Positive Flow Clamping Review

November 2007

Cover Note:

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1 Background

On the 27th of September 2007 AEMC released a draft report with regards to the Congestion Management Review. Stanwell Corporation, Tarong Energy Corporation and Intergen Australia are active participants in National Electricity Market policy debate and seek to proactively manage the impact of potential policy changes by being involved in industry consultation processes.

As part of the draft report on the Congestion Management Review the AEMC considered the way in which negative settlement residues are managed and whether improvements can be made to improve the existing SRA mechanism as a means of reducing inter-regional trading risk. In considering alternative mechanisms to the current 'zero flow clamping' a number of market participants raised the concept of 'positive flow clamping' (PFC) as a means of managing negative settlements residue. The Commission states in the report of 27 September 2007 that it wishes to explore the potential benefits of PFC.

The potential benefits that the Commission list as arising from PFC are improving the firmness of the IRSR units and increasing financial market competition and liquidity. The concept of PFC is relatively new and there is limited time available for market participants to provide feedback to the AEMC. As a result Stanwell Corporation, Tarong Energy Corporation and Intergen Australia have engaged Energy Edge to produce a report on the impact of PFC upon firmness of IRSR units, market competition and liquidity.

2 Scope of this report

The majority of the work in this scope of works will be a qualitative assessment of the PFC as a means of reducing negative settlements residue, firming up IRSR units, increasing competition and market liquidity. Some quantitative analysis will also be required in order to provide relative context and materiality for the qualitative assessment of PFC.

Some specific areas of focus in the scope of works will include but not necessarily be limited to the following:

1. Clearly define market competition and liquidity and provide general qualitative comment on its benefits for market participants.

2. High level comment on the risk management impact of the Commissions recommended improvements to the existing SRA mechanism.

3. Comment on the likely financial market benefits of interregional trading and hedging.

4. A qualitative and quantitative assessment on the impact negative settlements residue has upon the firmness of the IRSR units. This analysis will include quantitative assessment on the magnitude of the basis risk associated with current IRSR units and the proportion of that basis risk which relates to negative settlements residue.

5. A qualitative and quantitative assessment of the impact PFC will have on mitigating the basis risk associated with negative settlements residue. Quantitative analysis will be based on a high level statistical study of the IRSR UNIT payoff features based on some reasonable assumptions about the relative frequency of positive and zero flow clamping.

6. An assessment of the extent to which PFC can be expected to improve competition and market liquidity. This assessment will include a relative comparison to benefits arising from other recommendations on SRA improvements such as the introduction of a three year SRA process. The following questions will be considered in assessing the impact on competition and market liquidity.

    i. Does PFC materially improve the firmness of IRSR units?
    ii. Does PFC make IRSR UNIT units easier to price?
    iii. To what extent are IRSR UNIT used for IR Hedging purposes relative to speculative activities?
    iv. Will PFC change the extent to which market participants use IRSR UNIT and their volume of interregional trading?

7. Assess the extent to which adverse outcomes arising from the introduction of PFC might offset the potential benefits.

Energy Edge will work closely with the nominated responsible officers to ensure that any additional scope requirements are reflected in the analysis undertaken in line with requirements of Stanwell Corporation, Tarong Energy Corporation and Intergen Australia.

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3 Executive Summary

In order to meet tight timelines and budgetary constraints the quantitative findings of this paper are conducted on a sample based modelling approach under a number of simplifying assumptions. However, the findings with regards to basis risk of IRSR Units and the Statistical Pay-off Diagrams (SPD) are sufficiently dramatic to ensure that these modelling constraints have not adversely affected the results of the quantitative and qualitative findings of this PFC Review.

3.1 PFC and IRSR basis risk

Significant basis risk still exists in IRSR units relative to firm basis caps. The majority of this basis risk relates to Volume Basis Risk. Negative Settlement Residue is only a very small proportion of the total residue value attributable to IRSR units. The introduction of PFC will have very little impact on the level of basis risk associated with IRSR units.

3.2 Impact on liquidity

The impact of PFC on the firmness of IRSR Units is insufficient to lead to users of IRSR units and interregional trading strategies (hedgers or speculative traders) to increase, turnover of derivative trading volumes, market making, product development or other activities that are likely to lead to an improvement in Market Liquidity for electricity derivatives. Furthermore the regulatory change process and dispatch uncertainty created by physical interventions such as PFC will result in adverse outcomes for Market Liquidity due to reductions in Maximum Hedge Limits of some intraregional generators likely to be constrained.

3.2.1 Recommendation

Whilst PFC may have other attributes that might warrant its application its impact upon Market Liquidity of electricity derivatives should not be considered as a logical reason to warrant regulatory change to facilitate the introduction of PFC as a physical intervention designed to reduce the accumulation of negative settlement residues.

This is particularly the case given that the adoption of the recommendation to cease the netting off of negative settlement residue against positive residue will deliver much of the IRSR Unit basis risk reductions likely to be achieved by PFC without directly intervening in the physical settlement of the underlying electricity prices that form a basis for the value of all electricity derivatives.

Current AEMC Congestion Management Review (CMR) recommendations for a;

- A three year term for SRA processes;
- negative settlement residues to be funded by directly billing the importing TNSP; and
- improving the reliability and predictability of the underlying network;

will deliver far more benefits for the Market Liquidity of electricity derivatives with less direct intervention in the physical market than PFC. It is recommended that these CMR proposals be pursued and there impacts assessed before further consideration to changes such as the introduction of PFC are considered.

4 Market Liquidity

Many organisations and reports refer to the term Market Liquidity. However, in most cases it is far from clear what is being referred to when the term is used. It is even less clear as to how Market Liquidity can be measured. As many reports and pieces of analysis attribute the impact upon Market Liquidity as a major point to be considered when assessing market structure and regulatory issues, it is important that a clear and consistent definition of Market Liquidity is established.

The AEMC Congestion Management Review (CMR) cites a likely positive effect of PFC on financial market liquidity. The CMR refers to the number of market participants in each region and the volume of contracts offered in each region in the context of the impact of PFC on financial market liquidity. However, the CMR does not define Market Liquidity.

A general financial markets definition of Market Liquidity applied in a context of the electricity sector is as follows;

"The ability to execute a given volume of a particular electricity derivative product type easily through an act of buying or selling without causing a significant movement in the price and with minimum loss of value."

Implicit in this definition are the following features:

- Volume;
- Product Types;
- Price Sensitivity; and
- Cost of transacting.

On the basis of this definition there are a number of characteristics and areas of impact that need to be considered when analysing trends in general Market Liquidity or the impact a particular change may have upon Market Liquidity. In analysing the impact of PFC upon Market Liquidity this report will consider all these characteristics largely in a qualitative manor.

- Market Depth
    - Bid/Offer Volumes
    - Number of Bid/Offer Counterparties
- Turnover
    - Total Volume
    - Proportion of Physical NEM
- Product Choice
- Cost of Transacting

- Bid/Offer Spreads
- Brokerage

Whilst the CMR also refers to competition Energy Edge consider competition as simply another manifestation of market liquidity.

Some quantitative analysis will be undertaken with regards to the impact of PFC on Market Liquidity however detailed quantitative analysis is beyond the scope of this report and would be very dependant upon a number of high level subjective modelling assumptions.

The trend in Market Liquidity in the electricity derivative market is already in a strong growth pattern. Key contributors to the upward trend in Market Liquidity are an increasing number of financial institutions participating in the electricity derivative market, an increase in the size of the portfolios traded by speculators and an increase in the level of sophistication amongst physical market participants who are now actively managing hedge portfolios, running speculative trading portfolios and trading across multiple regions.

It is a matter of conjecture but this increase in Market Liquidity supporting activity amongst the above market participants is largely attributable to the following underlying factors;

- **A successful Sydney Futures Exchange (SFE)** – The success of the re-defined product specifications for electricity futures on the SFE has provided a solution to the credit risk, transparency and lack of market maker issues that had inhibited the development of the electricity derivative market when it was entirely OTC based. This in turn has raised the profile of the electricity derivative market and attracted financial institutions. The role of financial institutions in developing Market Liquidity is significant as they add volume to the system that is unrelated to physical exposures, depth in counterparties and diversity in product types.
- **Relative stability in market structure and rules** – The last three years has seen a general acceptance of the NEM market structure at a macro level and relatively few changes in rules and regulation that are likely to have an adverse impact on the trading activities of most market participants. There is now a much greater awareness amongst market participants and regulatory bodies of the adverse impact changes can have upon the derivative market. Where changes have been debated and/or introduced it has been in a considered manner with extensive consolidation and reasonable lead times prior to introduction. As a result the electricity market has become more attractive to potential new entrants and existing market participants have been more willing to actively manage portfolios and to trade derivatives further along the forward curve.

- **Continued privatisation, commercialisation and deregulation of market participants** – Consolidation and vertical integration within the electricity sector has had some negative implications for Market Liquidity. However, the increasing level of sophistication amongst private sector and government owned corporations has offset these factors through the use of a broader portfolio of product types and more active management of physical exposures which in turn has resulted in higher turnover in electricity derivative volumes.

  The continued privatisation of government owned corporations and recent moves forward in deregulation such as the introduction of FRC in Queensland and the unwinding of ETEF in NSW have all facilitated Market Liquidity by removing barriers to market and encouraging more commercial behaviour amongst the remaining market participants.

There are a lot of factors that impact Market Liquidity on both a macro scale such as the above points and at the micro level such as individual initiatives such as the introduction of PFC. This report considers the impact of PFC on Market Liquidity both as a stand alone initiative and in the context of all the other micro and macro drivers of Market Liquidity. It is only in the context of the other drivers of Market Liquidity that the merit of PFC can be adequately considered.

5 IRSR Units and Settlement Residue Auctions (SRA)

Inter-regional settlements residue (IRSR) is effectively a pool of funds that eligible Registered Participants can gain access to by bidding in auctions. IRSR is caused by price differences between regions and inter-regional power flows. It typically arises when Market Customers pay more than the supplying Generators are eligible to receive, and specifically relates to electricity transfers between regions (rather than within regions).

The IRSR is the result of inter-regional price differences and inter-regional power flows. IRSR only arises from the transfer of electricity through a regulated interconnector. IRSR occurs as a result of transmission losses and price variations between regions associated with power flows between those regions. IRSR is generally positive, when electricity flows from a lower-priced region to a higher-priced region and negative, when electricity flows from a higher-priced region to a lower-priced region (a Counter-Price Flow).

Inter-regional price differences are generally more significant when regulated interconnectors are operating at full capacity (when the price difference reflects the cost of inter-regional transmission constraints and inter-regional transmission losses) and less significant when regulated interconnectors are operating at less than full capacity (when the price difference reflects the cost of interregional transmission losses only).

IRSR is that component of settlements residue relating to inter-regional transmission over regulated interconnectors and settlement transactions between regions calculated on the basis of regional reference prices and inter-regional flows and made available via the auctions conducted by NEMMCO. The administration of IRSR is governed by the Rules, which set out basic principles guiding the way settlements residue must be allocated and distributed, but the details of the allocation and distribution methodology are left to NEMMCO.

Settlements residue relating only to settlement transactions within a region (after the Notional Interconnector component is excluded) are not made available via the auctions known as Settlement Residue Auctions.

Settlement Residue Auctions (SRA) give eligible Registered Participants access to IRSR by enabling them to bid for Units. Auctions are intended to make the NEM more efficient and competitive by providing a means of managing the financial risks of variations in regional reference prices between regions.

For the purposes of an auction, all of the regulated interconnectors between two particular regions are conceptualised as comprising two directional interconnectors (one for each direction of flow). For each trading interval, IRSR relating to net transfers of electricity in either direction will be attributed to the appropriate directional interconnector.

The value of an IRSR Unit is equal to the specified proportion of the net settlement residue for a particular directional interconnector during a given billing period less the relevant auction expense fee. The proportional entitlements for each Unit Category have been determined so that a Unit represents approximately 1MW of the relevant directional interconnector's Nominal Capacity. Nominal Capacities are solely used to define the proportional entitlement for each Unit Category. The actual capacity of an interconnector may vary from the directional interconnector's Nominal Capacity.

The rules associated with the SRA process restrict the entities eligible to participate in the auction to Market Customers, Generators or Traders. Other organizations such as TNSP's are not able to become a registered SRA Market Participant.

The structure of the IRSR Units auctioned is split into calendar quarters of billing periods. The IRSR units available for each quarter are sold in four tranches to provide Auction Participants with multiple opportunities to Bid. Normally, 25% of the maximum number of Units for each Unit Category for a Relevant Quarter will be made available at each of the four auctions for that Relevant Quarter. Any Units not sold at the first, second, and third auctions, will be rolled over and made available in subsequent auctions for the same Relevant Quarter.

The auction clearing price is set as the price of the lowest Bid that was allocated a Unit and is paid by all Successful Participants for the Units they acquire at the auction. Where Bids are received for less Units than were available in the Bid Category, all of the Bids will receive their full allocation and the price (for all Successful Participants) will be zero. Settlements residue that would have accrued to unallocated Units is distributed to the appropriate TNSPs for the relevant directional interconnector.

The Successful Participants are entitled to receive the greater of $10 for each Unit or the amount represented by the Units after deducting auction expense fees.

6 Issues with IRSR Units and the SRA

The IRSR Units acquired by market participants under the SRA process are acquired for two different purposes, hedging and as a means of taking a speculative position on the price differentials arising from directional power flows. IRSR Units are used as hedge instruments by organizations seeking to hedge a physical electricity exposure in one region with financial instruments or opposing physical exposures in another region. IRSR units are also used by organizations taking speculative interregional positions using derivatives who may wish to use IRSR Units to offset some of their interregional price risk.

In either case where the IRSR units are used for hedging their purpose is to reduce the level of basis risk as a result of having interregional exposures. Therefore the extent to which an IRSR unit can effectively eliminate interregional basis risk will determine how much it will be utilized as a product. It is fairly clear that the more interregional basis risk the IRSR Unit is effective in offsetting the more IRSR units will be used in hedge strategies. However, what is far less certain is the extent to which an increase in the use of IRSR units and interregional transactions as hedge instruments will actually improve Market Liquidity.

As a tool for taking speculative positions on interregional price differences it is unclear whether the IRSR unit ability to offset interregional price risks will have any impact on the level of buying interest in IRSR units let alone any knock on effect for Market Liquidity in electricity derivatives. The level of basis risk between the non-firm IRSR unit and the actual price differential is of little relevance to an entity using that product to create a speculative position rather than to manage the risk arising from a speculative position. What is of more significance to an organization using IRSR units as a speculative tool is the transparency and consistency in the process and rules associated with IRSR units and the SRA. An ability to price the IRSR units is also important. The extent that basis risk associated with IRSR units is important for the product to be used as an effective speculative tool is primarily the extent that the basis risk means the IRSR units do not create the exposure targeted by the speculators.

As can be derived from the above analysis of different applications for IRSR units the main issues associated with IRSR units is with it's effectiveness as a hedge instrument. At the highest levels the issues associated with IRSR units as a risk management tool can be split into two categories, the basis risk associated with IRSR units as a hedge against interregional price risk and the auction framework through which the IRSR units are traded.

6.1 IRSR unit basis risk

There are two main forms of basis risk associated with the IRSR units. The first form is basis risk arising from volume differences between the IRSR units and a fixed MW exposure 'Volume Basis Risk' and the second form of basis risk is the extent price differences captured by the IRSR units in any given trading interval are not the same as the price difference between the two relevant Regional Reference Prices (RRP) for the same trading interval, 'Price Basis Risk'.

6.1.1 Volume Basis Risk

The Volume Basis Risk arises from a number of sources where the actual volume of electricity covered by the IRSR unit diverges from the completely firm exposure for the same notional volume. If actual flows on the inter-connector equal notional capacity at all times during the period 1 IRSR Unit will be the equivalent to 1 MW of directional price difference. However, to the extent that actual flows vary from the notional capacity over a period then 1 ISRS Unit will be something other than a 1 MW hedge against directional price differences between regions. The sources of these variations are as follows:

- variations to the actual capacity of the inter-regional transmission through the transmission elements thermal ratings
- variations to the actual capacity of the inter-regional transmission through considerations of network voltage control and system stability issues.
- variation in actual flows relative to notional capacity as a result of intra-regional network constraints which includes constraints that arise as a result of the bidding and output of particular generators who utilize the same parts of the network as the interconnector.
- variation in actual flows relative to notional capacity as a result of inter-network testing
- variation in actual flows relative to notional capacity due to scheduled network services impacting interconnector flows or actual capacity.
- variation in actual flows relative to notional capacity due to counter price flows. Not only do the price differences contribute negative settlements which may be offset against any positive settlement residue accrued for the same billing period but the fact that the flow is against price means that the volume risk is increased because there was no flow when there should have been. ZFC does not resolve this issue but PFC does at least partially mitigate volume basis risk during these periods.

6.1.2 Price basis risk

The price basis risk arises where the accumulated settlements residue associated with 1 IRSR unit, adjusted to extract the effect of Volume Basis Risk (normalized), is something other than the sum of all the RRP differences in one direction. The primary cause of variations between the payout under normalized settlement residues and the actual RRP differences in one direction is Negative Settlement Residues.

The negative settlement residues manifest themselves into Price Basis Risk for IRSR Units as a result of the current rules associated with the recovery of negative settlement residue. Firstly any billing period with a trading interval in which a negative IRSR occurs, that amount will be deducted from the positive IRSR for the billing period to determine the net amount to be distributed to buyers of the IRSR Units for that billing period. Secondly, *NEMMCO* recovers any negative settlement residue that could not be recovered from positive IRSR in the same billing period from future auction periods.

However there are a number of different factors that contribute to Negative Settlement Residues.

The reasons for Counter-Price Flows include:

• **Dispatch process issues** (where the dispatch process requires a Counter-Price Flow across the Notional Interconnector in response to power system issues). The main dispatch process issues that may result in negative IRSR are intra-regional network constraints, market ancillary service requirements, inter-network tests and power system separation occurring away from region boundaries;

• **Dispatch process errors**; and

• **Metering and settlement issues** (where the metering and settlement process does not align with the dispatch process). As IRSR is determined on the basis of metered flows rather than scheduled flows, negative IRSR can accumulate when the scheduled and metered flows diverge, even though the scheduled flow is not a Counter-Price Flow.

Not all the negative settlement residue issues have adverse impacts upon the firmness of IRSR Units will be eliminated by the introduction of PFC. Some counter price flows are desirable and considered efficient. For example in the case of 'islanding' where a part of the network is physically separated and a counter price flow is required to provide support to a load that would otherwise be managed by load-shedding, within the islanded part of the network. PFC would not mitigate basis risk arising from negative settlement residue arising from dispatch errors or metering and settlement issues. Furthermore in managing dispatch process issues ZFC and PFC are not always effective in managing the accumulation of negative IRSR, as Counter-Price Flows can arise suddenly and without warning.

Additionally, the AEMC propose to only utilize PFC for counter priced flow events that are caused by generators' incentives to bid below affordable cost due to constraints binding that create a disjuncture between dispatch and settlement at the RRP (Disorderly Bidding). Therefore not only is negative settlement residue a small portion of the basis risk associated with IRSR Units but PFC would only mitigate a small portion of the basis risk attributable to negative settlement residue.

The AEMC has recommended that the netting of negative settlement residue against positive residue in the same billing period is to be ceased and replaced with the allocation of the cost to TNSP's. If this is the case then the majority, if not all, of the Price Basis Risk will be eliminated from the IRSR Units. Therefore if PFC is only to be introduced as part of these broader recommendations it will have no additional benefit attributable to Price Basis Risk associated with IRSR Units. There will be some Volume Basis Risk that is attributable to negative settlements residue but this will be relatively immaterial and therefore PFC impact on Market Liquidity would be minimal if all current AEMC recommendations were implemented. The potential impacts of the physical intervention in the market to institute PFC, chiefly reducing dispatch levels from certain generators, may lead to significant risks for generator participants who may suffer constraints preventing the accumulation of sufficient pool revenues to cover contract liabilities.

An obligation on NEMMCO to outline how it interprets and applies the provisions associated with flow clamping will probably have a more significant positive impact on Market Liquidity than the decision on whether it is PFC or ZFC or whether the threshold is $6,000 or $100,000. This is because the predictability of such actions has a positive impact on pricing and risk management for all derivative activity, not just interregional transactions, regardless of whether it's for speculative or hedging purposes.

6.2 IRSR auction process

The Settlement Residue Auctions (SRA) is the process and framework by which IRSR Units are released to the market. Changes to the process or the IRSR Unit structure that improve the IRSR Units value as a risk management tool can have significant impact on Market Liquidity of electricity derivatives. This is because changes in the SRA process do not have any knock on impact upon the supply, demand or price of the electricity. As a result any gain in Market Liquidity is not at risk of being eroded by changing the way in which the electricity spot market operates. On the other hand PFC whilst increasing the firmness of IRSR Units will also change physical flows of electricity, generator bidding behaviour and the RRP across nearly all of the regions in the NEM. In the short term all changes of any significance that impacts the electricity spot market have an adverse impact upon electricity derivative Market Liquidity as they creates uncertainty about the valuation of those derivatives.

There are a number of changes that could be made to the SRA process or the structure of the IRSR Units that may improve their effectiveness as a Primary Market for a risk management tool. These include longer and shorter dated IRSR Units, increasing the frequency of the auctions and peak and off-peak profiled IRSR Units. Other improvements such as the ability to link bids for IRSR Units have already been implemented and made positive contributions to their value as a risk management tool.

However, in light of other changes recommended by the AEMC, Energy Edge agree with the AEMC conclusion that the only process change likely to materially improve the risk management value of IRSR Units is to allow the SRA to sell IRSR Units further in advance.

The AEMC has recommended that IRSR Units be made available for auction up to 3 years in advance of the relevant IRSR quarter. This is likely to be a major contributor to Market Liquidity for electricity derivatives and will certainly enhance Market Liquidity to a greater extent than the introduction of PFC. Energy Edge believes that the sale of IRSR Units up to 3 years in advance will improve Market Liquidity for the following reasons.

The majority of generators in the NEM generally hedge at least 50% of their expected output more than 12 months in advance of settling against the pool. Furthermore the majority of generators will also have hedged at least some portion of their expected output 3 years or more in advance of settling against the pool. Generators have long exposures against pool price created by their physical assets for at least 20 years into the future. As a result they generally have a desire to match their revenue hedges for a longer duration than is often available in the derivative market.

Retailers have 'short' electricity price exposures as a result of retail contracts the majority of which are fixed at least 12 months in advance of settling against the pool and many of which are for a 2 to 3 year duration. Therefore both retailers and generators have a desire to hedge a reasonable portion of their expected exposures more than 12 months in advance. To the extent that generators and retailers would like to manage some of this risk by using electricity derivatives against a RRP other than that of the native exposure they have to take significant basis risk through unhedged interregional exposures between when those interregional hedges are executed and the start of the first SRA tranche (currently 12 months). This is a major deterrent to physical market participants (both generators and retailers) from using derivatives against another region as a hedge because not only do they have to contend with Volume and Price Basis Risk once they have acquired IRSR but they also have to carry the Price Basis Risk between when they execute longer dated hedges and the commencement of the SRA process.

Financial Institutions and other entities that undertake speculative trading activities are major contributors to market liquidity as they add volume over and above the natural trading activity relating to physical market exposures. Speculative traders also contribute significantly to the other characteristics of Market Liquidity as the success of their business is generally highly dependant upon Market Liquidity. As a result speculative traders not only add additional volume to the system but also as a result of constant market making activity help reduce the bid/offer spread and reduce transaction costs such as brokerage. Many speculative trading strategies relate to interregional price spreads. However, the majority of trading activity undertaken by speculative traders is focused on the immediate 12 to 18 months forward. This is partly because profitable speculative trading portfolios require a liquid market should a strategy need to be re-profiled or Value At Risk and Stop Loss limits are triggered. The current level of Market Liquidity in the later years is insufficient to give speculative players confidence that they can manage the market risk without any offsetting physical exposures.

This is somewhat of a dilemma as generators would like to be able to hedge more volume longer term and if they did so Market Liquidity would improve further along the forward curve. However, retailers are unlikely to provide the additional volume for longer dated transactions as the majority of their retail customers are generally reluctant to fix their energy costs beyond 3 years. Speculative trading activity further along the forward curve is likely to be the only source to provide that initial injection of additional volume further along the forward curve. Once speculative traders inject additional volume into the forward curve and provide market making benefits it is likely that generators will hedge a greater volume further in advance and in turn retail customers will become more comfortable in hedging (via retail contracts) longer term as a result of improved transparency.

Although the longer term IRSR Units auction process may not in its own right result in the confidence that speculative traders need to be more active further along the curve it will certainly increase the chances of that occurring. Given the magnitude of the risk management benefits that would arise for physical market participants (generators, retailers and end users) this change to process could be a massive contributor to market efficiency and liquidity.

It is noted that the AEMC Congestion Management Review Report documents that EUAA cautioned that improved risk management instruments may be used for speculative purposes rather than to facilitate the management of basis risk on wholesale supply contracts. It is the opinion of Energy Edge that these comments should be discounted as the success of an emerging market developing into a liquid and efficient market and in turn resulting in economic and commercial efficiencies across the electricity sector is dependant upon the role of speculative activity. The benefits of deregulating this and any other commodity or industrial sector is dependant upon an efficient market where speculators enforce the rules of arbitrage and contribute to Market Liquidity that in turn allows economic and commercial efficiencies to be gained via the application of market forces.

In the case of extending the SRA process to a three year term it is likely to be the best chance for Market Liquidity to evolve further along the forward curve thus allowing end users, the EUAA members, to obtain greater certainty through longer term contracts should they wish. It appears likely that the only players in the market to drive Market Liquidity further along the forward curve are speculative traders. It is generally also only the speculative traders who are likely to develop a secondary market in IRSR products from the SRA primary market.

7 Impact of Negative Settlement Residues on IRSR Units

Sections 7 and 8 of this report discuss and document quantitative analysis undertaken by Energy Edge in order to determine the impact of negative settlement residue upon IRSR units, the materiality of basis risk associated with IRSR units, what proportion of that basis risk is attributable to negative settlement residue and the extent to which PFC may reduce the basis risk associated with IRSR units. A comprehensive modelling exercise is beyond the scope of this project so analysis has been restricted to QLD-NSW and NSW-QLD flows and is conducted at a high level with a number of simplifying

assumptions. Therefore sections 7 and 8 also provide some detail on the modelling technique and assumptions made so that the reader of this report can interpret the results of the modelling in the correct context.

The objective of the modelling approach adopted by Energy Edge is to analyse the distribution of payoffs of the IRSR unit's derivatives under several 'operational' scenarios (i.e. rules of the NEM). The dependence of the payoff on underlying physical variables (particularly NEM price and interconnector flow) is used in conjunction with a portfolio of liquid derivative assets to establish the degree of unhedgable risk associated with the IRSR units. The model will deconstruct the causes that contribute to the basis risks inherent in an IRSR contract, for example, how much of the risk is attributable to negative residues, how much to interconnector thermal constraints, how much to interconnector contingency outages, etc.

7.1 Analysis model

The objective of the modelling for this section of the report is to establish the difference in risk profiles for IRSR units between two 'parallel worlds'. In one scenario, the current interconnector management rules are in place, while the parallel world has a change of rules to the proposals in the IRSR draft report.

The key aspects to the model are:

- pool outcomes associated with each scenario:
    - pool prices
    - dispatch volumes and corporation revenues
    - behavioural considerations

7.2 Modelling Assumptions

The model is intended to analyse the risk-return profile of IRSR under a distribution of possible outcomes. The model is instituted in parallel worlds where the rules underlying the SRA framework alter in several scenarios. The assumptions for those scenarios are dictated by the recommendations in the Draft Report.

The modelling undertakes 'first order' analysis that does not necessarily incorporate feedback effects. For example, in the scenario world, there will result an array of possible pool price and dispatch outcomes, and hence revenue distributions. That cashflow can be best hedged by a particular derivative portfolio. However, by holding that derivative portfolio, the participant may be encouraged to operate differently in the pool market, hence perturbing the initial price assumption. This last effect (feedback) is not incorporated in the model.

For comparison purposes in order to establish basis risk differences between IRSR and a firm product, a firm basis cap is the financial product used as it performs the same fundamental role of the IRSR units. That is, the contract pays off when $P_{regionA} > P_{regionB}$, but does not payoff when $P_{regionA} < P_{regionB.}$ There is no reference to flows in such a contract (no volume risk). Furthermore, the vagaries of variable loss factors are removed. The contract also removes reference to the natural price spread that may exist between two regions owing to losses on the interconnector. Of course, the accumulation of cash in the IRSR account will not agree with these contract liabilities, and the issuer of such a product is exposed to that basis risk, if the IRSR is used to fund the derivative.

Such a financial contract, settled on a half-hourly cycle contains the main characteristics of an IRSR unit, but is somewhat easier to analyse. The removal of physical references such as loss factors may remove the context somewhat from a physical hedger's perspective, but the financial contract with its transparency and volume-certainty would be a useful contract for hedging.

It has been observed that intermediaries produce synthetic IRSR units as pure financial instruments, so the concept is valid.

Statistical payoff diagrams (SPD) will be utilised here to illustrate the degree of nonfirmness inherent in various scenarios of IRSR structures.

The half-hourly payoff for an IRSR unit (flow from region A to B with *U* units assigned) is:

$$\text{Payoff} = \tfrac{1}{2} \times 1/U \times (P_B V_B - P_A V_A)$$

In the model this is simplified. Let the interconnector have a loss $\varepsilon(V)$., depending only on the flow level F. Then we simplify

$$\text{Payoff} \approx \tfrac{1}{2} \times 1/U \times [\, (P_B - P_A) F - P_B \varepsilon(F) F \,]$$

7.2.1 Base Scenario (current arrangements)

The base scenario for market rules is the current arrangement. Operational activities for managing negative residues is described in detail in the NEMMCO operating manual (SO_OP3705 (Dispatch), section 18). Basic details of the operations of SRA settlements are contained in NEMMCO SETTLEMENT RESIDUE AUCTION INFORMATION MEMORANDUM 2 JULY 2007.

Interconnector constraint management:

A discretionary constraint is activated by NEMMCO to limit interconnector flows to manage the accumulation of negative residues. The operational procedure for activating the constraint is summarized to:

- If predispatch indicates an upcoming period of negative residues exceeding $6,000, zero flow clamping is instituted provided that system security is assured. The limits are deactivated when NEMMCO perceives that the issue no longer prevails.
- If negative settlements begin accumulating to a level of $6,000 which was not identified in predispatch, then NEMMCO will invoke the constraint gradually until counter price flows are halted. Successive adjustments are made to tighten or relax the constraint as counter price flows reemerge or are no longer deemed likely.

- For counter price flows driven by FCAS constraints, discontinue co-optimisation with of FCAS and invoke the discretionary constraint to reduce flows on the interconnector in progressive steps by dispatch interval (NEMMCO recommends 50 MW steps) until the counter price flows cease or FCAS constraints bind for the local region to support its own security. If FCAS limits are reached, but counter price flows continue, generators contributing to the interregional flow are progressively constrained off.

SRA settlement and funding rules:

- The SRA financial instrument is settled on a weekly basis, with netting across the week, and only positive settlements paid. The formula for settlements of a directional interconnector from region A to B is (summing over half-hourly trading intervals)..

  Settlement = $\max\{ 0, \Sigma_{\text{week}} (P_B V_B - P_A V_A) \times ½ \}$

  - Where P_A, P_B are regional reference prices in regions A and B;
  - V_A is export volume in MW related to MW at node A
  - V_B is import volume in MW related to MW at node B

  The import and export volumes differ due to physical losses, and this supports a sustained small price differential between P_A and P_B without residue settlements accumulating.

- Negative settlements netted over a week are funded by future auction proceeds

7.2.2 Positive Flow Clamping (PFC) Scenario

The PFC scenario for market rules institutes positive flow clamping in place of the zero flow clamping. Finer details of how the clamping is initiated are drawn from the recommendations in the Draft Report (section 5.3.2.4 and Appendix G). Similar operational activities for invoking the constraints are assumed as in the current NEMMCO operating manual (SO_OP3705 (Dispatch), section 18). The *dynamic flow limit, k* assumption is made.

Interconnector constraint management:

A discretionary constraint is activated by NEMMCO to limit interconnector flows to manage the accumulation of negative residues. The operational procedure for activating the constraint is summarized to (see draft report page 110):

- If (i) predispatch indicates an upcoming period of negative residues exceeding $6,000, and (ii) the counter price flow is a consequence of **disorderly bidding** (that is, Draft Report Appendix G, figure G4 prevails and figure G6 does not prevail) then the flow is constrained to *flow* $\geq$ *k* MW, where *k* is the flow level in the dispatch interval prior to counter price flows. The limits are deactivated when NEMMCO perceives that the counter price flow issue no longer prevails.

- If (i) predispatch indicates an upcoming period of negative residues exceeding $6,000, and (ii) the counter price flow is a consequence of **price reversal** (that is, Draft Report Appendix G, figure G6 prevails and figure G4 does not prevail), then the zero flow clamping procedure k=0 applies (gradual reduction in flow limits until negative settlement residues no longer accumulate).
- If the interconnector **turns counter-price** or was already flowing counter-priced prior to PFC being invoked, the default arrangements for managing counterpriced flow (i.e. gradual clamping to k=0 MW) would apply.
- For counter price flows driven by FCAS constraints, follow the existing operational procedure. Discontinue co-optimisation with of FCAS and invoke the discretionary constraint to reduce flows on the interconnector in progressive steps by dispatch interval (NEMMCO recommends 50 MW steps) until the counter price flows cease or FCAS constraints bind for the local region to support its own security. If FCAS limits are reached, but counter price flows continue, generators contributing to the interregional flow are progressively constrained off.

IRSR UNIT settlement and funding rules:

- The IRSR UNIT financial instrument is settled on a weekly basis, with **no netting across the week**. Negative settlements are assumed to be funded by the importing TNSP in accordance with the Draft Report Recommendation 3, page 107. The formula for settlements of a directional interconnector from region A to B is (summing over half-hourly trading intervals).

  Settlement = Σ_{week} max{0, ($P_B V_B - P_A V_A$) $\times$ ½ }

  - Where P_A, P_B are regional reference prices in regions A and B;
  - V_A is export volume in MW related to MW at node A
  - V_B is import volume in MW related to MW at node B

  The import and export volumes differ due to physical losses, and this supports a sustained small price differential between P_A and P_B without settlements accumulating.
- Negative settlements netted over a week **are no longer funded** by future auction proceeds (Draft Report Recommendation 3, page 107).
- The application of PFC can lead to generators being constrained on. Commensurate with the draft report Recommendation 2 (Draft Report page 100), there is assumed **no additional compensation** for generators constrained on.

Summary

Key changes are: PFC is applied in some instances where currently ZFC is applied. This results in (i) an altered cash flow in the IRSR fund and (ii) different pricing structure in the NEM and (iii) an altered dispatch pattern for generating units on either side of the affected interconnector. Holders of IRSR units are not exposed to negative settlement risk as it is funded by the importing TNSP.

7.2.3 Raised threshold, TNSP Funding Scenario

The raised threshold, TNSP funding scenario for market rules institutes a higher dollar threshold before zero flow clamping is instituted. Finer details of how the clamping is initiated are drawn from the recommendations in the Draft Report (section 5.3.2.4 and Appendix G). Similar operational activities for invoking the constraints are assumed as in the current NEMMCO operating manual (SO_OP3705 (Dispatch), section 18).

Interconnector constraint management:

A discretionary constraint is activated by NEMMCO to limit interconnector flows to manage the accumulation of negative residues. The operational procedure is assumed to be identical to the current operating procedure, but the threshold of $6,000 in any counter price flow event is assumed to be increased to $100,000 (Draft Report page 109 Recommendation 4)

IRSR UNIT settlement and funding rules:

- The IRSR UNIT financial instrument is settled on a weekly basis, with **no netting across the week**. Negative settlements are assumed to be funded by the importing TNSP in accordance with the Draft Report Recommendation 3, page 107. The formula for settlements of a directional interconnector from region A to B is (summing over half-hourly trading intervals).

  Settlement = Σ_{week} max{0, ($P_B V_B - P_A V_A$) $\times$ ½ }

  - Where P_A, P_B are regional reference prices in regions A and B;
  - V_A is export volume in MW related to MW at node A
  - V_B is import volume in MW related to MW at node B

  The import and export volumes differ due to physical losses, and this supports a sustained small price differential between P_A and P_B without settlements accumulating.

- Negative settlements netted over a week **are no longer funded** by future auction proceeds (Draft Report Recommendation 3, page 107).

Summary

Key changes are that holders of IRSR units are not exposed to negative settlement risk as it is funded by the importing TNSP. There is some altered pool price and dispatching arrangements as counter price flows can continue for a longer sustained period than the current arrangements (base case).

7.3 Magnitude of historical negative residues.

The materiality of historical negative residues can be illustrated by displaying the total value of negative settlements in comparison to the positive residues accumulated. An attached table of data (in the appendix) contains:

- hours during which *positive* settlement residues accumulated
- hours during which *negative* settlement residues accumulated
- total value of positive settlement residues accumulated
- total value of negative settlement residues accumulated
- value of settlement residues after netting
- value of negative settlement residues to be funded from future auctions.

Values can be calculated on various time-resolutions. The spreadsheet of values contains the outcomes aggregated on a weekly basis (Sunday-Saturday) in line with the NEM settlement periods. Our calculations are not adjusted to take into account the part-weeks associated with a week crossing a quarter's boundary (e.g. 25-Sep-2005 to 1-Oct-2005).

7.3.1 Results summary.

Historical settlement residues accumulating along QLD to NSW directional interconnector over July 2003 to September 2007 have the properties in the table below.

The materiality of historical residues is summarized as:

- Historically, counterpriced flows have occurred for only a very small portion of time (and occurrence has been limited by NEMMCO clamping actions). Southward flow for 2% of time and Northward flow for 1% of time.
- The value of negative residues is small in comparison to the total residues accumulated. Southward residues around 3% and Northward around 0.8% of total value. This is negligible in comparison to the volatility of the total values.
- The nature of negative residues is to accumulate in large bursts. Under current arrangements, a large net negative value in a week is transferred to recover from future auctions. The nature of flooring negative residues on a weekly cycle mitigates their impact on total IRSR value accumulated. For holders of an IRSR UNIT, the value lost from negative settlements during its settlement period is around 0.5% Southward and 0.5% Northward.

QLDNSW interconnector		
Quantity	**Value ($M)**	**Interpretation**
Total residues	221.2	Total residues for Southerly flow
Positive residues	227.5	Positive residues only. Would relate to scenario of TNSP fully funding negative residues
Negative residues	-6.3	Negative residues only. Around 3% of total residue value.
Floored residues	226.4	Residues available for distribution (before deduction of auction fees etc). Constitutes 99.5% of the positive residues.
Carried residues	-5.2	Net negative residues in a given week which are (presently) recovered from future residue auction proceeds. Around 2.3% of the total residues accumulated but around 82% of the total negative residues.
Proportion of time accumulating positive	92%	For 92% of the time, positive residues were accumulating on Southerly flow
Proportion of time accumulating negative	2%	For 2% of the time, negative residues were accumulating on Southerly flow

NSWQLD interconnector		
Quantity	**Value ($M)**	**Interpretation**
Total residues	5.65	Total residues for Northerly flow
Positive residues	5.7	Positive residues only. Would relate to scenario of TNSP fully funding negative residues
Negative residues	-0.05	Negative residues only. Around 0.8% of total residue value.
Floored residues	5.67	Residues available for distribution (before deduction of auction fees etc). Constitutes 99.5% of the positive residues.
Carried residues	-0.025	Net negative residues in a given week which are (presently) recovered from future residue auction proceeds. Around 0.4% of the total residues accumulated but around 55% of the total negative residues..
Proportion of time accumulating positive	5%	For 5% of the time, positive residues were accumulating on Northerly flow
Proportion of time accumulating negative	1%	For 1% of the time, negative residues were accumulating on Northerly flow

Although the values in this table represent the aggregated amounts over the analysis timeline, the outcomes on a quarterly, weekly or even half-hourly basis are relevant for pricing and risk management purposes.

The nature of negative settlement residues on QNI has been to accumulate most value in several large bursts of high price separation within a short period. Under the current rules, the historical negative settlements caused entire weeks to contain net negative residues, and these negative values are not passed onto the current IRSR UNIT holder, but passed forward to recover from future auction proceeds.

The duration curves for the IRSR accumulations are illustrated below. They exhibit an even sharper knee point than the form familiar to pool price duration curves.

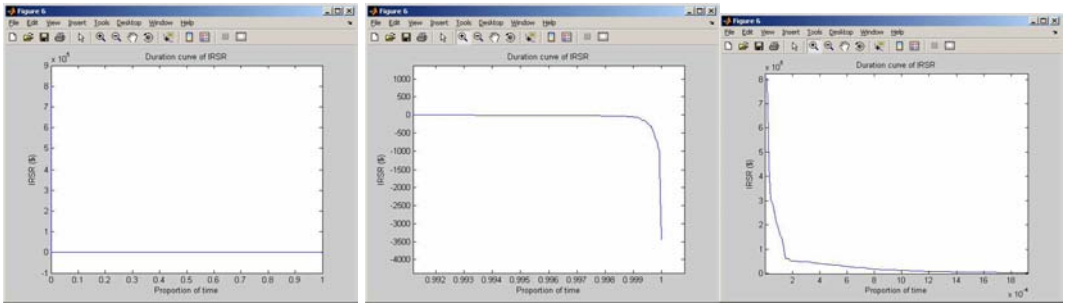


Figure 1: IRSR NSWQLD Northerly flow duration curve

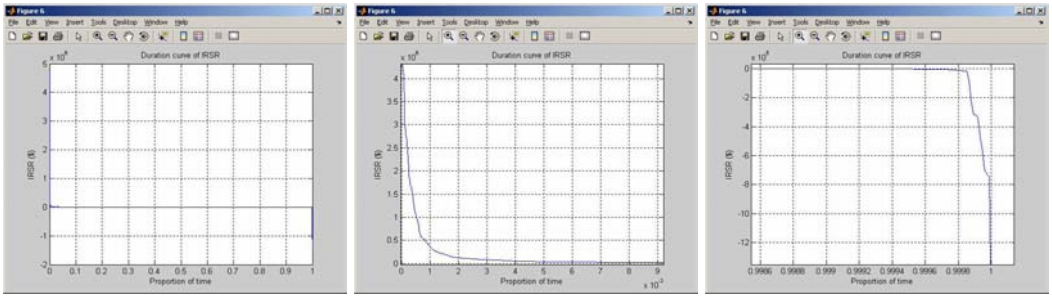


Figure 2: IRSR QLDNSW Southerly flow duration curve

7.4 Causes of Historical negative residues

Context

Negative residues can be attributed to the following causes (Draft report page 105). An explanation is provided in the context of QLD-NSW flows.

Islanding: Transmission is unavailable from Armidale to the NSW node. Flows from QLD to Armidale across the interconnector must take place to support the Armidale load. But NSW and QLD prices are set independently and may coincidentally induce counter priced flows. *Proposed new SRA arrangements **will not** manage this cause differently.*

Network loops: *Proposed new SRA arrangements **will not** manage this cause differently.*

Interaction between a DC and AC interconnectors crossing the same region boundary. *Proposed new SRA arrangements **will not** manage this cause* differently

FCAS constraints: *Proposed new SRA arrangements **will not** affect this cause differently.*

"Disorderly" bidding: For example, when a constraint occurs between SWQ and SEQ preventing additional generation from SWQ from reaching the load centre and meaning that SEQ generator bids set the QLD regional price. Generators in SWQ rebid volume to very low price bands and dispatch volume which flows across the interconnector to NSW which has a moderate regional price. *Proposed new SRA arrangements **will** manage this cause differently*

The 5/30 Issue: The volume-weighted average on the dispatch intervals gives a contrary outcome to the averaging of values over the full trading interval which is used for settlement purposes. *Proposed new SRA arrangements **will not** manage this cause differently.*

7.5 Classification of historical counter price flows

The application of positive flow clamping is restricted to counter price flow events where the change takes place in the direction of the flow, rather than a change in the sign of the price difference. An explanation is provided in the draft report Appendix G. A procedure of zero flow clamping is intended to be maintained for counter price flow events which are driven by changes in price.

Consistent with the descriptions of negative settlements in appendix G of the draft report we make the following assumption in our analysis of historical IRSR data:

- **historical negative settlement residue events where the price relativities remain the same but interconnector flow changes direction are an indication of disorderly bidding causes and would be managed by PFC under the proposal**
- **historical negative settlement residue events where the flow remains in the same direction, but the relative prices change to an unnatural state are an indicator of another cause and would be managed by current arrangements (ZFC) under the proposal**

An analysis of historical outcomes is performed to detect whether counter price flow events would have been classified as zero-flow or positive flow outcomes. An analysis of the bidding during certain periods can also confirm that disorderly bidding tended to drive the outcomes but this has not been taken on an event-by-event basis.

7.5.1 Example of negative settlement residue analysis process

The figure below illustrates a sample of the process for identifying nature of historical negative settlements. The plot contains pool prices for QLD and NSW regions, as well as the price difference. On the right axis, the graph displays MW flow from NSW to QLD (positive values represent Southerly flow). The period of the analysis is over 20-22 March 2007.

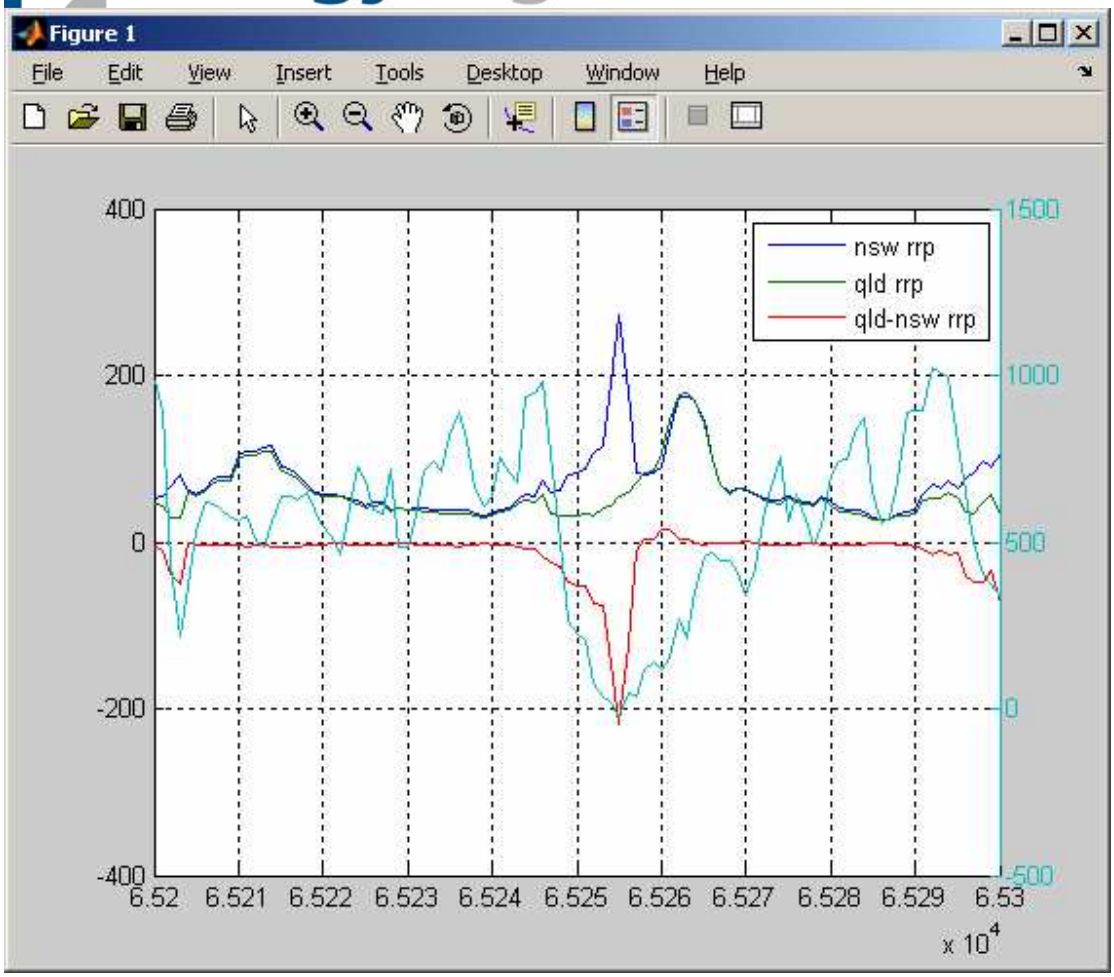


Figure 3: Illustration of the occurrence of counter price flows. Flow (MW) on right hand axes, price differential ($/MWh) on left hand axes.

During this period, negative settlement residues accumulated for the NSW-QLD directional interconnector in a single trading interval. The figure illustrates that NSW price was consistently higher than QLD price, and flow was generally positive (QLD to NSW). However, the flow reverses and at one point falls to a level below zero, whereupon negative IRSR occur. The figure illustrates that pool price consistently maintained a negative difference, but the direction of the flow reversed. This represents an instance where positive flow clamping may have been instituted if the residues were deemed likely to be sufficiently large.

In fact, the flow limits can also be observed. Further possibilities of counter price flow were made impossible because a constraint was induced on flow, being limited to near zero MW (blue curve in the figure). The zero flow clamping was deactivated a short time later when the risk of counter price flows became no longer apparent.

There is not an absolute guarantee that the PFC would have been instituted in this case. FCAS prices during that period are also high, providing the possibility of an alternative driver.

However, for the present analysis, automated detection of the likely causes for negative settlements (and resultant management actions) are confined to whether the flow changes sign (positive flow clamping initiated) or price changes sign (zero flow clamping initiated).

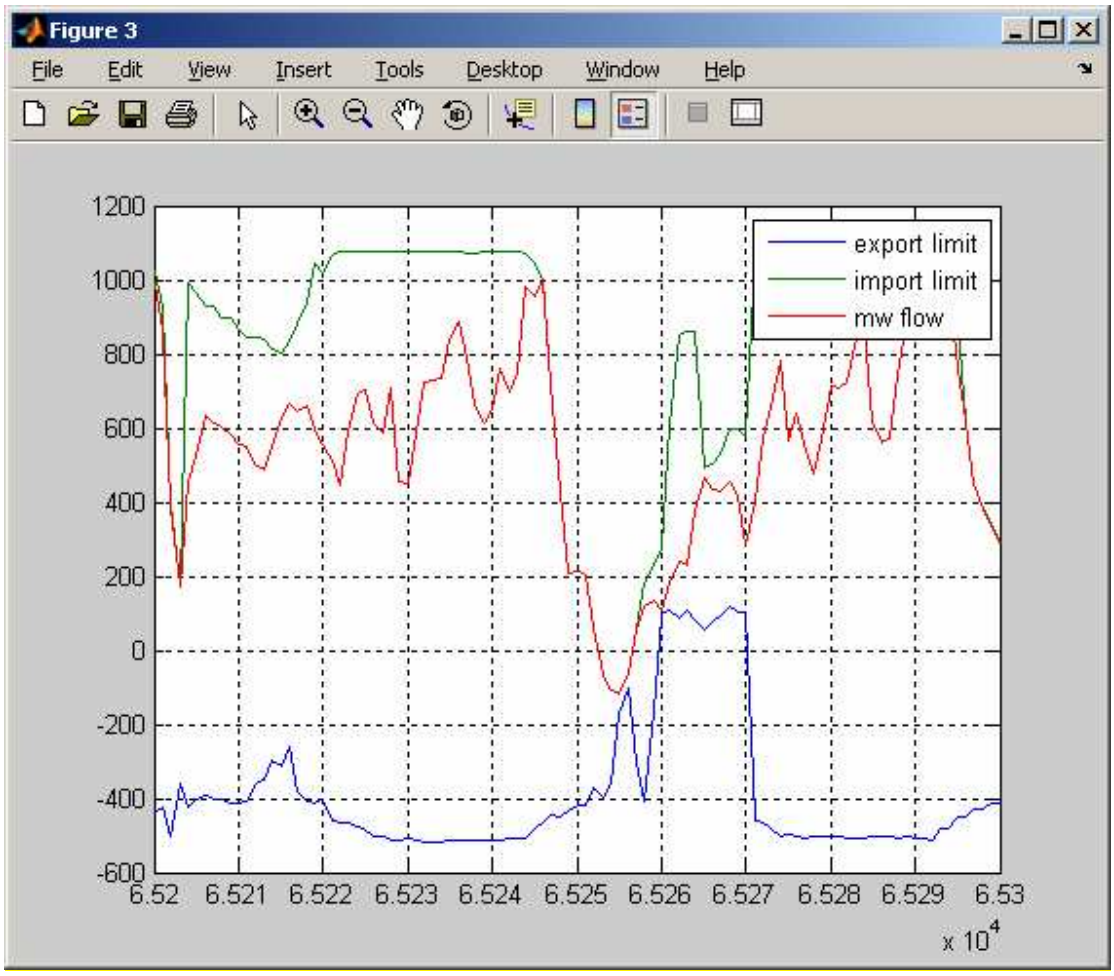


Figure 4: QNI flow limits around time of counter price flows

Over the period July 2003-September 2007, the nature of negative IRSRs has been established by broadly classifying into “flow changes sign” or “price changes sign” or an indeterminate cause. The hours and value of negative residues for each has been calculated. The events are referenced to the start of the negative settlement event by counting trading intervals from 1-Jul-2003. A threshold has been placed to remove very small spurious negative residue events.

The summary is that there is around 15 hours of negative settlements worth around $1.3M for events caused by ***flows*** **changing direction (the PFC events)** and 33 hours worth around $5M for events caused by ***prices*** **changing sign (ZFC events)**.

Classification of QLD-NSW flow events

QLD-NSW July 2003 to September 2007

Date	Trading interval	Duration	Negative settlements ($/unit)	Classification
30-Jul-03	1476	0.5	- 2.68	'changed price'
30-Jul-03	1478	0.5	- 2.43	'changed flow'
10-Nov-03	6414	0.5	- 9.19	'changed price'
17-Nov-03	6725	1	- 2,185.78	'changed price'
10-Dec-03	7845	0.5	- 9.71	'changed flow'
27-Sep-04	21864	0.5	- 92.22	'flow and price same direction: indeterminate'
6-Oct-04	22286	0.5	- 3.69	'changed flow'
6-Oct-04	22289	6	- 47.44	'changed flow'
6-Dec-04	25244	0.5	- 0.58	'changed price'
23-Dec-04	26048	1.5	- 2.08	'changed price'
12-Sep-05	38658	1	- 581.22	'changed price'
23-Oct-05	40647	0.5	- 0.66	'changed price'
4-Apr-06	48457	4	- 13.96	'changed price'
28-Nov-06	59881	1	- 1.10	'changed price'
14-Dec-06	60659	1	- 7.18	'changed flow'
21-Jan-07	62476	1	- 1.63	'changed price'
21-Jan-07	62479	1	- 1.29	'flow and price same direction: indeterminate'
22-Jan-07	62521	0.5	- 0.51	'changed price'
22-Jan-07	62523	1	- 1.05	'changed price'
22-Jan-07	62526	1	- 1,203.01	'changed flow'
23-Jan-07	62565	1	- 968.15	'changed price'
23-Jan-07	62568	2.5	- 684.40	'changed price'
23-Jan-07	62574	1	- 15.99	'changed flow'
23-Jan-07	62577	0.5	- 1.45	'changed flow'
1-Mar-07	64347	0.5	- 0.84	'changed price'
1-Mar-07	64349	0.5	- 0.66	'changed price'
20-Mar-07	65260	1	- 3.27	'changed price'
25-Apr-07	66986	0.5	- 6.17	'changed price'
18-Jun-07	69588	0.5	- 3.67	'changed price'
19-Jun-07	69635	0.5	- 0.60	'flow and price same direction: indeterminate'
21-Jun-07	69711	0.5	- 16.34	'changed price'
18-Jul-07	71028	1.5	- 4.89	'changed price'
12-Aug-07	72214	0.5	- 1.19	'changed price'
13-Sep-07	73749	0.5	- 1.09	'changed flow'
13-Sep-07	73751	0.5	- 1.02	'changed price'
13-Sep-07	73753	0.5	- 0.88	'changed price'

13-Sep-07	73755	1	-	1.50	'changed price'
15-Sep-07	73843	0.5	-	1.67	'changed price'
15-Sep-07	73847	1.5	-	2.72	'changed price'
15-Sep-07	73851	0.5	-	0.51	'changed price'
17-Sep-07	73954	0.5	-	1.75	'changed price'
19-Sep-07	74048	0.5	-	8.46	'changed price'
23-Sep-07	74228	0.5	-	322.64	'changed price'
23-Sep-07	74231	0.5	-	0.95	'changed price'
23-Sep-07	74233	1.5	-	6.77	'changed price'
24-Sep-07	74280	2	-	3.32	'changed price'
24-Sep-07	74290	0.5	-	1.34	'changed flow'
25-Sep-07	74328	1.5	-	7.11	'changed flow'
25-Sep-07	74332	0.5	-	1.16	'changed flow'
25-Sep-07	74335	0.5	-	0.56	'changed flow'
25-Sep-07	74337	0.5	-	0.63	'changed flow'
26-Sep-07	74373	0.5	-	0.75	'changed price'

Table 1: Classification of historical negative residue events. Events with "changed price" represent flow continued in same direction but the relative price changed sign (leading to the current ZFC management method). Events labeled "Changed direction" indicate that flow changed direction and the relative price signs remained (leading to a proposed application of PFC).

Summary of Negative Settlement Classifications

Classification	Number of events	Hours of events	$ Value/unit
Price changed direction	15	15.5	-1,305
Flow changed direction	35	32.5	-4,483
Indeterminate	3	3	-94.11

Table 2: Summary classification of historical negative residue events.

8 Impact of PFC on IRSR unit basis risk

8.1 Historical applicability of IRSR units for hedging

In this section, we examine the ability of the IRSR units to act as a hedge for physical or financial players. A key attribute of using a contract in a hedge portfolio is the ability to replicate the contract with a collection of other standard derivatives.

For example, a swap acts as a hedge against physical generation because the payoff is observed to completely offset variability in the physical revenues. However the hedge is not perfect because volume risk (plant outages or constraints) is endured on the physical revenue stream.

The methods to illustrate the risk profiles are:

1. Statistical payoff diagram - The horizontal axis is the principal predictor variable, in this case being flat pool price differentials between regions. The y-axis is the dollar payoff (per unit) of IRSR and/or other portfolio instruments or assets. Premiums paid are not taken into account in the payoff diagram.
2. Distribution of payoffs - A histogram illustrates the variability of settlement outcomes.
3. Differentials between scenarios - The difference in payoffs can be calculated under each scenario, and the distribution plotted. For example, we can run Q1 2007 under the current SRA rules, and a parallel run under an alternative SRA funding arrangement. The differences in derivative payoffs in each half hour can be calculated and the histogram of those differentials plotted. This provides an explicit illustration of the differences between outcomes, which can be lost in the wide distributions presented in method 2.

A reference contract (a firm basis cap) is also presented to illustrate the deviations of the IRSR contract for comparison. For the QLD-NSW IRSR units, a firm basis cap is used as a reference. Define a derivative whose payoff in each half-hour depends on the price differential between regions. Let the payoff for the contract with a nominal 1 MW face volume per be:

$$Payoff_{ref} = \text{Max}\{(1\text{-}0.1) \times (P_{NSW} - P_{QLD}), 0\}$$

The differences with an IRSR UNIT are:

1. the volume is firm at 1 MW, whereas the IRSR UNIT depends upon the volume of flow
2. the formula assumes a nominal 10% losses and does not take into account dynamic losses that will exist on the interconnector (*rate* of losses is smaller with less flow)
3. the formula does not recognize that a natural price differential can exist between NSW and Queensland without accumulating IRSR (due to losses on the interconnector).

However, the reference derivative does supply some feeling of the ability of the IRSR units to replicate this firm behaviour.

8.1.1 Risk Profile of Naked IRSR UNIT

This section illustrates the risk profile of a naked IRSR derivative on the QLD-NSW residues under the current rules and under alternative arrangements. The *risk profile* is deduced directly from the variability of historical outcomes. To illustrate the characteristics of the IRSR units, several visualization techniques are applied, including the statistical payoff diagram.

Half-hourly residues

The half-hourly residues from the actual pool price and flow outcomes agree with values in the settlement tables in the infoserver, or equivalently, can be calculated by the methods described earlier.

Estimates for the residuals arising under the alternative scenarios have been estimated using methodologies outlined in the modeling assumptions.

The residues are presented without taking into account any *weekly* netting processes in place or proposed.

(a) current arrangements, no half-hourly flooring (IRSR UNIT holders fund negative residues)

(b) positive flow clamping, half-hourly flooring, negative residues funded by TNSP

(c) $100K threshold before zero flow clamping, half-hourly flooring, negative residues funded by TNSP

Statistical payoff diagram half hourly: QLD-NSW

The statistical payoffs are illustrated for several selected quarters, and the plots are zoomed at several points. Blue reference points refer to the actual IRSR UNIT payoff. Red reference points relate to the reference portfolio of a firm basis cap.

The payoff for a theoretical reference firm basis cap is also illustrated.

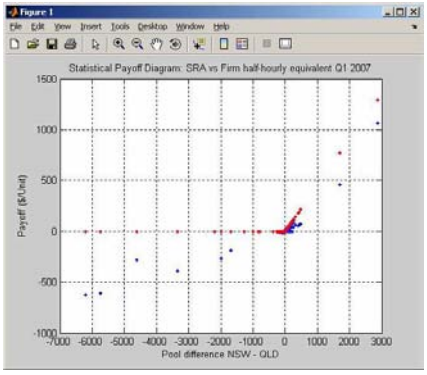


Figure 5: Q1 2007 QLD-NSW IRSR UNIT Payoffs per unit over a historical period in half-hourly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

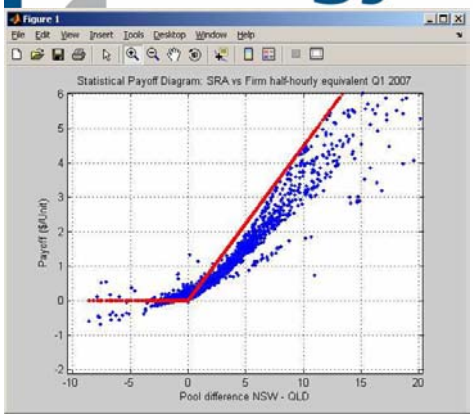


Figure 6: Q1 2007 QLD-NSW IRSR UNIT Payoffs per unit over a historical period in half-hourly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

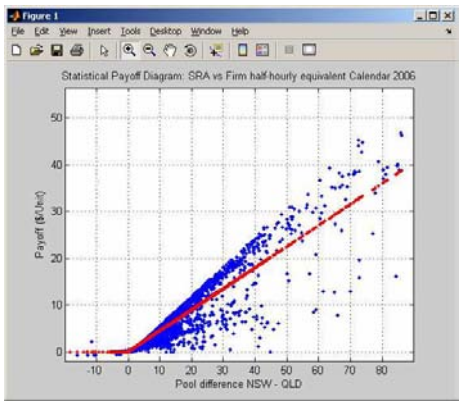


Figure 7: Calendar 2006 QLD-NSW IRSR UNIT Payoffs per unit over a historical period in half-hourly resolution (a) Current arrangements zoom near zero. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

Negative settlement residues are observed in the Q1 2007 period and some smaller amounts in the 2006 period under the current SRA rules. This risk source is seen to be mitigated under the alternative funding/management arrangements. However, the volume risk inherent in the IRSR unit is observed as the IRSR unit payoff does not follow the deterministic price-based curve of the reference basis swap, particularly during high pool price differentials. Especially in the Calendar 2006 data set, there are frequent observations when pool price differentials remain above $40/MWh, but the IRSR payoff is limited to only around one half of the firm basis cap.

The overstating of the half-hourly IRSR UNIT settlements in 2006 is explained by:

(1) DC link residues accumulated as the transmission line became regulated

(2) for extended periods in 2006, the interconnector transferred power at around 1150 MW, while there were only 1000 units sold and therefore nominally 1000 MW in the reference firm basis cap.

(3) The 10% losses in the nominal volume of the cap may also be a slight overstatement. Furthermore, the discreteness of the bid stack structures contributes only to increase the differential.

Statistical payoff diagram half hourly: NSW-QLD

In general, there is far less value accumulated in the NSW-QLD flow as QLD is usually a net exporting region. However, the risk profile of the IRSR UNIT is considerably higher, where risk is measured as deviation from expected outcomes (that is, a reference basis cap).

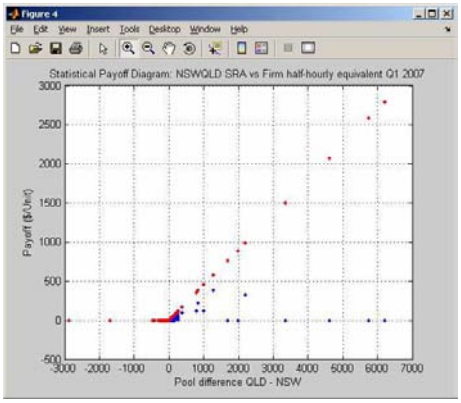


Figure 8: Q1 2007 NSW-QLD IRSR UNIT Payoffs per unit over a historical period in half-hourly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

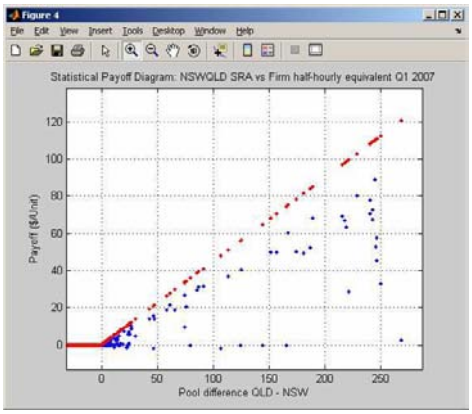


Figure 9: Q1 2007 NSW-QLD IRSR UNIT Payoffs per unit over a historical period in half-hourly resolution (a) Current arrangements zoom near zero. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

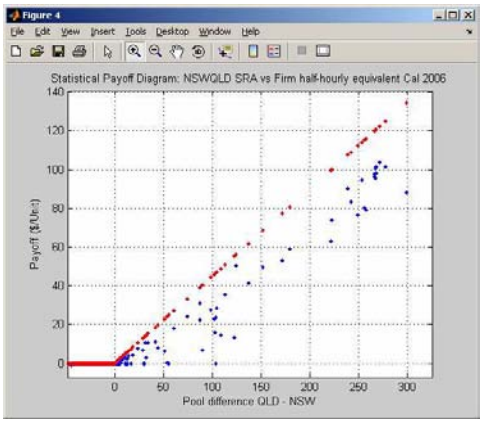


Figure 10: Calendar 2006 NSW-QLD IRSR UNIT Payoffs per unit over a historical period in half-hourly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

The Q1 2007 NSW-QLD residues under the current arrangements illustrate periods when large positive price differentials were observed for Queensland price higher than NSW, but no residues accumulated (limited flow). This provides the largest departure of the actual residue settlements from the firm reference basis cap settlements. This point emphasizes that the greatest driver of risk in the IRSR UNIT profile is the volume risk associated with flows and flow limits. Precisely at the times of large price differentials, when the residue accumulation is needed to offset other contract liabilities, the flow is reduced and settlements received are insubstantial to offset other potential contract liabilities. Altering the clamping arrangements of netting/flooring funding rules for the IRSR UNIT will not diminish this source of risk.

Counter price flows (points when price differential is negative) resulted in negligible residues accumulating due to near-zero flows (red and blue data points coinciding).

Histogram

Histograms of half-hourly naked IRSR settlements in a linear scale reveal little as the vast majority of residues are near-zero values, creating a spike near zero. An illustration is presented below to reinforce this aspect.

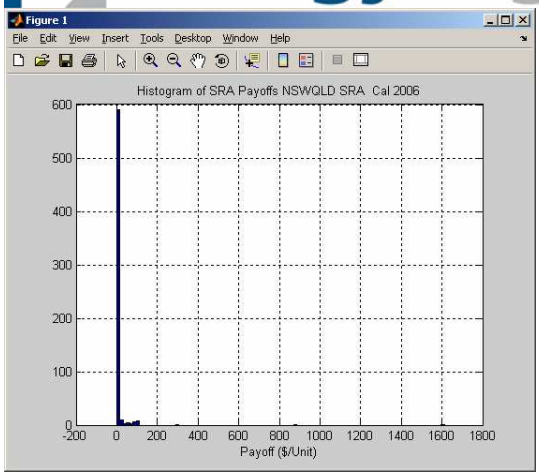


Figure 11: Calendar 2006 NSW-QLD IRSR unit Payoffs per unit over historical period in half-hourly resolution (histogram)

Weekly residuals

Weekly residuals are illustrated under the alternative netting arrangements. Statistical payoff diagrams are constructed with flat pool price differential as the predictor variable.

The residues are presented under the assumed weekly netting processes in place or proposed.

(a) current arrangements, weekly netting and flooring. Negative net values passed forward for future auctions to fund.

(b) positive flow clamping: no weekly netting

(c) $100K threshold before zero flow clamping, no weekly netting

Statistical payoff diagram weekly: QLD-NSW

The statistical payoffs are illustrated for several selected periods, and the plots are zoomed at several points. Blue reference points refer to the *weekly* IRSR UNIT settlement. Red reference points relate to the reference portfolio of a firm basis cap.

The payoff for a theoretical reference firm basis cap is also illustrated.

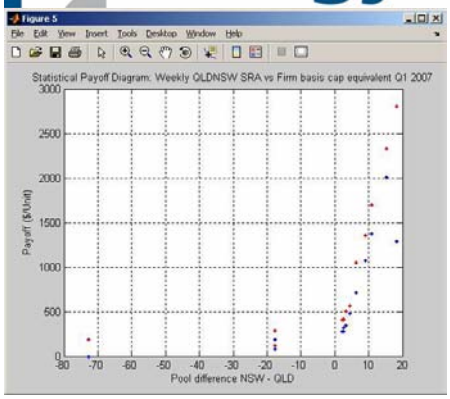


Figure 12: Q1 2007 QLD-NSW IRSR UNIT Payoffs per unit over a historical period in weekly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

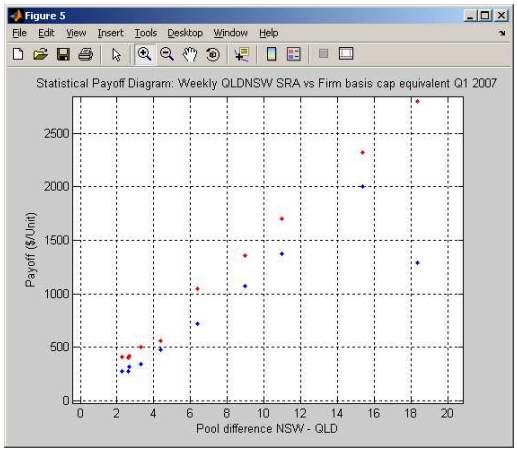


Figure 13: Q1 2007 QLD-NSW IRSR UNIT Payoffs per unit over a historical period in weekly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

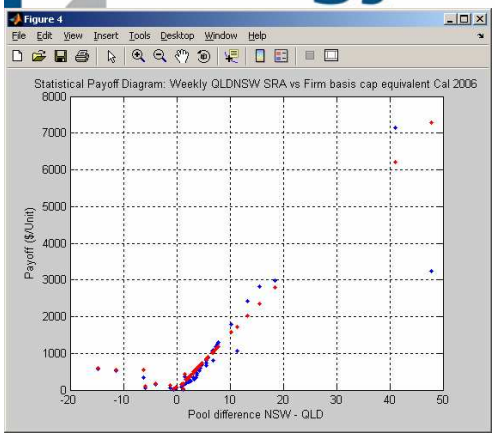


Figure 14: Calendar 2006 QLD-NSW IRSR UNIT Payoffs per unit over a historical period in weekly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

The large negative actual settlements observed in the half-hourly data have largely disappeared in the weekly settlement data. This is explained by the weekly netting process. The weeks containing large negative settlements netted to an overall negative value, and were therefore passed for funding by future SRAs. The magnitude of volume risk is placed in context by observing that the weekly settlement amounts contain values much closer to the firm basis swap, in contrast to the half-hourly volatility.

However, in the Calendar 2006 data, the volume risk is again observed as a point containing a high pool price differential (NSW at $50/MWh above QLD for the weekly average) but settlement residues representing only a half of the firm equivalent. Changes to the negative settlement residue processes are unlikely to change this outcome as the result is driven by reductions in export limits (possibly due to, say, lightning), meaning that the residues cannot accumulate at the full 1000 MW of the nominal IRSR unit.

Statistical payoff diagram weekly: NSW-QLD

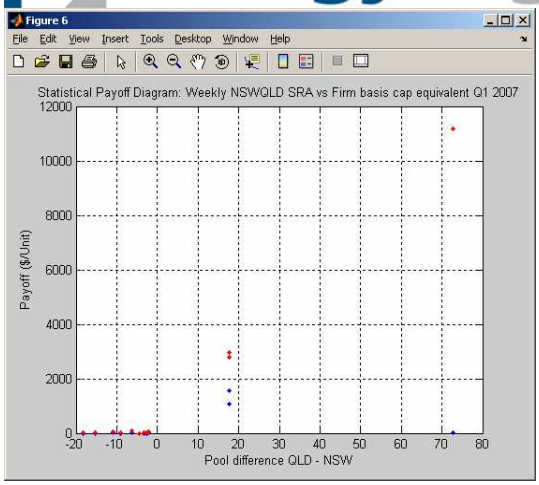


Figure 15: Q1 2007 NSW-QLD IRSR UNIT Payoffs per unit over a historical period in weekly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

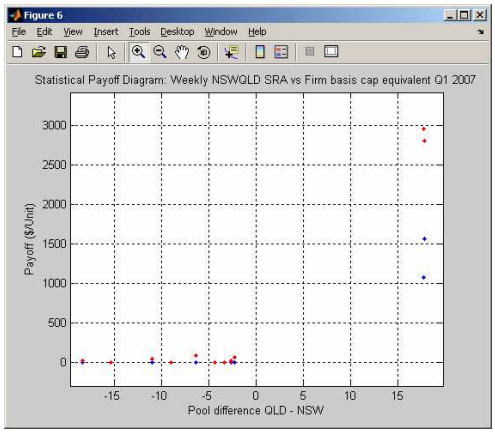


Figure 16: Q1 2007 NSW-QLD IRSR UNIT Payoffs per unit over a historical period in weekly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

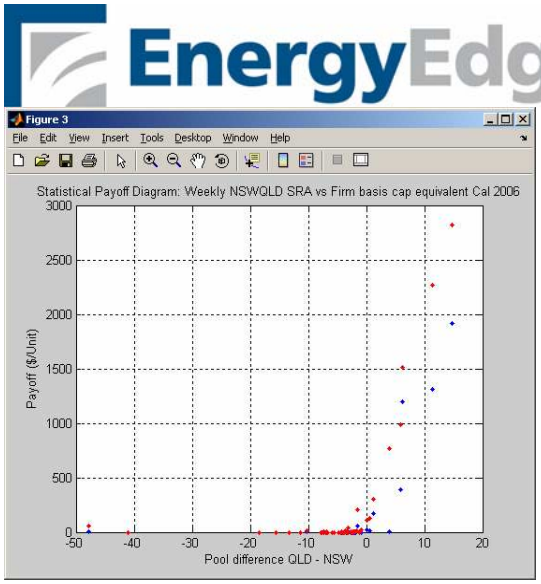


Figure 17: Calendar 2006 NSW-QLD IRSR UNIT Payoffs per unit over a historical period in weekly resolution (a) Current arrangements. Red curve is firm basis cap. Alternative scenarios (b) PFC, (c) Raised $100K threshold differ only as (b) negative settlement residue amounts will be zero and (c) negative settlement residue amounts will be reduced towards zero for all events with negative residues up to $100K.

As with the half hourly observations, there is significantly more risk in the NSWQLD SRA product as its behaviour has considerable deviations from the reference basis swap. There are periods when high pool price differentials are observed, but the value accumulating in the residue is considerably lower than what is anticipated.

The alternative management/funding scenarios indicate that deviations are *not* due to negative settlements netting from the positive returns on a weekly basis, but *instead* due to limit decreases in the QNI link, meaning that residues cannot accumulate.

8.1.2 Hedging with financial products

We consider holding an IRSR contract (a single unit) over historical periods, and attempt to hedge its riskiness away with a portfolio consisting of standard firm instruments.

The objective of this analysis is to quantify the degree of nonfirmness in the SRA product, and therefore its value as fungible trading instruments. The residual risk profile (a portfolio of an IRSR unit combined with other liquid instruments) can be illustrated under the scenarios of IRSR units operating under the current rules, or under alternative scenarios.

The figure below illustrates the statistical payoff diagram for the southward flow from QLD to NSW. It demonstrates that on the few occasions when pool prices departed significantly with QLD above NSW (that is the large negative pool price differences), the IRSR accumulated significant negative residues.

The reference line is again the firm basis cap equivalent.

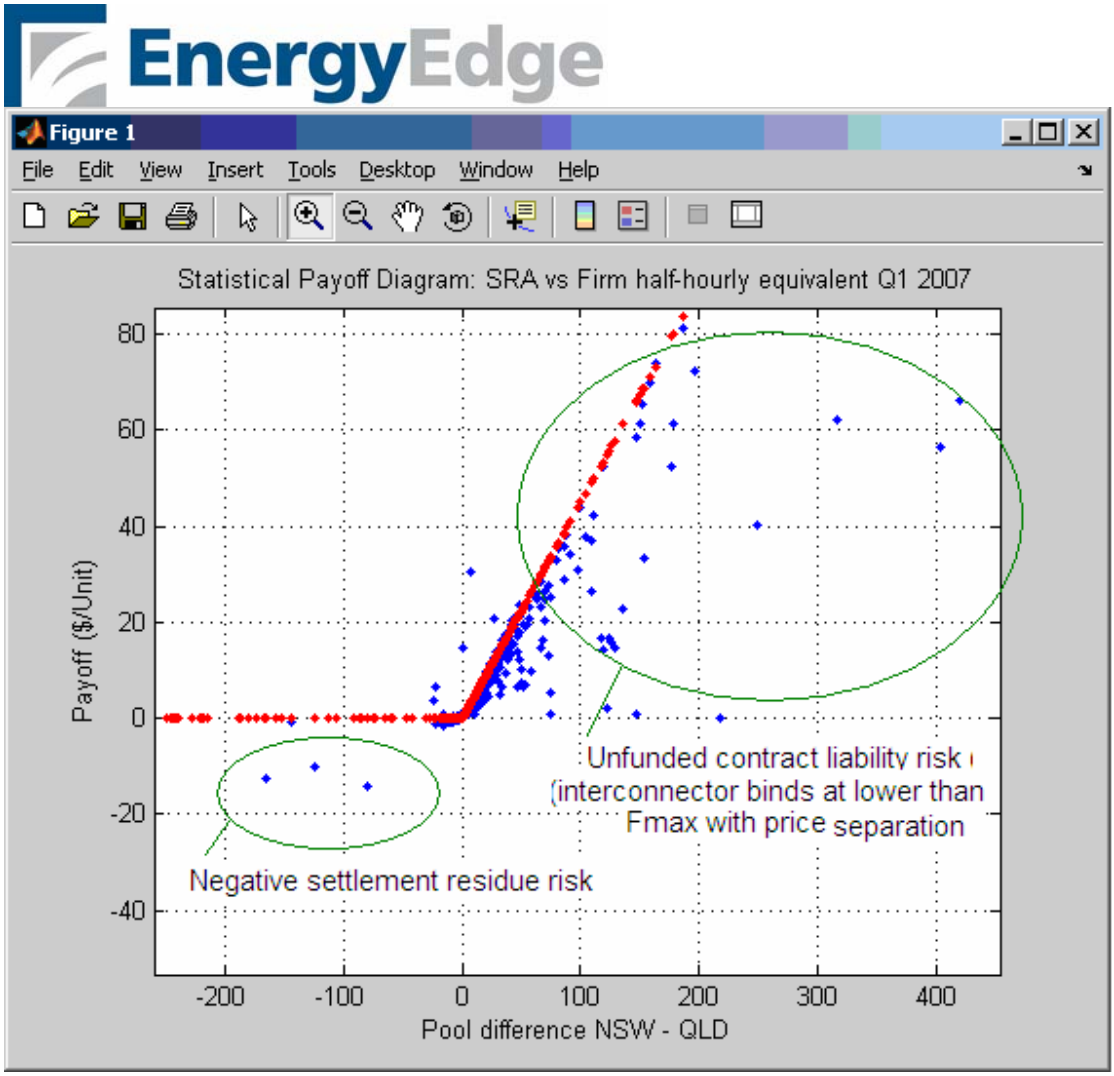


Figure 18: half-hourly payoff diagram for Q1 2007 SRA and firm basis swap equivalent (Southward flow)

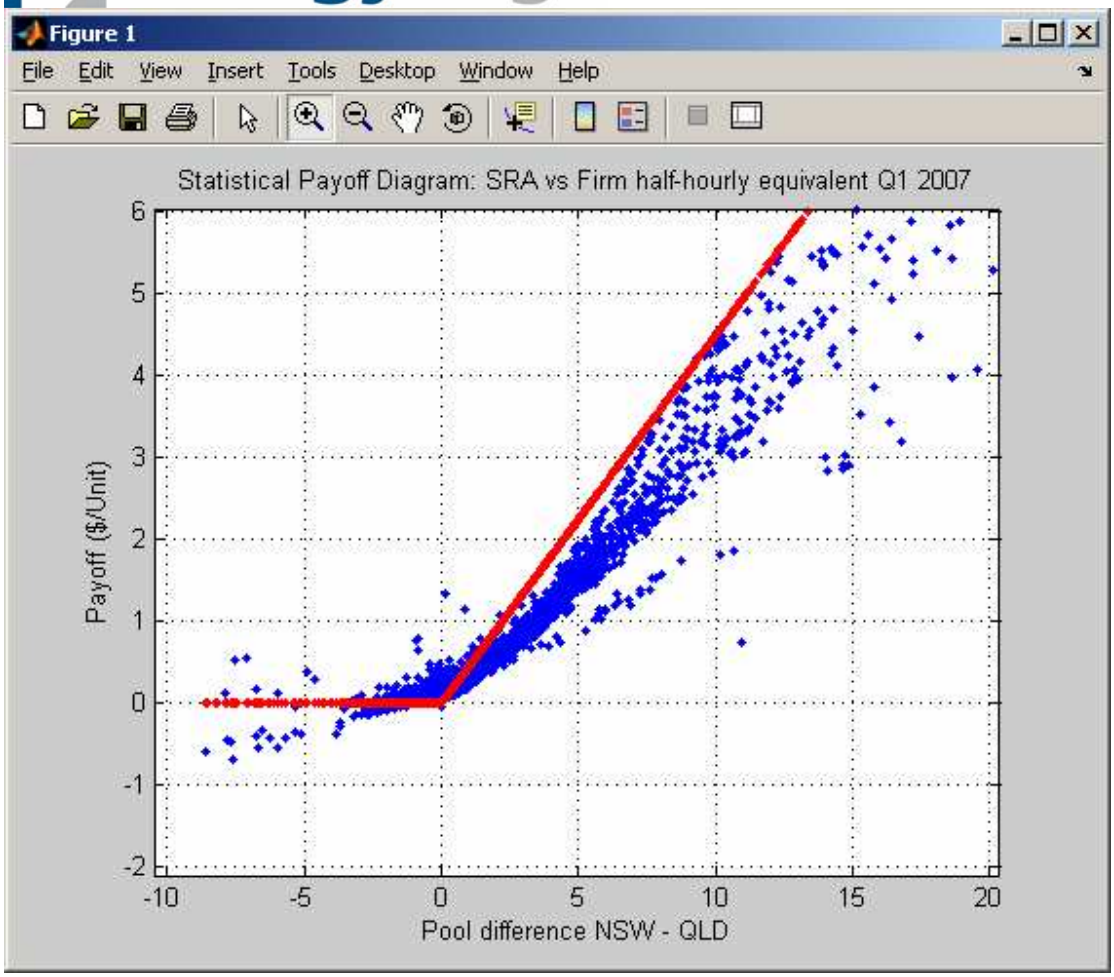
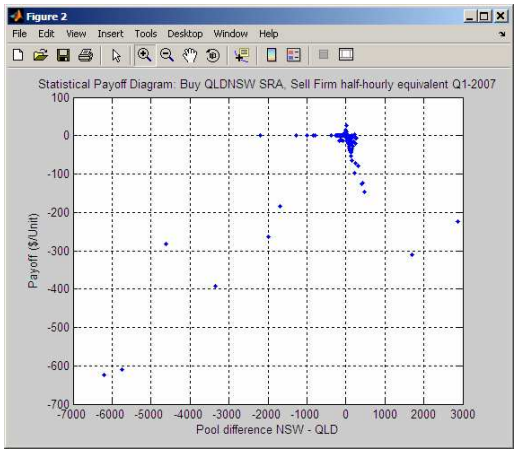


Figure 19: half-hourly payoff diagram for Q1 2007 SRA and firm basis swap equivalent (Southward flow)

The residual risk is the difference between these two and is illustrated below. Netting of the negative residues (or funding from alternative sources such as the TNSP) has not been applied, and in actual fact will not appear in the real-world settlement results.



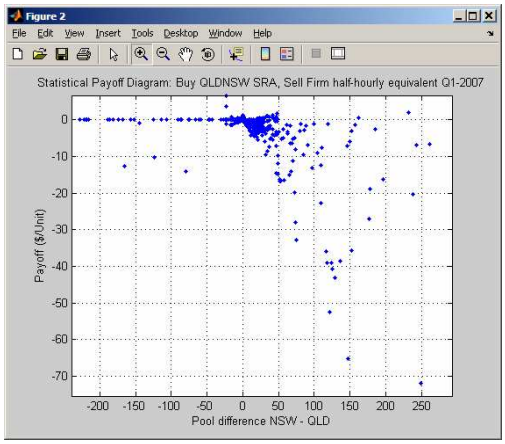


Figure 20: half-hourly payoff diagram for held Q1 2007 SRA and written firm basis cap equivalent (Southward flow)

More realistically, if the hedging strategy may be to enter into a pure interregional swap contract, of the same nominal volume as the SRA in order to hedge out one side of the swap contract, resulting in a much more one-side risk profile.

The following calculations provide an indicator of the risk profile adopted by a strategy attempting to hedge away risks accepted when holding an SRA. The risk profile for a physical generator is *even higher* than listed below due to an additional risk element: "physical revenues constrained due to ZFC or PFC preventing dispatch".

Settlements (Q1 2007) per unit (1 SRA, 1 MW cap)	**Dollar value per unit**
IRSR (no netting)	6,157
Sold Swap	-12,126
Residual risk settlements (SRA – Firm Basis Swap)	-5,969
Residual risk explained by interconnector flow being constrained below Fmax	-3,562
Negative residues	-2,407

The actual negative residues have been calculated after the (current) weekly netting process is imposed. The driver of the risk becomes much more stark:

Settlements (Q1 2007) per unit (1 SRA, 1 MW cap) with weekly netting	**Dollar value per unit**
Residual risk settlements (SRA – Firm Basis Swap)	-3,687
Residual risk explained by interconnector flow being constrained below Fmax	-3,562
Negative residues	-125

In other words for each MW unit of the strategy, $125 of settlement risk was due to negative residues (3% of unfunded settlements). However the vast majority 97% of risk was attributable to interconnector flow limitations at $3,600.

If the negative residues were to be funded by the TNSP, then it would have a negligible impact on the risk profile, as simply the $125 value would disappear from the settlement outcomes.

9 Impact of PFC on Market Liquidity

As discussed in section 6 of this report IRSR Units are utilized for hedging and speculative position taking purposes. This section of the report will look into the nature of the impact PFC has on both hedging and speculative trading activities and considers its impact on each of the characteristics associated with Market Liquidity in an attempt to determine what impact PFC might have on Market Liquidity.

9.1 PFC and hedging activity

Firstly we will consider the hedging activities of physical market participants (generators and retailers) in a simplistic hedging scenario in which organizations adopt a straight line hedge strategy (generators just sell delta and retailers just buy delta). Secondly we will consider the impact of PFC upon Market Liquidity if we assume physical market participants adopt a dynamic hedging strategy where parties both buy and sell and therefore turnover there portfolio more than once prior to reaching their target hedge position for any particular time bucket. Finally we will also consider whether the impact of PFC upon Market Liquidity might be any different when used as a hedging instrument by speculative traders.

9.1.1 Impact upon straight line hedge strategies

In general organistions that adopt straight line hedge strategies that involve no or very little turnover of their physical positions are conservative in their approach to the electricity derivative market, the product types they use and the level of basis risk they are willing to carry. Some generators select a target hedge position and only execute transactions that provide offsets to the physical price exposure e.g. sold swaps and do not execute any significant buybacks in the process of reaching that target hedge level. Likewise some retailers have very limited scope to reprofile hedge positions through selling activities in the derivative markets.

In the case of these types of organizations it is likely that their general risk averse approach to hedging in the electricity derivative market would not permit the significant use of IRSR Units or derivative transactions against regions other than the region in which the physical exposure exists. This risk aversion to using interregional trading activities is unlikely to change for such organizations whilst there is any material basis risk residual in IRSR Units. As PFC will only resolve a small portion of the basis risk with IRSR Units it is not expected to result in any material change in the level of interregional trading by these entities and therefore will not have any material impact on Market Liquidity.

However, even if we were to assume that the introduction of PFC was to result in some entities of this nature to utilize IRSR Units probably it would not have an impact on Market Liquidity.

(a) Turnover

Unless a market participant that uses a straight line hedge strategy increased its hedge limits there use of IRSR Units and hedging via other regions would not result in an increase in the volume of derivatives turned over in the market. It simply results in the movement of a certain volume of derivatives formerly traded against one regional reference price to the same volume of derivatives traded against an alternative RRP.

PFC and the access to IRSR units with less basis risk is not the sort of factors that influence hedge limit methodologies applied by market participants in the NEM.

(b) Market Depth

As per the comments on turnover the MW volume of bids and offers from risk averse entities of this nature will not be influenced by the introduction of PFC or any other factor that might improve the firmness of IRSR Units.

The number of counterparties trading in each region would increase if such entities did adopt interregional derivatives as a valid hedge instrument but Energy Edge does not believe that PFC will diminish the basis risk associated with IRSR Units sufficiently to drive a change in the level of acceptance of interregional derivatives as a hedge instrument amongst risk averse entities.

(c) Product Choice

Risk averse entities are unlikely to introduce any further diversity to derivative product types even if they were to adopt IRSR Units as a risk management tool.

(d) Cost of transacting

The cost of brokerage and the width of bid/offer spreads are unlikely to be influenced by the impact of PFC upon risk averse entities.

9.1.2 Impact upon dynamic hedge strategies

Many physical market participants whether they are generators or retailers actively manage their market risk by constantly reprofiling their hedge portfolio as market and corporate circumstances change. This means that target hedge volumes will change over time, product mixes might change and the path taken in obtaining a target hedge level will not be straight. Generators and retailers in this category will both buy and sell electricity derivatives and their physical exposure maybe turned over 2 to 5 times in volume of derivatives traded. Typically such physical market participants are willing to carry elements of market risk they feel they can optimize and off load other risk factors. Organisations of this nature are likely to already be registered as SRA market participants and utilize IRSR Units as a risk management tool to some extent.

A material increase in the firmness of IRSR Units might result in market participants of this nature increasing the extent to which the use IRSR Units and interregional derivatives as part of hedge strategies or result in an organization currently only using IRSR Units for speculative position taking to start using them as hedge instruments. However, as discussed in sections 6, 7 and 8 of this report it is questionable as to whether PFC will make any material difference to the firmness of IRSR Units and certainly significant basis risk will remain if PFC were to be the only change implemented. Therefore it is unlikely that the introduction of PFC alone would result in any great change to the extent active physical market participants might use interregional trading activities for hedging purposes.

However, even if they were to increase the extent to which IRSR Units and interregional derivatives were utilized for the purposes of hedging it is unlikely to have a material impact upon Market Liquidity.

(a) Turnover

A market participant that actively manages their hedge portfolio could deliver an improvement in the net turnover of electricity derivatives in the NEM by either increasing their Maximum Hedge Limits, Target Hedge Levels or the extent to which they turnover their physical portfolio via derivative trading. However, as negative settlement residues are only a small proportion of the basis risk associated with IRSR units and PFC only mitigates a small component of that basis risk it is unlikely that the marginal improvement in firmness of the IRSR units as a result of introducing PFC will have any material impact on Maximum Hedge Limits, Target Hedge Level or the extent to which participants turnover their physical portfolio.

It is also unlikely that the introduction of PFC will have a material impact on the level of buying interest for IRSR units in the primary market (SRA). However, even if their was an increase in the use of IRSR units for hedging purposes, as the Maximum Hedge Limits, Target Hedge Levels and level of turnover in the broader electricity derivative market is unlikely to change the use of IRSR Units and hedging via other regions would not result in an increase in the volume of derivatives turned over in the market. It simply results in the movement of a certain volume of derivatives formerly traded against one regional reference price to the same volume of derivatives traded against an alternative RRP.

PFC and the access to IRSR Units with less basis risk is not the sort of factors that influence hedge limit methodologies by market participants in the NEM.

(b) Market Depth

As per the comments on turnover the MW volume of bids and offers from risk entities of this nature will not be influenced by the introduction of PFC as it only has a marginal impact on the basis risk associated with IRSR Units and would not change the hedge strategies of these market participants.

In the case of entities that pursue dynamic hedging strategies the number of counterparties trading in each region might increase as these entities are likely to be users of IRSR units and have a risk appetite that would authorize the use of IRSR Units and interregional derivative positions as a means of managing natural market risk exposures in another region. However, the introduction of PFC alone is unlikely to change the extent to which these entities hedge interregionally as it only has a small impact on the basis risk associated with IRSR Units. The primary Market Liquidity benefit that accrues to parties from having a larger number of parties trading in a given region is its ability to assist in diluting counterparty credit exposure arising from hedging activities. However, even if PFC did result in an increase in counterparties trading in each region the extent to which it would mitigate credit risk and in turn facilitate greater Market Liquidity is very small relative to other factors in the market, such as the ongoing viability of Exchange Traded Futures, that help manage credit risk issues.

(c) Product Choice

Whilst some entities of this nature may have the skills and appetite to develop and make a market in new electricity derivatives it is unlikely that the introduction of PFC is going to provide the stimulus for the introduction of new derivative product types. Again this is because PFC does not make a material contribution to reducing basis risk associated with IRSR Units.

(d) Cost of transacting

The cost of brokerage and the width of bid/offer spreads are unlikely to be influenced by the impact of PFC upon dynamic hedging entities as a sizeable increase in total derivative turnover is the primary source of reduction in brokerage rates and bid/offer spreads are unlikely to be improved by the impact of PFC.

9.2 PFC and speculative position taking

The impact of a firmer IRSR unit has the potential to increase Market Liquidity as a result of speculative trading activity via two key areas of impact. Firstly, the effectiveness of IRSR units as a tool for taking on speculative positions and secondly greater speculative positions may be enabled under the same VAR Trading Limits afforded to speculative traders as a result of reduced basis risk associated with those positions.

It is unlikely that the use of IRSR Units for creating speculative positions is going to positively impact Market Liquidity because IRSR Units themselves are only a very small portion of the total electricity derivatives traded in the NEM. Furthermore the small improvement in the level of basis risk is not likely to be sufficient to entice speculative traders to introduce new derivative product types or provide tighter bid/offer spreads under their market making activities. The availability of a marginally firmer IRSR Unit is not going to be the trigger that attracts new speculative traders to the Australian electricity derivative market or to encourage existing speculative traders to trade in regions they are not already trading in.

9.2.1 IRSR Units as tool to create speculative positions

Speculative traders use IRSR Units as a means acquiring an exposure to the particular pay-off profile associated with the IRSR product. They will buy units at prices that they feel statistically have a reasonable probability of generating a pay out in excess of the SRA clearing price they will have to pay. Changing the nature of the IRSR Unit will change the nature of the pay-off diagram but is unlikely to change the extent to which speculative traders use IRSR Units. This is even more so when we consider the minimal impact that PFC will have on the pay-off diagram of the IRSR Units.

The main factors likely to result in speculative traders using IRSR Units to a greater extent for creating speculative positions is if they feel there is an increased probability of getting IRSR Units cheaper than their likely pay-off or if there is an increased demand for firm interregional products issued on the secondary market. Both of these circumstances are most likely to arise if basis risk associated with IRSR units actually increases and they become more difficult to price for less sophisticated market participants and demand for a firm secondary product increases.

9.2.2 Impact on speculative traders VAR Limits

An increase in VAR Limits speculative traders are authorised to take or an increase in the volume able to be traded under existing VAR Limits due to a material reduction in the risk associated with speculative positions being taken are two key potential sources of material improvement in electricity derivative Market Liquidity.

However, the introduction of PFC and its small impact on the firmness of IRSR Units will not have any impact on VAR Limits afforded speculative traders for all the electricity derivative trading activities undertaken by an organisation. Likewise the small improvement in basis risk associated with the introduction of PFC is not expected to reduce the risk profile of any derivatives currently traded in the NEM to an extent that would result in an increase in the volume of derivatives able to be executed within existing VAR Limits.

The impact of the measures undertaken to improve the reliability and predictability of the underlying network will have a far greater impact on Market Liquidity than PFC. This is largely because the Volume Basis Risk associated with IRSR Units is a much bigger proportion of the total basis risk of IRSR units than Negative Settlements Residue let alone the portion of Negative Settlement Residue that PFC will mitigate.

Additionally the nature of these changes will also be more positive for Market Liquidity because.

- Changes don't directly impact market structure (e.g. transparency);
- Changes are of a nature that improve Market Liquidity as a result of its impact on all derivative trading not just interregional transactions; and
- Changes are of a nature that will encourage increased speculative trading activity which has a multiplier impact on Market Liquidity.

Recommendation 3 – The proposal to cease the practice of netting negative settlement residue against the positive residues during billing periods and the funding of negative settlement residue by directly billing the importing regions TNSP, is also likely to have a more positive impact on firming up IRSR Units and therefore Market Liquidity than the PFC proposal.

10 Issues arising from PFC

There are a number of benefits and issues associated with PFC that do not have an impact on Market Liquidity but are important to include in any consideration on the adoption of a PFC mechanism. It is beyond the scope of this paper to discuss non Market Liquidity factors associated with PFC. However, some consequential outcomes associated with PFC do give rise to potential adverse impacts upon Market Liquidity.

In general any change to regulatory environment that impacts the fundamentals of a commodity or causes a reduction in transparency and predictability of market processes will have an adverse impact on Market Liquidity of the associated derivative market for at least the short term. This is particularly the case where such changes have a direct impact upon the price distribution of the underlying product of the derivative market. Therefore with regards to Market Liquidity the rule of thumb should be that Market Liquidity should not be used as a basis for a regulatory decision that changes the supply, demand and pricing fundamentals of electricity pool prices or reduces transparency associated with decisions relating to market processes unless there is a clear demonstrable and material Market Liquidity benefit that outweighs the adverse effects of uncertainty and opaque processes.

ZFC and PFC are physical interventions in market processes that will by definition result in dispatch outcomes and consequently pool prices behaving differently than would have otherwise occurred under the current regulatory regime. As the CMR states, intra-regional generators will be backed off to a greater extent, while interregional generators will be allowed to generate more. This will not always result in the lowest bid generation in the NEM being dispatched.

For this reason other modifications to IRSR Unit processes recommended by the AMEC such as a 3 years SRA process, allocation of negative settlement residue to TNSP's and reforms to improve reliability and predictability of interconnector transfer limits are likely to have a significantly more material impact on Market Liquidity than the introduction of PFC. These arrangements improve risk management tools, transparency and predictability without intervening in the physical outcomes of the underlying commodity.

One of the adverse impacts of ZFC and even more so PFC is the fact that some generators will actively be constrained off from dispatching during periods in which PFC is applied. In the context of Market Liquidity this will result in an effective decrease in plant reliability as a means of dispatching physical electricity to obtain cashflow offsets against firm electricity derivatives executed as hedges against that generation plant.

Physical reliability issues (Forced Outage Rates) associated with generation plant impact the volume a party is willing to hedge using electricity derivatives. An increase in Forced Outage Rates of a plant will result in a lower Maximum Hedge Limit for that generator and in turn at times will reduce the volume of electricity derivatives traded in the NEM. In fact, risk is amplified under the implementation of PFC, as the contraints suffered by plant will tend to coincide with high pool price events (intra regional pool prices or basis spreads), meaning that physical volume becomes unavailable precisely when it is needed to cover contract liabilities. As with physical constraints on reliability of generation plant, constraints on the reliability of plant in being dispatched during periods of system intervention such as PFC will reduce the volume parties are willing to hedge against that generation asset and in turn overall electricity derivative turnover.

Active management of the constraint under PFC can lead to increased physical volume risk (more dispatch constraints) but less transmission volume risk (fewer negative residues). The dominant effect depends upon modeling subtleties which are beyond the scope of the present analysis. However, by interpreting the risk profile under the assumptions above (half hourly exposures), an argument can be raised that PFC leads to reduced access to market which is a worse outcome from a hedging perspective than permitting negative residues to accumulate.

- Let the generator have a capacity (or hedgable volume) of $V = V_Q + V_N$.
- Let the generator dispatch volume V at price PQ.
- Let there be a region Q swap contract for volume V_Q at price K_Q.
- Let there be a region N swap contract for volume V_N at price K_N.
- Let there be U units of SRA contract for flow from Q to N
- Let the interconnector have maximum flow of Fmax (and equal to the number of SRA units available).
- Let $F_{max}\ U = V_N$ be the volume of SRA to hedge the interregional exposure.
- Let flow on the interconnector in direction Q to S be F MW.

The cash flows R from the portfolio are (over a given hour to scale time out of the expression):

$$R = V P_Q + (K_N - P_N) V_N + (K_Q - P_Q) V_Q + (P_N - P_Q) F U \qquad (*)$$

The following scenarios illustrate how the elements of this trading strategy interact.

Scenario	Parameters	Cash flow	Comment
1	$P_N \approx P_Q$ (No price separation) $V = V_Q + V_N$ (No dispatch constraint) F = any value (any flow outcome)	$V_Q K_Q + V_N K_N$	Swap contracts behave as perfect hedge, basis risk not present as no price separation.
2	$P_N > P_Q$ $V = V_Q + V_N$ (No dispatch constraint) $F = F_{max}$ (flow at limit)	$V_Q K_Q + V_N K_N$	Settlement residues accumulate and precisely offset losses from basis risk as $P_N > P_Q$.
3	$P_N < P_Q$ $V = V_Q + V_N$ F = 0 (flow in direction N to Q)	$V_Q K_Q + V_N K_N + V_N(P_Q-P_N)$	Last term is a windfall, relating to positive income from interregional contract but no liabilities from SRA. This element contributes to recovery of SRA premium
4a	$P_N < P_Q$ $V = V_Q + V_N$ (No dispatch constraint) $F = F_{max}$ (flow at limit) Negative IRSR netted from SRA settlements	$V_Q K_Q + V_N K_N$	Negative settlement residues are accumulating with flow at maximum rate. Illustrates that SRA acts as a hedge, even if negative residues accumulate.
4b	$P_N < P_Q$ $V = V_Q + V_N$ (No dispatch constraint) $F = F_{max}$ (flow at limit) Negative IRSR funded by TNSP	$V_Q K_Q + V_N K_N + V_N(P_Q-P_N)$	Agrees with scenario 3. Last term is a windfall, relating to positive income from interregional contract but no liabilities from SRA. This element contributes to recovery of SRA premium.
5	$P_N > P_Q$ $V = V_Q + V_N$ (No dispatch constraint) $F = L\ F_{max}$ (flow at reduced limit)	$V_Q K_Q + V_N K_N + (1-L)\ V_N\ (P_Q – P_N)$	Last tern is negative value which represents failures of SRA to provide perfect hedge to compensate for interregional contract liabilities.
6	$P_N >= P_Q$ $V = V_Q + V_N – C$ (C MW of output constrained off) Fmax	$V_Q K_Q + V_N K_N – C\ P_Q$	If P_Q is high, there are unfunded liabilities from being constrained off. Net cash flow can be negative for P_Q very large.
7	$P_N < P_Q$ $V = V_Q + V_N – C$ (C MW of output constrained off) F = 0 (zero clamped OR no flow from Q to N)	$V_Q K_Q + V_N K_N + V_N\ (P_Q - P_N)– C\ P_Q$	The first additional term $V_N\ (P_Q - P_N)$ is windfall from no SRA liabilities. The second term is the unfunded contract liabilities from constrained off. The balance can fall either way, but very high prices P_Q can yield negative outcomes.

Scenario 1 is the simple outcome that prices move in unison and no IRSR accumulate. The cash flow outcomes are the contract face values.

Scenario 2 illustrates that provided the interconnector is flowing fully, the SRA acts as a perfect hedge to the interregional liabilities.

Scenario 3 illustrates that this proposed hedging strategy can only return better than not implementing the strategy provided the SRA is acting as a firm instrument.

Scenario 4a illustrates that negative settlement residues do not form a risk to this hedging profile, where risk is interpreted as the possibility of catastrophic losses due to unfunded contract liabilities. Provided that the market knows that negative settlements may occur, they will be valued into the intial pricing (premium) of the SRA. Scenario 4b illustrates that under a regime where the negative residues are funded, a windfall is achieved by this hedging strategy (although the windfall settlements will be mainly wiped out by the increased SRA premiums).

Scenario 5 represents the greatest source of nonfirmness in an SRA. During periods in which the interconnector limit is constrained, the flow is much more likely to meet the limit and thus induce price separation between regions. Precisely at that time, the interregional contract suffers basis risk, and the generator is exposed to unfunded liabilities arising from the high interregional price. The cash flows arising from the SRA are diminished precisely because of the reduced volumes on the interconnector.
In summary, the volatility in interconnector limits creates both (i) price separation and (ii) a source of risk in that SRA volumes are insufficient to cover liabilities from that price separation just caused. A possible solution is to execute a larger volume of SRAs than nominally required to hedge the exposure in region N, and this emphasizes again the nonfirmness of the instrument.

Scenario 7 illustrates the risks induced by physical intervention regimes by the system operator,. In case positive flow clamping is imposed, the only changes to the cashflow line will be induced because the output from the regional generators will be constrained off (that is, C>0). This behaviour introduced the risk of having several intervals of unfunded contract liabilities.

11 Conclusion

Whilst the PFC may have a number of other reasons for being implemented this study shows that its contribution to Market Liquidity for electricity derivatives should not be a major driver in that consideration. There are a number of other positive and negative elements that are far more material to the decision on whether PFC should be implemented or not. However, assessment of these other factors to be considered in determining the costs and benefits associated with PFC is beyond the scope of this report.

Negative Settlements Residue is only a small portion of the basis risk associated with IRSR Units. The introduction of PFC will only mitigate part of the basis risk attributable to negative settlements residue. The residual basis risk associated with IRSR units will still be significant after the introduction of PFC and therefore PFC is unlikely to result in a significant increase in Market Liquidity as a result of its impact upon organizations using IRSR Units whether it is for hedging or speculative position taking purposes. Furthermore the proposal to fund negative settlement residue via TNSP's, rather than IRSR unit pay-offs, will achieve much of the reduction in IRSR basis risk attributable to PFC but in a far less interventionist manner.

At best PFC will result in an increase in the number of counterparties trading in each region but will not increase the level of turnover or other characteristics of Market Liquidity. This may have a second order impact on Market Liquidity as a result of a small improvement in market participant's ability to manage credit risk through increased numbers of potential counterparties and therefore an ability to dilute credit exposures is achieved. However, their marginal positive impact on Market Liquidity is likely to be offset by adverse outcomes arising from regulatory change processes and the increased dispatch risk arising from the constraining of intra-regional generators.

Other areas of analysis that would be conducted if time and budget constraints allowed include the following:

- ü A detailed survey across a range of market participant types on the use of IRSR Units, the impact of PFC and firmer IRSR units in general upon their trading activities and consequently Market Liquidity.
- ü Specific quantification of the proportion of IRSR unit basis risk attributable to Volume Basis Risk and Price Basis Risk.
- ü Quantitative analysis of IRSR unit basis risk across other NEM regulated interconnectors.
- ü Analysis of the extent to which IRSR units are currently used by market participants for speculative purposes versus hedging activities.

12 Appendix SRA outcomes

Settlement Residue Results

Link: QLD -> NSW

Period (week starting)	Negative residues	Positive residues	Total residues	Floored residues	Carried residues	Proportion positive	Proportion negative
01-Jul-2003'	-	170544.82	170544.82	170544.82	-	1.00	-
06-Jul-2003'	-	172909.64	172909.64	172909.64	-	1.00	-
13-Jul-2003'	-	196114.03	196114.03	196114.03	-	1.00	-
20-Jul-2003'	-	152820.20	152820.20	152820.20	-	1.00	-
27-Jul-2003'	-5,186.68	157352.02	152165.34	152165.34	-	0.89	0.03
03-Aug-2003'	-	88846.96	88846.96	88846.96	-	1.00	-
10-Aug-2003'	-	343089.79	343089.79	343089.79	-	1.00	-
17-Aug-2003'	-	228097.84	228097.84	228097.84	-	1.00	-
24-Aug-2003'	-	189343.90	189343.90	189343.90	-	1.00	-
31-Aug-2003'	-	1384175.21	1384175.21	1384175.21	-	1.00	-
07-Sep-2003'	-	142971.12	142971.12	142971.12	-	1.00	-
14-Sep-2003'	-	260234.12	260234.12	260234.12	-	1.00	-
21-Sep-2003'	-74.28	119896.95	119822.67	119822.67	-	1.00	0.00
28-Sep-2003'	-	228435.31	228435.31	228435.31	-	0.99	-
05-Oct-2003'	-	182158.85	182158.85	182158.85	-	1.00	-
12-Oct-2003'	-	192239.73	192239.73	192239.73	-	1.00	-
19-Oct-2003'	-	142461.57	142461.57	142461.57	-	1.00	-
26-Oct-2003'	-3.47	107294.18	107290.71	107290.71	-	0.97	0.01
02-Nov-2003'	-107.73	39237.88	39130.15	39130.15	-	0.75	0.08
09-Nov-2003'	-9,192.99	375953.65	366760.66	366760.66	-	0.99	0.01
16-Nov-2003'	-2,185,952.58	154633.09	-2031319.49	0.00	-2,031,319.49	0.99	0.01
23-Nov-2003'	-	185211.86	185211.86	185211.86	-	0.98	-
30-Nov-2003'	-	138692.55	138692.55	138692.55	-	0.98	-
07-Dec-2003'	-9,792.34	20147.81	10355.47	10355.47	-	0.49	0.07
14-Dec-2003'	-40.62	162151.25	162110.63	162110.63	-	0.94	0.02

21-Dec-2003'	-34.15	24997.14	24962.98	24962.98	-	0.58	0.06
28-Dec-2003'	-70.53	575625.62	575555.09	575555.09	-	0.66	0.06
04-Jan-2004'	-177.20	387759.01	387581.82	387581.82	-	0.78	0.06
11-Jan-2004'	-49.48	64612.24	64562.76	64562.76	-	0.92	0.04
18-Jan-2004'	-33.56	668132.76	668099.20	668099.20	-	0.91	0.01
25-Jan-2004'	-75.41	18898.41	18823.00	18823.00	-	0.84	0.07
01-Feb-2004'	-20.65	3340267.69	3340247.04	3340247.04	-	0.95	0.01
08-Feb-2004'	-71.80	5485850.72	5485778.92	5485778.92	-	0.94	0.03
15-Feb-2004'	-130.40	1525153.31	1525022.90	1525022.90	-	0.68	0.04
22-Feb-2004'	-69.04	57497.65	57428.62	57428.62	-	0.82	0.04
29-Feb-2004'	-10.87	441761.19	441750.32	441750.32	-	0.96	0.01
07-Mar-2004'	-163.49	1616340.17	1616176.68	1616176.68	-	0.78	0.07
14-Mar-2004'	-25.75	124784.84	124759.09	124759.09	-	0.96	0.02
21-Mar-2004'	-	217528.61	217528.61	217528.61	-	1.00	-
28-Mar-2004'	-9.75	201512.79	201503.05	201503.05	-	0.98	0.01
04-Apr-2004'	-1.75	247026.49	247024.74	247024.74	-	0.99	0.01
11-Apr-2004'	-172.82	95823.89	95651.07	95651.07	-	0.97	0.02
18-Apr-2004'	-695.86	11018.61	10322.75	10322.75	-	0.48	0.11
25-Apr-2004'	-11.81	230017.16	230005.35	230005.35	-	0.92	0.02
02-May-2004'	-33.14	247815.25	247782.11	247782.11	-	0.96	0.02
09-May-2004'	-107.61	158478.39	158370.77	158370.77	-	0.91	0.04
16-May-2004'	-31.56	314956.37	314924.82	314924.82	-	0.93	0.02
23-May-2004'	-29.59	220142.71	220113.12	220113.12	-	0.91	0.02
30-May-2004'	-175.57	198180.09	198004.53	198004.53	-	0.60	0.11
06-Jun-2004'	-131.35	139780.17	139648.82	139648.82	-	0.70	0.07
13-Jun-2004'	-	422371.11	422371.11	422371.11	-	0.99	-
20-Jun-2004'	-4.64	655951.82	655947.18	655947.18	-	0.99	0.00
27-Jun-2004'	-	684123.31	684123.31	684123.31	-	1.00	-
04-Jul-2004'	-0.84	315161.70	315160.85	315160.85	-	1.00	0.00
11-Jul-2004'	-18.16	208394.27	208376.12	208376.12	-	0.97	0.01
18-Jul-2004'	-	4885388.55	4885388.55	4885388.55	-	1.00	-
25-Jul-2004'	-42.62	203022.92	202980.30	202980.30	-	0.98	0.01
01-Aug-2004'	-58.37	141384.82	141326.45	141326.45	-	0.90	0.04
08-Aug-2004'	-34.94	189260.73	189225.79	189225.79	-	0.99	0.01
15-Aug-2004'	-31.16	187290.36	187259.20	187259.20	-	0.94	0.03

22-Aug-2004'	-157.36	18513.99	18356.64	18356.64	-	0.75	0.11
29-Aug-2004'	-158.59	117640.51	117481.92	117481.92	-	0.78	0.07
05-Sep-2004'	-21.55	257879.89	257858.34	257858.34	-	0.97	0.01
12-Sep-2004'	-11.76	245723.10	245711.34	245711.34	-	0.96	0.01
19-Sep-2004'	-110.56	62264.49	62153.93	62153.93	-	0.84	0.07
26-Sep-2004'	-93,139.90	11216.41	-81923.48	0.00	-81,923.48	0.44	0.14
03-Oct-2004'	-51,812.89	10018.04	-41794.85	0.00	-41,794.85	0.27	0.08
10-Oct-2004'	-97.25	9907201.77	9907104.52	9907104.52	-	0.89	0.04
17-Oct-2004'	-209.42	193718.55	193509.13	193509.13	-	0.95	0.03
24-Oct-2004'	-903.57	33059.04	32155.47	32155.47	-	0.56	0.15
31-Oct-2004'	-503.61	50926.29	50422.68	50422.68	-	0.79	0.10
07-Nov-2004'	-381.93	68400.91	68018.99	68018.99	-	0.82	0.09
14-Nov-2004'	-538.29	491869.94	491331.66	491331.66	-	0.76	0.10
21-Nov-2004'	-124.58	304304.67	304180.09	304180.09	-	0.93	0.04
28-Nov-2004'	-41.95	38750712.31	38750670.35	38750670.35	-	0.97	0.01
05-Dec-2004'	-890.00	351620.05	350730.05	350730.05	-	0.98	0.02
12-Dec-2004'	-353.22	68622.27	68269.06	68269.06	-	0.68	0.06
19-Dec-2004'	-2,525.21	210456.82	207931.62	207931.62	-	0.90	0.05
26-Dec-2004'	-	135858.30	135858.30	135858.30	-	1.00	-
02-Jan-2005'	-133.98	60718.80	60584.83	60584.83	-	0.82	0.05
09-Jan-2005'	-115.55	2763306.75	2763191.20	2763191.20	-	0.96	0.02
16-Jan-2005'	-80.02	101576.79	101496.77	101496.77	-	0.84	0.03
23-Jan-2005'	-25.41	253001.97	252976.56	252976.56	-	0.99	0.01
30-Jan-2005'	-160.66	122024.97	121864.30	121864.30	-	0.90	0.06
06-Feb-2005'	-143.14	336353.84	336210.70	336210.70	-	0.85	0.02
13-Feb-2005'	-26.20	110027.92	110001.73	110001.73	-	0.98	0.01
20-Feb-2005'	-56.92	108707.97	108651.05	108651.05	-	0.94	0.01
27-Feb-2005'	-	149908.17	149908.17	149908.17	-	1.00	-
06-Mar-2005'	-	122439.89	122439.89	122439.89	-	1.00	-
13-Mar-2005'	-	180375.37	180375.37	180375.37	-	1.00	-
20-Mar-2005'	-	192169.69	192169.69	192169.69	-	1.00	-
27-Mar-2005'	-	395636.52	395636.52	395636.52	-	1.00	-

03-Apr-2005'	-	466426.98	466426.98	466426.98	-	1.00	-
10-Apr-2005'	-12.82	666635.58	666622.76	666622.76	-	1.00	0.00
17-Apr-2005'	-	625910.47	625910.47	625910.47	-	1.00	-
24-Apr-2005'	-	699505.51	699505.51	699505.51	-	1.00	-
01-May-2005'	-5.31	363301.67	363296.36	363296.36	-	1.00	0.00
08-May-2005'	-	190954.62	190954.62	190954.62	-	1.00	-
15-May-2005'	-	433709.35	433709.35	433709.35	-	1.00	-
22-May-2005'	-	333307.31	333307.31	333307.31	-	1.00	-
29-May-2005'	-	372944.74	372944.74	372944.74	-	0.99	-
05-Jun-2005'	-	166261.58	166261.58	166261.58	-	0.96	-
12-Jun-2005'	-	188644.77	188644.77	188644.77	-	1.00	-
19-Jun-2005'	-13.77	1199305.64	1199291.87	1199291.87	-	1.00	0.00
26-Jun-2005'	-	309105.45	309105.45	309105.45	-	1.00	-
03-Jul-2005'	-	819411.26	819411.26	819411.26	-	1.00	-
10-Jul-2005'	-	1042433.56	1042433.56	1042433.56	-	1.00	-
17-Jul-2005'	-	703737.27	703737.27	703737.27	-	1.00	-
24-Jul-2005'	-	528431.09	528431.09	528431.09	-	1.00	-
31-Jul-2005'	-	1493075.52	1493075.52	1493075.52	-	1.00	-
07-Aug-2005'	-	1963228.38	1963228.38	1963228.38	-	1.00	-
14-Aug-2005'	-	397754.07	397754.07	397754.07	-	1.00	-
21-Aug-2005'	-	1099528.66	1099528.66	1099528.66	-	1.00	-
28-Aug-2005'	-16.49	193964.55	193948.06	193948.06	-	0.99	0.00
04-Sep-2005'	-	242667.49	242667.49	242667.49	-	1.00	-
11-Sep-2005'	-581,222.37	2442802.24	1861579.87	1861579.87	-	0.99	0.01
18-Sep-2005'	-	540806.77	540806.77	540806.77	-	1.00	-
25-Sep-2005'	-69.23	219706.65	219637.42	219637.42	-	0.99	0.01
02-Oct-2005'	-53.22	172200.82	172147.60	172147.60	-	0.98	0.01
09-Oct-2005'	-3.49	209319.32	209315.83	209315.83	-	1.00	0.00
16-Oct-2005'	-	324278.76	324278.76	324278.76	-	1.00	-
23-Oct-2005'	-1,118.95	92761.09	91642.14	91642.14	-	0.95	0.03
30-Oct-2005'	-	14302840.26	14302840.26	14302840.26	-	1.00	-
06-Nov-2005'	-12.31	18915993.82	18915981.51	18915981.51	-	0.99	0.01
13-Nov-2005'	-	280112.20	280112.20	280112.20	-	1.00	-

20-Nov-2005'	-43.88	179854.04	179810.16	179810.16	-	0.99	0.01
27-Nov-2005'	-	233641.99	233641.99	233641.99	-	1.00	-
04-Dec-2005'	-449.89	1405208.29	1404758.40	1404758.40	-	0.77	0.05
11-Dec-2005'	-281.57	22421.20	22139.63	22139.63	-	0.63	0.09
18-Dec-2005'	-169.61	284427.54	284257.93	284257.93	-	0.77	0.08
25-Dec-2005'	-811.71	2827013.49	2826201.78	2826201.78	-	0.90	0.09
01-Jan-2006'	-131.23	565840.27	565709.04	565709.04	-	0.61	0.07
08-Jan-2006'	-76.98	327957.72	327880.74	327880.74	-	0.95	0.03
15-Jan-2006'	-94.75	448173.13	448078.38	448078.38	-	0.85	0.05
22-Jan-2006'	-60.32	333145.93	333085.60	333085.60	-	0.84	0.02
29-Jan-2006'	-98.49	3237510.36	3237411.86	3237411.86	-	0.85	0.02
05-Feb-2006'	-294.34	17935.03	17640.69	17640.69	-	0.50	0.11
12-Feb-2006'	-216.05	49689.04	49472.99	49472.99	-	0.74	0.08
19-Feb-2006'	-297.68	54595.23	54297.55	54297.55	-	0.67	0.08
26-Feb-2006'	-75.22	175485.35	175410.13	175410.13	-	0.93	0.04
05-Mar-2006'	-274.64	61881.41	61606.77	61606.77	-	0.76	0.08
12-Mar-2006'	-	316679.76	316679.76	316679.76	-	1.00	-
19-Mar-2006'	-	662102.17	662102.17	662102.17	-	1.00	-
26-Mar-2006'	-	404723.36	404723.36	404723.36	-	1.00	-
02-Apr-2006'	- 14,208.51	536258.27	522049.76	522049.76	-	0.93	0.04
09-Apr-2006'	-	347940.11	347940.11	347940.11	-	1.00	-
16-Apr-2006'	-117.11	87683.74	87566.63	87566.63	-	0.96	0.03
23-Apr-2006'	-	262357.34	262357.34	262357.34	-	1.00	-
30-Apr-2006'	-	230591.44	230591.44	230591.44	-	1.00	-
07-May-2006'	-92.49	211107.76	211015.27	211015.27	-	1.00	0.00
14-May-2006'	-	196162.54	196162.54	196162.54	-	1.00	-
21-May-2006'	-	221507.35	221507.35	221507.35	-	1.00	-
28-May-2006'	-88.75	245010.40	244921.65	244921.65	-	0.99	0.01
04-Jun-2006'	-	301090.69	301090.69	301090.69	-	1.00	-
11-Jun-2006'	-	1074222.48	1074222.48	1074222.48	-	1.00	-
18-Jun-2006'	-	741997.94	741997.94	741997.94	-	1.00	-
25-Jun-2006'	-3.61	815162.45	815158.84	815158.84	-	0.98	0.00
02-Jul-2006'	-	2413564.39	2413564.39	2413564.39	-	1.00	-
09-Jul-2006'	-	2809608.95	2809608.95	2809608.95	-	1.00	-

16-Jul-2006'	-	7142750.86	7142750.86	7142750.86	-	1.00	-
23-Jul-2006'	-	1086414.17	1086414.17	1086414.17	-	1.00	-
30-Jul-2006'	-	1243881.88	1243881.88	1243881.88	-	1.00	-
06-Aug-2006'	-	575675.18	575675.18	575675.18	-	1.00	-
13-Aug-2006'	-	294950.85	294950.85	294950.85	-	1.00	-
20-Aug-2006'	-	1298528.38	1298528.38	1298528.38	-	1.00	-
27-Aug-2006'	-	517437.38	517437.38	517437.38	-	1.00	-
03-Sep-2006'	-	1177144.28	1177144.28	1177144.28	-	1.00	-
10-Sep-2006'	-	2978460.23	2978460.23	2978460.23	-	1.00	-
17-Sep-2006'	-	869804.77	869804.77	869804.77	-	1.00	-
24-Sep-2006'	-	596778.14	596778.14	596778.14	-	1.00	-
01-Oct-2006'	-	241763.15	241763.15	241763.15	-	1.00	-
08-Oct-2006'	-	1073336.31	1073336.31	1073336.31	-	1.00	-
15-Oct-2006'	-	700477.28	700477.28	700477.28	-	1.00	-
22-Oct-2006'	-	1061215.53	1061215.53	1061215.53	-	1.00	-
29-Oct-2006'	-	579368.63	579368.63	579368.63	-	1.00	-
05-Nov-2006'	-	817079.31	817079.31	817079.31	-	1.00	-
12-Nov-2006'	-	450025.56	450025.56	450025.56	-	1.00	-
19-Nov-2006'	-549.02	1778503.34	1777954.32	1777954.32	-	0.97	0.02
26-Nov-2006'	-2,401.54	354407.15	352005.61	352005.61	-	0.93	0.02
03-Dec-2006'	-	501671.69	501671.69	501671.69	-	1.00	-
10-Dec-2006'	-7,285.28	153512.65	146227.37	146227.37	-	0.96	0.03
17-Dec-2006'	-	411294.39	411294.39	411294.39	-	1.00	-
24-Dec-2006'	-	122510.64	122510.64	122510.64	-	1.00	-
31-Dec-2006'	-	588600.78	588600.78	588600.78	-	1.00	-
07-Jan-2007'	-155.79	863287.39	863131.60	863131.60	-	0.96	0.01
14-Jan-2007'	-180.31	331748.21	331567.89	331567.89	-	0.91	0.04
21-Jan-2007'	-2,879,094.83	158929.67	-2720165.17	0.00	-2,720,165.17	0.81	0.09
28-Jan-2007'	-158.86	100226.66	100067.80	100067.80	-	0.67	0.03
04-Feb-2007'	-	411810.20	411810.20	411810.20	-	1.00	-
11-Feb-2007'	-	2407359.03	2407359.03	2407359.03	-	1.00	-
18-Feb-2007'	-	1292005.63	1292005.63	1292005.63	-	1.00	-

25-Feb-2007'	-3,431.28	1651510.62	1648079.33	1648079.33	-	0.96	0.03
04-Mar-2007'	-178.06	381874.27	381696.21	381696.21	-	0.99	0.01
11-Mar-2007'	-1,094.08	230539.53	229445.45	229445.45	-	0.87	0.05
18-Mar-2007'	-3,676.76	1549365.66	1545688.90	1545688.90	-	0.98	0.01
25-Mar-2007'	-662.58	327417.57	326754.99	326754.99	-	0.98	0.02
01-Apr-2007'	-	429457.58	429457.58	429457.58	-	1.00	-
08-Apr-2007'	-201.61	357151.22	356949.61	356949.61	-	0.99	0.01
15-Apr-2007'	-33.74	486123.61	486089.87	486089.87	-	0.99	0.01
22-Apr-2007'	-6,737.39	361520.31	354782.92	354782.92	-	0.95	0.03
29-Apr-2007'	-15.82	345460.37	345444.56	345444.56	-	0.99	0.01
06-May-2007'	-17.52	457156.89	457139.37	457139.37	-	0.99	0.01
13-May-2007'	-902.15	213924.93	213022.77	213022.77	-	0.95	0.04
20-May-2007'	-36.41	492835.02	492798.61	492798.61	-	1.00	0.00
27-May-2007'	-926.48	101796.97	100870.49	100870.49	-	0.57	0.08
03-Jun-2007'	-359.27	261813.30	261454.03	261454.03	-	0.78	0.04
10-Jun-2007'	-223.41	14997207.45	14996984.03	14996984.03	-	0.86	0.04
17-Jun-2007'	-21,234.65	1871362.35	1850127.70	1850127.70	-	0.86	0.04
24-Jun-2007'	-20.53	5537979.58	5537959.06	5537959.06	-	0.99	0.00
01-Jul-2007'	-35.31	1048135.95	1048100.64	1048100.64	-	0.99	0.01
08-Jul-2007'	-263.26	1046283.37	1046020.11	1046020.11	-	0.98	0.01
15-Jul-2007'	-6,120.99	1145999.81	1139878.82	1139878.82	-	0.90	0.05
22-Jul-2007'	-378.16	159847.00	159468.84	159468.84	-	0.86	0.05
29-Jul-2007'	-167.88	302761.73	302593.85	302593.85	-	0.91	0.04
05-Aug-2007'	-928.07	176228.60	175300.53	175300.53	-	0.86	0.06
12-Aug-2007'	-2,798.93	324395.26	321596.33	321596.33	-	0.96	0.04
19-Aug-2007'	-691.35	157192.66	156501.31	156501.31	-	0.87	0.06
26-Aug-2007'	-318.42	186725.62	186407.19	186407.19	-	0.82	0.05
02-Sep-2007'	-563.60	78560.68	77997.08	77997.08	-	0.82	0.11

09-Sep-2007'	-6,552.87	91990.48	85437.60	85437.60	-	0.74	0.09
16-Sep-2007'	-18,627.24	150624.49	131997.25	131997.25	-	0.73	0.10
23-Sep-2007'	-350,705.02	37837.59	-312867.43	0.00	-312,867.43	0.52	0.18
30-Sep-2007'	-50.05	340.53	290.48	290.48	-	0.19	0.13

Settlement Residue Results

Link: NSW -> QLD

Period (week starting)	Negative residues	Positive residues	Total residues	Floored residues	Carried residues	Proportion positive	Proportion negative
01-Jul-2003'	-	-	-	-	-	-	-
06-Jul-2003'	-	-	-	-	-	-	-
13-Jul-2003'	-	-	-	-	-	-	-
20-Jul-2003'	-	-	-	-	-	-	-
27-Jul-2003'	-114.38	2,448.30	2,333.91	2,333.91	-	0.06	0.02
03-Aug-2003'	-	-	-	-	-	-	-
10-Aug-2003'	-	-	-	-	-	-	-
17-Aug-2003'	-	-	-	-	-	-	-
24-Aug-2003'	-	-	-	-	-	-	-
31-Aug-2003'	-	-	-	-	-	-	-
07-Sep-2003'	-	-	-	-	-	-	-
14-Sep-2003'	-	-	-	-	-	-	-
21-Sep-2003'	-	-	-	-	-	-	-
28-Sep-2003'	-3,613.58	-	-3,613.58	-	-3,613.58	-	0.01
05-Oct-2003'	-	-	-	-	-	-	-
12-Oct-2003'	-	-	-	-	-	-	-
19-Oct-2003'	-0.62	-	-0.62	-	-0.62	-	0.00
26-Oct-2003'	-13.54	92.69	79.16	79.16	-	0.01	0.01
02-Nov-2003'	-22.45	2,262.82	2,240.37	2,240.37	-	0.15	0.01
09-Nov-2003'	-	-	-	-	-	-	-
16-Nov-2003'	-	-	-	-	-	-	-
23-Nov-2003'	-1.30	288.07	286.77	286.77	-	0.02	0.00
30-Nov-2003'	-10.91	37.72	26.81	26.81	-	0.02	0.01

07-Dec-2003'	-108.19	42,066.69	41,958.49	41,958.49	-	0.40	0.04
14-Dec-2003'	-6.41	152.01	145.60	145.60	-	0.03	0.01
21-Dec-2003'	-37.16	4,704.07	4,666.91	4,666.91	-	0.32	0.04
28-Dec-2003'	-36.16	2,898.70	2,862.54	2,862.54	-	0.24	0.04
04-Jan-2004'	-104.25	788.86	684.61	684.61	-	0.13	0.04
11-Jan-2004'	-48.36	2.16	-46.20	-	-46.20	0.01	0.03
18-Jan-2004'	-40.06	539.57	499.51	499.51	-	0.05	0.02
25-Jan-2004'	-24.29	509.93	485.64	485.64	-	0.06	0.03
01-Feb-2004'	-6.59	92.89	86.30	86.30	-	0.02	0.01
08-Feb-2004'	-17.15	300.35	283.19	283.19	-	0.01	0.01
15-Feb-2004'	-61.00	311,925.46	311,864.47	311,864.47	-	0.25	0.03
22-Feb-2004'	-93.33	1,390.67	1,297.34	1,297.34	-	0.09	0.05
29-Feb-2004'	-0.78	58.89	58.11	58.11	-	0.02	0.00
07-Mar-2004'	-21.42	1,412.19	1,390.77	1,390.77	-	0.13	0.02
14-Mar-2004'	-4.97	12.22	7.25	7.25	-	0.02	0.00
21-Mar-2004'	-	-	-	-	-	-	-
28-Mar-2004'	-2.27	14.00	11.73	11.73	-	0.01	0.00
04-Apr-2004'	-1.86	-	-1.86	-	-1.86	-	0.00
11-Apr-2004'	-1.86	2.77	0.91	0.91	-	0.01	0.00
18-Apr-2004'	-27.42	31,454.64	31,427.22	31,427.22	-	0.37	0.04
25-Apr-2004'	-20.48	360.46	339.98	339.98	-	0.04	0.02
02-May-2004'	-12.68	84.70	72.01	72.01	-	0.02	0.00
09-May-2004'	-53.49	57.22	3.73	3.73	-	0.02	0.03
16-May-2004'	-10.83	234.54	223.71	223.71	-	0.04	0.01
23-May-2004'	-57.21	332.08	274.87	274.87	-	0.04	0.02
30-May-2004'	-94.23	3,322.89	3,228.66	3,228.66	-	0.25	0.04
06-Jun-2004'	-170.88	2,259.53	2,088.65	2,088.65	-	0.15	0.07
13-Jun-2004'	-8.35	15.51	7.17	7.17	-	0.01	0.01
20-Jun-2004'	-37.80	0.86	-36.94	-	-36.94	0.00	0.00
27-Jun-2004'	-	-	-	-	-	-	-
04-Jul-2004'	-	-	-	-	-	-	-
11-Jul-2004'	-6.68	94.76	88.08	88.08	-	0.01	0.01
18-Jul-2004'	-	-	-	-	-	-	-
25-Jul-2004'	-32.88	88.55	55.67	55.67	-	0.00	0.01
01-Aug-2004'	-93.20	516,550.28	516,457.08	516,457.08	-	0.05	0.02

08-Aug-2004'	-	22.04	22.04	22.04	-	0.00	-
15-Aug-2004'	-8.54	46.86	38.32	38.32	-	0.02	0.01
22-Aug-2004'	-65.46	734.07	668.61	668.61	-	0.11	0.04
29-Aug-2004'	-44.50	658.78	614.28	614.28	-	0.11	0.04
05-Sep-2004'	-	42.28	42.28	42.28	-	0.02	-
12-Sep-2004'	-3.13	53.36	50.24	50.24	-	0.02	0.00
19-Sep-2004'	-33.93	338.80	304.86	304.86	-	0.07	0.02
26-Sep-2004'	-105.20	12,692.49	12,587.29	12,587.29	-	0.37	0.05
03-Oct-2004'	-77.57	37,911.21	37,833.65	37,833.65	-	0.64	0.02
10-Oct-2004'	-60.45	443.51	383.05	383.05	-	0.06	0.01
17-Oct-2004'	-46.02	193.83	147.81	147.81	-	0.01	0.01
24-Oct-2004'	-667.80	4,216.64	3,548.84	3,548.84	-	0.20	0.09
31-Oct-2004'	-242.36	449.71	207.35	207.35	-	0.05	0.06
07-Nov-2004'	-55.63	861.51	805.88	805.88	-	0.07	0.02
14-Nov-2004'	-224.36	751.32	526.95	526.95	-	0.09	0.04
21-Nov-2004'	-33.80	93.25	59.45	59.45	-	0.02	0.01
28-Nov-2004'	-24.80	46.84	22.04	22.04	-	0.01	0.01
05-Dec-2004'	-	-	-	-	-	-	-
12-Dec-2004'	-133.32	289,736.41	289,603.09	289,603.09	-	0.22	0.03
19-Dec-2004'	-40.77	1,647.92	1,607.14	1,607.14	-	0.05	0.00
26-Dec-2004'	-	-	-	-	-	-	-
02-Jan-2005'	-96.13	1,080.83	984.70	984.70	-	0.10	0.02
09-Jan-2005'	-53.91	61.24	7.33	7.33	-	0.01	0.01
16-Jan-2005'	-141.06	5,057.38	4,916.32	4,916.32	-	0.11	0.02
23-Jan-2005'	-	-	-	-	-	-	-
30-Jan-2005'	-15.16	252.61	237.44	237.44	-	0.04	0.01
06-Feb-2005'	-43.19	8,481.67	8,438.48	8,438.48	-	0.11	0.01
13-Feb-2005'	-	6.42	6.42	6.42	-	0.00	-
20-Feb-2005'	-1.85	7,006.76	7,004.91	7,004.91	-	0.04	0.00
27-Feb-2005'	-	-	-	-	-	-	-
06-Mar-2005'	-	-	-	-	-	-	-
13-Mar-2005'	-	-	-	-	-	-	-
20-Mar-2005'	-	-	-	-	-	-	-
27-Mar-2005'	-	-	-	-	-	-	-
03-Apr-2005'	-	-	-	-	-	-	-

10-Apr-2005'	-	-	-	-	-	-	-
17-Apr-2005'	-	-	-	-	-	-	-
24-Apr-2005'	-	-	-	-	-	-	-
01-May-2005'	-	-	-	-	-	-	-
08-May-2005'	-	-	-	-	-	-	-
15-May-2005'	-	-	-	-	-	-	-
22-May-2005'	-	-	-	-	-	-	-
29-May-2005'	-3,305.09	-	-3,305.09	-	-3,305.09	-	0.01
05-Jun-2005'	-6,357.08	-	-6,357.08	-	-6,357.08	-	0.04
12-Jun-2005'	-	-	-	-	-	-	-
19-Jun-2005'	-	-	-	-	-	-	-
26-Jun-2005'	-	-	-	-	-	-	-
03-Jul-2005'	-	-	-	-	-	-	-
10-Jul-2005'	-	-	-	-	-	-	-
17-Jul-2005'	-	-	-	-	-	-	-
24-Jul-2005'	-	-	-	-	-	-	-
31-Jul-2005'	-	-	-	-	-	-	-
07-Aug-2005'	-	-	-	-	-	-	-
14-Aug-2005'	-	-	-	-	-	-	-
21-Aug-2005'	-	-	-	-	-	-	-
28-Aug-2005'	-	4.43	4.43	4.43	-	0.00	-
04-Sep-2005'	-	-	-	-	-	-	-
11-Sep-2005'	-	-	-	-	-	-	-
18-Sep-2005'	-	-	-	-	-	-	-
25-Sep-2005'	-	-	-	-	-	-	-
02-Oct-2005'	-	57.77	57.77	57.77	-	0.01	-
09-Oct-2005'	-	-	-	-	-	-	-
16-Oct-2005'	-	-	-	-	-	-	-
23-Oct-2005'	-17.82	65.90	48.08	48.08	-	0.01	0.01
30-Oct-2005'	-	-	-	-	-	-	-
06-Nov-2005'	-	-	-	-	-	-	-
13-Nov-2005'	-	-	-	-	-	-	-
20-Nov-2005'	-4.68	-	-4.68	-	-4.68	-	0.00
27-Nov-2005'	-	-	-	-	-	-	-

04-Dec-2005'	-25.54	28,998.72	28,973.18	28,973.18	-	0.16	0.02
11-Dec-2005'	-75.37	63,929.75	63,854.38	63,854.38	-	0.22	0.06
18-Dec-2005'	-8,108.41	843.51	-7,264.90	-	-7,264.90	0.10	0.05
25-Dec-2005'	-	202.52	202.52	202.52	-	0.01	-
01-Jan-2006'	-107.74	956,440.75	956,333.01	956,333.01	-	0.28	0.05
08-Jan-2006'	-40.74	82.60	41.86	41.86	-	0.01	0.01
15-Jan-2006'	-56.26	600.89	544.63	544.63	-	0.08	0.02
22-Jan-2006'	-62.85	597,158.61	597,095.75	597,095.75	-	0.13	0.01
29-Jan-2006'	-82.58	1,808.77	1,726.19	1,726.19	-	0.10	0.02
05-Feb-2006'	-109.14	5,293.78	5,184.64	5,184.64	-	0.33	0.06
12-Feb-2006'	-64.16	12,058.38	11,994.23	11,994.23	-	0.16	0.02
19-Feb-2006'	-212.83	195,020.07	194,807.24	194,807.24	-	0.21	0.04
26-Feb-2006'	-54.52	114.57	60.05	60.05	-	0.02	0.02
05-Mar-2006'	-156.52	85,544.56	85,388.03	85,388.03	-	0.11	0.05
12-Mar-2006'	-	-	-	-	-	-	-
19-Mar-2006'	-	-	-	-	-	-	-
26-Mar-2006'	-	-	-	-	-	-	-
02-Apr-2006'	-553.05	655,745.98	655,192.93	655,192.93	-	0.03	0.01
09-Apr-2006'	-	-	-	-	-	-	-
16-Apr-2006'	-22.23	13.76	-8.48	-	-8.48	0.00	0.00
23-Apr-2006'	-	-	-	-	-	-	-
30-Apr-2006'	-	-	-	-	-	-	-
07-May-2006'	-	-	-	-	-	-	-
14-May-2006'	-	-	-	-	-	-	-
21-May-2006'	-	-	-	-	-	-	-
28-May-2006'	-	-	-	-	-	-	-
04-Jun-2006'	-	-	-	-	-	-	-
11-Jun-2006'	-	-	-	-	-	-	-
18-Jun-2006'	-	-	-	-	-	-	-
25-Jun-2006'	-737.84	1.70	-736.14	-	-736.14	0.00	0.01
02-Jul-2006'	-	-	-	-	-	-	-
09-Jul-2006'	-	-	-	-	-	-	-
16-Jul-2006'	-	-	-	-	-	-	-
23-Jul-2006'	-	-	-	-	-	-	-
30-Jul-2006'	-	-	-	-	-	-	-

06-Aug-2006'	-	-	-	-	-	-	-
13-Aug-2006'	-	-	-	-	-	-	-
20-Aug-2006'	-	-	-	-	-	-	-
27-Aug-2006'	-	-	-	-	-	-	-
03-Sep-2006'	-	-	-	-	-	-	-
10-Sep-2006'	-	-	-	-	-	-	-
17-Sep-2006'	-	-	-	-	-	-	-
24-Sep-2006'	-	-	-	-	-	-	-
01-Oct-2006'	-	-	-	-	-	-	-
08-Oct-2006'	-	-	-	-	-	-	-
15-Oct-2006'	-	-	-	-	-	-	-
22-Oct-2006'	-	-	-	-	-	-	-
29-Oct-2006'	-	-	-	-	-	-	-
05-Nov-2006'	-	-	-	-	-	-	-
12-Nov-2006'	-	-	-	-	-	-	-
19-Nov-2006'	-6.38	29.57	23.18	23.18	-	0.00	0.00
26-Nov-2006'	-786.38	29,873.80	29,087.42	29,087.42	-	0.03	0.01
03-Dec-2006'	-	-	-	-	-	-	-
10-Dec-2006'	-	74.62	74.62	74.62	-	0.02	-
17-Dec-2006'	-	-	-	-	-	-	-
24-Dec-2006'	-	-	-	-	-	-	-
31-Dec-2006'	-	-	-	-	-	-	-
07-Jan-2007'	-72.79	216.72	143.93	143.93	-	0.02	0.01
14-Jan-2007'	-55.55	1,678.88	1,623.33	1,623.33	-	0.04	0.01
21-Jan-2007'	-2,590.79	8,336.17	5,745.38	5,745.38	-	0.09	0.01
28-Jan-2007'	-3,360.94	867,783.61	864,422.67	864,422.67	-	0.26	0.04
04-Feb-2007'	-	-	-	-	-	-	-
11-Feb-2007'	-	-	-	-	-	-	-
18-Feb-2007'	-	-	-	-	-	-	-
25-Feb-2007'	-2.54	40.43	37.90	37.90	-	0.01	0.00
04-Mar-2007'	-	-	-	-	-	-	-
11-Mar-2007'	-186.86	591,421.86	591,235.00	591,235.00	-	0.07	0.01
18-Mar-2007'	-2,930.86	-	-2,930.86	-	-2,930.86	-	0.00
25-Mar-2007'	-	-	-	-	-	-	-

01-Apr-2007'	-	-	-	-	-	-	-
08-Apr-2007'	-	-	-	-	-	-	-
15-Apr-2007'	-32.17	-	-32.17	-	-32.17	-	0.00
22-Apr-2007'	-43.74	495.98	452.24	452.24	-	0.02	0.00
29-Apr-2007'	-	-	-	-	-	-	-
06-May-2007'	-	-	-	-	-	-	-
13-May-2007'	-28.56	56.65	28.09	28.09	-	0.01	0.01
20-May-2007'	-	-	-	-	-	-	-
27-May-2007'	-248.78	18,773.26	18,524.48	18,524.48	-	0.31	0.03
03-Jun-2007'	-442.49	1,889.58	1,447.10	1,447.10	-	0.12	0.06
10-Jun-2007'	-10.47	22,132.49	22,122.02	22,122.02	-	0.10	0.01
17-Jun-2007'	-268.22	16,820.12	16,551.90	16,551.90	-	0.08	0.01
24-Jun-2007'	-7.05	-	-7.05	-	-7.05	-	0.00
01-Jul-2007'	-21.04	-	-21.04	-	-21.04	-	0.00
08-Jul-2007'	-132.46	178.60	46.14	46.14	-	0.00	0.00
15-Jul-2007'	-1,598.77	23,451.14	21,852.37	21,852.37	-	0.03	0.02
22-Jul-2007'	-41.32	4,128.64	4,087.32	4,087.32	-	0.07	0.02
29-Jul-2007'	-87.99	1,094.00	1,006.01	1,006.01	-	0.04	0.01
05-Aug-2007'	-125.98	6,457.56	6,331.58	6,331.58	-	0.06	0.02
12-Aug-2007'	-22.43	40.34	17.91	17.91	-	0.00	0.01
19-Aug-2007'	-395.49	2,754.09	2,358.60	2,358.60	-	0.04	0.03
26-Aug-2007'	-139.10	3,035.56	2,896.46	2,896.46	-	0.09	0.04
02-Sep-2007'	-257.80	66,070.15	65,812.35	65,812.35	-	0.04	0.04
09-Sep-2007'	-1,135.75	22,603.59	21,467.84	21,467.84	-	0.13	0.05
16-Sep-2007'	-115.11	54,191.68	54,076.57	54,076.57	-	0.14	0.03
23-Sep-2007'	-1,440.17	34,793.87	33,353.70	33,353.70	-	0.24	0.06
30-Sep-2007'	-17.13	10,183.60	10,166.47	10,166.47	-	0.58	0.10

Final Page Disclaimer:

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