



Australian Energy Market Commission

Review into the role of hedging contracts in the existing NEM prudential framework

February 2010

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Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
ASX	Australian Stock Exchange
CPT	Cumulative Price Threshold
ERAA	Energy Retailers Association of Australia
FOA	Futures Offset Arrangements
FLP	Futures Lodgement Price
MCE	Ministerial Council on Energy
MCL	Maximum Credit Limit
NEM	National Electricity Market
NEO	National Electricity Objective
NGF	National Generators Forum
NSW	New South Wales
OTC	Over-the-Counter
PM	Prudential Margin
PwC	PricewaterhouseCoopers
QLD	Queensland
RA	Reallocation Arrangements
RMCL	Reduced Maximum Credit Limit
RRP	Regional Reference Price
SA	South Australia
SFE	Sydney Futures Exchange
SFECF	Sydney Futures Exchange Clearing Participant
TL	Trading Limit
VIC	Victoria
Vol	Volatility
Voll	Value of Lost Load

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1 Executive Summary

1.1 Introduction

The Australian Energy Market Commission (AEMC) appointed PricewaterhouseCoopers (PwC) to conduct this review into the role of hedging contracts in the existing National Electricity Market (NEM) prudential framework. This report advises the AEMC on ways in which the NEM participants' futures and other types of hedging contracts can be integrated into the NEM prudential framework. The scope of this review was to undertake analyses and make recommendations on:

- the risks associated with the existing reallocation arrangements (RAs) in the NEM prudential framework and ways to potentially enhance these arrangements;
- the risks associated with the proposed models for futures offset arrangements (FOA) and ways to potentially enhance these arrangements; and
- the maximum credit limit (MCL) methodology.

The broad objective of this study was to assess whether the integration of hedging contracts would enhance the operation and efficiency of the prudential regime for the NEM and contribute to the achievement of the National Electricity Objective (NEO) and to evaluate the extent of the effectiveness and efficiency of the current MCL methodology.

This study was undertaken over an 8 week period 27th July through the 16th of September 2009 at which point an initial draft of the findings and recommendations of the review was to be presented to a working group.

The 62 deliverables for this report are listed in Appendix 7.1 along with the location in the report where each response to the deliverable can be found.

Please note that this report has been drafted with the assumption that the reader is informed of the NEM rules, the prudential requirements underpinning the spot electricity market and the interaction between the spot and forward electricity markets.

1.2 Background

The intent of the pricing mechanism structure in the NEM is to provide economic signals of network weakness and create investment incentives for new peak and base load generation. By establishing a value of lost load (Voll) figure of \$10,000/MWh, which has been market settled many times since market inception, a skewedness develops in the price duration curve and in price probability distributions. In addition, the cumulative price threshold (CPT) figure of \$150,000¹ and administered price cap of \$300/MWh after CPT is reached truncates the tail of the price probability distribution to provide protective measure to the market. This in turn creates volatility in the market, which, at times, can be difficult to manage. Therefore it should be noted that closing out all significant risk in the NEM regions through collateral or hedging instruments is difficult and expensive. The following analysis should be assessed with the understanding that the structure of the market provides additional risk coverage challenges and the balance between market effectiveness and market efficiency is more pronounced than in other energy markets.

¹ The cumulative price threshold (CPT) is reached when the sum of half hourly prices equal \$150,000

1.3 Approach

To address the 62 deliverables requested by the AEMC, PwC has split its approach into review of market information, stakeholder consultations and quantitative analysis. The approach to this review involved the following steps:

- Review of market information – Information was collected from the AEMC, AEMO, d-cypha Trade and other related information to comprehensively understand the issues involved in the review.
- Stakeholder consultations – PwC met with a full range of market participants, AEMO, the AEMC working group members, clearing members, Austraclear and ASIC to understand the range of views regarding the components of this review.
- Data compilation and analysis – NEM spot pool price data from AEMO, futures data from SFE and d-cypha trade and other relevant data were collected, compiled and analysed to assess pricing behaviours and risks under a range of different scenarios.
- Qualitative assessment – Based on the review of the market information qualitative analysis was undertaken, where sufficient data was not available and it was not appropriate to undertake quantitative analysis.
- Compilation of a report – We developed this report to address each of the focus areas in turn and provide both qualitative and quantitative results based on the terms of reference for this project and our findings from the market review and analysis

1.4 Summary of Findings

This section provides a high level summary of our findings and recommendations. Detailed findings and recommendations can be found in section 6.

1.4.1 Stakeholder Consultations

Stakeholders were largely supportive of addressing issues around existing and proposed hedging contracts Maximum Credit Limit (MCL) offsets and the MCL calculation methodology providing the prudential quality of the NEM is maintained and not jeopardised with any rule or methodology modifications arising from this review.

When discussing reallocation agreements the key concerns cited by NEM Participants related to the transfer of credit risk from the NEM to market participants. This related not only to the direct effect a generator failure could have on the NEM prudential reserves, but also to the knock on effects of the broader market in the case where the generator failure placed significant financial strain on a retailer or group of retailers.

The key issue that was raised in relation to introduction of Futures Offset Arrangements was a concern that the variation margins from gains in futures, deposited into an SDA account, may not be sufficient to maintain the prudential quality of the NEM to the current level of prudential coverage or fit in with the existing AEMO processes for management of prudential requirements in the NEM.

When commenting on the MCL process, NEM participants were concerned that the current MCL determination processes can be unresponsive to changes in market pricing and does not provide for anticipation of forward price movements. Again, NEM participants indicated that any alternative calculation methods to the current MCL process should not impair the prudential quality of the NEM,

especially at times of high prices. Also any proposed new MCL calculation methodology should perform better than the current MCL methodology in terms of effectiveness and efficiency.

1.4.2 Reallocations

Energy and Dollar Reallocation Arrangements

The current ex-post and ex-ante dollar and energy reallocation processes serve as an important function for both the management of market risk for retailers and generators, as well as, facilitating a mechanism to reduce bank guarantee requirements that are required to support fully risked trading positions with AEMO. Reallocation Agreements (RAs) have had limited uptake since their introduction in 2004 and currently represent approximately 9%² of the total NEM traded volume. The reallocations have largely been used in Victoria and Queensland. Stakeholders identified a number of factors which have impacted the uptake of reallocation agreements. These include the size of the premiums generally required by generators to enter into RAs, generators unwillingness to reallocate large proportions of their generation load, the risks to retailers in the event of termination of the reallocation agreement and the internal reallocation that is available for generation/retail companies (gentailers) in the MCL process.

The assessment of the risks of RAs identified a scenario which could result in a NEM spot market prudential shortfall. This scenario exists if a failure of a generator leads to the termination of an RA and the subsequent inability of the counterparty retailer of the RA to secure the additional bank guarantees required in the period allowed by AEMO, when both the retailer's and generator's prudential margins have been exhausted. Though the probability of this event appears to be low, in the event that it did occur, the exposure of the NEM is limited to the offtake load of the retailer over the period from the termination of the RA triggering AEMO's call for additional MCL and the failure of the retailer to provide the additional security on the following business day. The maximum incremental exposure above the current MCL is therefore an additional day under an RA.

As a result, we conclude that on balance RAs do not directly create sufficient additional market exposure to pose a major risk to the prudential quality of the NEM or to warrant a change to current AEMO processes for their management. However, should the AEMC require MCL coverage for the incremental risk of one day, one additional day could be added to the prudential margin (PM) period.

Swaps and Options Reallocation Arrangements

There is a great deal of support from market participants for incorporating over the counter (OTC) swaps and options into the reallocation process. Under these types of reallocations, the circularity of payment is avoided through AEMO's management of the settlement pricing process for both spot and the RA swap or option which settles the transaction payment to the generator of the bilaterally negotiated strike price. Under this type of RA the strike price is used as the basis for MCL relief, with no volatility factor uplift for the portion of the MCL the swap or option covers (the true value above the strike price). This value below the strike price would not receive MCL relief. Under this arrangement the credit exposure is shifted from AEMO to the swap and option counter parties (retailer and generator), for the value above the strike price of the swap or option RA, unlike the standard RA where the credit risk for the transaction value, in entirety, is shifted to the counterparties of the RA.

AEMO has applied to ASIC for an exemption from the requirements to hold a clearing and settlement facility licence for the swaps and options reallocation proposal. As a result of our analysis, we conclude that the credit risk profile of swap and option RAs is less than for sales on the spot market and therefore deserve MCL relief. Modifications to the rules around AEMO's role in the settlement process of the

² AEMO data

swaps and options may address the perception of AEMO acting as a facility for clearing and/or settling swaps and options.

Findings and Conclusions

Our findings from the analysis of RAs support the hypothesis that the existing RA process does not require modification. On balance, there is insufficient evidence to support the notion that there is a significant termination risk to be addressed. However, if the AEMC requires the termination risk to be covered an additional risk weighted day to the MCL prudential period could be added. For the proposed RA Swaps and Options we suggest that the proposed NEM rules be modified to minimise AEMO's involvement in the settlement process of swaps and options.

1.4.3 Futures Offset Agreements

It has been proposed that FOAs be introduced into the NEM prudential regime to provide an additional hedging instrument to assist market participants in the management of their MCL prudential requirements.

Two settlement models have been proposed for the introduction of FOAs

Model 1: AEMO would receive and hold onto all positive variation margins until settlement. At settlement, AEMO would apply the Security Deposit Account (SDA) corresponding to the billing periods against settlement amount and return any excess funds to the retailer.

Model 2: AEMO would return the positive margins if the futures prices fall following a rally. The amounts in the SDA however would be held with AEMO for the term of the FOA and not be applied at settlement.

We have reviewed both of the settlement models proposed and find that Model 2 matches the flow of funds under a futures agreement most closely. The stakeholders consulted as part of this process were also unanimous in their support of Model 2.

As part of this review we have identified three types of risk that could potentially be introduced to the NEM as a result of the introduction of FOAs. These are:

- Termination and other operational risk
- Systemic risk of differences between spot and futures prices
- Unique risk associated with a difference between the shape of the futures contract and the retailers load profile

In the event of termination of the FOA and the failure of a the retailer to provide additional credit support the NEM spot market may be exposed up to, the difference between the spot price and the greater of the futures lodgement price (FLP) and previous days futures price, for the time between the request for additional security and the failure of the retailer to provide this additional security on the next AEMO business day. Statistical analysis performed does not show a distinct trend in futures trading at a discount or premium to spot prices over the past four and half years and therefore no systemic risk was identified. A good correlation between spot and futures prices was found for each of the regions with futures on a like for like value basis.

Findings and Conclusions

Our analysis of FOAs supports the view that return of excess funds in the SDA account as envisaged in FOA Model 2 proves to be of significant value to retailers while not significantly adding to the NEM risk. On balance, it was not evident that termination risk represents a major risk which that needs addressing; however, if the AEMC requires the termination risk to be covered an additional risk weighted day could be added to the Prudential Margin period for participants with an FOA. We do not support the view that the use of FOAs introduces a systemic risk into the NEM prudential process, though at times there may be differences between the margin payments required by AEMO under the proposed models and the obligations of a retailer to AEMO. To address this risk we recommend that the variation margin calculation in the FOA model be modified to include a floor on the AEMO margin requirements in the SDA account to support FOA positions at the accumulating average spot price over the 35 day outstandings period. Our analysis shows that with the introduction of this floor, the funds in the SDA account cover the outstandings associated with the FOA³. We have also proposed an adjustment to the margin formula to ensure that the MWh reduction to the MCL is equal to the number of MWh for the margin payments. Although there may be unique risks to each market participant as a result of changes to the retailers load profile with the introduction of an FOA these risks are best managed individually through existing or revised AEMO load assessment processes rather than through a standard futures discounting factor, referenced for the purpose of this document as a *Beta Factor*.

The proposed FOA process is a significant departure from the way in which collateral is managed under the current prudential regime. Under the current prudential regime, collateral is posted through bank guarantees to cover a 'reasonable worst case' event leading to a financial shortfall and is reassessed every three months or as required. Under the proposed FOA agreement the risk above the futures lodgement price (FLP) is shifted from bank guarantees to a daily cash based collateral management process. The analysis and recommendations contained in this report display that the collateral coverage is not impaired under the FOA process, only managed in a different manner, daily as opposed to every three months. Of note, the existing RMCL process operates in a similar manner by reducing the retailer's MCL and trading limit and using a daily margining process to ensure that sufficient collateral is held to cover the retailer's outstandings.

1.4.4 MCL Calculation Methodology Alternatives

The scope of this review required an assessment of the applicability, effectiveness and efficiency of utilising forward pricing information contained in electricity futures. In addition, MCL alternatives that consider a stress test scenario, a modified historical approach and a hybrid approach were evaluated. These are described in turn below and then compared graphically in Figure 1.4.4.a to evaluate visually the relative effectiveness and efficiency. New South Wales (NSW) has been used for example purposes throughout this report and analysis for the other NEM regions which are also supported by futures contained in the appendices.

Current MCL (Current MCL) - The current MCL process utilises historical information to provide credit cover for forward looking credit exposures. The calculation methodology uses an average of time-weighted prices for the past year and a volatility factor derived from the peak value of a 42-day backward looking moving average of daily outstandings of each region. This MCL calculation methodology was developed prior to the development of a liquid futures market and has generally been accepted by market participants.

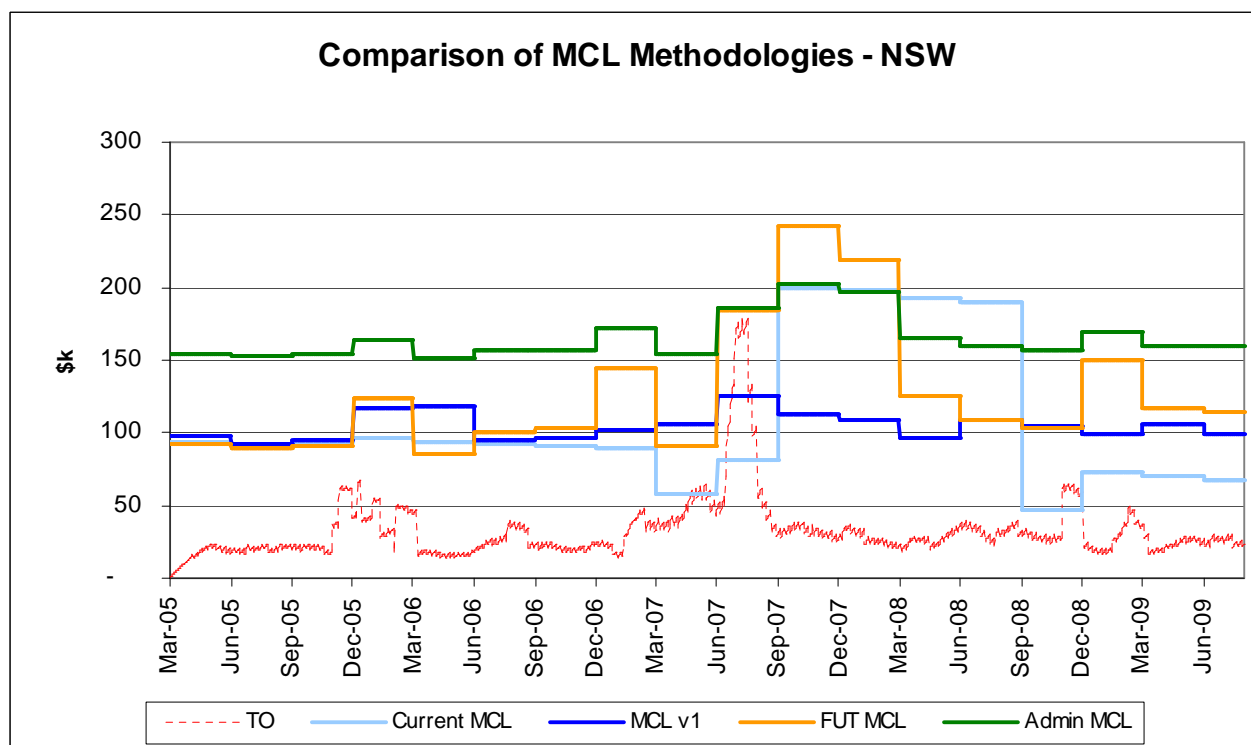
³ Note: Our analysis also confirms that the unfunded variation margins from the FOA is lower than the unfunded margin calls from the existing RMCL process

Futures MCL (FUT MCL) – A forward looking MCL was developed using spot futures and applying a volatility factor derived from the spot futures.

Stress Test MCL (Admin MCL) – A stress test MCL was developed by using one week of administered pricing once the Cumulative Price Threshold has been reached (for the prudential margin) coupled with 4 weeks of spot futures without volatility (for current outstandings) and a week of spot futures scaled to incorporate a volatility factor (for current accumulating outstandings). This methodology was developed to recognise the respective risks pricing of each of the 42 day MCL period (28 days of outstandings, 7 days accumulating outstandings and 7 day reaction period).

Hybrid Model (MCL V1) – A model that incorporates spot and futures prices has been developed by using spot prices for the 4-week outstandings period and futures prices for the one week of accumulating outstandings and the Cumulative Price Threshold for the one week reaction period. A volatility figure, using futures prices, is calculated for the one week of accumulating outstandings only.

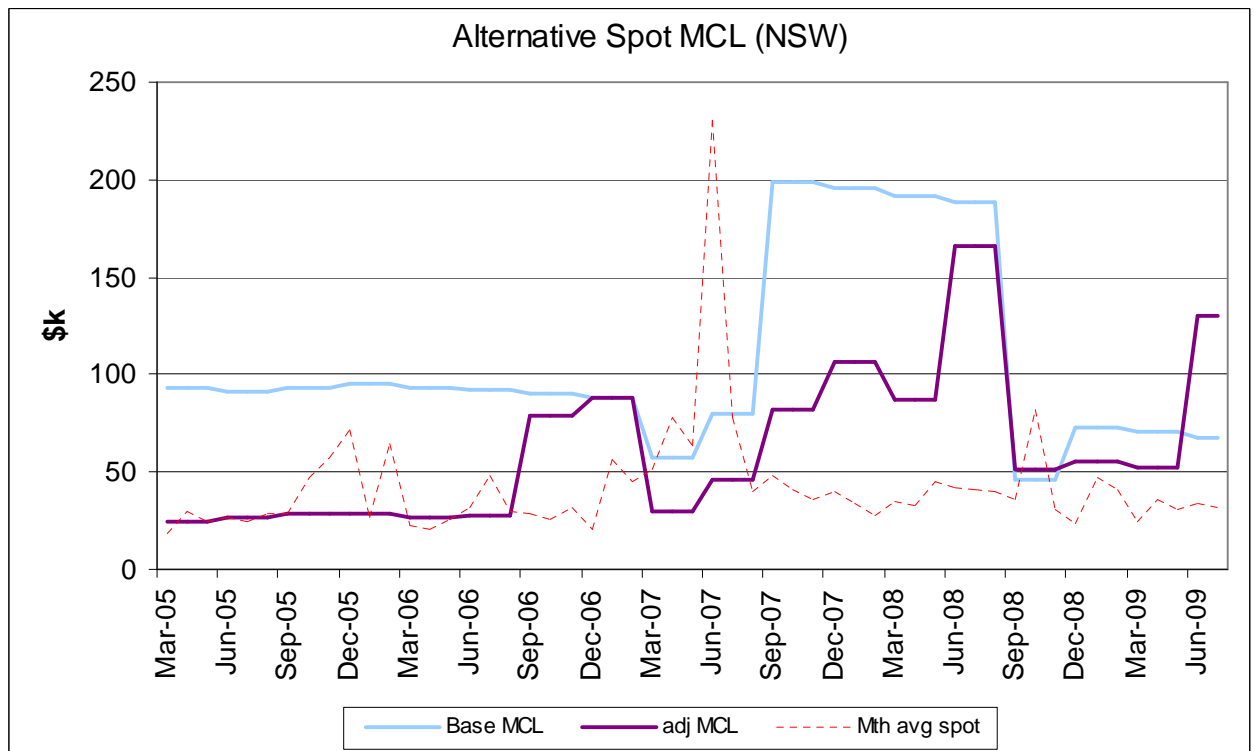
Figure 1.3.4.a displays graphically the performance of each MCL methodology against the load weighted total outstandings (TO) for NSW between March 2005 and July 2009 with Futures MCL (FUT MCL) displays the most sensitivity to movements in the spot price providing the most effective MCL cover over the 4 ½ year period.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 1.3.4.a – MCL Calculation Methodology Comparisons

Alternative Historical Spot MCL (adj MCL) – An alternative historical spot price MCL methodology was determined using the current historical base price methodology but scaling it with a seasonal factor and then applying a historical volatility factor using a price series derived by using a daily 28 day moving average price to reflect movements during the 28 day outstandings period. Figure 1.3.4.b below compares the performance of this alternative historical spot MCL methodology and reflects a less effective MCL over the period March 2005 through June 2009 than the existing MCL approach.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 1.3.4.b – Alternative Spot MCL Calculation

Findings and Conclusions

The futures MCL calculation methodology proves to be more effective than the current MCL process, especially the closer you move to calculating the MCL to the start of the spot futures contract. The efficiency of this methodology is not sufficiently different from the current MCL methodology. It should be recognised that there would be additional market efficiencies that could be realised by using futures for the MCL calculation, such as greater alignment of the physical and financial markets and the fostering of greater interest in short-term trade in the market to better facilitate load balancing risk. We, therefore, recommend that for NEM regions with sufficient trading activity, currently (NSW, QLD and VIC), that a forward looking approach using futures be considered for implementation due to its superior effectiveness, with further work to be done to create a formula that increases the efficiency and limiting any significant impairment to the effectiveness. For regions with insufficient trading activity or no futures contract, the MCL calculation methodology should default to the current historical methodology until further assessment of other historical MCL approaches prove more effective and efficient than the existing MCL calculation approach.

2 Background to the Current NEM Prudential Regime

The National Electricity Market (NEM) is a gross pool electricity market operated by the Australian Energy Markets Operator (AEMO). AEMO's responsibilities include the scheduling of all generation in to the NEM⁴ and the settlement of the market at the Regional Reference Price (RRP). The obligation of AEMO to settle payments with the NEM participants is limited to the extent of the funds received from the NEM participants for the billing period and credit support provided by participants. In the case where there is a shortfall of funds from any NEM participant, that shortfall shall be shared between all participants due funds in that period in proportion to the funds owed.

Given the potential exposure of all NEM participants to the failure of an individual NEM participant the NEM operates with a prudential regime designed to:

- (1) prevent generators pricing credit risk into the bid prices and therefore into the regional reference price (RRP), and
- (2) ensure that confidence is maintained in the settlement of the market at the RRP.

The key elements of the NEM prudential regime include:

- the Maximum Credit Limit (MCL) methodology including the Prudential Margin (PM) and Trading Limit (TL) processes,
- daily prudential monitoring,
- default and suspension, and
- settlement default.

2.1 Maximum Credit Limit

The MCL is set based on a 'reasonable worst case' estimate of the potential exposure of a NEM participant to AEMO over the 42 day credit period. The reasonable worst case is determined on the basis that the MCL should not be exceeded more than once in 48 months. The MCL is calculated for each NEM participant quarterly and participants are required to lodge credit support up to at least the level of the MCL in the form of bank guarantee⁵.

The MCL is calculated taking into account:

- the historical average price for each region over the previous year,
- the expected net consumption and generation for each region,
- the historic volatility for each region,
- a line loss estimate and GST,
- the billing period, credit period and reaction time, and
- an inter-regional adjustment.

The MCL is based on the reasonable worst case estimate of the exposure to the NEM over a 42 day period comprising the 7 days billing period, 28 days credit period and 7 days reaction time for AEMO in the case of a default event. The difference between the prudential margin (equal to the 7 days reaction time required to shut down the activities of a defaulting party) and the MCL is the trading limit (which represents the maximum allowable Total Outstanding for an individual participant). Generators generally have an MCL of zero due to their position in the NEM being a positive credit position. An example

⁴ All generators with a capacity over 30MW must be scheduled in the NEM

⁵ For all NEM participants with a non-investment grade credit rating

showing the break down of the calculation of the MCL for a retailer with an expected load of 1MW⁶ in a region using a volatility factor of 150% and 300% of an average price of \$40 is provided in Figure 2.1.a below⁷.

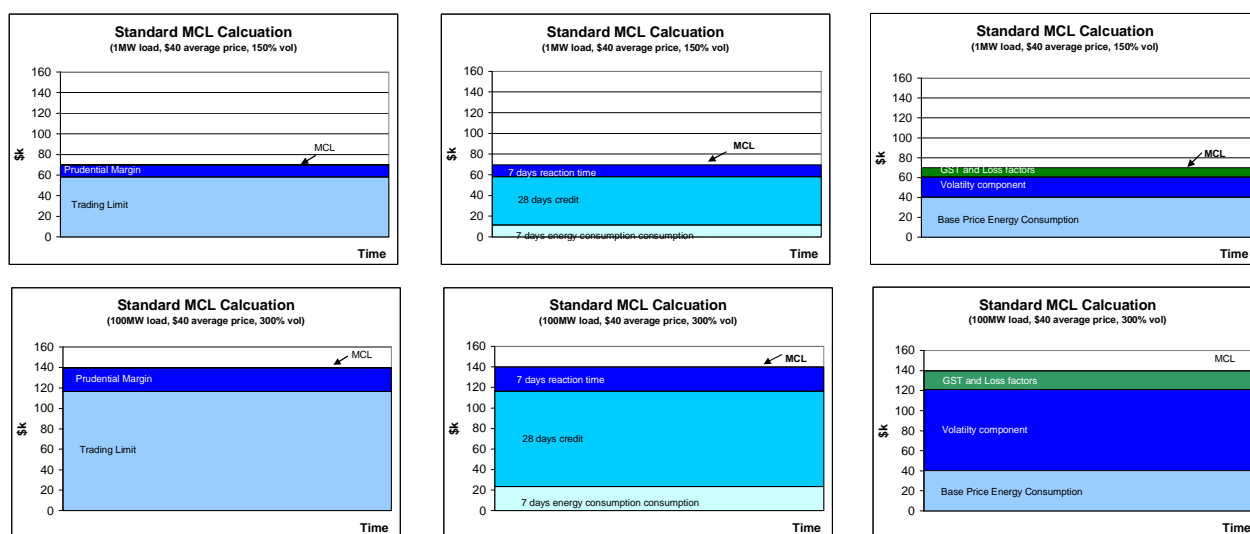


Figure 2.1.a – Example of MCL Calculation and Build-up

The MCL and prudential margin for each market participant is calculated on a regional basis and then summed to generate the total MCL, prudential margin and trading limit for each participant. The trading limit and prudential margin are monitored by AEMO on a national basis.

For vertically integrated companies with both generation and retail operations, a net MCL is calculated based on the expected generation into, and consumption from, the NEM in each region and then summed and an interregional adjustment factor applied.

2.2 Daily Prudential Monitoring

The total outstandings of each NEM market participant are monitored each AEMO business day by AEMO. If the total outstandings for any participant exceeds the trading limit, and the participant has not made a voluntary payment to resolve the breach prior to 10.30am, a call notice can be issued by AEMO. The call amount is equal to the difference between the NEM participant's total outstandings and its typical accrual, which is determined by AEMO as the level of outstandings for the participant if spot prices and consumption had been at average levels as shown in Figure 2.2.a below.

⁶ 1MW is used in all examples through out the report for illustrative purposes and ease of interpretation to expected profiles

⁷ This example is illustrative only and may not fully reflect the inputs used by AEMO

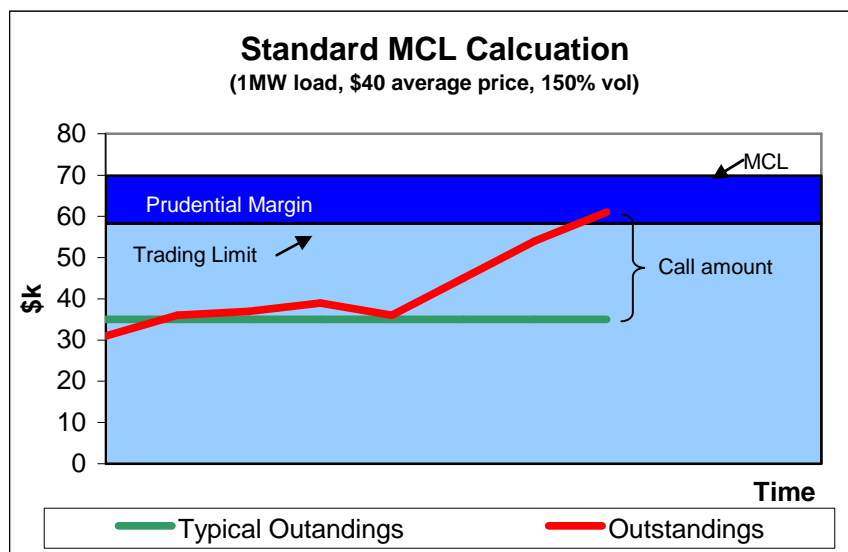


Figure 2.2.a – Trading Limit Calls Example

The additional security required to meet the call from AEMO can be provided by:

- Agreeing an increase to the MCL and providing additional security,
- Paying the call amount into a security deposit account, and/or
- An ex-post reallocation with another market participant

2.3 Default and Suspension

In the event that a NEM participant fails to respond to a call notice issued by AEMO, AEMO may issue a default notice. If AEMO is not satisfied that the default event has been rectified within the time period specified in the default notice, AEMO may issue a suspension notice to the participant and suspend their participation in the market. .

2.4 Settlement Default

In the event a participant defaults on a settlement payment, AEMO has the right to:

- issue a default notice;
- initially draw down on the bank guarantee until it is exhausted in order to make good on the defaulted settlement payment; and / or
- short pay the generators proportional to the amount of money each is owed by the NEM

2.5 Reduced MCL

The rules currently allow a NEM participant to request AEMO to provide a reduced MCL (RMCL). The RMCL calculation uses a 14 day credit period, rather than the usual 28 day credit period. The reduction in credit period results in a reduction of approximately 33% to the standard MCL. There is no change to the Prudential Margin (PM) when a RMCL is in place, rather the participants trading limit is reduced.

NEM participants with a RMCL are not required to settle on the shorter cycle, though the smaller trading limit requires more active management of total outstandings. The impact of the RMCL can be seen in Figure 2.5.a below.

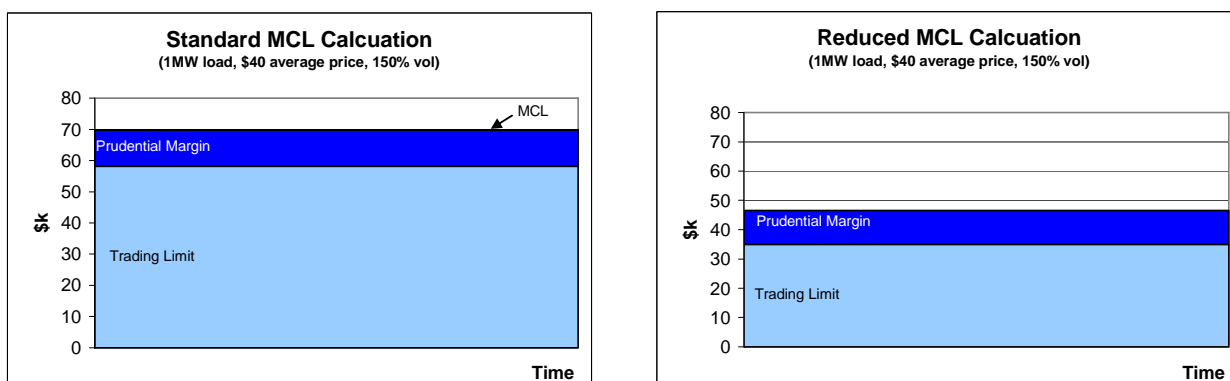


Figure 2.5.a – Comparison of MCL and RMCL

Any specific comments or recommendations on the effectiveness or efficiency relating to the reduced MCL process are outside the scope of this review.

2.6 Reallocation Agreements

Reallocation Agreements (RA's) were introduced to the NEM in 2004 as a mechanism for NEM participants with bilateral over-the-counter (OTC) contracts to net their positions outside of the NEM. The reallocation mechanism was introduced to minimise the settlement risk associated with circular cash flows and to reduce the prudential support requirements for NEM participants that have bonifide hedges in place. Where a reallocation agreement is in place, the payments or energy associated with the OTC contract are netted off the total outstandings of the retailer and off the funds owed to the generator, with the parties to the OTC contract settling the contract outside of AEMO. In the situation where a retailer has an OTC contract with no associated RA and a price spike occurs, the retailer may owe the NEM pool a significant sum of money until the settlement of that period⁸ and be owed a significant sum of money from a generator under an OTC contract. In such circumstances the circular cash flows and requirement to post additional security to cover the increased outstandings may create financial strain for the retailer who has a hedge in place.

Reallocation requests can be submitted either prior to a specified trading period (ex-ante reallocations) or after the specified trading period has occurred (ex-post reallocations). When ex-ante reallocations are accepted by AEMO, the MCL can be recalculated to take into account the OTC contract supporting the RA and reduced credit risk to the NEM spot market.

Reallocation requests can currently be submitted in the form of energy or dollars and it is proposed that this be extended to include swaps or options. Energy reallocations must be submitted with an energy load profile. Energy reallocations reduce the energy load for which the retailer has an obligation to pay the NEM and reduce the volume of energy for which a generator can expect payment from the NEM. Dollar reallocations specify a dollar amount and reduce the NEM payment obligation of the retailer and the generator payment receipt by the specified dollar amount.

⁸ Up to 35 days

Swap and options reallocations are not currently functional. There is a proposal that three types of reallocations be permitted under these process, swap offsets, cap offsets and floor offsets. Under swap and option reallocations, AEMO would be responsible for the settlement of the reallocation of the swap, cap, floor at the strike price as appropriate.

Only ex-ante energy, dollar, swap and cap reallocations can be used to reduce the MCL of a retailer. Ex post reallocations act to reduce the total outstandings of a retailer and therefore reduce the likelihood of a spot market shortfall or trading limit breach.

Note that there is no requirement for parties who have entered into an OTC contract to request a reallocation agreement from AEMO.

Examples of the NEM cash flows with and without RAs are show in Figures 2.6.a, 2.6.b., 2.6.c. and 2.6.d.

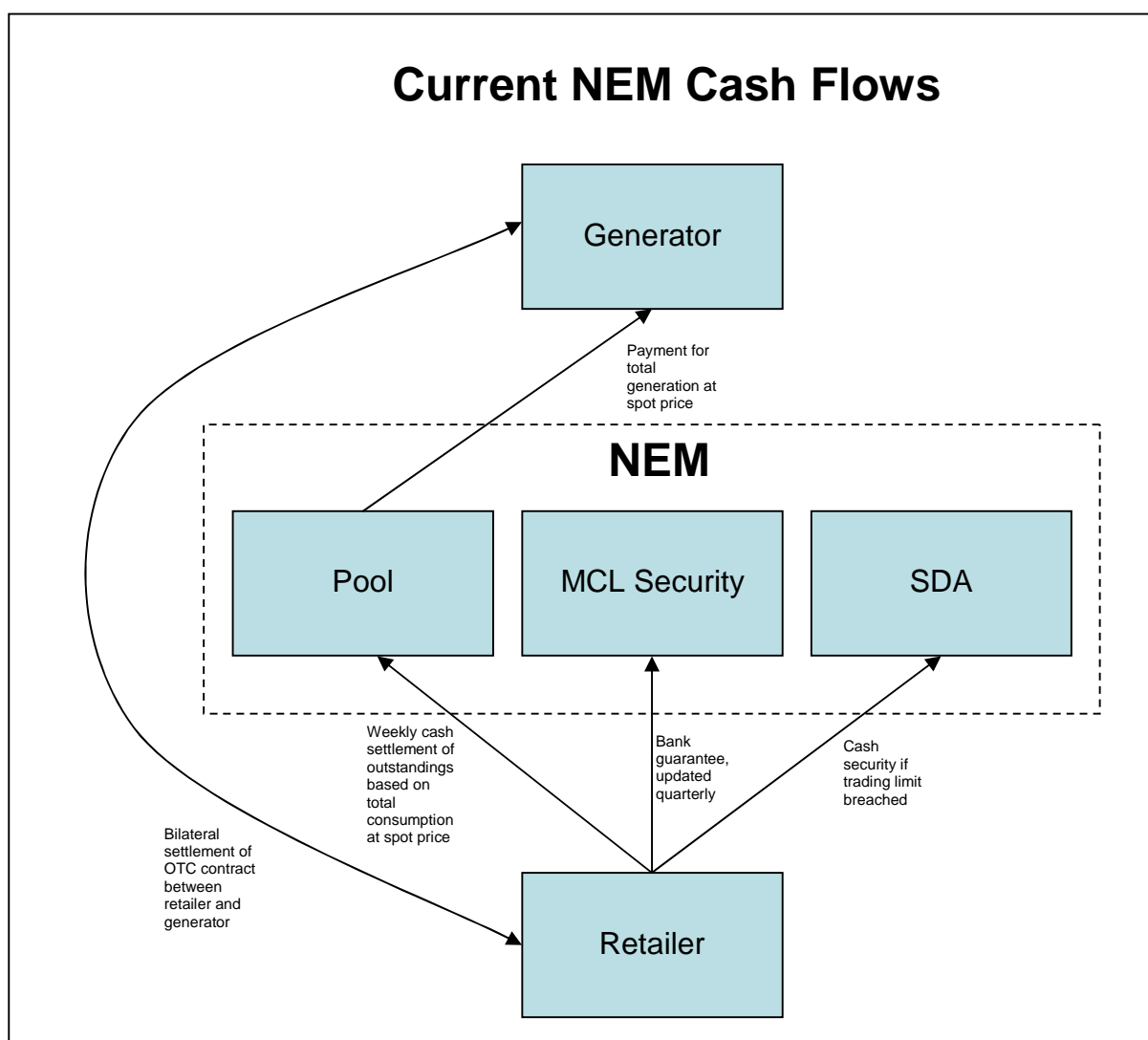


Figure 2.6.a. – NEM Cash flows without Reallocation Agreement

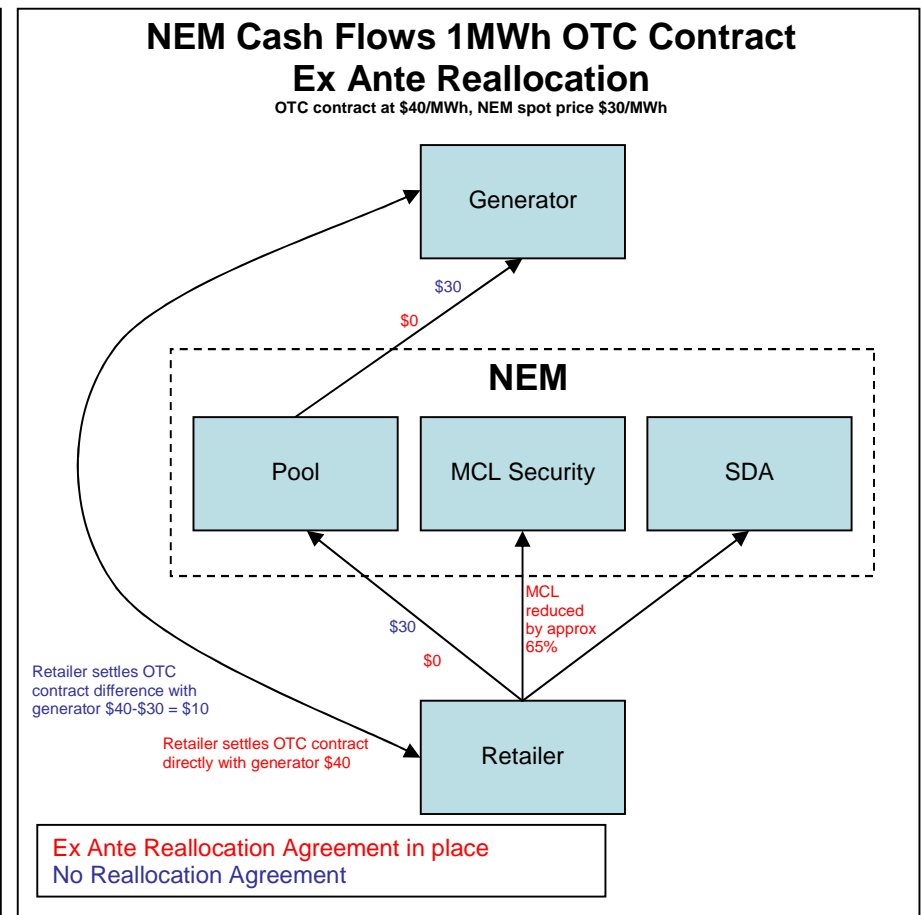
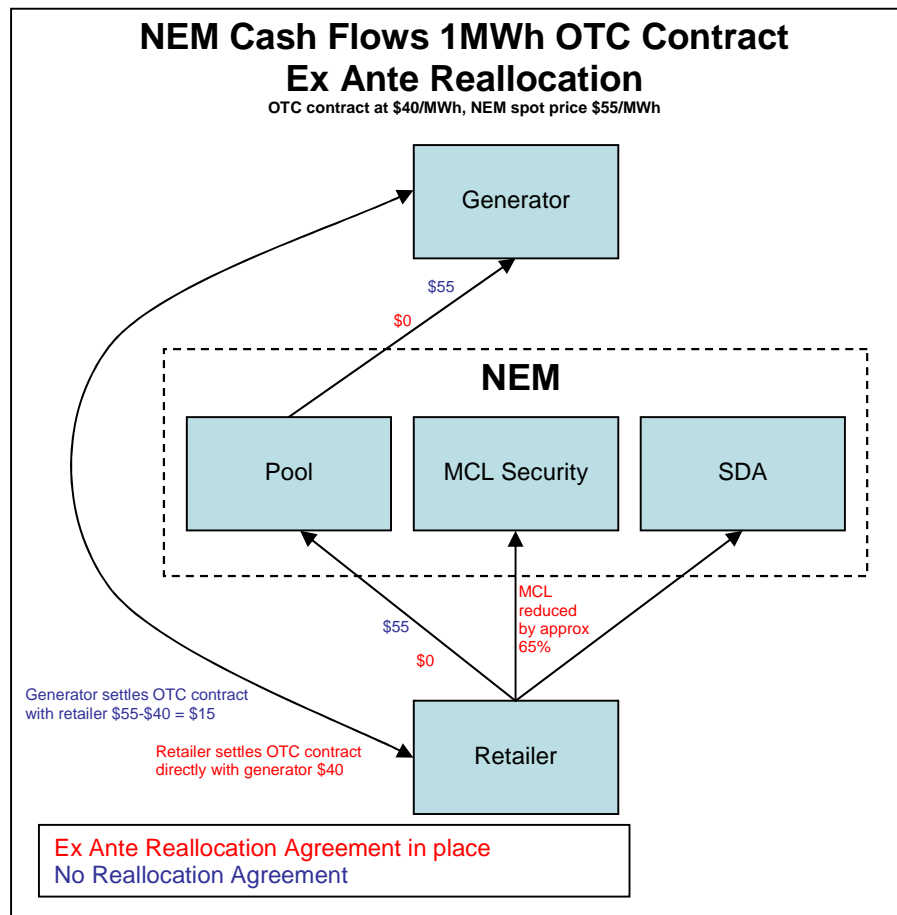


Figure 2.6.b. – Worked Examples of NEM Cash Flows with Ex Ante Reallocation

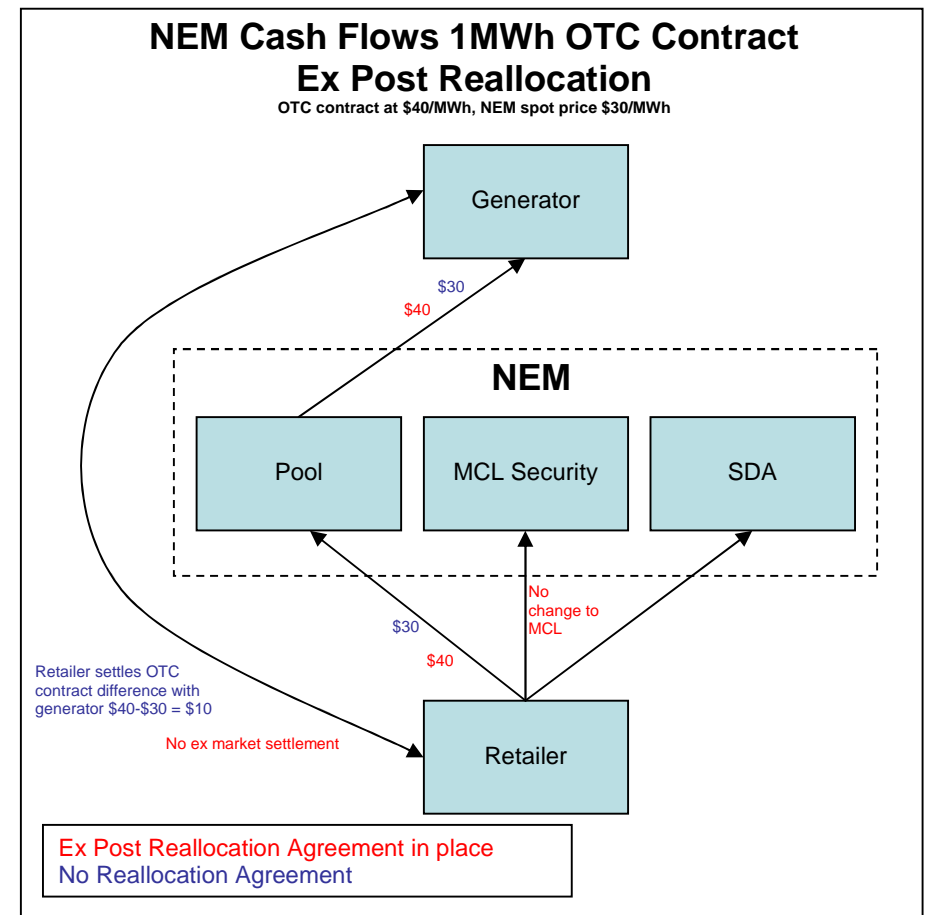
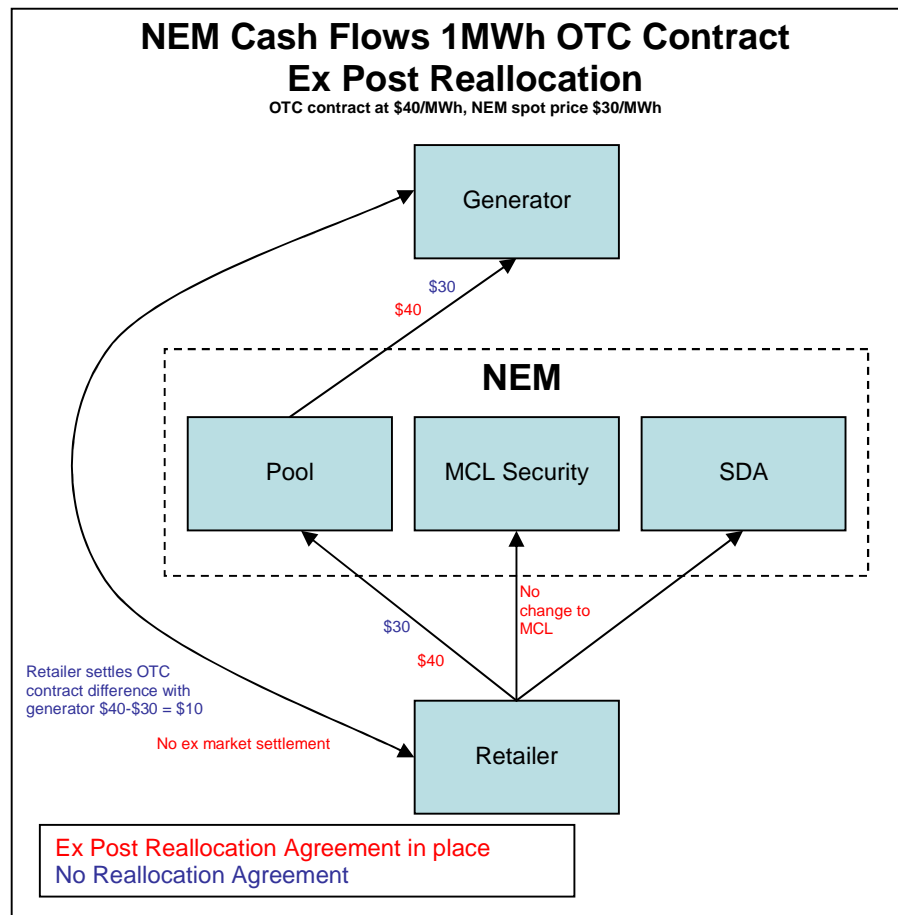


Figure 2.6.c. – Worked Examples of NEM Cash Flows with Ex Post Reallocation

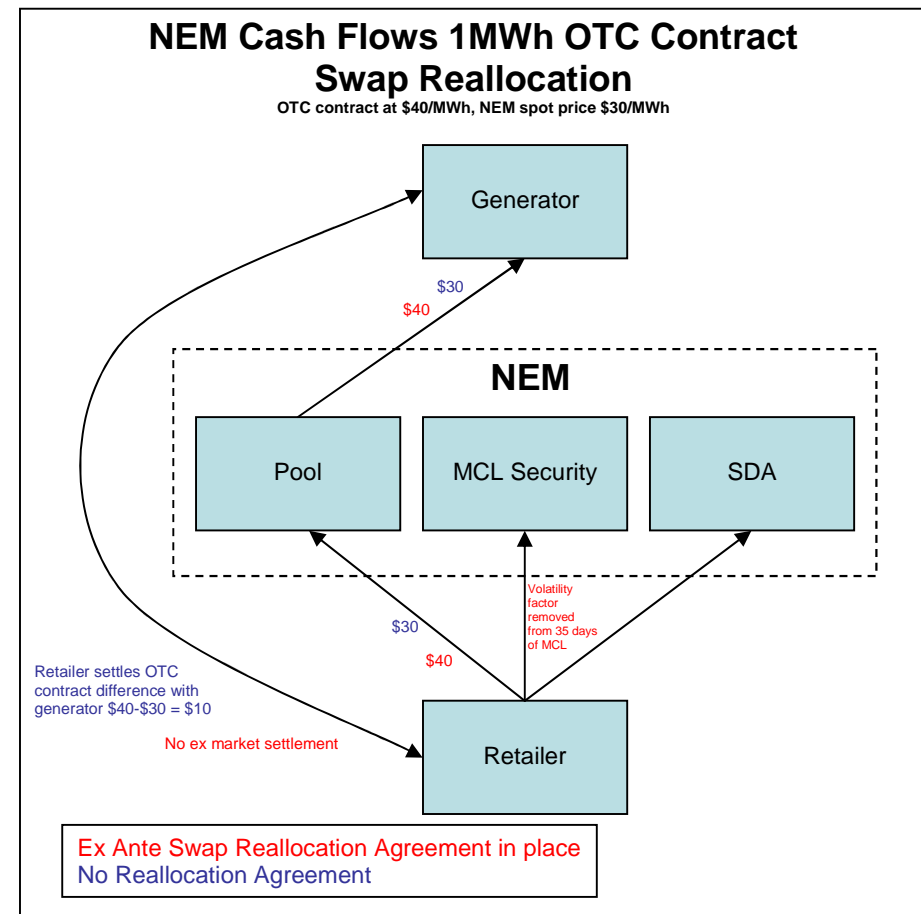
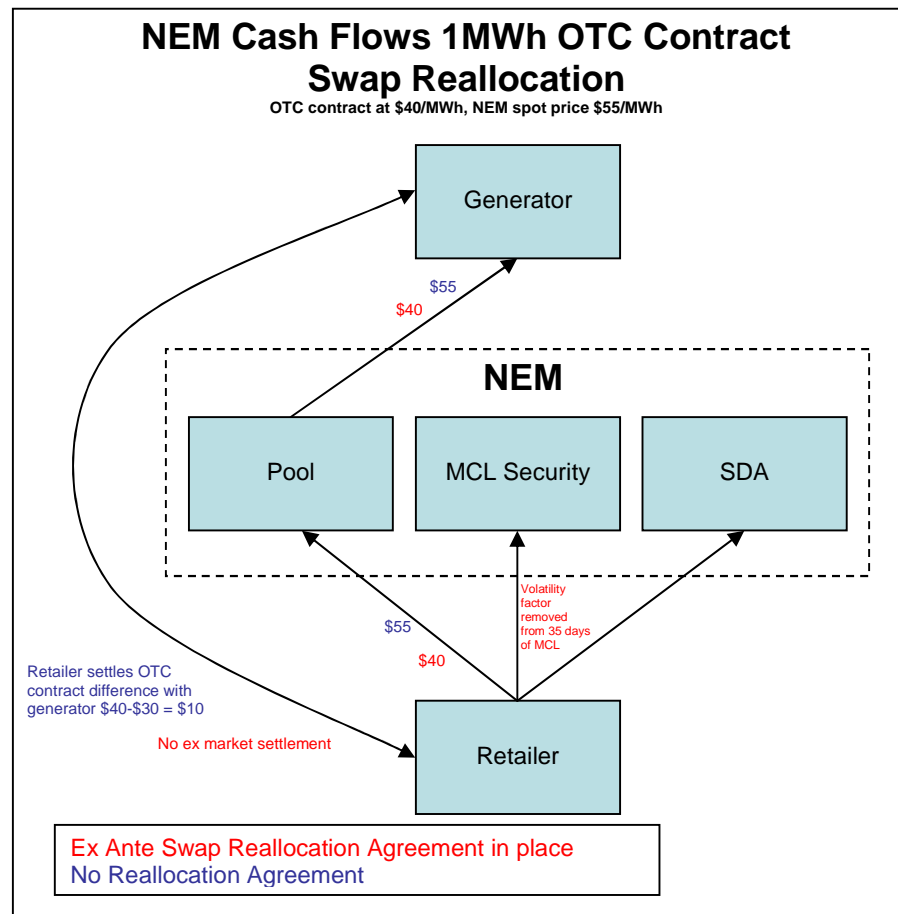


Figure 2.6.d. – Worked Examples of NEM Cash Flows with a Swap Reallocation Enter landscape section text here

3 Reallocation Agreements

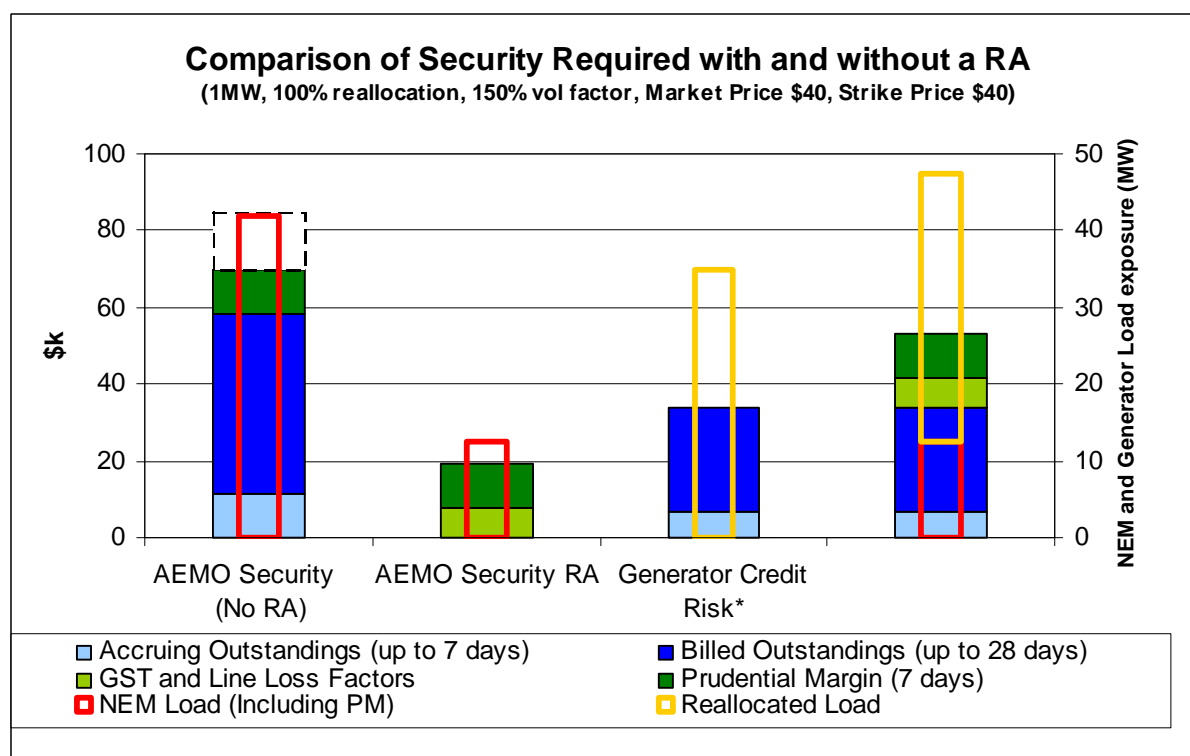
The AEMC is seeking to understand the risks and issues associated with reallocation agreements when compared to an unconditional bank guarantee, including the incremental risk of each category of reallocation, and the possible methods for mitigating these risks.

3.1 Transfer of Credit Risk

Under normal NEM operations, reallocation agreements can be used to reduce the prudential requirements or total outstandings of a NEM participant by taking the responsibility for settlement of specified energy or funds outside of the market and as such shift credit risk for those funds or energy from the NEM spot markets to the participants in an OTC transaction. The magnitude of the credit risk shifted between the parties is dependent on the type of reallocation, the spot and contract prices and the credit terms of the OTC contract.

Under all ex-post and dollar ex-ante reallocations the value of the credit risk shifted from the NEM is predetermined. The value of credit risk shifted to the generator will be a function of the value of the reallocation and associated credit terms documented in the OTC contract.

A worked example of the value of the credit risk transferred between the parties for an ex-ante volume reallocation is shown below in Figure 3.1.a. and the diagrammatic representation of the reduction in credit exposure to the NEM and the apportionment of credit risk is shown in Figure 3.1.b. Details of the calculations can be found in Appendix 7.3.1 (Figure 7.3.1.a). It should be noted that when a generator enters into an RA AEMO recalculates the generators prudential margin, increasing this to take into consideration the reduction in the retailers security held with AEMO.



Source: AEMO and PwC Analysis

Figure 3.1.a. – Transfer of Credit Risk between Participants to a Reallocation Agreement

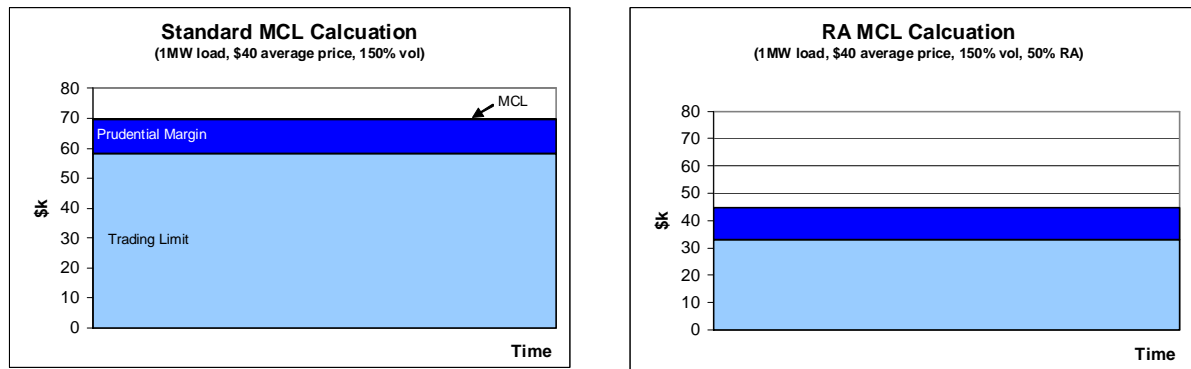


Figure3.1.b. – Reduction in MCL as a Result of Reallocation

It is not possible to fully quantify the credit exposure of a generator where a reallocation agreement is in place as the credit terms of the OTC contract remain confidential between the retailer and the generator. It is possible that a generator could set the credit terms equal to those of the NEM, require pre payment for the energy to be consumed or anything in between. What is clear is that the value of the energy sold under an OTC contract and associated reallocation agreement will, in almost all circumstances⁹, be lower in value than the credit security held by AEMO for that energy. As a result the credit risk of the generator is increased and the credit risk to the NEM Pool is reduced. The total security provided, in terms of prudential support, by the retailer is reduced when compared to a situation with no RA.

In the case of an ex post reallocation, the transfer of credit risk from the NEM to the generator will be equal to the specified dollar value of the reallocation. Given that ex-post events occur after the conclusion of the specified trading period, there is no risk with price uncertainty as the RRP's have already been fixed. Again the credit exposure of the generator will be determined based on the confidential terms of the OTC contract and could involve measures such as prepayment, short settlement cycles or other security deposits.

It should be noted that gentailers (i.e. vertically integrated generator/retailers) have an internal hedge in the MCL process as they receive a MCL reduction using their net generation and/or consumption position and thus their net NEM spot market exposure. The transfer of credit between parties in the case of a Swap or Option reallocation is discussed in Section 3.4.

3.2 Risks of the Reallocation Process

The day to day operation of reallocation agreements does not introduce additional risk of a shortfall in the NEM spot pool. In fact, it could be argued that the normal operation and under most termination scenarios reallocations may actually reduce the risk of spot market shortfall by shifting the credit risk from the NEM spot pool to the generator and obligating the generator to provide additional prudential margin to cover the event of a failure event.

3.2.1 Reallocation Agreement Termination Risk

The situations which may result in the termination of an RA by AEMO include:

- a default event occurs in respect of either party to the RA;

⁹ It is technically possible that the price set in an OTC contract is greater than the average future pool price estimate set by AEMO as part of the MCL calculation and volatility, but a retailer would have limited incentive to enter into this arrangement

- failure of either of the parties to the RA to satisfy their prudential requirements;
- failure of either party to the RA to comply with conditions imposed by AEMO at the time of registration; and
- both parties to the RA notify AEMO in accordance with the procedures that they require termination of the RA.

Following the termination of the RA the NEM participants have 24 hours to respond and provide increased levels of credit support to AEMO.

In effect the risks of termination can be broken down into three categories:

- Termination as a result of retailer actions
- Termination as a result of generator actions
- Joint termination

Reallocation Agreement Termination as a Result of Retailer Actions

In the event that a retailer fails to satisfy their prudential requirements AEMO has the right to terminate a reallocation agreement. In the case of an ex-ante reallocation AEMO has the right to bind both parties to the reallocation until suspension of the defaulting participant occurs¹⁰. Assuming that AEMO does not terminate the reallocation until the point of suspension, the introduction of the RA does not introduce any additional risk of shortfall to the NEM as the generator has committed itself to the credit exposure from the time of default until the time of suspension. The additional prudential margin provided by the generator and the commitment by the generator to honour the RA until the suspension of the retailer from the market provides the NEM spot market with additional protection over the case where no RA is in place in the event of a retailer failure.

For an ex-post reallocation, there is no change to the prudential support provided via the MCL by the retailer to AEMO and no ability to terminate an ex-post RA which has already been accepted.

This qualitative assessment of termination shows there is no additional risk of a NEM spot market shortfall from a reallocation agreement termination caused by a retailer default, failure or actions.

Reallocation Agreement Termination as a Result of Generator Actions

Where a generator defaults on its obligations, AEMO may terminate any reallocation agreements with that generator. In the case of ex-ante reallocations this will result in an immediate increase to the retailer's MCL and a call on the retailer to provide the additional security. In the event that the retailer is unable to provide the required additional security within 24 hours of the call, they may be suspended from the market. It is therefore possible, in the rare event that the generator's PM has been consumed at the point where the default occurs¹¹, that the retailer may have consumed load from the market for up to one day without the full MCL in place prior to default. This represents an additional one day's credit risk compared to the situation where a reallocation agreement was not in place. Our discussions with market participants indicate that retailers are aware of the risk of generator default under RA and many have provisions in place to deal with this risk and other risks associated with high price environments. As AEMO holds additional security in the form of an increased generator PM, and in the event of a generator failure assuming that the generator PM has not been exhausted, AEMO may increase the

¹⁰ Reallocation Information Paper and Examples states - "Ex-ante reallocations allow NEMMCO to validate before the current date, that a participant will have sufficient reallocation credits locked in to cover the 7 days of the reaction period. If the participant defaults, both parties will be bound to the ex-ante reallocation until suspension. In this way total outstandings should be covered by the current credit support. The NEM will not be faced with a shortfall."

¹¹ The additional prudential margin held by AEMO for the generator could be consumed in cases where the generator is a gentailer who has stopped generating and continues to consume from the market at times of extreme pricing.

period of time available to the retailer to secure additional bank guarantees without changing the risk to the NEM Pool. In the case where the generator PM has been exhausted, and given the difficulty of obtaining a bank guarantee in one day, there may be an argument that the risk to the NEM spot market pool could be minimised by allowing a prudent retailer additional time to secure a bank guarantee if alternative security is in place (say through funds in an SDA) rather than immediately commence termination proceedings.

Where a generator with ex-post reallocations defaults on its obligations to AEMO the ex-post reallocations can not be terminated retrospectively. As a result there is no additional risk associated with a shortfall to the NEM as a result of reallocation termination.

Mutual Termination of the RA

AEMO will not accept the termination of an RA by market participants, which would result in the immediate breach of the prudential margin by either party to the RA. As a result the ability of the parties to an RA to jointly request a termination does not add incremental risk of default to the spot market as any termination request that would increase this risk would not be accepted by AEMO.

Summary

The incremental risk of a NEM spot market shortfall as a result of the reallocation agreements as opposed to the situation with no reallocation agreements is summarised in Figure 3.2.1.a below. As we have discussed, where RAs are used they can reduce the risk of a NEM spot market short fall in the case of retailer default. Given that these processes are used at the option of market participants the ability of retailers to enter RAs does not in its self increase the credit quality of the NEM spot market.

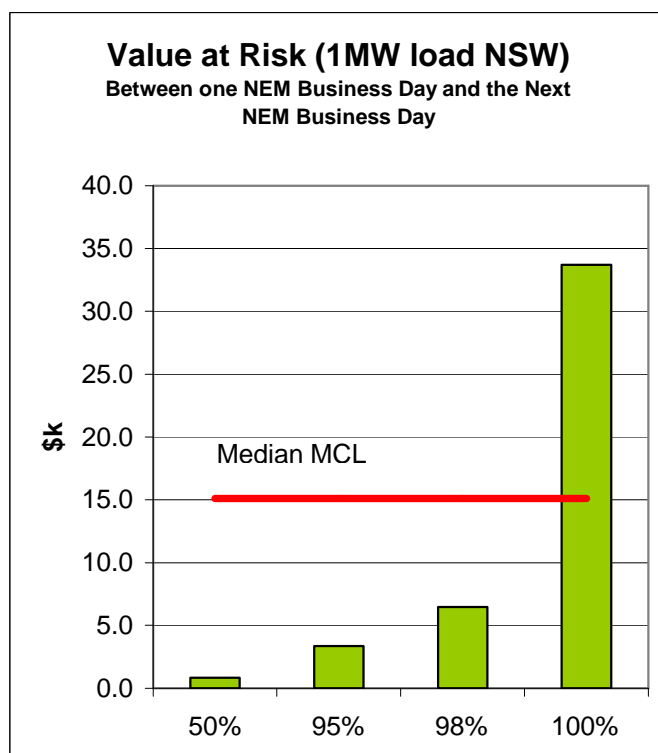
Termination event	Ex Post Reallocations	Ex Ante Reallocations
No Default		
Mutual Termination	No Incremental Risk	No Incremental Risk
Single Party Default		
Retailer default, PM or RA conditions breach	No Incremental Risk	No Incremental Risk
Generator default, PM or RA conditions breach	No Incremental Risk	No Incremental Risk
Two Party Default		
Generator default, PM or RA conditions breach causing retailer PM breach and default and Generator PM has been consumed	No Incremental Risk	Up to 1 day of retailer consumption at market prices

Figure 3.2.1.a – Increase in NEM Spot Market Shortfall Risk as a Result of Reallocation Agreements

To estimate, in quantitative terms, the magnitude of one day's additional risk to the NEM, we have analysed the cost of 1MW of electricity over the period from one NEM business day to the next NEM business day using actual data from Jan 2004 until July 2009. Figure 3.2.1.b below shows the value of a 1MW flat load in the period from one NEM business day to the next NEM business day at the 50th, 95th, 98th and 100th percentile compared to the median MCL over the same period for NSW. This figure

displays no evidence of MCL breach at the 98th percentile level, though does not take into consideration the existing outstandings. Similar charts for the other states including the maximum value can be found in Appendix 7.3.1. (Figure 7.3.1.b). It should be noted that the 100th¹² percentile level does not, for any of the markets, equate to the technical maximum daily price based on Value of lost load (Voll) and the cumulative price threshold (CPT), only the actual observed pricing over the 4 ½ year period.

Throughout the report where actual historical data is displayed, the 50th, 95th and 98th percentiles are used as a basis for displaying the range of normal operational conditions. The 50th percentile represents the point at which 50 per cent of the observations fall below and 50 per cent of the observations fall above. The 98th percentile represents the level below which 98th of the observed occurrences have fallen, this equates to approximately 1/48 occurrence (ie 1 out of every 48 occurrences will be above the 98th percentile).



Source: AEMO and PwC Analysis

Figure 3.2.1.b – Timing Settlement Risk (NSW): Value of 1MW Load between One NEM Business Day and the Next NEM Business Day

3.2.2 Retailer Financial Stress Following Reallocation Termination

AEMO has advised that a fully reallocated retailer can decrease their MCL to approx 35% of the pre reallocation level¹³ in the case of a full reallocation. In the event of the termination of a reallocation by AEMO as a result of a generator default or failure, conditions imposed by AEMO require that the retailer provide the additional bank guarantee the following business day. The ease with which any retailer can secure an additional bank guarantee will be dependent on the credit and financial standing of the

¹² The percentile is not based on a probability distribution but the actual observation at the 100th percentile of the data set

¹³ AEMO take into account load balancing when determining the expected average load for MCL and reallocation calculations

individual retailer as well as the nature of their banking relationships. Several market participants have indicated that it can be very difficult for retailers to secure a bank guarantee within a 24 hour time period and smaller retailers may be placed under significant financial stress if forced to secure these additional bank guarantee in this short time period.

In the event an RA is terminated as a result of a generator failure event, which sees the generator cease production and operation, the retailer's ability to rely on any underlying OTC contract may be impaired. As a result, the retailer may need to secure replacement electricity supply at the prevailing market price and/or try to secure alternative OTC contracts to replace the hedge at previous price levels. Given that the failure of a significantly sized generator is likely to result in a reduction in supply or supply certainty in the market, there is a high probability there will be a corresponding increase in the market price for both spot and contract electricity. This element of financial stress on the retailer exists regardless of whether an RA is in place with the generator it is contracted with or not.

AEMO is not obliged to automatically terminate a reallocation agreement if this represents an incremental risk to the prudential quality of the NEM spot pool. In the event of a generator failure, it is likely that the generator has a number of days credit with AEMO and therefore AEMO will not automatically cancel the reallocation agreement without allowing the retailer a reasonable time to provide the additional bank guarantees required. This AEMO process helps to protect the prudential quality of the NEM spot pool and reduces the risk of a retailer failure in the event of a generator failure.

3.2.3 Risk of Generator Default Resulting in Reallocation Termination and Spot Market Short fall

The only scenario identified where the presence of an RA can increase the risk of a NEM spot pool shortfall is a default event of a generator leading to the failure of a retailer when the overall prudential support provided is insufficient to cover the incremental exposure in the period from the issue of the call notice for additional MCL and the failure of the retailer on the following NEM business day to provide the funds to cover the increased prudential requirement and the suspension process is commenced. For a NEM spot pool shortfall to occur as a result of this scenario the RA must be ex-ante and the additional prudential margin held by AEMO from the generator must be insufficient to cover the retailer's liabilities.

It is not possible to assess the incremental likelihood of a generator default resulting in retailer failure causing a MCL breach in the NEM pool in the case with or without an RA in place, without a full understanding of a retailers financial position including hedges, debt structures and covenants, other business operations and OTC contacts at the time of a generator failure. In our stakeholder consultation process, a number of retailers informed us that they were aware of the risk of generator default (or generator requirement to terminate an RA) and they maintained funds to cover this contingency.

As such, given the two party nature of the default event it is reasonable to assess the probability of generator default resulting in retailer default and a resultant short fall in the NEM pool as a low probability event. There is some debate between stakeholders regarding the nature and size of this risk. While the overall probability of a generator failure should be relatively low, the difficulty of even a prudent retailer securing a bank guarantee within 24 hours should not be understated, much less several retailers if the generator has multiple reallocation agreements.

3.2.4 Generator Default for Commercial Purposes

There are a number of situations which, on face value, would appear to create an incentive and ability for a generator to trigger their own default for commercial purposes. This default could then result in the

termination of an ex-ante reallocation with a retailer and therefore have a significant impact on the retailer as they attempt to get additional bank guarantees in place to cover an increased MCL.

In the event of very high spot prices, a generator may wish to have an RA terminate so as to receive the spot price for generation. In the event that the generator is required to post prudential margin as a result of the increased market prices and low or no generation, they could fail to post the increased prudential margin, triggering an AEMO termination of all reallocation agreements and then resume generation once the reallocation agreements and requirement to post prudential margin is removed. This may appear to provide an incentive for the generator to reduce production and terminate the RA, but is unlikely to result in a removal of the obligations on the generator under the OTC contract used in support of the RA, thus minimising its incentive for termination of the RA. We would expect that the majority of OTC contracts would contain provisions that require a generator to honour its obligations unless a specified set of circumstances occur which would be unlikely to include the termination of a RA. It is reasonable to conceive that in most instances the generator would likely have to cover the contractual obligations to the retailer during the period it is not generating. Should these underlying protections not be in place, a generator that behaves in this manner would probably find it difficult to secure future OTC contracts and would therefore be exposed to the market price, which may negatively impact on the generators ability to secure appropriate levels of financing.

A generator could potentially force the termination of a reallocation agreement by ceasing to generate power for a period of time. However, it is unlikely that it would be financially viable for a generator to take this action in times of high prices as they would forgo the high spot prices on any generation load that was not reallocated. At times when the spot price is low it is difficult to see what incentive the generator would have for terminating the RA (unless in the event of expected retailer failure) as they are likely to be receiving above market payments as a result of the OTC contract and associated reallocation.

A generator experiencing financial difficulties may also try to terminate an RA if they believe they can receive payment for the spot price for all electricity generated and not have to fulfil obligations under the terms of the OTC contract as a result of insolvency provisions or other contractual means. This could also be the case if there is a difference between the settlement terms in the NEM and under the OTC contract.

We understand that at times generators have demanded the right to terminate an RA on one week's notice. This can be affected by placing conditions in an OTC contract that require the retailer to issue a termination notice to AEMO as directed by the generator. AEMO will only agree to the termination if this does not force the retailer to exceed the terms of the NEM prudential requirements and additional MCL coverage is provided. Retailers who enter into such arrangements should be fully aware of this contractual risk and should manage their prudential requirements accordingly.

3.2.5 Costs of Reallocation Termination Risk

While the uptake of reallocation agreements is relatively low at only 9%¹⁴ of total spot electricity volume traded on the NEM, retailers employed RAs on 50 per cent of trading days in the period from January 2007 until July 2009. It should be remembered when looking at these statistics that generators effectively perform an internal reallocation in the netting of generation and retail offtake in the MCL calculation, which does not get recognised in the RA figures. It is also unlikely that a generator would be willing to enter into a reallocation agreement for a large proportion of its load as any unscheduled outage require the posting of a significant prudential margin with AEMO.

¹⁴ Source: AEMC RFP

As part of our stakeholder consultation discussions a number of retailers commented that the primary reason for the lack of uptake of reallocation agreements was the premium charged by the generators for reallocation of between \$0.50/MWh and \$3.00/MWh. Combining these costs with the risk of termination /deregistration of the reallocation, which may leave the retailer forced to quickly secure additional bank guarantees that may not be available (with the associated risk of market suspension) or if they are able to be secured are likely to be very expensive (at a cost of up to 4% of the bank guarantee value for a small retailer), mean that some retailers view the costs and risk of reallocation as greater than the benefits in reduced MCL. As such, it appears that the RA process does not provide an effective means, in itself, to reduce the prudential requirements of retailers who seek out other means to hedge their price exposure through OTC or futures contract positions, as displayed by the relatively low uptake.

3.2.6 *Review of Peak/off peak Disparity in RA Process*

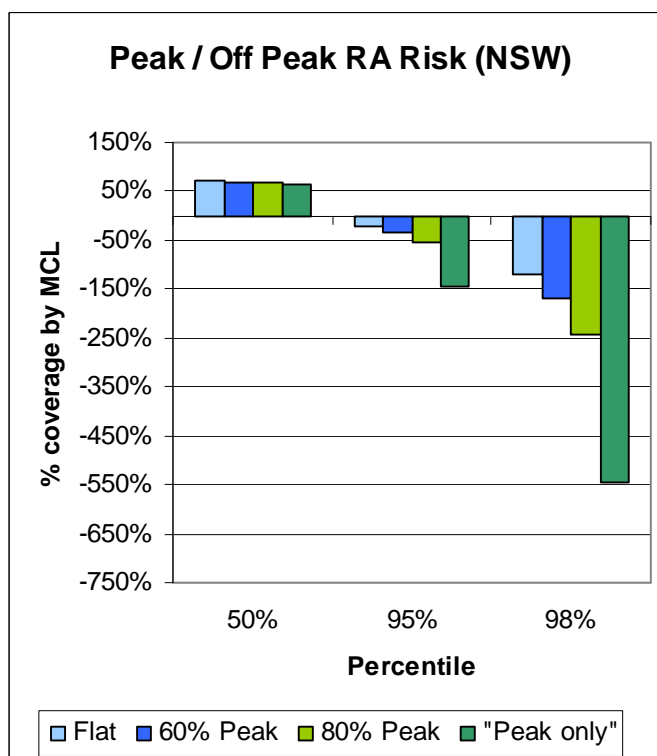
Some market participants have raised the concern that there may be an opportunity for NEM participants to use off peak reallocations to create a reduction across the entire MCL time period and therefore receive a disproportionate reduction in their MCL. The risk for an unwarranted reduction in the MCL exists for reallocations when a retailer enters into a reallocation with a load that is significantly different in shape than its actual load profile. In particular, this occurs when a retailer has many more peak hours in its load than it has lodged in its reallocation. Any risk associated with peak and off peak profiling of reallocated loads will only occur in the case of ex-ante reallocations. In the case of ex-post reallocations this risk is minimised as AEMO makes use of actual outstandings or volumes in the determination of the reallocation.

AEMO have advised that they do not believe that there is any opportunity for gaming of the system by participants in their use of peak and off peak volumes for ex ante reallocations. When requesting a reallocation, the parties must provide details of the reallocation profiled on a half hourly basis for the NEM trading periods. AEMO has advised PwC that it splits the profile provided between the peak and off peak periods and matches the peak and off peak profile against the participant's historic load. In the case the load profile does not match the actual load forecast AEMO has the right to not consider the reallocation when calculating the MCL relief for the RA. It should be noted that the AEMO processes are such that a retailer may submit a number of RAs with different profiles but they must aggregate to the retailer's load profile to be accepted for MCL relief. It should also be noted that AEMO's daily monitoring process should detect any significant differences between the accepted reallocation profile and the actual offtake of the retailer. AEMO then has the right to make security deposit calls on the retailer or recalculate the MCL of the retailer to ensure that the prudential quality of the NEM spot pool is maintained if there has been a significant change to the load profile.

In reviewing the reallocation rules and procedures we have not found any provisions that explain the profiling processes other than a comment in the Reallocation Information Paper and Examples which states "NEMMCO can only allow an MCL credit where there is a regular pattern of reallocation credit that can be reconciled to a **fixed percentage** of the participant's physical market exposure". Clarification of the details of the processes used by AEMO to assess and manage profiled reallocations may be beneficial in providing comfort to market participants on the protection of the prudential regime.

In the case of a failure of the AEMO processes, we have assessed the impact of load risk at peak times (60/40 peak/offpeak, 80/20 peak / offpeak, and during high peak hours during week days) when MCL is reduced for a base load reallocation to display the impact of volume-weighted value variance to a base load profile. The results are shown at the 50th, 95th and 98th percentile of MCL coverage for NSW in Figure 3.2.6.a below. The results for each of the other state and for the 100th percentile level are shown in Appendix 7.3.1 (Figure 7.3.1.c.). This figure displays the percentage cover that the MCL would provide in the event an offpeak reallocation was accepted for a retailer with a profiled load. The 50th

percentile, or median level shows MCL coverage exceeding the profiled base load value by over 50% in all cases where the 98 percentile displays considerable potential for an MCL breach. The figure below utilises information from Jan 2004 until present and negative values indicate that the MCL was exceeded.



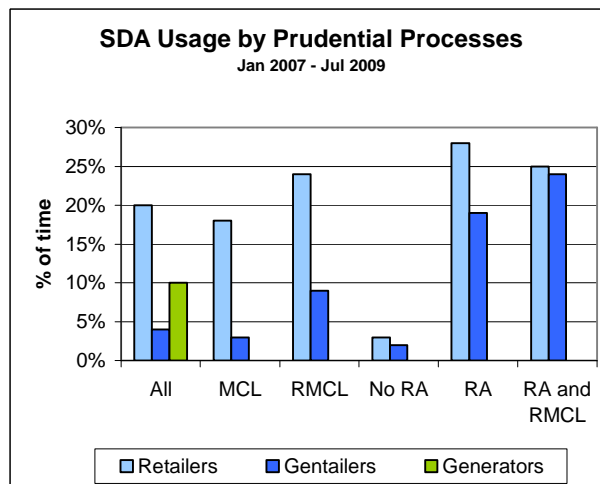
Source: AEMO and PwC Analysis

Figure 3.2.6.a – Flat RA Adjusted MCL Coverage of Peak Loads

3.3 Clawback Risk

3.3.1 Use of SDA Accounts

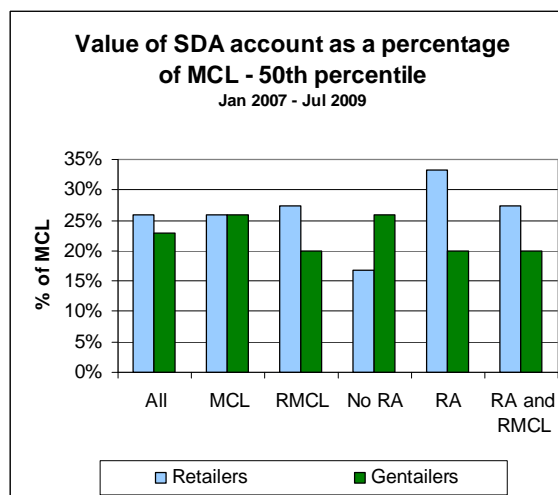
The current processes allow NEM participants, in certain circumstances, to pay funds into a security deposit account (SDA) to remain below their trading limit. A review of AEMO SDA data from January 2007 until July 2009 is presented below in Figure 3.3. and shows the percentage of all retailer days where prudential processes were used and funds were held within SDA accounts for retailers, gentailers and generators. As expected, Retailers are the heaviest users of the SDA accounts in all circumstances. As also expected, the users of the RMCL process display an increase in the percentage usage of SDAs as does the use of reallocation agreements. Where a retailer has both a RMCL and a reallocation agreement the use of SDAs is reduced slightly over the situation without an RA indicating that reallocation agreements may be being used to manage the outstandings of the retailer. The situation is the same for gentailers except that the highest usage of SDA accounts occurs when there are both reallocation agreements and an RMCL is in place.



Source: AEMO and PwC Analysis

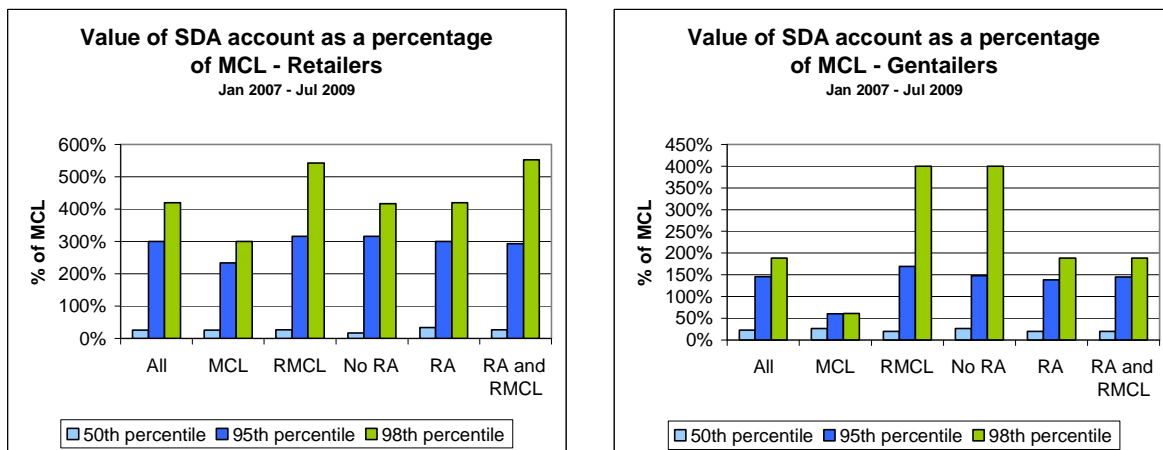
Figure 3.3.a. – SDA Usage by Prudential Process

Figures 3.3.b and 3.3.c. show the value of the funds contained in the SDA account as a percentage of the NEM participants MCL. As would be expected, the funds held in the SDA account are highest in the situation where the participant is operating with an RMCL. Where both an RA and RMCL are in place, the SDA as a proportion of RMCL is lower than that with just the RMCL in place. This likely indicates that RAs are being used to manage the outstandings when an RMCL is in place. Given that the proportion of funds in the SDA is well above the level of the MCL for all situations at the 95th and 98th percentiles this indicate that AEMO is actively managing the Total Outstandings and prudential margin processes.



Source: AEMO and PwC Analysis

Figure 3.3.b. – Funds in SDA Accounts as a Percentage of MCL at 50th Percentile



Source: AEMO and PwC Analysis

Figure 3.3.c. – Funds in SDA Accounts as a Percentage of MCL for Retailer and Gentailers

A table showing the summary data used for the construction of these charts can be found in Appendix 7.3.1. (Figure 7.3.1.d.)

3.3.2 Commercial Risk of Clawback

In most circumstances clawback risk associated with SDAs is introduced as a result of the legal structure surrounding the set up of the SDA and the rights of each of the parties to control and access the funds in the SDA. In the case where SDAs are set up such that the creditor has unilateral control of the funds in the SDA and the right to receive payment in full prior to other creditors, a Receiver and Manager, administrator or liquidator would generally not have recourse to clawback funds from the SDA. The main exemption to this principle is in the case where preferential or other arrangements outside of the original legal structure have been put in place with the debtor for debt management or repayment purposes in the six months prior to the collapse of the company.

The key issue in these other arrangements is giving the right to the debtor for the cash sweep that falls outside of the original arrangements. If there is not a unilateral control of the cash sweep, then there is a reasonable risk of clawback. The risk of clawback, therefore is minimised in the situation where there is an original legal payment structure in place that is based on standard principles and is offered to other market participants or customers on a non-preferential basis. An example of an instance where clawback risk could increase would be if AEMO and the market participant were to negotiate some sort of repayment plan if a shortfall of funds were to occur. AEMO has indicated that it does not enter into unique credit management arrangements with market participants. Another issue raised is potential clawback for an uncommercial RA transaction and the extent the NEM may be exposed to clawback risk. This issue requires a legal interpretation to assess the realities of this risk.

This advice is general in nature only and has considered legal issues but this commentary is not to be taken as qualified legal advice.

3.4 Swaps and Options Reallocations

The proposal for swaps and options to be incorporated into the reallocation process was raised in November 2008. This reallocation process is intended to provide MCL relief above the swap or option bilaterally negotiated strike price, not MCL relief for the full value of a participant's reallocated

obligations. Swaps and options that are traded in the OTC market are also classified as derivative instruments meaning that their value is derived from the underlying spot market. Market participants have been keen to see OTC swaps and options included as a mechanism to reduce their MCL obligations through the AEMO reallocation process.

Under this type of reallocation agreement, the credit risk for the difference payments from the strike price to the underlying market value of electricity on a \$/MWh basis is transferred from AEMO to the counterparties - a generator and retailer where they have contractually agreed to a fixed price. There is a greater balancing of risks in this type of reallocation arrangement where both parties are reliant on AEMO to manage settlement of spot and swaps & options opposed to relying on one another for the full value of the reallocation as in the case of the current RA process. Therefore, the risk transfer from AEMO to the counterparties of the swap or option will be to the account of both counterparties as reflected in the OTC bi-lateral swap agreement. This proposed reallocation arrangement is currently under review by ASIC following an application to it by AEMO.

Unlike the existing reallocation arrangement, which is unique, specific to the needs of each counterparty of the reallocation and covers the full value of electricity, a swap or option is usually a standardised arrangement and is guided by standard International Swaps & Derivatives Association (ISDA) master agreements. AEMO's obligations, under the proposed NEM rules, for this type of reallocation are very similar to the current reallocation arrangements for non-standard contracts and include:

- An approval process where both swap or options counterparties provide relevant information on the derivative instrument confirming they have an arrangement between themselves in the first instance.
- AEMO has relevant approval procedures that they undertake to verify that the swap or option transaction is bona fide.
- Under AEMO's Rule 3.15, in regards to settlement:

3.15 Settlements

3.15.1 Settlements management by NEMMCO

(a) AEMO must facilitate the billing and settlement of payments due in respect of transactions under this Chapter 3, including:

- (1) spot market transactions;
- (2) reallocation transactions (this is to include swap and option RAs); and
- (3) ancillary services transactions under clause 3.15.6A.

From this review of the swaps and options proposal, we provide the following conclusions:

- The risk of a swaps and options reallocation to the prudential quality of the NEM spot pool would be less than under the current reallocation agreements due to the contract for differences structure and AEMO's role in settling the agreed swap or option contractual value. Also, the MCL support is provided up to the bilaterally negotiated swap or option strike price.

- There have been concerns expressed by various entities over swaps and options reallocation which put into question whether or not AEMO may need to acquire a clearing and settlement facility¹⁵ licence and comply with certain requirements under the Corporations Act.
- AEMO will manage the payments owed to and from AEMO by the parties to the swap and options reallocation and the terms of the actual underlying OTC agreement remain unaffected by these payments and will be settled (or discharged) by agreement between the counterparties in a process that occurs between the parties outside of the reallocation process.
- Pending the ASIC review of swap and option reallocations, the National Electricity Market rules may need to be reconsidered if Reallocations of Swaps and Options is to proceed (Rule 3.15.1 Settlements management) and AEMO does not receive an ASIC clearing and settlements facility exemption or choose to be bound by clearing and settlement licence requirements.

As is the case with energy and dollar reallocations the additional prudential margin from the generator maintained by AEMO as part of the swap and option RA does reduce the risk of a NEM spot pool shortfall in the event of a retailer default. As discussed in section 3.2.1 the bespoke nature of these arrangements means the they can not be assumed to operate as a part of a comparative risk assessment of like for like agreements.

3.5 Summary of Findings

From our review we do not support the hypothesis that that the inclusion of RAs introduce significant incremental risk of a spot pool shortfall to the NEM with our findings articulated in Figure 3.5.a.

Termination event	Ex Post Reallocations	Ex Ante Reallocations
No Default		
Mutual Termination	No Incremental Risk	No Incremental Risk
Single Party Default		
Retailer default, PM or RA conditions breach	No Incremental Risk	No Incremental Risk
Generator default, PM or RA conditions breach	No Incremental Risk	No Incremental Risk
Two Party Default		
Generator default, PM or RA conditions breach causing retailer PM breach and default and Generator PM has been consumed	No Incremental Risk	Up to 1 day of retailer consumption at market prices

Figure 3.5.a. – Increase in Risk to NEM Spot Market as a Result of RA

The only scenario identified where the risk of a NEM spot market shortfall is increased, as a result of the use of reallocation agreements, is if the failure of a generator leads directly to the failure of a retailer, where insufficient PM is held by AEMO for both the retailer and the generator to cover the retailer offtake. Given the series of failures required for this to occur the possibility of this occurrence is assessed as very low. In circumstances of retailer default the obligation of the generator to maintain the

¹⁵ Note: AEMO has applied for an exemption from these requirements.

RA until the retailer is terminated from the market and the additional prudential margin held from the generator may reduce the risk of a NEM spot pool shortfall.

Recommendations to Improve the Use, Effectiveness and Efficiency of RAs

- **Effectiveness** – Under single party default scenarios there is no additional risk to the NEM spot pool as a result of the introduction of reallocation agreements. In the case where an RA is in place and where a termination event by a generator results in a call for additional credit support from a retailer and the retailer fails to provide this additional support, the NEM spot pool is potentially exposed to an additional day's electricity load of that retailer, if both the retailers and generators prudential margin have been consumed. While a precise evaluation of the likelihood of this event is difficult, the probability of this scenario occurring appears to be low from historical record. An evaluation of the load risk over this period and the median MCL shows the MCL covers the additional exposure to the 98th percentile level.

PwC Recommendation - On balance, there is no major need to change the current RA lodgement and MCL process, however, if the AEMC is concerned regarding the mitigation of the potential one day termination risk in the event of a two party failure event where the both prudential margins have been exhausted, the best way to address this is by adding additional coverage to the 7 day prudential margin equivalent to increasing this to an 8 day period.

- **Efficiency** – RAs perform a valuable function in the market by reducing the requirement for capital to be held inefficiently in bank guarantees with AEMO when a risk transfer occurs from AEMO to market participants for physical delivery oriented contracts.

PwC Recommendation - RAs should continue to be supported by AEMO as a means to minimise the prudential support burden for NEM participants.

- **Load Profiling of Ex-ante Reallocations** - While we understand that AEMO has a calculation method and a process to address load profile versus RA profile disparities, we have found no reference to this calculation in either the rules or procedures that document the operation of the reallocation transactions.

PwC Recommendation - Clarification of the details of the processes used by AEMO to assess and manage profiled reallocations may be beneficial in providing comfort to market participants on the protection of the prudential regime.

- **Market Rules Section 3.15.1** - The current rules state that AEMO has the responsibility for the billing and settlement of reallocation agreements. AEMO is not responsible for the settlement of the underlying OTC contracts which facilitate the RA as the RA removes the requirement to settle these from the market.

PwC Recommendation - A review of the NEM rules should be conducted to ensure that 3.15.1 correctly represent AEMO's role in the settlement process for RAs.

- **Swap and option RA's** - The current rules state that AEMO has the responsibility for the billing and settlement of reallocation agreements. The proposed NEM rules for the incorporation of swaps and options indicate that AEMO has a role in the settlement process of swaps and options in order to reduce circular cash flows, which commercially interposes it between counterparties of the swap or option arrangement. This rule absolves the counterparties in a swap or option reallocation agreement of the responsibility for settling these contracts between themselves. As above, the RA swap and options lodgement process should place a responsibility on NEM participants using this type of RA to provide surety that a hedging contract

exists between the two parties of the RA outside of AEMO. *Appropriate legal advice on these matters should be obtained where it is necessary.*

PwC Recommendation - For the proposed RA swaps and options we suggest that NEM rules 3.15.1 be modified to minimise AEMO's involvement in the settlement process of swaps and options and reflecting the settlement risk it is willing to take.

- **Credit Concerns** – An RA transfers the burden of credit risk management from the NEM to the generator and potentially to the retailer. If credit processes are weak at either the retailer or generator, the risk and value of credit may not be appropriately covered should a default occur. For generators, the reallocation risk should be managed by their individual credit policies and priced into the reallocation agreement. Under a reallocation, the generator has assumed this risk and would be exposed to any outstandings it has with the retailer. This does not become an AEMO issue. For the retailer, should the generator fail and its obligations not held up it would not only lose its hedge, it would also have to replace it and potentially secure an additional bank guarantee which would put additional financial stress on the retailer. Credit concerns are a real risk for reallocations, not so much to AEMO but with respect to the ripple on effects to the broader electricity market should there be a failure of a generator.

4 Futures Offset Agreements

4.1 Overview of the Proposed FOA Models

It has been proposed that Futures Offset Agreements (FOA) be introduced into the market to reduce the costs of credit support by reducing the prudential support requirements on NEM participants who have hedged their exposure to the NEM spot market price through futures contracts on the Sydney Futures Exchange (SFE). Like RAs, FOAs are intended to:

- reduce the settlement risks of NEM participants, and
- provide retailers with alternatives for managing their credit support requirements

Unlike RAs, the proposed FOA is a single party process, where the counterparty to the futures contract remains confidential but is backed by a SFECF. As a result it is proposed that a retailer would provide credit support to AEMO in the form of a bank guarantee to the price level at which the FOA is lodged with AEMO, the futures lodgement price (FLP), and pay any positive variation margins from the futures position into an SDA. At each billing period the retailer is still responsible to AEMO for the payment of the full value of the energy consumed at the market price.

Two models have been proposed for the treatment of the funds in the SDA account at settlement.

Model 1 - AEMO would receive and hold onto all positive variation margins above the FLP until settlement. At settlement, AEMO would apply the SDA corresponding to the billing period against settlement amount and return any excess funds to the retailer.

Model 2 - AEMO would return the variation margins if the futures prices fall below the FLP. The amounts in the SDA however would be held with AEMO for the term of the FOA and not be applied to settlement.

The cash flows for Model 1 are shown below in Figure 4.1.a and for Model 2 are shown below in Figure 4.1.b.

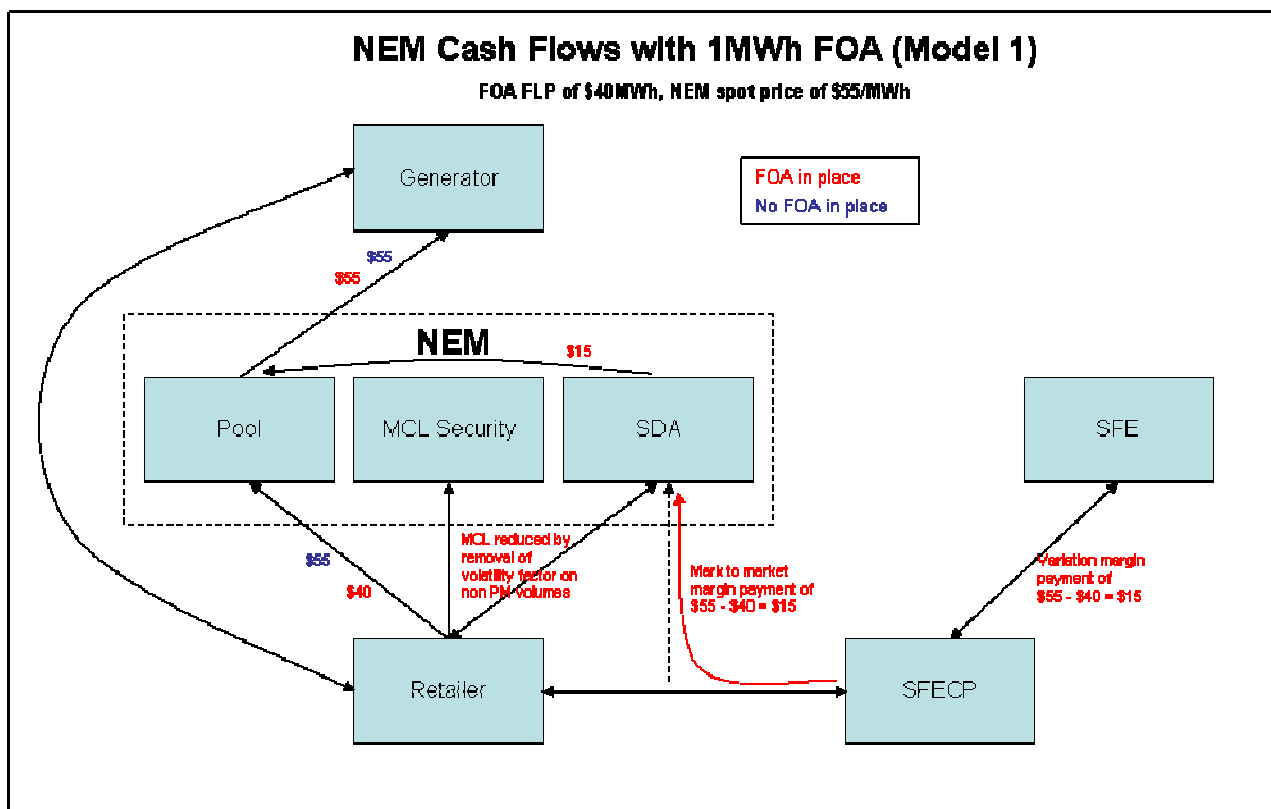


Figure 4.1.a – NEM Cash Flows with FOA Settlement Model 1

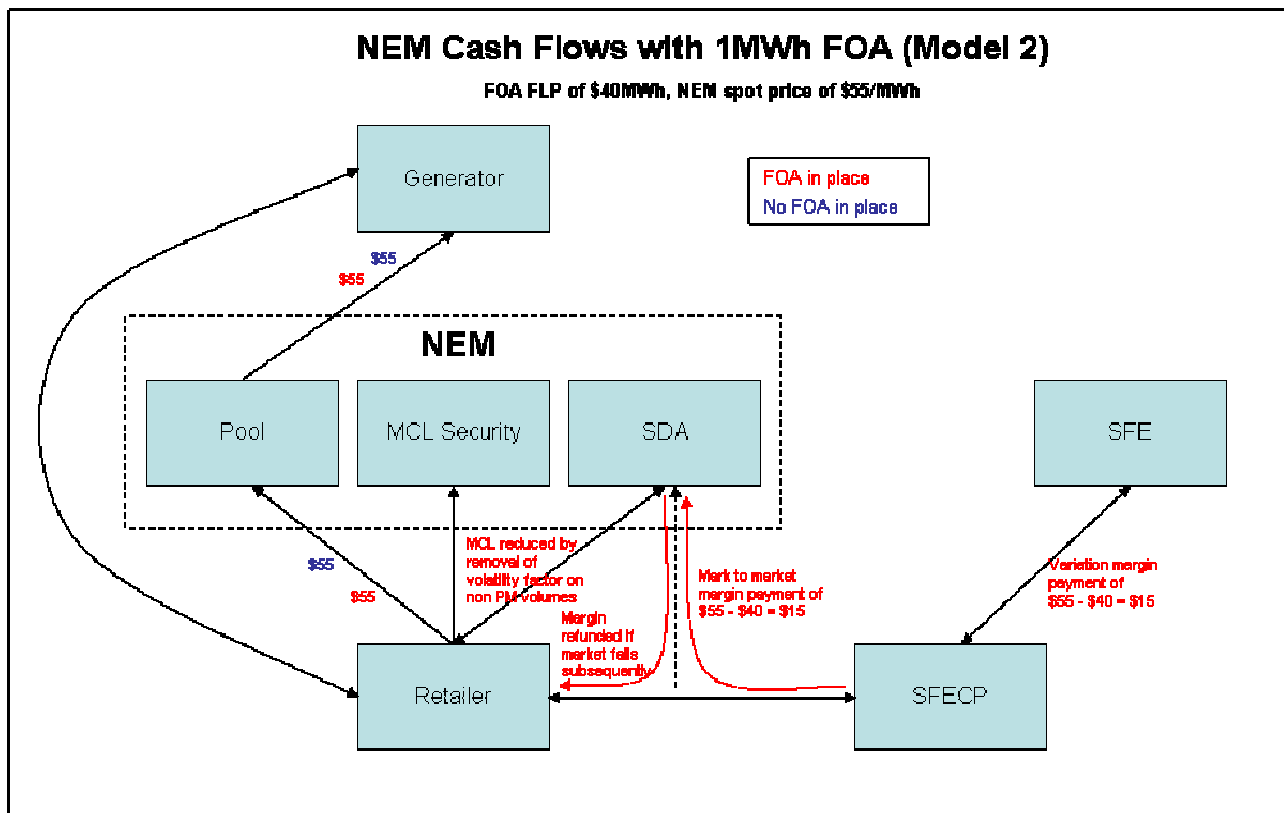


Figure 4.1.b – NEM Cash Flows with FOA Settlement Model 2

4.2 FOA Settlements and Return of Funds

FOA Model 1 - Comments

The calculation of the variation margin payments under the FOA Model 1 does not reflect the management of variation margin monies on a day to day basis by a market participant. The drawing down of funds to cover outstandings payments will create a requirement for the FOA participant to establish a separate process for the management of its variation margin obligations, as funds would be drawn down against settlements and would not be available for when payments back to the CP are required and not required at settlement. It should be noted that the intent of the passing of variation margins is to protect forward looking risks and not billing risks. Creating a process where both are simultaneously managed may be difficult and costly to implement in practice.

A system where funds are always maintained by AEMO, even in the event of a significant price fall, may result in additional financial stress on retailers who are required to pay variation margins to the SFECF when futures prices dip below the previous period's futures settlement price, while the funds received by AEMO from the SFECF to cover the high price event are quarantined.

FOA Model 2 - Comments

The FOA margin payment formula for FOA Model 2 is more consistent with the SFE and SFECF process involved in the calculation and payment of the variation margins. Variation margins are paid to the SDA account daily, where price variations occur, causing movements of funds, and the funds can be returned to the NEM participant in the case where the previous day's price is less than the highest price in the period and excess margin is being held by AEMO. It is proposed that the return of funds be at the discretion of AEMO and we would not expect AEMO to release any funds in the SDA account which are required to cover outstandings or expected price movements.

Unlike FOA Model 1, where AEMO would use the amount in the SDA to offset the amount owed to the NEM spot pool by the NEM Participant, FOA Model 2 allows for the SDA account to operate in a manner that supports the retailer to fulfil its obligations back to the SFECF for variation margins owed and therefore results in a lower level of financial stress on the retailer than Model 1. Another positive feature of this model is that once the period of the FOA has expired the party to the FOA can decide to have surplus funds refunded or can apply them as payment against its FOA Total Outstandings.

Conclusion

The stakeholders consulted as part of the review were unanimous in their lack of support for FOA Model 1, which envisages the use of funds held in the SDA account for settlement, as too complicated a process to be workable in practice.

We have not identified any additional risks associated with the return of funds in the SDA account (subject to AEMO consent) in the event of a fall in futures prices as envisaged by FOA Model 2 which would increase the risk of NEM spot pool shortfall as opposed to FOA Model 1. Given the financial stress that quarantining payments could have on retailers in Model 1, we have therefore confined our comments that follow to cash flow and settlement processes detailed in FOA Model 2. In establishing the rules and procedures for the FOA SDA accounts particular consideration should be given to the points raised in section 3.3.2 in relation to unilateral control of funds held in SDA accounts, as Model 2 includes the rights for participants to request monies back in circumstances where the value in the SDA account held exceeds the AEMO variation margin calculation.

4.3 Use of FOAs with Existing Processes

The proposed FOA models require a bank guarantee to be held by AEMO and variation margins paid into an SDA account in the event that the previous day's futures prices are greater than the FLP. When a retailer requests an RMCL a shorter 14 day credit period is used rather than the usual 28 day cycle. There is no obligation for a retailer operating under a RMCL to settle their account on the shorter settlement cycle though the lower trading limit requires more active management of outstandings, generally though the payment of funds into the SDA account. Should an FOA be accepted where a retailer has an RMCL in place and the MCL for the FOA calculated on the basis of 14 days rather than 28 days a disjoin between the payment period and the calculation period is more likely to result in shortfalls in the variation margin payments to AEMO. As a result it is proposed that RMCLs and FOAs do not apply to the same volumes. In the case where a retailer has requested an RMCL the MCL component for the FOA should be calculated based on a bank guarantee for the 35 day outstandings period at the level of the FLP.

4.4 Risks and Mitigations for the Introduction of FOAs

Three types of risk that could potentially result in an increased exposure to the NEM settlement pool have been identified as:

- Systemic risk of differences between spot and futures prices
- Termination and other operational risks
- Unique risk associated with a difference between futures contract and retailer load profile

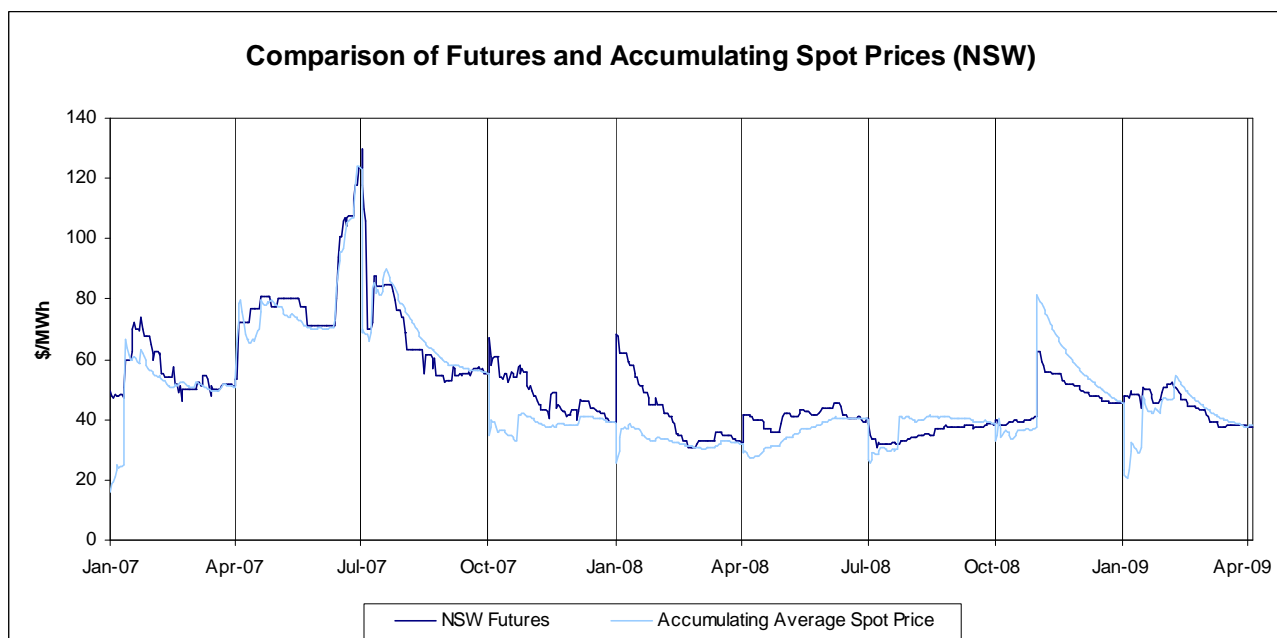
Below we discuss each of these risks in turn and the most appropriate means for AEMO to mitigate these risks to protect the prudential quality of the NEM spot pool.

4.4.1 *Systemic Risk of Differences between the Spot and Futures Prices*

The approach adopted in the assessment of systemic risk of the failure of spot to track futures prices is to back test the relationship of spot and futures prices over time. This allows for the actual relationship between the spot and futures prices to be tested and for actual stress test periods over time (such as July 2007) to be considered in the assessment. While it may be possible to develop other scenarios for testing these price relationships for the proposed FOA models and formulae it would be very difficult to assign a realistic probability of occurrence to these scenarios without looking to history to observe and understand possible reasons for spot and futures prices to diverge.

The variation margins from a futures position are intended to cover all or the majority of the price movements in the NEM spot pool for a region. Although the time coverage is different between a futures and a spot pool purchase obligation, accumulating information in a futures contract will capture any spot price movements. For instance, if prices move to \$100 average for a day from \$30 an additional \$1,680 will accrue as a debit amount to the retailer for 1MW. The base load price of futures will move approximately the same \$1,680 but will be spread across the 91 days of the futures contract and will move the futures price approximately \$.77. As the futures contract comes to expiry the price movements in the spot pool will be almost perfectly reflected in the price of the futures displaying convergence of the accumulating spot and futures markets. The tracking of spot and futures are displayed in Figure 4.4.1.a below and the convergence of the two price series at the end of the quarter can be clearly seen. Similar

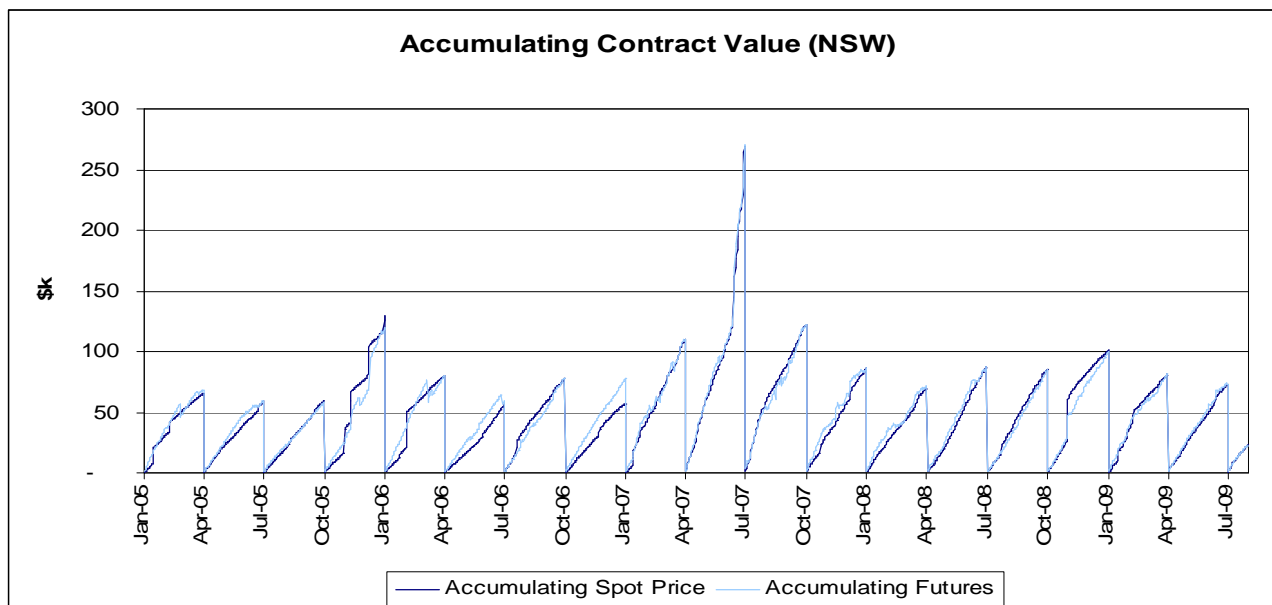
charts for each of the other states can be found in Appendix 7.3.2 (Figures 7.3.2.b, 7.3.2.c and 7.3.2.d). It also should be noted that futures coverage follows the trend of the spot exposures for the accumulating spot market value through the course of a quarter. It should be noted that all the analysis in this section 4.4.1 is on a time weighted basis consistent with the SFE flat futures contract that provides the basis for the FOA. A discussion of the impact of a retailer's load profile can be found in section 4.4.3.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.a – Correlations between Futures Price and Accumulating Average Spot Price

A beta factor is often an appropriate means to deal with systemic risk as the impact of a systemic risk will be common to all users of a process or instrument. A beta factor is also appropriate when a consistent discount or premium is evident over time. In the case of FOAs, much of the potential for systemic risk is removed by only allowing FOAs in the case of 'like for like' regions contracts. We have investigated the potential for systemic risk in the introduction of FOAs by comparing the time weighted accumulating spot prices, through a financial quarter, and the daily futures prices within that financial quarter. The results of this analysis for a 1MW contract over the period from January 2005 until July 2009 are shown below in Figure 4.4.1.b. This shows that there is no consistent trend for the futures prices to be above, below or lag the market over the period. Similar charts for the other states can be found in Appendix 7.3.2 (Figures 7.3.2.e, 7.3.2.f and 7.3.2.g).



Source: AEMO, d-cypha trade and PwC Analysis

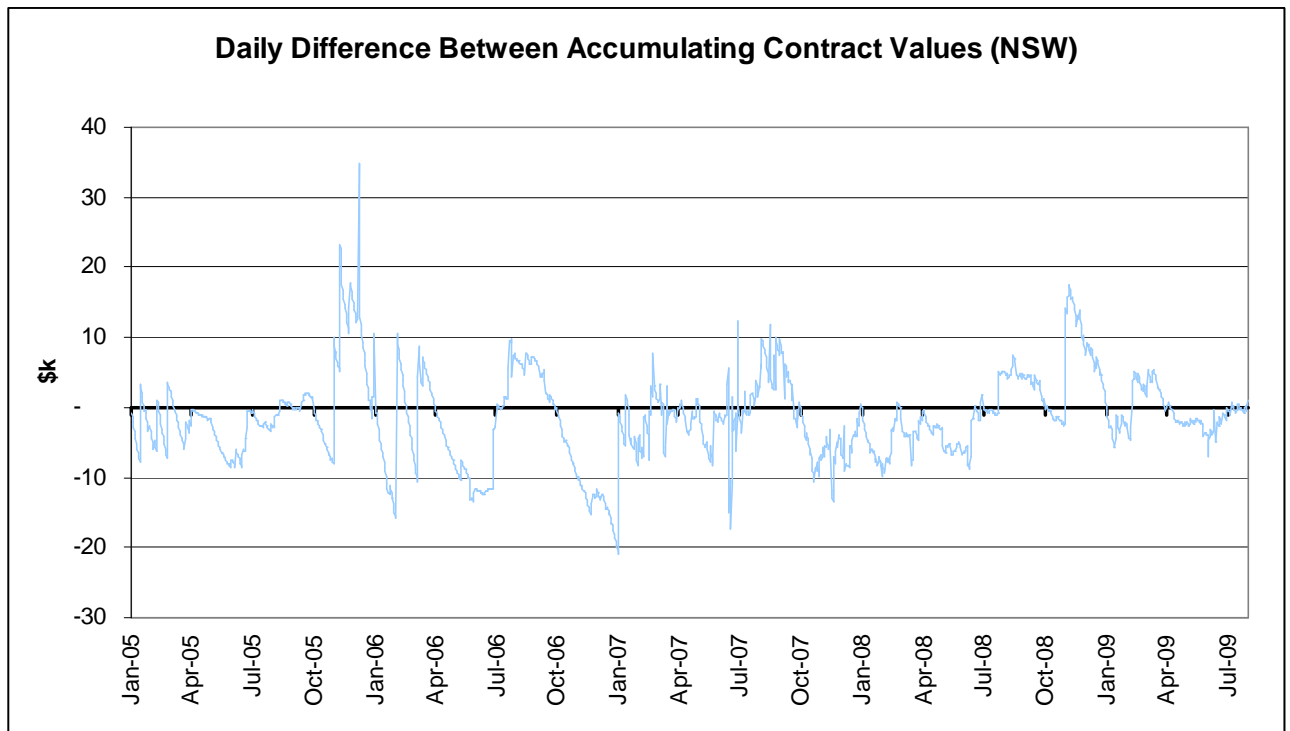
Figure 4.4.1.b – Correlation of NSW Accumulating Spot and Futures Prices

We have also performed a regression analysis on the correlation between accumulating spot and futures pricing for each of the states which is shown below in Figure 4.4.1.c. Regression results indicate high correlations between spot and futures prices and a small premium, on average, of futures compared to spot prices.

State	Average Coefficient (1/beta factor)	Regression R ²
NSW	1.09	0.95
VIC	1.10	0.95
SA	1.14	0.94
QLD	1.05	0.96

Figure 4.4.1.c – Comparison of Accumulating Spot and Futures Regression Analysis

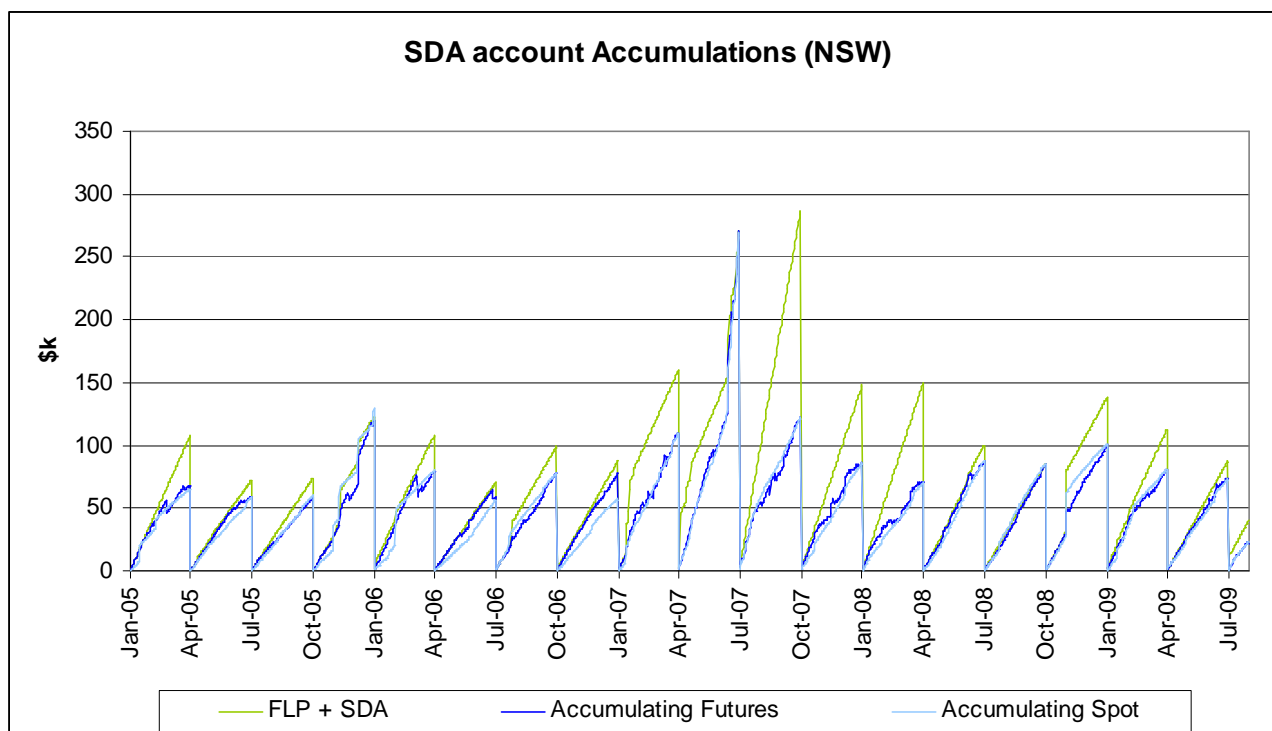
The actual value of funds in the SDA account with an FOA in place will be fully dependent on the size of the FOA, the futures lodgement price and the movement of the spot market. The analysis below in Figure 4.4.1.d shows the difference between the futures price at the start of the quarter and the actual spot prices for NSW. Similar charts for each of the other regions can be found in Appendix 7.3.2 (Figures 7.3.2.h, 7.3.2.i and 7.3.2.j). At times when the delta is positive, funds will accumulate in the SDA account. At times when the delta is negative, the start of quarter futures contract, covered by a bank guarantee, is greater than the resulting accumulating spot pool value. In the case of FOA Model 1 these would be used at settlement against the outstandings, and in the case of Model 2 these could be returned to NEM participant holding the FOA as the variation margin is reduced. In reality the FLP may vary from the spot price at the start of the quarter depending on the time the NEM participant registered the FOA.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.d – Daily Differences between Accumulating Contract Values and Futures for NSW

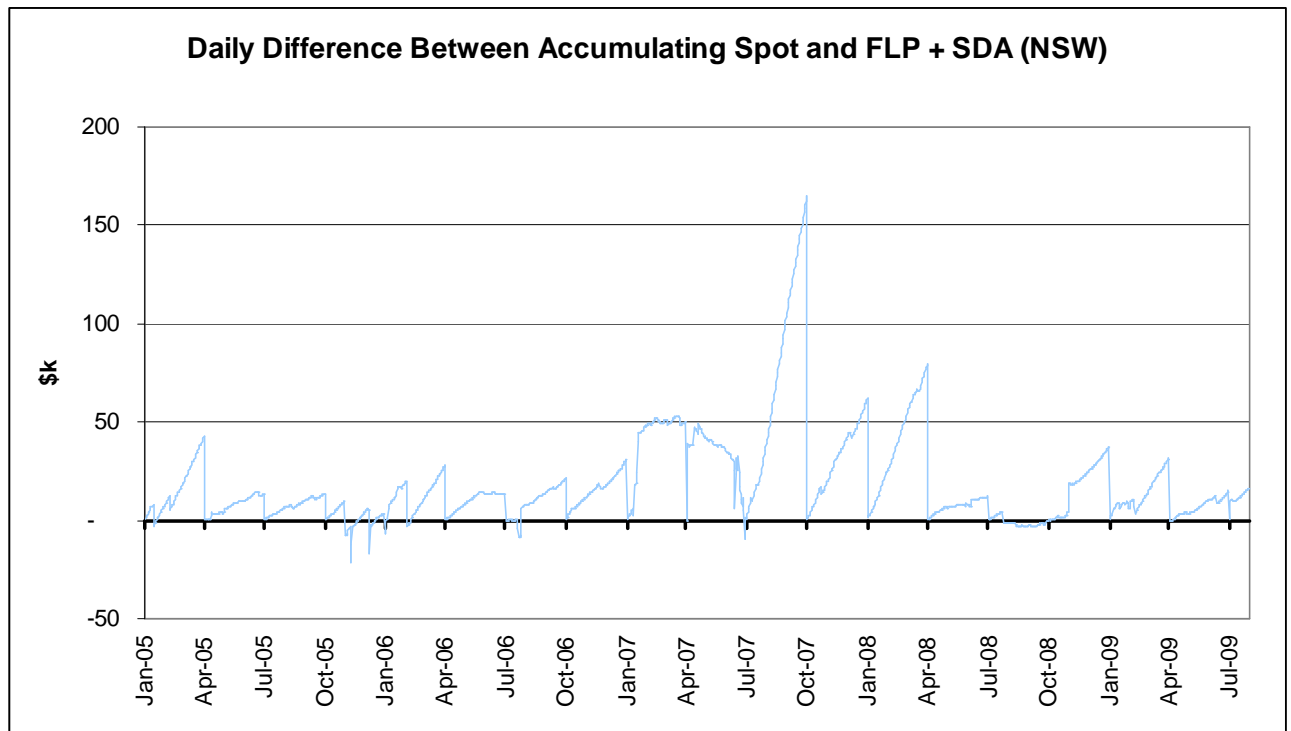
Figure 4.4.1.e below compares the theoretical build up of funds in an FOA SDA account to the accumulated futures lodgement price and accumulated spot price for NSW. Where the green line (showing the FLP and the build up of funds in the SDA account) is greater than the pale blue line (showing the accumulating spot price), AEMO will be holding more security than is required to cover the retailers outstandings on the futures position. Similar charts can be found in Appendix 7.3.2 (Figures 7.3.2.k, 7.3.2.l and 7.3.2.m) for the other states. When reviewing Figure 4.4.1.e it should be recognised that the FLP may differ from the futures price and therefore the spot price at the start of the quarter as the futures contract which underpins the FLP may have been lodged up to 90 days prior to the start of the period. This will result in either the requirement for a large payment into the SDA account on the first day the FOA come into place or the security held for the volumes being above that required based on the market prices.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1 e – Accumulation of Funds in the SDA Account (NSW)

Figure 4.4.1.f below displays the difference between the accumulating spot price and the futures lodgement price and SDA value for NSW since January 2005. Figures for other states can be found in Appendix 7.3.2 (Figures 7.3.2.n, 7.3.2.m and 7.3.2.o). From this figure it can be seen that, while the futures and spot prices track each other well, there are times when the payment of funds into the SDA is not sufficient to cover the obligations of the retailer to AEMO. While a beta factor could be introduced to cover this risk at times it would often provide a much higher level of security than required, and in the event of a major deviation between the spot and futures prices (which has not been seen to date) there still exists the potential for a difference between the funds held as security and the obligations of the retailer to AEMO. As such, the introduction of a static beta factor would be an inefficient way to deal with the risks associated with the deviation between the spot and futures market.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.f – Difference between Accumulating Spot and FLP + SDA (NSW)

A concern has also been raised regarding the potential for a change in the spot price after the close of the futures market at 16:50 each business day, which may not be reflected in the variation margin calculation by AEMO, and therefore may not reflect the funds paid into the SDA for that day. The NEM prudential supervision process will expect variation margins to move into the SDA account from settlement prices that occur from the day before. As such, price movements that take place after the previous day's settlement may not be reflected until the next settlement period and variation margins movement into the SDA account the following day. It should also be noted that in many cases the futures settlement price will move to reflect any expected changes in the spot price post futures market closure often providing financial coverage ahead of a pricing event.

Conclusion

Our analysis has shown that there is no systemic risk associated with the futures and accumulating spot prices to warrant a static discounting beta factor, though as can be seen in Figure 4.4.1.f and Appendix 7.3.2 (Figures 7.3.2.n, 7.3.2.m and 7.3.2.o) there are times when the FLP + SDA is lower than the accumulating spot. This risk and the risk associated with changes to the spot price after the close of the future market can be best addressed by placing a floor on the value of the SDA account equal to the accumulating spot over the outstandings period. This will ensure that there will always be sufficient funds in the SDA account to cover accumulating and existing outstandings of the retailer and help to protect the prudential quality of the NEM spot pool.

The FOA models provided do not define the size of the reduction a retailer will receive further than to say 'load under FOA' and multiply this by a number of days. As such, and based on our discussions, we have assumed this is meant to refer to the daily quantity of the underlying futures agreement. The reduction is therefore based on a futures agreement for a period of 35 days (the outstandings period) rather than the period of 90 to 92 days for which the margin payments to the SFECP are calculated. As a result of the difference in calculation periods, the margin and MCL reduction formulas proposed in the FOA models the retailer would be required to pay variation margins on a significantly larger volume of MWh than MCL relief is provided for. For example, if a retailer has a 10MW FOA in place they would

receive MCL relief for 10MW x 35 days x 24 hours = 8,400MWh but would be required to pay variation margins based on 10MW x 90 days x 24 hours = 21,600MWh. Movements in the futures prices are based not only on changes in the spot price but also changes in expectation of price movements for the period until the end of the futures contract, in the case where there is an expectation of high prices for the remainder of the period a retailer could be requested to make payments based on this higher price expectation for the remaining period of the futures agreement (could be up to 90 days) while the exposure of the retailer to AEMO will be less than 7 days. In the case of a spot price movement on the last day of a future contract, the movement in the price of the futures market should reflect only this price movement as the prices for each of the other days in the contract have already been set. One approach to addressing this issue is to scale the futures payments to equate the number of days for which MCL relief is granted with the number of days variation margin in the outstanding period. While not perfect this solution goes some way to addressing the issues associated with the differing MWh between the MCL relief, variation margin and outstandings period. Should the AEMC elect to include a scaling factor in the variation margin formula it should be remembered that in the event that the calculation does not cover the outstandings it does not follow that the retailer has not received sufficient funds from the SFECP to cover the change in market price simply that the AEMO is not automatically requesting this as security.

To take the issues identified in our analysis into account we have adjusted the variation margin formula contained in Model 2 as detailed below:

Variation Margin Payment = **Max [(Max [DSPt,AS] – Max [FLP,DSPh]) x FQ x (OP/DQ), 0]**

AS = Accumulating spot price over the previous 35 days (representing the maximum NEM outstanding period)

FLP = Futures Lodgement Price

OP = Days in outstanding period (35 days)

DQ = Days in Futures quarter

DSPt = Official daily future contracts settlement price as the close of business immediately prior to the calculation day

DSPh = Previous highest daily settlement price for futures contract since Effective Date during the NEM outstanding periods or the previous days accumulating spot price which ever is greatest

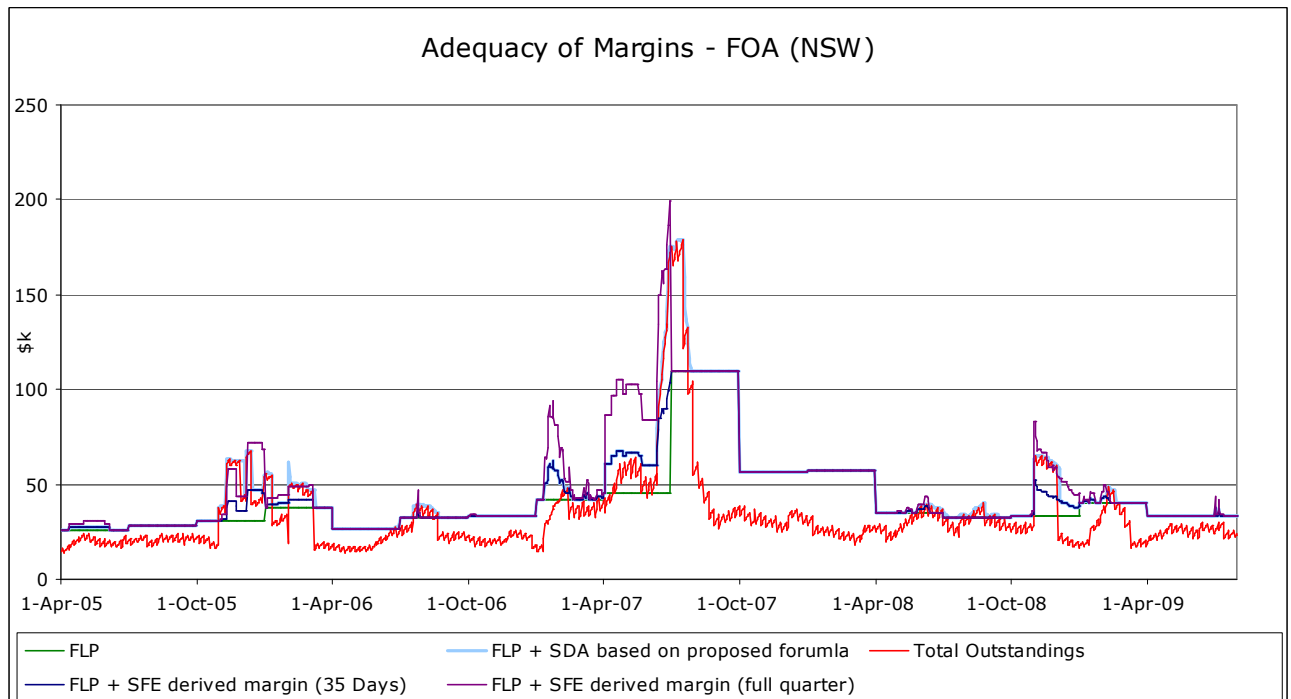
FQ = Quantity of futures contracts x energy covered under each FOA futures contract

The above formula can be used for each state with futures contracts, including SA and removes risks associated with a lack of liquidity or a detachment of futures and spot prices in any market by ensuring that the margins cover a period equal to the outstandings period. The rolling 35 day accruing outstandings floor is preferred to a floor at the actual outstandings as it:

- Provides some degree of coverage for the days which are still to accrue in the billing period
- Does not fall on the day following settlement and then potentially require unfunded variation margins to support price movements on subsequent days

Using the formula developed above, and assuming that a retailer requests and is granted the return of funds into the SDA on each day when the funds in the SDA account are greater than that required to cover the previous days futures price or accumulating spot price, the applicability of this approach has been assessed for viability in Figure 4.4.1.g below. This figure shows that this variation margin calculation approach effectively covers the movement in spot prices and therefore covers the exposure

of the NEM spot pool. Similar charts for each of the other regions can be found in Appendix 7.3.2 (Figures 7.3.2.p, 7.3.2.q and 7.3.2.r).

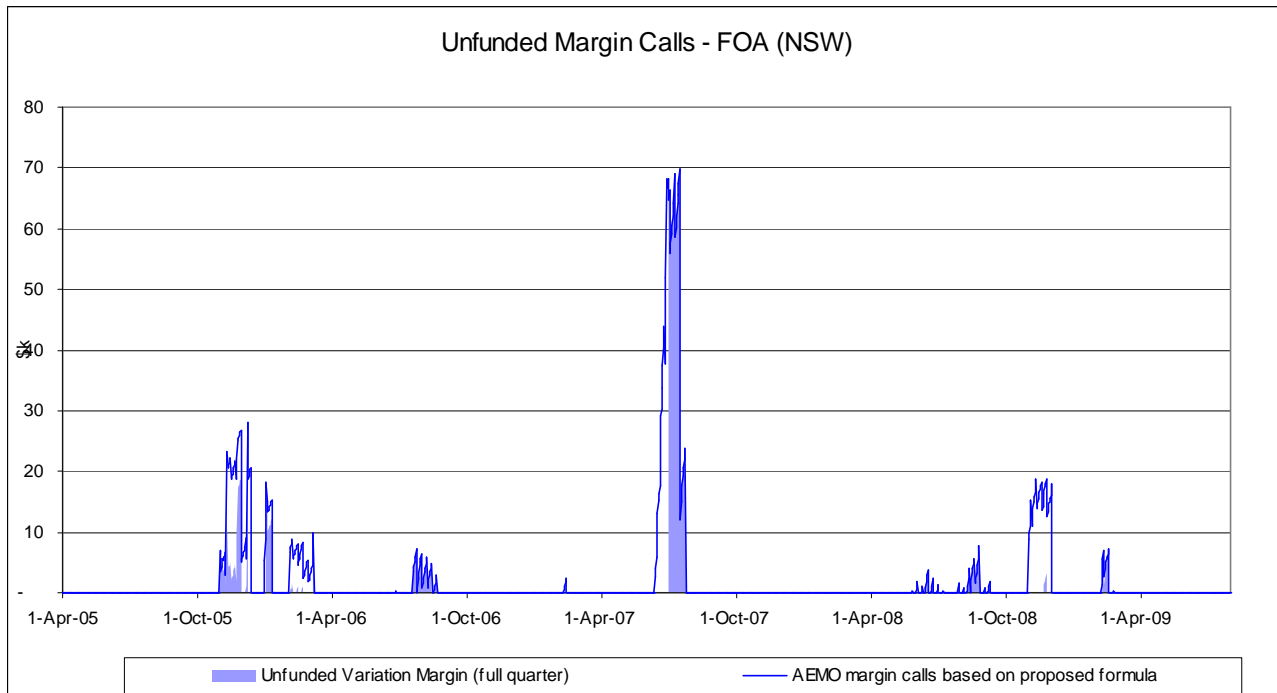


Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.g – Comparison between FLP + SDA and Total Outstandings - NSW

Figure 4.4.1.g shows not only the comparison between the FLP + SDA and total outstandings but also shows how this can be funded. The thin blue line represents the FLP + SDA funds based on 35 days and the thin purple line represents the funds received from the SFE CP for the futures positions which should be available to make variation margin payments to AEMO.

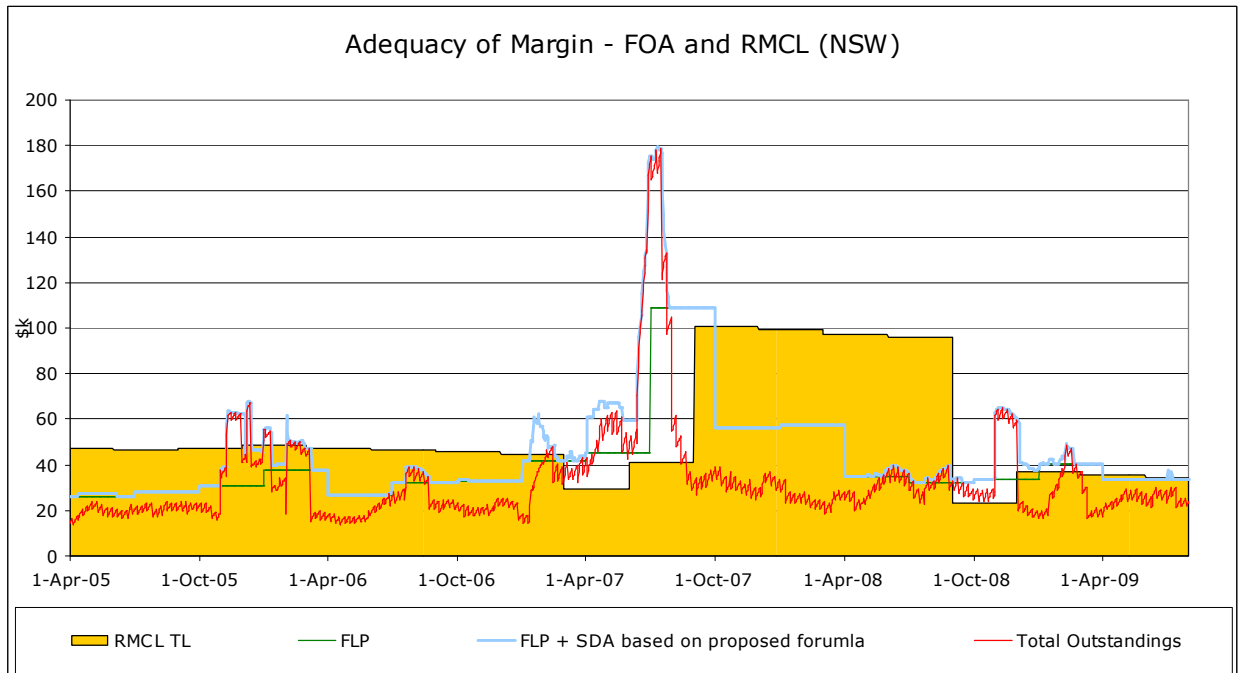
Figure 4.4.1.h below displays the unfunded variation margins as well as the margin calls required by AEMO in using a 35 day FOA margin period. This analysis shows that there is not frequent and significant payments required to AEMO which are not supported by funds from the futures contract. Similar charts for each of the other regions can be found in Appendix 7.3.2 (Figures 7.3.2.p, 7.3.2.q and 7.3.2.r).



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.h – Unfunded FOA Margin Calls - NSW

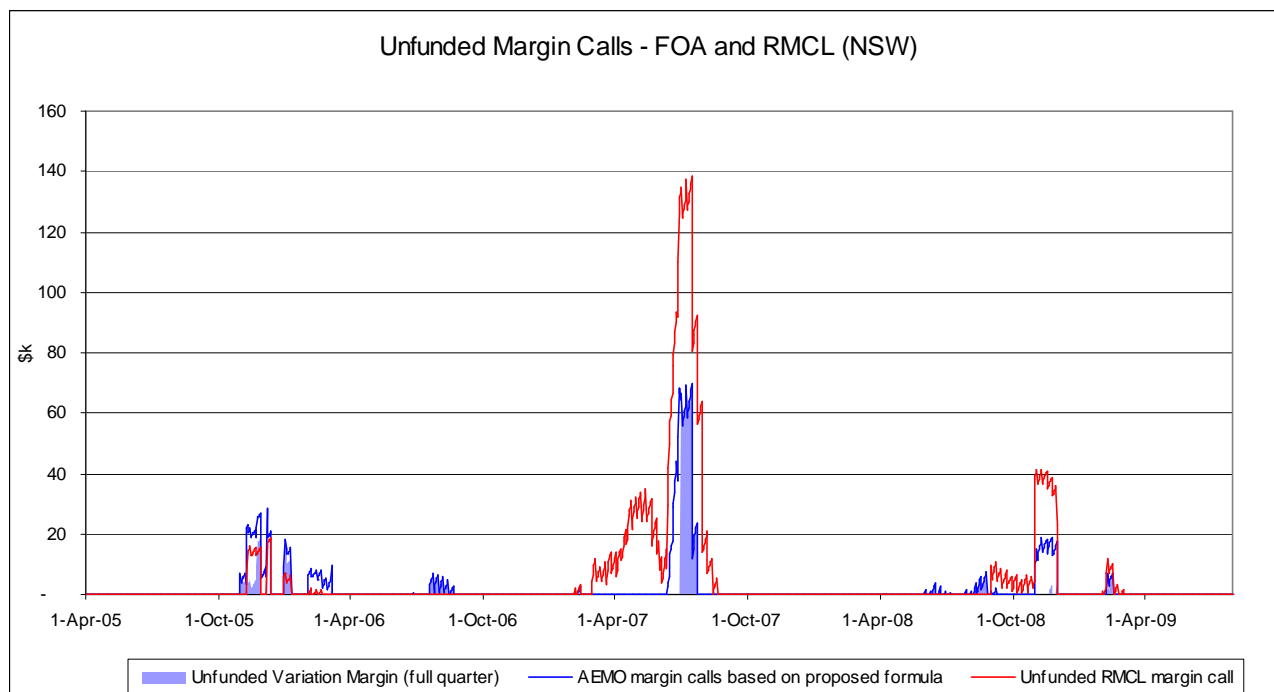
While Figure 4.4.1.h shows some unfunded variation margins, and therefore some risk to the NEM spot pool, to assess the incremental risk these unfunded variation margins create the frequency and magnitude of unfunded variation margin calls should be compared to the risk currently accepted by the NEM spot pool with the lowest level of prudential support, the RMCL. Figure 4.4.1.i below compares the FLP + SDA to the RMCL (trading limit) which could have been requested by the retailer solely for MCL reduction purposes. It can be seen from this figure that in many cases the FLP + SDA is near or greater than the RMCL. Similar charts for each of the other regions can be found in Appendix 7.3.2 (Figures 7.3.2.v, 7.3.2.w and 7.3.2.x)



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.i – Adequacy of Margin - Comparison of FOA and RMCL - NSW

A comparison of the unfunded variation margins from figure 4.4.1.h with the unfunded margin calls which would have been placed on a retailer who had an RMCL in place can be seen graphically in Figure 4.4.1.j and numerically in Figures 4.4.1.k and 4.4.1.l below. It can be seen from these figures that the number and value of unfunded margin calls is lower when an FOA is used in preference to an RMCL. As such it can be argued that the use of an FOA can reduce the risk of a NEM spot pool shortfall by reducing the unfunded margin calls on retailers and increase the prudential quality of the NEM spot pool when compared to the a potentially un hedged RMCL. Similar charts for each of the other regions can be found in Appendix 7.3.2 (Figures 7.3.2.y through 7.3.2.gg).



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.j – Unfunded Margin Calls - Comparison of FOA and RMCL - NSW

RMCL	2005	2006	2007	2008	2009
Unfunded TL breaches per year	29	23	179	92	22
Average value of TL breach (\$k)	14	3	37	16	5
Total value of TL breaches	399	63	6564	1475	107
Max	19	7	138	41	12

Source: AEMO, d-cypha trade and PwC Analysis

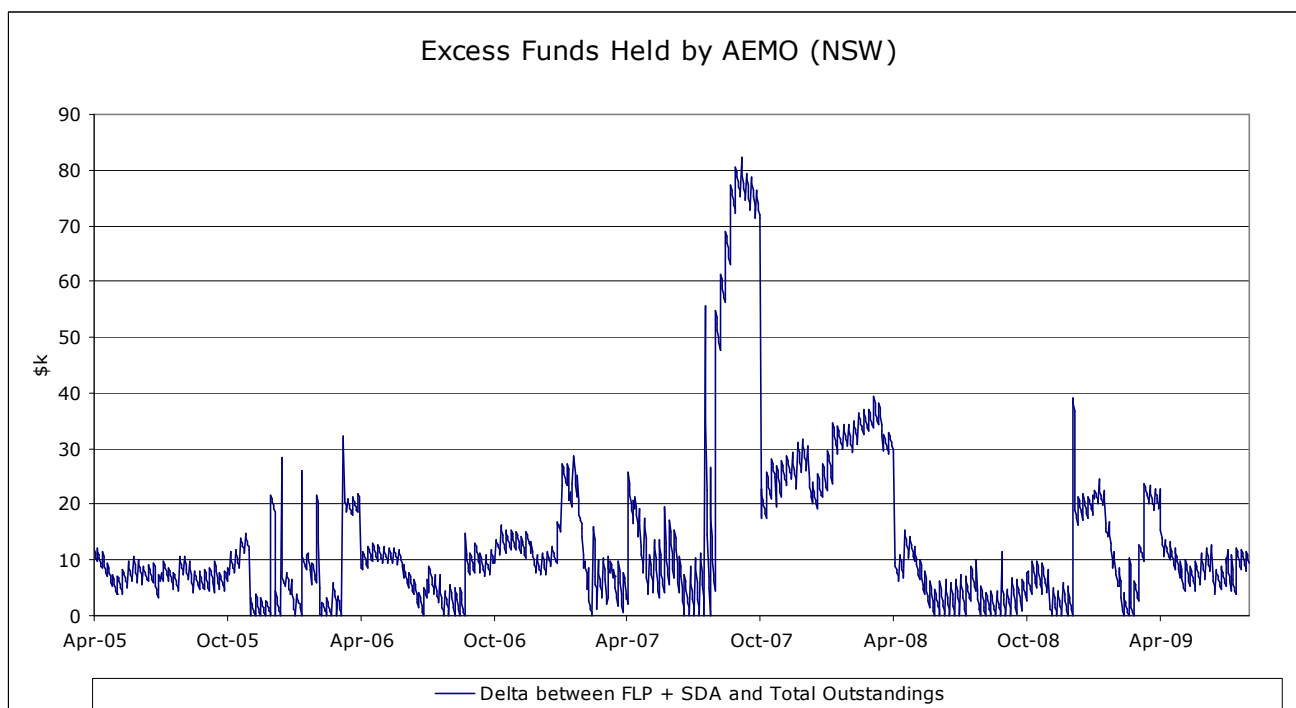
Figure 4.4.1.k – Summary of Unfunded Margin Calls RMCL - NSW

FOA	2005	2006	2007	2008	2009
Unfunded TL breaches per year	32	51	23	43	10
Average value of TL breach (\$k)	8	4	49	2	4
Total value of TL breaches	249	229	1138	97	40
Max	20	18	70	8	7

Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.l – Summary of Unfunded Margin Calls FOA - NSW

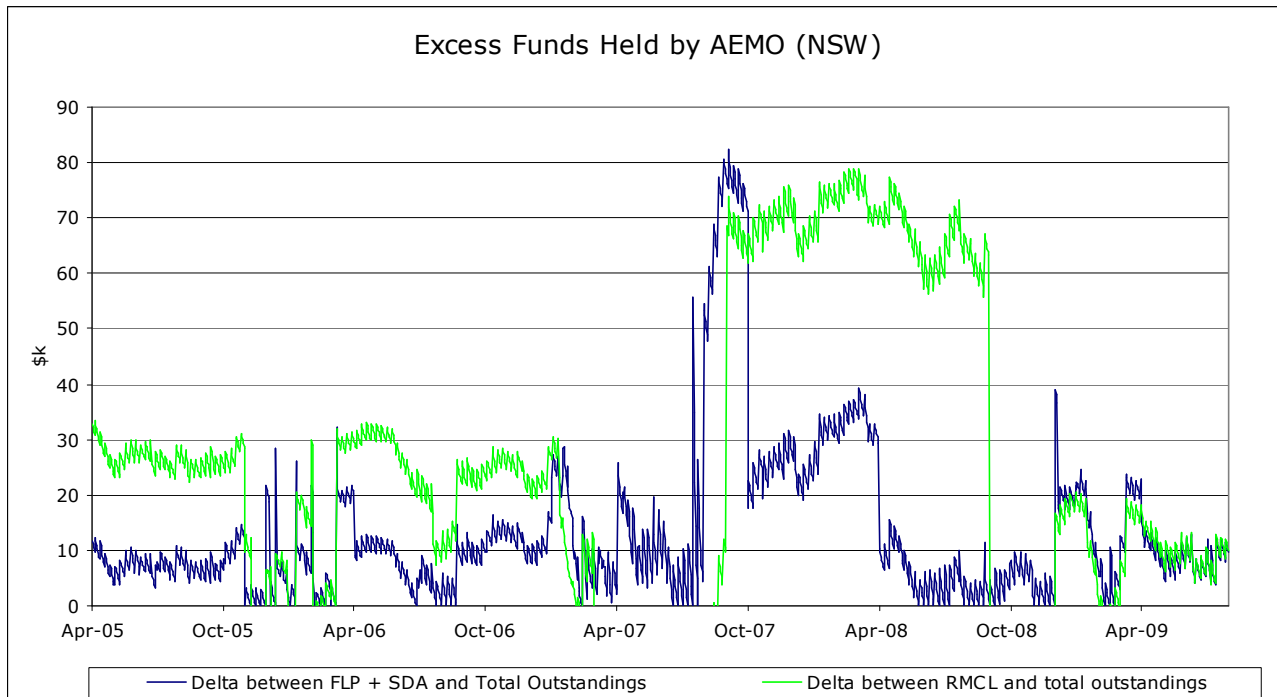
Figure 4.4.1.m displays the excess security held by AEMO over the retailer's total outstandings based on the amended formula developed by PwC. In analysing this data there are no days where the security held by AEMO does not cover the retailer's total outstandings in any region. Similar charts for each of the other regions can be found in Appendix 7.3.2 (Figures 7.3.2.hh, 7.3.2.ii and 7.3.2.jj).



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.m – Funds Held by AEMO in excess of Trading Limit - FOA - NSW

Figure 4.4.1.n below compares the delta between FLP + SDA and total outstandings to the delta between RMCL and total outstandings. It can be seen from the figure that introduction of an FOA does not necessarily result in an increase in the period of time at which a retailer is operating at or close to its TL. This figure also demonstrates the inefficiency which is often built into the MCL / RMCL process requiring significant additional security to be posted by the retailer at times where this is not reflected by movements in the actual market price.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.n – Funds Held by AEMO in excess of Trading Limit – FOA and RMCL - NSW

It has been argued by some that a retailer would not request an FOA if the MCL reduction allowable under an FOA was less than that available under an RMCL. As shown in Figure 3.3.a the RMCL process is employed less than 25% of all days by retailers. There are many potential reasons for the low uptake of RMCL including the increased effort required to manage the lower trading limit and the simplicity of keeping funds required to back trading with AEMO rather than as additional cash reserves. The FOA can provide additional value to the retailer by providing a source of funds to back margin calls required at times of high prices. Therefore it may be preferable to some retailers than an RMCL even in the case where the MCL reduction from the FOA is not greater than that available as a result with an RMCL.

4.4.2 Termination and Other Operational Risks

Termination

There are a number of situations that could result in the termination of an FOA. These include;

- Expiry;
- Voluntary;
- No margin payment; and
- Involuntary.

The risks to AEMO of each of these are discussed in turn below:

Expiry or Voluntary Termination

In the case of futures contract expiry or a voluntary termination AEMO will require additional prudential coverage at least 10 days prior to the expiry or termination of the FOA and as such there is no additional risk to the prudential quality of the NEM.

No Margin Payment

In the event a retailer fails to pay the margin required and calculated by AEMO into the SDA account by 10.30am on a NEM business day, AEMO may issue a call notice at 12pm and should there not be rectification of the matter through payment of funds into the SDA account, issue a default notice at 1pm on the following NEM business day. The magnitude of this risk is discussed below under 'Value of NEM shortfall Risk as a Result of FOA Termination'.¹⁶

Involuntary

In the event that a retailer fails to make a variation margin payment required to the SFE via the SFECP there is a risk that the SFECP could close out the position. In the event this occurs AEMO needs to be informed at the same time as the retailer to allow it to expeditiously terminate the FOA.

SFECPs retain the right to close out futures positions in line with the conditions of their contract with a futures participant who holds the FOA, positions may also be closed out by the SFE in the event of failure of the SFECP.¹⁷

Close out for commercial reasons

Concerns have been raised regarding the risks and incentives for either a NEM participant or SFECP to close out a FOA for commercial reasons. A retailer may wish to close out a position for a number of reasons, including:

- Replacement with an alternative FOA
- Change in load requirements
- Change in market prices

In the event of low market prices below the level of the FLP and the associated requirement to pay variation margins to the SFE, a retailer may wish to pay to close out the futures position and associated FOA and take market price risk for the remainder of the period. Should the retailer close out this position, the credit support held up to the level of the FLP should be sufficient to cover the outstandings of the retailer up until the point of cancellation. At the point the position was closed out the retailer would have to provide additional prudential coverage to AEMO.

In the event of a market price in excess of the FLP, a retailer may wish to sell out of a position if they have a reduced offtake requirement or a belief that prices are going to fall more than market expectations. If a retailer was to close out a futures position when the spot market price is greater than the futures price used in the previous variation margin calculation and the retailer fails to make variation margin payments as calculated by AEMO, AEMO may be exposed to the difference between the previous futures settlement price and the spot price for the period of time between the close of the position (or the failure to pay the required margin). AEMO will make a call for additional security and failure of the retailer to provide the additional security on the next AEMO business day should result in the commencement of suspension proceedings. The penalties for a retailer in closing out their position (in terms of potential market suspension, loss of business, bank guarantees and funds held in SDAs) should outweigh any benefits available to the retailer through the value of sale of the position.

¹⁶ Based on PwC's review and stakeholder consultations the likelihood of a retailer having an incentive to not make its variation margin payment to AEMO to support its FOA position is very low. If the retailer does not pay AEMO and default and suspension proceedings are commenced it would be walking away from its business, customers, bank guarantees, and SDA account balances as well as potentially facing other fiduciary issues.

¹⁷ A clearing member does not have an incentive to close out a retailer's position or to not pass variation margins in a rising market as the position will be cash positive, and thus reducing a large clearing member's risk to the retailer.

The likelihood of a SFECP closing out a retailer's futures position prematurely is difficult to qualify or quantify as it is not possible to calculate risk factors for individual companies at different points in time. Therefore, a binary approach is taken where a default is assumed, or not, and the consequence of the incremental time exposure to market prices when compared to the current trading limit monitoring methodology is determined. On the assumption that there is no information disparity between the SFECP's client and AEMO regarding the FOA position¹⁸, it is not expected there would be any incremental risk to AEMO other than the one-day risk associated with the time between a call for additional security and the failure of a retailer to provide the additional security on the next AEMO business day. At this point the retailer has only provided credit support up to the level of the FLP + previous day's SDA payments prior to the commencement of suspension proceedings. If the obligation on the NEM participant to pay variation margins to the SDA account is maintained, the ability for a SFECP to terminate a futures agreement does not increase the value of the potential spot exposure from the introduction of FOAs over that which results from a retailer's failure to make margin payments.

Impact of Retailer Failure or FOA termination

For the existing reallocation process the responsibility for settlement of the energy or dollars associated with the RA is taken off the market and no security (other than the prudential margin, GST and line loss) is held by AEMO for the energy subject to the RA. Under the proposed swap or option RA AEMO would hold security up to the strike price of the swap or option and settle the swap or option at this price. In the event of failure of either the retailer or the generator the other party to the RA could be bound to the RA up until the point of termination of the party who has failed to ensure that there is not risk to the NEM prudential quality.

For the proposed FOA model AEMO holds in the form of bank guarantees up to the level of the FLP and funds in an SDA account from variation margin payments. In the event of a failure event by the retailer, AEMO will need to rely on the security it holds to minimise NEM spot pool shortfall and will not be able secure funds from any other party to cover this risk.

As discussed in section 3.2, while it can be seen that RA, when used, can offer some incremental benefit to AEMO in protecting the credit quality of the NEM spot pool there is no obligation on any party to utilise RAs and the uptake of RAs has historically been poor for the reasons described in section 3.2. When making comparative assessments on the risk of introducing FOAs into the NEM the comparison should be made to the lowest level of credit support current allowable, the RMCL, rather than a direct comparison with RAs. As shown in figure 4.4.1.j both the RMCL and FOA processes require more active management of collateral.

SFECP Failure

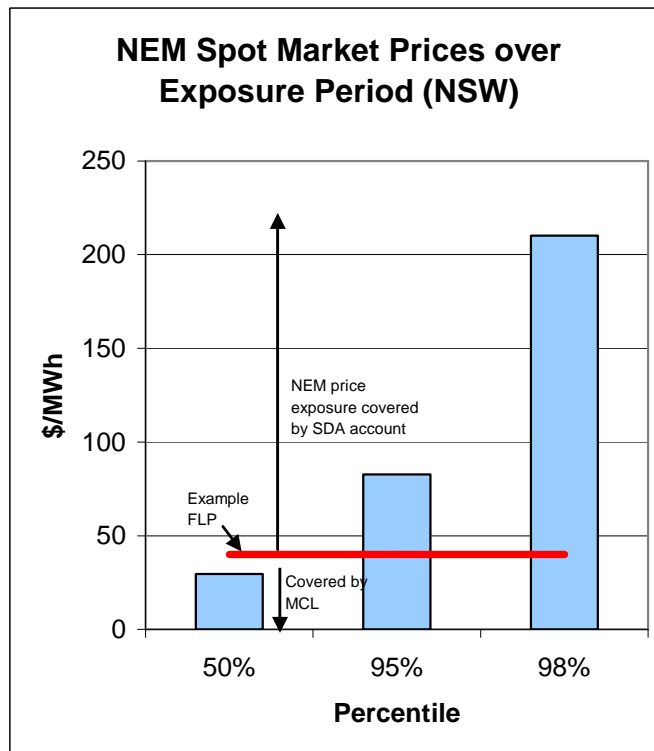
A concern has been raised regarding the failure of any SFECP. Like AEMO, the SFECPs are obligated to support positions of any failed clearing member, and therefore variation margins should continue to follow the retailer in the case of SFECP failure. It should also be noted a number of the SFECP are also parties who provide the bank guarantees to support the NEM prudential processes.

Under Basel II a futures contract attracts a zero percent credit rating which implies the SFE has a AAA credit rating due to daily margining and clearing processes.

¹⁸ See section 14.5.1 and consider that AEMO can verify the settlement prices from published public information

Value of NEM Shortfall Risk as a Result of FOA Termination

In the case of an FOA, the retailer is responsible for the settlement of the energy subject to an FOA at the spot market price. As security AEMO holds a bank guarantee up to the level of the FLP and funds in an SDA account to cover price movements above the spot pool price¹⁹. In the case of default by a retailer, the maximum incremental exposure over non-FOA operations is the difference between the FLP and the spot market price, for the load taken by the retailer from the period of termination of the FOA or failure to pay funds into the SDA. At this point a call notice will be issued for an incremental bank guarantee to cover the revised MCL and the commencement of the process for suspension of the retailer at the same time on the next business day. Once the AEMO suspensions proceeding have commenced the retailer is in normal termination mode and the full prudential margin is maintained to cover this period. To provide an indication of the potential value at risk over a 24 hour period (the maximum incremental exposure of NEM spot pool) is shown in Figure 4.4.2 for NSW and in Appendix 7.3.2.(Figure 7.3.2.a) for each of the states (including NSW) with the 100th percentile included²⁰. Therefore, in the case of retailer failure the NEM may be exposed to the difference between the previous FLP (or previous day's futures settlement price) and the spot price between one NEM business day and the next.



Source: AEMO and PwC Analysis

Figure 4.4.2.a. – NEM Spot Market Pricing for FOA Exposure Period

The FLP + SDA line in this figure is an example only as the FLP + SDA will differ for each contract and would be expected to rise in times of high prices. It is provided to highlight the potential funds at risk for the 24 hour offtake period. When assessing the risk to the NEM as a result of failure to pay FOA margins and / or failure of a retailer it should be noted that as per section 4.4.1 that in vast majority of

¹⁹ The proposed models base this payment solely on the movement of futures prices, we have devised an alternative approach incorporating notional outstandings over the credit period to ensure that any lag in the futures prices is covered. This is discussed in section 14.4.1

²⁰ It should be noted that the current MCL does not necessarily cover the 100th percentile as is designed to cover the reasonable worst case scenario.

days the FLP and SDA account contain sufficient funds which are over and above that required to meet existing and accruing outstandings of the retailer. This incremental exposure to the NEM spot pool is capped at the difference between the security provided to support the FOA (both FLP bank guarantee and SDA cash) on the day prior to failure and the RMCL, as the RMCL is the lowest level of exposure allowed under the current market operation. More detail on the historic relationship between FLP + SDA and RMCL can be found in section 4.4.1 figures 4.4.1.i and 4.4.1.j.

Probability of default and financial impact of default

While the impact of any default event may (subject to the relationship between the FLP and RMCL) be greater than the value at risk under the existing prudential processes the probability of default is different. If an extreme pricing event occurs without an FOA (or other hedging arrangement) the retailer must provide funds to AEMO on the next day to cover breaches to the trading limit. Retailer contracts are generally set at fixed prices and without a hedge in place they would be exposed to the full price increase. If the retailer does not have appropriate access to funds in an un hedged situation there is a high probability that the retailer may default on its obligations to AEMO at the time of extreme pricing.

If the retailer has a futures agreement and an FOA in place at the time of extreme pricing the retailer will receive funds from the SFECF at the time of the extreme pricing event which can be used to cover its obligation to AEMO. As a result the probability of a retailer defaulting at times of high prices when the risk to AEMO and the spot pool is greatest is reduced with the introduction of FOAs and creates a linkage of futures hedging arrangements to AEMO and its prudential processes.

Settlement

It should be recognised movements in the futures prices may be out of step with movements in the spot prices. This may occur at times when significant and unexpected price changes occur between the close of the futures market and the calculation of the variation margins by AEMO the next morning. The most likely cause of any such movement is an unplanned supply incident (generator or transmission failure). As a result, the monies moving in and out of the SDA account may be out of step with accumulating outstandings as the futures prices reflect the historical quarter pricing and expected pricing for the remainder of the quarter. This is displayed in the Figure 4.4.1.e below. The risk of futures being out of step with spot is considered low over the duration of the futures contract due to the self correcting nature of the futures contract over the course of the quarter (final future settlement being a time weighted average of quarterly spot prices). Any adjustment solution may add additional operational risk as the adjustment processes use a shortfall equation for the risk that it intends to cover.

Participant total outstandings are managed on a day to day basis by the AEMO prudential monitoring process. A shortfall in prudential coverage could occur when a FOA is lodged at the beginning of a quarter and there are outstandings existing at higher prices from the previous quarter. For example, if outstanding on a \$/MWh basis are more than the FLP AEMO would not have the full billing coverage for the outstandings, only the billing coverage of the FLP. As previously mentioned, the prudential monitoring process would pick this up and require a deposit into the SDA account to cover this gap, therefore mitigating this risk.

Information Disclosure and Flow

A key risk for a spot market shortfall is a failure of the SFECF or retailer to notify AEMO in the event of a change to, or close out of, the futures position which underpins an FOA contract.

Under an RA there is a two party approach and the responsibility for settlement or the RA is taken off market (except in the case of swap or option agreements) and no billing security is held for energy settled off market. In the case of an FOA, security is held for the value of the outstandings with AEMO

through a MCL bank guarantee up to the level of the FLP and funds in the SDA account up to the value of the accumulating spot over the outstandings period (based on our proposed amendment to FOA model 2) to the spot market price for each period. Unlike the trading limit processes, which can require funds to be paid into an SDA account to cover historic price movements, the funds in the FOA / SDA account should cover all of the days in the outstanding and accruing outstanding period, ie there is forward looking coverage of the potential load exposure. In the case of default by the retailer, the maximum the NEM Pool should be exposed is the difference between the FLP + SDA and the spot market price for the difference between one AEMO business day and the next.

No changes are required to the FOA Model 2 design to provide AEMO with improved powers over the SFECP to ensure surety of correct and timely provision of information and funds as long as the requirement remains on the retailer to ensure that funds are paid into the SDA in accordance with the variation margin calculations performed by AEMO. In the event that the funds are not paid into the SDA, AEMO has the powers to suspend the FOA and call for additional credit security. In the event that the retailer is not able to fulfil this request AEMO has the power to suspend the retailer from the market.

Risk Mitigation

The only incremental risk introduced to the prudential quality of the NEM spot pool as a result of the introduction of FOAs is the value equal to the difference in price between the FLP + SDA and the spot market price for load of the retailer between the termination of the FOA and call for additional security or the failure of a retailer to make margin payment to AEMO for an FOA and the initiation of suspension procedures by AEMO on the next AEMO business day. As shown in section 4.4.1, historically it has often been the case that the FLP and SDA have exceeded the accumulating spot price. To reduce the risk to AEMO of a shortfall in line with the current prudential processes, additional risk coverage could be added to the prudential margin and should be equivalent to an additional day's coverage on the same basis as the existing MCL. This additional risk coverage would be put in place to cover the additional period of time AEMO may be exposed to the full spot market price while the participant is suspended from the market. Based on the current method of calculating the prudential margin the inclusion of an additional equivalent day's coverage to the prudential margin would not cover all potential pricing scenarios over the day of incremental risk (or over the suspension period) but would provide some added protection to account for expected scenarios in a manner consistent with the current prudential margin process²¹.

4.4.3 Load Balancing Risks

Base futures contracts are for a flat load across each hour of the period. This load profile may differ from the load profile of the retailer entering into the FOA. If this is the case and no change is made to the MCL calculation for the remainder of the retailer's load, AEMO may hold insufficient security to cover the retailer's load not covered by the FOA. Given that the magnitude of this risk will be directly related to the shape of the retailer's load and the proportion of their load covered by the FOA, this is not a systemic risk that can be effectively covered by a futures adjustment factor (Beta Factor). This risk is also not linear as the lowest levels of exposure will exist when there is very limited or full coverage of the retailer's load, and the highest risk will exist where an FOA is taken to the level of a retailer off peak load therefore exposing the retailer to a very peaky load from the market.

We believe that this risk can best be managed by AEMO adjusting the expected average load used in the calculation of the base MCL to cover the added risk of the peakier profile. We understand that

²¹ Should the approach to the calculation of the prudential margin be changed to reflect the risk of AEMO over the suspension period as discussed in the stress test MCL, section 15.3.4, the additional risk coverage in the prudential margin would fully cover the incremental risk to AEMO.

AEMO already has the ability to do this under the current MCL processes. It should be noted that this is a different approach than the current RA processes where the generator submitted RA must match the retailer's submitted load for the RA. For FOAs a change to the average load component of the MCL is proposed to be undertaken by AEMO in order to compensate for the modification of the risk profile as a result of incorporating an FOA representing the flat load nature of Futures contracts.

4.4.4 Clawback

Our comments on the risk of clawback to SDA accounts are covered in section 3.3.2 and Section 4.2. As a result, we do not believe the calculation of a separate Beta factor in the event of high and low claw back risk is appropriate. Depending on the uptake of FOAs and the difference between the FLP and the current spot price, there is the potential for a significant increase in the quantum of funds in SDA accounts with the introduction of FOAs, which could attract further attention to entities seeking to recover funds from a failed market participant.

4.5 Structure of Proposed FOA Model (Revised Model 2)

4.5.1 Parties to the FOA

The proposed revised FOA model 2 includes a two part contract arrangement:

- (1) the arrangement between a SFE Clearing Participant (SFECP) and its customer who is a NEM participant, and
- (2) the NEM Participant and AEMO.

These relationships are independent of one another but require a linkage so that information disparities do not occur between the SFECP and AEMO. To avoid any information regarding the futures position nominated for the FOA disparities on the FOA from the corresponding futures position, identical information should be provided from the SFECP to AEMO and the NEM participant to allow AEMO to confirm the ongoing existence of the position and calculate variation margin payments due.

As part of our stakeholder consultation process SFECPs have informed us that this can easily be accommodated by the establishment of an operational account for administration of confirmation emails on the status of the FOA position, this is similar to the way trust accounts are currently operated by the CPs.

4.5.2 Specifications of the FOA

Clause 5.1.2.3. of the proposed FOA models envisages a retailer having FOAs separated by the use of a different SFECP for futures contracts used as FOA for all other futures contracts. As FOAs can only be registered 90 days prior the relevant period, and it is likely that a retailer may wish to cover positions further out in the future that are not covered by this period, it would not make sense for these positions to be initially set up with one clearing member and then transferred to another clearing member at the time that they are to be registered for an FOA.

4.5.3 Precondition for FOA registration

The proposed FOA model contains the following preconditions to registration of the FOA:

- Existence of an underlying futures contract with a separate client sub account;

- Confirmation from the SFECP that positive margins from the FOA futures contract will be payable without netting against other positions held between the NEM participant and the SFECP; and
- Commitment not to sell or otherwise dispose of the futures contract without the provision of alternative credit support 10 days prior to the proposed close out.

It may not be possible to obtain the confirmation from the SFECP that the positive margins from the FOA futures contract will be payable without netting against other positions held by the NEM participant in all circumstances. The precondition for the registration of an FOA should include a commitment by the NEM participant to pay the margin as calculated by AEMO to mitigate this risk. The risk to the NEM pool exists if the retailer fails to deposit the variation margins calculated by AEMO, not in the case where the SFECP nets margins or takes a fee from the margin paid.

Under the alternative variation margin calculation which we have proposed in section 4.4.1 the variation margin payable into the SDA account will differ from the payments required to and from the SFE as a result of the different MWh value of the loads and potentially the accumulating spot floor. As a result the risk of netting of funds does not present a significant risk to the funds available to the retailer to make variation margin payments to AEMO.

A number of stakeholders have raised the issue relating to proportion of a retailer's load that could be covered by FOAs and whether a precondition for registration should be that the FOA or combination of FOAs and RAs does not exceed the retailer's estimated NEM load. We do not believe that there are any risks associated with a retailer lodging FOAs at a greater level than their average load as this will require the retailer to provide additional security over and above that required to meet the estimated load from AEMO and there is no additional MCL relief above the estimated load. Therefore, the level of MCL relief provided to the retailer should be capped at their average load.

4.5.4 Penalties for Failure to Provide Information

AEMO has included a right to perform random audits on any contracts and futures positions covered by an FOA in clause 1.3. of the proposed rules for FOAs.

Additional penalties to discourage the provision of incorrect or false information or failure to provide information on timely basis could include:

- AEMO closing out all other FOA positions (and the requirement to provide additional security to the AEMO in line with the change in positions);
- A ban from registering any further FOA agreements for a specified period of time; and / or
- A fixed financial penalty for breach.

4.5.5 AEMO Termination Rights

The proposed FOA model has identified the following termination scenarios;

- Expiry
- Voluntary removal and provision of other credit support by the retailer
- Failure to pay funds into SDA as required
- Failure to provide information as required
- An audit of the FOA by AEMO has identified breaches of the rules by the retailer

AEMO may also wish to have the right to terminate the other FOAs of a retailer who is found in an audit to have breached the rules in relation to an other FOA position that has been accepted by AEMO.

AEMO may wish to have the right to terminate FOAs if there is a fundamental change in the structure of the futures market, so that it is no longer representative of the NEM spot market, such as the introduction of CPRS or other similar scheme that potentially cause an unforeseen distortion to the market.

4.5.6 Errors and Disputes

The introduction of a third party process into the AEMO settlement processes does increase the risk of errors and disputes. d-cypha Trade had advised that errors with the settlement of the daily futures spot price are very rare but have occurred in the past.

In the event of a manifest error, AEMO should be able to easily verify this by comparing spot market and futures pricing. If AEMO believes that a manifest error has occurred in the futures settlement price, it should retain the unilateral right to set the futures price for the calculation of the variation margin. In the event of a minor error in the settlement price, it is unlikely that this will have a significant impact on the prudential quantity of the market, although AEMO should retain the right for retrospective changes to the funds held in the SDA account to cover the possibility of any such errors.

4.6 Potential uptake of FOAs

All of the small to mid-size retailers indicated a strong interest in utilising an FOA mechanism, providing the FOAs were not substantially discounted as a hedging tool. As in all new trading instruments or mechanisms, there can be an initial slow uptake until there is both confidence in the offering and until the internal processes, procedures and sign-offs of companies take place.

4.7 Summary of Findings

We have reviewed the proposed introduction of FOAs into the NEM prudential regime and found that while FOAs may introduce additional risks to the NEM prudential quality, additional processes can be introduced to mitigate these risks. The introduction of FOAs into the NEM prudential processes would provide an important additional means for retailers to manage their prudential requirements given the shortcomings associated with the existing reallocation processes, as discussed in Section 3.

Recommendations for the Introduction of FOAs into the NEM Prudential Regime

- **FOA Settlement Model** - We have reviewed both of the FOA models proposed for the introduction of FOAs and found that a revised Model 2 matches the flow of funds under a Futures agreement most closely. The stakeholders consulted as part of this process were unanimous in their support of the original Model 2. We have not identified any incremental risks to the NEM spot pool as a result of the use of the Model 2 SDA and cash flow processes as opposed to those in Model 1.

PwC Recommendation - Progress with the cash flow and return of excess margin payment process as detailed in Model 2, subject to our recommendations below regarding changes to the variation margin calculation and other revisions to FOA Model 2.

- **Termination and Other Operational Risks** - In the event of the termination of an FOA as a result of the termination of the underlying futures agreement by the SFECP, or as a result of the failure of a retailer to deposit to AEMO the required variation margin payments, the NEM spot

market may be exposed to the difference between the FLP + SDA and the spot market price for the period of one business day..

PwC Recommendation – The review indicates that there is not a significant termination risk that needs addressing, however, if the AEMC is concerned with the mitigation of this termination risk a simple approach might be to add risk coverage equivalent to an additional day of prudential margin (ie an 8 day rather than a 7 day prudential margin period) to the MCL period for NEM Participants with an FOA for the volume subject to FOA.

- **Systemic Price Risk and Margin Calculation** - A review of historic spot and futures prices for each of the traded markets has not identified any systemic pricing risk in the difference between spot and futures pricing which could be addressed appropriately with a Beta Factor. Our review has identified days where FLP MCL coverage and accumulated SDA funds will be less than the value of energy consumed under the FOA by the retailer. There is difference between the number of MWh for which MCL relief is granted under the proposed Model and the number of MWh for which the variation margin is paid.

PwC Recommendation - Placing a floor on the value of the SDA account equal to the accumulating spot over the outstandings and accumulating outstandings period. This will ensure, at a minimum, that there are always sufficient funds in the SDA account to cover accumulating and existing outstandings of the retailer and help to protect the prudential quality of the NEM. The difference in the number of MWh for MCL relief and the number of MWh used in the variation margin calculation should also be addressed by a change to the variation margin formula as described in Section 4.3.2.

- **Load Balancing Risks** – Futures agreements are for a flat load over their period of cover, as a result, the level of FOA coverage that a retailer requests will follow this flat load shape. If no adjustments are made vis-à-vis the retailer's unhedged expected load, the current MCL process could result in lower than required coverage of unhedged volumes.

PwC Recommendation - Load balancing risk is unique to a NEM participant and is appropriate to be handled through the AEMO MCL load assessment processes rather than through the use of a generic FOA discounting Beta Factor. This risk can be best addressed by AEMO adjusting the unhedged volume in the calculation of the MCL.

- **Use of FOAs and RMCL** - The proposed FOA models require a bank guarantee to be held by AEMO and variation margins paid into an SDA account in the event that the previous days futures prices is greater than the FLP. When a retailer requests an RMCL a shorter 14 day credit period is used rather than the usual 28 day cycle. There is no obligation for a retailer operating under a RMCL to settle their account on the shorter settlement cycle though the lower trading limit requires more active management of outstandings, generally though the payment of funds into the SDA account. Should an FOA be accepted where a retailer has an RMCL in place, and the MCL for the FOA calculated on the basis of 14 days rather than 28 days a disjoin between the payment period and the calculation period is more likely to result in shortfalls in the variation margin payments to AEMO.

PwC Recommendation – RMCLs and FOAs should not apply to the same volumes. In the case where a retailer has requested an RMCL the MCL component for the FOA should be calculated for the FOA load based on a bank guarantee for the 35 day outstandings period at the level of the FLP.

- **Parties to the FOA** – We have reviewed the FOA processes and found that the risks associated with not binding the SFECP can be managed through other processes.

PwC Recommendation – NEM Participants wishing to have an FOA registered should be required to confirm that the FOA has been established and resides within a structure that requires the SFECP to provide identical information regarding the position backing the FOA to both the Retailer and AEMO simultaneously.

- **Specification of the FOA** – In practice the provisions in clause 5.1.2.3 of the proposed FOA rules will be very difficult to achieve and in the case that our recommendations relating to the calculation of the variation margin are adopted would not be applicable.

PwC Recommendation - The AEMC should consider the removal of clause 5.1.2.3 and the obligation of retailers to place funds into a separate sub account with the SFECP.

- **Preconditions for FOA Registration** - The preconditions for registration of the FOA models include the requirement for a confirmation that the positive variation margins from the futures contract controlled by the SFECP, which underpins the risk coverage of the FOA, are payable without netting against other positions held by the NEM Participants.

PwC Recommendation – The preconditions for registration of an FOA should include a commitment by the NEM participant to pay the variation margin as calculated by AEMO, into the SDA and therefore does not require a confirmation to AEMO of positive variation margins paid by the SFECP to the market participant, only the identical information supplied to the retailer on changes to the status of the FOA futures position.

- **Penalties for Failure** – AEMO has the right to perform random audits on any contracts or futures positions covered by the FOA. We have identified penalties that could be imposed on a NEM Participant who is found to have provided false information or failed to provide information on a timely basis.

PwC Recommendation – The AEMC should consider the inclusion of each of the following penalties in the event a NEM participant breaches the terms of the FOA:

- AEMO closing out all other FOA positions (and the requirement to provide additional security to the AEMO in line with the change in positions);
 - A ban from registering any further FOA agreements for a specified period of time; and / or
 - A fixed financial penalty for breach.
- **AEMO Termination Rights** – Under the proposed rules AEMO has the right to terminate an FOA in a number of defined circumstances

PwC Recommendation – The AEMC should consider including the right to terminate an FOA in the event a NEM participant has been found to have breached the conditions of the FOA through an AEMO Audit of the FOA position or in the event of a fundamental change to the market pricing or structure of a Futures contract.

5 Risks and issues associated with Maximum Credit Limit Methodology

The maximum credit limit (MCL) of a NEM participant, in a NEM region, is established to cover a reasonable worst case estimate of its potential financial exposure to the NEM and AEMO over a 42 day credit period. The purpose of establishing MCLs for NEM participants is to ensure that AEMO holds an adequate level of prudential support to meet a NEM participant's accrued and potential liabilities to the NEM over the 42 day credit period. A key objective in establishing the MCL level is balancing effectiveness, a measure of the degree to which the MCL protects the market, and efficiency, a relative measure of the cost of providing the MCL. These measures should represent a balance between how well the market is protected from failure of a participant and the cost of providing that support.

5.1 Review of the 'Reasonable Worst Case' Definition

The MCL is intended to cover a reasonable worst case which is defined by the NEM rules as a position that while not being impossible, would not reasonably be exceeded more than once in 48 months. The once in 48 months could be interpreted in a number of ways; for example the estimated MCL not being exceeded for one month in 48 (outstandings period), one week in 48 months (a billing period) or one day (a pricing period) or potentially others.

Some of the issues with this definition include:

- Which once in 48 month period is to be covered?
- What is the magnitude of cover required for the once in 48 (1/48) month's event?
- Does a once in 48 month event provide effectively 98% coverage that an MCL level will not be breached?
- Is the reasonable worst case estimate not to be exceeded in a trading day, one billing period, an outstandings period or other?

Based on the MCL formula, which covers a 42 day period, the credit coverage could be interpreted for the full 42 day period incorporating the 28 days of outstandings, 7 days of billings and a 7 day reaction period. The credit position that the once in 48 months is therefore intended to cover is the entire 42 day period. This does not necessarily mean that taking the high water mark looking backward over 48 months would provide the appropriate measure for the once in 48 month reasonable worst case.

A key issue in the debate on what 'Reasonable Worst Case' actually means is that the definition is qualitative leaving the quantitative interpretation open to interpretation. Recognising this issue, an alternative way to look at the qualitative definition is to turn the definition into a statistical definition that can be used to obtain an MCL measure that has a high degree of effectiveness and efficiency.

An analogy of the MCE is the banking sector who reserve against a worst case scenario with a 95% to 99% level of confidence, based on APRA prudential and/or Basel II requirements. Trading desks traditionally operate at the lower to mid end of this range, while treasury activities are likely to be at the upper end. The 'reasonable worst case' scenario defined by the NEM rules identify a reasonable worst case scenario as a one in 48 month event or a 98% level of confidence. This falls between the banking industries 95% to 99% confidence level²². While risk can be measured at a consistent level across industries / markets the method of measuring risk is necessarily specific to the particular asset, portfolio or application.

²² Note: Using higher percentile levels than the 98th percentile might not be statistically sound as they are based on too few price observations

The NEM is characterised as a market that does not lend itself to a normal or log normal price distribution due to the occasional occurrences at extreme pricing levels. Although this is true on an hour to hour and day to day basis, with the averaging of pricing over time the extreme price events have a lesser impact in skewing the distribution. Electricity is highly mean reverting, as such the application of standard deviation multiple and square root of time extrapolation of the distribution beyond observed pricing points is likely to be inaccurate.

To address the question of trying to fit the NEM into a defined probability distribution we suggest taking an approach that utilises historical information and creating a discrete pricing distribution based on all pricing points over a specified period of time and taking a percentile (98th), or actual pricing event, as the reasonable worst case scenario.

As an example clarifying the qualitative description and turning it into a quantitative measure that can be used to assess an MCL methodology, a once in 48 month event could use any time period, whether it be 48 months or 12 months, and take the once in 48 month or approximately the 98th percentile (i.e. 47/48) of the MCL value observations²³. There have been suggestions that this method could be used with the current MCL calculation methodology of the rolling 42 days average of prices looking back over a specified time period, 12 months as in the current MCL, and identify the highest price spike. This price spike would be considered the 100 per cent event under the current MCL methodology, given the discrete time period that contains all available information for that time period. In order to derive the 98 percentile you would scale down from the 100th percentile event to the 98th percentile of all pricing information from the evaluation period providing for a more statistically robust reflection of the 98th percentile or once in 48 month event.

The AEMC has proposed yet another interpretation of the reasonable worst case scenario, such that the MCL should be set to ensure adequate security to meet all settlement liabilities (allowing for reaction time) for all except one 42 day credit support period – in 48 months. This would be with respect to:

- AEMO issues 208 bills in 48 months
- There are 208, 42-day “credit support periods” in 48 months
- The MCL may not be exceeded more than once in a 48 month period (207/208 or 99.5% probability that MCL is sufficient)

The AEMC has solicited views on the appropriateness of this interpretation of MCL and our analysis suggests that utilising the 99.5th percentile, as described in this AEMC proposition is possible. However, it should be recognised that increasing the reasonable worst case MCL cover from a 98th to 99.5th percentile will only incrementally increase the effectiveness at a serious impairment to the efficiency (or cost) of the MCL. If extreme pricing becomes more of a regular occurrence, rather than just a once in 48 month event, this would be picked up in the 98th percentile. It can be seen from the analysis provided in Section 5.3 that the 98th percentile approach provides MCL values of the same order of magnitudes as the current MCL methodology.

5.2 Overview of the current MCL methodology

The aim of establishing a collateral amount for a credit position is to derive an amount that provides a reasonable level of assurance of payment for any liabilities. There is a delicate balancing act in determining a reasonable level for the coverage of the potential liabilities while not setting the coverage at an excessive level which could potentially curtail the development of a market. The current MCL methodology aims to provide credit coverage to cover a reasonable worst-case estimate of the potential financial exposure which is based upon the aggregate accrued payments (after reallocations) to be made by a NEM participant to AEMO over the NEM participant’s credit period. It is expected that the

²³ This is not to be confused with the 98th percentile of a normal distribution.

MCL is set such that the reasonable worst case estimate should not be exceeded more than once in 48 months, or as discussed in Section 5.1 above, at a confidence level of approximately the 98th percentile. The MCL is calculated for each participant and a bank guarantee of at least the MCL level must be lodged with AEMO as credit support. The MCL is currently reassessed quarterly, though can be reassessed due to major changes in the market resulting in a market participant frequently exceeding its trading limit or as a result of the addition of AEMO approved hedging offsets to market participant's NEM position. The MCL comprises of two major components:

- a prudential margin; and
- a trading limit

The prudential margin represents the buffer below the MCL and above the TL and its purpose being to ensure that AEMO is not exposed to a prudential risk during the period of removing a participant from the NEM. These elements of the NEM prudential framework are displayed in Figure 5.2.a below:

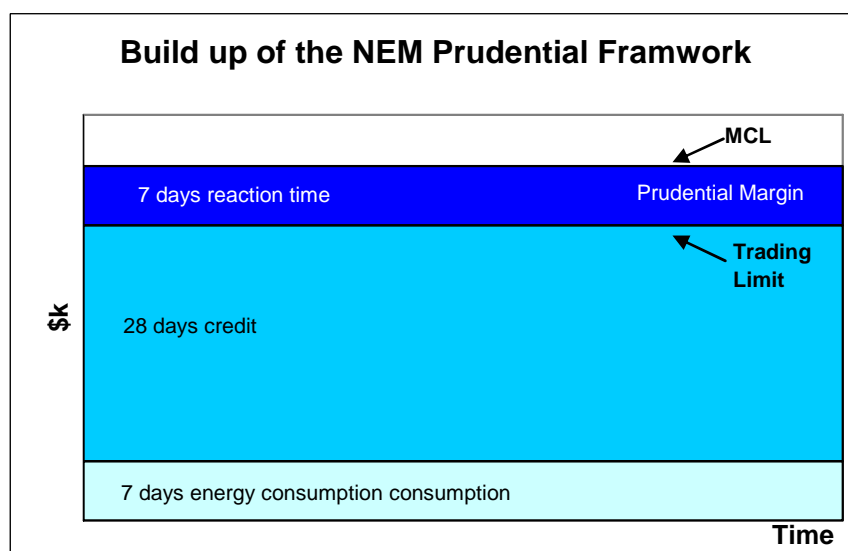


Figure 5.2.a: Build-up of NEM Prudential Framework

The above framework takes into account a 28 day period of outstandings, with a reduced MCL (RMCL) this figure could drop to 14 days, thus reducing the Trading Limit and the MCL.

The method by which the MCL is currently calculated utilises the 6-week time period. Based on the credit components and the breakup of the 6-week period alternative MCL methodologies have been developed. When developing alternative MCL methodologies the following considerations have been taken into account as to whether or not the methodology:

- improves or at least maintains the prudential quality of NEM?
- reduces or at least maintains the cost of capital to trade in the NEM wholesale market?
- improves or at least maintains operational effectiveness?

When comparing the alternative MCL methodologies the analysis has also considered:

- the setting of the MCL at an appropriate and cost efficient level
- the operational effectiveness and predictability of the MCL calculation

5.3 Alternative MCL calculation methodologies

The scope of this review requires an assessment of the applicability, effectiveness and efficiency of utilising forward pricing information contained in electricity futures. In addition, MCL alternatives that consider a stress test scenario, a modified historical approach, a hybrid approach and an alternative seasonally scaled historical approach were evaluated. These are discussed in turn below and then compared graphically and quantitatively to assess for effectiveness and efficiency. New South Wales (NSW) has been used for example purposes through the course of this section and analyses of the other states can be found in Appendix 7.3.3. ***The MCL alternatives are calculated for a flat 1MW load for ease of comparison. However, the effectiveness and efficiency are calculated on a load weighted basis for each region.***

5.3.1 Current MCL Approach

AEMO defines the maximum credit limit as:

The maximum credit limit for a Market Participant is a dollar amount determined by AEMO applying the principles set out in schedule 3.3, being an amount determined by AEMO on the basis of a reasonable worst case estimate of the aggregate payments for trading amounts (after reallocation) to be made by the Market Participant to AEMO over a period of up to the credit period applicable to that Market Participant.

The current MCL process utilises historical information to provide credit coverage for forward looking credit exposures. This MCL calculation methodology was developed prior to the development of a liquid futures market and has generally been accepted. The key market based inputs to the current MCL methodology are:

- Base Price – is calculated as the time-weighted average of all spot prices of a region over the previous 12 month period in the relevant region
- Volatility – is calculated for each region by dividing the peak value of the 42 day outstandings (price and demand weighted) from the prior 12 months by the mean of those 42 day outstandings over the prior 12 months on a rolling basis.
- Specific to market participant - additional factors are included for load, marginal losses and the GST
- Prudential Margin – represents seven days worth of credit support based on the base price, volatility and factors specific to the market participant

5.3.2 Considerations for the Use of Futures in the MCL Process

We reviewed the range of different ways in which to incorporate forward looking pricing into the MCL methodology. The following points were considered in evaluating the most appropriate forward pricing mechanism:

- Should more than one forward pricing period be used for an alternative MCL calculation?
- Should OTC pricing also be included?

- How do you get a representative value for a futures price to be used as the base price?
- What happens if there is no liquidity in a contract in one of the regions?
- What happens in regions where no futures contract exists?
- How do you deal with overlapping futures during the 42 days of the rolling billing periods?
- How can futures price volatility be incorporated and is it representative of a 42 day exposure?
- What is the time risk factor between the daily futures settlement process and the AEMO daily settlement process?
- How can an alternative methodology using futures for a base price, and potentially for the volatility factor, fit into the definition of reasonable worst case?
- How could a forward looking methodology using futures be incorporated into the AEMO process for the 3-monthly timing of the MCL calculation?

Preconditions for using futures

The continuing robustness of pricing for a futures contract largely depends on the level of confirmed deals that end up as open interest. Where open interest exists in a futures contract both sides of that contract will want to ensure the daily settlement prices reflect the market to ensure they are not over margined in the first instance. Disparities of information enter the market at various times and this can create uncertainty in pricing which translates into volatility. Volatility is why market participants trade the market, so there will always be some level of discrepancy on a fair market value and rarely exact agreement, except in the case where two parties transact. A methodology that could be considered to assess the robustness of a market is;

- (1) how many transactions have occurred during your pricing assessment window, and
- (2) what is the level of open interest in the futures contract of concern?

If reasonable open interest with several entities on both sides of the market and there are several transactions have taken place during the price establishment period you would place a positive weighting on the robustness of futures pricing for that region.

A key determinant of a liquid futures market is the open interest figure. Where reasonable open interest exists there is a commercial interest on both sides of the market to see market reflective values established for the settlement prices each day. It is also important that more than one party represents a single side of the open interest to provide a competitive comfort that more than one party will influence the outcome of the futures. A baseline open interest level of over 1000 contracts for the spot month is a regular occurrence at the SFE for NSW, QLD, Vic and therefore could be used as a minimum threshold level for inclusion for MCL calculations.

The settlement methodology utilised by the futures exchange is intended to provide a fair representation of the transacted market value of the futures. Bid/offer spreads can have additional problems depending the depth of the market underlying the futures. The calculation methodology could get quite difficult to do outside of the exchange. A better approach may be to utilise an average of several days' settlements of the exchange to derive the base price for the next quarter. This would help alleviate the concerns of an outlier transaction having sole influence on the base price for the next quarter.

Information Requirements

Over the past several years trading activity has increased significantly in electricity futures across the NEM regions providing confidence that forward looking prices are representative of the market's expectations of price. The question of which futures should be considered and should it be more than one time period was the first issue to be addressed. The preferred method for using futures as a base price would be the spot futures entering the maturing cycle for the following reasons:

- It covers 90-91 days before its final settlement therefore reflecting the greatest amount of the exposure of the 42 days. The least amount of coverage would be the 14 or 28 days prior to the initiation of the spot futures contract which would be reflected in part by the previous expired futures contract. This in turn would mean that there would be coverage for those 28 days for the next 62-63 days.
- The forward month futures generally have the greatest price transparency due to the greater open interest and trading activity.
- The forward month futures incorporates the most relevant information to the spot settlement period given it incorporates significant ex-post pricing (up to 63 days in a quarter) within the expiring period along with expectations of price movements looking towards the futures final settlement period.

Utilising a forward looking MCL calculation approach incorporating futures would require access to historical information through d-cypha Trade, disseminators of the ASX/SFE electricity futures pricing information. The full data set of information would be required so the appropriate analysis could be performed to understand the movements of price and the level of trading activity over time. Where trading activity is limited or absent a futures contract altogether this methodology would need to be modified (see Section 5.3.6 below).

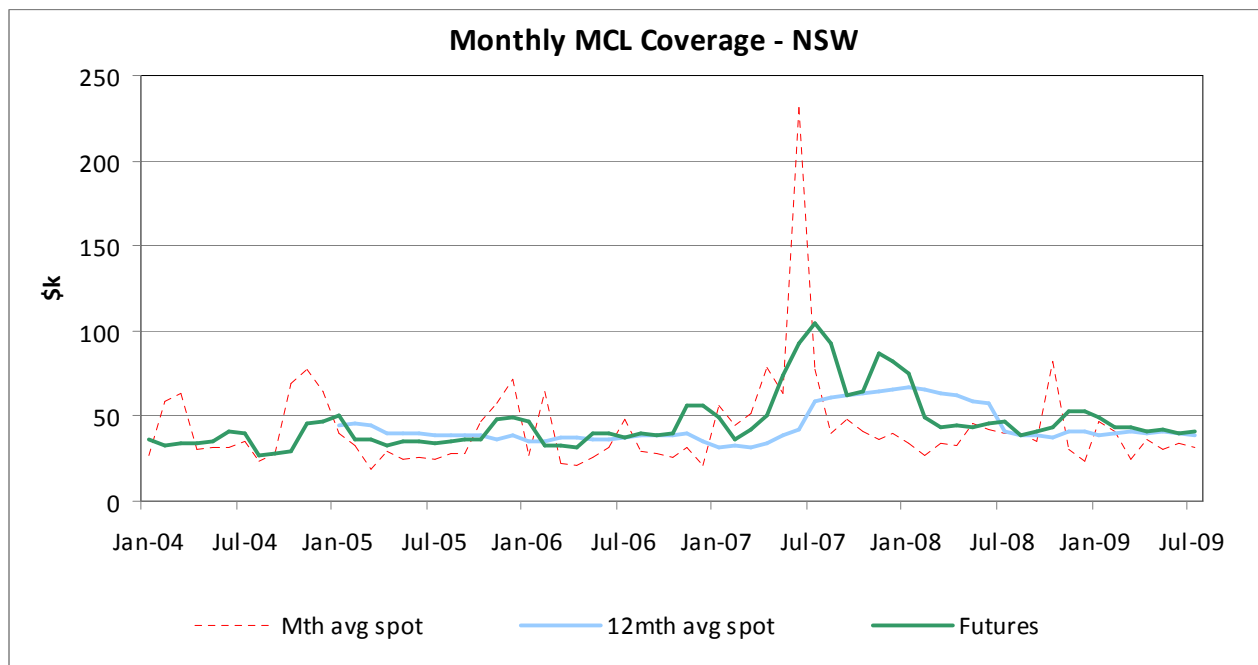
In order to use spot futures as the basis for calculating a base price, and using it for assessing volatility, a minimum requirement of open interest would be desired, say 1000 contracts. A coordination of the MCL calculation time period with the start of the spot futures quarter would have some effectiveness advantages and provide the best correlation with the spot pricing risk that the futures is intended to cover for the MCL. It is recognised that this may provide some operational challenges for AEMO given the current MCL calculation time period is significantly out of step with the start of each financial quarter. Detailed below is a proposed futures based MCL calculation process.

5.3.3 Alternative 1 - Futures Approach (FUT MCL)

Base Price Calculation: To establish a base price using futures, it is relevant to consider the futures contract pricing that most closely resembles the pricing, and value calculation, of the 42-day MCL period if the calculation continues to be done on at least a quarterly basis. Given the 28 day settlement period reflects the most recent history of pricing the near quarter, the spot futures contract is utilised in Alternative 1 to develop the base price. Currently, AEMO establishes its MCL some 60 days ahead of the start of a financial quarter. We recognise there are certain operational issues that support the rationale for the MCL calculation date. However, in utilising futures for the MCL calculation the effectiveness of the MCL improves the closer you move to the start of a financial quarter. Analysis has been done to develop the MCL using futures both close to the start of a financial quarter, (using futures pricing information beginning 10 days before the start of the financial quarter) and further from the start of the quarter (using futures data 40 days prior to the start of the quarter) in order to assess differences in MCL effectiveness. To alleviate concerns over using a settlement price from a single settlement day/period, an averaging of the spot settlement prices for the previous 5 trading days was used. The base price calculation uses the following formula:

Base Price = AVG(5 spot futures settlement prices 5 weeks prior to start of spot futures contract)

A comparison of the existing MCL methodology for the Base Price in NSW is displayed in Figure 5.3.2.a. A calculation time period of one month was used to expand the resolution to 12 calculation periods a year opposed to the quarterly (4 per year); in order to display futures contracts market predicting potential.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.2.a – NSW Base Price MCL Comparison

This analysis shows that the futures based MCL calculation provides a better means to anticipate future price moves than the historical pricing method (on a monthly calculation basis).

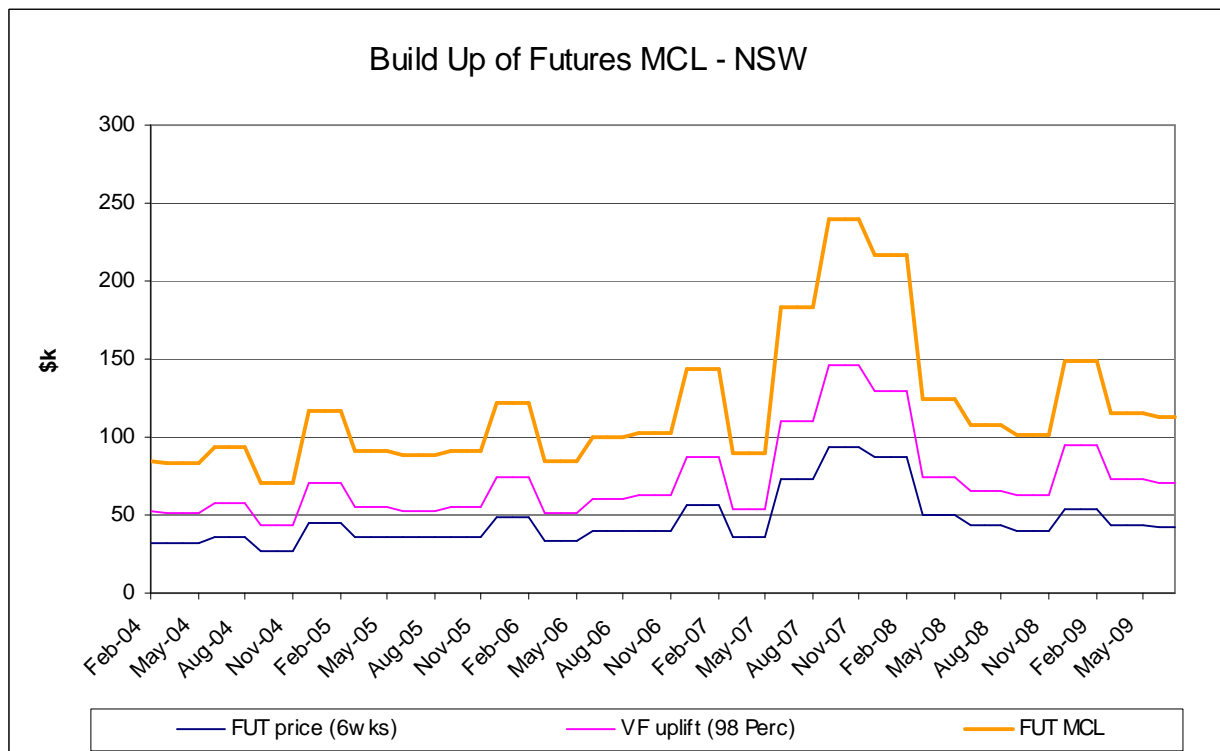
Volatility Calculation: It has been suggested that an implied volatility measure could be used in the calculation of the MCL volatility factor. An implied volatility (volatility derived from options pricing) figure would be relevant if options on futures were actively traded, especially options that have strike prices close to the prevailing futures prices. Given there is minimal activity in options trading near the strike prices in each of the NEM regions with futures contracts the implied volatility calculations can not be accurately derived due to insufficient information or would not be sufficiently robust where minimal information was available. Therefore, the historic volatility of the spot futures price is used here for the volatility calculation, which provides sufficient data points so that the volatility figure calculated are statistically robust.

Consistent with the MCL calculation methodology, Alternative 1 develops a volatility factor to provide additional MCL coverage to cover the risk of spot market deviations from the expected price in the Base Price established above. This factor is calculated by using the historic volatility of the spot futures price by incorporating one year's worth of futures price information for the futures contract used in the Base Price Calculation above. To be consistent with the week to week billing periods, volatility was developed using week to week price changes for the year and capturing the 98th percentile relative to the 52 week average and to be consistent with the 42 day (6 week) MCL period by multiplying by a time factor of square root of 6. The volatility calculation uses the following formula which is consistent with standard volatility calculation approaches:

Volatility multiplier = $\sqrt{6}$ * (98 percentile of futures prices / average of futures prices)

Prudential Margin – As with the existing MCL the prudential margin is equal to 7 days of the MCL.

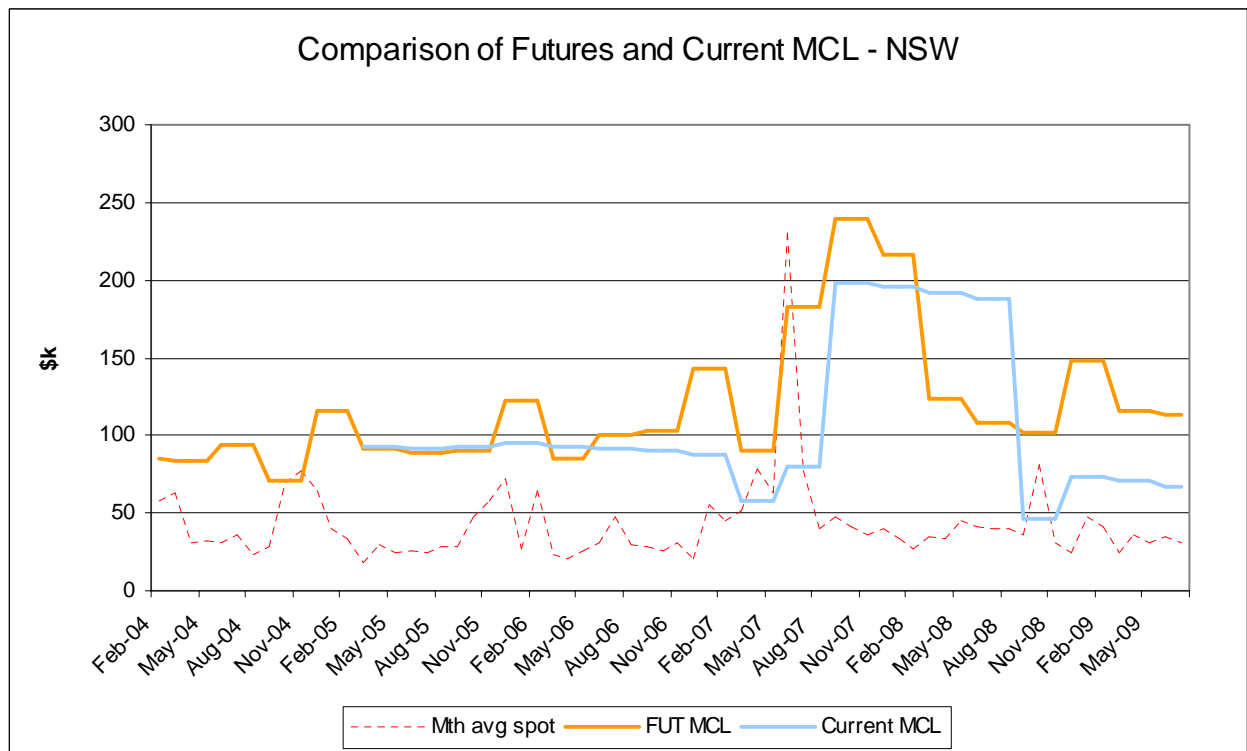
The MCL Alternative 1 in Figure 5.3.2.b below displays both the Base Price and Volatility Factor components of this alternative MCL calculation.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.2.b – Build up of Futures MCL (NSW)

A comparison of the Futures MCL, the current MCL methodology and the monthly average spot price can be found below in Figure 5.3.2.c.

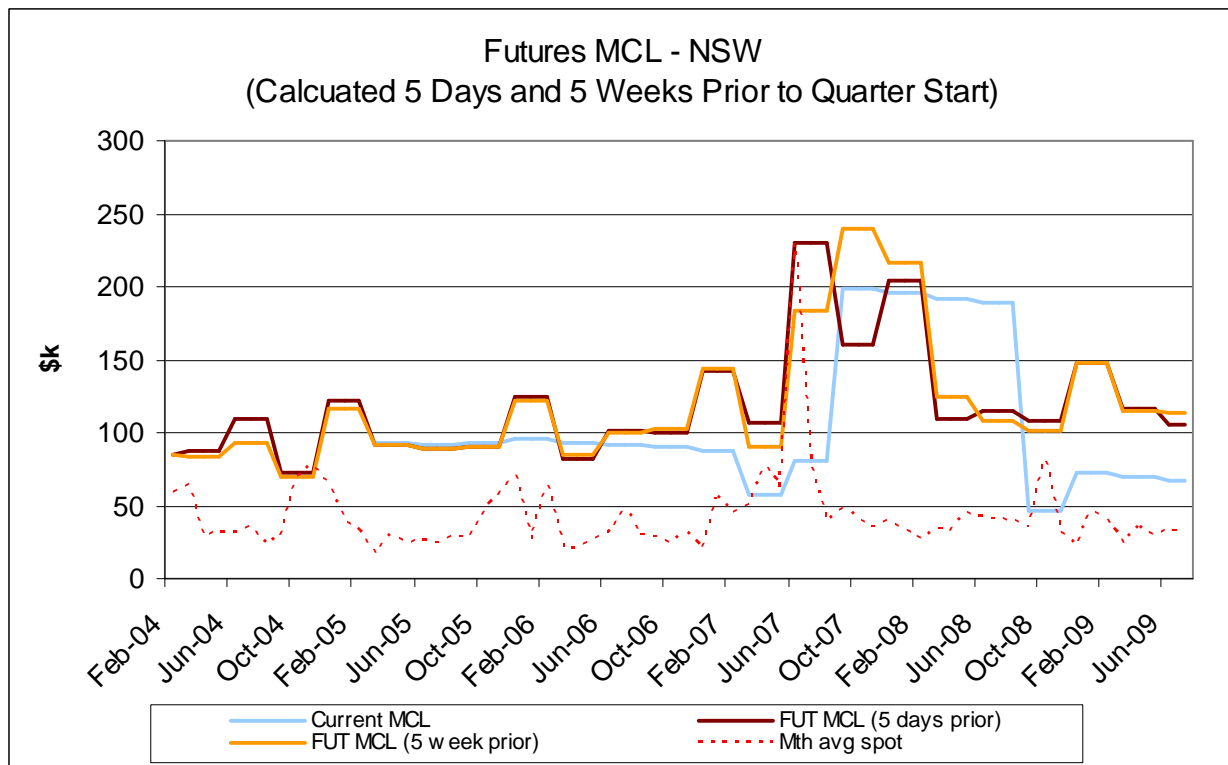


Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.2.c – Comparison of Futures MCL to Current MCL (NSW)

As displayed in Figure 5.3.2.c using futures as a means for deriving an MCL proves to capture high pricing events at or closer to the time of occurrence than the current MCL process. Visually the effectiveness is improved with results of effectiveness and efficiency articulated in Section 5.3.5.

Figure 5.3.2.d below visually displays the effectiveness of futures if the futures prices 5 business days prior to the start of the spot futures maturing cycle are used, instead of 5 weeks as in Futures MCL. Similar charts for each of the other states can be found in Appendix 7.3.3 (Figures 7.3.3.a, 7.3.3.b and 7.3.3.c).



Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.2.d – Comparison of Futures MCL calculated 5 days and 5 Weeks Prior to the Period (NSW)

The figure above displays that there is fairly close correlation between futures 5 days prior and 5 weeks prior to the start of the maturing cycle of spot futures except when significant spot pricing events occur. However, during high price events the 5-day futures MCL proves to be more effective than the 5 week MCL.

Issues to Consider

When using a calculation time period significantly in advance of the start of the spot futures maturing cycle, a bootstrapping methodology where a percentage of spot and the next month futures should be taken into account in the MCL calculation. This could be easily done by weighting the spot and next month futures prorated for relevancy of time between calculation periods (ie 1st of May through 1st of August would use 2 months of April futures contract and 1 month of July futures contract).

In calculating the volatility factor, a $\sqrt{5}$ could be justified in the calculation formula to address the risk of the outstanding periods only. This modification to the volatility factor would give an efficiency gain in this methodology of up to 9% (difference between the $\sqrt{5}$ and $\sqrt{6}$).

5.3.4 Alternative 2 - Stress Test Methodology (Admin MCL)

A stress test methodology has been developed to consider a single event, as opposed to a probability of several events, and its historical performance over the current MCL methodology. A stress test approach involves also estimating a “reasonable worst case” scenario against the current MCL methodology. In evaluating ways to derive an appropriate stress test it is best to consider realistic

events and the potential magnitude of that impact. Looking back over the past 60+ months a likely worst case pricing scenario is a cumulative price threshold event which caps the electricity price at \$300/MWh once the sum of electricity prices in the previous 336 trading periods (one week) in the region is equal to \$150,000. This effectively provides a stress test that reflects a reasonable worst case scenario.

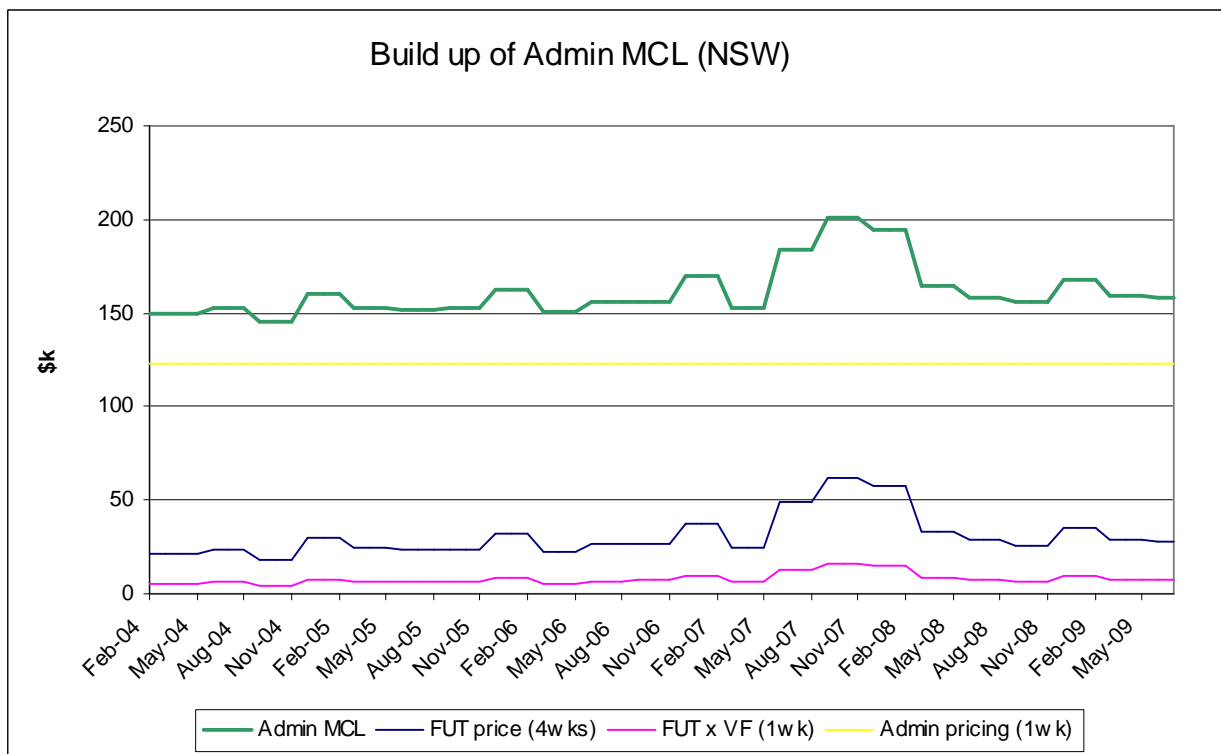
Stress Test Component Calculation - Assessing a reasonable worst case scenario against the entire 42 day period would overestimate the MCL so a more realistic stress test deploying the maximum value of energy over a week period which is equal to 7.5 hours at \$10,000/MWh and 161.5 hours at \$300/MWh or a total cost for 1MW over the week of \$123,450.

Base Price Calculation – For the other 35 days of exposure in the 42 day MCL period MCL alternative the spot futures price is used with its calculation the same as above in Section 5.3.2.

Volatility factor – No volatility factor is assigned for the 28 days of outstandings. For the one week of accumulating billings a volatility factor was calculated using the formula in Section 5.3.2 but only for one of the six weeks. The rationale for not including the volatility factor for the outstandings is that the cumulative price threshold week provides, on average, sufficient coverage for the outstandings which are monitored as part of the daily prudential monitoring process.

Prudential Margin – The prudential margin will be equal to the stress test component ensuring that AEMO has access to funds to cover the obligations of a defaulting retailer in the worst case scenario.

It is assumed that the PM will be calculated based on the cumulative price threshold period. Figure 5.3.2.e below displays the build up of each of the MCL components incorporated into this Stress Test alternative.

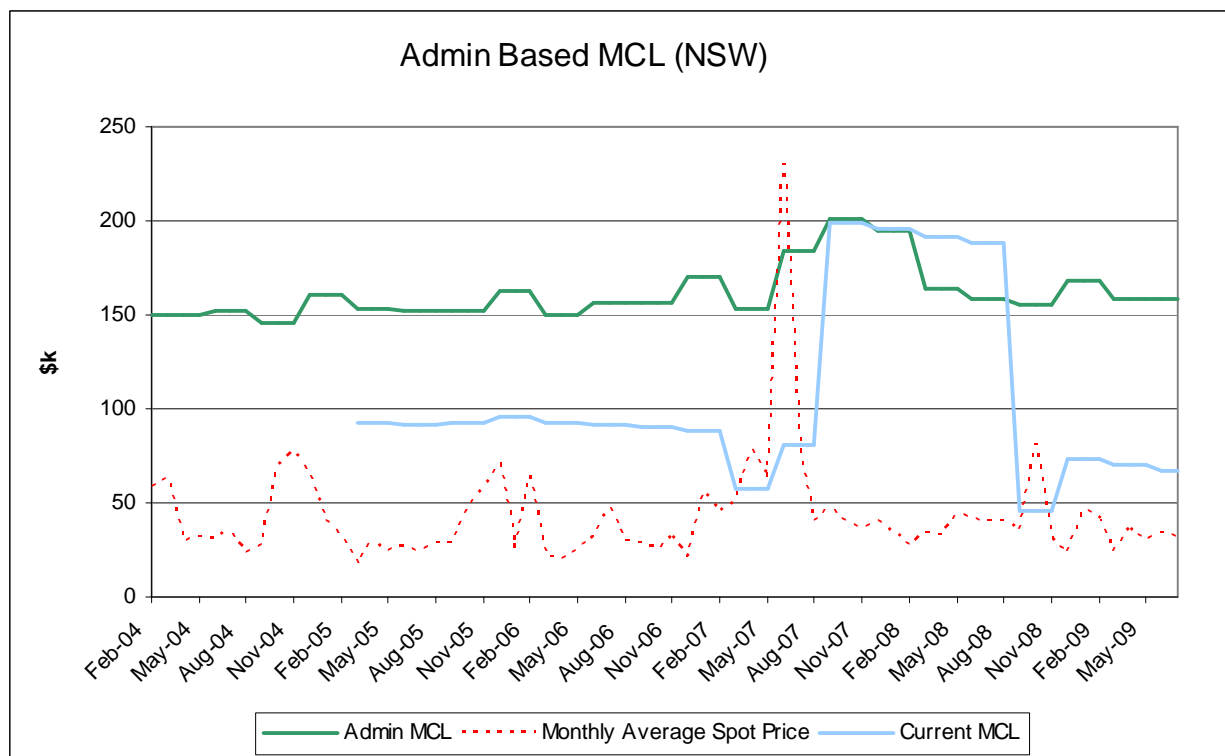


Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.2.e – Stress Test MCL Alternative Component Build-up

This figure displays the significant impact of one week of administered pricing as well as the pickup of market volatility in futures prices and the incorporation of a volatility factor.

Figure 5.3.2.f displays the results of this Stress Test MCL alternative (articulated as Admin MCL below) against the current MCL methodology.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.2.f – Stress Test MCL Alternative

An alternative to this approach would be to set the stress test week and therefore the prudential margin at the cumulative price threshold which is the point at which admin pricing is commenced (equal to \$75000/MW for a week). This is probably more representative of a reasonable worst case scenario than a full week of admin pricing.

This alternative has been calculated on a 3-month basis and appears to fall down in terms of effectiveness and efficiency as it requires a greater level of MCL coverage than the current approach and also provides a decrease in MCL cover during the large pricing spike. However, if the efficiency measures were based on the probability of funds being available to cover the AEMO pool in the case of a retailer default event this approach would be the most effective. The numeric effectiveness and efficiency results are developed in Section 5.3.6 for this Stress Test alternative.

5.3.5 Alternative 3 - Historical Methodology (adj MCL)

Analysis and subsequent consideration for adopting a seasonal approach to the MCL calculation, using historical spot data, was undertaken in October 2007 as a response to extreme prices in June 2007 in the NEM. This seasonal approach was not supported by market participants as the methodology incorporated 4 years worth of seasonal data, which would see a single high price event impacting the MCL for several years.

Taking this previous analysis into account an alternative approach has been developed to incorporate seasonal trends in pricing but to be sensitive about the issue of carrying a high pricing event, which influences the MCL each year until it is no longer part of the data set. The methodology we have used for this alternative consists of:

Base Price Calculation – A base price reflective of the seasonal price is calculated by first calculating a base price using the average of the previous year's spot price and then taking the median price of daily 28 day rolling averages (outstandings period) during each financial quarter . A seasonal ratio is then established for each financial quarter, using the median season price divided by the 12 month spot average

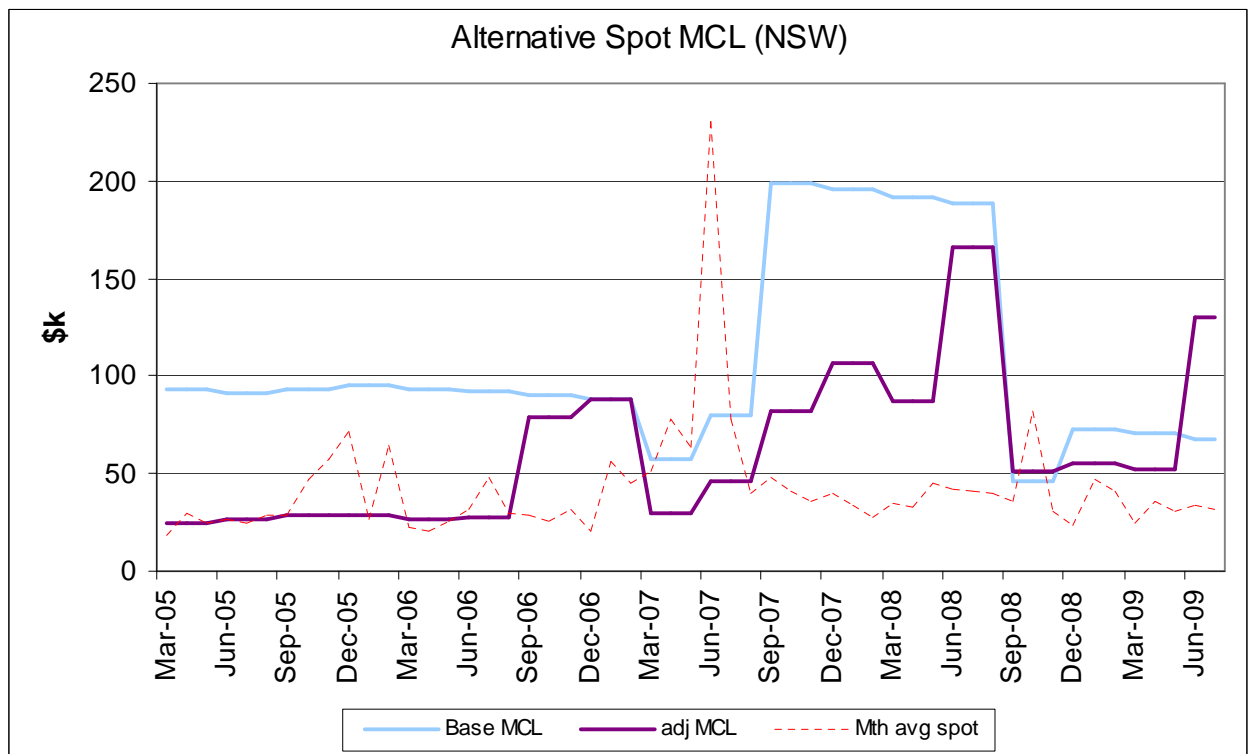
Volatility Factor - The volatility factor is calculated by using these same prices on a weekly basis to capture week to week price variations. As in the calculation of the futures volatility, take the 98 percentile price and divide through the calculated seasonal price to derive the 28 day rolling average volatility factor.

MCL Calculation

- The **seasonal ratio is established**, which is the median season price over the 12mth spot average 1mth prior to start of the season (reflects AEMO's timing needs)
- **Adj MCL = (current 12mth spot average) x (season ratio) x (Volatility Factor)**

Prudential Margin – The prudential margin is equal to 7 days of the MCL

Figure 5.3.2.g below displays the performance of this alternative historical MCL methodology, denoted as adj MCL, against the existing MCL.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.2.g – Alternative Historical MCL

The results in Figure 5.3.2.g clearly display a potential for a higher degree of MCL breaches than the current historical MCL. This also should be considered in terms of efficiency where the sizes of the breaches are measured, to determine overall performance against the Base MCL. Effectiveness and efficiency is assessed in Section 5.3.6.

5.3.6 Alternative 4 - Hybrid Methodologies (MCL V1)

In order to consider both spot and futures information, and separately consider the time/risk buckets defined by the 4 week outstandings period, the one week of accumulating outstandings and the one week reaction period, a hybrid model was developed to assess its performance against other calculation methodologies. This hybrid alternative model develops the base pricing and a volatility factor as follows:

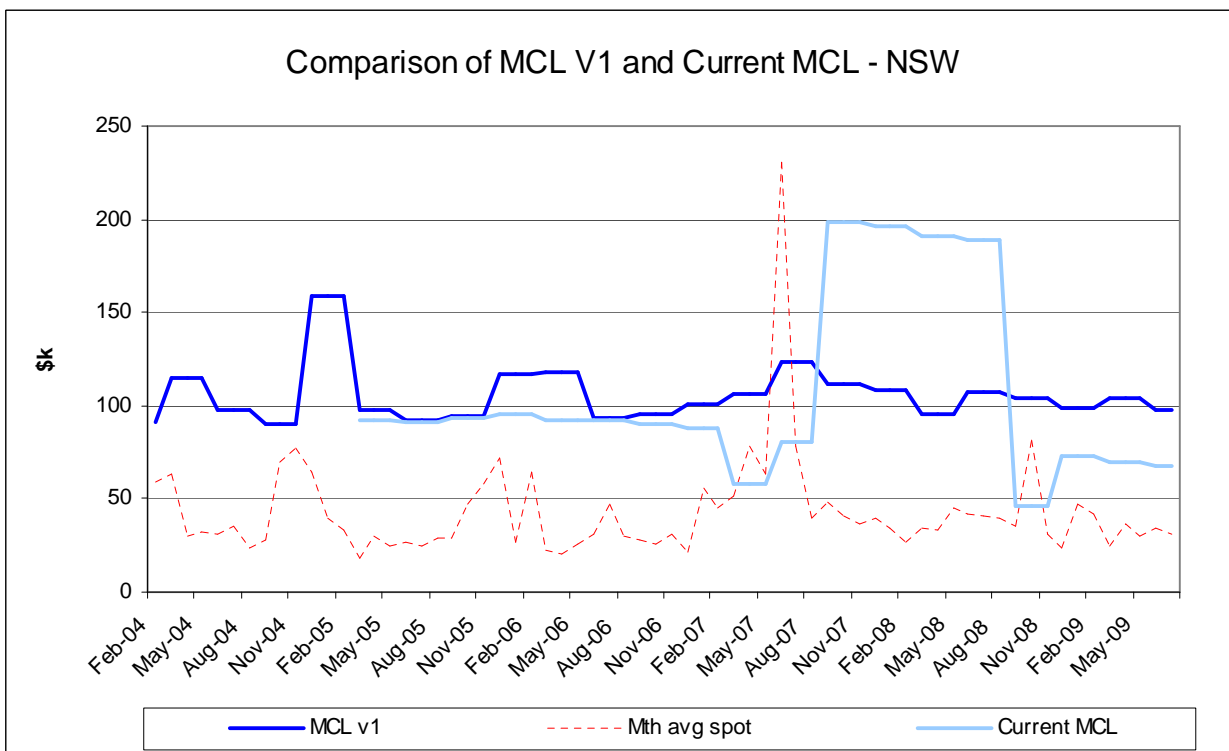
Base Price Calculation – The 4-week outstandings period is calculated first using the previously settled 4 weeks of average pool prices, which covers the outstandings. In order to cover the one week of accumulating outstandings, one week of spot futures is used as calculated before. To cover the one week reaction period cumulative price threshold is added for that week.

Volatility – One week of volatility covering the accumulating spot is added due to the uncertainty around the pricing of that week as it accumulates value. The volatility is calculated using spot futures prices to the 98th percentile, as described previously.

MCL Calculation

V1 MCL = (4/6*(4 weeks of average spot)) + (1/6*(spot futures)*volatility factor)) + (1/6*(cumulative price threshold))

Figure 5.3.2.h below provides a comparison chart of the current MCL methodology for NSW with a futures MCL methodology (MCL v 1) for quarterly cycles of the MCL calculation process using the hybrid alternative MCL methodology described above.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.2.h – MCL Comparison (NSW)

This analysis visually displays some better predictive qualities than the current MCL process but appears to have a lower level of efficiency over the time period analysed. The effectiveness and efficiency are quantified below in Section 5.3.6.

Regions without Futures Prices

The NEM rules allow for the use of differing methodologies for different regions to derive a MCL calculation, which means the existing MCL methodology could be used for NEM regions where futures can not be used. However, it has been pointed out throughout the stakeholder consultation process that the consistency of approaches could be subject to scrutiny.

A potential approach for using a consistent approach across all NEM regions is a hybrid model that uses the most active futures contract over the period (the regional futures, say NSW with the greatest open interest) as the base price for the price calculations. The other regions could then be price indexed using the average spot pool price differentials over the previous year as an indexation basis or to be more accurate the differential for the previous like quarters so seasonal variations in the differential are taken into account. The volatility multiplier for the region could then be incorporated using the existing MCL methodology or using the alternative approach to volatility calculations and a scaling factor applied for each region.

This hybrid structure for regions without futures, though simple, would on average provide a reasonable basis for establishing a base price for each region utilising forward looking pricing. Given there has been a reasonable level of correlation between pricing nodes in the NEM, static quarterly pricing differentials should be representative of the expected outcomes of quarterly pricing. A hybrid methodology may be required for regions that have lightly traded futures contracts as well. The above hybrid approach requires additional investigation for appropriateness.

5.3.7 Summary

In order to assess the most attractive MCL methodology, performance measures for effectiveness and efficiency have been previously established by AEMO. All of the effectiveness and efficiency measures are calculated on a volume weighted basis to reflect outstandings. When reviewing these measures it should be considered that calls will be made on any retailer who breaches the Prudential Margin. These calls will require the payment of funds into an SDA account or an additional bank guarantee. As a result many of the theoretical MCL breaches calculated for these MCL methodologies would not occur in reality. The AEMO efficiency and effectiveness measures are discussed in turn below:

Effectiveness

- A measure of the degree to which the MCL protects the market over time;
- It is calculated as the percentage of days for which the MCL exceeded outstandings over a particular period of time (100% effectiveness would indicate the MCL exceeded the outstandings for every day of the period).

$$\text{Effectiveness} = \text{MCL non Breaches} / \text{days in time period}$$

Efficiency

- A relative measure of the cost of providing the MCL;
- It is calculated by determining the aggregate outstandings value over a period of time, as a percentage of the aggregate MCL value over the same period (100% efficiency in a period would indicate that the MCL is just adequate to cover the outstandings for each day, with no over provisioning of MCL at any time).

$$\text{Efficiency} = \text{Total outstandings} / \text{max (TO, MCL)}$$

The effectiveness and efficiency of each MCL for NSW is compared in the Figures 5.3.7.a and 5.3.7.b below. Similar tables for the other states can be found in Appendix 7.3.3 (Figure 7.3.3.d through to Figure 7.3.3.i).

<i>By Year - % breach</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	100%	100%	100%	100%	58%
2006	100%	100%	100%	100%	67%
2007	73%	88%	93%	100%	63%
2008	91%	100%	100%	100%	83%
2009	100%	100%	100%	100%	100%
Average	92%	97%	98%	100%	72%

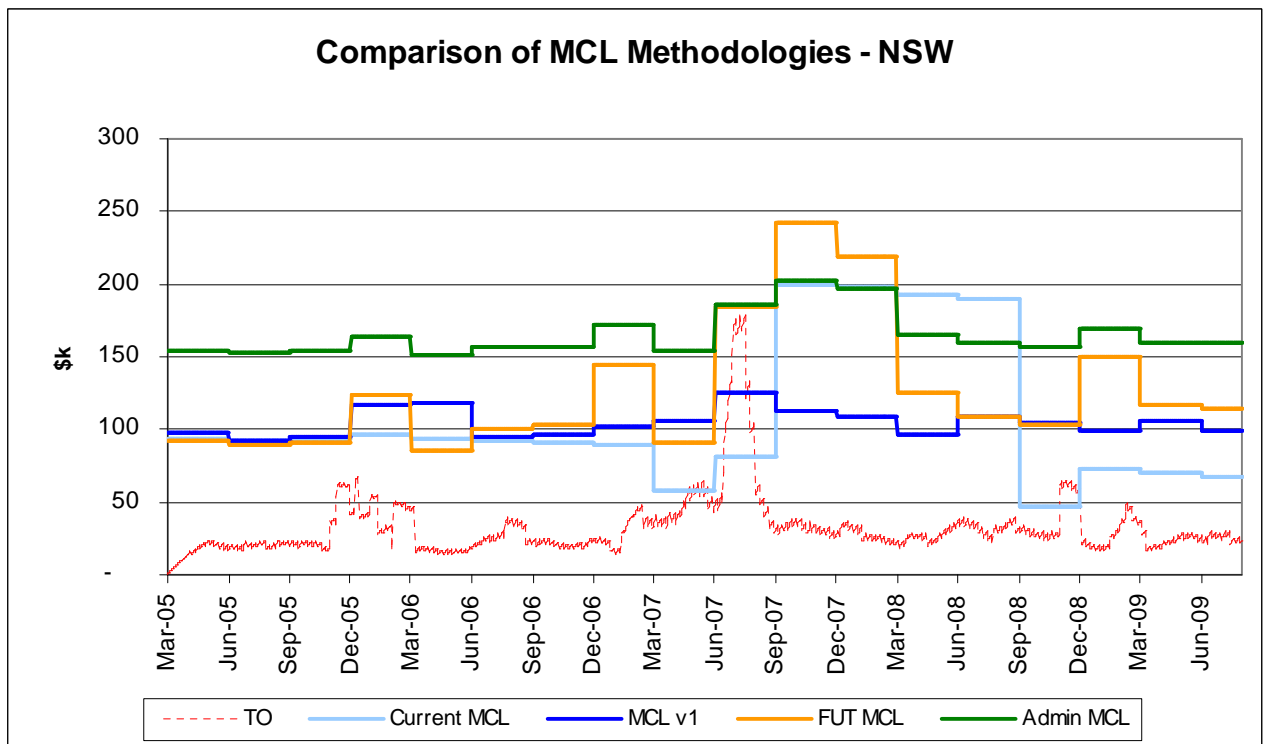
Figure 5.3.7.a – MCL Effectiveness (ratio of days of MCL non breach vs. time period) - NSW

<i>By Year – MCL cost</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	34%	33%	34%	16%	52%
2006	37%	32%	33%	16%	58%
2007	51%	56%	39%	29%	86%
2008	27%	38%	30%	18%	35%
2009	49%	34%	28%	16%	95%
Average	38%	40%	33%	20%	58%

Figure 5.3.7.b – MCL Efficiency (Ratio of Outstandings vs. MCL) - NSW

The Futures Price MCL alternative displays a strong effectiveness at 98% coverage of all days during the 5-year time period while also having low ratio of outstandings to MCL implying a low efficiency and the high cost. Additional fine tuning of the futures methodology should provide sufficient evidence for futures to be used as a more effective and efficient means to calculate MCL. This fine tuning could include moving the calculation period close to the start of the quarter and modifying the volatility factor as discussed in Section 5.3.3.

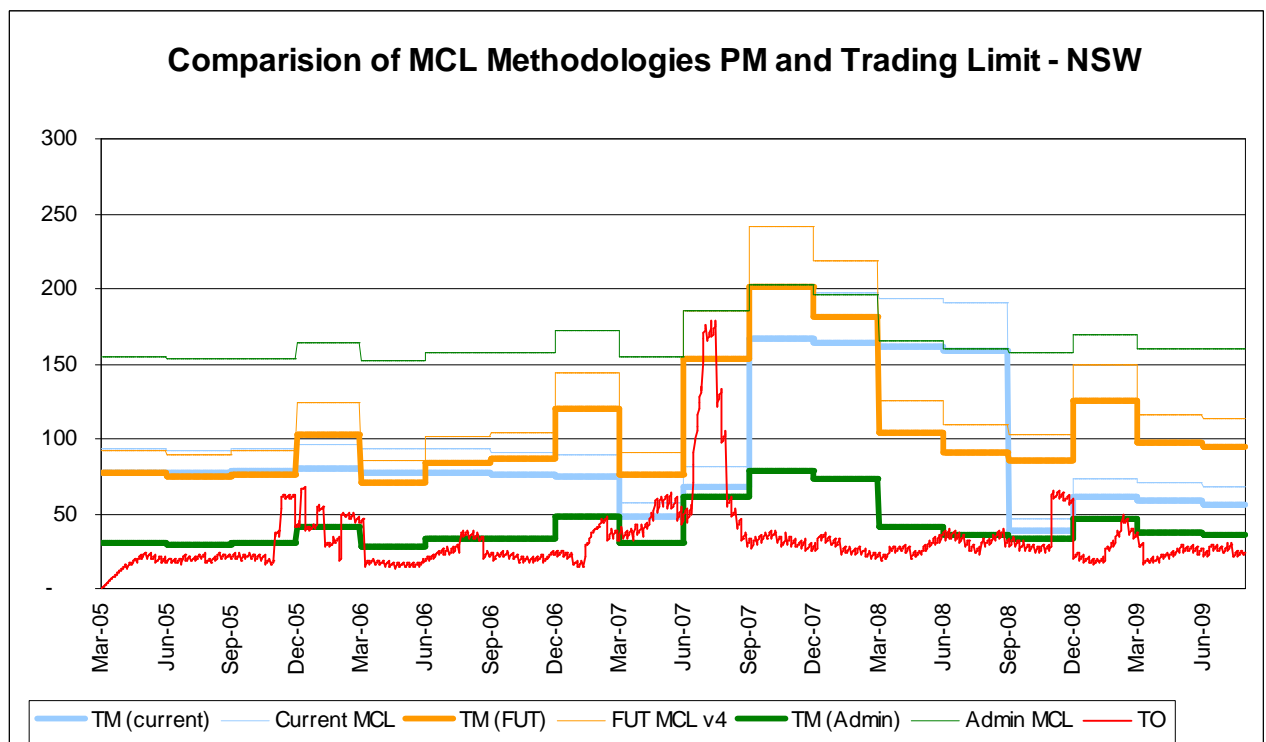
For visual comparison of MCL methodologies developed in this review Figure 5.3.7.c below displays the each MCL methodology against one another and total outstandings. Similar charts for each of the other states can be found in Appendix 7.3.3 (Figures 7.3.3.m, 7.3.3.n and 7.3.3.o).



Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.7.c – MCL Current and Alternative Methodologies

Figure 5.3.7.d below shows a comparison of the trading limit, MCL and total outstandings for the current, futures and admin MCL methodologies.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 5.3.7.d – Comparison of MCL Methodologies PM and Trading Limit - NSW

It should be noted that none of the alternative MCL methodologies developed and assessed include a component of load volatility. The current method for calculating the MCL volatility takes into account changes in load (by dividing the peak outstandings by the average outstandings). The effectiveness of the alternative MCL methodologies could be further improved by adding a load volatility component.

5.4 Risks Associated with a Change in MCL Methodology

There are several potential risks for changing the current methodology. These include:

- **Market Acceptance** - The existing MCL calculation process is well known and any change would require market education and buy in.
- **AEMO Processes Change** – A new MCL methodology incorporating futures would require a change to information required, procedures for calculation and IT systems modification.
- **Cost and Benefit** – The cost of implementation exceeds any potential benefit.
- **Regions without Futures** – This will require AEMO to run two calculation methodologies.

5.5 Summary of Findings

PwC, through its investigation of alternative MCL methodologies and an assessment of risk, view that the MCL alternatives provide:

Effectiveness and Efficiency – The effectiveness and efficiency of alternative MCL methodologies have been investigated as part of this review. The effectiveness is intended to be a measure of the degree to which the MCL protects the market as a percentage of days for which the MCL exceeded outstandings. The efficiency is a relative measure of the cost of providing the MCL represented as aggregate outstandings as a percentage of the aggregate value of the MCL. The effectiveness and efficiency of each MCL is compared in the tables below.

<i>By Year - % breach</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	100%	100%	100%	100%	58%
2006	100%	100%	100%	100%	67%
2007	73%	88%	93%	100%	63%
2008	91%	100%	100%	100%	83%
2009	100%	100%	100%	100%	100%
Average	92%	97%	98%	100%	72%

Table 6.3.3.a – MCL Effectiveness (ratio of days of MCL non breach vs. time period)

<i>By Year – MCL cost</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	34%	33%	34%	16%	52%
2006	37%	32%	33%	16%	58%
2007	51%	56%	39%	29%	86%
2008	27%	38%	30%	18%	35%
2009	49%	34%	28%	16%	95%
Average	38%	40%	33%	20%	58%

Table 6.3.3.b – MCL Efficiency (Ratio of Outstandings vs. MCL)

The Futures Price MCL alternative displays a strong effectiveness at 98% coverage of all days during the 5-year time period while also having low ratio of outstandings to MCL implying low efficiency and the highest cost. Additional fine tuning of the futures methodology should provide sufficient evidence for futures to be used as a more effective and efficient means to calculate MCL. This fine tuning could include moving the calculation period close to the start of the quarter and modifying the volatility factor.

Of particular benefit over historical approaches futures provides:

- **Forward looking information benefits**– Forward looking information helps to capture expected price movements sooner than the existing MCL calculation process. A more dynamic monthly MCL calculation process using futures provides even greater MCL coverage.
- **A prompt increase in MCL when prices rise** – Futures incorporate all available information that filters in from the market. It therefore is naturally better at predicting price movements than historical data from previous time periods. When prices are tipped to increase the futures price will reflect what the market believes will be the magnitude of the increase rather than relying solely on past high pricing events as in the current MCL calculation process.
- **A prompt decrease in MCL when prices fall** – When expectations of price decreases enter the market the futures expectations will adjust almost immediately to account for this market sentiment. Utilising futures prices will release prudential cover quicker, without increasing the risk to the NEM, as a result minimising the volatility factor, which can be influenced by one pricing event over the course of the last year. The responsiveness of futures to expected spot price movements performs even better when a monthly MCL calculation process takes place.
- **Futures prices are often greater than the underlying spot** – Because spot futures prices during a quarter incorporate historical pricing information and expectations of future price information they often price higher than the underlying accumulating spot price during a quarter. This higher trading value will often provide an additional MCL buffer when compared to the existing MCL base price calculation, which only incorporates ex-post pricing.
- **A settlement process that is well scrutinised** – the SFE financially clears a number of markets each day. It has constructed a process in which all available information will be taken into account if trading activity is insufficient to settle the market or if trading activity exceeds expected price ranges. One issue using SFE futures is that the market does not create settlement prices on weekends or holidays.

PwC Recommendation- We recommend that for NEM regions with sufficient trading activity, currently (NSW, QLD and VIC) that a forward looking approach using futures be considered for implementation due to its modelled superior effectiveness with further work to be done to create a formula that increases the efficiency without impairing the effectiveness. For

regions with insufficient trading activity or no futures contract the MCL calculation methodology should default to the current methodology until further assessment of historical MCL approaches prove more effective and efficient than the existing MCL calculation approach.

6 Core Findings and Recommendations

In this report section we provide the background to stakeholder positions, and summarise the core review findings and highlight recommendations derived from the qualitative and quantitative analysis undertakings.

6.1 Summary of Stakeholder Comments

The comments from stakeholder discussions are broadly summarised below. Appendix 7.5 provides greater detail of the stakeholder responses to this review.

Review Area	Key Comments
Reallocations	<ul style="list-style-type: none"> • Retailers would like to be able to do more reallocations but there seems to be a limit to the extent generators will reallocate. • Reallocations seem to only be available in Victoria and Queensland so there are limitations on their widespread use across the NEM. • For swaps and options reallocations there is a concern that the ability for AEMO to deregister reallocations if prudential requirements are not met which causes uncertainty and will impair the use of this risk offset mechanism. • For the swaps and options RA proposal there is concern that AEMO is moving towards a global clearing role for financial and spot market transactions without assuming the full responsibility of a clearer. • There is concern that in the case of retailer failure there is a risk to the generator of the RA not being deregistered and the generator being exposed to the retailer if they are still consuming from the NEM.
FOAs	<ul style="list-style-type: none"> • There are concerns over the ability of FOAs to be unilaterally terminated by clearing members prior to a replacement security being lodged with AEMO. • There are concerns over clawback risks for the SDA accounts that warehouse variation margins placed with AEMO. • The lack of a clear dispute resolution process. • Futures not having the same settlement time horizon as the NEM and OTC swaps and options creates some disincentive to use FOAs for MCL relief. • Concerns were cited over the withdrawal of an FOA without immediate replacement of an alternate security. • There is question to the extent all the time and effort to establish FOAs will really achieve a true benefit to the market. • The introduction of FOAs would help assist the furthering of a short term hedging market by placing additional emphasis on trading the front quarter. • There was concern that variation margins from the futures may not exactly match the outstandings and thus an adjustment factor to futures would need to be employed in the FOA calculation process.
MCL Methodology	<ul style="list-style-type: none"> • The MCL is too onerous and out of step with the market creating a barrier to growth as it inhibits small retailer's ability to grow their business. • Using futures prices as a proxy for expected pool prices is considered to be a more realistic representation of the expected price for a quarter. • MCL breaches have occurred more than once in the last 48

Review Area	Key Comments
	<p>months and there is concern that the current MCL calculation methodology is not adequately reflecting the market risk.</p> <ul style="list-style-type: none"> • Certainty of payment for all electricity generated at the pool price is paramount to generators and any impairment of the MCL outside of the RA process, which they have a level of control on pricing credit, would be a negative for generators. • For a forward looking MCL using futures, there would need to be different rules in different states for the MCL calculations given liquidity issues of certain futures contracts and the lack of a contract in Tasmania. This would go against NEO objectives of driving effectiveness and efficiency across the NEM by having multiple calculation methods to look after. • The futures price is perceived to be subject to manipulation and may therefore be not suitable as a proxy for an MCL calculation

6.2 Comparison of Processes, Failure Modes and Implications

Table 6.2 below compares each of the process we have been asked to investigate. The alternative MCL models proposed in section 5 are of the same form as the standard MCL listed below.

	Standard MCL	RMCL	Energy or \$ RA	Swap or Options RA	FOA
Basis of MCL calculation	Calculated based on 7 days of unbilled offtake, 28 days of previous period's outstandings and 7 days prudential margin.	Period of outstandings reduced to 14 days. PM maintained.	MCL reduced for non PM period by the volume of energy reallocated. PM maintained for full energy load (reallocated and non reallocated).	MCL reduced for non PM period to the strike price for RA volumes. PM maintained for full energy load (reallocated and non reallocated).	MCL volatility factor reduced to zero for FOA volume. PM maintained for full energy load and volatility factor.
NEM Settlement process	Full value of energy offtake settled with the NEM.	Full value of energy offtake settled with the NEM. Early payment of accounts or the deposit of funds into an SDA may be required to maintain below trading limit.	Energy and dollar reallocation settled between parties to the reallocation agreement outside of the NEM. All other offtake settled via the NEM at the spot price.	Swap and option reallocation settled at the strike price by AEMO. All other offtake settled via the NEM at the spot price.	Full value of energy offtake up to the FLP is settled with the NEM. Variation margins from SFE accrue in SDA to cover difference between the strike price and spot price.
Form of security held by AEMO	Bank guarantee (and potentially cash in an SDA to manage outstandings in a high price environment).	Bank guarantee (and cash in a SDA to manage outstandings).	Bank guarantee (and potentially cash in an SDA to manage outstandings in a high price environment). The generator is also required to increase its PM when an RA is in place... A generator may require the retailer to post additional security directly to cover the RA credit risk.	Bank guarantee (and potentially cash in an SDA to manage outstandings in a high price environment).	Bank guarantee up to the FLP and funds in an SDA account to cover any movements of the spot price above the futures lodgement price.
Failures modes which could result in a NEM spot market	Failure of a retailer where value of the load over the reaction period exceeds	As per MCL.	Failure of a retailer to secure additional bank guarantees following termination of a RA as a result of	Failure of a retailer to secure additional bank guarantees following termination of a RA as a result of	Cancellation of the FOA by the SFECF or as a result of the failure of a retailer to pay variation margins

	Standard MCL	RMCL	Energy or \$ RA	Swap or Options RA	FOA
shortfall	the PM (and any unused MCL).		generator failure.	generator failure.	into the SDA.
Incremental risk as a result of failure	Base case exposure equal to the value of load during the reaction periods exceeding PM (and any unused MCL).	As per MCL.	Full value of load for one day between the call for additional MCL as a result of termination of the RA and the failure of the retailer to supply the additional MCL.	Value of load above the RA strike price for one day between the call for additional MCL as a result of termination of the FOA and the failure of the retailer to supply the additional MCL.	Value load above the FOA FLP for one day between the call for additional MCL as a result of termination of the FOA and the failure of the retailer to supply the additional MCL.

Figure 6.2.a – Comparison of NEM Prudential Process, Failure Modes and Associated Risks

When comparing an equal sized RA (energy or dollar) and FOA, the value at risk to the NEM is lower under the FOA scenario due to the MCL requiring bank guarantees up to the strike price and payment of variation margins into the SDA **but** the probability of an event which may result in a NEM shortfall is higher for the FOA than for the RA given that there is no alternative NEM participant backing the FOA.

6.3 Summary of Findings and Recommendations

The AEMC has sought analyses and recommendations in this review into the role of hedging contracts in the existing NEM prudential framework. We have responded in turn to these requests specifically by:

- **Reallocation Arrangements** – Assessing the risks associated with the existing reallocation arrangements, which include a review of the proposed swaps and options reallocation, within the National Electricity Market prudential framework. This task also requires PwC to provide comment on ways to enhance these arrangements where weaknesses or inconsistencies in how the rules may be applied in practice exist.
- **Futures Offset Arrangements** – Assessing the risks associated with the two proposed models for futures offset arrangements along with providing comment on ways to enhance these arrangements where weaknesses or inconsistencies exist.
- **Maximum Credit Limit** – Assessing the current MCL calculation methodology and its effectiveness and efficiency. In addition this task required the assessment of alternative models using forward looking information and a stress test then comparing them with the current MCL methodology for effectiveness and efficiency. The definition of ‘reasonable worst case’ was also qualified so effectiveness and efficiency measures could be consistently assessed for each MCL methodology.
- **Cost and Benefit Assessment** – assessing the high level cost and benefit of both the FOA implementation and the implementation of an alternative MCL methodology.

The matters examined in this review are complex and inter-related. Recommendations have been developed by PwC covering the terms of reference in order to provide an independent assessment of the issues identified by the AEMC. These recommendations should be considered as recommendations provided to the AEMC by PwC based on the analysis that has been undertaken in the limited time available for this review. Although we believe these recommendations to be robust and backed up qualitative and quantitative analysis a vetting of these recommendations by the industry will be an important step prior to putting them forward to the AEMC commissioners for decision.

6.3.1 Reallocation Arrangements

Existing Reallocation Arrangements

The current energy and dollar reallocation arrangements appear to serve an important function for both the management of market risk for retailers and generators as well as reduction of the value of bank guarantees retailers are required to provide to support trading positions with AEMO. Reallocations themselves do not appear to be the complete answer for market participants to reduce their MCL requirements. Reallocations have had limited uptake since their introduction and as of 2008 have represented approximately 9% of the total NEM traded volume. The reallocations have largely been in Victoria and Queensland. In discussions with market participants and other stakeholders some of the reasons for the limited uptake include:

- Reluctance by generators to provide the volume of reallocations required by the retailer;
- Timeliness of generators' confirmation of reallocations;
- Additional generator margins incorporated into reallocation arrangements are sometimes perceived as high;
- Additional credit risk incurred by generators under reallocations compared with trading the full value of their load through the NEM;
- The risks of reallocation termination to the retailer;
- A limit on the level of reallocations a generator can provide prior to facing the risk of having to post prudential margin in the event of a full or partial shutdown; and
- The ability for gentailer to net their retailer and generation loads via the MCL calculation reduces the requirement for these parties to enter into reallocation agreements with generators.

Swaps and Options Reallocations

In addition to the traditional reallocation arrangements for non-standard physical type contracts, an assessment of the proposed Swaps and Options reallocation has been conducted. Under a swap or option reallocation the credit risk for the difference payments from the strike price of the contracts to the NEM spot price is assumed by the generator and retailer but settled by AEMO. There is a greater balancing of risks in this type of reallocation arrangement where both parties are reliant on AEMO to manage settlement of spot and swaps & options compared to relying on one another for the full value of the reallocation as in the case of the current RA process.

Findings and Conclusions

The rules and procedures for reallocations are well defined by AEMO and have been structured to minimise the risk to the prudential quality of the NEM. In regards to swaps and options reallocations, the proposed method by which AEMO settles these arrangements interposes it between buyer and seller in the settlement process as proposed in modification to the NEM rules.

PwC through its investigation of the reallocation processes and procedure, the commercial use of RA and an assessment of the risk involved, has reached the following conclusions.

- **Effectiveness** – Under single party default scenarios there is no additional risk to the NEM pool as a result of the introduction of reallocation agreements. In the case where an RA is in place and where a termination event by a generator results in a call for additional credit support from a retailer and the retailer fails to provide this additional support, the NEM spot pool is potentially exposed to an additional day's electricity load of that retailer, if both the retailers and generators prudential margin have been exhausted. While a precise evaluation of the likelihood of this event is difficult, the probability of this scenario occurring appears to be low from historical record. An evaluation of the load risk over this period and the median MCL shows the MCL covers the additional exposure at the 98th percentile level.

PwC Recommendation - On balance, there is no major need to change the current RA lodgement and MCL process, however, if the AEMC is concerned regarding the mitigation of the potential one day termination risk in the event of a two party failure event where both prudential margins have been exhausted, the best way to address this is by adding additional coverage to the 7 day prudential margin equivalent to increasing this to an 8 day period.

- **Efficiency** – RAs perform a valuable function in the market by reducing the requirement for capital to be held inefficiently in bank guarantees with AEMO when a risk transfer occurs from AEMO to market participants for physical delivery oriented contracts.

PwC Recommendation – RAs should continue to be supported by AEMO as a means to minimise the prudential support burden for NEM participants.

- **Load Profiling of Ex-ante Reallocations** - While we understand that AEMO has a calculation method and a process to address load profile versus RA profile disparities, we have found no reference to this calculation in either the rules or procedures that document the operation of the reallocation transactions.

PwC Recommendation - Clarification of the details of the processes used by AEMO to assess and manage profiled reallocations may be beneficial in providing comfort to market participants on the protection of the prudential regime.

- **Market Rules Section 3.15.1** - The current rules state that AEMO has the responsibility for the billing and settlement of reallocation agreements. AEMO is not responsible for the settlement of the underlying OTC contracts which facilitate the RA as the RA removes the requirement to settle these from the market.

PwC Recommendation - A review of the NEM rules should be conducted to ensure that 3.15.1 does correctly represent AEMO's role in the settlement process for RAs.

- **Swap and option RA's** - The current rules state that AEMO has the responsibility for the billing and settlement of reallocation agreements. The proposed NEM rules for the incorporation of swaps and options indicate that AEMO has a role in the settlement process of swaps and options in order to reduce circular cash flows, which commercially interposes it between counterparties of the swap or option arrangement. This rule absolves the counterparties in a swap or option reallocation agreement of the responsibility for settling these contracts between themselves. As above, the RA swap and options lodgement process should place a responsibility on NEM participants using this type of RA to provide surety that a hedging contract exists between the two parties of the RA outside of AEMO. *Appropriate legal advice on these matters should be obtained where it is necessary.*

PwC Recommendation - For the proposed RA swaps and options we suggest that NEM rules 3.15.1 be modified to minimise AEMO's involvement in the settlement process of swaps and options and reflecting the settlement risk it is willing to take.

6.3.2 Futures Offset Arrangements

The FOA proposal has the potential to significantly decrease cost to retailers for the provision of MCL support in the form of bank guarantees and therefore increase the efficiency of the NEM prudential regime. It has been proposed that FOAs be introduced into the NEM prudential regime to provide an additional hedging instrument to assist market participants in the management of their MCL prudential requirements.

Two settlement models have been proposed for the introduction of FOAs

Model 1: AEMO would receive and hold onto all positive variation margins until settlement. At settlement, AEMO would apply the SDA corresponding to the billing periods against settlement amount and return any excess funds to the retailer.

Model 2: AEMO would return the positive margins if the futures prices fall following a rally. The amounts in the SDA however would be held with AEMO for the term of the FOA and not be applied at settlement.

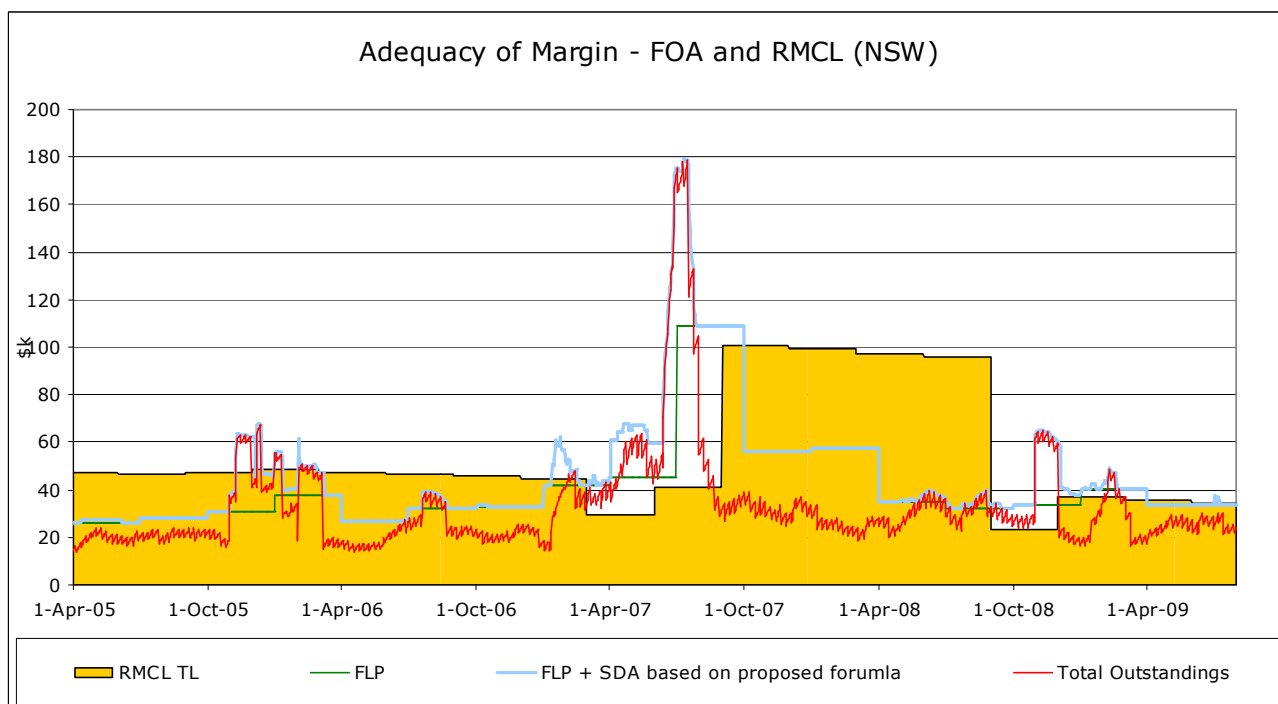
We have reviewed both of the settlement models proposed and find that Model 2 matches the flow of funds under a futures agreement most closely. The stakeholders consulted as part of this processes were also unanimous in their support of Model 2.

However, in order for an FOA to provide value it must be effective and therefore not impair the prudential quality of the NEM. As part of this review we have identified three potential types of risk that may be introduced to the NEM as a result of the introduction of FOAs. These are:

- Termination and other operational risk
- Systemic risk of differences between spot and futures prices
- Unique risk associated with a difference between the shape of the futures contract and the retailers load profile

In the event of termination of the FOA, and the failure of a the retailer to provide additional credit support, the NEM spot market may be exposed to up to the difference between the spot price and the greater of the futures lodgement price (FLP) and previous days futures price for the time period between the request for additional security and the failure of the retailer to provide this additional security on the next AEMO business day. The statistical analysis does not show a distinct trend in futures trading at a discount or premium to spot prices over the past four and half years and therefore no systemic risk has been identified. A consistent correlation between spot and futures prices was found for each of the regions on a like for like value basis.

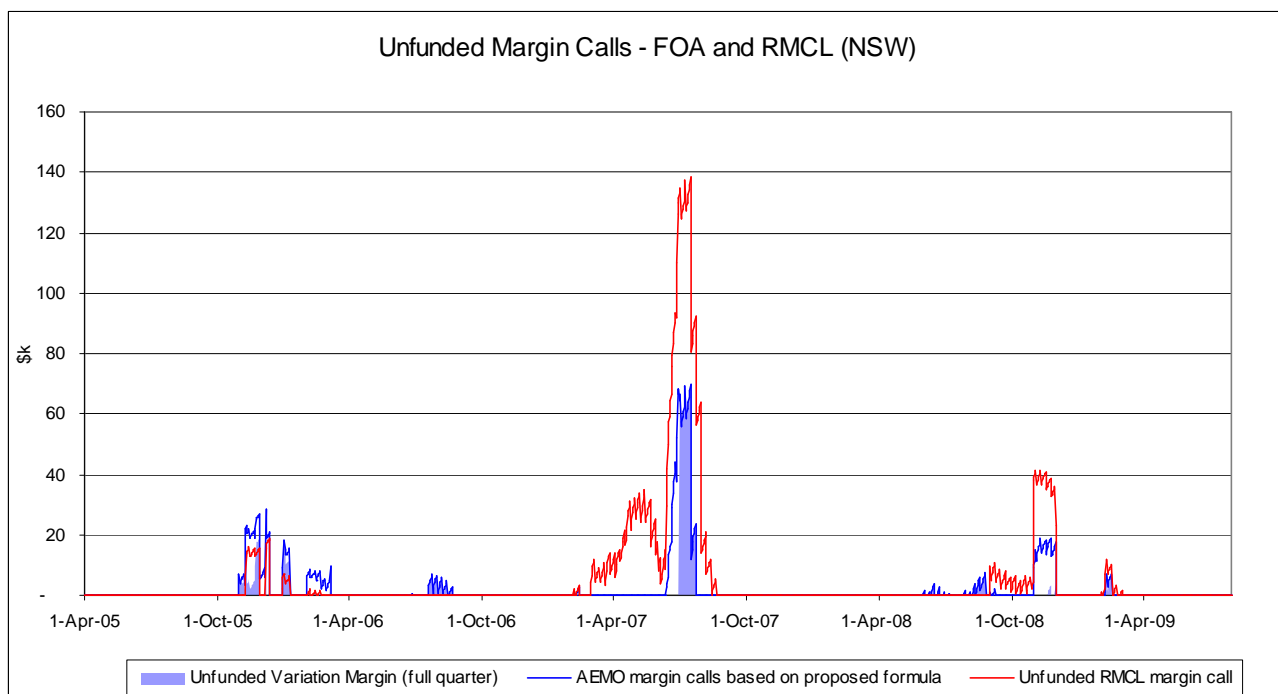
An alternative variation margin calculation has been proposed and the FLP and the funds in the SDA were found to cover the retailer's outstandings in all circumstances, as displayed and compared to the current RMCL process in the figure 6.3.2.a below.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 6.3.2.a – Adequacy of Margins – Comparison of FOA and RMCL – NSW

The unfunded margin calls under both the FOA and RMCL processes are displayed below in Figure 6.3.2.b.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 6.3.2.b. – Unfunded Margin Calls - Comparison of FOA and RMCL - NSW

Findings and Conclusions

PwC through its investigation of the FOA process, and the two FOA models that have been proposed, have reached the following conclusions:

- **FOA Settlement Model** - We have reviewed both of the FOA models proposed for the introduction of FOAs and found that Model 2 matches the flow of funds under a futures agreement most closely. The stakeholders consulted as part of this processes were unanimous in their support of Model 2. We have not identified any incremental risks to the NEM as a result of the use of the Model 2 SDA and cash flow processes as opposed to those in Model 1.

PwC Recommendation - Progress with the cash flow and return of excess margin payment process as detailed in Model 2, subject to our recommendations below regarding changes to the margin calculation and other revisions to FOA Model 2.

- **Termination and Other Operational Risks** - In the event of the termination of a FOA as a result of the termination of the underlying futures agreement by the SFECF or as a result of the failure of a retailer to pay the required margin payments, the NEM spot market may be exposed to the difference between the FLP + SDA and the spot market price for the period of one business day.

PwC Recommendation – The review indicates that there is not a significant termination risk that needs addressing, however, if the AEMC is concerned with the mitigation of this termination risk a simple approach might be to add risk coverage equivalent to an additional day of prudential margin (ie an 8 day rather than 7 day prudential margin period) to the MCL period for NEM Participants with an FOA for the volume subject to FOA.

- **Systemic Price Risk and Margin Calculation** - A review of historic spot and futures prices for each of the traded markets has not identified any systemic pricing risk in the difference between spot and futures pricing which could be addressed appropriately with a Beta Factor. Our review has identified days where FLP MCL coverage and accumulated SDA funds will be less than the value of energy consumed under the FOA by the retailer. There is difference between the number of MWh for which MCL relief is granted under the proposed Model and the number of MWh for which the variation margin is paid.

PwC Recommendation - Placing a floor on the value of the SDA account equal to the accumulating spot over the outstandings and accumulating outstandings period. This will ensure, at a minimum, that there are always sufficient funds in the SDA account to cover accumulating and existing outstandings of the retailer and help to protect the prudential quality of the NEM. The difference in the number of MWh for MCL relief and the number of MWh used in the variation margin calculation should also be addressed by a change to the variation margin formula as described in Section 4.3.2.

- **Load Balancing Risks** – Futures agreements are for a flat load shape over their period of cover, as a result, the level of FOA coverage that a retailer requests will follow this flat load shape. If no adjustments are made vis-à-vis the retailer's unhedged expected load, the current MCL process could result in lower than required coverage of unhedged volumes.

PwC Recommendation - Load balancing risk is unique to a NEM participant and is appropriate to be handled through the AEMO MCL load assessment processes rather than through the use of a generic FOA discounting Beta Factor. This risk can be best addressed by AEMO adjusting the unhedged volume in the calculation of the MCL.

- **Use of FOAs and RMCL** - The proposed FOA models require a bank guarantee to be held by AEMO and variation margins paid into an SDA account in the event that the previous days futures prices is greater than the FLP. When a retailer requests an RMCL, a shorter 14 day

credit period is used rather than the usual 28 day cycle. There is no obligation for a retailer operating under a RMCL to settle their account on the shorter settlement cycle, though, the lower trading limit requires more active management of outstandings, generally through the payment of funds into the SDA account. Should an FOA be accepted where a retailer has an RMCL in place and the MCL for the FOA calculated on the basis of 14 days rather than 28 days a disjoin between the payment period and the calculation period is more likely to result in shortfalls in the variation margin payments to AEMO.

PwC Recommendation – RMCLs and FOAs should not apply to the same volumes. In the case where a retailer has requested an RMCL the MCL component for the FOA should be calculated based on a bank guarantee for the 35 day outstandings period at the level of the FLP.

- **Parties to the FOA** – We have reviewed the single party FOA processes and found that the risks associated with not binding the SFECF can be managed through other processes.

PwC Recommendation - NEM Participants wishing to have an FOA registered should be required to confirm that it has been established and resides within a structure that requires the SFECF to provide identical information regarding the position backing the FOA to both the retailer and AEMO simultaneously.

- **Specification of the FOA** – In practice the provisions in clause 5.1.2.3 of the proposed FOA rules will be very difficult to achieve and in the case that our recommendations relating to the calculation of the variation margin are adopted would not be applicable.

PwC Recommendation - The AEMC should consider the removal of clause 5.1.2.3 and the obligation of retailers to place funds into a separate sub account with the SFECF.

- **Preconditions for FOA Registration** - The preconditions for registration of an FOA include the requirement for a confirmation that the positive variation margins from the futures contract controlled by the SFECF, which underpins the risk coverage of the FOA are payable without netting against other positions held by the NEM Participants.

PwC Recommendation - The preconditions for registration of an FOA should include a commitment by the NEM participant to pay the variation margin as calculated by AEMO, into the SDA.

- **Penalties for Failure** – AEMO has the right to perform random audits on any contracts or future positions covered by the FOA. We have identified penalties that could be imposed on a NEM Participant who is found to have provided false information or failed to provide information on a timely basis.

PwC Recommendation - The AEMC should consider the inclusion of each of the following penalties in the event a NEM participant breaches the terms of the FOA.

- AEMO closing out all other FOA positions (and the requirement to provide additional security to the AEMO in line with the change in positions);
 - A ban from registering any further FOA agreements for a specified period of time; and / or
 - A fixed financial penalty for breach.
- **AEMO Termination Rights** – Under the proposed rules AEMO has the right to terminate an FOA in a number of defined circumstances.

PwC Recommendation - The AEMC should consider including the right to terminate an FOA in the event a NEM participant has been found to have breached the conditions of the FOA in an Audit or in the event of a fundamental change to the market pricing or structure of a Futures contract.

6.3.3 Maximum Credit Limit Review

The aim of establishing a collateral amount for a credit position for a retailer, as in the case of a generator, is to derive an amount that provides a reasonable level of assurance of payment for any liabilities. There is a delicate balancing act in the establishment of a reasonable level to cover these risks and an excessive level, which could potentially curtail the development of a market.

The review of the Maximum Credit Limit Methodology involved:

- Review and comment on an interpretation of the definition of 'Reasonable Worst Case'
- Develop an approach to incorporate forward looking information into the MCL to improve its effectiveness and efficiency

Interpretation of the 'Reasonable Worst Case'

Based on the MCL formula, which covers a 42 day period, the credit coverage can be interpreted for the full 42 day period incorporating the 28 days of outstandings, 7 days of billings and a 7 day reaction period. The credit position that the once in 48 months is therefore intended to cover is the entire 42 day period. This does not necessarily mean that taking the high water mark of a look back over 48 months would provide the appropriate measure for the once in 48 month reasonable worst case.

A key issue in the debate on what 'Reasonable Worst Case' means the definition is qualitative and leaving the quantitative interpretation to the market, therefore any of the quantitative interpretations of the 'Reasonable Worst Case' will be a subjective judgement. An alternative way to look at the definition is turning the qualitative definition into a statistical definition of a once in 48 month event, which would be to use any time period, whether it be 48 months or 12 months, and take the once in 48 month or the 98th percentile (ie 47/48) of the MCL value observations. There have been suggestions that this method could be used with the current MCL calculation methodology of the rolling 42 days average of prices and looking back over a specified time period, 12 months as in the current MCL, and identify the highest price spike. This price spike would be considered the 100 per cent event under the current MCL methodology, given the discreet time period that contains all available information for that time period. In order to derive the 98 percentile you would scale down from the 100th percentile event to the 98th percentile of all pricing information from the evaluation period providing for a quantitative and statistical reflection of the 98 percentile or once in 48 month event qualitative definition.

Alternative MCL Methodologies

Several different methodologies were analysed to evaluate the performance of alternative approaches to the MCL calculation process. The AEMC requested that alternative approaches include forward looking information, such as futures contract prices, as well as a stress test approach that utilises administered pricing in its calculation. In addition, an alternative historical approach and a hybrid approach were developed for MCL performance comparison. These methodologies are developed and presented below and then compared for effectiveness and efficiency against one another to provide recommendations to the AEMC.

MCL - Existing Approach (Current MCL)

The current MCL process uses historical information to provide credit cover for forward looking credit exposures. This MCL calculation methodology was developed prior to the development of a liquid futures market and has generally been accepted. The key market based inputs to the current MCL methodology are:

- Base Price – Calculated as the time-weighted average of all spot prices of a region over the previous 12 month period in the relevant region
- Volatility – Calculated for each region by dividing the peak value of the 42 day outstandings (price and demand weighted) from the prior 12 months by the mean of those 42 day outstandings over the prior 12 months on a rolling basis.
- Specific to market participant - Additional factors are included for load, marginal losses and the GST

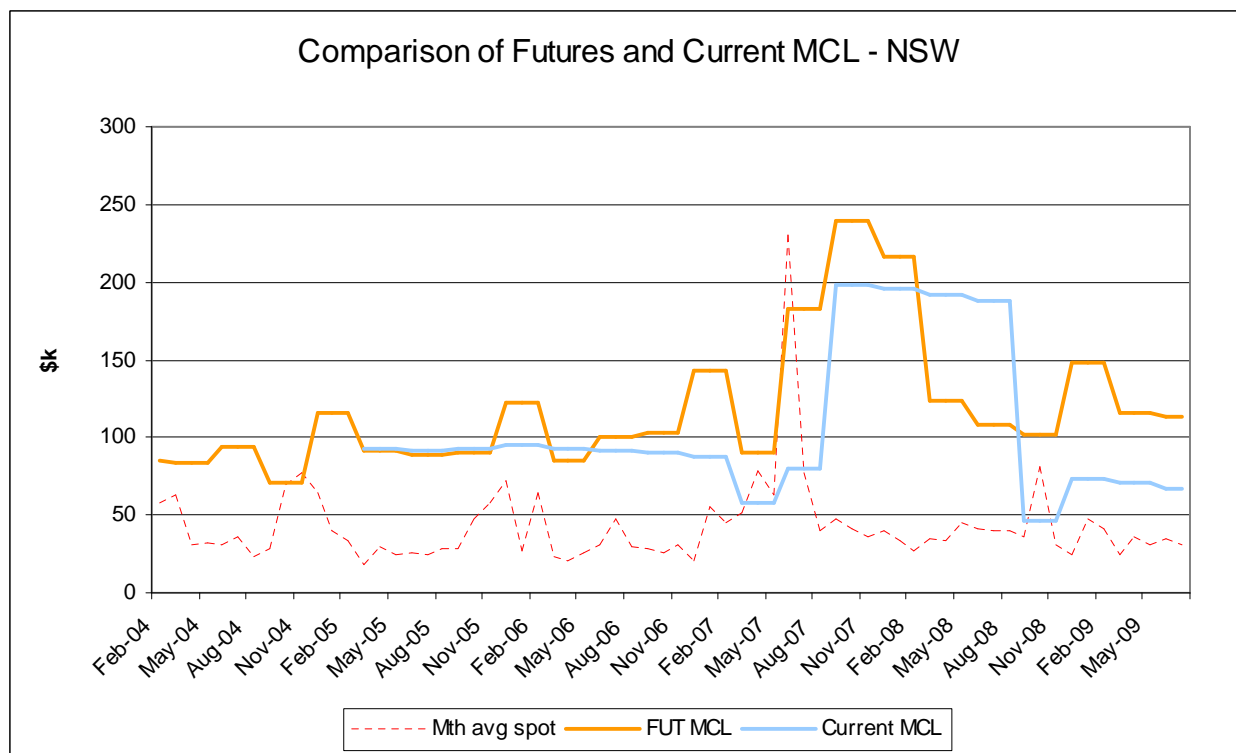
MCL - Futures Approach (FUT MCL)

This method involves two components. First it utilises forward looking information from the spot futures contract to establish the base pricing. Second, it develops a volatility factor also using the spot futures contract. Each component is described in turn below.

Base Price Calculation: Analysis has been undertaken to develop this alternative using futures both close to the start of a financial quarter, using futures pricing information beginning 10 days before the start of the financial quarter, as well as some 40 days prior to the start of the quarter in order to assess differences in MCL effectiveness.

Volatility Factor - The volatility factor developed in Alternative 1 (FUT MCL) was calculated by using the historic volatility of the spot futures price using one year's worth of futures price information for the futures contract used in the Base Price Calculation above. To be consistent with the week to week billing period's volatility was developed using week to week price changes for the 42 day (6 week) MCL period.

Figure 6.3.3.a below displays a comparison of Alternative 1 against the existing MCL calculation methodology.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 6.3.3.a – Futures MCL Methodology

MCL - Stress Test Methodology (Admin MCL)

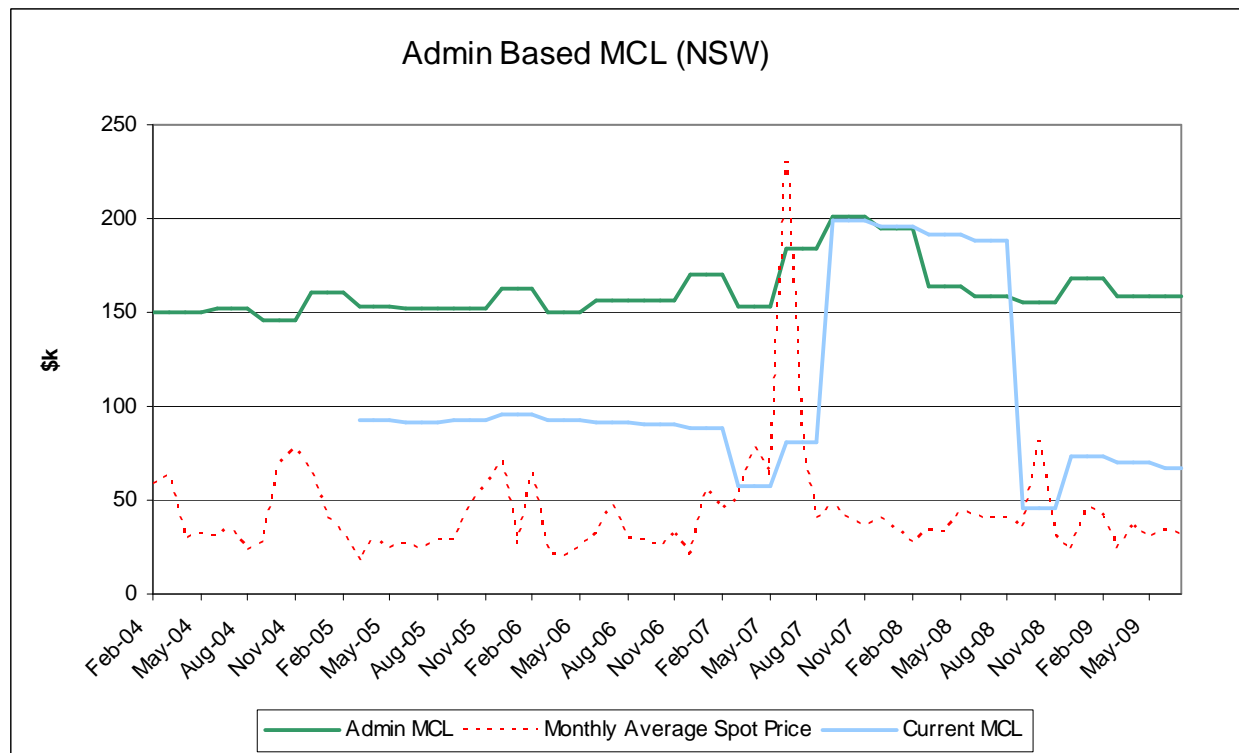
In evaluating ways to derive an appropriate stress test it is best to consider realistic events and the potential magnitude of that impact. The worst case pricing scenario is the cumulative price threshold event followed by admin pricing for a week. Applying the cumulative price threshold and admin pricing for the entire 42 day period would prove to be inefficient in terms of overfunding MCL so the 42-day period was broken down into three parts.

Stress Test Component Calculation - Assessing a reasonable worst case scenario against the entire 42 day period would overestimate the MCL so a more realistic stress test deploying the maximum value of energy over a week period which is equal to 7.5 hours at \$10,000/MWh and 161.5 hours at \$300/MWh or a total cost for 1MW over the week of \$123, 450.

Base Price Calculation – For the other 35 days of exposure in the 42 day MCL period for this stress test MCL alternative the spot futures price is used with its calculation the same as above in Section 5.3.2.

Volatility factor – No volatility factor is assigned for the 28 days of outstandings. For the one week of accumulating billings a volatility factor was calculated using the formula in Section 5.3.2 but only for one of the six weeks. The rationale for not including the volatility factor for the outstandings is that the cumulative price threshold week provides, on average, sufficient coverage for the outstandings which are monitored as part of the daily prudential monitoring process.

Alternative 2 is displayed below in Figure 6.3.3.b utilising NSW data and compared against the current MCL calculation methodology (analysis of Queensland, Victoria and South Australia are displayed in Appendix 7.3.3).



Source: AEMO and PwC Analysis

Figure 6.3.3.b – Stress Test MCL Methodology based on Admin Pricing

MCL – Hybrid Approach (MCL v1)

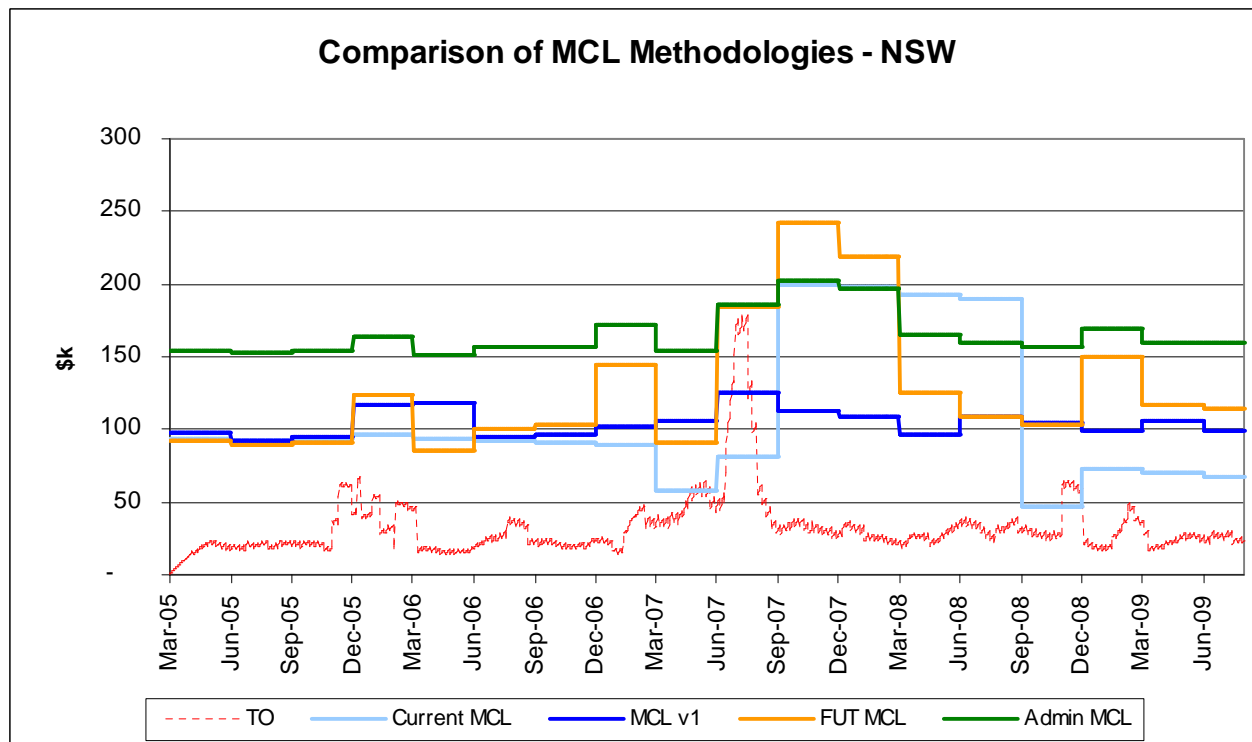
In order to consider both spot and futures information, and separately consider the time/risk buckets defined by the 4 week outstandings period, the one week of accumulating outstandings and the one week reaction period, a hybrid model was developed to assess its performance against other calculation methodologies. This hybrid alternative model develops the base pricing and a volatility factor as follows:

Base Price Calculation – The 4-week outstandings period is calculated first using the previously settled 4 weeks of average pool prices, which covers the outstandings. In order to cover the one week of accumulating outstandings, one week of spot futures is used as calculated before. To cover the one week reaction period cumulative price threshold is added for that week.

Volatility – One week of volatility covering the accumulating spot is added due to the uncertainty around the pricing of that week as it accumulates value. The volatility is calculated using spot futures prices to the 98 percentile, as previously described.

MCL – Approach Comparison

Figure 6.3.3.c compares the MCL methodologies against the outstandings that were developed by PwC.



Source: AEMO, d-cypha trade and PwC Analysis

Figure 6.3.3.c – Current and Alternative MCL Methodologies

The MCL utilising futures prices for determination (FUT MCL) is visually the most effective of the alternative MCL calculation methodologies in responding to expected price changes.

Findings and Conclusions

PwC through its investigation of alternative MCL methodologies and an assessment of risk, view that the MCL alternatives provide:

Effectiveness and Efficiency – The effectiveness and efficiency of alternative MCL methodologies have been investigated as part of this review. The effectiveness is intended to be a measure of the degree to which the MCL protects the market as a percentage of days for which the MCL exceeded outstandings. The efficiency is a relative measure of the cost of providing the MCL represented as aggregate outstandings as a percentage of the aggregate value of the MCL. The effectiveness and efficiency of each MCL is compared in the tables below.

<i>By Year - % breach</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	100%	100%	100%	100%	58%
2006	100%	100%	100%	100%	67%
2007	73%	88%	93%	100%	63%
2008	91%	100%	100%	100%	83%
2009	100%	100%	100%	100%	100%
Average	92%	97%	98%	100%	72%

Table 6.3.3.a – MCL Effectiveness (ratio of days of MCL non breach vs. time period)

<i>By Year – MCL cost</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	34%	33%	34%	16%	52%
2006	37%	32%	33%	16%	58%
2007	51%	56%	39%	29%	86%
2008	27%	38%	30%	18%	35%
2009	49%	34%	28%	16%	95%
Average	38%	40%	33%	20%	58%

Table 6.3.3.b – MCL Efficiency (Ratio of Outstandings vs. MCL)

The Futures Price MCL alternative displays the strong effectiveness at 98% coverage of all days during the 5-year time period while also having low ratio of outstandings to MCL implying a low efficiency and the high cost. Additional fine tuning of the futures methodology should provide sufficient evidence for futures to be used as a more effective and efficient means to calculate MCL. This fine tuning could include moving the calculation period close to the start of the quarter and modifying the volatility factor.

Of particular benefit over historical information, futures provide;

- **Forward looking information benefits**– Forward looking information helps to capture expected price movements sooner than the existing MCL calculation process. A more dynamic monthly MCL calculation process using futures provides even greater MCL coverage.
- **A prompt increase in MCL when prices rise** – Futures incorporate all available information that filters in from the market. It therefore is naturally better at predicting price movements than historical data from previous time periods. When prices are tipped to increase the futures price will reflect what the market believes will be the magnitude of the increase rather than relying solely on past high pricing events as in the current MCL calculation process.
- **A prompt decrease in MCL when prices fall** – When expectations of price decreases enter the market the futures expectations will adjust almost immediately to account for this market sentiment. Utilising futures prices will release prudential cover quicker, without increasing the risk to the NEM, as a result minimising the volatility factor, which can be influenced by one pricing event over the course of the last year. The responsiveness of futures to expected spot price movements performs even better when a monthly MCL calculation process takes place.

- **Futures prices are often greater than the underlying spot** – Because spot futures prices during a quarter incorporate historical pricing information and expectations of future price information they often price higher than the underlying accumulating spot price during a quarter. This higher trading value will often provide an additional MCL buffer when compared to the existing MCL base price calculation, which only incorporates ex-post pricing.
- **A settlement process that is well scrutinised** – The SFE financially clears a number of markets each day. It has constructed a process in which all available information will be taken into account if trading activity is insufficient to settle the market or if trading activity exceeds expected price ranges. One issue using SFE futures is that the market does not create settlement prices on weekends or holidays.

PwC Recommendation - We recommend that for NEM regions with sufficient trading activity, currently (NSW, QLD and VIC) that a forward looking approach using futures be strongly considered for implementation due to its superior effectiveness with further work to be done to create a formula that increases the efficiency without impairing the effectiveness. For regions with insufficient trading activity or no futures contract the MCL calculation methodology should default to the current methodology until further assessment of historical MCL approaches prove more effective and efficient than the existing MCL calculation approach.

6.3.4 Cost and Benefit Assessment

The **cost** of undertaking the implementation of FOAs and modification of the MCL calculation process would involve:

- Recognition of the time spent to date by the AEMC and members of the working group to develop proposals and oversee the evaluation process
- The time involved for further development of the proposals
- The actual costs for outside assistance to develop proposals
- The implementation costs including the costs for AEMO, clearing members, d-cypha trade and the SFE to implement changes
- The ongoing operations and monitoring of the FOA process by AEMO and the AEMC
- Any compliance costs that may be required by ASIC
- Potential dispute resolution costs if a disagreement is to occur
- Additional investment required by AEMO to incorporate FOAs and an alternative MCL calculation methodology

The **benefits** that would accrue as a result of FOA implementation and the adoption of an alternative MCL calculation model include:

- Improved credit quality in the pool of AEMO allowed hedging contracts
- A reduction in barriers to growth for smaller retailers
- A release of bank guarantees to the market which may be required for other bank guarantees upon the sell off of New South Wales retailers and generation rights

- For establishing the MCL, a more effective and efficient MCL that better captures price expectations and therefore improving the prudential coverage in the NEM and protecting it against reasonable worst case events that happen from time to time.
- The addition of FOAs will provide alternatives to the existing RA for MCL relief which would bring competitive tension to these AEMO approved hedging products.
- Further price transparency will develop in the spot futures contract assuming a reasonable uptake level of FOAs, which would translate into increased trading activity in the spot futures.
- There will be significant quantifiable benefits with the implementation of the FOA. Quantifying these benefits by region would need to take into account: the NEM region, for MCL relief the volatility factor and average strike price, the uptake of FOAs and their growth path, cost of bank guarantees. (An example is provided below).

Measuring the benefits of FOAs

The net benefits of MCL relief due to hedging arrangements can be significant. This of course will be dictated by the amount of take-up in the market of AEMO approved hedging contracts, the MCL levels and the cost of bank guarantees. As an example of the potential monetary benefits we provide the following assessment of MCL and MCL direct costs in scenarios of no hedging arrangements, 25% RAs and additional 25% FOAs. We have used the aggregate load from New South Wales, Victoria and Queensland which capture close to 90% of the overall NEM load, and the AEMO formula for calculating MCL, which the full 42 day MCL period has been used for this example.

MCL Inputs	Without offsets	Reallocation (25%)	FOA (25%)	Reallocations (25%) + FOAs (25%)
Estimated System Load for NSW QLD & VIC	20,000MW	20,000MW	20,000MW	20,000MW
Unhedged Load	20,000MW	15,000MW	15,000MW	10,000MW
Base Price	\$35 / MWh	\$35 / MWh	\$35 / MWh	\$35 / MWh
Volatility Factor (based on ave across regions)	2.2	2.2	2.2	2.2
Lodgement Price		\$36/MWh	\$36/MWh	\$36/MWh
Example MCL	\$1792 M	\$1469 M	\$1620 M	\$1297 M
Prudential Margin	\$298 M	\$298 M	\$298 M	\$298 M
Net MCL Relief	None	\$327 M	\$172 M	\$495M

Table 6.3.3.c – MCL Benefits Example

In addition to the benefits of MCL reduction cited above, an outright financial benefit will also accrue to each MWh in terms of bank guarantee cost reduction. Using the above estimated system load for NSW, QLD and VIC an actual dollar benefit of for the MCL reduction and the corresponding reduction in bank guarantee costs equate to between \$0.10/MWh and \$0.16/MWh (assuming a bank guarantee cost of between 2.5% and 4.0% of face value)

Conclusions

This example displays a potential for MCL relief of over 28% for these percentages of hedging with RAs and FOAs. In regards to the FOA MCL relief benefits exist, providing the processes for incorporating FOAs do not extensively deviate from current operational practices today. These benefits will exist in perpetuity will provide a significant net benefit to the market both immediately and over time. Using futures as the basis for the MCL calculation will provide increased effectiveness and with modification to the analysis in this paper can also increase efficiency. This in turn could provide additional MCL relief while better protecting the NEM against reasonable worst case events. The benefits of the implementation of FOAs appear to significantly outweigh the costs. Incorporating a forward looking approach to the MCL calculation process will bring future effectiveness to minimising breaches in the MCL, however, further work and market consultation is required to refine the proposed methodology and increase the efficiency.

7 Appendices

7.1 Summary of deliverables with brief comment or location of deliverable in the report

7.1.1 Reallocation Agreements Deliverables

Deliverable	Outcome
Transfer of credit risk under different reallocations arrangements	
Quantitative analysis demonstrating the shift in credit risk exposure of NEM participants under the three available reallocation agreements	See section 3.1 and 3.4
Peak/off-peak disparity	
Review of the current Rules and Procedures and analysis of risks associated with peak/off-peak disparity	See Section 3.2.6
Security Deposit Accounts (SDAs) and clawback risk	
Value held in security deposit accounts (SDAs) and value at risk due to SDAs under current arrangements including where a NEM participants operates under RMCL	See Section 3.3.1
Value of reallocation transactions and quantification of the values held in SDAs under different RAs that may be subject to clawback including where a NEM participant operates under RMCL	See Section 3.3.1
Termination of the reallocation	
Quantitative evaluation of the likelihood and magnitude of a NEM spot market payment shortfall occurring due to a reallocation termination (triggered by options as described in the RFP)	See Section 3.2.1
Quantitative analysis of the range of scenarios and the probability of NEM spot market payment shortfall occurring under the various RAs	See Section 3.2.1
Quantitative evaluation of the retailers' financial stress under reallocation termination	See Section 3.2.2
Assessment of likelihood of generator default and reallocation termination resulting in spot market shortfall	See Section 3.2.3
A quantification of reallocation termination risk or other directly related default risks arising from reallocations including quantification of the risk of such occurrence and identification of mitigation measures	See Sections 3.2, 3.4 and 3.5
Analysis regarding the value deduction seen by a retailer where there is a risk of de-registration	See Section 3.2.5
Other risks and issues	
Other risks and issues will be identified and analysed as required.	See Sections 3.4 and 3.5

7.1.2 Futures Offset Agreement Deliverables

Deliverable	Outcome
Parties to the FOA	
Recommendation on any changes to the parties to the FOA to provide the maximum practical surety of payment and provision of correct information to NEMMCO	See Section 4.1
Analysis of risks and ratings of proposed arrangement (comparing the risks to relevant parties under a FOA with reference to that under current arrangements without and with RAs)	See Section 4.4 and Section 6.2
Specifications of FOA	
Recommendations of any elements of a registered FOA that may be required and are not included in the models	See Section 4.5.2.
Preconditions for FOA registration	
Recommendation on any preconditions that should be included to ensure the underlying futures contract is in place as expected, and that positive margin payments will be forthcoming until the FOA expiry date	See Section 4.5.3
Recommendations as to the form and quantum of such penalties imposed on Retailers as a disincentive for them not to provide inaccurate information and/or not comply with the Rules in relation to FOA	See Section 4.5.4
Termination of the FOA	
Identification of scenarios that may lead to termination of a FOA that have not been identified in the proposed FOA models	See Section Error! Reference source not found.
Quantitative analysis of the impact on the NEM for each type of termination, including its likelihood and impact	See Section Error! Reference source not found.
Recommendation of mitigation strategies for termination without alternative credit support being provided prior to termination, and options to minimise the risk of spot market shortfall under all scenarios	See Section Error! Reference source not found.
Review of both FOA models to ensure that the termination rights of a FOA are clear and evaluate the impacts of these termination rights on the prudential quality of the NEM	See Section Error! Reference source not found.
Analysis of incentives, risks and mitigation measures for retailers to terminate FOAs and SFECs to close out an underlying futures contract of FOA for commercial purposes	See Section Error! Reference source not found.
Margin calculations	
Recommendations on any improvements to margin calculations outlined in proposed model	See Section 4.4.1
Evaluation of the futures margin payments to ensure that would be sufficient in all cases to cover spot price movements	See Section 4.4.1
Identification of additional scenarios that may result in an insufficient margin payment	See Section 4.4.1
Recommendation on calculation for determining margin payments	See Section 4.4.1
Evaluate the proposed FOA margin payment formula	See Section 4.4.1
Identify additional scenarios where proposed adjustment formula may be insufficient to cover all spot price movements, and showing the effectiveness of this proposed adjustment formula	See Section 4.4.1
Comparison of insufficient FOA margin payments to situations where the MCL and RMCL of the current arrangements may be insufficient to cover a NEM participant's outstandings	See Section 4.4.1

Deliverable	Outcome
FOA margin payments and clawback risk	
Provide examples, with quantitative evidence, outlining the expected change in SDA values, and any resultant change in overall clawback risk exposure faced by the NEM, compared to current MCL, and RMCL with and without RAs	See Section 4.4.1
FOA settlement and return of funds	
Provide recommendation on changes to the return of funds policy in the FOA model and on circumstances under which NEMMCO should be able to retain the SDA funds for use against a NEM participant's outstandings	See Section 4.4.1
Dealing with errors and disputes	
Assess the risk introduced into the NEM as a result of the proposed contractual arrangements	See Section 4.5.6
Recommend changes to the FOA design that will give NEMMCO improved powers over the SFECF, and surety of correct and timely provision of funds and information	See Section 4.5.1 and 4.5.6
Timing within the FOA process	
Evaluation of the timeline for the FOA process against the timeline for the NEM prudential supervision process and impact of the differences on the prudential quality of the NEM	See Section Error! Reference source not found.
Assessment of any changes to prudential cover arising from the timetable for registration and margin payments under the FOA models when compared to current arrangements, without and with RAs	See Section 4.4 and Section 6.2
Likely users of FOA	
Assessment on the likely take up rate of a FOA, and the retailers who are likely to use the FOA and its impact on the prudential quality of the NEM	See Section 4.6
MCL Reduction	
Recommendations of β factor calculation including inputs, calculation, ownership, flexibility and any other considerations	See Section 4.4.1
Evaluation of two sets of β values - for low clawback risk and high clawback risks	See Section 4.4.1 and Section 4.4.4
Recommendations regarding the guidelines for future review of the β factors and mitigation measures for risks not included in the β factor	See Section 4.4.1
SFECF closes out a futures position	
Assessment on the likelihood and consequence SFECF closing the sub-account positions, and assessment of the implication of this risk on the β factor	See Section 4.4.1 and Error! Reference source not found.
Other risks and issues	
Where appropriate, identification and analysis of additional risks that have not been identified earlier	See Section 4.2 and Section 4.4.3

7.1.3 Maximum Credit Limit Deliverables

Deliverable	Outcome
Reasonable worst case	
Evaluation of the Reasonable Worst Case interpretation and if appropriate the provision of an alternative interpretation	See Section 5.1
Defining the methodology as to how the interpretation may be given effect	See Section 5.1
Assessment of the impact on the MCL under the current and/or alternative interpretation in terms of its effectiveness and efficiency compared	See Section 5.3.7

Deliverable	Outcome
to current approach	
Review interpretation to ensure it meets the effectiveness and efficiency criteria	See Section 5.3.7
Methodology for the determination of the MCL	
Review the options for MCL calculations, including a variation to the current approach that would meet the 'reasonable worst case' criteria	See Section 5.1 and 5.3
Establish the information needs for the preferred method and the adequacy of such information	See Section 5.3.2
Defining the preconditions for the use of the methodologies	See Section 5.3.2
Assess the impact the method would have on NEM participants and the market generally	See Section 5.3.7
Assess the effectiveness and efficiency of the MCL determined under the preferred model	See Section 5.3.7
Analysis on the impact variations in load will have on the determination of the MCL in terms of its effectiveness and efficiency	See Section 4.4.3
Historical approach	
Recommendation as to whether the current historical approach may be improved in terms of its effectiveness and efficiency	See Section 5.3.5
Recommendation as to the most appropriate historical price and time period to be used as input in MCL calculations, if the current methodology were to be adopted	See Section 5.3.5.
Future prices replacing historical average prices	
Recommendation as to whether futures prices provide a more reasonable input into the MCL calculation in terms of effectiveness and efficiency	See Section 5.3.7
Recommendation as to the most appropriate futures period to use in MCL calculations, if the futures price methodology were to be adopted	See Sections 5.3.2, 5.3.6 and 5.3.7.
Recommendation as to whether the differing price periods of 91 and 42 days could cause issues with price volatility being incorrectly calculated for the MCL period	See Section 5.3.
Volatility component in the futures price	.
Recommendation, if relevant, on a methodology for determining the implied spot market volatility in futures prices, and a methodology for updating the MCL calculation with an adjusted volatility factor	See Section 5.3.2 and 5.3.6
Recommendation, if relevant, on how the volatility factor component of the MCL calculation should be adjusted with the introduction of futures prices, including calculation, ownership and updating the calculation	See Section 5.3.2 and 5.3.6.
Regions with no futures price or illiquid futures markets	.
Recommendation on methodology for assessing the robustness of pricing in a futures market region	See Section 5.3.6

Deliverable	Outcome
Development of guidelines for pricing activity levels that are sufficient to allow a reliable forward price to be input into the MCL calculation	See Section 5.3.2
In the circumstance where there is a lack of trading activity, recommendation whether bid/offer outcomes can be used as a reliable proxy for forward price	See Section 5.3.2
Comments on the appropriateness of a hybrid methodology, in which different regions may have different price inputs	See Section 5.3.6
Stress test	
Recommendation, as to whether the 'stress test' approach or a variation to it ensures a more effective and efficient MCL outcome	See Section 5.3.4

7.2 Response to Submissions

A draft of this report was posted on the AEMC web site on the 14th of October 2009. Interested market participants were asked to provide submissions by the 4th of November 2009. Our response to the submissions on the draft report are detailed below.

7.2.1 AEMO Submission

The comments below relate to the submission received by the AEMC from AEMO on the 6th of November 2009.

Section	Comment	Response
1.1	NEM prudential framework and compliance	The analysis in sections 3.2 and 4.4 consider the risks and benefits under normal operation and in the event of a failure event
1.2	FOA termination risk	Additional analysis has been provided in section 4.4 showing the potential magnitude of a failure event when an FOA is in place. We disagree that the proposed FOA represents an optional MCL model (for the basis of discussion we assume this to be a bank guarantee for the PM and cash held up to total outstanding) <ul style="list-style-type: none"> • A bank guarantee is held up to the FLP • Variation margins based on movements in the futures price are placed in a SDA account as additional security • The futures market is forward looking covering not just the historic exposure (outstandings) but also a market expectation of future price movements
1.3	Time take to remove a party from the market	We agree with AEMOs comments on the time taken for the removal of a party from the NEM. As discussed in section 3.2 and 4.4.2 the period additional risk we have identified is the period prior to the commencement of suspensions preceding where the retailer is taking electricity from the NEM prior to providing additional security.
1.4	Prudential Margin verses MCL component	As discussed in reference to comment 1.3 we do not believe that the analysis is comparable with

Section	Comment	Response
		<p>an optional MCL model.</p> <p>The FOA termination risk analysis contained in section 4.4.1 assesses the termination risk in comparison with the RMCL process. It does not assume that the retailer will be at its TL at the point of failure and section 4.4.2 discusses the way an FOA can change the probability of default at times of extreme pricing</p> <p>A discussion on the appropriateness of the current prudential margin and the coverage that an additional day of prudential margin would provide is discussed in section 4.4.1. We acknowledge that this does not cover all the incremental risk but covers risk on a basis consistent with existing AEMO processes</p>
1.5	Two Party Default	<p>PwC has been asked to address the two party default scenario in the RFP. A three party default scenario would be required for the follow on effects of a retailer failure to have a direct effect on the NEM spot pool. As we have identified that failure of retailer does not have a direct impact on the funds available for the settlement of the spot market pool though may have an impact on the generator who has committed to back the RA, as a result the flow on effects is the same as is the case of generator failure without retailer failure</p>
1.6	FOA formula and the PwC Model	<p>Analysis is continued in section 4.4.1 on Model 2 contained in the RFP. As envisaged by the RFP issues were identified with the model which have been addressed by the modifications developed by PwC in section 4.5.</p> <p>An analysis of the unfunded component is included in section 4.4.1 and a comparison is made to the unfunded margin payment required under the existing prudential regime. The AS factor does not duplicate the current AEMO processes for two reasons</p> <ul style="list-style-type: none"> • It covers an exposure period equal to the outstandings period (35 days) rather than looking only at the existing outstandings • The existing processes would only require the payment of additional funds into the SDA if the retailer was above their trading liming on an aggregate basis (ie FOA and non FOA loads) we believe that the margins required for the FOA should not be supported by collateral provided to support non FOA volumes <p>Analysis of the funded and unfunded components is contained in section 4.4.1. The analysis is based on funds from the SFE and FLP.</p> <p>Additional discussion on the scaling factor is contained in section 4.4.1 we agree the changes in the futures price are as AEMO describes but that they also include a forward looking element. The models provided by the AEMC imply that a retailer should receive credit support relief on a much lower volume than variation margins are paid.</p>
1.7	FOA modelling and analysis	<p>The analysis has been performed on a daily basis taking into account actual outstandings and the settlement cycle as shown in section 4.4.1 and figures 4.4.1 g through j</p>

Section	Comment	Response
		<p>A comparative assessment of FOA Model 2, the amended model 2 formula provides by PwC on a full and proportioned basis and the RMCL is provided in section 4.4.1 and figures 4.4.1.g and 4.4.1.i. As discussed in section 4.2 we do not believe that Model 1 will be workable in practice and our analysis is therefore limited to Model 2.</p> <p>A discussion on the impact of different FLPs is included in section 4.4.1.g.</p> <p>The AS factor used in the PwC modelling and the formula is based on a rolling 35 day period which is not limited to the futures quarter and therefore will help in the management of the transition between futures quarters. The wording of section 4.4.1.g has been updated to ensure that there is no further confusion. The clarification of this point should deal with all of the operational points raised by AEMO.</p> <p>We agree the consultative process for identify the risks associated with the proposed formula and completing the associated risk analysis would have been beneficial but the scope of the engagement did not allow for any consultative processes.</p>
1.8	Security Deposit SDA (Clawback)	As stated in sections 4.4.4 and 3.3 the advice provided is general in nature only and specific legal advice should be sort by interested parties to clarify the legal position.
1.9	Load shape analysis and hedging agreements	No response required
1.10.1		<p>The analysis is carried out on daily rolling 35 day basis not on a daily basis; therefore the 98th percentile will not exclude all prices above \$300 as per the AEMO analysis. The periods excluded by the 98th percentile analysis are those with the greatest average prices over the 35 day rolling period.</p> <p>PwC agrees that an agreed and workable definition of 'Reasonable worst case'. The scope of this report is limited to Scope was limited to PwC providing its view and backing it statistically to the extent possible and therefore consultation and the next steps proposed by AMEO are beyond the scope of the PwC review.</p>
1.11.1	Baseline assumptions – time taken to run and MCL review	Based on the advice provided by AEMO early in the review processes the analysis was carried on both a 5 day and 5 weeks prior to the start of the quarter. As discussed in section 5.3.3 the 5 day case is shown only as an example of how the process may be improved by moving the calculation date closer to the start of the quarter. The charts and analysis that are carried through section 5 are all based on the 5 week analysis
1.11.2	Prudential Margin Adequacy and linearity	We agree that one day of prudential margin does not represent the maximum risk for one day load by a retailer, supplementary discussion on the basis for the additional of one day to the prudential margin has been included in section 4.4.2 to clarify the assessment.
1.11.3	Prudential margin used in new models	We agree with the comments made by AEMO on the inclusion on the prudential margin in the calculations on the efficiency and effectiveness of the alternative MCL methodologies. The assessments of effectiveness and efficiently were made based on formulas provided by the AEMC which we were asked to use as the basis of this assessment.

Section	Comment	Response
1.11.4	Futures Price Volatility	See response to element 8.5 of the AEMO submission
1.11.5	MCL volatility	We agree that the process would benefit from industry consultation to assess the preferences, risks and benefits of a change to the current MCL methodology
1.11.6	Summary of MCL methodology	We note AEMOs view that additional work is required prior to any change in the MCL methodology
2.0	FOA Termination Risk	The discussion on termination risk in section 4.4.2.g has been enhanced
3.0	Participant failure risk analysis	See comments in section 1.3 of this response to AEMO submission. Timings in the report have been updated to reflect the timings advised by AEMO in section 3.0 of their submission
3.7	Additional MCL buffer	The additional buffer below the trading limit is also relevant in the case of an FOA. There is no reason to assume that a retailer will fail when it is at its trading limit with an FOA in place, analysis contained in section 4.4.2 and section 4.4.1 explain why the probability of default at times of high prices with an FOA is lower than without an FOA. Our analysis has focused on the worst case scenario when failure occurs and a retailer is at their trading limit
4.1	Comparison of Model 1 and Model 2	The additional risks associated with FOA Model 1 are discussed in section 4.2. Operation difficulties have also been identified with the use of Model 1 as discussed in 4.2 and therefore PwC did not fully develop Model 1 methodologies as in Model 2, which was unanimously supported by market participants over Model 1.
4.2	Systemic Risk	These charts and regression factors have been provided as background to assure the reader that the futures prices do track spot prices. This is an essential pre requisite to assessing a basis for the inclusion of FOAs. Analysis of the correlations over the actual outstandings period is contained in section 4.4.1
4.3	Floor on variation margin payment	A detailed discussion on unfunded variation margins is contained in section 4.4.1 along with a comparison to the existing minimum prudential quality, the RMCL.
4.4	Prorating of futures payment	Please refer to discussion in section 4.4.1
4.5	Cash build up to PwC model	The AS component in the proposed formula relates to a rolling 35 day period not to the accruing outstandings in the futures quarter
5.1	The PwC Model	An analysis of the unfunded margin payments and a comparison to the payment required under the existing prudential processes is contained in section 4.4.1
5.2 – 5.6		We refer to our analysis in section 4.4.1 comparing the value of unfunded margin calls under an FOA and a RMCL. .
6.0	Reasonable worst case definition	See comments in relation to section 1.10.1 of this response to AEMOs submission
7.1	Peak/off peak disparity in RA processes	We acknowledge that AEMO has processes to deal with load profiling and RAs. Given the concerns raised by market participants regarding these processes the simple act of publishing a summary of these processes may alleviate the concerns of the market participants
7.2	Load balancing	We have not proposed a process for managing load balancing. There are a number of different potential approaches. The operational practicality of each solution would need to be addressed as

Section	Comment	Response
		part of any change
7.3	Load volatility	We agree that any load profiling should also take into consideration the variation of load with price
8.1	Futures Price Prior Quarter	See comments in relation to section 1.11.1 of this response to AEMOs submission
8.2	Prudential Margin Adequacy	Additional discussion has been added to section 4.4 which address these comments
8.3	Increasing the Prudential Margin	See discussion in section Error! Reference source not found.
8.4	Prudential Margin tied up	See comments in relation to section 1.11.3 of this response to AEMOs submission
8.5	Futures volatility	Futures volatility has the advantage of anticipating forward price movements where using historical price for volatility assumes the past will be replicated.
8.6	Volatility multiplier	Given the MCL coverage is for 5 weeks, plus prudential margin and volatility is calculated weekly in order to capture the volatility for the full 5 weeks not just on week a sqrt(5) multiplier is used.
8.7	Volatility of MCL	See comments in relation to section 1.11.5 of this response to AEMOs submission
9.1	Benefit of an FOA	<p>The comments relating to margin payments in this table appear to assume that the spot prices in a quarter are likely to follow the level of the MCL. Given that the MCL does not contain a seasonal component a price spike during summer will result in a higher MCL but not necessarily higher prices.</p> <p>The benefits to a retailer of lodging an FOA are likely to extend further than simply a reduction in credit support.</p> <p>We agree that a processes that would allow a retailer to estimate the MCL and the relief available for lodging an FOA would be useful</p>
9.2	Resetting the Futures Price	It is envisaged in the models that AEMO should have the ability to reject a price reset and associated return of futures margin. We are not sure how this would work on an automated basis within AEMOs systems
9.3	Email Process	We were not previously advised of AEMOs concerns regarding non automated delivery of FOA position information. A cost benefit analysis of establishing an electronic interface would need to be conducted to see if such a step is justified. This analysis would also need to take into account the SFCEP processes for informing AEMO of the nature of the FOA
Appendix B		Addressed as appropriate in the report
Appendix C		Addressed as appropriate in the report

7.2.2 National Generators Forum Submission

The National Generators Forum (NGF) commissioned Seed and Taylor Fry to provide an analysis of our draft report. This report along with an NGF cover letter was received by the AEMC on the 5th of November 2009. Our comments on this report are as follows

Section	Comment	Response
2.0		PwC's assessment of market risk does not suggest the use of a normal price distribution. PwC recognises that the ENM experience extreme pricing events on a day to day and weekly basis. It should be recognised that averaging these extreme events or expectations of extreme events over periods longer than a day or week will reduce the size of the tail of the

Section	Comment	Response
		distribution of actual prices. The 42 day MCL exposure recognises a 42 day period. PwC recognises this issue by suggesting an actual discrete historical distribution of prices over a historical period should be used rather than assuming a normal, log normal or other assumed price distribution. The 98 th percentile will therefore reflect the 98 th price that exists in the in the actual price distribution of 35 day rolling average prices. Further discussion in contained in section 5.1
3.0		<p>It should be recognised that in all commodity markets there are often departures between physical and futures markets before futures correct prior to termination. However, the reason entities will only support a futures contract if there is convergence between the physical and futures contract at the end of the period. This is the case with the SFE electricity futures.</p> <p>We have highlighted that static bank guarantees held as collateral for electricity load are one method to management are one method to manage the risk of non payment. The FOA process line the RMCL process substitute bank guarantee cover for a daily prudential monitoring process that requires active management of existing and expected outstandings.</p> <p>There are a range of benefits to a market participant in taking up an FOA, not just reduced bank guarantee costs. The reduced pressure on the banks who provide these bank guarantees should be under estimated, especially given the potential requirements for substantial incremental bank guarantees to support companies acquiring the NSW retail assets</p>
4.0		PwC developed a series of MCL calculation approaches and evaluated their effectiveness and efficiency against one another. No conclusive result of a superior MCL methodology prevailed and PwC indicated, in consultation with stakeholders, modification the of the MCL approach using futures as a calculation base could achieve a more effective and efficient MCL methodology.

7.2.3 Energy Retailers Association of Australia

The comments below relate to the submission received by the AEMC from the Energy Retailers Association of Australia (ERAA) on the 5th of November 2009.

Section	Comment	Response
FOA Model 2	Bullet Point 1	The analysis in section 4.4.1 is conducted on an daily basis and figures 4.4.1 g though j show the price movements on a daily basis.
	Bullet Point 3	We agree that an additional day for raising additional credit support in the event of termination of the FOA may reduce the risk of unintended suspensions. The benefits of this would need to be weighted against the additional risks to the NEM spot market of an additional day without full MLC support.

Section	Comment	Response
	Bullet Point 4	A comparison of the cash requirements and funding of those requirements between FOAs and RMCL is contained in section 4.4.1
	Bullet Point 5	As discussed in sections 3.3 and 4.4.4 a legal review is required to fully understand the risk of clawback
MCL	Bullet Point 2	We agree that a prudent retailer should maintain sufficient cash or callable lines to meet an AEMO margin call should a stress event occur. AEMO is concerned that it has not recourse to funds which it does not hold in the event of a retailer failure event

7.2.4 d-Cypha Trade

We do not believe there any issues are raised in the submission by d-cypha Trade submission.

7.3 Summary of quantitative analysis

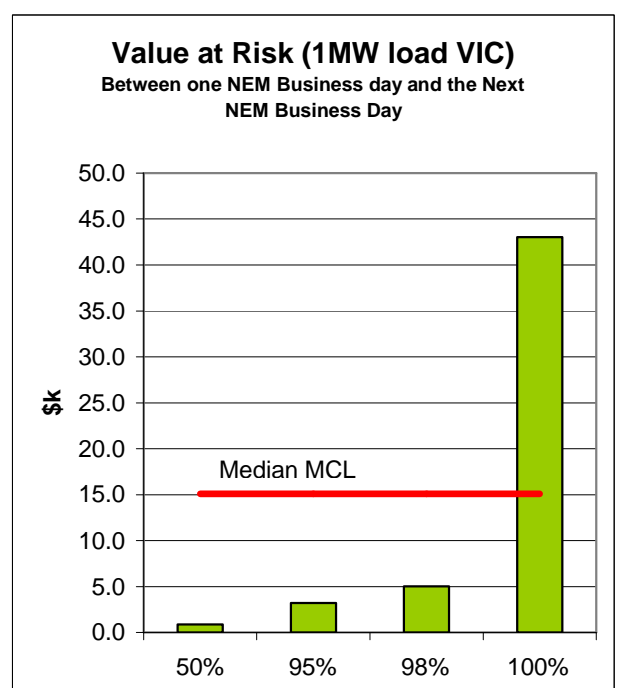
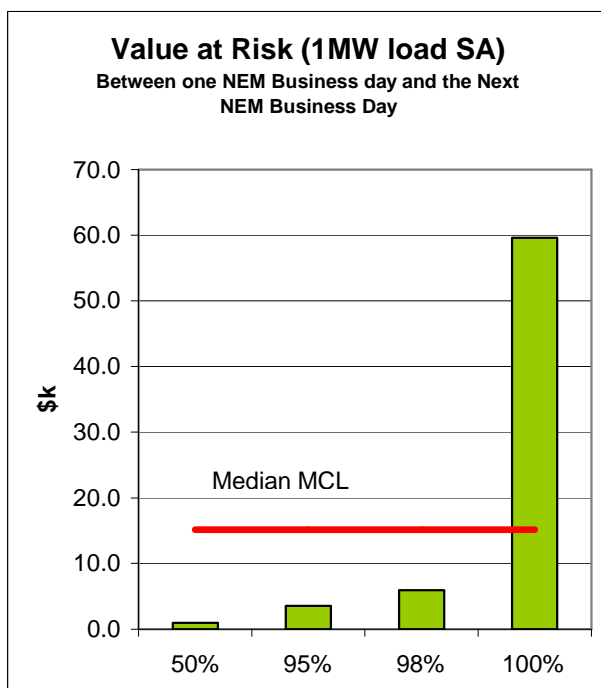
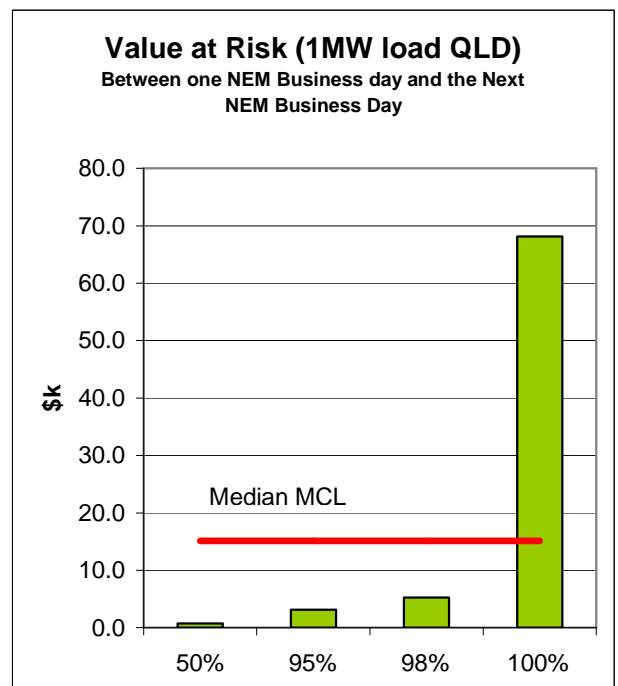
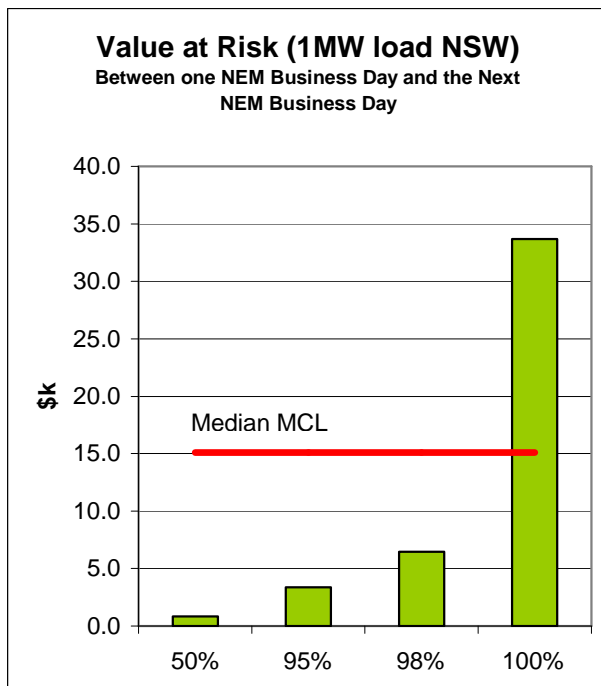
7.3.1 Reallocation Agreements Quantitative Analysis

Change in Credit requirements with and without reallocation

Retailer: 1MW base load, 100% load reallocation				
Expected Average Pool Price	\$/MWh	40	40	40
OTC Contract Price	\$/MWh	40	40	40
Actual Spot Price	\$/MWh	30	60	100
Average daily load estimate	MWh	24	24	24
Reallocated daily load	MWh	24	24	24
Volatility factor		1.5	1.5	1.5
NEM Credit Period	days	42	42	42
Billing Period	days	7	7	7
NEM Credit requirements without reallocation				
MCL	\$k	69.9	69.9	69.9
PM	\$k	11.6	11.6	11.6
TL	\$k	58.2	58.2	58.2
NEM Credit requirements with reallocation				
MCL	\$k	19.5	19.5	19.5
PM	\$k	11.6	11.6	11.6
TL	\$k	7.8	7.8	7.8
Reduction in NEM credit exposure				
Difference between MCL with and without reallocation	\$k	50.4	50.4	50.4
Increase in Generator credit exposure				
Value of energy under OTC for 7 day billing period	\$k	6.7	6.7	6.7
Value of energy at spot price for 7 day billing period	\$k	5.0	10.1	16.8
Value of energy for 7 day billing and 28 day credit period	\$k	33.6	33.6	33.6

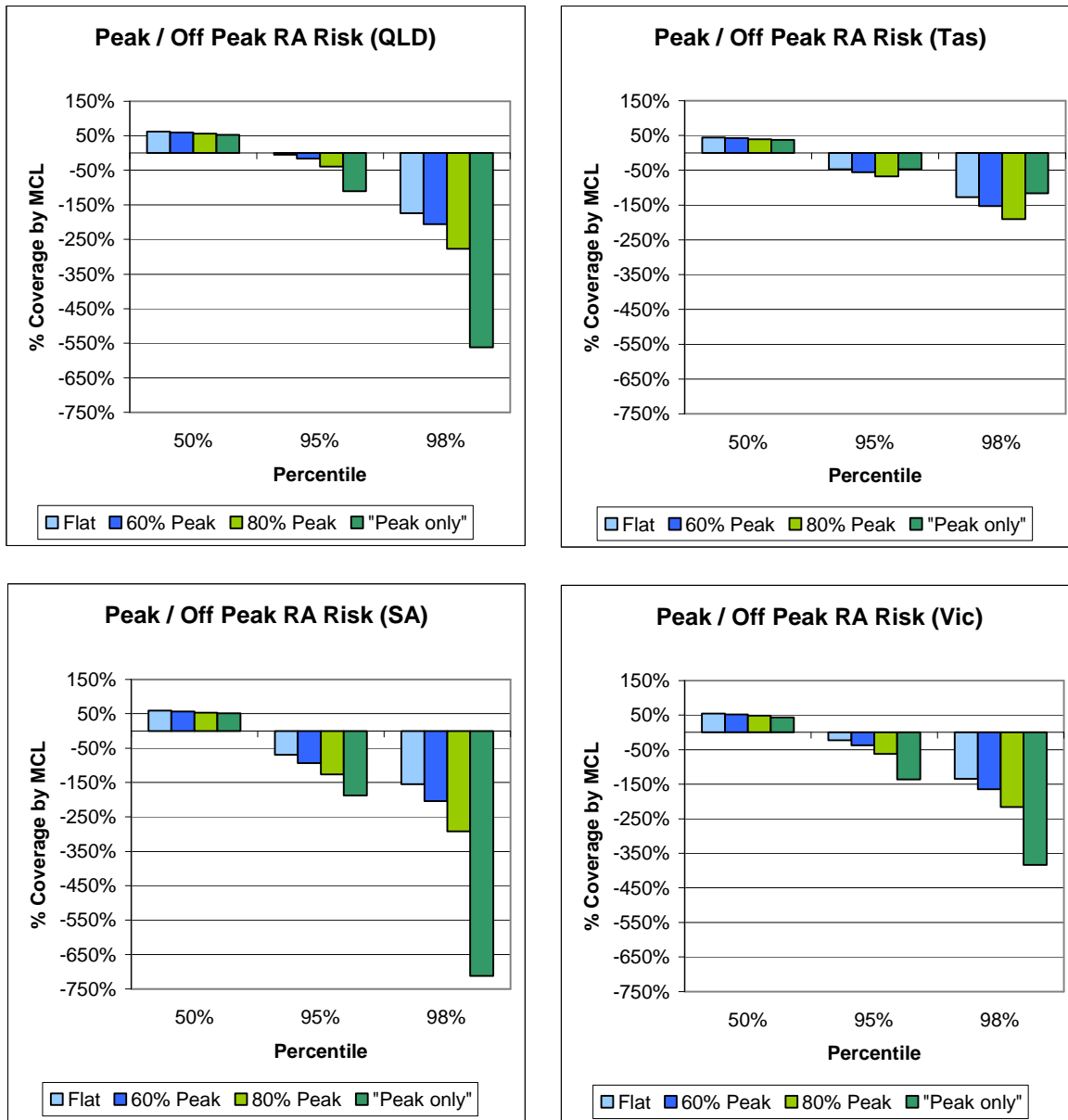
Figure 7.3.1.a – Worked Example – Transfer of Credit Risk under Reallocation

Settlement Timing Risk



Source: AEMO and PwC Analysis
Figure 7.3.1.b – Timing Settlement Risk: Value of 1MW load between one NEM business days and the next NEM Business Day

Peak / Off Peak disparity in RA Process



Source: AEMO and PwC Analysis

Figure 7.3.1.c – Peak / Offpeak Adjusted MCL Coverage of Peak Load by State

Usage of SDA accounts by Prudential Process

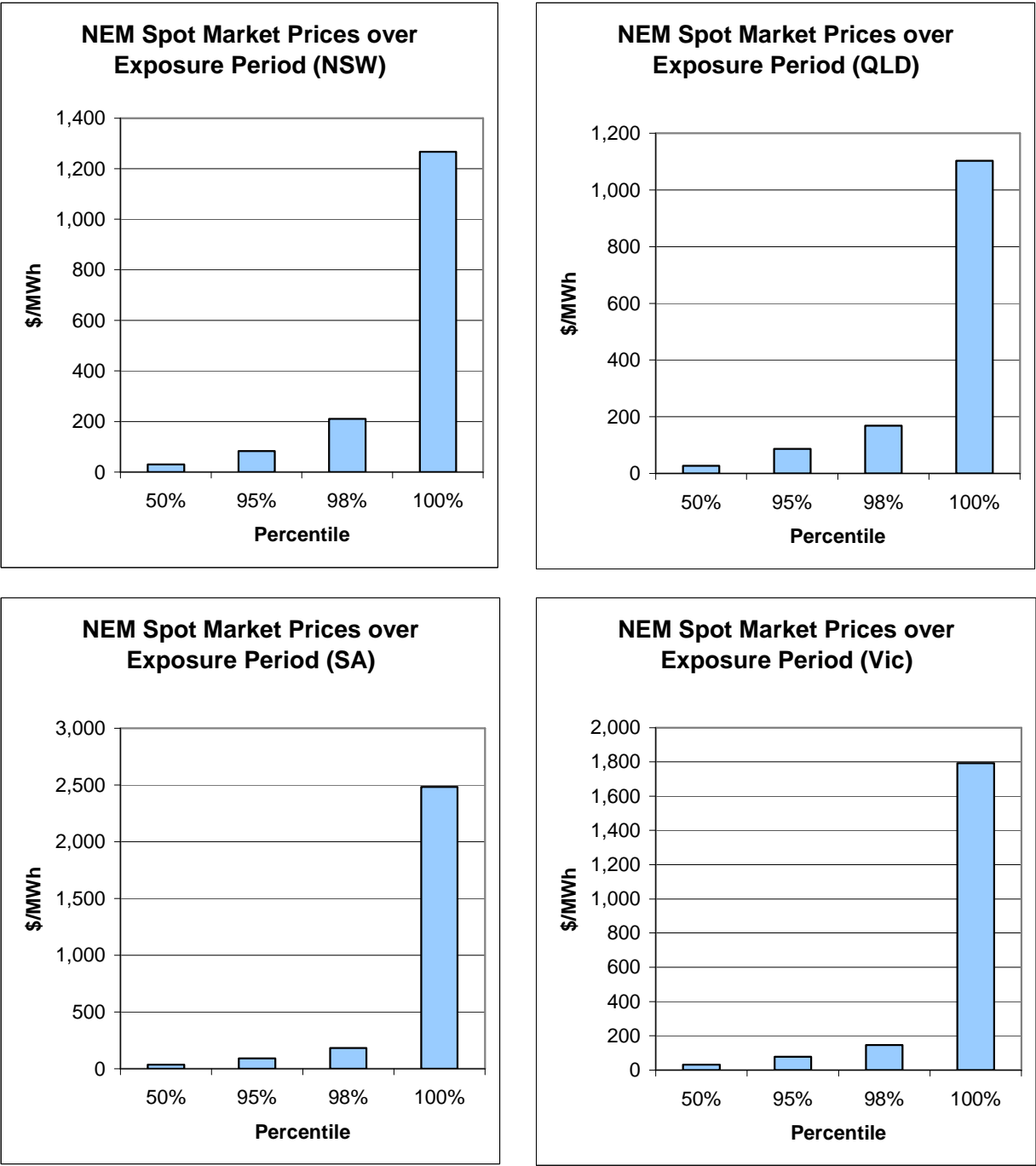
	All	MCL	RMCL	No RA	RA	RA and RMCL
Retailers						
Proportional use process			71%	29%	50%	20%
Proportional use of SDA (days)	20%	18%	24%	3%	28%	25%
50th percentile	26%	26%	27%	17%	33%	27%
95th percentile	300%	233%	316%	316%	300%	293%
98th percentile	420%	300%	543%	418%	420%	552%
100th percentile	571%	420%	571%	550%	571%	571%
Gentailers						
Proportional use process		81%	19%	95%	5%	3%
Proportional use of SDA	4%	3%	9%	2%	19%	24%
50th percentile	23%	26%	20%	26%	20%	20%
95th percentile	146%	60%	169%	148%	139%	145%
98th percentile	188%	61%	400%	400%	188%	188%
100th percentile	400%	61%	400%	400%	188%	188%
Generators						
Proportional use of SDA	10%					

Source: AEMO and PwC Analysis

Figure 7.3.1.d. – Summary of Values Held in SDA Accounts by Prudential Regime Process

7.3.2 FOA Quantitative Analysis

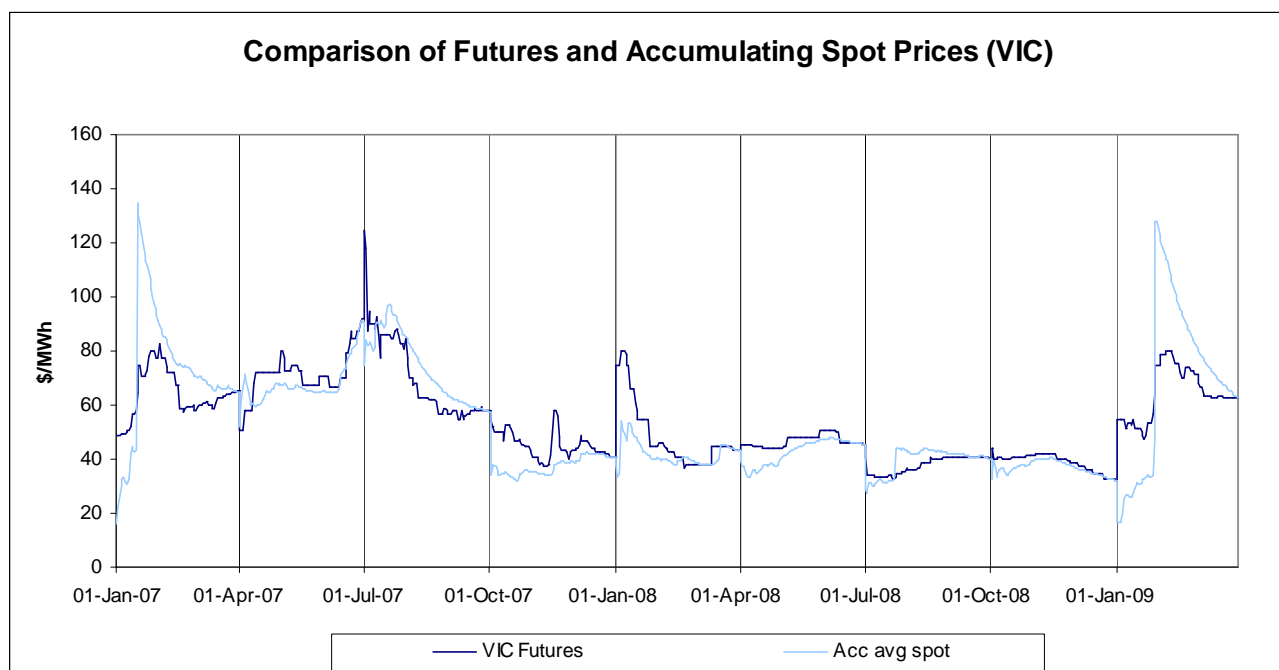
NEM Spot Market Pricing over FOA Exposure Period



Source: AEMO and PwC Analysis

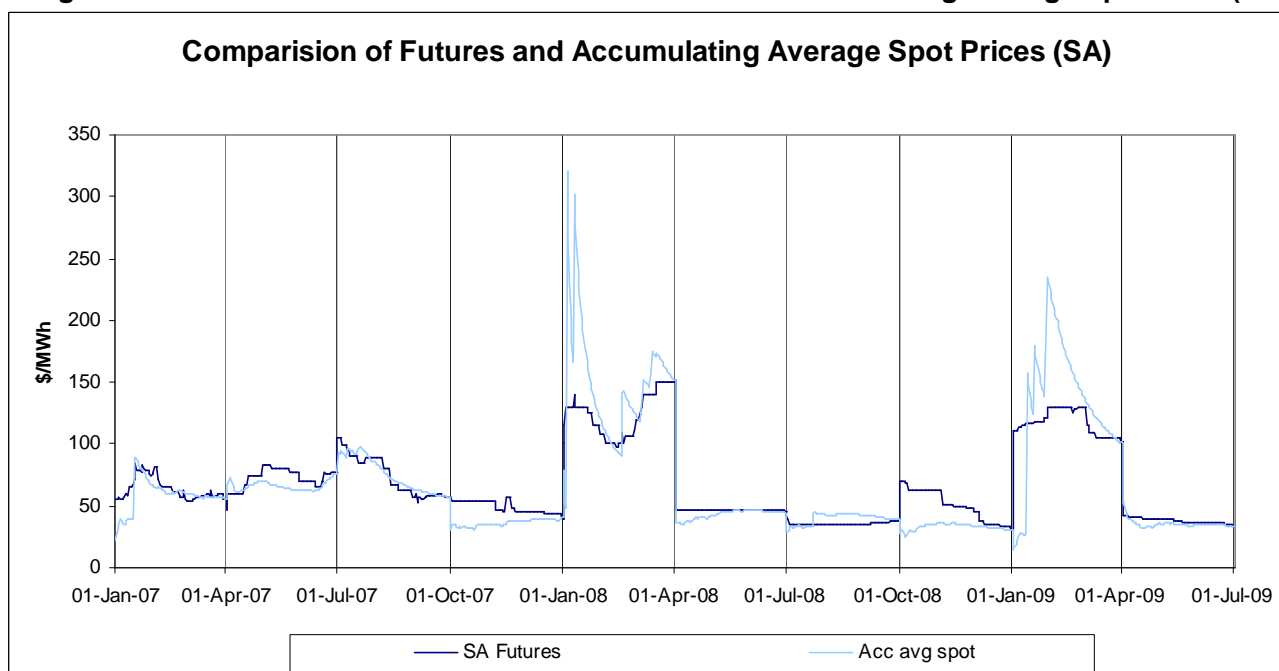
Figure.7.3.2.a – Historic Prices over FOA Termination Risk Period

Correlations between Futures Prices and Accumulating Average Spot Price by State



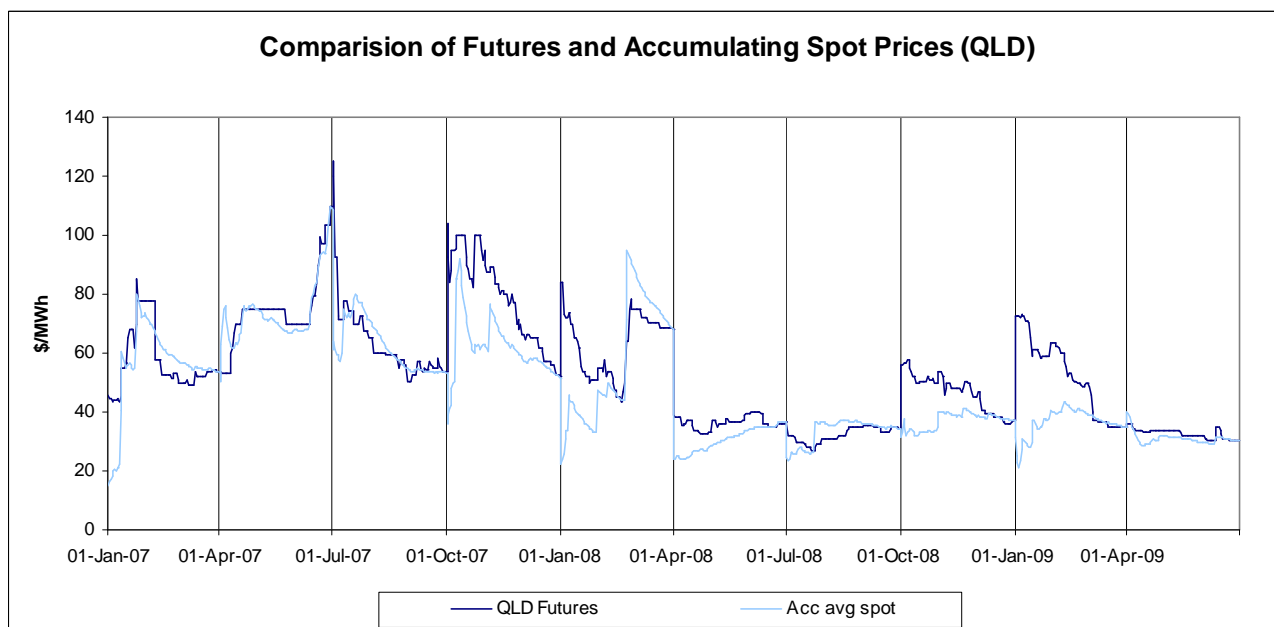
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.b Correlations between Futures Prices and Accumulating Average Spot Price (VIC)



Source: AEMO, d-cypha trade and PwC Analysis

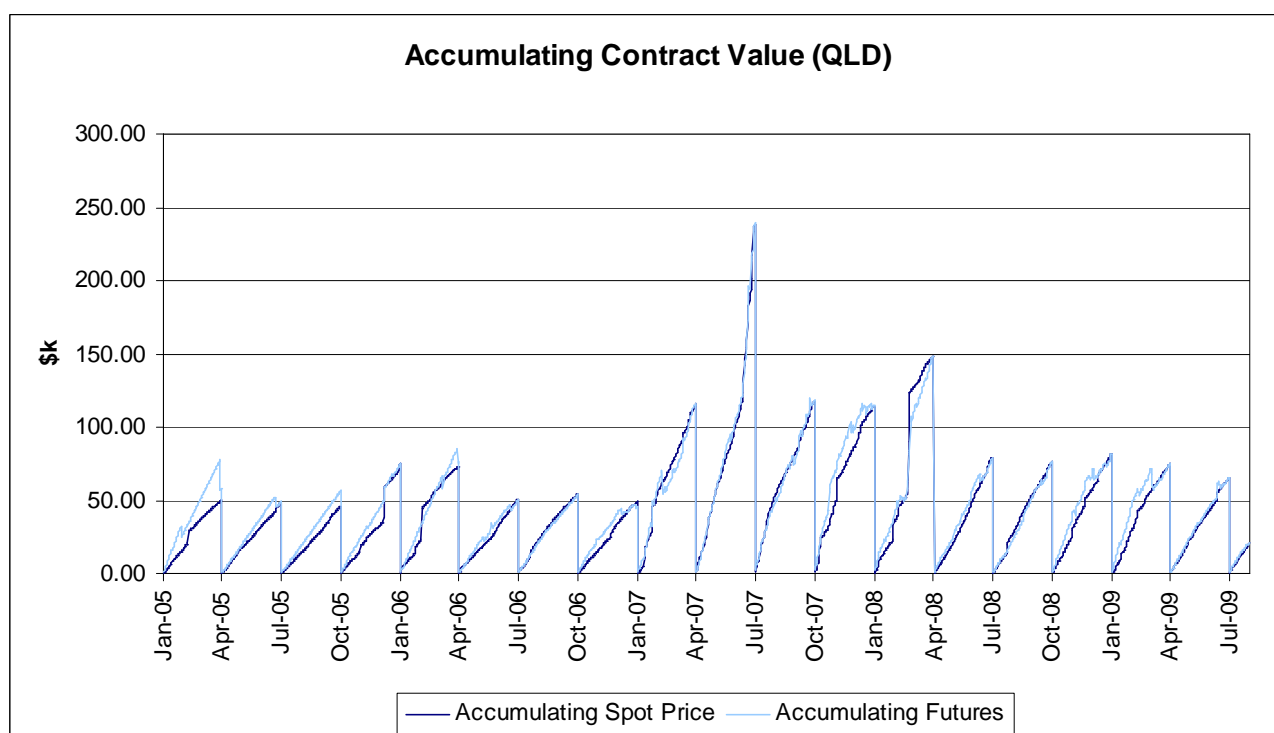
Figure 7.3.2.c Correlations between Futures Prices and Accumulating Average Spot Price (SA)



Source: AEMO, d-cypha trade and PwC Analysis

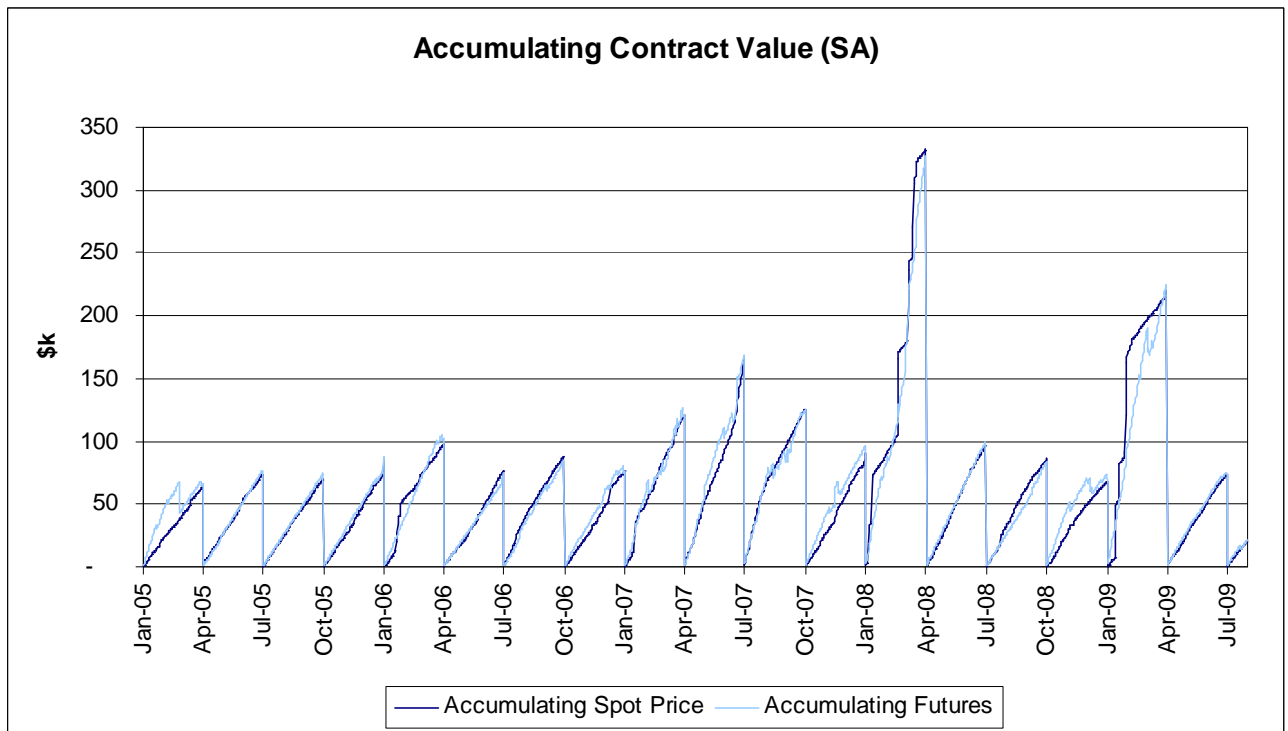
Figure 7.3.2.d Correlations between Futures Prices and Accumulating Average Spot Price (QLD)

Comparisons of Accumulating Contract Values by State



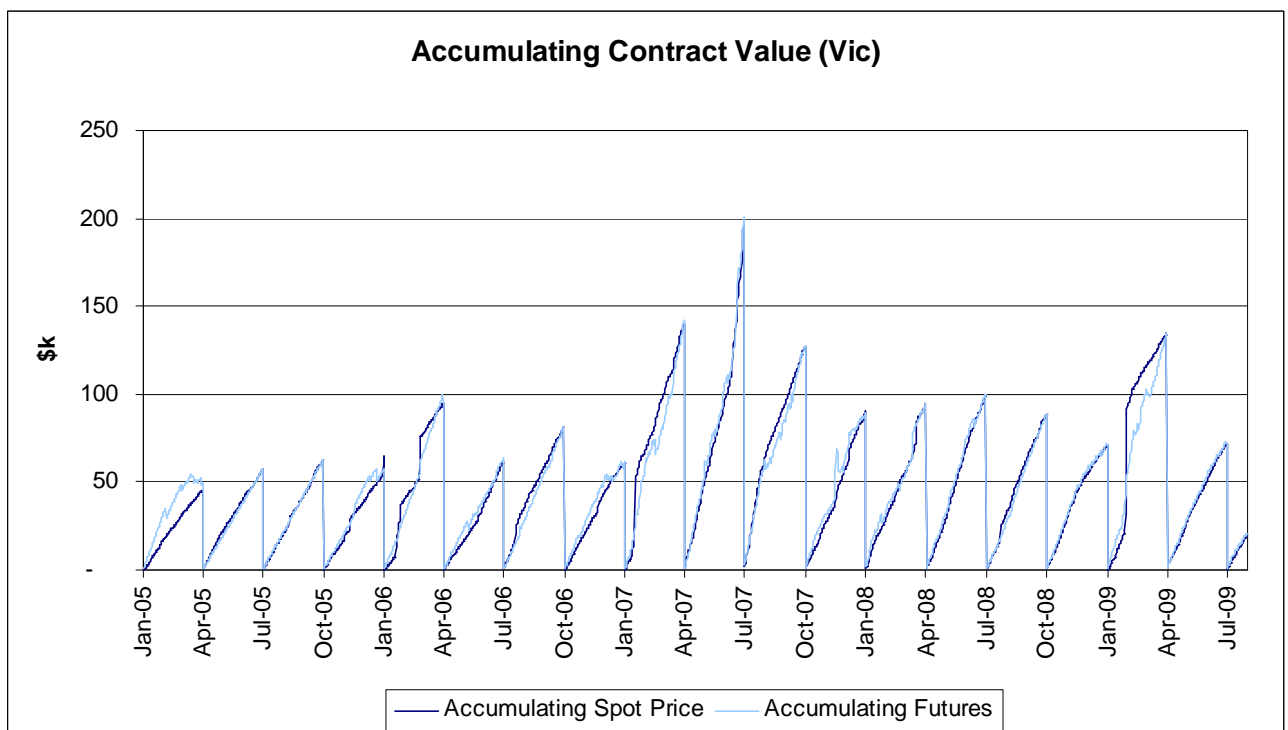
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.e Comparison of Accumulating Contract Value (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

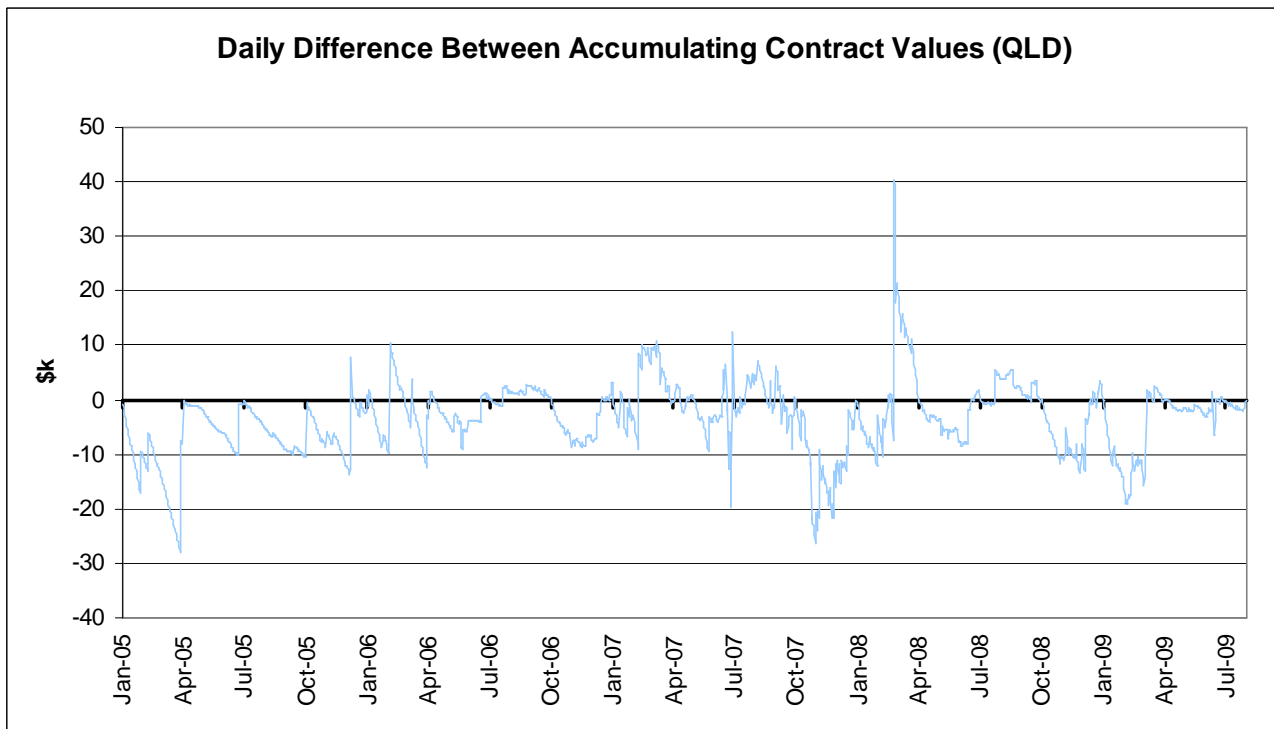
Figure 7.3.2.f Comparison of Accumulating Contract Value (SA)



Source: AEMO, d-cypha trade and PwC Analysis

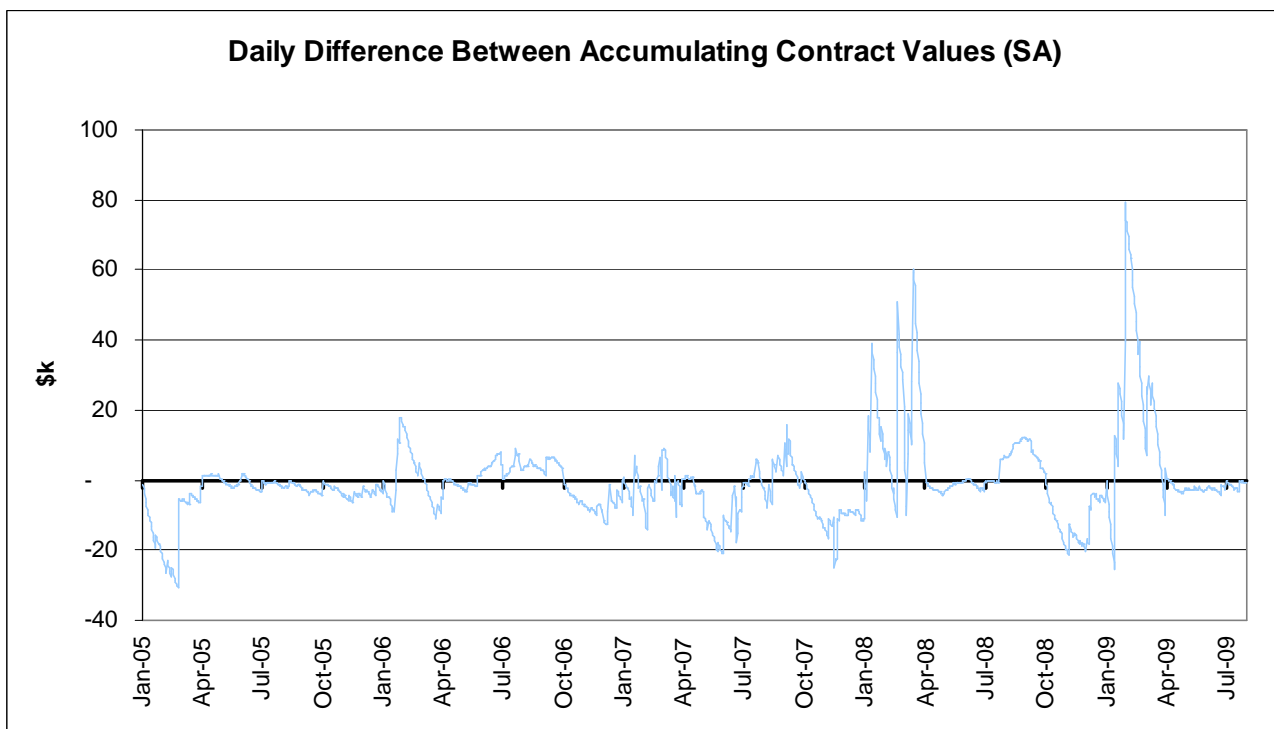
Figure 7.3.2.g Comparison of Accumulating Contract Value (VIC)

Delta between Accumulating Contract Values by State



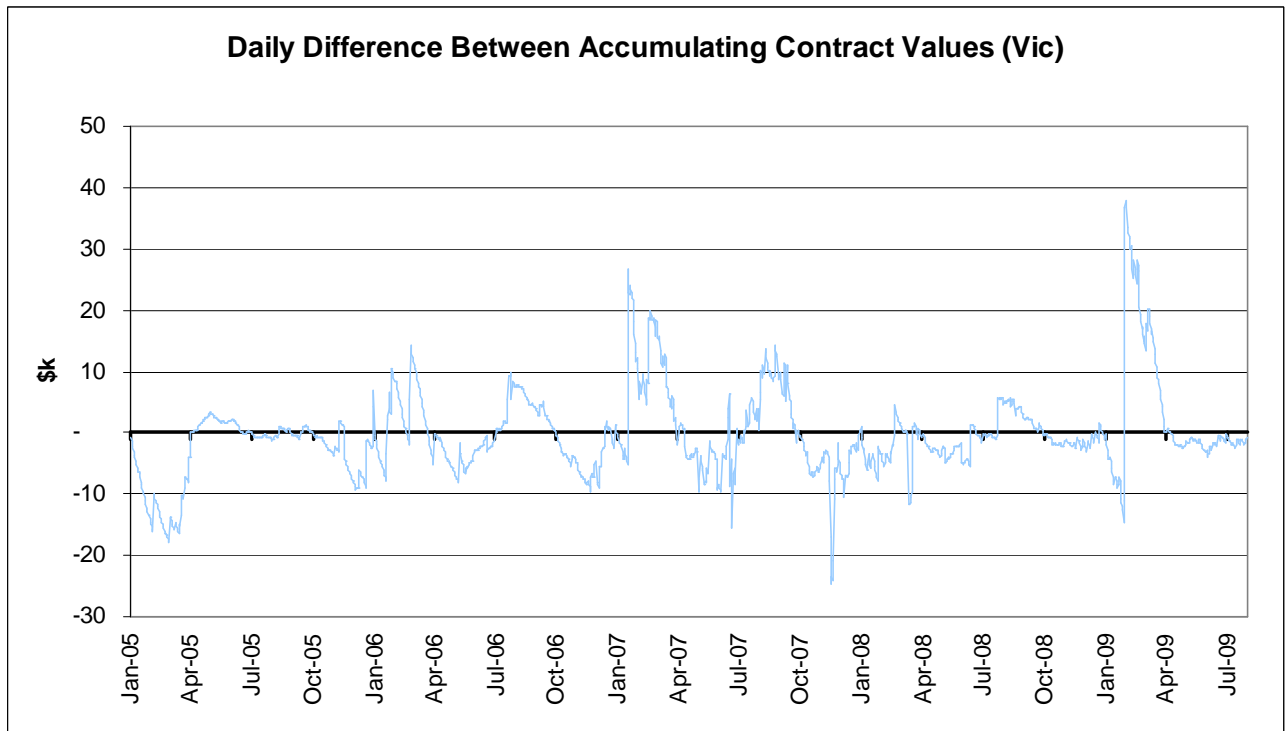
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.h Daily difference between Accumulating Contract Values (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

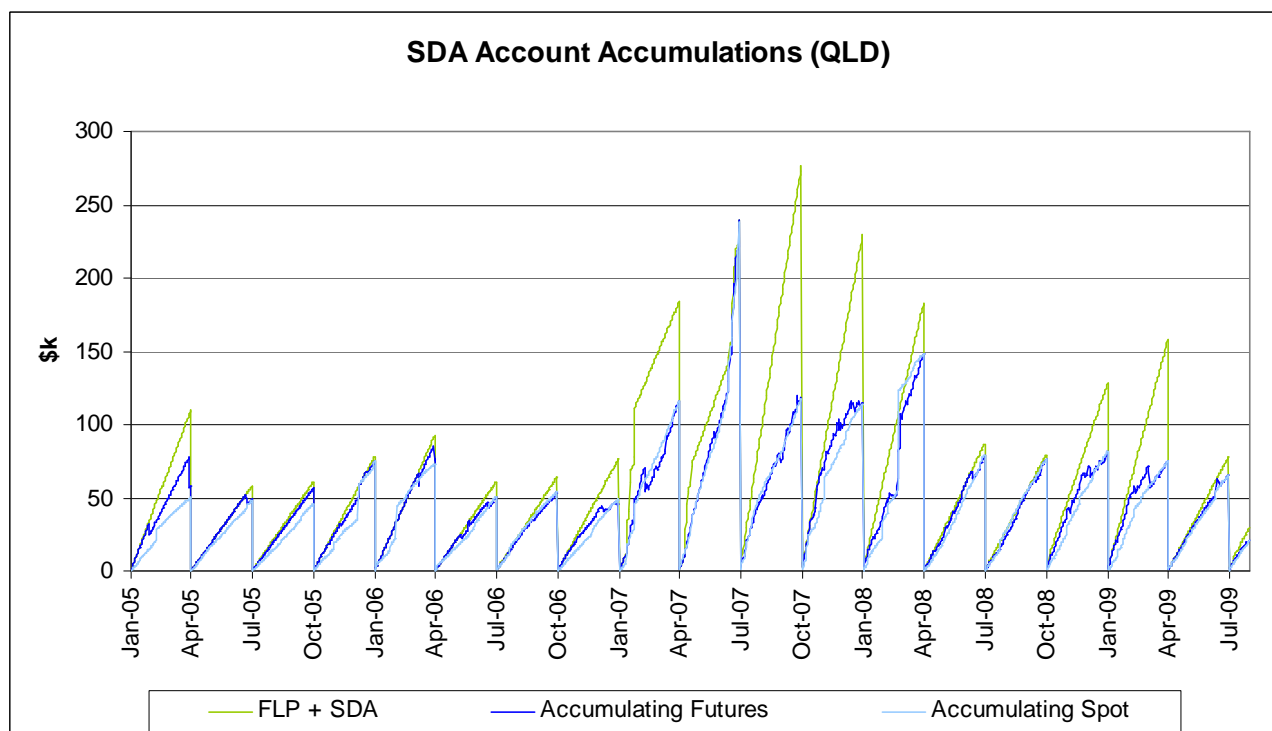
Figure 7.3.2.i Daily difference between Accumulating Contract Values (SA)



Source: AEMO, d-cypha trade and PwC Analysis

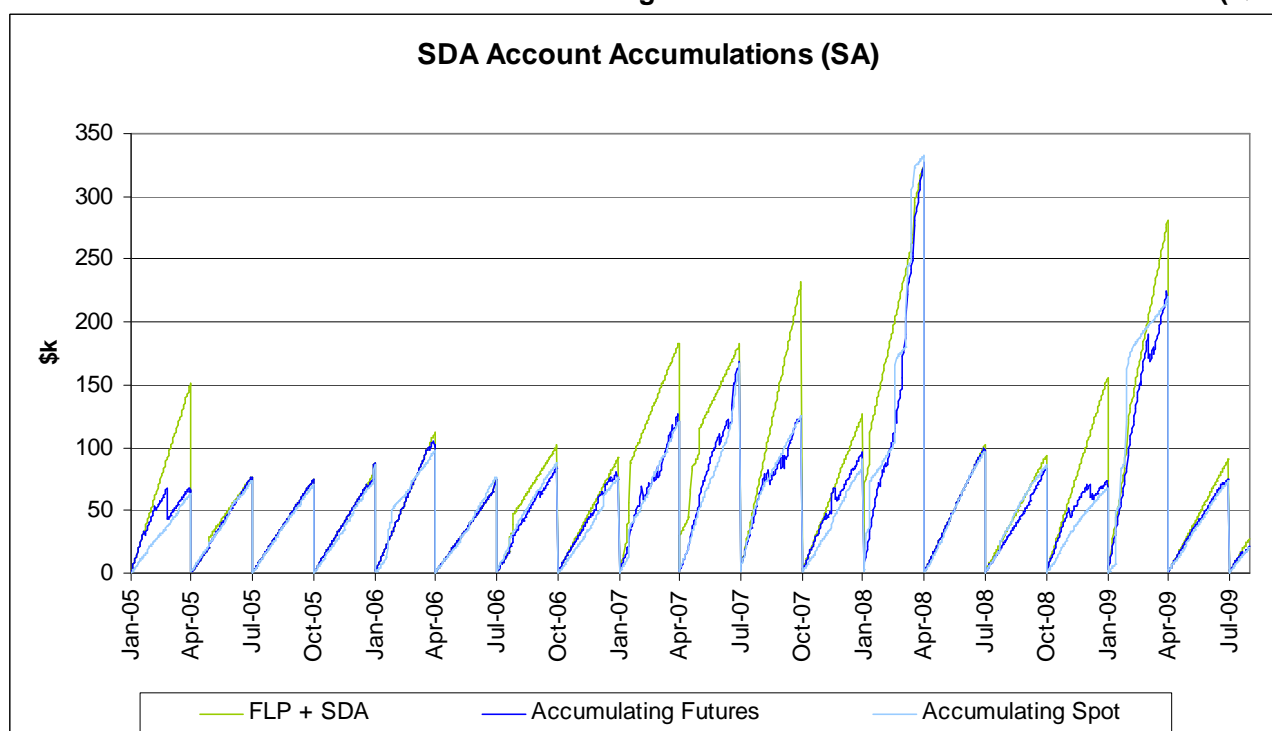
Figure 7.3.2.j Daily difference between Accumulating Contract Values (Vic)

SDA Account Accumulations by State



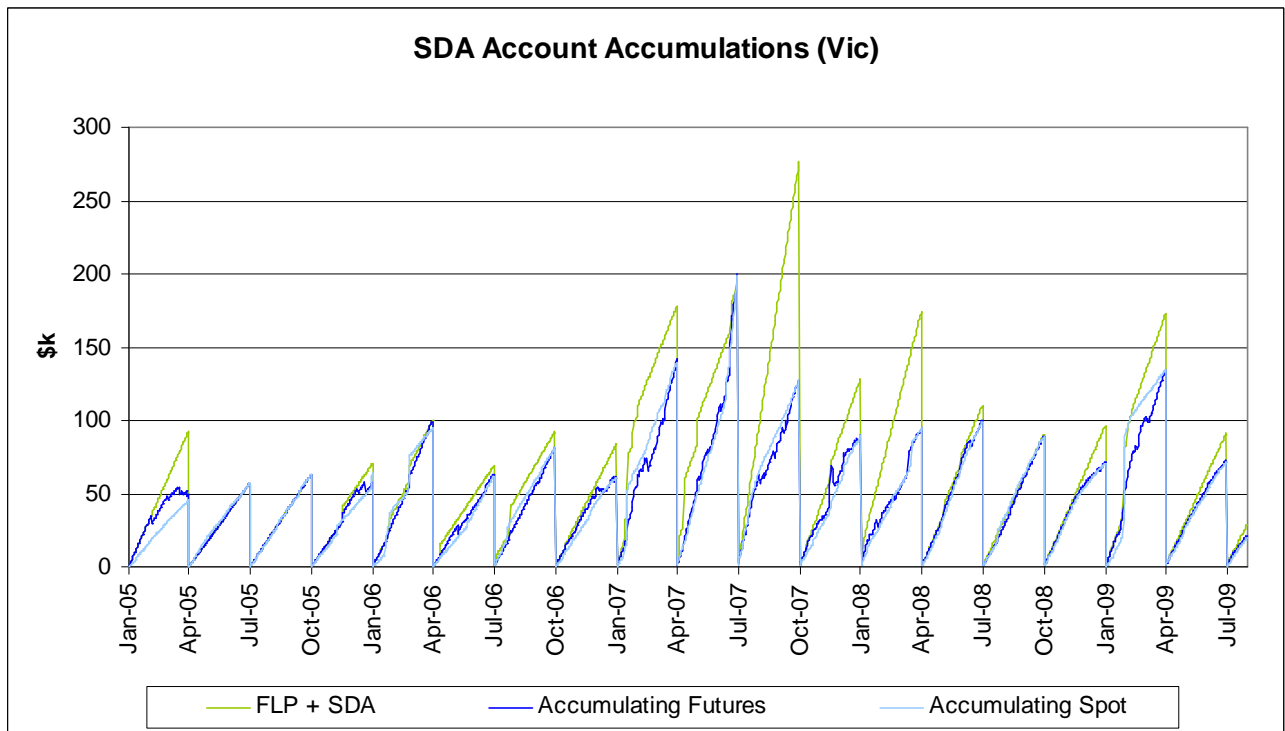
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.k – SDA Account Accumulations (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

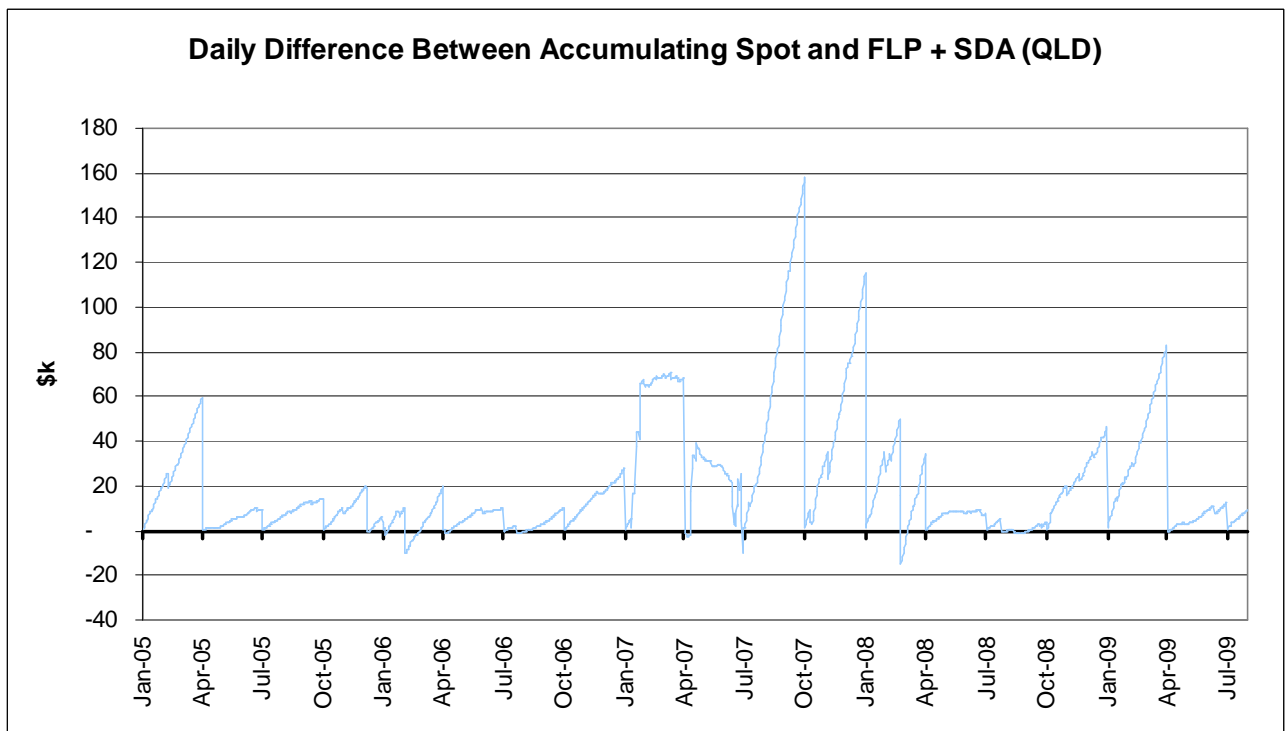
Figure 7.3.2.l – SDA Account Accumulations (SA)



Source: AEMO, d-cypha trade and PwC Analysis

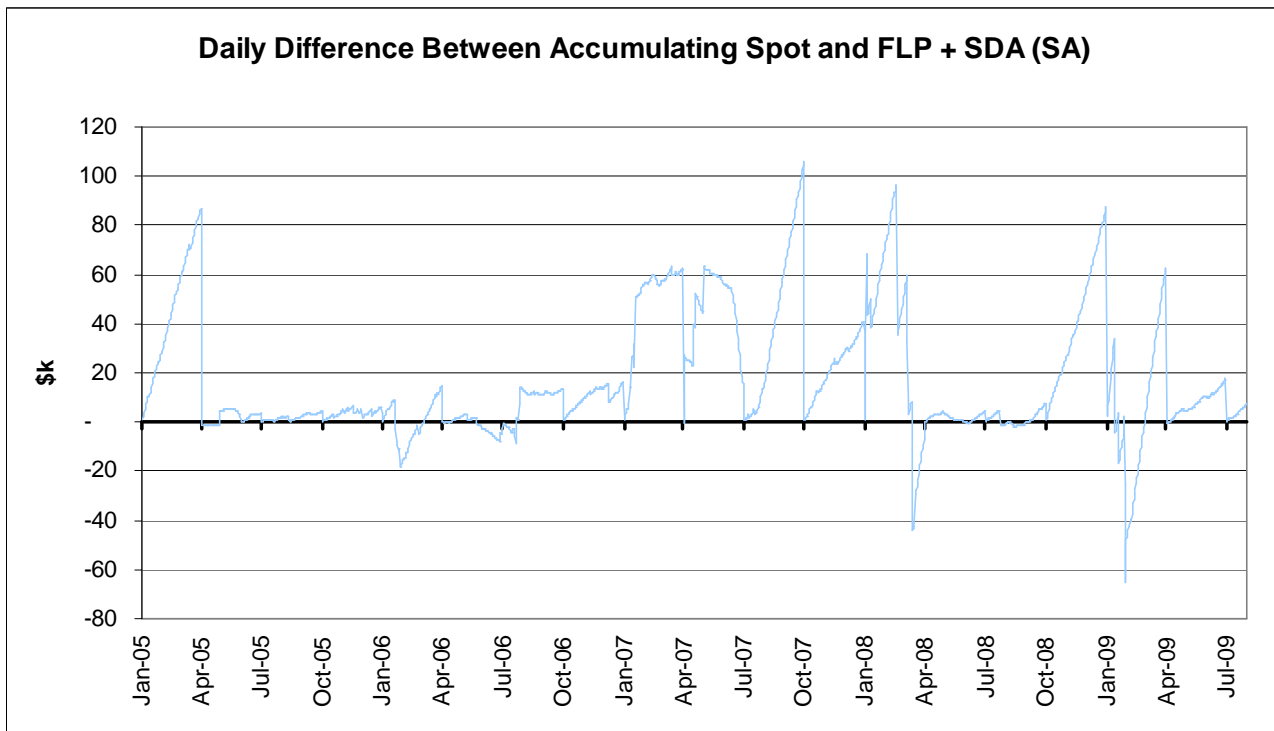
Figure 7.3.2.m – SDA Account Accumulations (Vic)

Difference between Accumulating Spot and FLP + SDA Accumulations



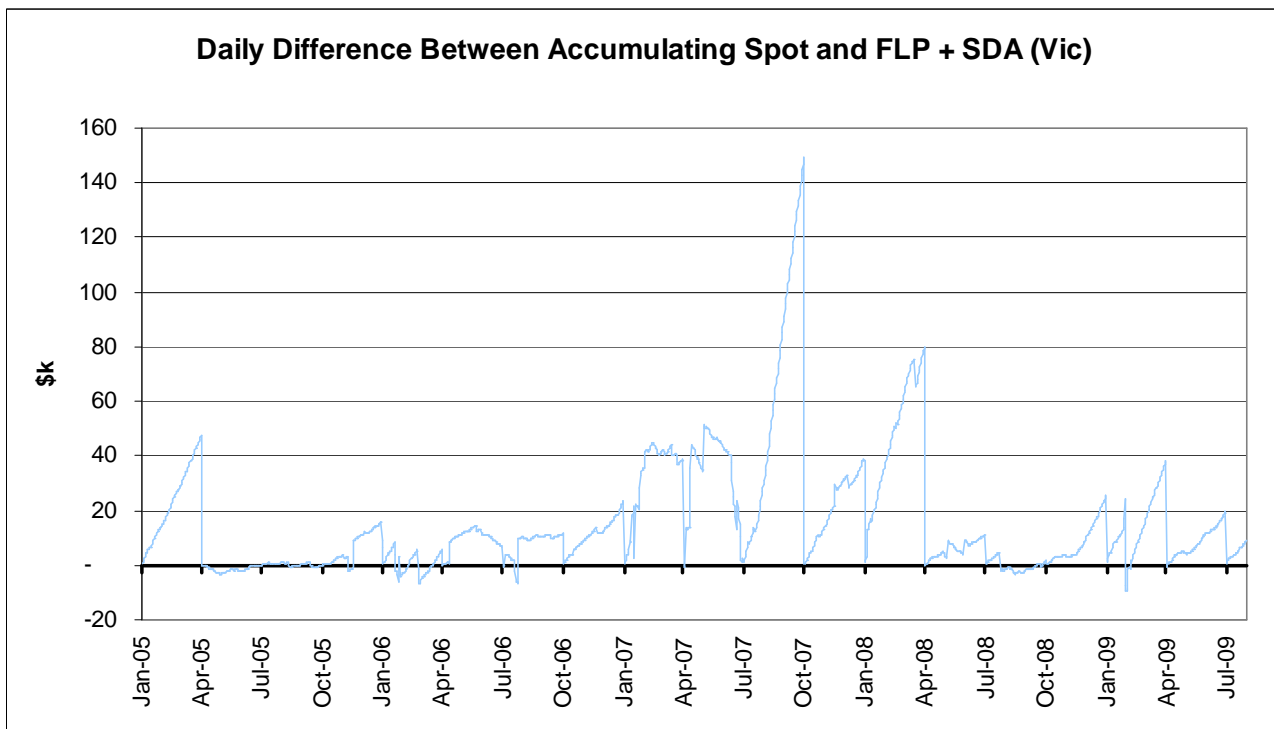
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.n – Difference between Accumulating Spot and FLP + SDA (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

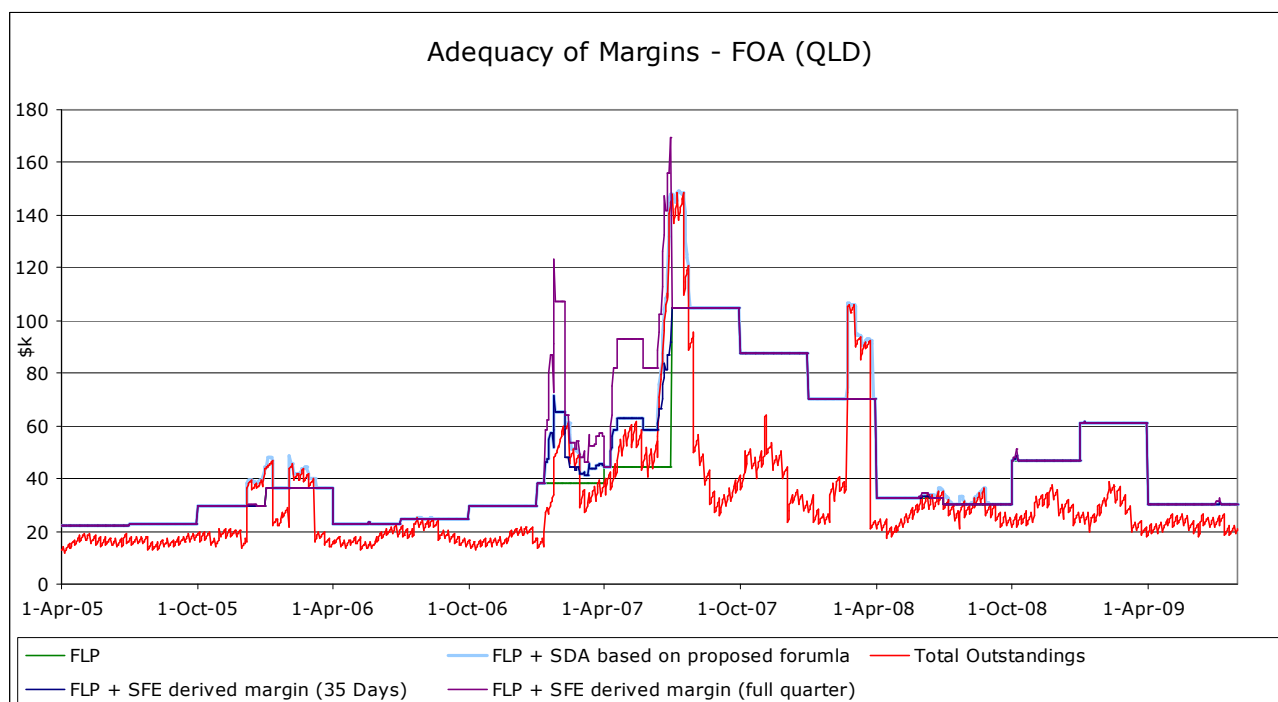
Figure 7.3.2.m – Difference between Accumulating Spot and FLP + SDA (SA)



Source: AEMO, d-cypha trade and PwC Analysis

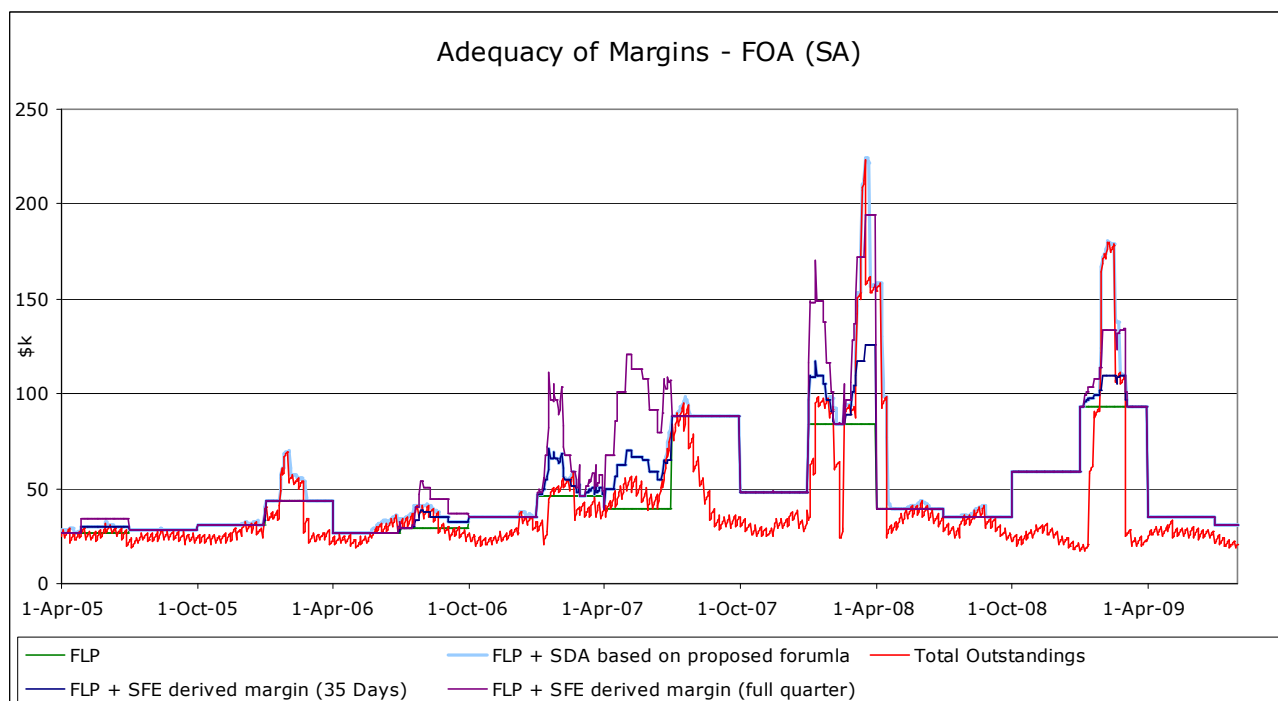
Figure 7.3.2.o – Difference between Accumulating Spot and FLP + SDA (Vic)

Comparison between FLP + SDA and Total Outstandings



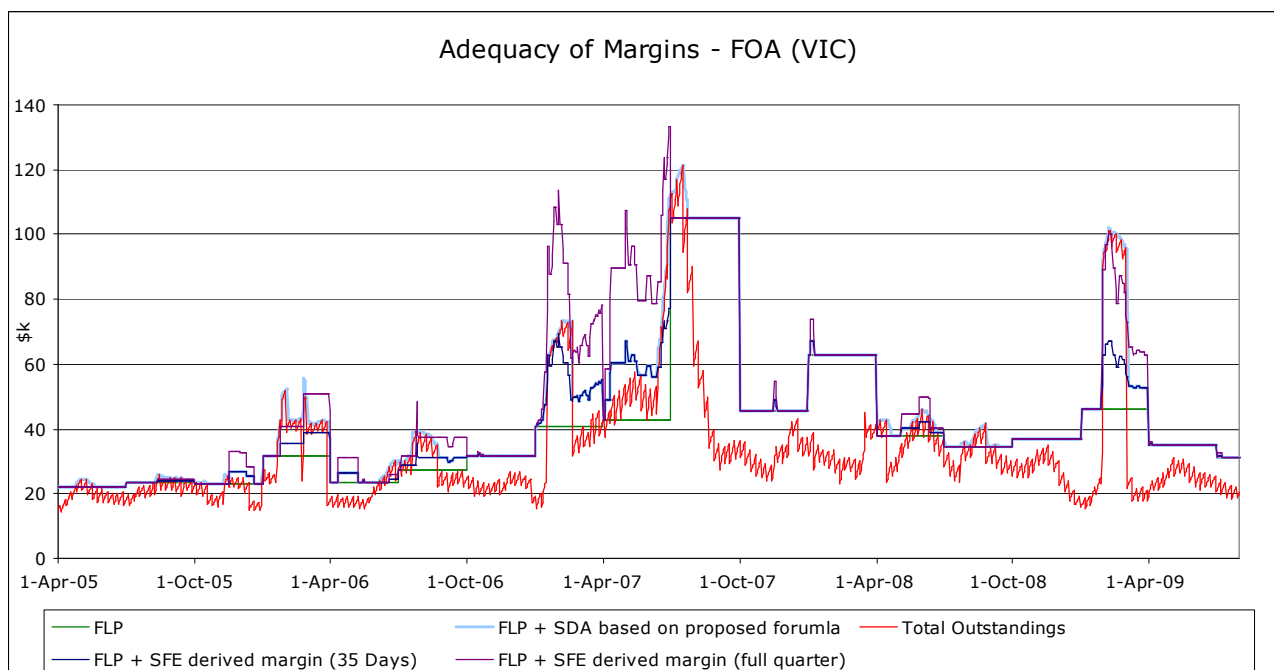
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.p – Comparison between FLP + SDA and Total Outstandings (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

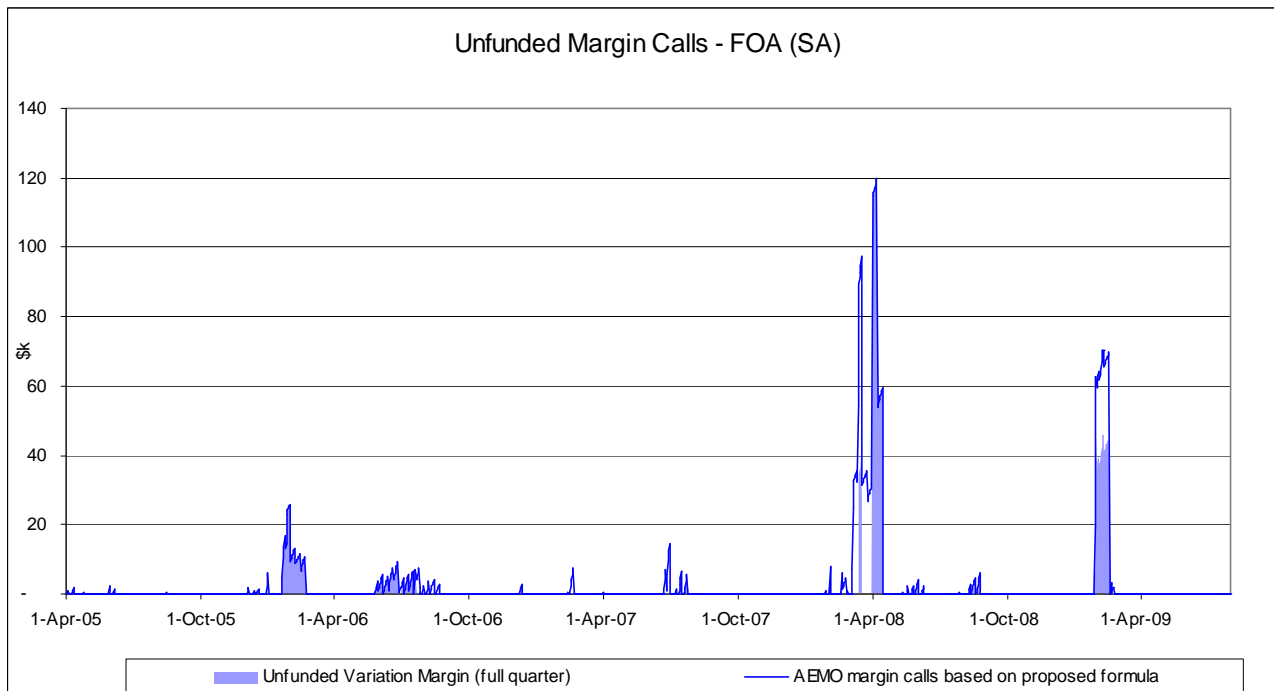
Figure 7.3.2.q – Comparison between FLP + SDA and Total Outstandings (SA)



Source: AEMO, d-cypha trade and PwC Analysis

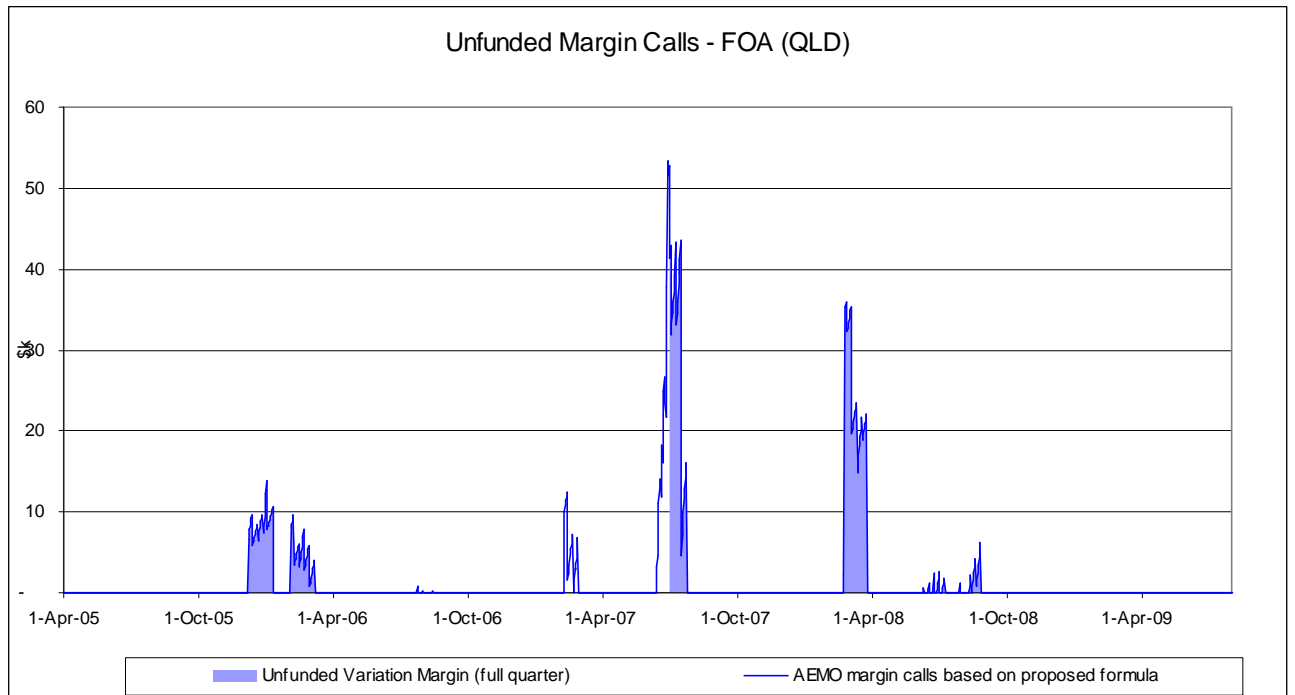
Figure 7.3.2.r – Comparison between FLP + SDA and Total Outstandings (Vic)

Unfunded FOA Margin Calls



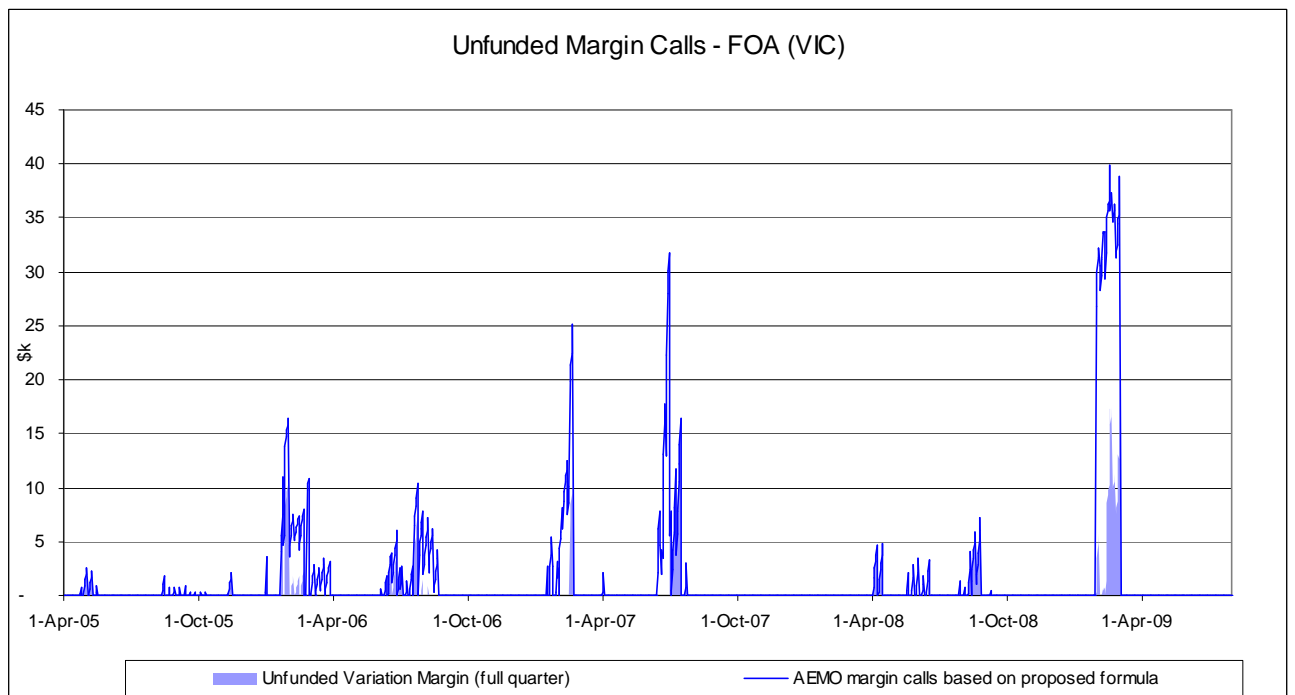
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.s – Unfunded FOA Margin Calls (SA)



Source: AEMO, d-cypha trade and PwC Analysis

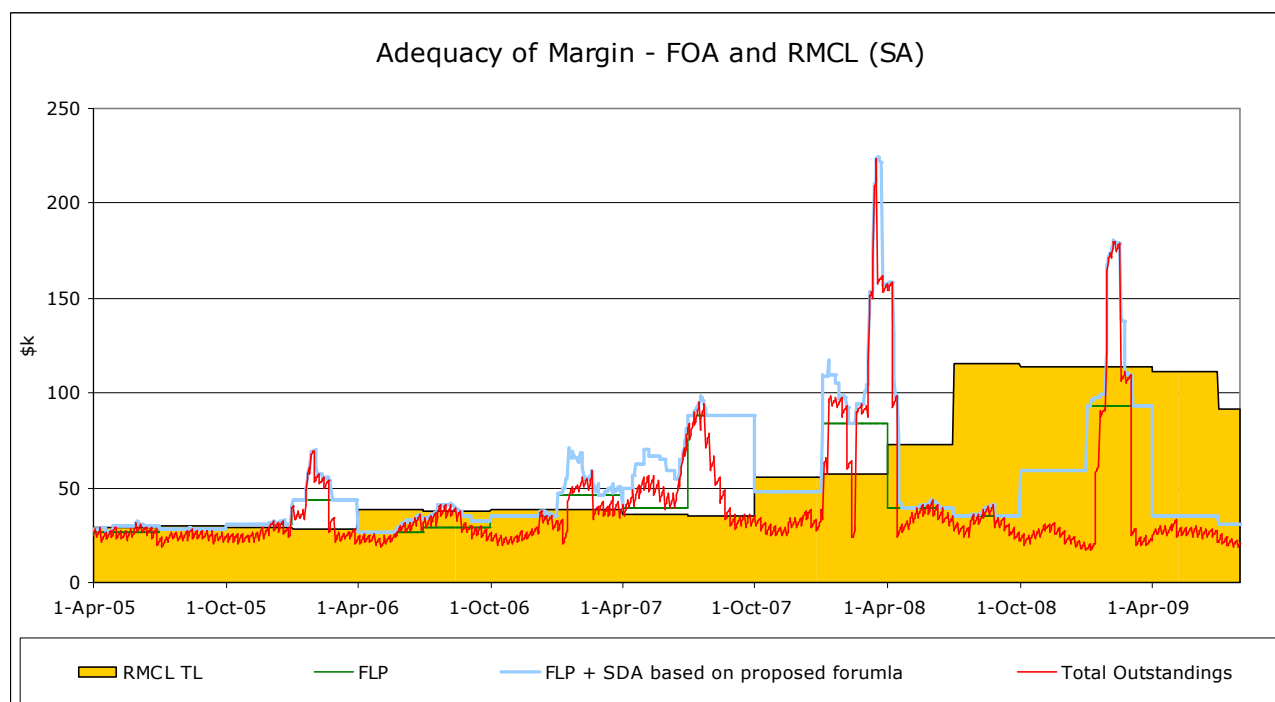
Figure 7.3.2.t – Unfunded FOA Margin Calls (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

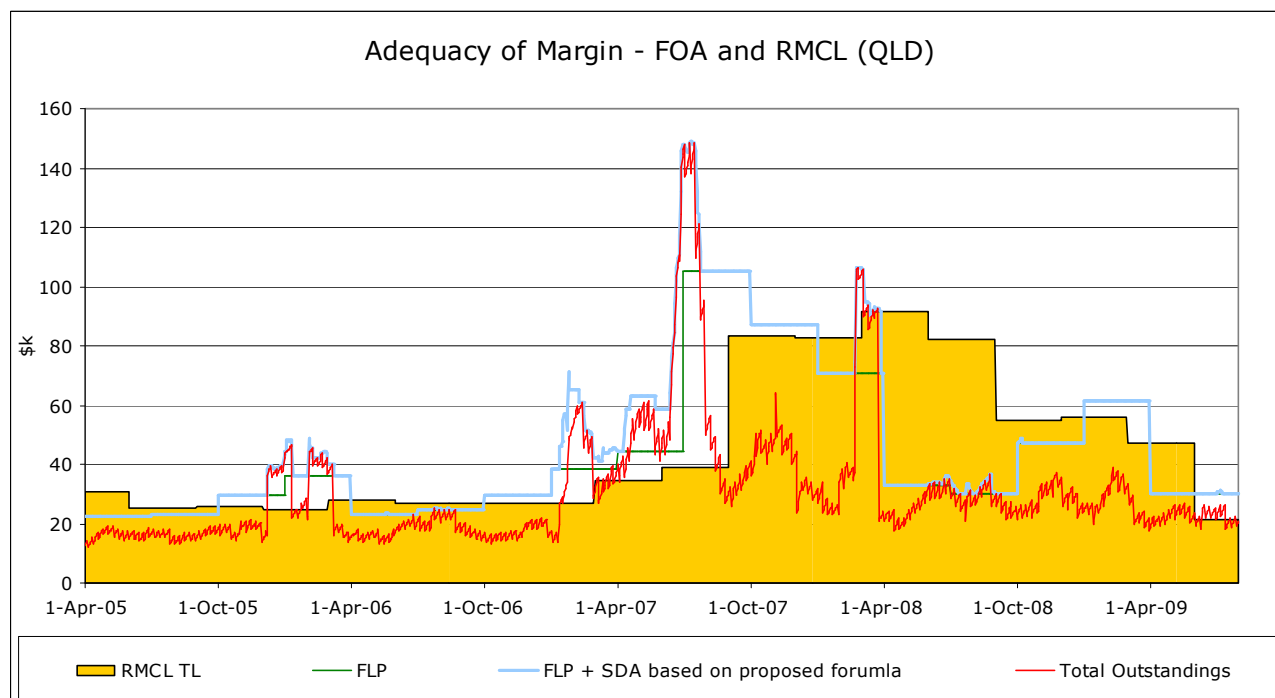
Figure 7.3.2.u – Unfunded FOA Margin Calls (VIC)

Adequacy of Margins, Comparison of FAO and RMCL



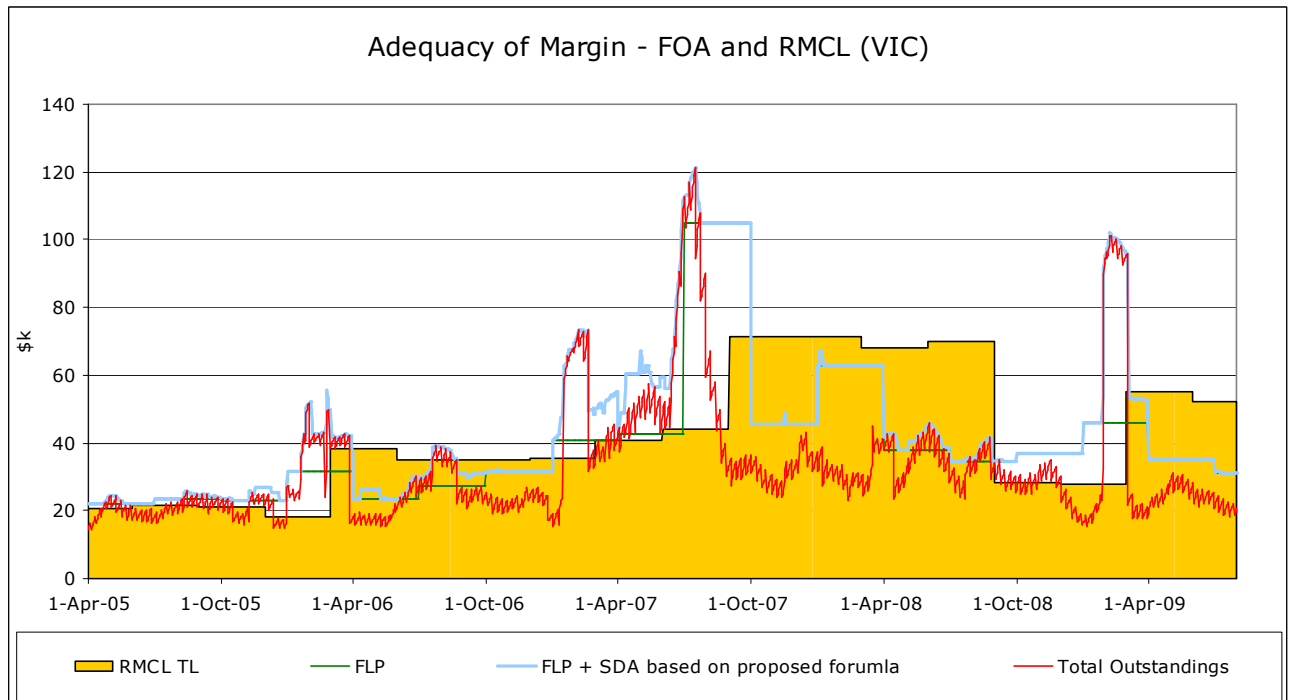
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.v – Adequacy of Margins – Comparison of FOA and RMCL (SA)



Source: AEMO, d-cypha trade and PwC Analysis

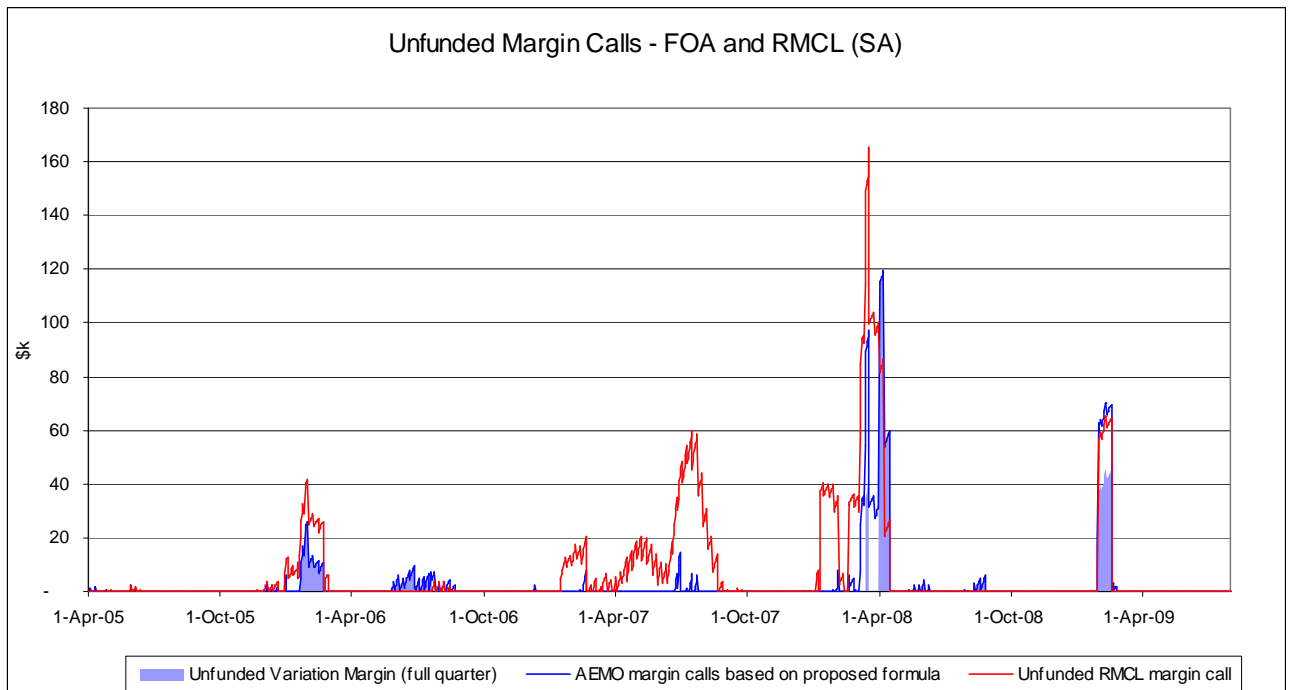
Figure 7.3.2.w – Adequacy of Margins – Comparison of FOA and RMCL (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

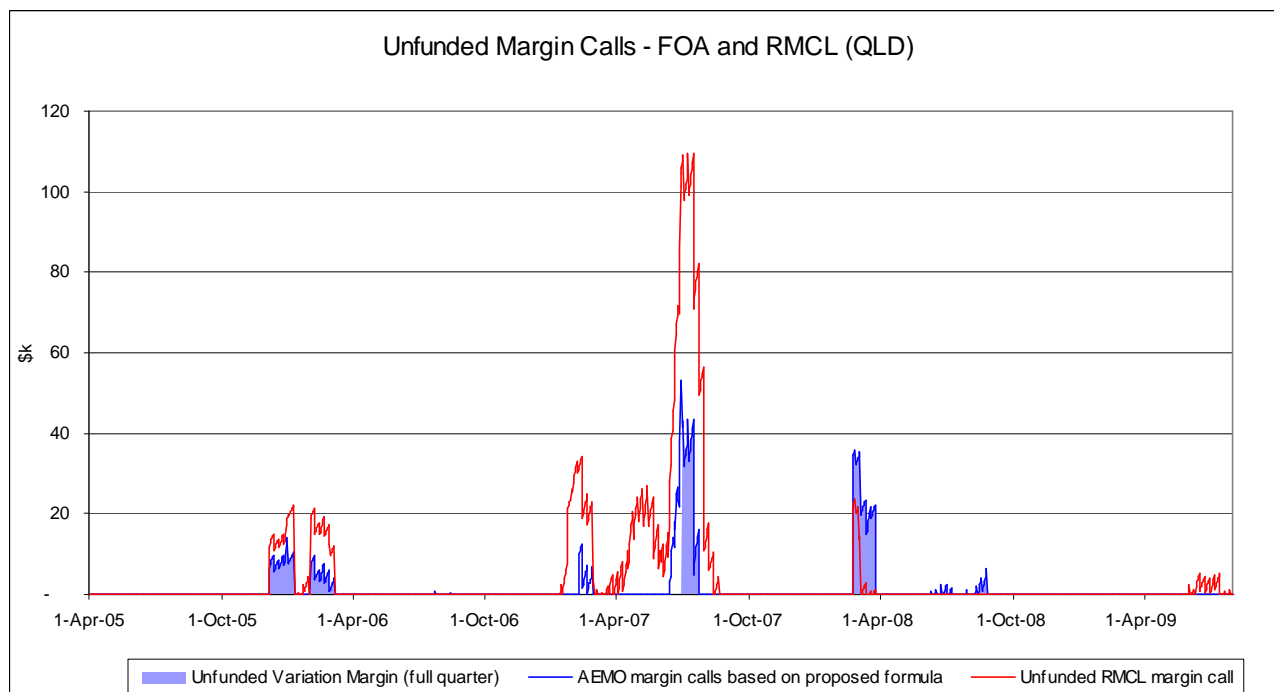
Figure 7.3.2.x – Adequacy of Margins – Comparison of FOA and RMCL (VIC)

Unfunded Margin Calls – Comparison of FOA and RMCL



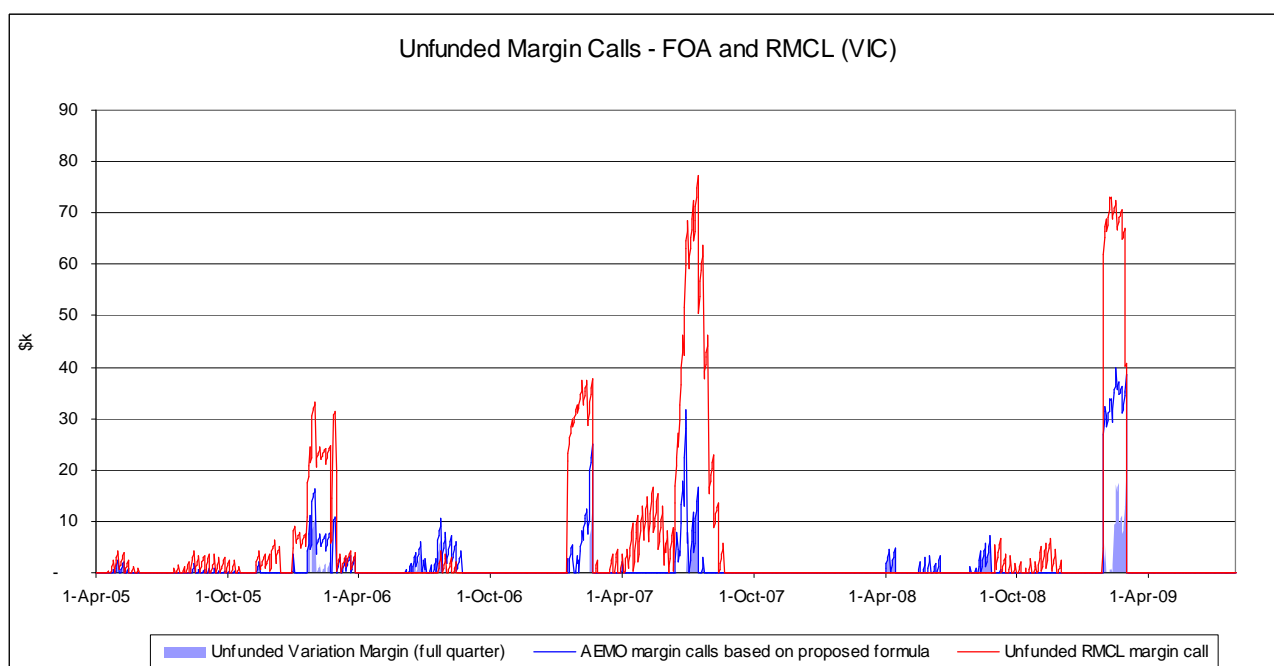
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.y – Unfunded Margin Calls - Comparison of FOA and RMCL – (SA)



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.z – Unfunded Margin Calls - Comparison of FOA and RMCL – (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.aa – Unfunded Margin Calls - Comparison of FOA and RMCL – (Vic)

RMCL	2005	2006	2007	2008	2009
Unfunded TL breaches per year	30	73	205	95	20
Average value of TL breach (\$k)	2	15	17	55	58
Total value of TL breaches	71	1110	3523	5193	1159
Max	12	41	60	166	65

Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.bb – Summary of Unfunded Margin Calls RMCL - SA

RMCL	2005	2006	2007	2008	2009
Unfunded TL breaches per year	26	52	200	19	41
Average value of TL breach (\$k)	14	14	29	11	2
Total value of TL breaches	358	730	5797	205	100
Max	19	22	110	24	5

Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.cc – Summary of Unfunded Margin Calls RMCL - QLD

RMCL	2005	2006	2007	2008	2009
Unfunded TL breaches per year	126	104	186	62	34
Average value of TL breach (\$k)	2	11	23	2	65
Total value of TL breaches	269	1159	4315	154	2217
Max	9	33	77	7	73

Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.dd – Summary of Unfunded Margin Calls RMCL - VIC

FOA	2005	2006	2007	2008	2009
Unfunded TL breaches per year	17	87	10	50	20
Average value of TL breach (\$k)	1	7	3	29	40
Total value of TL breaches	15	613	29	1468	809
Max	2	26	7	120	50

Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.ee – Summary of Unfunded Margin Calls FOA - SA

FOA	2005	2006	2007	2008	2009
Unfunded TL breaches per year	26	46	23	59	0
Average value of TL breach (\$k)	8	5	30	14	N/A
Total value of TL breaches	213	243	682	823	0
Max	14	11	44	36	0

Source: AEMO, d-cypha trade and PwC Analysis

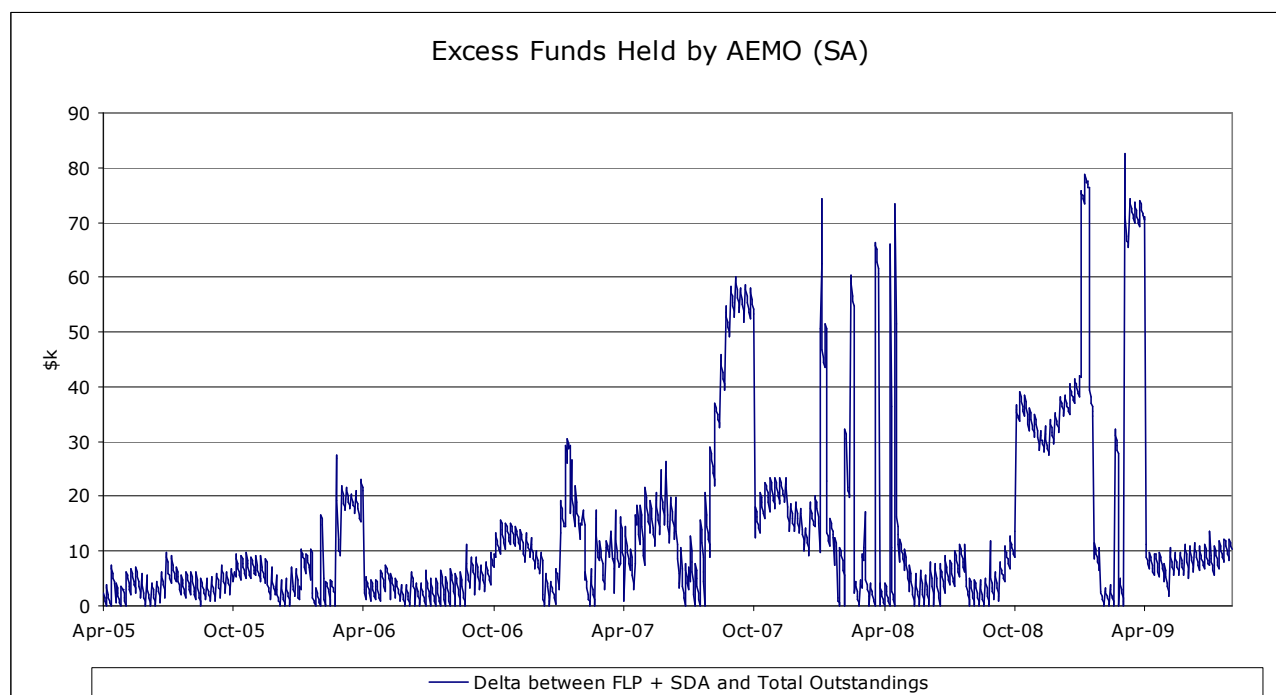
Figure 4.4.1.ff – Summary of Unfunded Margin Calls FOA - QLD

FOA	2005	2006	2007	2008	2009
Unfunded TL breaches per year	30	51	23	35	28
Average value of TL breach (\$k)	1	3	7	3	9
Total value of TL breaches	29	161	162	96	248
Max	4	11	16	7	21

Source: AEMO, d-cypha trade and PwC Analysis

Figure 4.4.1.gg – Summary of Unfunded Margin Calls FOA - VIC

Funds Held by AEMO in excess of Trading Limit – FOA



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.hh – Funds Held by AEMO in excess of Trading Limit – FOA (SA)

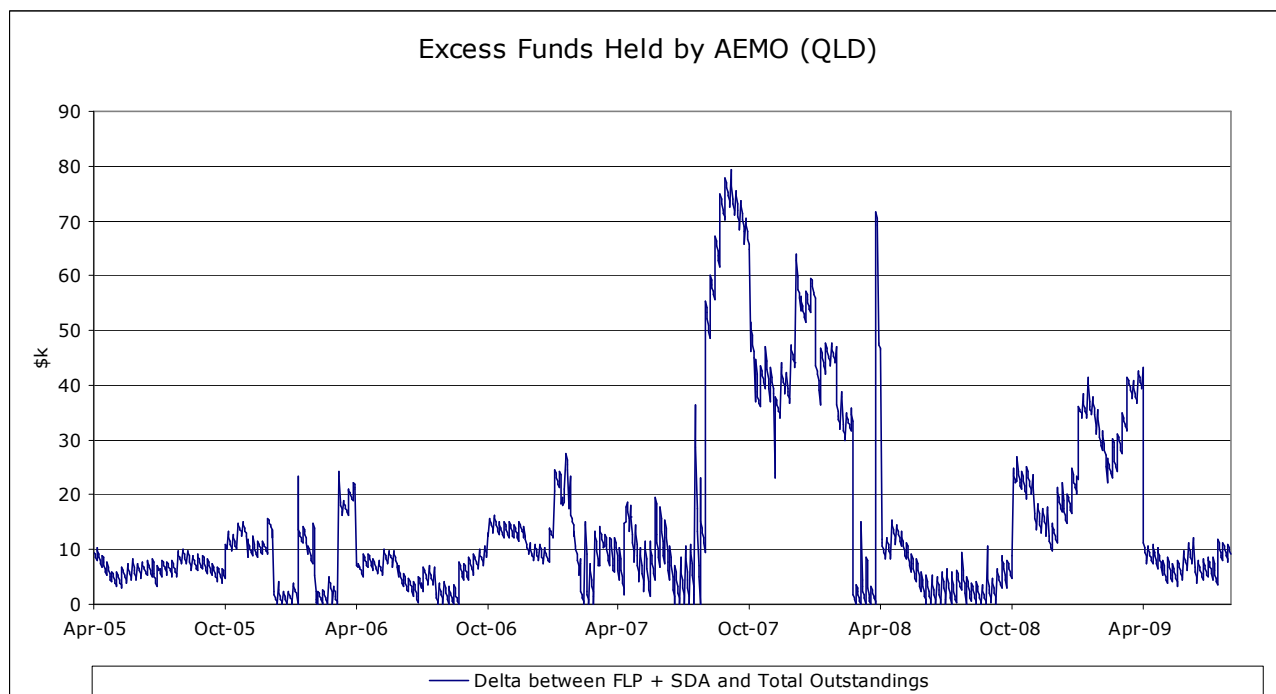
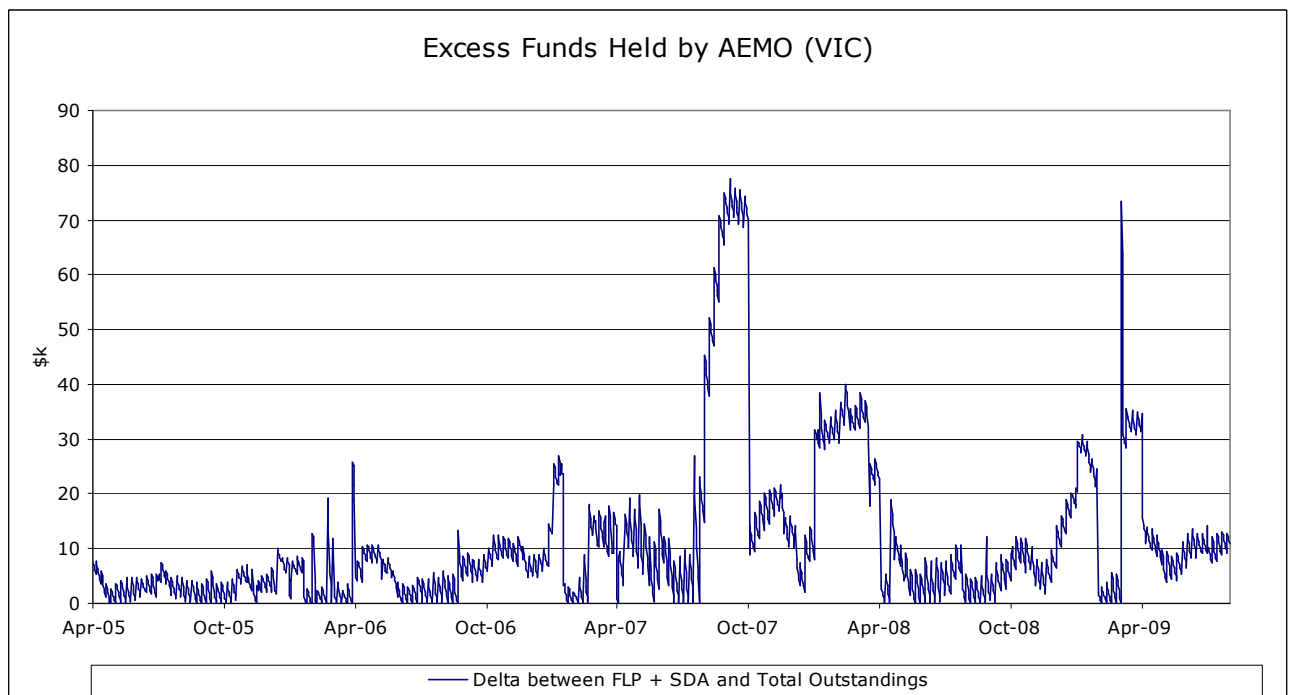


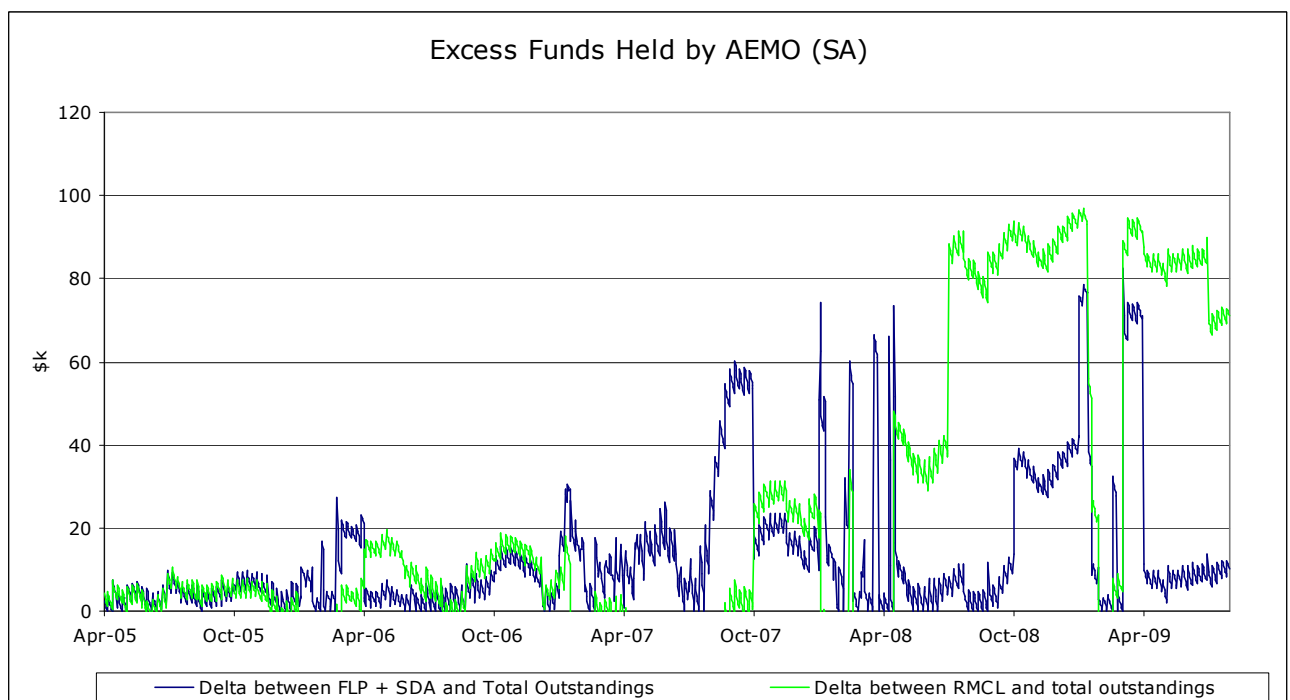
Figure 7.3.2.ii – Funds Held by AEMO in excess of Trading Limit – FOA (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.jj– Funds Held by AEMO in excess of Trading Limit – FOA (Vic)

Funds Held by AEMO in excess of Trading Limit – FOA and RMCL



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.2.kk– Funds Held by AEMO in excess of Trading Limit – FOA and RMCL (SA)

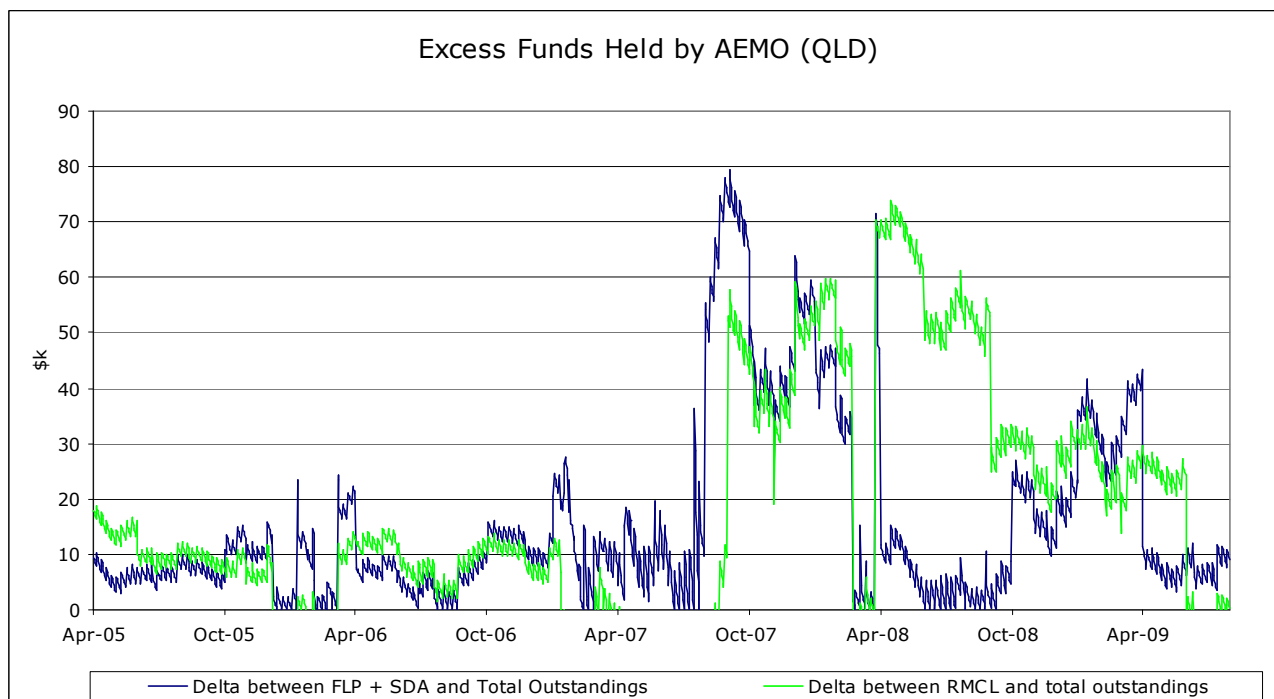


Figure 7.3.2.kk– Funds Held by AEMO in excess of Trading Limit – FOA and RMCL (SA)

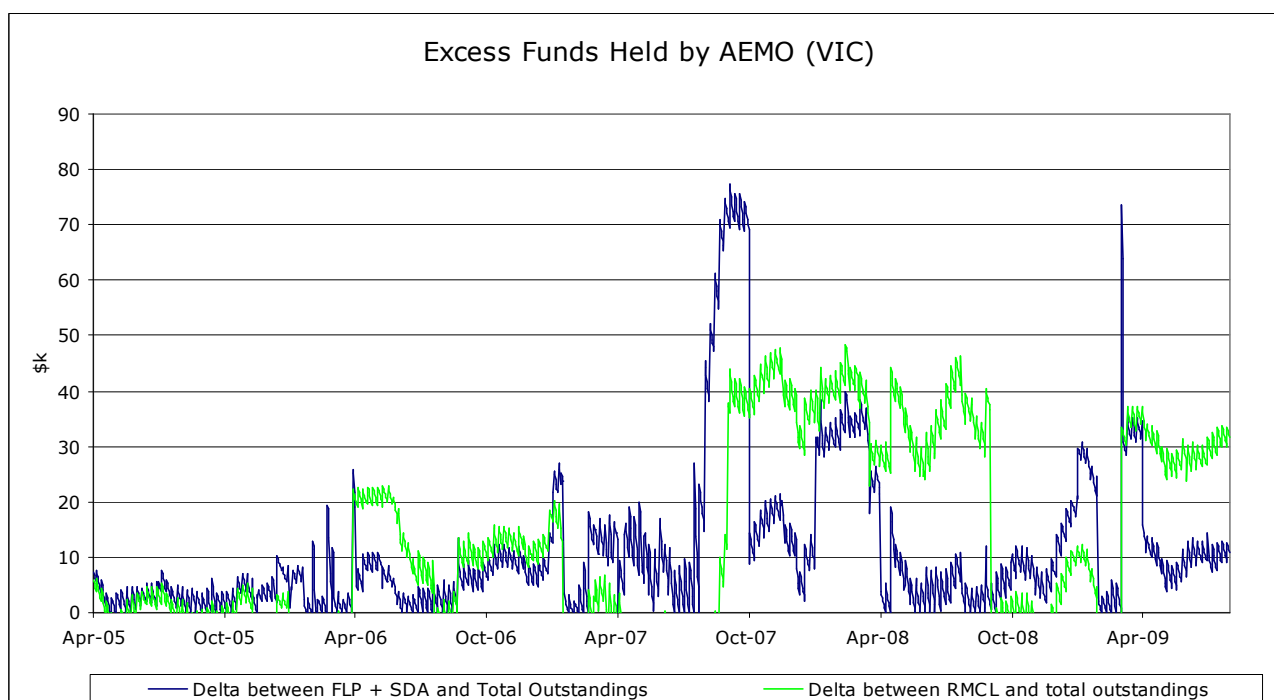
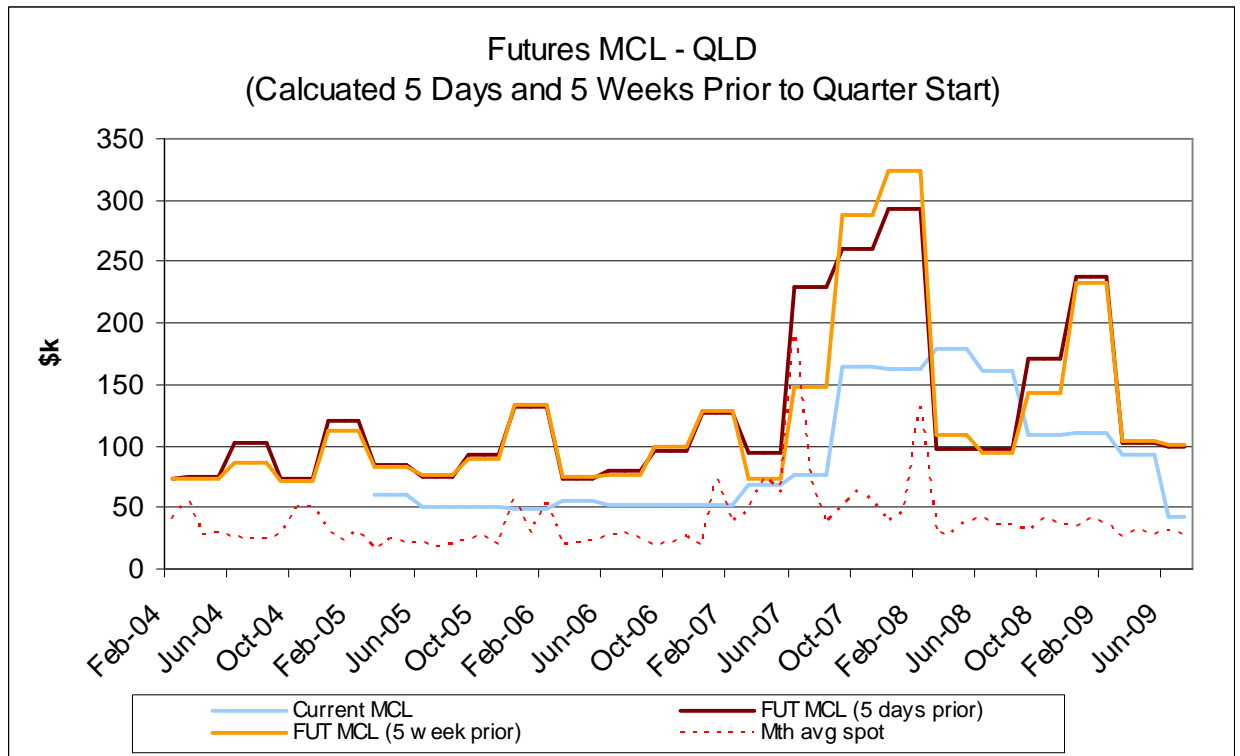


Figure 7.3.2.kk– Funds Held by AEMO in excess of Trading Limit – FOA and RMCL (VIC)

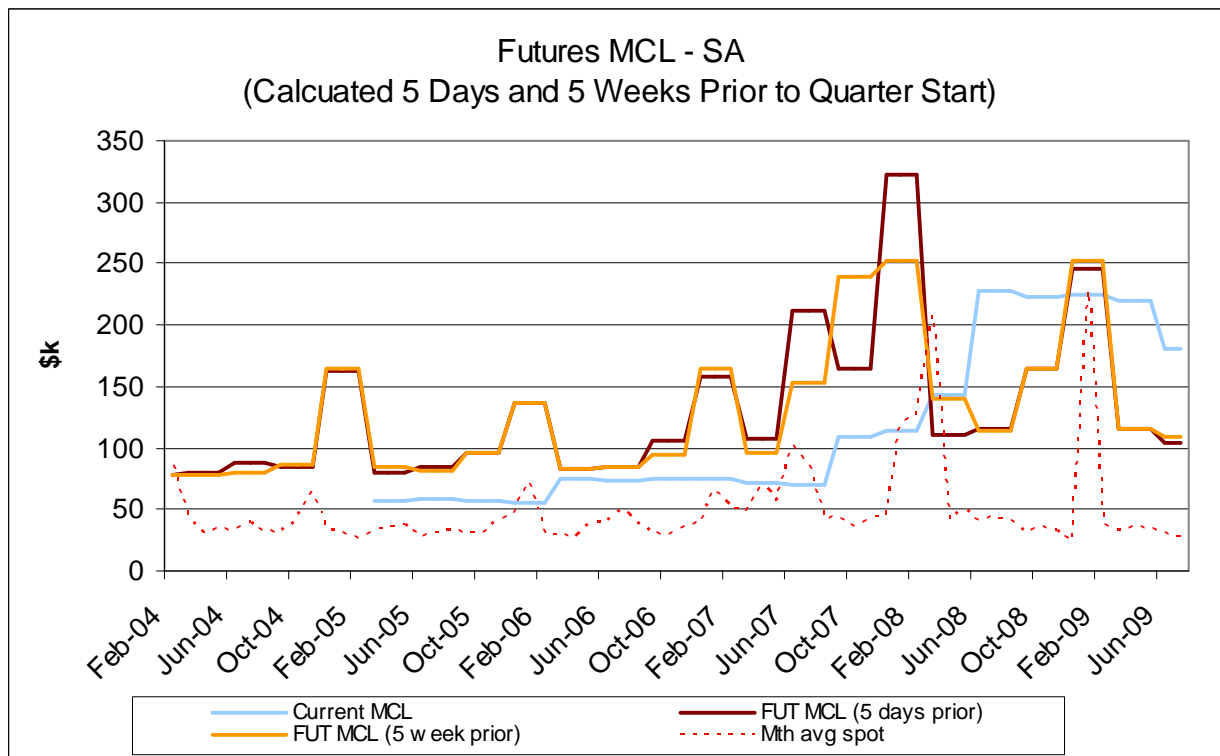
7.3.3 MCL Quantitative Analysis

Impact of Calculating the Futures MCL 5 Weeks Prior to the Start of the Quarter



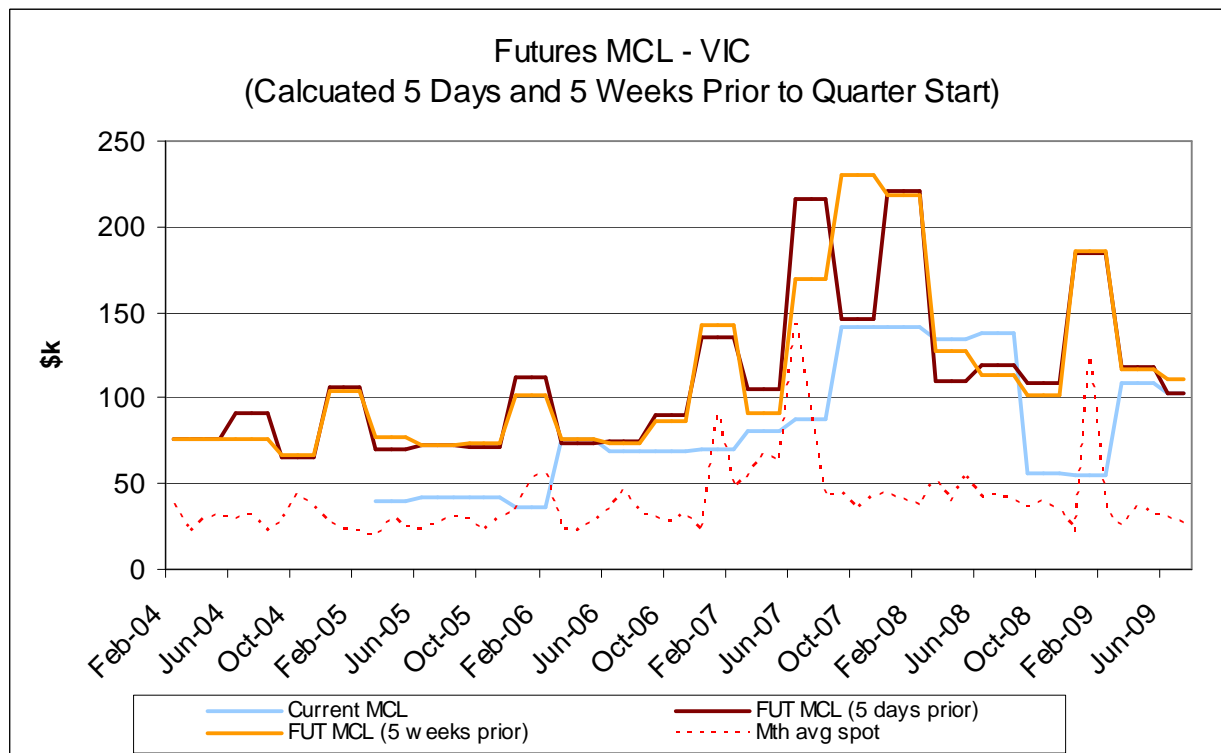
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.3.a – Comparison of Futures MCL Calculation Timing (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.3.b – Comparison of Futures MCL Calculation Timing (SA)



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.3.c – Comparison of Futures MCL Calculation Timing (VIC)

Effectiveness and Efficiency of Proposed MCL Methodologies

<i>By Year – MCL cost</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	99%	100%	100%	100%	64%
2006	89%	100%	100%	100%	52%
2007	72%	89%	93%	100%	33%
2008	100%	100%	95%	100%	92%
2009	100%	100%	100%	100%	100%
Average	91%	98%	97%	100%	65%

Table 7.5.3.d – MCL Effectiveness (ratio of days of MCL non breach vs. time period) - QLD

<i>By Year - % breach</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	40%	23%	24%	11%	90%
2006	52%	28%	29%	14%	78%
2007	60%	58%	37%	28%	83%
2008	30%	36%	27%	19%	43%
2009	38%	31%	23%	15%	39%
Average	43%	37%	30%	18%	61%

Table 7.5.3.e – MCL Efficiency (Ratio of Outstandings vs. MCL) – QLD

<i>By Year – MCL cost</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	100%	100%	100%	100%	60%
2006	89%	100%	100%	100%	63%
2007	84%	100%	100%	100%	56%
2008	77%	77%	89%	98%	73%
2009	100%	76%	96%	100%	85%
Average	89%	92%	97%	100%	66%

Table 7.5.3.f – MCL Effectiveness (ratio of days of MCL non breach vs. time period) - SA

<i>By Year - % breach</i>	<i>Current MCL</i>	<i>MCL v1</i>	<i>Futures Price MCL</i>	<i>Stress Test MCL</i>	<i>Alternative historical MCL</i>
2005	53%	31%	33%	16%	90%
2006	54%	40%	39%	20%	84%
2007	64%	50%	33%	24%	82%
2008	37%	55%	41%	29%	66%
2009	31%	56%	43%	28%	49%
Average	44%	47%	38%	23%	70%

Table 7.5.3.g – MCL Efficiency (Ratio of Outstandings vs. MCL) – SA

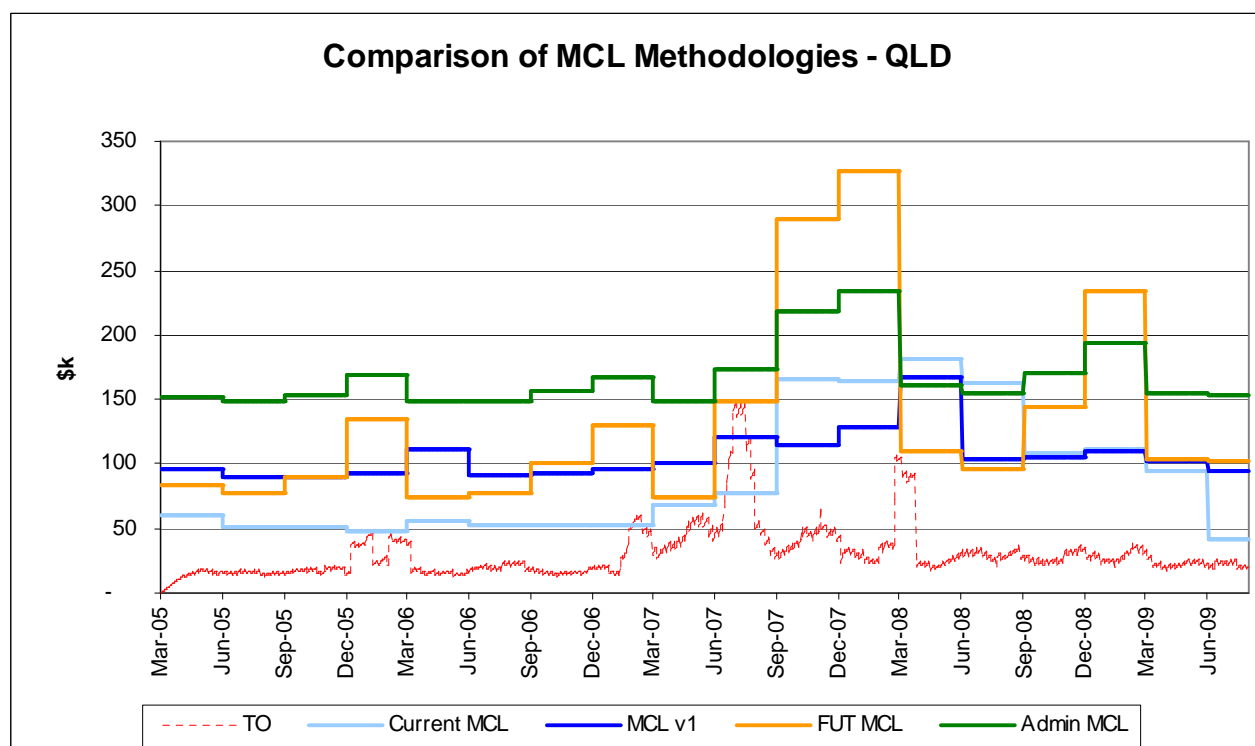
By Year – MCL cost	Current MCL	MCL v1	Futures Price MCL	Stress Test MCL	Alternative historical MCL
2005	100%	100%	100%	100%	71%
2006	89%	100%	100%	100%	59%
2007	76%	93%	100%	100%	52%
2008	100%	100%	100%	100%	83%
2009	81%	81%	100%	100%	81%
Average	90%	96%	100%	100%	68%

Figure 7.5.3.h – MCL Effectiveness (ratio of days of MCL non breach vs. time period) - Vic

By Year - % breach	Current MCL	MCL v1	Futures Price MCL	Stress Test MCL	Alternative historical MCL
2005	58%	26%	31%	13%	87%
2006	51%	35%	40%	18%	79%
2007	58%	55%	37%	27%	83%
2008	37%	37%	29%	19%	48%
2009	45%	44%	34%	21%	54%
Average	48%	40%	34%	20%	67%

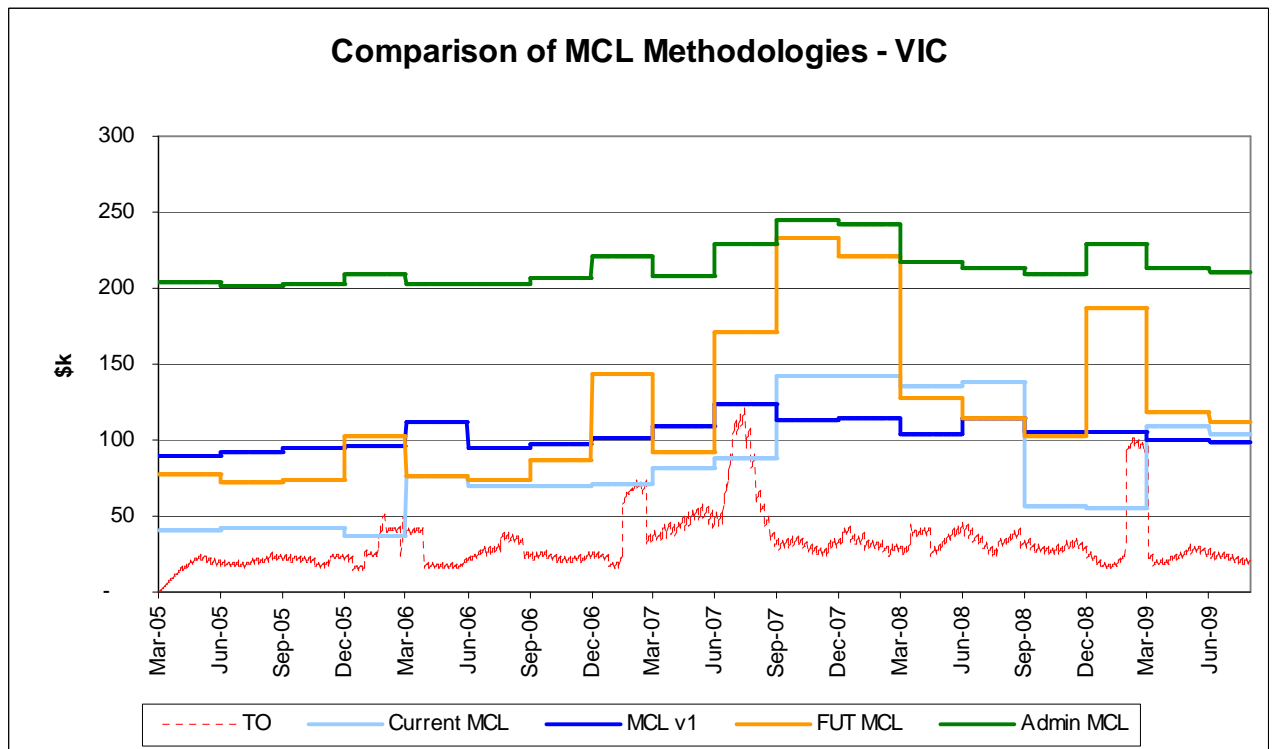
Table 7.5.3.i – MCL Efficiency (Ratio of Outstandings vs. MCL) – Vic

Comparison of MCL Methodologies by State



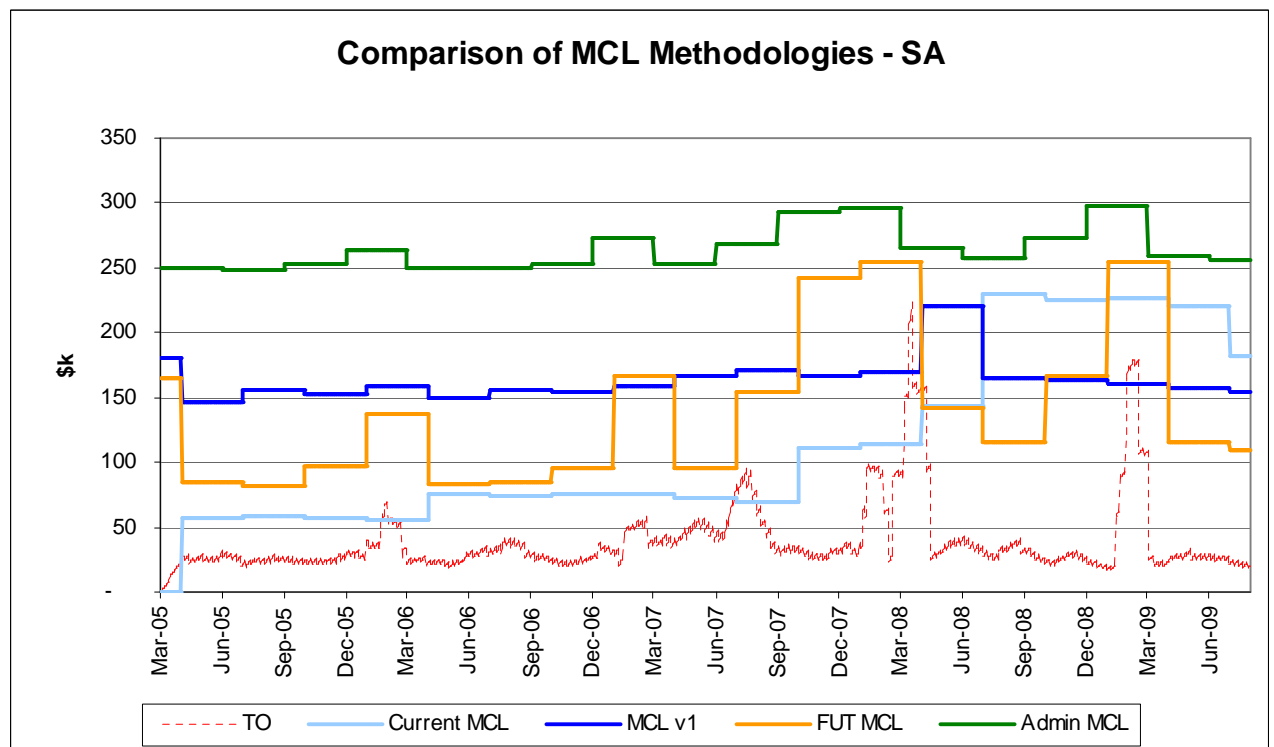
Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.3.m – Comparison of MCL Methodologies (QLD)



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.3.n – Comparison of MCL Methodologies (Vic)



Source: AEMO, d-cypha trade and PwC Analysis

Figure 7.3.3.o – Comparison of MCL Methodologies (SA)

7.4 Stakeholder consultations

As part of the qualitative assessment PwC contacted a full range of market participants to discuss the proposed FOA arrangements and also to solicit views on reallocation arrangements and the current MCL process. The following companies were contacted during this assignment:

Stakeholder Group	Stakeholder
Generator	International Power Delta Electricity Intergen Macquarie Generation Stanwell
Retailer	Infratil Energy Australia Power and Gas ERM
Gentailers	Truenergy Origin Energy Aurora Electricity
Market Operator	AEMO
Futures Exchange	SFE Austraclear d-cypha Trade
Clearing Participants	Citi Group Deutsche JP Morgan Chase
Regulator	AEMC ASIC

7.5 Summary of stakeholder comments

The above stakeholders were asked a series of questions regarding the issues being investigated in this review. Below is a summary of the material comments arising from these stakeholder discussions.

7.5.1 Reallocation Agreements

Stakeholder Type	Key Comments
Retailers	<ul style="list-style-type: none">• Reallocations have been a way for new retailers to enter the market and grow, otherwise constrained by credit support for a full MCL.• Retailers would like to be able to do more reallocations but there seems to be a limit to the extent generators will reallocate, especially in states outside of Victoria.• Reallocations seem to only be available in Victoria and Queensland so there are limitations on their widespread use across the NEM.• For swaps and options reallocations there is a concern that the ability for AEMO to deregister reallocations, if prudential requirements are not met ,causes uncertainty and will impair the use of this risk offset mechanism.

Stakeholder Type	Key Comments
	<ul style="list-style-type: none"> In regards to swaps and options there is concern that AEMO is moving towards a global clearing role for financial and spot market transactions without assuming the full responsibility of a clearer. The reallocation mechanism needs competition by other products. As it stands it has a monopoly on providing prudential relief to retailers, outside of the reduced MCL.
Generators	<ul style="list-style-type: none"> Reallocations are the preferred hedge offset for generators because they feel they can manage the credit risk in a variety of ways. There is concern that if a retailer fails that there is a risk to the generator of no de-registration of the reallocation agreement.
Clearing Members	<ul style="list-style-type: none"> No comments of significance
Others	<ul style="list-style-type: none"> The ability for NEM retailers to use off-peak reallocations to arbitrage AEMO's prudential arrangements. Reallocations result in substantially less MCL bank guarantee protection than FOAs. Termination of a reallocation contract potentially exposes the generator to a substantial financial loss. compared to an FOA when they are terminated AEMO's prudential arrangements. Under generator failure and the removal of a reallocation agreement the market could immediately be put under pressure if several retailers are pushed into a default position. For swaps and options reallocation offset there is no fallback if a party gets into financial difficulty. The accounting treatment futures versus reallocations make futures less attractive to generators. Concerns were sighted in regards to the appropriateness of the AEMO systems (management, processes and IT) to handle swap & options reallocations. Concern was sighted over insolvency risks and the extent that reallocations provide an incentive to default.

7.5.2 Futures Offset Agreements

Stakeholder Type	Key Comments
Retailers	<ul style="list-style-type: none"> There is concern of the ability of FOAs to be unilaterally terminated by clearing members prior to a replacement security being lodged. Concerns over clawback risks for the security deposits placed with AEMO. Lack of a clear dispute resolution process. The futures do not have the same settlement time horizon as AEMO and over-the-counter swaps and options which creates some disincentive to use the FOA for MCL relief.

Stakeholder Type	Key Comments
Generators	<ul style="list-style-type: none"> • There is concern over the withdrawal of an FOA without immediate replacement of an alternate security. • Under a FOA, a for in the Proposed Rule, is a major risk for the NEM Banks that have lent money to generators would behave a problem with a reduction in NEM prudential credit support from the electricity pool. • Futures are carbon free where the spot market will have carbon incorporated which will mean futures will not be a proper proxy for spot. • There is question to the extent all the time and effort for FOAs will really achieve a true benefit from to the market. • The introduction of FOAs would help assist the furthering of a short term hedging market by placing additional emphasis on trading the front quarter. • Retailers could use an FOA as a means to reduce their MCL by buying a future but could also then reverse out of that position over the counter effectively exposing themselves to full pool volatility with no extra coverage. • There was concern that variation margins from the futures may not exactly match the outstandings and thus a beta factor needs to be considered.
Clearing Members	<ul style="list-style-type: none"> • Clearing members cater for many different markets so when considering the procedures for FOAs it would be best to avoid bespoke rules that may be hard for Clearing Members to implement. Most likely the issue that is trying to be covered by a bespoke rule has previously been considered in another market and has arrived at a solution.
Others	<ul style="list-style-type: none"> • There is a risk of insufficient AEMO prudential coverage when the SFE Clearing Corporation does not pay its clearing participants.

7.5.3 Maximum Credit Limit

Stakeholder Type	Key Comments
Retailers	<ul style="list-style-type: none"> • The current MCL calculation methodology may not provide the level of coverage that could be required as it is historically looking. • The MCL is too onerous in terms of the magnitude of financial cover relative to the market risk and creates a barrier to growth as it inhibits small retailer's ability to grow their business. • Using futures prices as a proxy for expected pool prices is considered to be a more realistic representation of the expected price for a quarter. • MCL breaches have occurred more than once in the last 48 months and there is concern that the current MCL calculation methodology is not adequately reflecting the market risk.

Stakeholder Type	Key Comments
Generators	<ul style="list-style-type: none"> • If the MCL is perceived as too high the better avenue to address this would be to shorten up the billing settlement cycle as this would give the best chance at significant MCL relief compared to the other initiatives. • Certainty of payment for all electricity generated at the pool price is paramount to generators and any impairment of the MCL outside of the RA process, which they have a level of control on pricing credit, would be a negative for generators. • For a forward looking MCL using futures, there would need to be different rules in different states for the MCL calculations given liquidity issues of certain futures contracts and the lack of a contract in Tasmania. This would go against NEO objectives of driving effectiveness and efficiency across the NEM. • The futures price is perceived to be subject to manipulation and may therefore be not suitable as a proxy for an MCL calculation. • It was questioned whether futures prices would provide a better price signal to potential investors in electricity generation.
Clearing Members	<ul style="list-style-type: none"> • No comments of concern
Others	<ul style="list-style-type: none"> • The NGF advised that generators are generally comfortable with a forward looking MCL methodology.

7.6 List of Documents Reviewed

Document	Source
Framework and Issues Paper – Review into the role of hedging contracts in the existing NEM prudential framework 26 March 2009	AEMC
Submission to AEMC Rule Consultation Futures Offset Arrangement - Proposed Reallocation Procedure – Developed by NEMMCO/ASX	NEMMCO
Letter to AEMC from d-cypha Trade – Futures Offset Arrangement Rule Change Proposal 2008 – 13 March 2009	d-cypha Trade
Letter to AEM from the NGF – Review into the role of hedging contracts in the existing NEM prudential framework – issues paper – 29 April 2009	National Generators Forum
Shorter NEM Settlements Cycle – March 2009	MCE Financial Markets Working Group
Reallocation Procedure: Swap & Option Offset Reallocation (Final Determination) –	AEMC

Document	Source
20 November 2008	
Futures Offset Arrangements (FOAs) – Rule change Proposal	AEMC
National Electricity Amendment Rule Futures Offset Arrangement (FOAs) – 2009 – Final Determination	AEMC
AEMC Presentation – Review into the role of hedging contracts in the existing NEM prudential framework	AEMC
AEMC Futures Offset Arrangements – March 2008	d-cypha Trade
Credit Limits Methodology – May 2009	NEMMCO
Reallocation Procedure: Energy and Dollar Offset Reallocations – December 2007	NEMMCO
Reallocations Information Paper and Examples – May 2004	NEMMCO

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