Low to moderate	None to low	Short-term
Load shedding via standby generation	Low to high	None to medium	Short-term
Load shifting via fuel substitution	Moderate to high	Medium to high	Longer-term
Load shifting via time-of-use tariffs	Moderate to high	Medium to high	Longer-term
Strategic energy efficiency improvements	Low to moderate	Medium to high	Longer-term
Price Elasticity	Not Applicable	Medium to high	Longer-term

Load Shedding

There are two major dynamic response load-shedding options suitable for implementation amongst large commercial and industrial customers in Victoria:

- ***Interruptible loads*** –load reduction via rescheduling of essential process loads or shedding of discretionary loads.

- ***Standby generation*** – load reduction by substituting local standby generation plant for grid based electricity consumption.

In the small business and residential sectors dynamic DSM primarily occurs via:

- ***Direct load control***. Remote duty cycling of loads such as air conditioning, refrigeration equipment, swimming pool pumps or hot water utilising remotely controlled switching gear to reduce coincident peak demand.

- ***Voluntary load control***. Behavioural response by customers to switch off energy consuming equipment in their business or home on request from government or electricity supply authorities.

As has been evidenced by the VPX Capacity Support Program, and by market-based programs hosted by electricity retailers, response times for large customer interruptible/standby generator DSM resources can be as little as 5 minutes to 30 minutes and can provide sustainable capacity support for a number of hours. Hence, it technically offers a mechanism for providing the capacity to meet short duration peaks. This type of DSM resource is particularly attractive to: 1) electricity retailers hedging exposure to pool prices; 2) T and D businesses with system elements exhibiting sharp needle peaks; 3) generators managing their hedging contracts at times of high pool prices; or 4) commercial DSM aggregators.

Fuel Substitution and Load Shifting

Fuel substitution is self-explanatory in that involves replacing electrical equipment with alternative technologies that operate on fuels such as gas or renewables. Offsetting electrical usage will intrinsically reduce total electrical demand on the SA system in the longer term. Thus, fuel substitution may be a particularly effective DSM mechanism in situations where a transmission or distribution system element exhibits a relatively flat profile with no distinct short-term peak. Load shifting via time-of-use tariffs may also be a useful DSM technique in these instances.

Strategic Energy Efficiency

Strategic energy efficiency improvements encompass a broad range of techniques and technologies that effectively decrease total energy usage over a broad time band. All energy efficiency initiatives, by reducing usage, will tend to have the impact of lowering the total system demand. However, like fuel substitution, energy efficiency does not have the capacity to provide a short lead-time response to peak demand conditions; rather its main utility lies in the management of relatively flat system load profiles over a longer time frame.

Price Elasticity

In response to regional pricing signals, large electricity consumers elect to locate in regions with lower average pool prices. This a long term effect with highly geographically-specific DSM outcomes

Any or all of these mechanisms have the capacity to generate benefits for Victoria's Market Participants and end-use customers by increasing competition, lowering costs and reducing risk.