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AEMC

NATIONAL ELECTRICITY MARKET DEVELOPMENT

DSP Contribution to Standing Reserve for Reliability Purposes in the NEM

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VERSION HISTORY

Version History					
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1) ABBREVIATIONS

AEMC	Australian Energy Market Commission
CQ	Central Queensland
CRA	Charles River Associates
CRR	Comprehensive Reliability Review
DSP	Demand side participation
DUoS	Distribution use of system (charges)
EUAA	Energy Users Association of Australia
ESIPC	Electricity Supply Industry Planning Council
ERIG	Energy Reform Implementation Group
FCAS	Frequency Control Ancillary Services
MLF	Marginal Loss Factor
MRL	Minimum Reserve Level
MT PASA	Medium term projected assessment of system adequacy
NEL	National Electricity Law
NEM	National Electricity Market
NEMDE	NEM dispatch engine
OCD	Over-constrained dispatch
OCGT	Open cycle gas turbine
QNI	Queensland to New South Wales Interconnector
RT	Reserve Trader
RERM	Reliability emergency reserve mechanism
RERT	Reliability emergency reserve trader
SOO	Statement of Opportunities
SR	Standing Reserve
ST PASA	Short term projected assessment of system adequacy
SWQ	South West Queensland
TUoS	Transmission use of system (charges)
USE	Unserved energy
VoLL	Value of lost load

2) OVERVIEW OF THE PROJECT

2.1) BACKGROUND

The AEMC's review of demand side participation (DSP) in the NEM includes three stages. This project is concerned with Stage 2. Stage 2 is a broad review of the Rules to identify barriers to integration of DSP in the NEM and to develop Rule change proposals where changes may improve efficiency. Four aspects of the NEM arrangements are relevant to Stage 2:

1. Economic regulation of networks;
2. Network Planning;
3. Wholesale and financial markets; and
4. The utilisation of DSP for reliability purposes.

It is the last of the above aspects to which this project relates.

A standing reserve (SR) was identified by the Comprehensive Reliability Review (CRR) as a potential mechanism to assist the achievement of reliability standards in the NEM. The essential elements of SR are:

1. The SR would contract ongoing levels of reserve for periods of several years;
2. The volume of reserve to be contracted would be set centrally and the price paid for the reserve would be determined from a tender or auction process;
3. The reserve would be comprised of supply-side elements, or demand-side elements or both;
4. The SR would only be able to operate when a NEM Region wholesale dispatch price was at the level of VoLL and only as a substitute for physical shedding of customer load.

This project is concerned with the use of DSP for reliability purposes, and in particular through the potential SR mechanism.

2.2) PURPOSE OF THE PROJECT

The purpose of this project is to assess the implementation of SR in the NEM, in the context of Reserve Trader arrangements and other available alternatives.

In particular, AEMC is seeking to investigate whether the use of SR would improve the efficiency of supply of reserve and ensure the maintenance of reserve in the market. In addition, AEMC want to investigate if there are other alternative mechanisms that may improve the use of the demand-side in providing reserve.

2.3) SCOPE OF INVESTIGATION

The scope of this project has been identified by the AEMC as follows:

1. Whether, in contrast to the existing Reserve Trader arrangements, efficiency in the market would be improved through the introduction of SR, having regard to:
    - The need to ensure that reserve levels are maintained;
    - The likely and probable impacts on existing plant (including peaking plant) and future investment;
    - The impact on transaction costs for demand-side providers of reserve;
    - The extent to which SR may crowd out alternative market mechanisms for using demand-side resources to meet reserve levels.

2. If there are other potential mechanisms in addition to the existing Reserve Trader and potential SR scheme that may facilitate DSP and also ensure the reliability of supply in the NEM in an efficient way. If other mechanisms are identified, the consultant should have regard to the same matters as those provided for the SR.

As advised by the AEMC, this analysis is predicated on the fact that the standing reserve (or alternatives) would operate outside the energy market, and centrally contracted reserve under the SR mechanism would only come into operation in VoLL circumstances.

2.4) NATIONAL ELECTRICITY LAW OBJECTIVE

The NEL objective provides the assessment framework against which the proposed SR mechanism can be judged in order to achieve consistency with the principles underpinning the NEM. The objective of the National Electricity Law (NEL) is set out below.[1]

The objective of this Law is to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

(a) price, quality, safety, reliability and security of supply of electricity; and

(b) the reliability, safety and security of the national electricity system.

This objective may be summarized as requiring efficiency of investment and operation and use of electricity services for the long term interests of consumers. In the circumstances of demand side bidding this means that where DSP can be utilized in the NEM to increase efficiency of operation or use of electricity, it should be allowed to do so.

The long term interests of consumers are served by both price and non-price (such as service quality and reliability) outcomes. For the purposes of this review, an increase in reliability of supply, even if it came at an increase in price, may be in the long-term interest of consumers. That is, an increase in price is not a *per se* indication that a particular mechanism does not achieve the NEL objective.[2]

The long term interests of consumers are served under the NEL by the promotion of efficiency. It was noted in the Second Reading Speech for the NEL that the long run interests of consumers are maximized when the NEM achieves economic efficiency.[3]

Accordingly, in assessing whether SR will be consistent with the NEL Objective, we have taken a long term view of whether or not its introduction would advance economic efficiency in the electricity market.

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[1] National Electricity Law, Cl 7.

[2] Expert Panel on Energy Access Pricing, Report to the Ministerial Council on Energy, April 2006, p36.

[3] Expert Panel on Energy Access Pricing, Report to the Ministerial Council on Energy, April 2006, pp36-37.

3) BACKGROUND

The National Electricity Rules require NEMMCO to operate an electricity spot market that balances electricity supply and demand through a central dispatch process. This process incorporates the provision for demand side dispatch bids for scheduled loads in the NEM,[4] and scheduled loads must provide to NEMMCO two days ahead of each trading day its available dispatch, energy availability for energy constrained scheduled load and ramp rate constraints.[5] This report has been based on the *National Electricity Rules Version 20*, 1 May 2008, current at time of preparation of the report.

Under the Rules, the NEM is in a Reliable Operating State when the following conditions are met:[6]

1. Load has not been disconnected, and is not expected to be disconnected by NEMMCO pursuant to Cl 4.8.9;
2. Load shedding is not occurring and is not expected to occur within the NEM; and
3. Short term and medium term levels of capacity reserve are assessed by NEMMCO to at least be sufficient to meet the required levels.

Meeting the 0.002% unserved energy reliability standard in the NEM is currently predicated upon the operation of two core mechanisms. The first is based on prices in the NEM. Competitive market forces and VoLL[7] signal the need for investment in reliability, operating in conjunction with the calculation of minimum reserve levels (MRLs). When market prices are high or VoLL events occur due to an inability to meet demand in the NEM, a signal is provided to potential investors in capacity options such as peaking generation.

The minimum reserve levels consistent with achieving the Reliability Standard are calculated by NEMMCO. MRLs convey to the market when reserve is not sufficient within the NEM to meet projected demand, thereby creating an investment signal for alternative sources of reserve. In the event that the published MRLs are not sufficient to attract the required investment for the operation of the NEM in accordance with the reliability standard, intervention mechanisms can be used in the NEM. It is a primary function of the MRLs to signal when investment is required in the NEM to avoid the necessity for market intervention. MRLs provide a signal for investment to meet forecast demand, for example additional generation investment, but do not provide the same signal for investment in demand side participation to ameliorate the need for such investment.

A distinction must be drawn between capacity and USE. The reliability standard in the NEM is expressed in terms of the permissible amount of USE. USE refers to that level of supply of electricity that is not delivered to customers, thereby failing to meet customer demand. Reserve capacity is the means to ensure compliance with the reliability standard.

[4] *National Electricity Rules Version 20*, 1 May 2008, Cl 3.8.7.

[5] *National Electricity Rules Version 20*, 1 May 2008, Cl 3.8.4(d).

[6] *National Electricity Rules Version 20*, 1 May 2008, Cl 4.2.7.

[7] The other price mechanisms related to reliability in the NEM are the Cumulative Price Threshold which operates to control financial exposure risk and a market floor price.

The reserve capacity in the NEM is equal to the amount by which available generation exceeds the demand for electricity.[8] Capacity is measured by reference to whether there is sufficient capacity within the network to ensure that demand is met at all times.

3.1) PRICE MECHANISMS AND MRLS

NEMMCO calculates MRLs that provide the reserve required to meet the reliability standard and monitors the supply-demand balance in the NEM to determine whether sufficient capacity reserve is available, or sufficient investment is being undertaken to ensure that capacity reserve will be available by the time it is required.

As a first step in NEMMCO's process to ensure that sufficient capacity reserve is available, reserve requirements are published in a number of forums. These forums include the Statement of Opportunities (SOO), short term and medium term projected assessment of system adequacy (ST PASA and MT PASA), and also in seven day outlooks during summer and in market notices where appropriate.[9]

In response to the reserve requirements identified, price mechanisms in the NEM operate to allow a market based response to identified reserve requirements. When the market operates effectively, it is expected that the response by the market will be sufficient to deliver the reserve required. It is only when the market is not seen to be responding by providing adequate capacity reserve that intervention may be undertaken.[10]

3.2) INTERVENTION MECHANISMS – RESERVE TRADER

The only intervention mechanism currently in place in the NEM with respect to the reliability standard is the Reserve Trader. The trigger for the operation of the Reserve Trader mechanism is the declaration of a low reserve condition in accordance with Cl 4.8.4. Reserve Trader also operates to ensure that the reliability standard in the NEM is met, although it only comes into operation when the market has failed to provide sufficient capacity to meet scheduled demand. As the market is intended to provide capacity reserve requirements for the NEM in most circumstances, the Reserve Trader mechanism operates in the short term to provide for an additional contracting mechanism to meet capacity reserve.

The National Electricity Rules provide the process that is to be undertaken in relation to the Reserve Trader mechanism in Cl 3.12.

3.3) DEMAND SIDE PARTICIPATION

The term 'demand side participation' (DSP) can be referred to in a number of contexts in relation to electricity markets. DSP refers to actions that can be undertaken by the

[8] NEMMCO, *Management of Capacity Reserves*, 25 September 2003, p1.

[9] NEMMCO, *Management of Capacity Reserves*, 25 September 2003, p3.

[10] NEMMCO, *Management of Capacity Reserves*, 25 September 2003, p4.

demand side (that is, end users of electricity) to provide better price signalling and potentially improved market efficiency. It is a hallmark of electricity markets internationally, as well as the NEM, that while supply side participation in an electricity market can be readily facilitated, a number of barriers appear to frustrate attempts to allow efficient participation by the demand side. This review is focused upon the use of DSP for reliability.

Electricity markets are akin to other markets in that efficient market operation entails both demand and supply side participation, with the lowest possible informational barriers and market distortions in place. [11] As electricity cannot be effectively stored and technology is not in place facilitating better information transfer, it is commonly noted that end user participation is not a feature of electricity markets, even where there is a competitive supply side in place.

Efficient provision of reliability is ensured when the mandated amount of reliability for the electricity market is delivered at least cost, with as few resources dedicated to delivering reliability as possible.[12] Allowing least cost provision of reliability requires that all sources of reliability that may be used are available to the market. As DSP may be used to provide reliability to the market, its absence could indicate that reliability may be more efficiently provided by incorporating DSP. Whether DSP is more efficient than other forms of reliability will be determined by its effectiveness, and its cost (as measured by reference to other available alternatives). With respect to the delivery of reliability at least cost, the potential for DSP to be lower cost than other sources of reserve should not be used to justify overlooking the fact that DSP is also likely to have more uncertainty associated with its operation, particularly until more experience is gained in the NEM with the use of DSP. The uncertainty of DSP is often referred to as a lack of ‘firmness’ when compared to other reserve alternatives such as network and generation investment.

Energy only markets must avoid the ‘missing money’ problem in the provision of reliability in order to ensure the efficient provision of capacity reserve. To maintain reserves in energy only markets, high prices for electricity must be paid to reserve providers for short periods. If prices are suppressed when supply is deficient (or close to deficient), a missing money problem is said to develop as investors in generation are not able to recover the full costs of the investment that has been made. Commonly however, some cap is placed on prices in electricity markets to avoid prices rising to levels that are externally perceived as unacceptably high. Avoiding the creation of a ‘missing money’ problem must be balanced against the risks to market participants of allowing energy prices to rise too high during shortfalls. One alternative to operating an energy only market as in the NEM is to also operate capacity markets in order to ensure the provision of sufficient capacity reserve by the market. In some circumstances capacity markets can reduce the difficulties presented by the missing money problem, but this is by no means certain: markets with capacity trading can experience under-investment, and energy only markets can support

[11] Richard Cowart, ‘*Efficient Reliability The Critical Role of Demand-Side Resources in Power Systems and Markets*’ June 2001, p31. “Efficient prices result from the constant, well-informed interaction of supply and demand in an open marketplace.”

[12] It is theoretically possible to set the appropriate reliability level through market mechanisms, but as a matter of practice, and because of the complex inter-relationship between retail supply, distribution, transmission and generation, reliability is not left solely to the market. Rather, reliability standards are externally mandated.

efficient investment. The actual impact of these 'alternative' markets is fundamentally dependent on the market rules that are put in place.

An efficiently operating electricity market will have sufficient generation capacity to meet demand, including during peak periods, at prices that customers are willing to pay. Should the market signals fail to provide an investment incentive sufficient to meet demand at all times (or if the costs of reaching the imposed reliability standards are in excess of the value to customers), some form of back-up, currently the Reserve Trader mechanism in the NEM, is generally considered appropriate (and indeed necessary in order for the USE obligation to be met).

Whether or not the NEM will operate satisfactorily by reference to the 0.002% USE reliability standard is determined by reference to the actual reserve level. Reserve has generally been provided by the supply side through generation investment, supplemented by certain highly specialised short duration interruptible loads such as smelter pot lines.

The use of SR has been proposed as a potential means to allow DSP to be involved in delivering reliability in the NEM as the SR is a mechanism to secure generation or load reserve. The key features of SR are introduced in section 4) of this report. SR does not necessitate DSP, nor is DSP fundamental to its operation. But there appears to be an implicit assumption that an increased DSP participation in reliability (and in the NEM more generally) is desirable, in the sense of raising market efficiency. This further implies that there is some market failure at work that prevents DSP that would, absent the failure, be forthcoming. It would therefore seem to be sensible to address, first, whether there is a market failure and if so, its nature, and second whether SR as proposed is the best way of correcting the failure.

3.3.1) Barriers in Rules to Efficient Integration of DSP in the NEM

It has been contended that the current Rules do not provide for the conditions required to stimulate DSP in the NEM. This lack of provision for DSP has been said to include the Reserve Trader provisions. The timeframes required to develop a tender for Reserve Trader, and the duration of the Reserve Trader contract have been criticized as too short, thereby not providing a sufficient incentive for end users of electricity to invest in DSP. [13]

The ENA has also contended that a long term policy commitment to demand side management is required to increase the utilization of DSP and to encourage investment and research in demand side management. The current Reserve Trader mechanism does not provide such a long term policy commitment, and nor does the Rules, except to the extent that market prices should provide credible signals as to long term investment in demand side management.[14]

[13] Energy Response, *Comments on the Second Interim Report August 2007*, 28 September 2007, p2.

[14] ENA, Demand Management Regulatory & Policy Framework, February 2008, p iii.

With respect to reliability, the ENA noted that concerns over the firmness of demand side options constitute a barrier to greater utilization of DSP. This was attributed to the strong regulatory incentives for reliability for electricity networks as in this environment with a strong focus on reliability the lack of firmness of demand side options relative to other alternatives led to a lack of DSP utilization. Incentives for demand management in delivering reliability were suggested as a mechanism to increase demand side management. Suitable incentives targeting a reduction in the risk of uncertainty as to the firmness of demand side responses will decrease the justification for intervention over time, as accepted by the ENA.[15]

Deterministic planning criteria are suggested by the ENA to entrench the use of infrastructure investment to deliver network reliability. Demand management is not always available in a manner that is a direct substitute for infrastructure investment, particularly as infrastructure investment occurs in discrete units that do not necessarily reflect how demand management is available. A probabilistic planning approach was suggested as a way to avoid this bias against demand side management.[16]

3.3.2) Proposed Rule Changes to Reduce or Remove Barriers

To prevent the Rules presenting a barrier to the efficient integration of DSP in the NEM they should be written in technology neutral language. This must include, to the greatest extent practicable, making obligations for participation suitable for all types of technology and ensuring that the timeframes used are suitable for the greatest mix of technology possible. However, a mechanism that is designed to ensure reliability in the NEM in the event of market failure is not necessarily the most appropriate mechanism to facilitate the efficient integration of DSP in the NEM.

It is suggested that Rule changes be directed at policies in the short to medium term that address the market failure represented by under provision of DSP in the NEM. Once the utilization of DSP in the NEM has increased, indicating that the market failures have been corrected, the need for such policies should be reviewed as it is likely that they could be efficiently removed from the Rules.

3.4) IMPACTS OF OTHER PROPOSED RULE CHANGES ON MODELLING OUTCOMES

This modelling has been predicated on the operation of the Rules currently in place for the NEM. Possible Rule changes that could or will impact upon the operation of VoLL or reliability when implemented will have profound implications for the operation of the SR mechanism. The following box addresses a rule change proposal by the AER (the energy industry regulator) that is currently being considered by the AEMC (the rule maker for Australia's energy markets). The significance of this Rule change proposal for the operation of the NEM's VoLL mechanism, and the SR mechanism considered in this

[15] ENA, Demand Management Regulatory & Policy Framework, February 2008, pp iv, 5.

[16] ENA, Demand Management Regulatory & Policy Framework, February 2008, p 22.

project should not be underestimated, including the persuasive force represented by the fact that the AER has proposed the Rule change.

Box 1 AER's Request for a Rule Amendment Relating to the Determination of Spot Prices

The AER provided a rule change proposal to the AEMC on 17 March 2008. The rule change proposal relates to the operation of Clause 3.9.2 of the Rules, and would represent a change to the responsibility of NEMMCO in the event of contingency events in the NEM. The rule change would relate to the circumstances in which VoLL currently is invoked when a contingency event occurs under the automatic load shedding provisions. NEMMCO's dispatch algorithm would be used to determine the price during automatic load shedding. The role of NEMMCO during manual load shedding in setting VoLL would be unchanged. In the event of manual load shedding in response to a supply shortfall, VoLL would still be invoked representing the value of lost load.

The AEMC is currently considering the proposal under s94 of the National Electricity Law.

The AER has identified that in circumstances such as those that occurred on 16 January 2007 when transmission lines were tripped due to bushfires in the region of interconnectors between NSW and Victoria NEMMCO may experience difficulty in complying with its obligations. These obligations include the requirement for NEMMCO to determine whether more load could be restored after an automatic load shedding event and whether the power system has been restored to a secure operating state whilst also under the obligation to invoke VoLL when required by the Rules.

The AER states that its proposal is intended to allow NEMMCO to focus on returning the power system to a secure operating state.

The effect of this change is predicted by the AER to be that in the event of automatic load shedding, as load is restored prices will approach VoLL based on generator offers. The AER notes that the usual structure of bids in the NEM means that the highest offer in each region is at or close to VoLL. For this reason, once all load that can be restored has been restored in the event of automatic load shedding in makes intuitive sense that prices based on generator bids will have risen close to VoLL. In the event of a sustained supply/demand imbalance that initially triggers automatic load shedding, once NEMMCO is required to give instructions to interrupt load blocks the conditions for VoLL based on manual load shedding would be satisfied.

The frequency of VoLL events due to manual load shedding would not be expected to change. It should also be noted that VoLL events due to this type of load shedding are relatively rare in the NEM. By contrast the frequency of VoLL events in the NEM in total would be likely impacted by the removal of NEMMCO's responsibility to set prices to VoLL in the event of automatic load shedding. While periods of high prices around such events are still likely to occur based on the AER's analysis provided in its rule change proposal, the frequency of actual VoLL events in the future is far less certain.

The importance of this rule change if implemented stems from the fact that SR is to be used in the NEM only during VoLL events. A reduction in the number of VoLL events would reduce the impact that SR would have on the market in terms of delivering reliability and also the extent to which SR would be relied upon as less VoLL events would occur.

In the event that SR is not used as much as current Rules would suggest it may be, SR will have an even smaller benefit in terms of increasing the utilisation of SR in the NEM.

A Rule change that influences the number of VoLL events in the NEM will have profound implications for the operation of the SR mechanism. In addition, the proposed Rule change will have a fundamental impact on the role of VoLL in the NEM. It is antithetical to the operation of an energy only market for price to not move to VoLL when the market is forcibly interrupted. As it is the value assigned to unmet demand in the NEM, in circumstances of unmet demand in the NEM the price of electricity should be VoLL.

Data source: Australian Energy Regulator, Request for making of a rule amendment relating to the determination of spot prices, available from http://www.aemc.gov.au/electricity.php?r=20080409.130713 .

A Rule change proposal has also been lodged with the AEMC relating to demand management in the NEM and its treatment in the Rules. The Draft Rule Determination on this Rule change proposal is not to be released until 26 September 2008. The Rule changes proposed relate to substantially increased use of demand management in place of supply side alternatives. Unlike the Rule change proposed by the AER above however, these changes are not likely to have a substantial impact on the operation of a standing reserve mechanism.

The Total Environment Centre has recently submitted a Rule change proposal that at its core suggests that demand management should be considered as a means of meeting energy demands before alternative options are considered. It has been suggested by the TEC in its Rule change proposal that there lack of demand management is fundamentally due to inherent market biases against demand side alternatives.[17]

4) PROPOSED STANDING RESERVE MECHANISM

The proposed role of SR, as articulated in the CRR, is to form an additional mechanism for ensuring the reliability standard in the NEM is met. The SR would form an additional 'layer' between the price mechanisms and Reserve Trader as currently in place under the Rules.

The figures below demonstrate the additional layer that would be created by the SR mechanism, and indicate that the SR mechanism will be analogous to an insurance that levels of USE will not be exceeded in the NEM.

[17] Total Environment Centre, Rule Change Package Demand management and transmission networks, November 2007.

Figure 4.1 – Current reserve and reliability in the NEM

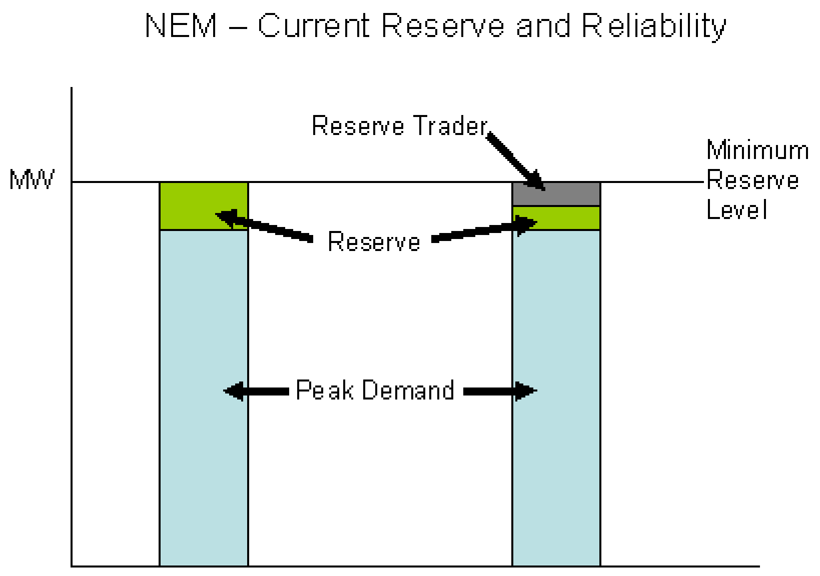
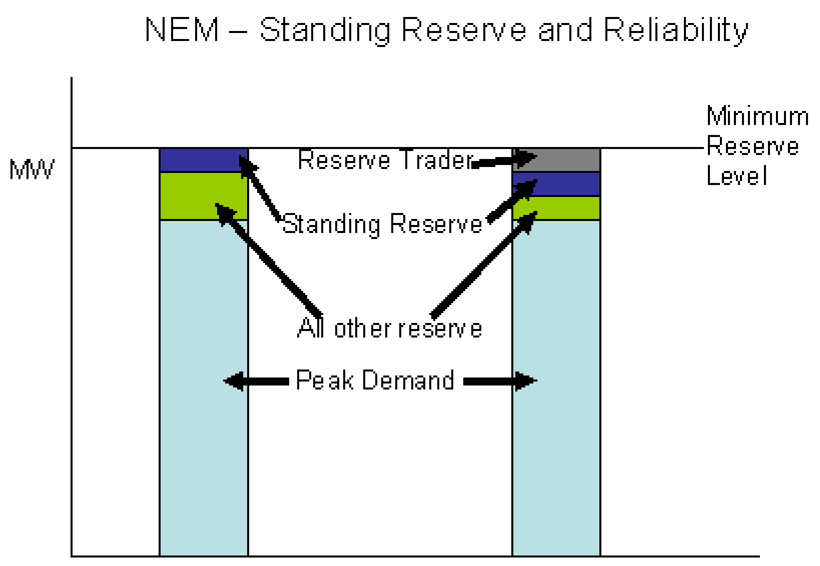


Figure 4.2 – Standing reserve and reliability in the NEM



The SR mechanism is proposed to contract SR on an ongoing basis when compared to the short term operation of the existing Reserve Trader arrangements. For the purposes of this analysis the AEMC has advised to assume that the contracted SR will be in place for a period of 3 years. The proposal for SR explicitly notes that the SR will be ongoing. For this reason, it has been assumed that SR would be contracted on a 3 year rolling basis.

The design of the SR mechanism would need to maintain neutrality between demand and supply side sources of reserve in order to maximize the efficiency of its operation.

Reserve is to be procured centrally under the SR mechanism. The requirement to procure SR centrally would be likely to manifest as a role to be undertaken by NEMMCO. There are two main alternatives that are proposed: a tender process and an auction process. For either of these alternatives it must be determined whether the volume of SR that NEMMCO wishes to procure will be released prior to the call for tenders or the auction taking place. The alternative to this would be for the volume of SR to be determined once further information on the price that reserve is being offered at by the market is revealed.

Under a tender process, the central authority would call for tenders to provide SR in the NEM. It would then be up to the central authority to determine, with the NEL objective in mind, which tenders can best assist in meeting reliability reserve in the NEM. A tender process could operate with the volume of SR to be contracted released prior to the tender process, or the volume determined once the tenders have been received by the central authority. The primary advantage of not releasing the volume of reserve required under the SR is that the central authority can then determine the volume based on the tenders received. It should be noted however that if tenderers knew the volume of reserve required prior to tendering they would have more information as to the volume of reserve they may wish to offer.

An auctioning process akin to the current operation of the spot market for energy could be used to procure reserve. Under such an auction, reserve bidders could bid a volume of reserve at a certain price, and the use of a number of bids could be facilitated. As with the tender process, the volume of SR to be contracted could be released prior to the auction, or alternately could be decided by the central authority once bids have been received. It would be advantageous to bidders to have at least some knowledge of the volume that is intended to be contracted (even if this volume could be varied once bids are made) to inform their formulation of bids.

Under the tender or auction process it would also need to be identified what price would be paid to the reserve providers. For example, each reserve provider could receive their tender or auction bid price, or as in the current NEM arrangements for energy in the spot market, each bidder could receive the market clearing price, based on the volume of reserve that the central authority wishes to procure.

Prior to the end of the 3 year contracting period a new call for tenders or another auction would need to be held to provide for the continuing operation of the SR mechanism.

5) REVIEW OF PREVIOUS WORK

5.1) RELIABILITY PANEL CRR REPORT

The Reliability Panel's Comprehensive Reliability Review (CRR) was undertaken to examine the NEM's reliability settings. The Panel noted that the NEM's existing reliability standard had allowed the NEM to perform well and did not suggest any change to the target level of USE. Instead, a number of options that could be used to change the reliability mechanisms were proposed.[18]

A standing reserve (SR) was considered in the CRR Report as one of the options that would provide additional targeted reliability reserve. The SR contemplated involved introducing contracts for SR over several years, with the volume of reserve to be provided through the SR to be set centrally. The SR was not to operate other than when VoLL events occurred. It was clear that SR, as contemplated by the Reliability Panel, was to operate in a longer term manner than the current Reserve Trader arrangements. The potential for SR to replace all reserve currently in the market was noted, but the matter was not considered in detail.[19]

It was stated that additional contracting (that is, the SR) would lower USE and increase total costs for the NEM. If the SR was provided by plant it was expected that the costs of the SR would be approximately $50M across the NEM, but that these costs would be lower if lower-cost plant or demand side response were employed.[20] In so far as the current NEM does not appear to attract large scale DSP, it is not entirely clear that high levels of DSP in the SR would result in lower costs.

The AEMC noted that a number of factors, including the lack of demand side participation, limit the ability of electricity customers in the NEM to provide demand side price signals.[21]

The Reliability Panel noted that the design of the SR must avoid distorting incentives for capacity to be provided through market mechanisms. Rather, SR would operate as insurance against the failure of the market mechanisms. The market should be allowed to deliver the money required to encourage investment that is required. This appears to be a difficult ideal: there can be no doubt that creating a market for capacity that is separate from the energy spot market, with different pricing and operating rules, will change investment incentives and in that sense can be said to distort incentives relative to the current market arrangements. Whether those 'distortions' make the market more or less efficient is an open question.

The Reliability Panel has not made a recommendation in relation to standing reserve:

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[18] AEMC Reliability Panel, '*Comprehensive Reliability Review Final Report*', December 2007, pp xi, xiii.

[19] AEMC Reliability Panel, '*Comprehensive Reliability Review Final Report*', December 2007, p58.

[20] AEMC Reliability Panel, '*Comprehensive Reliability Review Final Report*', December 2007, pp58-59.

[21] AEMC Reliability Panel, '*Comprehensive Reliability Review Final Report*', December 2007, p13.

> *The analysis work and the modelling undertaken for the Panel suggests that the standing reserve concept (either demand-side, generation or a combination thereof) may be capable of making a contribution to reliability in the future. The Panel is not recommending the adoption of a standing reserve mechanism as a fundamental change to the current market design at present. This would require consideration of, and decisions by, policy makers to implement. However the Panel intends to provide information and analysis gathered in this Review to the AEMC in relation to the potential to develop medium-term demand-side reserves (as discussed in Section 5.5).*[22]

The following extract from the CRR final report, states that the effect of additional contracting would be to lower USE and increase total costs by the cost of the contracting.

> *The effect on the market of additional contracting would be to lower USE and increase total costs by the cost of the contracting. As the standby plant would not be permitted to operate other than at VoLL, and only as a substitute for physical shedding of customer load, market prices and revenues to all other plant would be largely unaffected.*[23]
>
> *To illustrate the effect, standby reserve generation was added in the modelling as follows:*
>
> - *140 MW in Queensland;*
> - *360 MW in NSW;*
> - *150 MW in Victoria;*
> - *40 MW in South Australia.*[24]
>
> *With standby capacity in these locations, USE would fall by approximately 0.0003%.*[25]

It is unclear as to how the arrangements have the potential to replace all reserve currently provided in the market if the contracting is intended to lower USE, as stated in the following extract:

> *In each case, the volume of reserve sought under contract would be decided centrally, and there would be discretion as to how much reserve is*

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[22] AEMC Reliability Panel, '*Comprehensive Reliability Review*Pg 63; CRR Final Report', December 2007, p 63. Dec 07

[23] AEMC Reliability Panel, '*Comprehensive Reliability Review*Pg 58; CRR Final Report', December 2007, p 58. Dec 07

[24] AEMC Reliability Panel, '*Comprehensive Reliability Review*Pg 58; CRR Final Report', December 2007, p 58. Dec 07

[25] AEMC Reliability Panel, '*Comprehensive Reliability Review*Pg 59; CRR Final Report', December 2007, p 59. Dec 07

> *likely to be required. Such arrangements may have the potential to replace all reserve currently provided by the market.*[26]

The following extract implies again that the SR is a true insurance provision and not a replacement reserve.

> *…standby contracts should not be seen as a substitute for part of the existing arrangements but as a true 'insurance' against the failure of those arrangements to work.*[27]

Whether this outcome is correct depends fundamentally on the contracting and payment rules of the SR scheme. It is, however, unlikely that SR will have no impact on the incentives of participants operating in the energy market, and therefore that the scheme solely operates as insurance against market arrangements failing to work.

Since the role of SR as defined by the CRR and supporting materials appears slightly ambiguous as to whether it is intended for inclusion within the installed capacity to meet MRLs[28], or to augment the existing reserve mechanisms, both possibilities have been addressed as part of this investigation.

5.2) MODELLING BY CRA

Part of the modelling commissioned by the Reliability Panel concerned standing reserve analysis. In undertaking this modelling, it was assumed that SR would account for 25% of the reserve that NEMMCO normally requires to meet the capacity reserve margin. This equates to approximately 2% of system peak coming from the demand side. The demand side reserve was bid into the market at VoLL -$1. The demand side response was distributed on a pro rata basis across the regions of the NEM based on peak demand.[29]

It was concluded, based on the analysis undertaken, that demand side SR will reduce the volume of peak generation that will be profitable. The first order effect of demand side SR was considered to be a substitution effect, where the demand side SR replaced the most marginal (highest cost) peaking generation. It was considered that a second order effect would also however eventuate. This was that the remaining peaking generation would experience increased certainty of revenue based on higher utilisation of remaining peaking generation.[30]

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[26] AEMC Reliability Panel, '*Comprehensive Reliability Review*Pg 58; CRR Final Report', December 2007, p 58. Dec 07

[27] AEMC Reliability Panel, '*Comprehensive Reliability Review* Pg 63; CRR Final Report', December 2007, p 63. Dec 07

[28] MRL= Minimum Reserve Levels

[29] CRA International, '*Final CRR Report Appendix Modelling Methodology, Input Assumptions and Results Second Stage Modelling*' December 2007, p29.

[30] CRA International, '*Final CRR Report Appendix Modelling Methodology, Input Assumptions and Results Second Stage Modelling*' December 2007, p30.

The amount of SR that would be required in the NEM was predicted to increase substantially over the forecast period. Under a standing reserve arrangement the revenue:cost ratio of OCGT generation would be slightly lower than under the status quo, but the certainty of OCGT revenues would be substantially greater.[31]

6) IMPACTS OF THE PROPOSED STANDING RESERVE MECHANISM

SR could impact on two aspects of NEM operation:

1. It could increase reliability in the NEM by providing another class of reserve to reduce unserved energy (USE) where lost load would otherwise occur; or
2. It could increase the quantum of DSP in the NEM.

As can be seen from the discussion of the Comprehensive Reliability Review undertaken by the Reliability Panel, and the modelling completed pursuant to it (see section 5.1), the possibility for SR to impact on both of these targets was acknowledged. The objective of the proposed SR mechanism as advised by the AEMC was that SR was not intended to increase the reliability of the NEM by changing the level of USE, but only to ensure that reserve levels are maintained.

It is important to identify the objectives of the SR mechanism in order to assess whether the SR mechanism is the most efficient means of fulfilling those objectives. It should also be noted that the targets for a policy measure must be aligned with the instruments to deliver those targets. An efficient alignment of instruments with targets generally requires that each policy instrument address only one target.[32] In the circumstances of the proposed SR mechanism (or its alternatives), a decision must be made as to whether the chosen mechanism is to be used to:

1. Deliver increased reliability in the NEM, or to
2. Increase utilisation of DSP.

Requiring a mechanism to achieve both of these targets may only result in the chosen alternative failing to optimally achieve either.

6.1) DSP FOR STANDING RESERVE

The fundamental question to be asked in order to determine whether demand side resources can be effectively and efficiently used in an area of the market has been expressed as follows:[33]

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[31] CRA International, '*Final CRR Report Appendix Modelling Methodology, Input Assumptions and Results Second Stage Modelling*' December 2007, pp35-36.

[32] The need for equality between instruments and targets is attributed to Tinbergen see The New Palgrave Dictionary of Economics, Volume 4, 1998, p653.

[33] Richard Cowart, '*Efficient Reliability The Critical Role of Demand-Side Resources in Power Systems and Markets*' June 2001, p34.

Could the function of this market or the purpose of this rule be served at lower cost and/or lower risk through demand side resources? And if so, how can we organize this market or structure this rule to ensure that high-reliability, low cost solutions are in fact developed?

For the purposes of this report, this can be expressed as:

Could the reserve in the NEM be served at lower cost and/or risk through the use of SR? Can SR be organized to ensure that DSP is efficiently facilitated, and how can it be structured to secure efficient reliability?

6.1.1) Potential for Improvement

Whether SR causes an improvement or deterioration in the efficiency of the delivery of reliability in the NEM can be judged by reference to the following critical issues:

- The price of electricity in the NEM (including any additional costs of SR);
- The frequency and duration of VoLL events in the NEM;
  - More frequent VoLL events would be expected to increase average prices in the NEM. As the level of reliability in the NEM is to remain unchanged, this would represent a decline in efficiency;
- The impact on the Reserve Trader mechanism of SR;
  - If SR is to improve the efficiency of the delivery of reliability in the NEM then it would be expected that it would supplant either entirely or substantially the role of the Reserve Trader mechanism, which is only in place in the NEM to apply in circumstances of market failure.

It should be noted that, to the extent that VoLL truly represents the value of unserved energy to the marginal customer on the network (that is interrupted), it follows that that consumer is entirely indifferent to whether they are or are not supplied when there is a VoLL event. If VoLL is set correctly, there is no efficiency gain from providing energy (to avoid actual interruption) when prices reach VoLL. Simply put, no customer is willing to pay for it. On its face, then, SR is unlikely to improve long-run outcomes, unless it reduces the risk of a severe follow on event such as a system collapse (which would necessitate a black start).[34]

There may be an efficiency gain from SR if VoLL reflects that average willingness to pay for USE, in so far as replacement of that energy at VoLL provides energy to customers at prices that they would be willing to pay. Unfortunately, if this is the case then the NEM is effectively capping market prices below maximum willingness to pay. If so, market prices will not encourage sufficient investment and it is entirely unsurprising that DSP is modest.

[34] If this is, indeed, the source of the efficiency gain, it is not clear that the pricing model in SR as proposed reflects this.

On the assumption that VoLL does reflect the preferences of the marginal consumer, it is important that measures to encourage DSP result in market prices at which the customer is willing to cease consuming, *not* VoLL.

Whether the introduction of SR is intended to increase reliability in the NEM was ambiguous in the CRR. If the reliability margin will remain with USE of 0.002% then as the proposed SR will be neutral as to whether demand or supply side sources of reserve are utilised, DSP would be expected to displace at least some generation reserve. The extent of this displacement would depend on the volume and price of SR that is contracted, the extent to which DSP constituted the SR and the extent to which the SR market pays a premium to expected revenues from the energy only market (or represents less risk for a given expected revenue). To the extent that DSP is lower cost than supply side alternatives (and provided market failures that impede DSP do not prevent this lower cost resource from participating), the utilisation of demand side reserve will represent an improvement in efficiency for reliability in the NEM. By contrast, if SR were to be used to deliver additional reserve in the NEM then generation reserves may be displaced to a lesser extent or may not be displaced at all. The AEMC has confirmed that the intended use for SR is to meet the existing reliability standard rather than improve upon it.

Other potential improvements to the efficiency of reliability in the NEM relate to the fact that DSP remains a small part of NEM operations, but SR could provide a mechanism to increase DSP involvement. This increased potential for DSP involvement would be likely to be evidenced if a SR firmed up DSP in the NEM, and increased the opportunities for DSP involvement by lengthening the timeframes for DSP involvement relative to Reserve Trader, and providing increased certainty of a return being paid for DSP investment.

The implementation of SR will not remove the need for the Reserve Trader mechanism in the NEM, though SR may decrease the NEM's reliance on the Reserve Trader. The same Reserve Trader arrangements will be necessary as a mechanism to ensure reliability in the NEM in the event of market failure in delivering required capacity, but the incidence of Reserve Trader being called upon may decrease. To the extent that less reliance on Reserve Trader represents an increase in efficiency of delivering reliability in the NEM, for example through providing reliability using less resources, then SR may increase the efficiency of delivering reliability in the NEM.

6.1.2) Potential for Deterioration

The introduction of SR may also pose a risk to the efficiency of the NEM. The assessment of any deterioration of efficiency can also be judged by reference to the critical issues identified in section 6.1.1). Some of the issues that may be associated with the operation of SR are introduced below. These issues are considered further in our modelling and analysis below.

With respect to the price of electricity, if SR increases the frequency and duration of VoLL events in the NEM, the average wholesale price of electricity will increase. Whether this is associated with a loss of efficiency will depend on whether this allows reliability to be delivered at less cost (or lower resource cost). At least in the short run, higher prices alone may be a transfer from some market participants to others, rather than a loss of efficiency per se (noting that the NEL Objective requires a long term assessment of efficiency consequences). However, to the extent that VoLL does not reflect the true opportunity cost of power (to the marginal generator or customer) — which seems likely as the increase in VoLL events is an artefact of the separation of energy markets and SR, there will inevitably be an allocative efficiency penalty and some dead weight losses. The magnitude of these losses is difficult to determine.

An increase in the price of electricity in the NEM and an increase in the frequency and duration of VoLL events would also change future generation investments, and the decisions of investors in relation to future generation capacity. For some existing generation, an increase in electricity prices, and an increase in the frequency and duration of VoLL events will increase returns to these investments. For other, higher cost, generation that SR supplants in meeting reserve requirements in the long run, the standing reserve will have a negative impact on this investment. These changes to the returns of existing generation may be inefficient results arising from the operation of SR. A change to the long term investment decisions of participants may not be efficient or lead to least cost investment decisions.

For new generation investments, an increase in the frequency and duration of VoLL events and in NEM prices would be associated with a change to generation investment decisions towards peaking plant.

If SR is used to increase DSP in the NEM, then SR will not always address the issue at hand in VoLL events, particularly in the case of a local network issue. The use of SR in these circumstances is an inefficient mechanism to address reliability issues in the NEM.

6.2) ALTERNATIVE MECHANISMS

Alternative mechanisms are available to be used in the NEM to achieve the objectives of the SR mechanism. The objectives that could be achieved through the use of the SR mechanism are either to

1. Increase reliability in the NEM, or to
2. Increase the utilization of DSP.

In this context, the alternatives are those that could be used to achieve either of these objectives.

6.2.1) Alternative Mechanisms to improve reliability

If the intention of the SR mechanism were solely to increase reliability in the NEM, the most effective mechanism to achieve this would be through an explicit change to the current reliability setting, expressed by reference to the level of USE. An increase in the level of VoLL would also be likely to be required in accordance with a tightening of the reliability standard. However, the emphasis on DSP seems to indicate a broader objective than reliability alone.

6.2.2) Alternative Mechanisms to improve use of DSP

Increased DSP in the NEM can be achieved by correcting the market failure associated with its lack of provision. The SR mechanism is an indirect mechanism to achieve this objective, providing only a relatively narrow role for DSP to be increased. In addition, the SR mechanism means that the value of DSP is tied to the VoLL settings of the NEM, rather than being signalled to the market. A more suitable alternative would be to use a mechanism that brings DSP into the market to prevent VoLL occurring. Some electricity customers would be expected to have a valuation of electricity supply less than VoLL, in which case such customers should have their involvement in the NEM facilitated to increase efficiency of NEM operation. Alternative mechanisms can increase utilization of DSP for reliability, particularly load management measures. Demand side mechanisms that can contribute to effective load management include:

1. Pricing reform of DUoS (and, to a lesser extent, TUoS);
2. Smart metering as price signals will be able to be provided to the demand side during peak load periods;
3. Load control;
4. Interruptibility agreements (eg ripple control);
5. Research and trials of DSP to remove concerns as to uncertainty and firmness of demand side management.

Load control mechanisms such as ripple control are not new to Australia, particularly ripple control in relation to hot water systems. Reliability and network investment are substantially impacted by the volume of peak demand in the electricity network, particularly as during off-peak times much of the network's capacity is not utilized. By shifting demand from peak to off-peak periods, such mechanisms can be effective in changing peak demand, and improving reliability and efficiency of the electricity network.

Box 2 Ripple Control in NEM Jurisdictions

Ripple control is an established load control mechanism in NSW, QLD and SA. It is widely used for switching residential water heating off in peak times and on in off-peak times. Further applications are found in pool pumps, air conditioning and street lighting. It is also used to signal different electricity tariffs. Ripple control mechanisms are not as common in the other NEM participants ACT, VIC and TAS. The planned national mandatory roll-out of smart meters which is scheduled to start at the end of 2008 might have adverse effects on ripple control systems. The reason is that smart meters will be able to be used for load control and this might make ripple control redundant. States that do not have ripple control system or are faced with the replacement of its system might support smart meters rather then ripple control systems.

In NSW, all electricity distributors use ripple control mechanisms. The most common usage is for load control. Integral Energy, for instance, uses ripple frequency signals to operate off-peak hot water heater and street lighting systems. Energy Australia is involved in load control trials related to air conditioning and pool pumps. It has been installing ripple control receivers (e.g. RM1+, RM1P+ and RC5000) for users of its distribution network. Ripple control is also used by Country Energy which estimates the annual costs of running its ripple control system to just below $10 million.[35]

In Queensland, ENERGEX uses ripple control receivers to control tariffs in most areas excluding the CBD.[36] Further applications are the remote control of curtailable load such as electric hot water. An alternative to ripple control signals would be local control of curtailable load through e.g. time clocks or light sensors. ENERGEX is also undertaking the so-called “Cool Change” trial[37], which is a project for small customers and involves air conditioner direct load control.

In South Australia residential demand management through direct load control has been identified as an important demand management instrument for ETSA Utilities. ETSA use receivers and relay switches to cycle large numbers of off-peak water heaters using a ripple control signal carried along the low and medium voltage distribution network.[38]

In Victoria and Tasmania, direct load control based on ripple control is not as common as in QLD, NSW or SA. In an attempt by Citipower and Powercor to receive an allowance for the expenditure for a roll-out of ripple control technology in Victoria, the ESC rejected this proposal.[39] However, the Victorian Government plans a roll-out of a Mandatory Advanced Metering Infrastructure Program based on smart-meters with remote reading and remote switching facilities towards the end of 2008. Implications of a nation-wide roll-out of smart meters for ripple control is discussed in the next section.

New technology, particularly smart metering, offers the opportunity for increased DSP through more sophisticated load control alternatives. In particular, unlike the mandatory, automated character of ripple control, smart metering would also facilitate increased voluntary demand shifting to increase efficiency through price responsiveness in the NEM.

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35 http://www.mce.gov.au/assets/documents/mceinternet/Country_Energy_submission20080417103110.pdf, p. 7.

36 http://www.energex.com.au/upload/technical_documents/20050610_134837_1373.pdf

37 http://www.aer.gov.au/content/item.phtml?itemId=718846&nodeId=f7b367214df8f39abd73dcfcb58558a4&fn=Issues%20paper%20(April%202008).pdf

38 http://www.efa.com.au/Library/PeakDemandonETSASystem.pdf

39 http://www.advocacypanel.com.au/documents/Applic57.pdf

Load management mechanisms can assist reliability by either reducing energy demand or shifting energy use to different time periods (from peak to off-peak consumption). It is particularly important to note that alternatives to SR can provide increased DSP utilization during NEM operation in more diverse market situations than only during VoLL.

A number of other options may be available to be used in the NEM to improve the use of DSP participation. However, these options do not relate specifically to VoLL events or reliability. The most prominent of these measures include energy efficiency and tariff reform (particularly if associated with smart metering).

To the extent that SR is costly, it may be more efficient to use those same resources on targeting the well understood impediments to more generalized DSP in the energy only market (a cost of $50m to implement SR has been suggested).

7) ASSESSMENT OF PAST VOLL EVENTS

7.1) VOLL BY TIME AND LOCATION

Since December 2006, there have been approximately 78 5-minute periods of VoLL, and several of these have been assessed to identify the primary causes of VoLL and the potential for SR to be of benefit in these circumstances. There have also been many additional 5-minute periods for which prices in at least one region have exceeded $5000/MWh, including many periods approaching VoLL. However, only the periods of VoLL have been given consideration here, as these are the occasions for which SR would be invoked.

Historically, the majority of VoLL pricing events are short duration price spikes resulting from sudden 'step' changes in system conditions, often due to an outage, or the reclassification of a multiple contingency. This results in very high ramp rate generation being 'must run' for a short period after the step change – which is typically hydro generation bidding at or near the market price cap. As these events are both transient and do not represent any supply deficit or reliability/security issue, standing reserve is unlikely to have been utilised.

17th March 2008

One of the sequences involving VoLL (depicted in Figure 7.2) was the high load period on 17 March 2008, when VoLL in Victoria was reached. This was due to Murray in Snowy region trading at $9999, uplifted by the MLF, resulting in VoLL in Victoria. This was a classic example of a period of VoLL, owing to record loads, but was not associated with any reliability reduction and, in fact, spare capacity existed in Victoria at the time. An increase in load in the VIC-SA region could only be met by local generation as both BassLink and Tumut-Murray were constrained. As most generation in the region was already fully dispatched ramp rate capability in response to changes in system conditions was limited. In this situation, even small changes in supply demand balance can result in large price spikes.

The 5-minute periods immediately before and after the VoLL event had prices well below VoLL, as shown in Figure 7.1 and Figure 7.3. SR is likely to have alleviated the reserve shortfalls present – both SA and VIC were in reserve deficit.

In the 5-minute dispatch immediately following the VoLL event, units bidding at below the market price limit were able to ramp up, changing the marginal generator and reducing the price to less than VoLL.

Figure 7.1 – 17-03-2008 4:00PM VIC – Prior to VoLL event

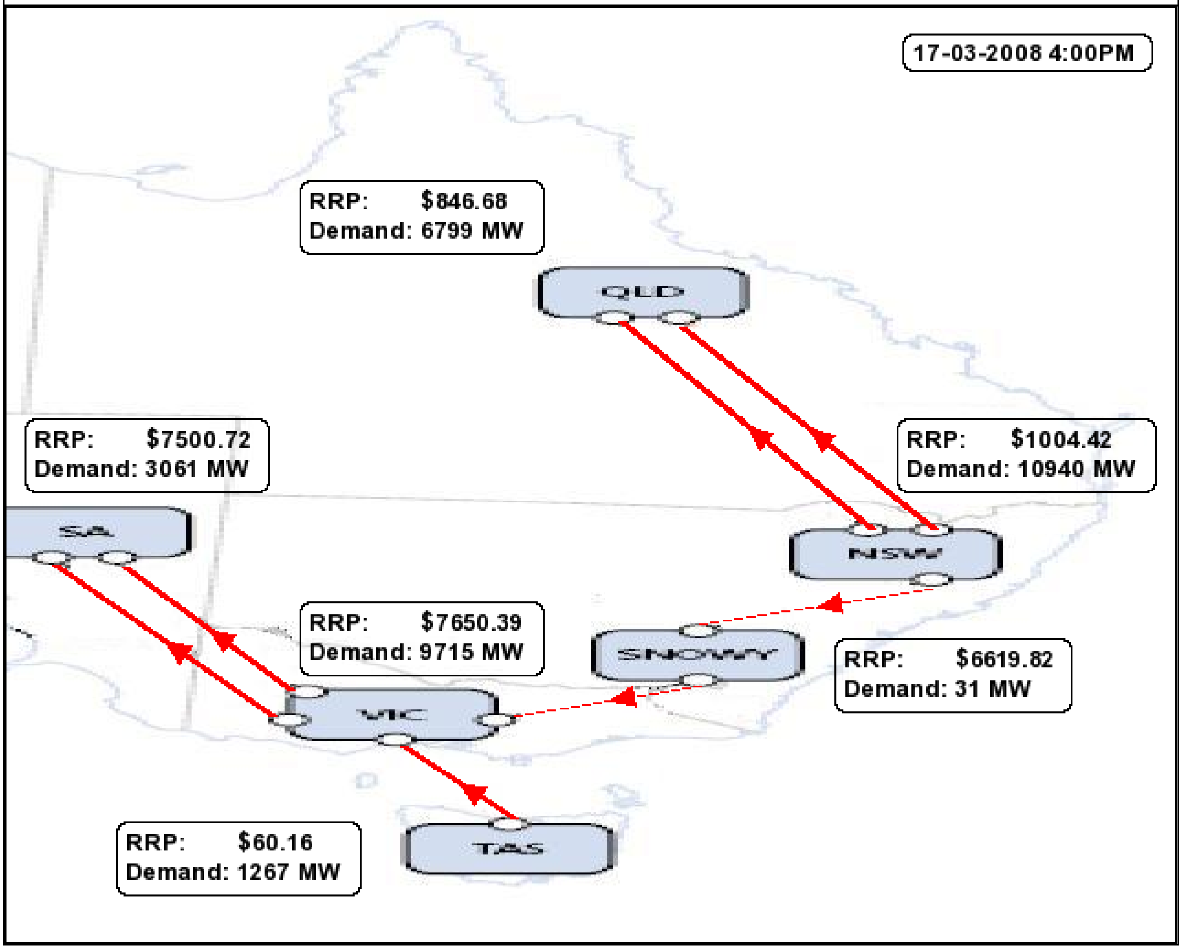


Figure 7.2 – 17-03-2008 4:05PM VIC – During VoLL event

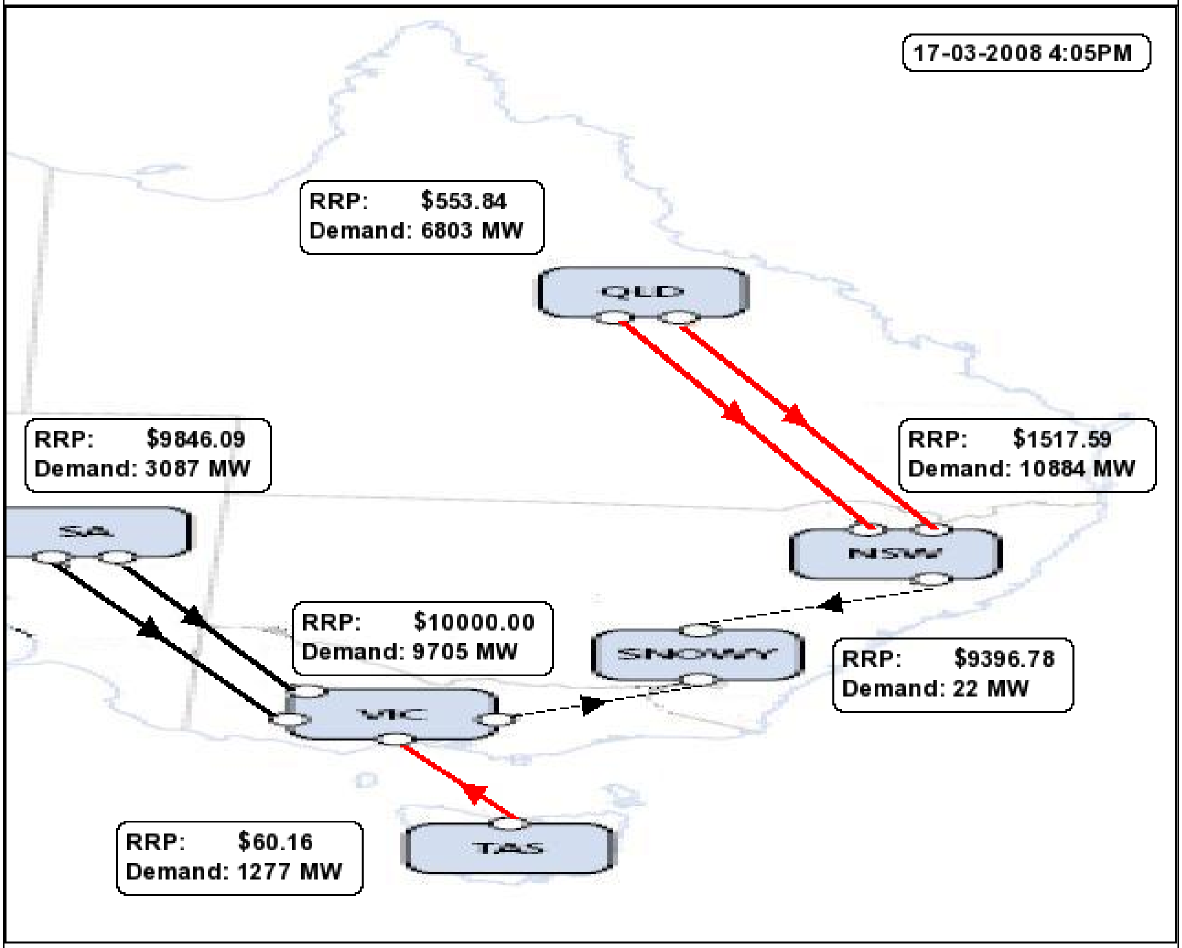
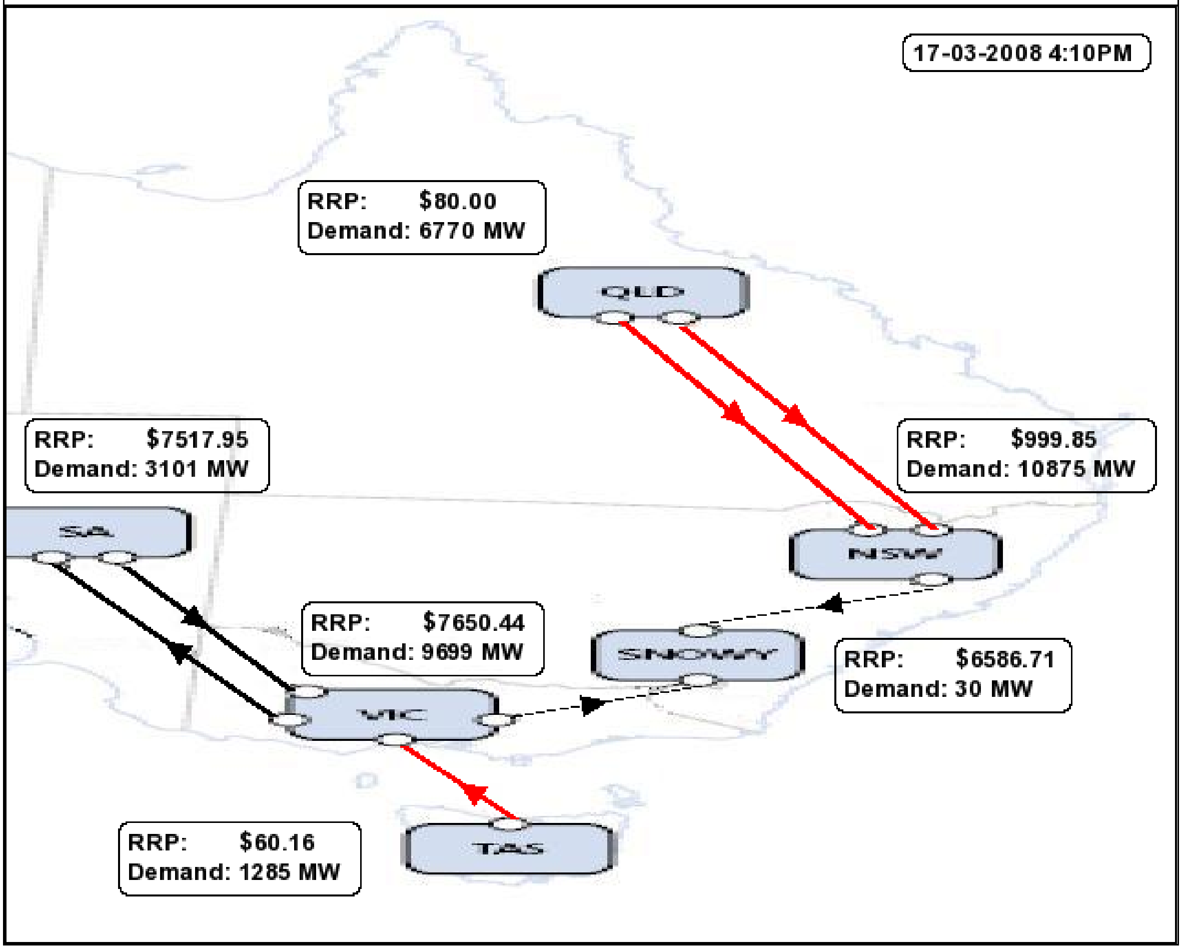


Figure 7.3 – 17-03-2008 4:10PM VIC – Post VoLL event



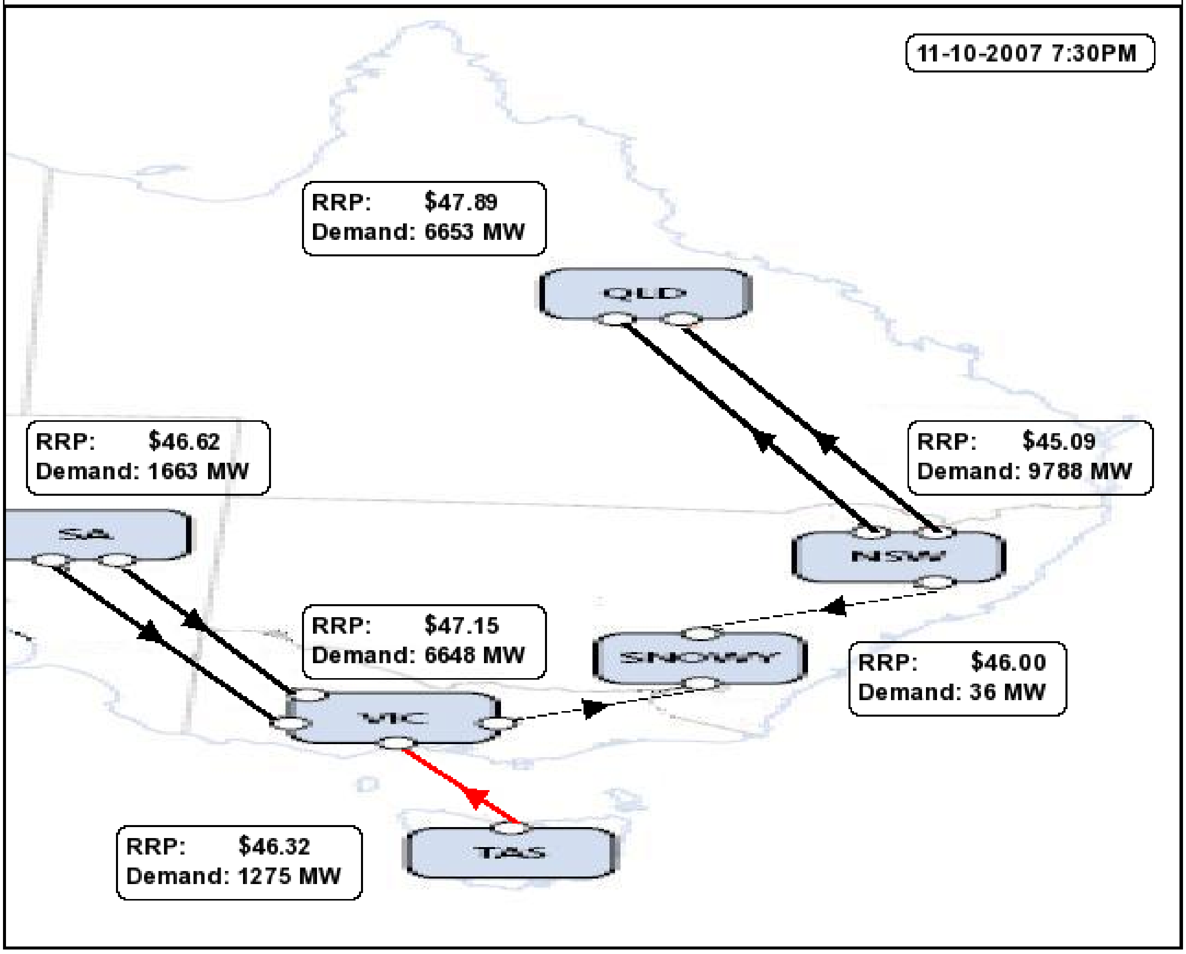
11th October 2007

Figure 7.4 to Figure 7.7 illustrate two successive periods of VoLL pricing in Queensland due to the reclassification of the double circuit Tarong to Braemar lines, resulting in a step change in the QLD import limit of approximately 800MW based on the existing SWQ generation levels. This also forced dispatch of all high ramp rate generation in QLD, some bidding at the price cap. No loss of consumer load occurred.

This is typical of many historical VoLL pricing events – brief price spikes resulting from sudden step changes imposed by altered network conditions, yet not representative of any supply demand imbalance. The QLD regional load was unremarkable and there was significant spare capacity.

SR is not expected to be used under these conditions.

Figure 7.4 – 11-10-2007 7:30PM QLD – Prior to VoLL



System conditions before reclassification are shown in Figure 7.4.

Figure 7.5 – 11-10-2007 7:35PM QLD – VoLL event occurs

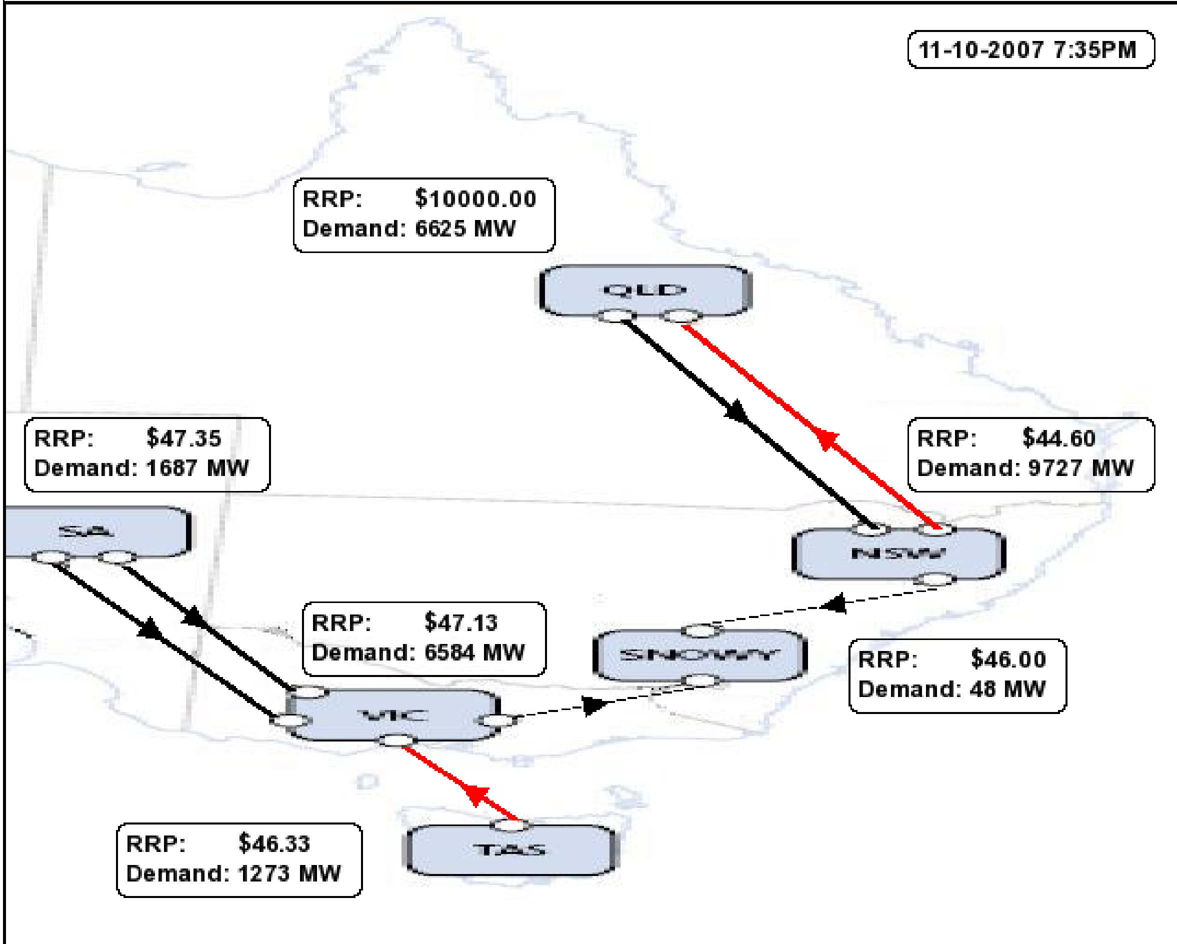
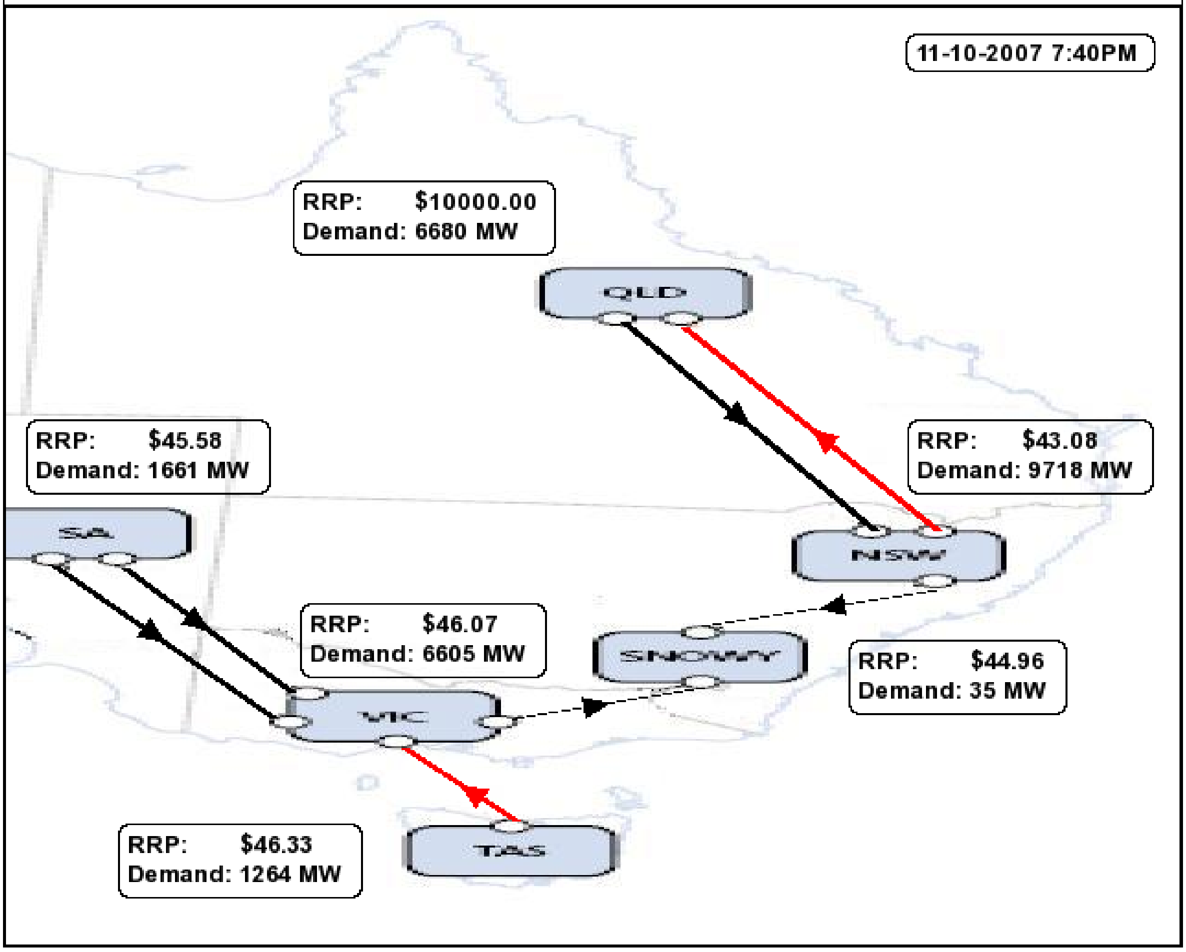


Figure 7.5 shows the initiation of the VoLL event. The simultaneous loss of both Tarong – Braemar circuits due to lightning activity is declared credible, QNI reverses flow and significant additional generation in QLD is dispatched to maintain supply demand balance. Generation in SWQ is constrained down but does not immediately alter output.

The QNI export limit at this point is -600MW and the constraint managing this flow is violated in dispatch.

Figure 7.6 – 11-10-2007 7:40PM QLD – First period after reclassification



The first period after the reclassification is shown in Figure 7.6. Lower cost generation is still limited by ramp rates and the QLD price is still being set by hydro generators. SWQ generation starts ramping down output.

SWQ generation has not yet responded to ramp down targets, thus the QNI export limit is still -600MW and is again violated in dispatch.

Figure 7.7 – 11-10-2007 7:45PM QLD – Prices return to more typical levels

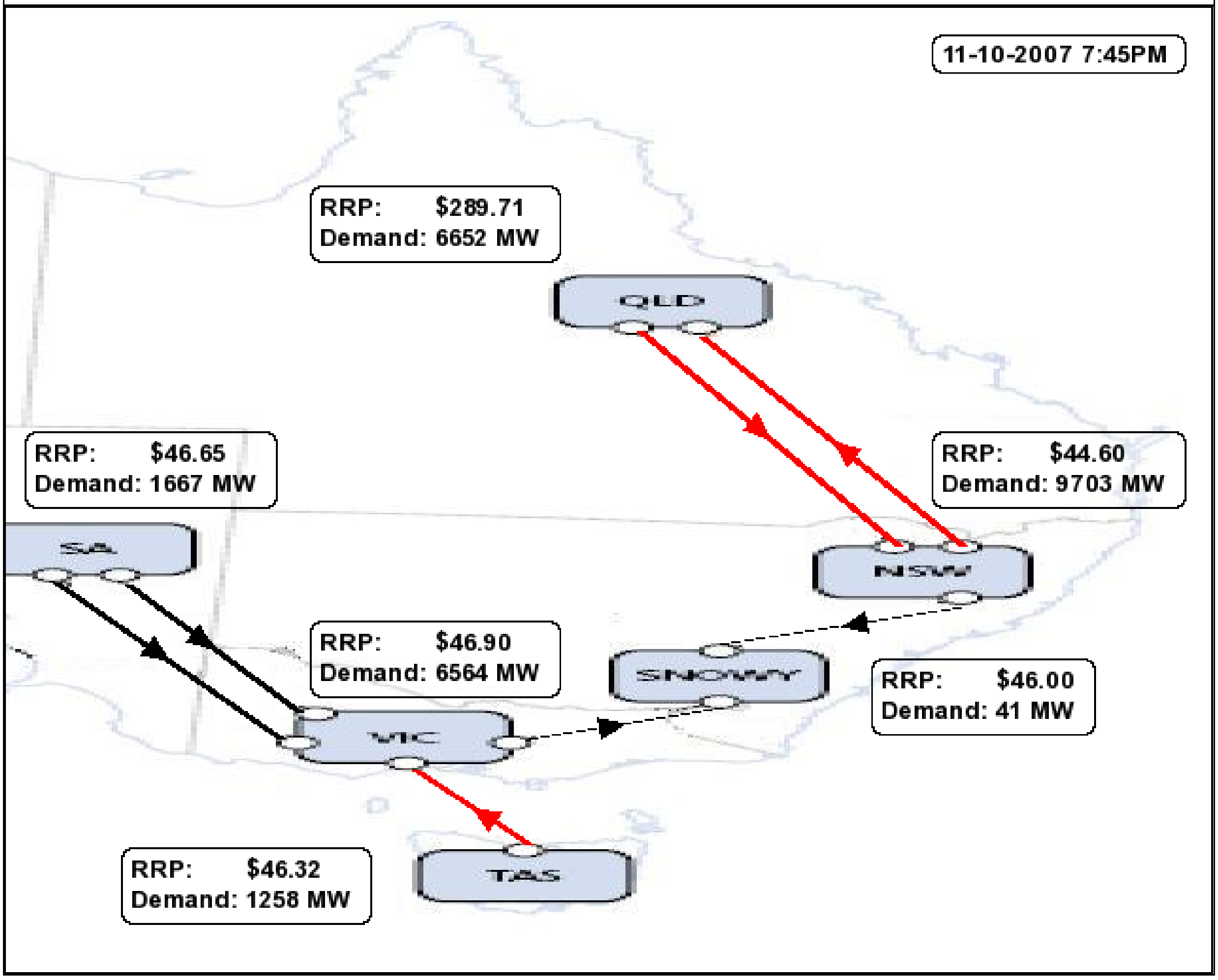


Figure 7.7 shows the post-VoLL event situation. Prices return to more typical levels as CQ generation ramps up and SWQ generation ramps down, reducing the QNI export limit to -200MW and hydro generation priced at the market cap is no longer required to meet load and forced exports.

27th June 2007

Figure 7.8 to Figure 7.10 illustrate a period of VoLL pricing in Tasmania resulting from significant supply scarcity leading to an inability to meet the raise 5 minute and raise regulation FCAS services. No consumer load was lost, although the FCAS raise requirement was violated in dispatch.

Due to tight supply demand conditions and Basslink flowing northward (the implementation of Basslink in NEMDE cannot reverse direction and provide FCAS transfer in a single dispatch interval, and as such often is 'stranded' flowing the 'wrong' way), a small increment in TAS regional load led to the inability to concurrently meet both energy and delayed raise FCAS requirement, resulting to the FCAS requirements violating in dispatch and an over constrained dispatch re-run, which resulted in the VoLL price.

Although no load was lost, standing reserve may have been utilised in either the energy or FCAS markets to reduce the supply shortfall. This may have resulted in considerably lower prices in one market as the VoLL price was an outcome of the OCD run, not a generator bid.

Figure 7.8 – 27-06-2007 11:05AM TAS – Prior to VoLL

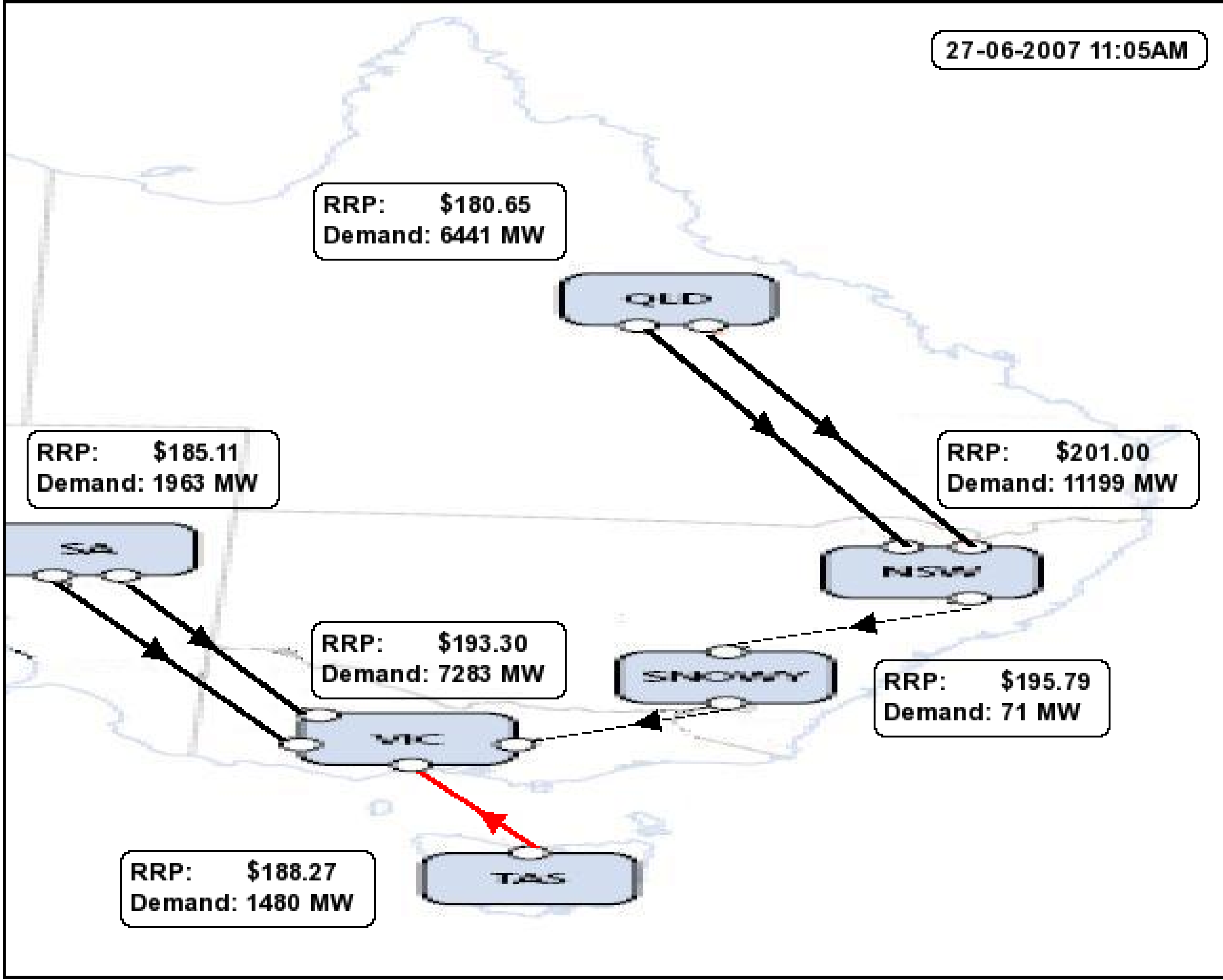


Figure 7.8 shows the system conditions before the price spike.

Figure 7.9 – 27-06-2007 11:10AM TAS – VoLL event occurs

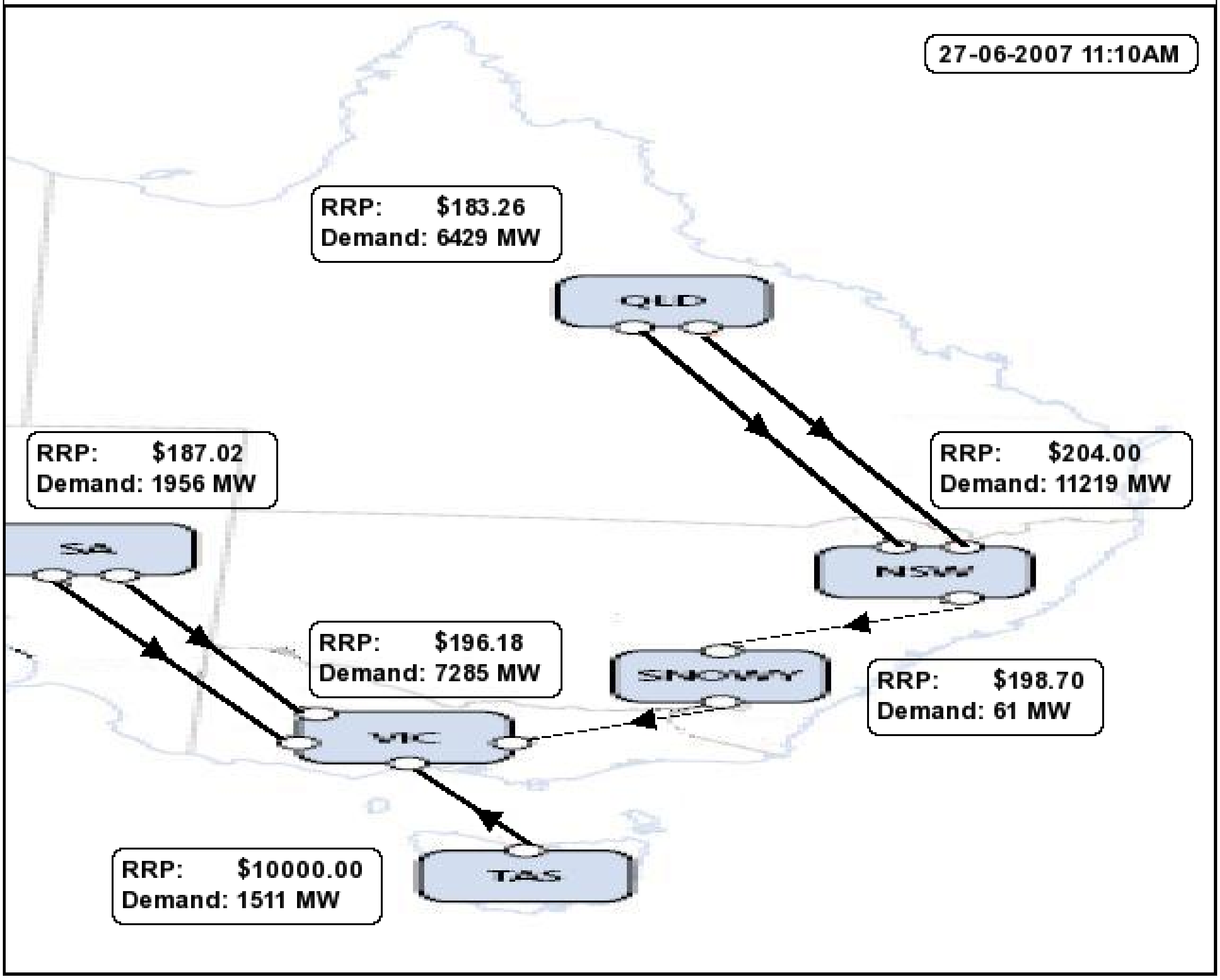


Figure 7.9 shows the situation as the VoLL event occurs. A small increment in Tasmanian load results in FCAS requirements unable to be met, both energy and delayed FCAS raise clearing prices reach VoLL.

The delayed raise FCAS requirement is violated by approximately 20MW in dispatch.

Figure 7.10 – 27-06-2007 11:15AM TAS – Post VoLL event

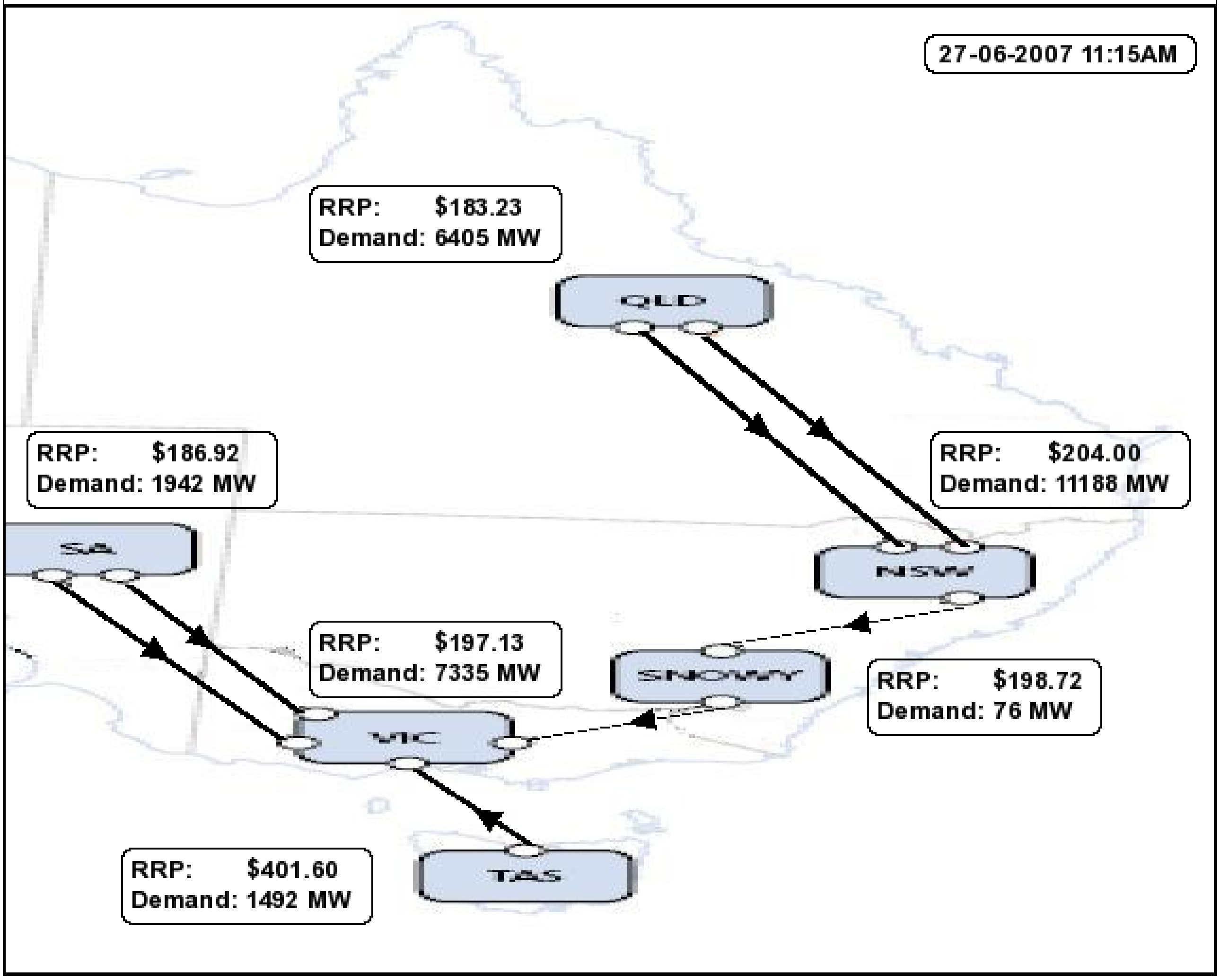


Figure 7.10 shows the situation after the VoLL event has occurred. Tasmanian load falls slightly and prices fall dramatically as the FCAS requirement is able to be met.

7.2) ANALYSIS OF CAUSES OF VOLL

Historical analysis of all VoLL pricing events for the current financial year has revealed that the most common reason for VoLL pricing is a transient price spike resulting from large step changes in network capability, and usually reflects market participant bids rather than being set to VoLL.

Most notably, an outage or reclassification of a major flow path as a credible contingency results in the application of a constraint set which may drastically change interconnector flows and/or constrain generation down – often resulting in a large price spike due to either high ramp rate units (often bidding the market price limit) becoming 'must run', or creating artificial supply scarcity due to large forced exports until generators respond to the changed network capabilities.

Step changes in QNI flow due to reclassification is the most common cause of VoLL price events, with a large proportion of VoLL price events in the current financial year being lightning effects in Queensland.

VoLL pricing events related to supply scarcity are rare.

7.3) INFERRED EVENTS UNDER SR MECHANISM

Standing reserve is unlikely to be utilised in response to transient price spikes related to network capability changes, due to both the nature and frequency of the events. VoLL pricing outcomes rarely reflect supply shortfall, and may often not represent supply scarcity.

Standing reserve in place of physical generation or demand side participation that replaces existing capacity is likely to have significantly increased the number and duration of historical VoLL price outcomes, while not providing any reliability benefit. This is a direct result of standing reserve only entering the market at VoLL pricing, tightening the supply demand balance and therefore increasing prices for all periods *not* priced at VoLL. Standing reserve implemented in this fashion may be required frequently in peak load periods.

Standing reserve in the form of demand side participation that does not replace existing capacity is likely to have had a minimal effect on the number and duration of historical VoLL price outcomes, and no effect on reliability as no loss of load relevant to the reliability standard has occurred. This option would however be expected to increase future reliability, providing additional reserve on top of what market forces deliver.

Note that standing reserve entering the market at VoLL only provides a strong incentive for other plant to treat the market price cap as slightly below VoLL so as to ensure full dispatch before standing reserve. This may drastically reduce the number of VoLL priced periods (as generators would have strong incentives to limit bids to $9,999.99[40] for example, not $10,000), but have no practical effect on price outcomes, or the number of periods nearly at VoLL. This effect is not considered above.

8) MARKET MODELLING WORK UNDERTAKEN

8.1) OUTLINE OF MODELLING APPROACH

Minimum Reserve Level's (MRL's) are presently the margin, as determined by NEMMCO, by which installed generation capacity should exceed forecast peak demand in each region to meet the Reliability Standard.

[40] There are significant concerns about market rules that mean, as a matter of practice, that allocatively efficient outcomes depend in large part on generators being willing to offer small proportions of their capacity at prices that are substantially above marginal cost, and close to VoLL.

The modelling has attempted to identify the attributes needed from SR to meet the MRL and therefore potentially replace the RT mechanism. Modelling has assessed:

1. Capacity, availability and locational aspects of SR (by year, season, time of day);
2. Duration of invocation of SR (by year, season, time of day);
3. Influence on market price in the NEM (since SR will potentially replace generation that may otherwise have been bidding below VoLL).

The modelling has shown the relative NEM market outcomes with and without SR for detailed analysis.

Modelling has included particular fixed volumes of reserve or proportions of MRLs for reserve, including quantities modelled by CRA for the Reliability Panel of Standing DSP.

8.2) MODELLING ASSUMPTIONS

ROAM has modelled the three years from 2008-09 to 2010-11 based on generation, network and load data from our ROAM Insight publication which provides a base case outlook of the NEM based on best available information of existing and committed projects in the NEM.

The level of SR has been modelled by subtracting the assumed capacity of SR from the existing generation capacity which is bidding into the market[41]. Key assumptions in modelling the levels of SR are based on the medium economic energy growth 10% probability of exceedence demand forecast (M10) as shown below.

Table 8.1 – M10 Summer Peak Demand (MW gross)

	QLD	NSW	VIC	SA
2008/09	10,435	15,500	10,124	3,421
2009/10	10,850	15,930	10,297	3,483
2010/11	11,273	16,350	10,515	3,522

To provide a comparison study, ROAM has included a scenario where the capacity of SR is the same as that modelled by CRA for the CRR. A comparison of this level of SR is provided in the following table for convenience:

Table 8.2 – CRA SR capacities

	QLD	NSW	VIC	SA
MW SR Modelled	140	360	150	40
% of 2008-09 M10 peak demand	1.3%	2.3%	1.5%	1.2%

[41] We have subtracted the SR from the existing generation capacity to avoid the situation whereby SR contributes to higher reliability than required by the standard. However, the modelling approach would be equivalent, if SR had been treated as an additional capacity above the MRLs.

In addition to replicating the CRA levels of SR, ROAM has modelled three additional cases as follows:

Table 8.3 – ROAM SR Capacities Modelled				
SR 1% of Peak Demand				
	QLD	**NSW**	**VIC**	**SA**
2008/09	104	155	101	34
2009/10	109	159	103	35
2010/11	113	164	105	35
SR 2% of Peak Demand				
	QLD	**NSW**	**VIC**	**SA**
2008/09	209	310	202	68
2009/10	217	319	206	70
2010/11	225	327	210	70
SR 3% of Peak Demand				
	QLD	**NSW**	**VIC**	**SA**
2008/09	313	465	304	103
2009/10	326	478	309	104
2010/11	338	491	315	106

ROAM has conducted the modelling with 20 Monte Carlo simulation years at half hourly intervals.

8.3) MODELLING OBSERVATIONS

General observations of the modelling outcomes are:

- As SR replaces physical plant to the same level of capacity, reliability expressed as USE does not materially change. i.e. the level of unserved energy remains essentially the same;
- As the level of SR increases:
  - The *frequency* and *duration* that SR is required to operate increases;
  - Pool price volatility increases;
  - The period of time that the pool price is at VoLL increases;
  - Average annual pool price increases.

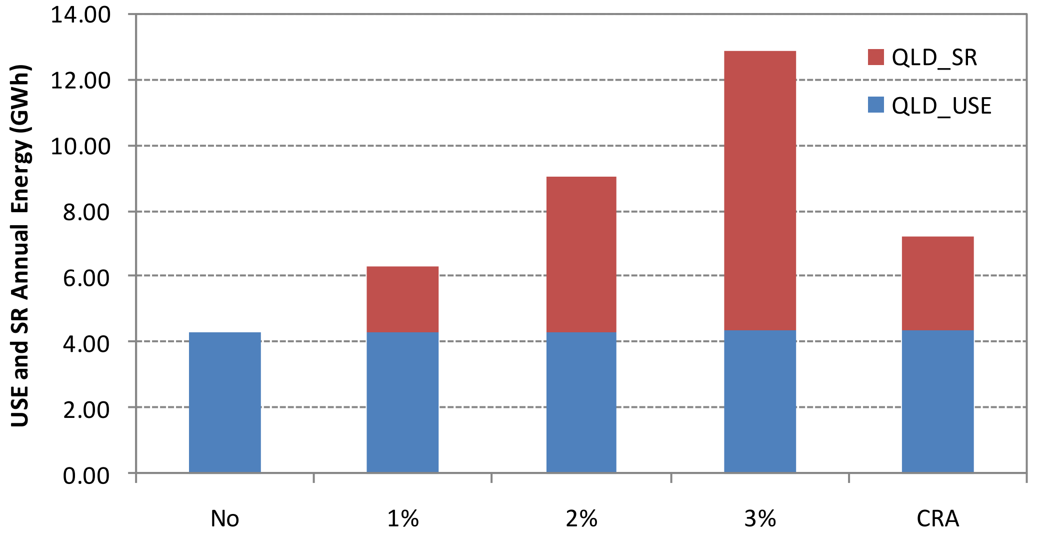
The observations that have been made are consistent with a situation where the overall level of USE remains the same, at or about the target USE of 0.002%, but with SR now contributing to meeting that reliability target. This situation is equivalent to a situation of market failure, whereby the market does not bring forth sufficient capacity to meet the NEMMCO MRL targets and SR makes up the shortfall.

However, if SR is used as 'insurance' capacity only and MRLs are met by installed capacity through the normal energy only market mechanisms, SR would then substitute for USE at times of VoLL, which would result in a decrease in USE, and an increase in system reliability, probably delivering a higher standard of reliability than the NEM target. This latter situation has not been modelled, owing to the rarity of these events, as evidenced by the analysis of historical occurrences as discussed in Section 7. However, the performance of SR would remain the same, regardless of whether the market has or has not failed to bring forth sufficient capacity to meet MRLs, except for the frequency and duration of SR events.

8.3.1) Outcomes

ROAM's modelling, based on replacing physical capacity with SR, shows that USE does not materially change, as expected. However, the total energy provided by SR, including the frequency and duration that SR must be active, increases as the proportion of SR increases. This is illustrated in the following series of charts which show the level of SR and USE for the four mainland regions, for the 2008-09 year. Whilst USE is shared differently between the southern regions across the five cases[42], the total level of USE is consistent across all sensitivity cases.

Figure 8.1 – Queensland USE and SR Dispatch for 2008-09



[42] USE may be shared arbitrarily between regions where interconnectors are unconstrained. Whilst USE 'pain sharing' is implemented in the actual dispatch of the NEM, this is not applied in the modelling completed for this assessment.

Figure 8.2 – NSW USE and SR Dispatch for 2008-09

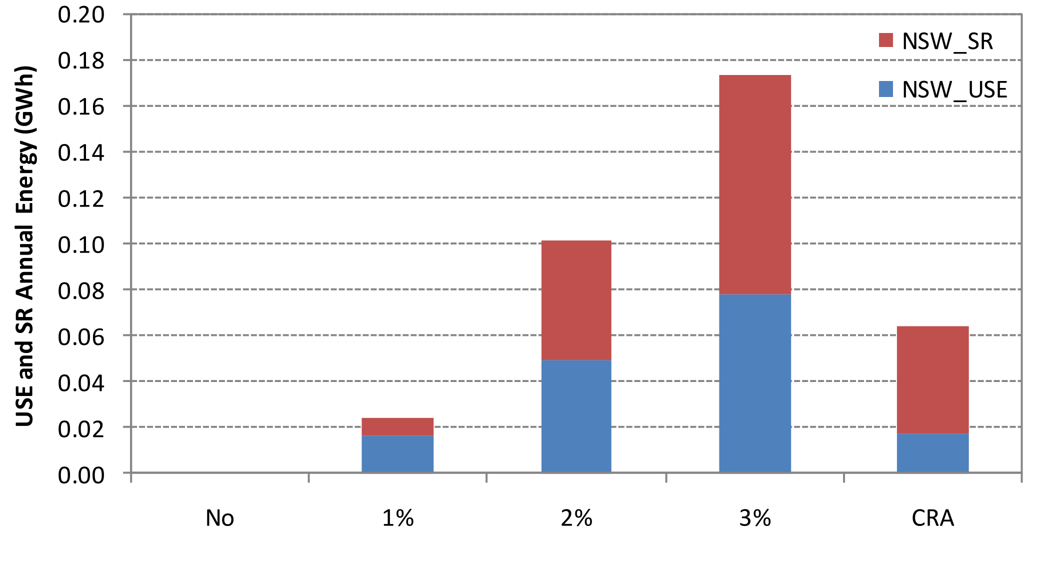


Figure 8.3 – VIC USE and SR Dispatch for 2008-09

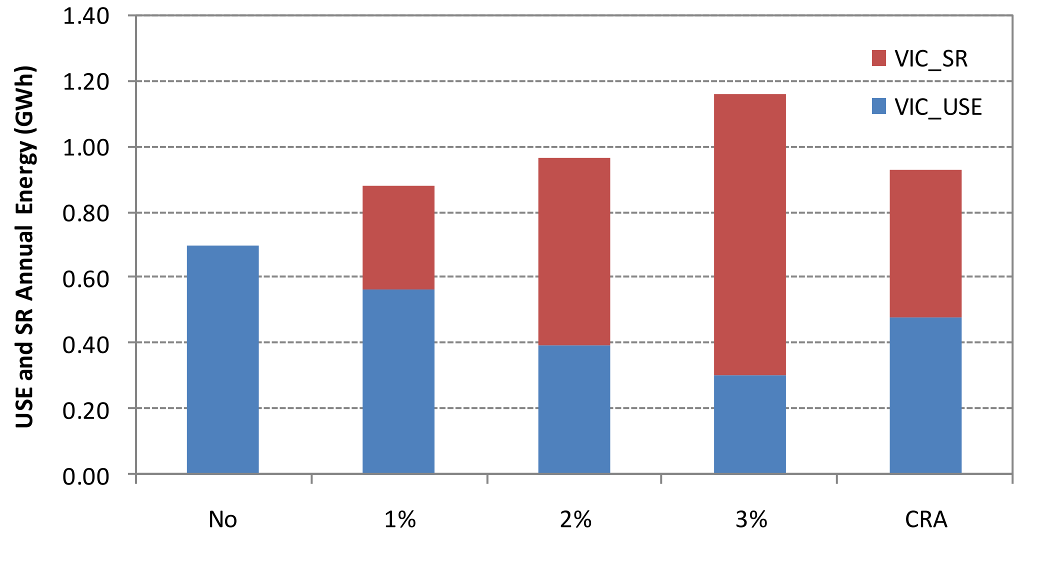
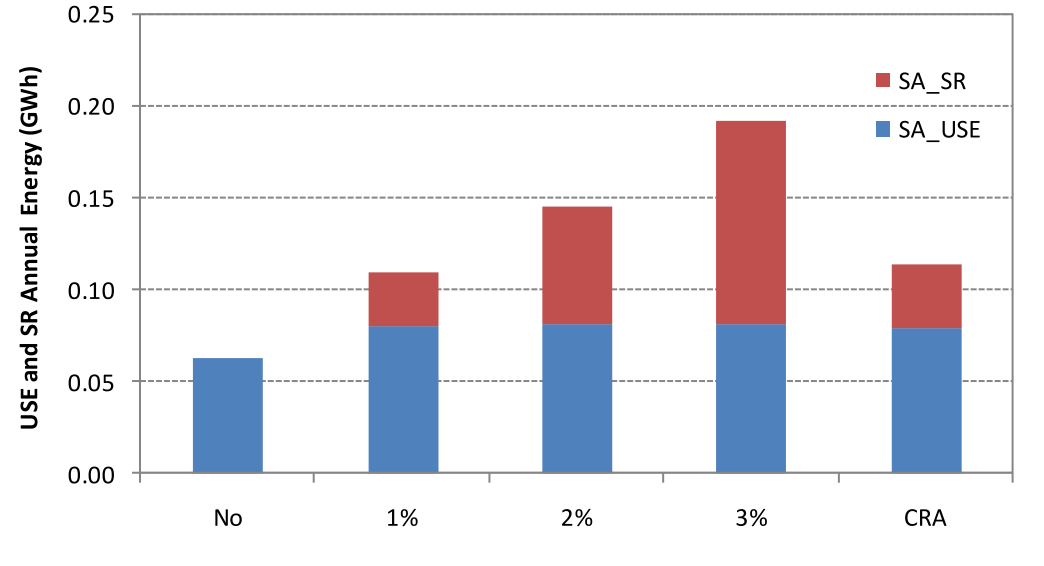


Figure 8.4 – SA USE and SR Dispatch for 2008-09



USE and SR outcomes for all three years are tabulated below.

Table 8.4 – USE and SR Dispatch for all Modelled Cases (GWh)

2008-09					
	No SR	**1%**	**2%**	**3%**	**CRA**[43]
NSW_USE	0.00	0.02	0.05	0.08	0.02
QLD_USE	4.34	4.34	4.33	4.36	4.37
SA_USE	0.06	0.08	0.08	0.08	0.08
TAS_USE	0.00	0.00	0.00	0.00	0.00
VIC_USE	0.70	0.57	0.40	0.31	0.48
NSW_SR	0.00	0.01	0.05	0.10	0.05
QLD_SR	0.00	1.98	4.75	8.52	2.87
SA_SR	0.00	0.03	0.06	0.11	0.03
VIC_SR	0.00	0.31	0.57	0.86	0.45
Total USE	**5.10**	**5.00**	**4.86**	**4.82**	**4.95**
Total SR	**0.00**	**2.33**	**5.43**	**9.58**	**3.40**
Total USE + SR	**5.10**	**7.33**	**10.29**	**14.41**	**8.35**
2009-10					
	No SR	**1%**	**2%**	**3%**	**CRA**
NSW_USE	0.00	0.00	0.00	0.08	0.00

[43] The percentage of capacity used for SR in the CRA modelling in each state is shown in Table 8.2

Table 8.4 – USE and SR Dispatch for all Modelled Cases (GWh)

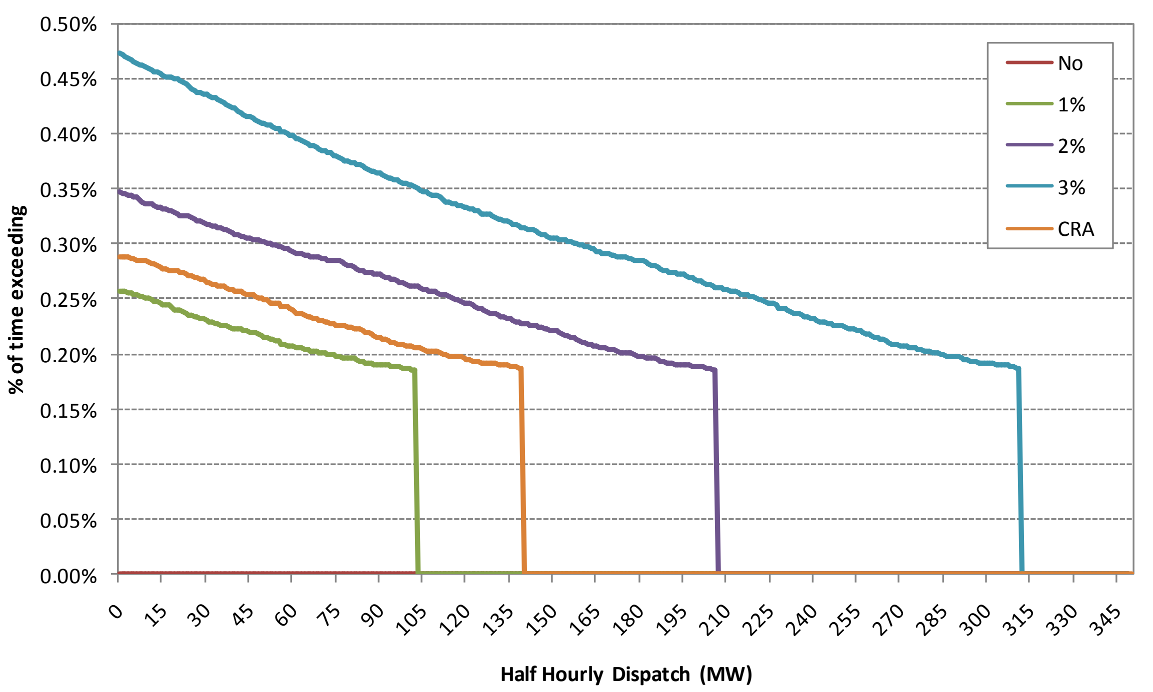
QLD_USE	0.68	0.68	0.68	0.68	0.68
SA_USE	0.05	0.05	0.05	0.05	0.05
TAS_USE	0.00	0.00	0.00	0.00	0.00
VIC_USE	0.42	0.35	0.29	0.18	0.33
NSW_SR	0.00	0.00	0.01	0.08	0.02
QLD_SR	0.00	0.51	1.32	2.52	0.75
SA_SR	0.00	0.02	0.05	0.09	0.03
VIC_SR	0.00	0.21	0.38	0.50	0.30
Total USE	**1.15**	**1.08**	**1.02**	**0.99**	**1.06**
Total SR	**0.00**	**0.74**	**1.75**	**3.19**	**1.09**
Total USE + SR	**1.15**	**1.82**	**2.78**	**4.17**	**2.16**

2010-10

	No SR	1%	2%	3%	CRA
NSW_USE	0.16	0.09	0.34	0.09	0.12
QLD_USE	0.25	0.26	0.27	0.42	0.27
SA_USE	0.00	0.00	0.00	0.00	0.00
TAS_USE	0.00	0.00	0.00	0.00	0.00
VIC_USE	1.28	1.19	0.76	0.76	1.08
NSW_SR	0.00	0.03	0.14	0.19	0.12
QLD_SR	0.00	0.34	0.91	1.83	0.50
SA_SR	0.00	0.00	0.01	0.01	0.00
VIC_SR	0.00	0.48	0.85	1.24	0.69
Total USE	**1.70**	**1.55**	**1.38**	**1.27**	**1.48**
Total SR	**0.00**	**0.85**	**1.90**	**3.28**	**1.32**
Total USE + SR	**1.70**	**2.39**	**3.28**	**4.55**	**2.80**

Figure 8.5 below illustrates the 'Dispatch Duration Curve' for SR in the Queensland region for the 2008-09 year. The area under the curve is the energy that SR must provide over the year. This shows that SR is fully utilised for around 0.19% of the time. Further to this, SR is invoked for around 0.5% of the time when it makes up 3% of peak demand, whereas it is invoked for only around 0.25% of the time when it makes up only 1% of peak demand. The relative 'shape' of these SR Dispatch Duration Curves for the other regions are similar. In all cases, USE is occurring whenever SR is committed to its full capacity, and in the case of Figure 8.5, this is 0.19% of the time.

Figure 8.5 – Queensland SR Dispatch Duration Curve for 2008-09



The increasing reliance on SR results in the pool price reaching VoLL more frequently. As a result, average pool prices are higher, as well as the frequency and duration of price spikes. In general, price volatility increases as the level of SR increases. The resulting impact on annual average pool prices is shown in the series of figures below. This shows annual average pool prices increasing by up to $18/MWh when SR is as much as 3% of peak demand and reserves are becoming low, as is the case in the Queensland region. In the southern regions of the NEM where reserves may be shared more readily and the prevailing reserve levels are higher, increasing SR in 1% increments increases annual pool prices initially by around $0.50/MWh at 1% SR, doubling to $1/MWh at 2% SR and doubling again to around $2/MWh at 3% SR.

Figure 8.6 – Queensland Pool Price Outcomes

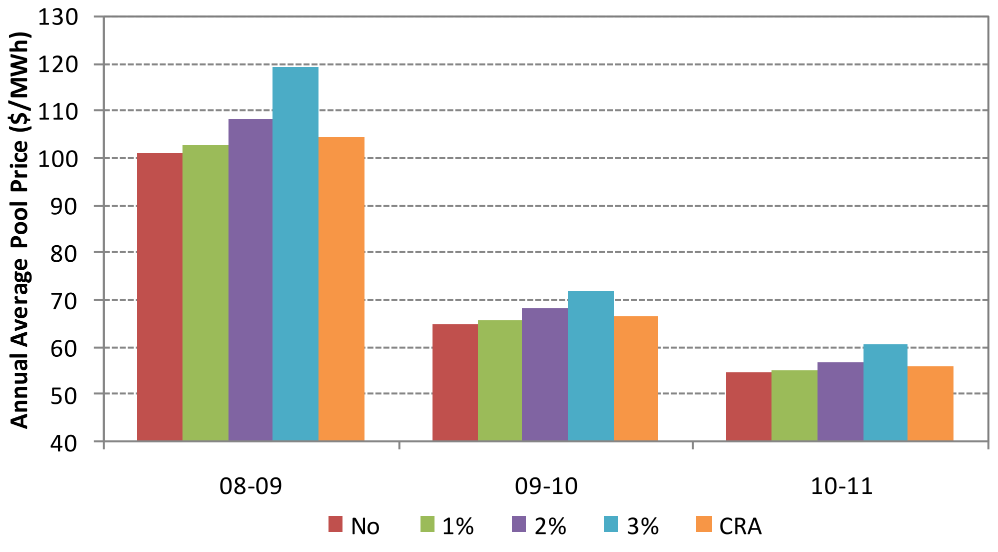


Figure 8.7 – NSW Pool Price Outcomes

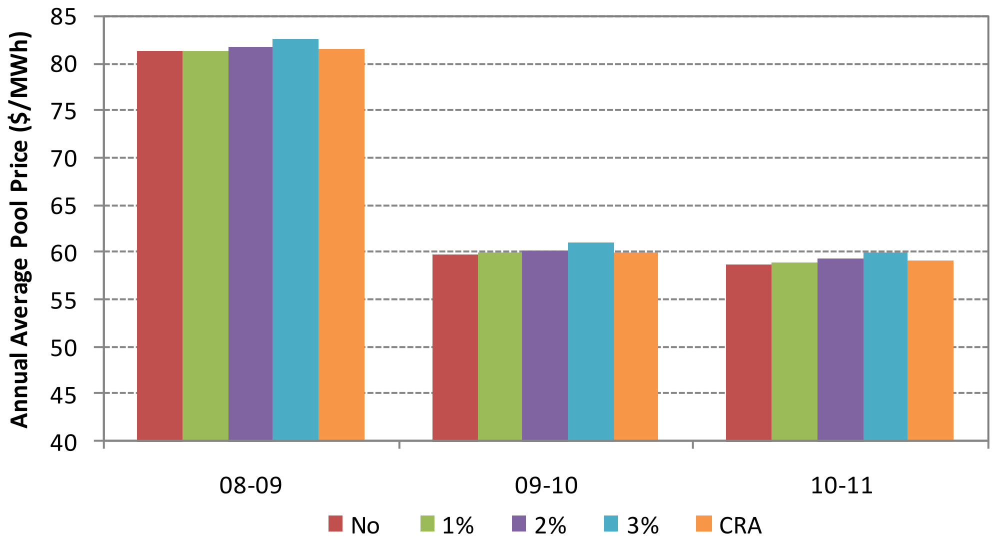


Figure 8.8 – VIC Pool Price Outcomes

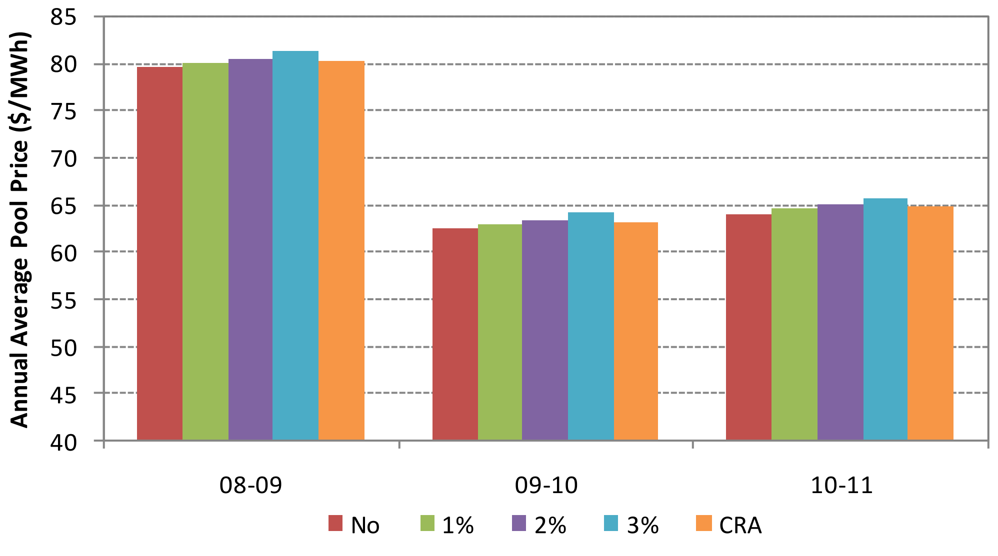
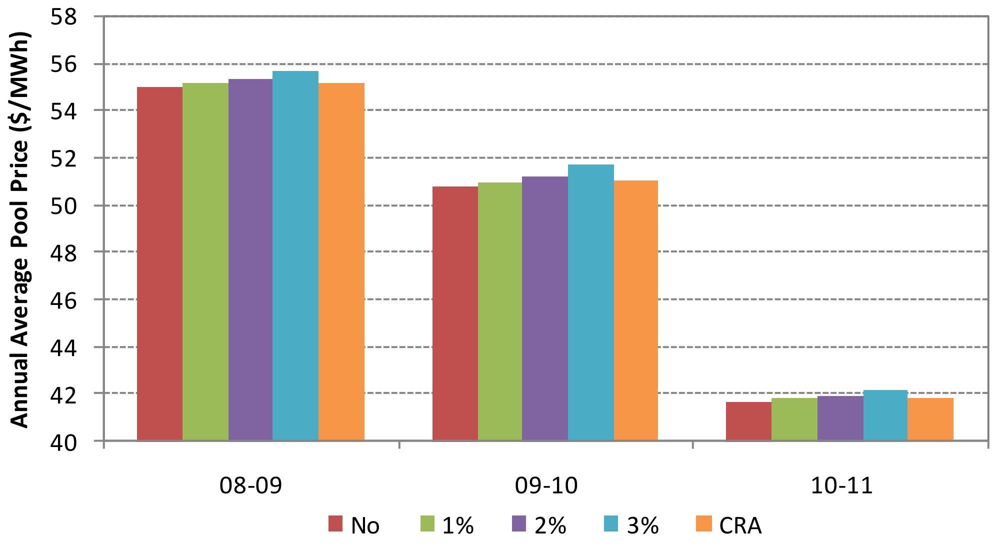


Figure 8.9 – SA Pool Price Outcomes



8.3.2) Attributes needed from SR to meet MRL and Replace Reserve Trader

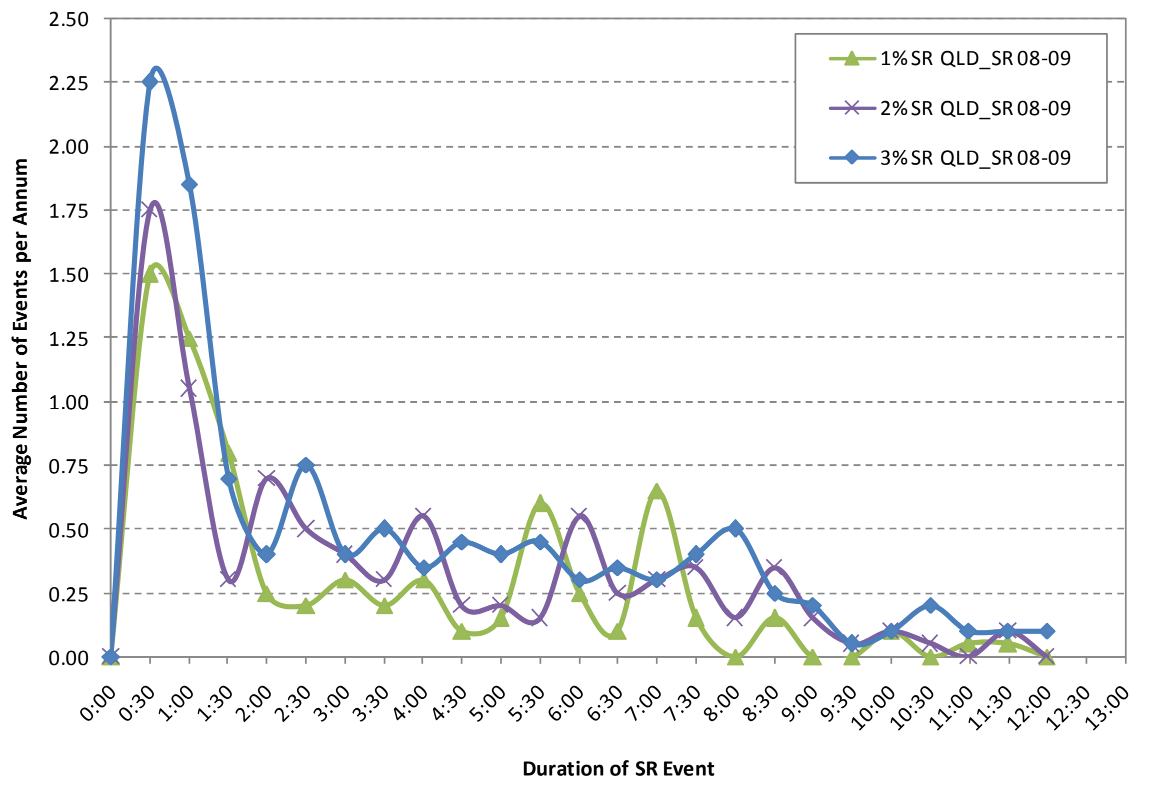
In order to provide certainty in delivering a service capable of providing for reliability of supply, SR must exhibit certain key attributes. In the context of providing DSP for SR, the DSP must be:

1. On-line as a load at the time it is required;
2. Readily available to be curtailed at extremely short notice;
3. Suitable for switching back into service in as little as a single trading interval;

4. Capable of remaining off-line for as long as twelve hours (although this may be overcome by aggregation of DSP providers)

Analysis of the SR dispatch from the market simulations shows that as the proportion of SR increases in the market (or the reliance on SR in the event of market failure increases), it will be called upon more frequently and for longer periods of time on average. Figure 8.10 illustrates the frequency of SR events as a function of time. This shows that SR is most frequently required for only a short period of time, typically less than one and a half hours around twice per year. The 1% SR case shows that longer duration events do occur around once every four years (0.25 times a year on average). As SR increases to 3% of peak demand these longer duration events up to eight hours in duration occur with a more sustained probability of around once every two years.

Figure 8.10 – QLD SR Operation Availability Requirement



The frequency and duration of events depends heavily on the prevailing level of reserve generation in the NEM and the proportion of SR which makes up the remainder of reserve requirements.

8.4) CHARACTERISTICS OF DSP AVAILABLE IN THE NEM

There are many different types of electricity consumers, and the different types will be able to offer DSP in different forms. For example, Energy Response (a DSP aggregator) offers (or is planning to offer) three different DSP programs, each of which will be suitable for different customers. These are:

Price response

Under this program, energy users will curtail in response to a price rise to a predetermined level. This program features a dispatch lead time of 30 minutes, may require curtailment for up to 5 hrs, and will be used with a frequency of 8 to 10 times per annum.

Security response

Under this program, energy users elect to be curtailed to avoid involuntary load shedding. This program features a dispatch lead time of between 5 minutes and 24 hours, may require curtailment for up to 6 hrs, and will be used with a frequency of approximately 5 times per annum.

Safety Net

Under this program, energy users provide DSP for system reserve. This program features a dispatch lead time of 24 hours, may require curtailment for up to 15 hrs, and it is anticipated that curtailment will not be required in most years.

Industries that will have a strong potential to provide DSP of the first type (price response)[44] will include those with the following features:

1. Interruptible processes such as pumping, gas compression, stockpiling materials
2. Thermal inertia such as cool stores
3. Capability to offset demand by transferring it to an on-site generator
4. An interest in reducing electricity costs

These businesses will feature interruptible processes that can be curtailed with a minimum of inconvenience. These energy users are not ideal for providing DSP for SR, because for maximum economic efficiency, they should be offering DSP at a much lower price than VoLL.

The second and third types of programs offered by Energy Response (Security response and Safety net) target those energy users for whom it is less convenient to curtail, but still possible in extreme rare circumstances. The Safety Net program, in particular, targets energy users that will be appropriate for providing DSP for SR. Some characteristics that will be important for these energy users to be ideal in this role will be:

- The process must be typically operating when VoLL occurs, so that it can offer curtailment.
- The process must be able to be curtailed when VoLL occurs.
- The location of the DSP will be important. DSP at load centres is more likely to be useful (since it can typically alleviate transmission congestion, which may often contribute to the pool price reaching VoLL).
- The length of time that the DSP is available for is significant; if VoLL occurs for many hours at a time, some participants may not be able to offer curtailment for that long. This may be overcome by aggregating a number of DSP providers that can cycle their curtailment over the period required.

[44] Demand Side Response in the National Electricity Market Case Studies: End-Use Customer Awareness Program. By Ross S. Fraser, Fraser Consulting Services Pty Ltd, for Energy Users Association of Australia. April 2005. P.8.

- The level of inconvenience of curtailment is significant.
  - Where the level of inconvenience is prohibitively high, the user is not appropriate for any form of DSP
  - Where the level of inconvenience is very low, the user would ideally offer DSP at a much lower price than VoLL (for maximum economic efficiency)
  - Users that are appropriate for providing DSP for SR will have a high, but not prohibitively high level of inconvenience (dictated by the regularity of occurrence of VoLL).

Some energy users that are likely to be able to provide DSP in some form are listed in Table 8.5, with their likely applicability to SR.

Table 8.5 – Forms of DSP, and applicability to SR

Form of DSP	• **Commercial buildings** • **Residential buildings** • **Government facilities (such as hospitals)**	• **Dairy processors** • **Seafood processors** • **Other food industries**	**Energy intensive industries, such as:** • **Metal processing (including aluminium smelters)** • **Concrete processing** • **Glass manufacture**	• **Recycling (metal, glass, plastic)** • **Waste processing** • **Plastics manufacturing** • **Chemicals processing**
Interruptible processes	• Space cooling	• Refrigeration • cold storage	• Air compressors • industrial heating • space cooling • pumping • stockpiling materials	• Refrigerated cooling processes • Air compressors • industrial heating • space cooling • pumping • stockpiling materials
Length of time DSP offered for	5-10 minutes[45]	Several hours[46]	24 hrs	24 hrs
Location	Urban	Rural / Urban	Rural	Rural / Urban

[45] Automated cycling of aggregated resources is possible to give DSP on longer timescales.

[46] Automated cycling of aggregated resources is possible to give DSP on longer timescales.

Table 8.5 – Forms of DSP, and applicability to SR				
Available at time of peak demand?	This form of DSP is likely to be prohibitively inconvenient at times when VoLL occurs (typically very hot days, when air conditioning will be operating at its limit)	Likely	Likely	Likely
Level of inconvenience	Low on medium temperature days, high on hot days.	Low	Will vary	Will vary
Appropriate for SR?	Unlikely. More appropriate as a form of DSP available more regularly at lower prices.	Unlikely. More appropriate as a form of DSP available more regularly at lower prices.	Will vary	Will vary

8.5) POTENTIAL CAPACITY OF DSP AVAILABLE

It is difficult to determine the amount of potential capacity available in DSP, and estimates vary widely. A study by the EUAA identified that up to 600 MW of DSP could be provided in Australia by the combined industries of:

- Dairy Industry / cold storage (eg. milk processing sector)
- Energy intensive industry (eg. glass manufacturing)
- Plastics and chemicals industry (eg. vinyl production)
- Commercial building management (eg. space cooling)

Another study identified 700 MW of “low hanging fruit” DSP, with a maximum potential of up to 3,000 MW (with small electricity consumers included via the use of advanced metering infrastructure)[47]. Energy Response has currently aggregated 500 MW of DSP, including 125 MW of firm DSP contracted to NEMMCO Reserve Trader. Energy Response claims to have sourced 1,000 MW of DSP in the NEM (and estimates that significantly more is available). They also identify a further 3,000 to 4,000 MW that should be used ahead of manual load shedding[48]. This suggests the existence of 2,000 to 3,000 MW of DSP that is possible, but sufficiently inconvenient that it should not be dispatched except at VoLL events. This is the DSP that could be targeted for SR, provided they meet all the above listed requirements.

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[47] Electricity Demand Side Management Study – Review of Issues and Options for Government, Charles Rivers Associates (for VENCorp), September 2001.

[48] Energy Response, Comments on the Second Interim Report, August 2007, to the Australian Energy Market Commission, 28th September 2007.

9) ECONOMIC ANALYSIS

9.1) EFFICIENCY OF SR IN FACILITATING DSP FOR RELIABILITY

The volume of DSP in the NEM does not reflect the actual amount of DSP that is available to be offered if barriers to the use of DSP were removed. ERIG has stated: "the demand side in the NEM remains relatively inactive compared with its potential." [49] The fact that the demand side of the NEM is "relatively inactive"[50] suggests a market failure may arise from not allowing an efficient volume of DSP to be offered in the NEM. The current returns from DSP do not overcome the costs to the bidder due to the market failure.

SR establishes a mechanism to offer DSP in the NEM (though it is also to apply to other types of reserve) which may assist in overcoming the market failure preventing the full involvement of the demand side in the NEM, although the narrow circumstances under which SR is used may not reflect how DSP would operate optimally in an efficient energy market with no impediments to DSP. To the extent that there is disequilibrium in the NEM reflecting the fact that more interruptible supply could be offered than is currently being offered, SR may be a suitable mechanism to correct the disequilibrium.

As the NEM is an energy-only market, interaction between supply and demand and the prices associated with this interaction are intended to be the primary mechanism to signal the need for capacity investment. VoLL is also used to provide a signal for investment, as VoLL pricing is invoked whenever there is unmet demand in the NEM.

The NEM is expected to provide sufficient incentive through this energy-only operation to result in capacity investment under normal operation. The current Reserve Trader mechanism and the proposed RERT amendments to that mechanism[51] operate to ensure that electricity demand is met in circumstances where it is identified that the existing market signals and incentives have failed.[52]

[49] Energy Reform Implementation Group, 'Energy Reform The Way Forward for Australia', January 2007, p17.

[50] Energy Reform Implementation Group, 'Energy Reform The Way Forward for Australia', January 2007, p9.

[51] These amendments do not amount to fundamental change in the operation of the Reserve Trader mechanism. They are primarily a change in name from Reserve Trader to Reliability Emergency Reserve Trader, an extension of NEMMCO's time in which it may contract from 6 to 9 months and attempts at increased contracting flexibility.

[52] It is not clear that the market has really 'failed' in that the NEM does not allow the market to endogenously set a reserve margin if this is less than the administratively set margin deemed appropriate by the Reliability Panel. It is a moot point whether the efficient margin is, in fact, lower. But it could well be if a significant proportion of demand valued unserved energy below currently determined VoLL.

Box 3 Operation of VoLL in the NEM

VoLL is intended to serve a number of purposes in the NEM. These purposes include providing a cap for NEM prices, to reflect the value to be placed on customer reliability, to decrease market volatility in the NEM and to restrain market power of generators by capping the prices that can be received in the market.

In accordance with Cl 3.9.5(b) of the Rules if the dispatch price in the NEM would otherwise be greater than VoLL at a regional reference node then the dispatch price at the regional reference price must be set to VoLL. In the circumstances of load shedding, that is when demand cannot be met by available supply in the NEM, then Cl 3.9.2 (e) requires that the dispatch price at the regional reference price be set to VoLL.

VoLL is invoked on either a manual or automatic basis, in accordance with Clause 3.9.2(e)(1). Manual load shedding is used by NEMMCO in the event that load in a region cannot be supplied, requiring load shedding to meet the unmet demand. In the event of manual load shedding VoLL is invoked. VoLL is also invoked during automatic load shedding, which occurs when a contingency event causes load to be shed, and no more load can be restored. As has been noted previously, these Rules are subject to a Rule change proposal by the AER.

SR has been proposed to stand, in a conceptual sense, between the NEM and Reserve Trader to provide reliability in the NEM. It has also been identified as a potential means to facilitate the use of DSP for reliability. The performance of alternatives to SR in alleviating impediments consistent with the NEL objective must also be considered.

With respect to reliability, the AEMC in its Issues Paper identified the following two barriers to DSP:[53]

1. The use of a short term emergency Reserve Trader as it may not facilitate efficient development and use of DSP; and
2. Use of reserves may not allow DSP a fair market value for the services provided.

In relation to reliability as a whole, rather than the Reserve Trader mechanism specifically, the impediments to DSP for reliability have been identified as set out below.

Informational asymmetry

The NEM demonstrates informational asymmetry in relation to electricity prices. Although retailers are exposed to wholesale electricity prices the prices charged to end use customers, particularly those customers on regulated tariffs, do not reflect the frequent price fluctuations that characterise NEM operation. For example, a regulated tariff does not efficiently reflect the price and consumption signals that should be provided by electricity consumption during VoLL events.

It is possible that if retail customers received greater exposure to electricity price volatility some smoothing of demand peaks may occur, which would impact positively on reliability in the NEM by allowing existing reserve to meet peak demand.

[53] AEMC, Review of Demand-Side Participation in the National Electricity Market Stage 2: Issues Paper, 16 May 2008, p3.

Transaction costs

Many of the potential participants in reliability from a demand side perspective are small electricity consumers. It has been noted that although at an individual level the impact of such consumers on electricity prices and reliability is localised, if a sufficient number were involved then the aggregate impact could be far more substantial.[54] It is possible that returns from involvement for small electricity users do not exceed the costs to the DSP provider.

Consequently, the transaction costs associated with participation in providing reliability from a demand side perspective may represent a barrier to participation. Small electricity users will require commensurately smaller transaction costs, or access to some form of aggregation, in order to lower the costs to the DSP provider. Similarly, transaction costs may be a barrier for businesses who view DSP as a non-core part of their business.

ERIG has noted that administrative impediments for electricity consumers represent the biggest obstacle to demand side contracting. A reduction in these administrative impediments, which constitute a transaction cost associated with DSP, could lead to an improvement in the efficiency of NEM operation.[55]

Principal/agent problems through a misalignment of incentives

The fact that many demand side users of electricity do not see the wholesale or spot market price of electricity can lead to a principal/agent problem as there is not a sufficient incentive for these electricity users to vary their consumption of electricity in accordance with price movements.

In addition, retailers do not necessarily have an incentive to provide DSP for reliability purposes. Allowing end users to consume more electricity may, depending on the tariffs of the particular customers, be in the interests of the retailer. For this reason an incentive for the retailer to engage in DSP may be absent.

Transmission companies receiving TUOS based revenue may have a disincentive to seek demand side alternatives to network investment, as such demand side alternatives involve reduction in electricity consumption which can have the effect of decreasing revenues to the transmission company.

Technological barriers

Technological barriers also contribute to the absence of DSP in the NEM for reliability purposes. During reliability events that trigger VoLL in the NEM it is likely that if improved price signals were provided to consumers, consumption during high price events would fall. It is therefore likely that the absence of a price signal to electricity users impedes the

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[54] EUAA, EUAA Demand Side Response Facility Trial – Independent Assessment, April 2004, v.

[55] Energy Reform Implementation Group, 'Energy Reform The Way Forward for Australia', January 2007, p252.

impact that DSP may have on reliability. During VoLL events a reduction in demand would in some circumstances be sufficient to ease the reliability constraint in the NEM.

The absence of this consumption response under high price events, which could improve reliability in the NEM, may be attributable to a failure of current metering and tariffs to transfer pricing signals to end users. This constitutes a technological barrier to the use of DSP for reliability in the NEM.

The AER has commented "Effective demand-side management requires suitable metering arrangements to enable customers to manage their consumption."[56] To the extent that the development of suitable metering arrangements is hampered by the absence of metering technology this is a barrier to the use of DSP for reliability.

The Council of Australian Governments has agreed to a national implementation strategy for the rollout of smart electricity meters where it is established that a net benefit can be expected from the rollout. This initiative may have some impact upon the gradual removal of the technological barrier to DSP represented by suitable meters, although the impact of the rollout will not be enjoyed immediately.[57]

Another aspect of technology that is required for increased use of DSP for reliability is increased automation. ERIG noted that although the use of smart metering to increase voluntary control may work for large loads, for smaller customers to influence peak demand some form of automation would be necessary. ERIG also noted that it is not clear whether any party is sufficiently incentivised to undertake such a program. It would seem apparent that demand aggregators at least will have incentives to implement such automation.[58] The lack of implementation of an automation mechanism is likely to represent a barrier to DSP in the NEM from a technology perspective, and also due to the lack of an appropriate incentive for automation to be developed.

Market design biases that may favour some forms of reserve capacity over others

Reliability in the NEM has typically been provided by increased investment in network or generation alternatives. The tradition of meeting reserve requirements in the NEM by using the supply side has been criticised, and market biases in the NEM have been attributed with responsibility for the lack of response to market prices by the demand side, and the design of NEMMCO interventions to secure reliability (for example the short time frames that apply under the Reserve Trader mechanism).

Market biases in the NEM are also criticized for creating barriers to efficient integration of DSP. These include the stringency of requirements for participation in the NEM's spot and FCAS markets. While large generators and scheduled loads can accommodate the

[56] AER, State of the Energy Market, 2007, p93.

[57] Ministerial Council on Energy, 'Information Paper on the development of an implementation plan for the roll-out of smart meters', January 2007.

[58] Energy Reform Implementation Group, 'Energy Reform The Way Forward for Australia', January 2007, p255.

requirements for NEM participation, smaller demand side resources cannot necessarily meet the requirements for participation in an effective manner.[59]

Network planning processes have been criticized as favouring 'traditional' network solutions in preference to utilizing DSP. This has been particularly attributed to the perceived risks associated with DSP. For these reasons, it has been requested by a demand side aggregator that greater access be granted to planning studies undertaken by TNSPs to identify when DSP is an alternative to the identified network solutions.[60]

The use of regulated retail price caps has also been identified as a barrier to further penetration of DSP in the NEM, as there is not a sufficient incentive for retailers to pursue DSP. In the context of NEM reliability, this has been said to be relevant as increased DSP would be able to reduce the 'peakiness' of demand, particularly during periods of very high prices.[61]

9.1.1) Efficiency of SR Mechanism

Increased use of DSP in the NEM, particularly in the short term has considerable appeal based on the ability of relatively small changes in demand for electricity to relieve supply constraints during peak periods. Reductions in demand during periods of supply scarcity would be expected to have a price impact in the NEM's spot market, which would increase efficiency. In addition however, reduced demand during supply scarcity would also have efficiency benefits with respect to reliability in the NEM, as demand could operate as reserve, ensuring reliability of supply in the same way that supply side reserve can. In particular, to the extent that DSP could reduce the need for peaking investment by offering demand side reserve at lower cost than such investment, efficiency of NEM operation would be expected to increase.[62]

The use of SR is not intended to improve the reliability currently in place in the NEM, but is instead intended to assist in meeting the existing reliability standard. For this reason, SR will not have a material impact on the actual level of USE in the NEM. Its impact will rather be on the efficiency in the NEM.

Modelling undertaken in the preparation of this report has demonstrated the following key aspects of SR operation:

- SR is to meet the reliability standard, not improve it, so SR replaces installed capacity in the NEM. The extent to which DSP replaces installed capacity will depend on the amount that is contracted by the central contracting authority and the price offered for DSP relative to other sources of SR;

[59] Energy Response, AEMC Reliability Panel Comprehensive Reliability Review Response, 30 June 2006, pp2-3.

[60] Energy Response, AEMC Reliability Panel Comprehensive Reliability Review Response, 30 June 2006, pp4-5.

[61] ERAA, AEMC Reliability Panel: Comprehensive Reliability Review, 30 June 2006, p7.

[62] Energy Reform Implementation Group, 'Energy Reform The Way Forward for Australia', January 2007, p251.

- SR may increase the frequency and duration of VoLL events, which will have a subsequent impact of increasing average pool prices in the NEM;
- As SR is invoked when VoLL occurs, modelling indicates that it is likely that SR will be invoked between zero and 50 hours each year; and
- To ensure that reliability is met in the NEM, it is unlikely that SR will be able to replace the Reserve Trader mechanism in the NEM.

The impact of SR on the efficiency of the NEM is likely to be mixed. While some aspects of SR will increase NEM efficiency, some aspects of SR will cause a decline in NEM efficiency.

SR will increase the efficiency of DSP for reliability in the NEM by increasing the firmness of DSP. Formal contracting for DSP involvement will increase the firmness of DSP by virtue of the contractual obligation on contracted parties in order to receive payment for the SR contracted.

Demand side bidding is not present to a significant extent in the NEM. DSP in the NEM for reliability purposes could be only one aspect of a broader issue in the NEM that DSP is not prevalent to an efficient extent. Experiences in other electricity markets indicate that while a competitive supply side can be developed, DSP may not be present. Absence of DSP may lead to a failure of an electricity market to achieve efficiency with respect to demand side signals.

DSP should be used in the NEM to operate in broader circumstances than just for reliability purposes. For this reason, the operation of SR must be considered in the context of its interaction with other DSP mechanisms. Currently in the NEM demand side bidding is facilitated through aggregators, or is undertaken by large scheduled loads. DSP contracted for SR will only be invoked for limited periods during VoLL events. To the extent that DSP contracted under the SR could not then be bid into the NEM at other times, this may impede the efficiency of NEM operation, particularly to the extent that it curtailed the current level of DSP.

It is possible that the reserve provided by the SR mechanism could be entirely constituted by DSP. However, in some circumstances this would lead to a situation where DSP could not be used to relieve reliability issues, depending on the location of the demand side reserve relative to the reliability issue. To illustrate, a local network reliability issue close to a major demand centre may not be relieved by demand side reserve offered by a major industrial load in a regional or rural area. The use of DSP if located within the load centre would however be very effective in relieving a local network reliability issue located nearby.

A number of unintended or perverse consequences for DSP may stem from the implementation of SR. One perverse consequence of the use of DSP to provide reserve is the possibility that phantom bids may be offered. The possibility of a phantom bid arises because demand side bidding of a reduction in load requires an initial benchmark load against which to require reduction. Two possible inefficiencies could result. The first is that demand side bidders are required to be turned on, that is consuming electricity, before a demand side bid can be accepted, thereby requiring a prospective bidder to first consume electricity, potentially exacerbating the supply shortfall that is present, before they can then be switched off. The second is that when contracting for SR, the actual demand of a prospective demand side bidder could be inflated in order to increase the volume of demand reduction which could be compensated. Both of these unintended consequences related to phantom bids and artificial load profiles must be avoided.

Another unintended consequence for DSP due to the operation of SR relates to the fact that aggregators may be adversely affected by the operation of SR.

A further unintended consequence for DSP is that the role of existing peaking plant in the provision of reserve may be undermined or replaced due to the SR mechanism. As the SR is not intended to increase reliability in the NEM, DSP would be expected to replace existing forms of reserve. The likely type of reserve replaced would be the most costly peaking plant. However, as the SR mechanism is also expected to increase the frequency and duration of VoLL events, this will lead to a change in investment signals that will encourage investment in peaking plant to benefit from an increase in high price events in the NEM.

SR will impact on the frequency and duration of VoLL events. Increased periods of high prices in the NEM including VoLL events would be expected to lead to increased investment in peaking plant as investors endeavour to benefit from increased returns during periods of high prices. This may be a perverse outcome because efficient generation investment will be made based on demand and supply interaction and VoLL events, but SR has increased VoLL events relative to the established base case.

The SR mechanism will operate for relatively long periods of time based on modelling undertaken. Some of the current sources of demand side bidding in the NEM will not be readily suited to the SR mechanism because of the length of time it may be invoked for. A supplier of demand side reserve for SR will need to be able to offer interruptible supply for longer periods than some of the current demand side bidders would be capable of offering.

9.1.2) Efficiency of other alternatives

Other mechanisms would also be able to deliver the efficiency gains to the NEM offered by the SR mechanism, but they would be able to do so in a more targeted manner. In particular, the SR mechanism would allow the firming up of DSP, and would facilitate the NEM increasing information as to uncertainty associated with its operation. As the SR mechanism is confined to operation during VoLL events, its impact upon the utilisation of DSP is limited. To maximise the efficiency gains that can be realised through increased utilisation of DSP, demand side participation should not be limited in any manner, including by limiting its operation to VoLL events.

9.2) REDUCTION OF IMPEDIMENTS TO DSP THROUGH SR

With respect to technological barriers to the utilisation of DSP for reliability purposes, it is not apparent whether or not SR will have a positive impact on the uptake of smart meters by electricity users. More particularly, it is not apparent whether SR will improve NEM efficiency by increasing utilisation of smart meters as the costs of SR may outweigh the benefits associated with utilisation of DSP. It is also clear that the rollout of smart meters has already been identified as a priority by CoAG and on this basis it is most likely that the rollout of smart meters would have occurred whether or not SR was implemented.

To the extent that there is a lack of incentive for any particular NEM participant to implement automation of demand response during peak demand periods, the implementation of an SR mechanism may provide a sufficient longer term return to create such an incentive. SR would particularly help by providing a longer term return over the 3 year contracting period than would the existing Reserve Trader mechanism which operates on a more short term basis.

SR may be a desirable mechanism to allow parties in the NEM to capture the benefits from demand side participation. This would assist in the short term in correcting the evident market failure that leads to a lack of DSP in the NEM. The benefit of SR over the long term however, once the market failure leading to a lack of DSP is corrected seems less apparent.

10) CONCLUSIONS

The modelling analysis and economic analysis undertaken has provided a number of observations as to the likely operation of the SR mechanism under consideration. The first of these is that DSP, and its efficiency in providing reliability in the NEM is very dependent upon locational issues. This is a particularly pertinent issue in the context of local network issues where some sources of DSP for SR are unlikely to be located in a suitable region to relieve the network issue.

Since SR would be needed to be contracted several years ahead, there may also be a substantial and costly mismatch between contracted SR and required SR region by region. This is particularly significant since reserve shortfalls have not been experienced NEM wide to any extent, compared with those on a regional basis.

As the likely effect of the SR mechanism is to increase the NEM pool price through extending the periods of VoLL, with little impact upon reducing the resources required to deliver reliability to the NEM, it is not consistent with achieving the NEL objective as it is not in the long run interests of electricity consumers.

The use of SR to deliver DSP in the NEM is a narrow way to attempt to enliven demand side responses. Lower hanging fruit is available to participants, regulators and rule makers in the NEM compared to the SR mechanism. This low hanging fruit consists of a wide variety of other mechanisms to increase utilisation of DSP in broader circumstances.

Our preliminary conclusions from the assessment of SR are as follows:

- If reliability in the NEM remains very high, consistent with the past several years, with the reliability standard continuing to be met, SR would be called upon for very short periods, usually one or at most several 5 minute dispatch intervals, and SR (including DSP) will be relatively ineffective as the response time to VoLL events will be too great to contribute to reliability; furthermore, any effect would be to improve the network reliability beyond the standard;

- On the other hand, if reliability is poor, owing to a failure of sufficient capacity to be developed to meet the reliability standard, the periods for which SR (and DSP) will be called upon will be lengthy, typically lasting for many hours in a day, and DSP may have difficulty in contributing to significant improvements in reliability; this is evidenced by the need, in emergency conditions, for standby plant to have sufficient fuel to manage up to a week at full output without additional supplies;
- Under intermediate conditions, where reliability is at borderline in meeting the standards, the benefits of SR and DSP may be the maximum, as the duration of SR may be consistent with the ability of DSP to contribute; under these circumstances the capacity of SR (and DSP) to be contracted will be a key factor to the success of the scheme; the contracted capacity of SR should then ideally be just sufficient to ensure meeting the reliability standard.

The most significant factors against introducing SR to the NEM are:

a) SR will be ineffective for VoLL events in many, if not most, situations where VoLL is not associated with a supply shortfall
b) SR will be contracted several years ahead across all regions, whereas VoLL events may be localised to a particular region
c) DSP within SR has localised benefits and may even exacerbate reliability if actioned inappropriately
d) A rule change has been proposed by AER which will diminish VoLL events resulting from automatic under frequency load shedding and therefore reduce scope for SR.

The main advantage seen for SR, and for promoting DSP for reliability, is for potentially catastrophic and unforeseen events resulting in periods of mandatory load shedding when prices remain at VoLL owing to a NEM-wide supply shortfall. Such events should be extremely infrequent, with an incidence no more than once in 10 years. In these events, there would be benefit in high levels of contracted DSP. In these events, more benefit would result from contracts allowing periods of hours of interruption per day for several days sequentially. If this DSP can be contracted for a price well below that of equivalent installed capacity, say half or less, market efficiency may be enhanced.