AEMC

REVIEW

Australian Energy Market Commission

FINAL REPORT

Management of negative inter-regional settlements residues

20 February 2014

Reference: EPR0032
Final Report

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About the AEMC

The Council of Australian Governments (COAG), through its then Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005. In June 2011, COAG established the Standing Council on Energy and Resources (SCER) to replace the MCE. The AEMC has two main functions. We make and amend the national electricity, gas and energy retail rules, and we conduct independent reviews of the energy markets for the SCER.

Executive summary

An inter-regional settlements residue is the product of the difference in the regional reference price between two regions in the National Electricity Market (NEM) and the quantity of electricity flowing over an interconnector between those two regions. A negative inter-regional settlements residue (IRSR) arises where there are counter-price flows; that is, electricity flows from a high-priced region to a low-priced region.

Consumers in the low-priced region, which is importing electricity, pay for the negative IRSRs through their network charges. However, negative IRSRs are a relatively minor component of the overall price of electricity paid by consumers.

The Australian Energy Market Commission (AEMC or Commission) has reviewed the efficiency of the management of negative IRSRs by the Australian Energy Market Operator (AEMO). The AEMC is required to conduct this review under the National Electricity Rules (NER). The obligation originated from recommendations in the AEMC's 2008 Congestion Management Review.

It is AEMO's policy and practice that when the accumulated value of negative IRSRs is or is expected to reach $100,000, then AEMO intervenes to reduce the counter-price flow of electricity in the affected direction of an interconnector. This intervention can also be referred to as 'clamping'.

After reviewing AEMO's management of negative IRSRs, our key findings and final recommendations are that:

- The current clamping threshold of $100,000 should be retained as the evidence does not support increasing or decreasing it.
- Cycling[1] increases the frequency of intervention in the market particularly over the Queensland to New South Wales interconnector. We consider that given the available evidence, there is benefit in reducing the incidence of cycling and we recommend that AEMO investigate and consult on potential operational responses, which may involve changes to its policies and procedures.
- AEMO should communicate the basis for its approach to the increments[2] used in applying and releasing the clamp to interested stakeholders;
- Where possible, AEMO should publish its estimate of the negative IRSRs within a current trading interval in real-time.
- AEMO's use of the metered initial interconnector flow to estimate the value of the negative IRSRs within a current trading interval is appropriate.

1 Discussed in Chapter 4. It refers to the repeated application and removal of the process that AEMO uses to 'clamp' counter-price flows, particularly multiple times throughout the course of a trading day.

2 The size of the targeted change to the interconnector flow.

Contents

1 Introduction

This chapter sets out the background and purpose of the review. We also outline our assessment framework.

1.1 Background to the review

The requirement to conduct this review originated from the Congestion Management Review (CMR) completed by the AEMC in 2008. The CMR provided a set of recommendations to address network congestion in the NEM.

One of the recommendations of the CMR was to change the threshold that would trigger AEMO, the market operator in the NEM, to intervene or 'clamp' the interconnector flow and thus the amount of negative IRSRs[3] from $6,000 to $100,000.[4] The clamping threshold is not an obligation under the National Electricity Rules (NER or Rules); rather, it exists in AEMO's operational policy and practice.

The NER requires the AEMC to review AEMO's management of negative IRSRs three years after the CMR changes were implemented. At the time, the Commission noted that any intervention in the market (ie clamping negative IRSRs) is a sub-optimal arrangement but considered that removing such an intervention altogether could distort generator bidding incentives.[5] The threshold was increased from $6,000 to $100,000 to reduce uncertainty for participants around excessive intervention in dispatch.[6]

The AEMC consulted on a number of issues relevant to this review through the Transmission Frameworks Review (TFR). The TFR Final Report was published on 11 April 2013.[7] One of the recommendations of the TFR is to provide a way forward to manage issues related to network congestion. The 'Optional Firm Access' arrangements presented in the TFR could, if implemented, address many of the causes of negative IRSRs, and would be likely to remove most of the need for AEMO to manage their effects. While this represents a potential long term solution, current arrangements need to remain appropriate in the interim.

1.2 Purpose and scope of the review

As indicated above, we conducted this review to fulfil an obligation on the AEMC under the NER. This obligation is set out in clause 3.8.10(g) of the NER.

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3 These concepts are explained further in Chapter 2 of this Final Report.

4 Australian Energy Market Commission, *Congestion Management Review*, final report, June 2008, p. 22.

5 AEMC, ibid, p. 22.

6 Dispatch refers to AEMO's centrally coordinated process of maximising the value of trade in the electricity spot market; generator bids are matched to meet forecast demand, subject to maintaining the security and reliability of the power system.

7 Available at www.aemc.gov.au.

Box 1.1: Clause 3.8.10(g) of the National Electricity Rules

Within 3 years from 1 September 2009, the AEMC must commence a review, under section 45 of the National Electricity Law, in respect of the efficiency with which AEMO is managing circumstances in which the settlements residue arising in respect of a trading interval is a negative amount.

In order to determine the scope for this review, we considered both the express terms of the obligation in the NER as well as the original intent behind this obligation as expressed in the Final Report to the AEMC's CMR. As a result, the scope for this review is how AEMO manages the effects of negative IRSRs. The review has therefore considered:

- the efficiency of AEMO's current policy and practice of managing negative IRSRs, including the 'clamping' of negative IRSRs when their value reaches $100,000; and
- the appropriateness of the $100,000 clamping threshold, including consideration of alternative thresholds.

We considered that the time frame for reviewing AEMO's management of negative IRSRs applies from when the arrangements stipulated in the CMR came into effect, which is 1 July 2010 to the present.[8]

1.3 Principles of the review and assessment framework

When conducting reviews, the AEMC must have regard to the achievement of the National Electricity Objective (NEO)[9], which implicitly includes the promotion of principles of good regulatory practice.

Box 1.2: National Electricity Objective

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

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

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

8 The date of 1 September 2009 is when the AEMC's Final Determination of the Arrangements for Managing Risks Associated with Transmission Network Congestion - Rule 18 was made. This Rule implemented the CMR recommendations, including the present requirement to review AEMO's management of negative IRSRs and came into effect on 1 July 2010.

9 As set out in section 7 of the National Electricity Law (NEL).

Fulfilment of this regulatory objective involves evaluating:

- whether current arrangements achieve the intended outcome - principally, an efficient NEM in the long term interests of consumers; and

- the means - principally, through regulatory practice and procedure - by which these outcomes are achieved.

In light of the NEO and with consideration of good regulatory practice, the assessment framework for this review is comprised of the following principles and assessment questions, as follows:

- **Economic efficiency** - whether the role of AEMO to manage negative IRSRs contributes to the efficient operation of the NEM?;

- **Administrative effectiveness** - whether the current processes and procedures of AEMO to manage negative IRSRs achieve intended outcomes?; and

- **Transparency and accountability** - whether the decisions made to manage negative IRSRs are done under a clear framework and communicated effectively to affected stakeholders?

We have used this assessment framework to evaluate the issues arising within this review.

1.4 Issues Paper

We published an Issues Paper on 18 April 2013. We received 9 submissions from stakeholders and took these submissions into account in preparing the Draft Report and Final Report.

1.5 Draft Report

We published a Draft Report on 24 October 2013. We received 4 submissions from stakeholders and took these submissions into account in preparing the Final Report.

1.6 Structure of the Final Report

The remainder of this Final Report is structured as follows:

- Chapter 2 describes AEMO's current management of negative inter-regional settlements residues;

- Chapter 3 discusses AEMO's clamping threshold and evaluates whether it is justified and assesses the appropriate level of this threshold; and

- Chapter 4 discusses issues with AEMO's application of the clamp, which were raised in submissions.

In addition, there are two Appendices:

- Appendix A sets out the Terms of Reference for the review; and
- Appendix B summarises key points made in submissions to the Issues Paper and Draft Report and our responses.

2 Management of negative IRSRs in the NEM

In this chapter we explain why negative IRSRs arise and the impacts that negative IRSRs can have on market participants. We also provide some data on the materiality of negative IRSRs in the NEM. We then describe AEMO's current processes for managing negative IRSRs.

2.1 Inter-regional settlements residues

In the NEM, the value of an IRSR is defined as the difference in the regional reference price between two regions[10] multiplied by the power flows between those regions.[11]

In normal circumstances, electricity would be expected to flow from a low priced region to a high priced region via an interconnector.[12]

If there is relatively lower priced generation in one region supplying a relatively higher priced load in another region, then AEMO would receive a surplus of funds equivalent to the difference between the amount of money to be paid by market customers for inter-regional flows (in the higher priced region) and the amount of money to be paid to generators for inter-regional flows (in the lower priced region). This surplus of funds is an IRSR; in this case, it is a positive IRSR.

A positive IRSR can be used by market participants to support trading between regions by partially hedging price risk or price differences between the regions. Market participants acquire positive IRSRs in advance by bidding for them at a Settlements Residue Auction (SRA).

2.2 Negative IRSRs

The dispatch of generation in the NEM is based on generators' offer prices, which represent the lowest price at which they are willing to be dispatched. The National Electricity Market Dispatch Engine (NEMDE)[13] seeks to minimise total dispatch costs (as represented by the price offers) while ensuring that:

- sufficient generation is dispatched to meet the load in total; and
- any capacity limitations in the transmission network are not exceeded.

10 Regions in the NEM approximately correspond to state boundaries.

11 There would also need to be an adjustment for losses.

12 The elements of the transmission network that connect regions are referred to as interconnectors. Electricity can flow through an interconnector in two directions. For a given interconnector joining two regions, there are two directional interconnectors - one for each direction.

13 NEMDE is a computer program maintained by AEMO that assembles and optimises NEM bids, forecasts and constraint information to optimise dispatch.

Following dispatch, a single Regional Reference Price (RRP)[14] is calculated for each region of the NEM. The RRP is set at the cost of supplying an additional unit of electricity at the Regional Reference Node (RRN). The RRN is a specified point in a region; it is normally close to the region's largest demand centre. All generation and load in a region is settled using the relevant RRP.

During the process of dispatch optimisation, the lowest cost result according to the objective function of NEMDE in the presence of constraints can result in counter-price flows between regions.

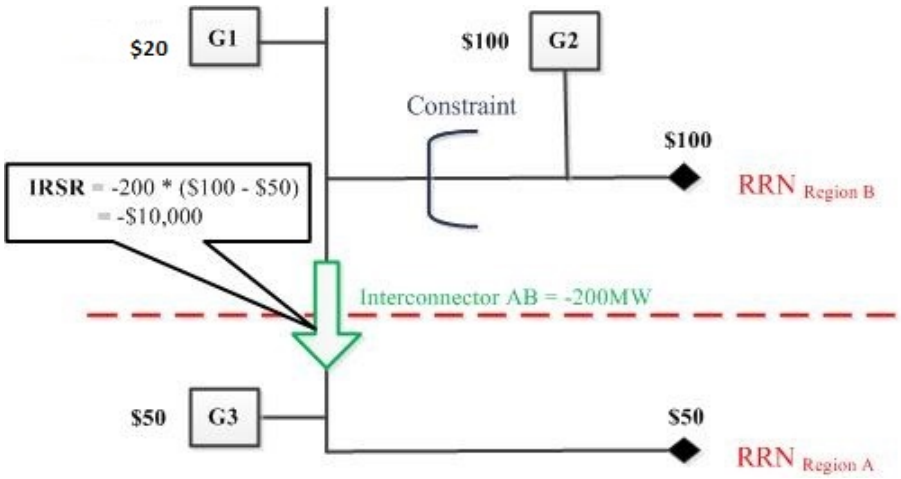
Such counter-price flows result in the accrual of negative IRSRs as the amount of energy flowing between the regions is multiplied by a negative price difference between the exporting region and the importing region.

These concepts are illustrated in the diagram below. For simplicity, we assume an hourly trading interval. While there can be many causes of counter-price flows, in this simplified example there is a constraint between the RRN in region A and the RRN in region B. This constraint causes the two RRPs to diverge.

Generator G1 has the lowest offer price, and is dispatched by NEMDE on that basis. However, the location of the constraint *within* region B means that not all of the power generated by G1 can reach the demand centre at the RRN, and some is instead consumed in region A.

In order to ensure that demand is met in region B, it is necessary to dispatch generator G2, and this sets the RRP in that region of $100/MWh (megawatt hour). As G1 is located in region B, it is then also paid $100/MWh. However, consumers in region A will pay only the RRP in region A of $50/MWh, including for the 200MW of G1's output consumed in that region. This results in a negative IRSR of $10,000 per hour.

Figure 2.1 Network congestion and negative IRSRs



14 This is the spot price at the regional reference node.

2.3 Magnitude of negative IRSRs in the NEM

Determining the magnitude of negative IRSRs in the NEM provides a sense of the materiality, in terms of dollar value, attributable to negative IRSRs in the NEM to date. From 1 July 2010[15] until January 2013, approximately $26 million of negative IRSRs were accrued across all three interconnectors (with each interconnector operating in both directions) in the NEM. The following table shows the cumulative values of both positive and negative IRSRs accrued since 1 July 2010 to January 2013.

Table 2.1 Cumulative value of positive and negative IRSRs in the NEM from July 2010 to January 2013

Directional interconnector	Positive IRSR Value ($'000)	Negative IRSR Value ($'000)
SA>VIC	16,133	734
VIC>SA	42,934	530
NSW>QLD	1,475	1,193
QLD>NSW	88,170	16,768
NSW>VIC	7,261	2,045
VIC>NSW	69,322	4,676
Total	225, 295	25,946

These figures indicate that the interconnectors with the greatest value of negative IRSRs are on the directional interconnector of Queensland to New South Wales followed by the directional interconnector of Victoria to New South Wales. The Australian Energy Regulator (AER), the organisation responsible for enforcement, market monitoring and economic regulatory functions in the NEM, prepared a report titled - 'Special Report: The impact of congestion on bidding and inter-regional trade in the NEM' - that outlines case studies of counter-price flows on both of these interconnectors.[16]

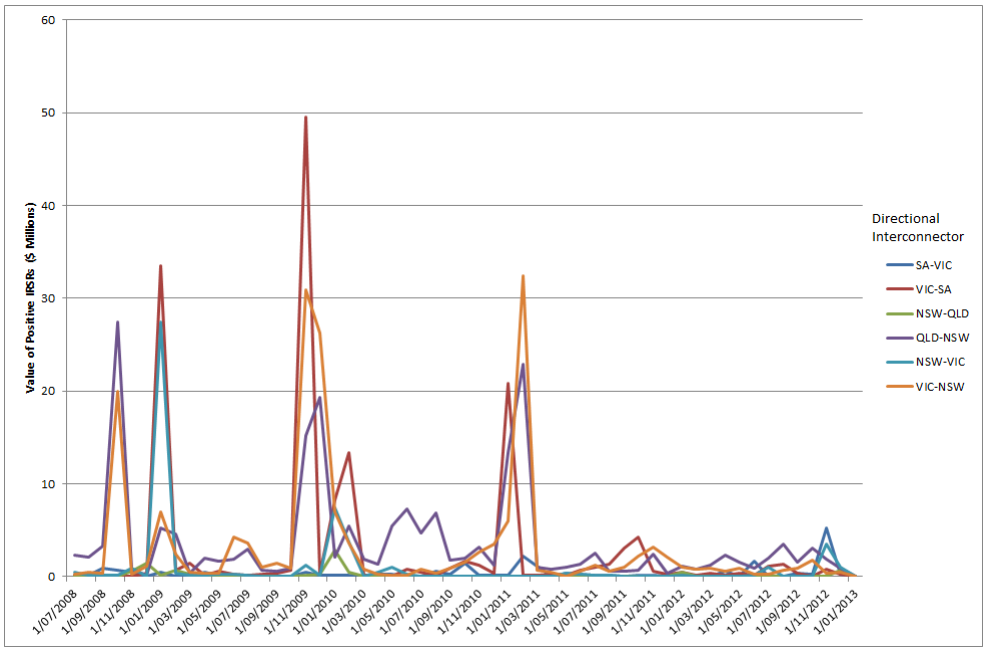
The two figures below show, respectively, the value of positive and negative IRSRs flowing over each of the six directional interconnectors in the NEM from 1 July 2008 to January 2013 on a monthly basis. It is important to note that the change in AEMO's intervention threshold to clamp negative IRSRs from $6000 to $100,000 took effect from 1 July 2010.

15 At this date, changes were made such that negative IRSRs were recovered from the importing region's Transmission Network Service Provider (TNSP).

16 Australian Energy Regulator, *Special Report: The impact of congestion on bidding and inter-regional trade in the NEM*, December 2012. Available at www.aemo.com.au

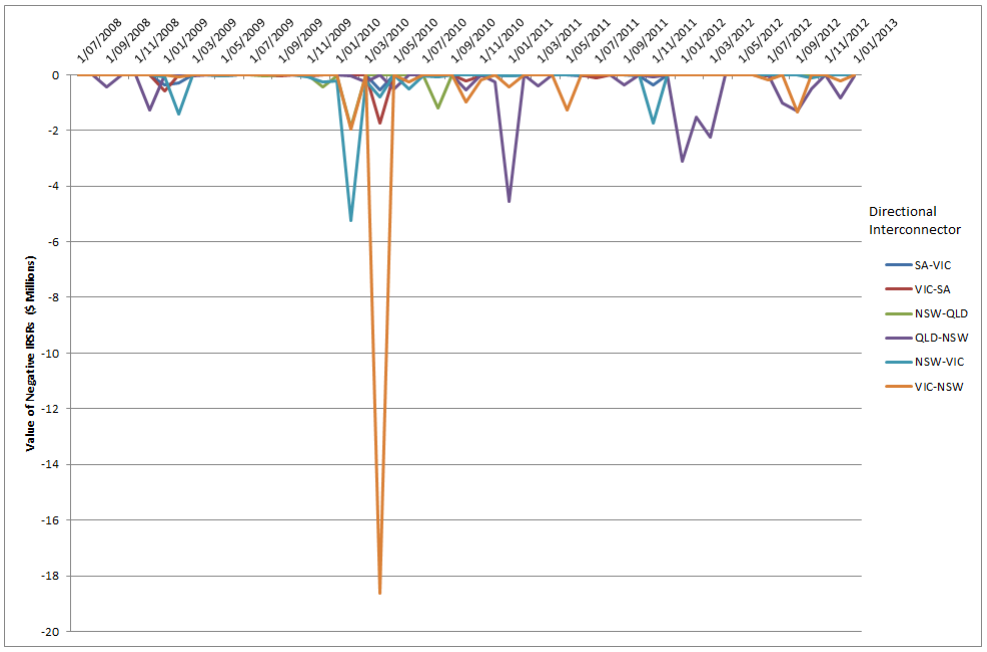
Of significance was the almost $19 million worth of negative IRSRs accruing due to counter-price flows from Victoria into NSW for the month of April 2010. This negative IRSR event arose out of a network constraint in Victoria resulting in NEMDE calculating that electricity should flow from Victoria (a relatively higher price region) to NSW (with a relative lower price) in order to maintain system security.

Figure 2.2 Positive IRSRs by directional interconnector in the NEM



It is important to note that Figure 2.3 below is on a different scale (in terms of the value of IRSRs) from Figure 2.2 above. This should be taken into account when drawing comparisons between the two Figures.

Figure 2.3 Negative IRSRs by directional interconnector in the NEM



2.4 AEMO's current management of negative IRSRs

2.4.1 Overview

When the value of negative IRSRs reaches or is expected to reach $100,000, AEMO intervenes to manage negative IRSRs by 'clamping' or, in other words, invoking constraint equations (the mathematical representation that AEMO uses to manage power system limitations in NEMDE) over a directional interconnector, to reduce counter-price flows and hence limit the further accumulation of negative IRSRs. These constraint equations remain in place until AEMO decides that the constraint equations can be revoked because the conditions causing the counter-price flows no longer persist.

AEMO would only intervene by invoking constraint equations to reduce the flow of negative IRSRs as long as the security of the electricity system is maintained. AEMO will strive to maintain the security of the electricity system even if there are counter-price flows and negative IRSRs continue to accumulate above the threshold. AEMO can only do this to the extent it can control variables in the dispatch process.[17]

The value of $100,000 to be used as a threshold first emerged in 2006 when the National Electricity Market Management Company (NEMMCO now AEMO) consulted on lifting the clamping threshold from $6000 to $100,000.[18] The value of $100,000 of negative IRSRs per event was derived as a result of balancing NEMMCO's ability to carry market liability (approximated as $150,000 per event) and the shorter duration of AEMO carrying the negative IRSR liability (the maximum liability period changed from 21 months down to 3 months). The final recommendations in the AEMC's CMR adopted the $100,000 value for reasons expressed previously.[19]

AEMO's change of the clamping threshold from $6000 to $100,000 corresponded with a change in the party bearing the cost of negative IRSRs: from AEMO to the importing region's TNSP. This change arose out of a recommendation in the CMR where the importing region's TNSP bears the cost of funding negative IRSRs[20] and can recover these costs from market customers through Transmission Use of System (TUOS) charges.

17 AEMO submission to the Draft Report, p.3. AEMO explained that where generators bid low rates of change or fail to follow dispatch targets, then controllable variables that could be used to reduce interconnector flow are removed from the dispatch process.

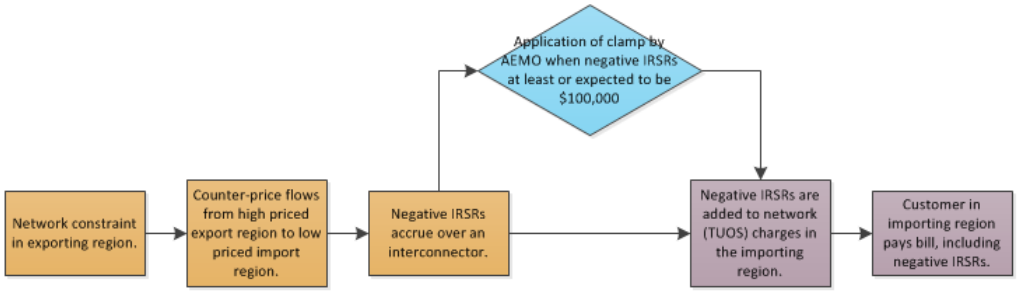
18 NEMMCO, Final Determination Report - Review of the Trigger Level for Management of Negative Settlement Residues, 27 June 2006.

19 Please refer to section 1.1.

20 Clause 3.6.5(a)(4) of the NER.

Figure 2.4 illustrates these arrangements schematically.

Figure 2.4 Arrangements for managing negative IRSRs



When the $100,000 threshold triggers AEMO's application of the clamp, this marks the beginning of an 'event'.[21] An event automatically applies from the current trading interval to the next trading interval. If at a start of a trading interval within an event, the accumulated negative IRSRs continue to breach the threshold, then the event will be extended.

For a current trading interval, AEMO uses the average prices, flows and losses from all available 5-minute dispatch intervals that have elapsed within that trading interval to obtain the latest estimate of the negative IRSRs accrued. This estimate of the negative IRSRs for the current trading interval is updated at the start of each ensuing dispatch interval within that trading interval.[22]

Within an event, AEMO will attempt to progressively reduce the accrual of negative IRSRs. To reduce negative IRSRs, AEMO applies and releases the clamp in set increments.[23] In addition, AEMO can temporarily suspend and re-activate the clamp within a management period if certain conditions are met.

An event ends when the accumulated negative IRSRs are below the threshold and there are no further extensions to the event.

It is possible to have multiple events within a trading day.[24]

The application of the clamp places challenges on AEMO because negative IRSRs are an outcome of the dispatch process and not an input variable that can be constrained. AEMO must observe input conditions that appear likely to result in negative IRSRs, and then apply the clamp.

21 AEMO refers to an event as a 'management period'

22 AEMO, submission on draft report, p. 5.

23 Please refer to section 4.2.

24 This is the issue of cycling and is discussed in section 4.1.

2.4.2 Operational process

Automated process for managing negative IRSRs

To manage negative IRSRs, AEMO generally applies an automated process. The process entails Negative Residue Management (NRM) constraint equations[25] being invoked when the negative IRSR is estimated to reach or has exceeded the threshold.[26] The NRM constraint equations aim to prevent further negative IRSRs by reducing the counter-price flow over the relevant directional interconnector. AEMO constrains the flow over a directional interconnector at a rate no greater than that which applies for a planned outage.

As set out in AEMO's *Brief on automation of negative residue management*[27], the NRM constraint equation will be revoked when one of the following conditions occurs:

- for the last three dispatch intervals, the NRM constraint has not bound and non-negative IRSRs were occurring (ie the negative IRSR event has finished);
- for the last three dispatch intervals, the NRM constraint has been violated (ie. a constraint of a higher order of priority has displaced the NRM constraint) and non-negative IRSRs were occurring;
- AEMO's control room manually intervenes to block the NRM constraint equation, for example, to meet system security concerns; and
- the management period (which is the current trading interval plus two additional trading intervals) has expired with none of the above conditions being met and no further negative IRSRs exceeding $1000 have occurred.

Manual process for managing negative IRSRs

AEMO applies a manual process for managing negative IRSRs when there is a price revision event.[28] Price revision events must first be addressed before AEMO manages negative IRSRs. The general principle is that management of negative IRSRs should not commence unless there are firm prices. Therefore, if there is a price revision event (which implies that prices may not be firm), this must first be addressed before a manual process to manage negative IRSRs is implemented. Conversely, if there is no price revision event, then an automated process for managing negative IRSRs can be implemented.

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25 A constraint equation is a mathematical representation that AEMO uses to manage power system limitations in NEMDE.

26 Australian Energy Market Operator, *Brief on automation of negative residue management*, 8 June 2012. Available at www.aemo.com.au.

27 ibid.

28 A price revision event occurs when large changes in dispatch prices are detected by AEMO's systems and such prices are automatically flagged to be subject to review. In the price revision event, AEMO may replace the dispatch price in question with a previous dispatch price if it is

AEMO's communication of its management of negative IRSRs

Market participants are informed of AEMO's execution of the NRM process through Market Notices that state when an NRM process begins and ends. These Market Notices contain information about:

- the affected directional interconnector;
- the actual or forecast time of the event; and
- any constraints invoked to manage the event.

considered to be a manifest input error, such as a Supervisory Control and Data Acquisition (SCADA) interruption.

3 AEMO's clamping threshold

This chapter examines AEMO's clamping threshold that triggers the application of the clamp on an interconnector. In doing so, this chapter considers the rationale for a clamping threshold before considering issues relating to the appropriate level of the threshold.

3.1 Recommendation

Based on stakeholders' comments and the AEMC's consideration of the issues, the AEMC has not identified significant benefits that are likely to arise if the threshold is raised or lowered from its current level. Therefore, we recommend the current threshold of $100,000 be retained.

3.2 Description of the issue

As noted in section 2.2, counter price flows create negative IRSRs. When negative IRSRs exceed or are expected to exceed $100,000, then AEMO will reduce the flow of electricity across the interconnector. However, AEMO will only reduce flows across the interconnector if system security is maintained. Intervention by AEMO to apply the clamp has the effect of limiting the amount of negative IRSRs that accumulate. As noted in the CMR, the clamping threshold was designed to balance the need to minimise the risk to market participants from counter-price flows against the need to avoid inefficient market intervention.

3.3 Analysis: rationale for clamping

When negative IRSRs accrue, it is market customers in the importing region who pay for them through their network charges. Currently there is no mechanism available to market customers to be able to hedge against the negative IRSR cost. In order to stop the large accumulation of negative IRSRs in short run events AEMO applies a clamp to restrict the counter price flow across the interconnector.

However, AEMO's application of the clamp can directly affect dispatch outcomes in the wholesale electricity market and wholesale electricity spot prices. This is because the clamp reduces flows across the interconnector. The reduced flow across the interconnector means that less generation from the exporting region will be dispatched. This in turn would affect the spot price determined for that half hour period. In this way, market participants are affected by AEMO's application of the clamp which creates uncertainty and risks for these parties to manage.

The CMR recognised that discretionary, ad-hoc physical intervention in the market was 'inherently problematic'.[29] It recognised the difficulty for participants to predict

29 AEMC (2008), Congestion Management Review, Final Report, p. 125.

when clamping will take effect and how it will impact upon dispatch and pricing outcomes.

Given the risk of imposing costs on market participants (and ultimately consumers), we consider that AEMO's application of the clamp to halt the accumulation of negative IRSRs remains necessary.

3.4 Analysis: the appropriate level for the clamping threshold

We next analysed whether AEMO's threshold level remains at an appropriate value.

3.4.1 Stakeholder views

Issues Paper submissions

Both Delta Electricity and Macquarie Generation supported lowering the threshold given AEMO has automated its negative residue management process. Macquarie Generation supported a return to a $6000 threshold, which was AEMO's (then NEMMCO) clamping threshold prior to the implementation of the AEMC's CMR recommendations. This is because it would balance a customer's exposure to large and variable IRSR costs and allow generators to respond to dispatch price signals.[30] Delta Electricity also supported lowering the threshold preferably to either zero or $6000.[31]

However, AEMO indicated that, based on their analysis, lowering the threshold could still result in a high volume of negative IRSRs due to other events (such as safeguarding system security).[32]

Alinta Energy suggested that there should be an increase in the clamping threshold above $100,000 as it may reduce intervention and provide certainty to affected parties.[33]

Snowy Hydro stated their support for the continuation of the current threshold.[34]

Draft Report submissions

AEMO and Origin Energy supported the AEMC's draft recommendation that the level of the current threshold be retained.[35] However, while supporting the AEMC's draft recommendation, Alinta Energy expressed its disappointment that no further assessment of increasing the intervention threshold to over $100,000 had been made.[36]

30 Macquarie Generation, submission on issues paper, p .2.

31 Delta Electricity, submission on issues paper, p. 3.

32 AEMO, submission on issues paper, p. 5.

33 Alinta Energy, submission on issues paper, p. 5.

34 Snowy Hydro, submission on issues paper, p. 1.

35 AEMO, submission on draft report, p. 3; Origin Energy, submission on draft report, p. 1.

36 Alinta Energy, submission on draft report, p. 2.

3.4.2 Lowering the clamping threshold

Lowering the threshold would enable AEMO to intervene to halt the accumulation of negative IRSRs earlier. The lower threshold would be administratively facilitated by AEMO's automated negative residue management process.

However, lowering the threshold would result in more frequent intervention by AEMO in the NEM. This is generally not desirable because, as explained in section 3.3, such interventions affects dispatch and prices and therefore increases risk to participants.

The likely magnitude of the increase in interventions is shown in data provided by AEMO for the calendar year 2012. This data showed that there were 71 events with a negative IRSR value of over $6,000 but under the current threshold $100,000. However, these 71 additional events were responsible for 21 per cent of the total value of negative IRSRs for the same period. By contrast the 36 events where the value was at or near the current threshold of $100,000[37] accounted for 79 per cent of the total value of negative IRSRs for the same period. While the Commission recognises that the balance between the number of interventions and the reduction in accumulated negative IRSRs is subjective it does not consider the benefit that would arise from lowering the threshold to $6,000 is sufficient to warrant the additional number of interventions.

Intervention also appears to be unnecessary in order to facilitate earlier resolution of smaller counter-price flows. The majority of occasions where negative IRSRs accrue dissipate in 1-2 trading intervals without intervention.[38] For the period from July 2010 to July 2013 about 60 per cent of trading intervals where negative IRSRs accrued to a value between $0 and $10,000, stopped accruing further negative IRSRs after two trading intervals had elapsed.

This data suggests that lowering the threshold significantly would result in more frequent intervention by AEMO which may result in less desirable outcomes without producing substantial benefit. On this basis, we do not support lowering the clamping threshold.

3.4.3 Increasing the clamping threshold

Increasing the clamping threshold is likely to reduce the number of interventions by AEMO to apply its clamp. However, conversely, increasing the threshold would likely mean that market customers in the importing region will be exposed to the risk of increased payments for negative IRSRs.

37 Defined as amounts over $90,000. This value was selected to recognise that the application of the clamp does not result in a negative IRSR of exactly $100,000. It should be noted that a number of the events included in both totals would not be clamped for system security reasons.

38 Trading interval refers to the 30 minute period beginning on the hour or on the half hour.

It is important to note that the effect of raising the clamp is unknown because there is no counter-factual.[39] That is, because the clamp was applied in those occasions, there is no ability to determine what the value of that event would have been had the clamp not been applied. This means there is no basis to determine the reduction in the number of interventions by AEMO or the value of negative IRSRs that would have accrued.

However, data provided by AEMO for instances where the clamp was not applied because of higher priority system security or other considerations shows that there can be instances where negative IRSRs well above $100,000 accrue over an interconnector. The highest recorded negative IRSR event, under such circumstances, in 2012 was for $1.3 million.

Also, as stated in the CMR[40], increasing the clamping threshold increases the risk of prolonging the effects of non-cost reflective generator bidding behaviour during times of network constraint.

To avoid these risks for an uncertain level of benefit, we do not support increasing the clamping threshold.

3.4.4 Maintaining the current clamping threshold

On balance, we consider that the evidence does not show that a different clamping threshold would provide a more economically efficient and administratively effective balance of minimising the cost of negative IRSRs and limiting AEMO's intervention in the market. Therefore, we do not consider that material change from current arrangements is warranted and recommend that AEMO continue applying its clamp under the current clamping threshold set at $100,000.

39 This makes it difficult to conduct further assessment of the raising of the clamp as suggested by Alinta Energy in its Draft Report submission. Refer to section 3.4.1.

40 AEMC (2008), Congestion Management Review, Final Report, p. 126

4 Application of the clamp

A number of matters were raised by stakeholders in response to the AEMC's issues paper and draft report. This chapter considers those issues raised by stakeholders regarding the application of the clamping mechanism by AEMO. In particular, it considers the following issues:

- cycling;
- asymmetry in the application of the clamp;
- real time publication of negative IRSRs within a current trading interval; and
- the use of metered versus target interconnector MW values to estimate negative IRSRs within a current trading interval.

4.1 Cycling

4.1.1 Recommendation

Cycling increases the frequency of intervention in the market particularly over the Queensland to New South Wales interconnector. We consider that given the available evidence, there is benefit in reducing the incidence of cycling and we recommend that AEMO investigate and consult on potential operational responses, which may involve changes to its policies and procedures.

4.1.2 Description of the issue

When the clamping threshold is breached and AEMO applies the clamp, this signals the start of an event.[41] An event ends when the accumulated negative IRSRs are below the threshold and there are no further extensions to the event.

However, once the clamp is removed and the event ends, negative IRSRs can begin to accumulate. It is not until the $100,000 threshold is breached that the clamp would be reapplied. This can result in AEMO applying and releasing the clamp repeatedly in a relatively short space of time, for example within one trading day.[42] The repeated application and removal of the clamp is known as cycling.

The effect of cycling is that it can result in the accrual of increased amounts of negative IRSRs more than once in a trading day. For example, if there are two applications of the clamp within a trading day, then at least $200,000 value of negative IRSRs would have

41 Please refer to section 2.4.1 of this Final Report for a description of AEMO's process for managing negative IRSRs.

42 Under the NER, a trading day is the 24 hour period commencing at 4 am and finishing at 4 am of the following day.

accrued over that day.[43] These negative IRSRs are paid by the market customers located in the importing region through network (TUOS) charges.

4.1.3 Stakeholder views

Issues Paper submissions

The issue of cycling was raised by two NSW generators: Delta Electricity and Macquarie Generation.[44] These stakeholders submitted that they noticed a pattern of cycling behaviour where the intervention threshold is breached and reset over a period of hours or sometimes over trading days. This results in higher negative IRSRs being paid for by the market customers in the importing region.

Draft Report submissions

AEMO requested clearer instructions from the AEMC with respect to whether AEMO should develop an operational response to cycling.[45]Alinta Energy supported a mechanism to address cycling and specifically suggested a 3 hour time period for the application of the clamp and for AEMO to implement these changes within 6 months.[46] However, the National Generators Forum, in its proposals for alternative ways to manage negative IRSRs, considered that 'another, better, process' should be adopted rather than 'fiddling' with the existing process.[47]

4.1.4 Analysis

The effect of cycling is that market customers in the importing region pay a greater amount of negative IRSRs than they would have if the clamp had been maintained across the entire time period of negative IRSRs. However, we note that these market customers in the importing region may also get the benefit of relatively lower wholesale spot prices when the clamp is applied at times of prolonged network congestion.[48] For example, if a network constraint occurs in Queensland resulting in counter-price flows to New South Wales, the market customers in New South Wales pay the negative IRSRs but also potentially obtain the benefit of lower electricity spot prices at those times. This argument was the justification for the current arrangements that originated from the CMR.[49]

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43 Two applications of the clamp would require the trigger of at least 2 x $100,000 of negative IRSRs.

44 Macquarie Generation, submission on issues paper, p.1; Delta Electricity, submission on issues paper, p. 1.

45 AEMO, submission on draft report, p. 4.

46 Alinta Energy, submission on draft report, p. 3.

47 NGF, submission on draft report, p. 3.

48 However, the one off change in price may not be reflected in the market customer's price due to the existence of hedging arrangements

49 AEMC (2008), Congestion Management Review, Final Report, p. 165 available at www.aemc.gov.au.

In addition, the AEMC analysed a 12 month period of data provided by AEMO for 2012. We found 17 occasions where AEMO intervened and a clamp was applied on two separate occasions within a 24 hour trading period. Additional analysis found that if the definition of the event had been extended to cover at least a 3 hour period (rather than to the end of the next trading interval), then 9 of these incidents of cycling would not have occurred because they would be captured by the extended application period of the clamp.

If there were no system security or higher priority concerns then each of these events would have been capped at $100,000. Assuming that they were all capped at $100,000 then the combined negative IRSRs would have been reduced by approximately $2.5 million. This data shows that relatively few cycling events account for a relatively significant level of IRSRs. It is not possible to determine based on the information available to the AEMC whether this represents an efficient outcome in the NEM. However at a minimum there is a question as to whether this represents the intended outcome of an efficient balance between minimising consumers' risks from negative IRSRs and limiting interventions in the market by AEMO.

If this 3 hour definition of an event had been applied both the total value of negative IRSRs and the actual number of interventions would have also been reduced. However, it is important that the distinction be drawn between the number of interventions and the number of trading intervals that would have been subject to the clamp. In this hypothetical scenario of an extended event there would have been an increase in the trading intervals that would have been subject to the clamp. That is, trading intervals with negative IRSRs more significant than $1000 which were beyond the end of the next trading interval but within 3 hours of the last expected or actual application of the clamp would be clamped. These periods would not currently be clamped unless they exceeded or were expected to exceed $100,000.

Based on this data, we consider that there is scope to improve the effectiveness of current arrangements in a way that minimises both the frequency of intervention and the risk to market customers that arise from counter-price flows. We consider that there is merit in AEMO investigating alternatives to its current clamping arrangements to determine if an alternative approach would improve administrative effectiveness in achieving intended outcomes.

AEMO in its submission identified different approaches that could be adopted for dealing with this issue. For example, a rolling 24 hour period or increasing the number of tested non-negative residue intervals.[50] We recommend that AEMO investigate and consult on potential operational responses to reduce the incidence of cycling. AEMO's investigation should focus on balancing the need to minimise the frequency of intervention in the NEM while attempting to minimise risk to market participants from counter-price flows.

50 AEMO, submission on issues paper, pp.4-5

4.2 Increments used in applying and releasing the clamp

4.2.1 Recommendation

We recommend that AEMO should communicate to stakeholders the basis for its approach to the increments used in applying and releasing the clamp.

4.2.2 Description of the issue

Currently, once the clamping threshold is triggered, AEMO applies and releases its clamp in set increments of target interconnector flow.[51] These increments are set out in Figure 4.1.[52] For example, in Figure 4.1 it can be seen that negative IRSRs over the Queensland-NSW interconnector with a value of $1000 are clamped at a target interconnector flow of 50MW whereas for positive IRSRs with a value of $1000, the clamp is released at a target interconnector flow of 30MW. As can be seen AEMO applies and releases the clamp asymmetrically, that is, AEMO applies the clamp in greater increments than it releases the clamp.

Figure 4.1 Increments (MW) used in applying and releasing the clamp (Source: AEMO)

Directional Interconnector	IRSR estimate within a current trading interval			
	Less than -$5000	Between -$5000 and -$1000	Between -$1000 and $1000	Greater than $1000
NSW to QLD	-100MW	-50MW	0MW	30MW
QLD to NSW	-100MW	-50MW	0MW	30MW
NSW to VIC	-100MW	-50MW	0MW	30MW
VIC to NSW	-100MW	-50MW	0MW	30MW
VIC to SA	-50MW	-30MW	0MW	30MW
SA to VIC	-30MW	-25MW	0MW	25MW

4.2.3 Stakeholder views

Issues Paper submissions

The National Generators Forum suggested that the constraint equations that apply to negative IRSRs should be adjusted in a symmetrical manner with positive IRSRs.[53] Macquarie Generation and Delta Electricity also proposed that AEMO's relaxation and tightening of the clamp be symmetrical.[54] Macquarie Generation also suggested

51 Target interconnector flows (in MW) refer to the projected interconnector flows calculated by NEMDE at the end of a given dispatch interval

52 AEMO 2012, Brief on automation of negative residue management. Available at www.aemo.com.au

53 National Generators Forum, submission on issues paper, p. 4.

54 Macquarie Generation, submission on issues paper, p. 4; Delta Electricity, submission on issues paper, p. 2.

introducing a new threshold above $10,000 per 5-minute dispatch interval for positive and negative IRSRs and increase the steps in interconnector flows for dispatch intervals above $10,000 to provide greater flexibility in addressing IRSRs. Alinta Energy also submitted that should clamping continue, then there should be a review of the constraint increments and methods for applying negative residue constraints so that it impacts upon regions in a more balanced manner.[55]

Draft Report submissions

AEMO supported the AEMC's draft recommendation.[56] Alinta Energy also supported the AEMC's draft recommendation and suggested that AEMO should explore methods for a symmetrical application of the clamp.[57]

4.2.4 Analysis

AEMO explained to the AEMC that when it attempts to apply and release the clamp its aim is to reach a state where there are zero IRSRs. In doing so it can encounter oscillations in the value of the target interconnector flow (MW). Oscillations refer to movements (either increasing or decreasing) in the target interconnector flow over a series of consecutive 5-minute dispatch intervals.

AEMO explained that if the clamp was applied symmetrically, the target interconnector flow can oscillate over consecutive 5-minute dispatch intervals. These oscillations pose difficulties for AEMO to make the target interconnector flow reach a stable state where there are zero residues. In response to these oscillations, AEMO applies and releases the clamp asymmetrically consistent with control systems theory so that a state of zero residues may be more readily achieved.

AEMO stated that asymmetry was done for this reason and is not a preference for positive IRSRs over negative IRSRs.

Given the degree of confusion that was exhibited in response to the AEMC's issues paper in relation to this issue we consider that there is benefit in AEMO communicating its rationale for its use of asymmetry in the clamping increments in its publications on negative residue management.

We note that the introduction of a new threshold and additional increments as recommended by Macquarie Generation could increase the flexibility that AEMO has in managing IRSRs. However, there was no evidence put forward that AEMO currently has insufficient flexibility to manage IRSRs.

55 Alinta Energy, submission on issues paper, p. 6

56 AEMO, submission on draft report, p. 4.

57 Alinta Energy, submission on draft report, p. 3.

4.3 Real time publication of negative IRSR within a current trading interval

4.3.1 Recommendation

We recommend that where possible AEMO publish the value of negative IRSRs within a current trading interval in real time.

4.3.2 Description of the issue

Currently, AEMO publishes when it applies and releases the clamp in market notices.[58] The negative IRSR amounts are published at the end of the billing cycle by the settlement date.

The estimate of the value of the negative IRSR within the current trading interval is the estimate of the negative IRSR amount for a given directional interconnector for a particular trading interval. It is re-estimated every 5 minutes at the beginning of the 6 dispatch intervals that comprise a given trading interval. In NEMDE, this value is represented as 'NRM_DI_AMT'.

It is estimated as follows: for an interconnector connecting region A and region B, the NRM_DI_AMT is calculated as the price difference between the average of the dispatch prices for region A and the average of the dispatch prices for region B, which is then multiplied by the average of the actual interconnector flows over each of the 5-minute dispatch intervals that have elapsed in that trading interval.

However, the estimated value of the negative IRSR amount within a current trading interval is not published in real time by AEMO. Stakeholders consider there would be benefit from this material being published in real time.

4.3.3 Stakeholder views

Issues Paper submissions

Delta Electricity considered that AEMO should publish the negative IRSR amount within a trading interval to reduce uncertainty to participants.[59] Alinta Energy also supported the publication of negative residue management equations in real-time.[60] The National Generators Forum suggested AEMO publish the estimate of the negative IRSR for the dispatch, 5 minute pre-dispatch and 30 minute pre-dispatch.[61]

58 See section 2.4.2 of this Final Report.

59 Delta Electricity, submission on issues paper, p. 2.

60 Alinta Energy, submission on issues paper, p.6.

61 National Generators Forum, submission on issues paper, p.4.

Draft Report submissions

AEMO and Alinta Energy supported the AEMC's draft recommendation to publish the value of negative IRSRs within a current trading interval in real time.[62]

4.3.4 Analysis

In principle, the AEMC considers that providing market participants with information on negative IRSRs would enable market participants to make more informed decisions when participating in the NEM. In addition, providing this information will enhance the transparency of AEMO's application of the clamp. While we note that publishing estimates of negative IRSRs within a current trading interval will involve additional costs for AEMO to implement this change to its systems, we consider that there are advantages in AEMO publishing estimates of the negative IRSRs in real-time.

However, we are also aware that market participants can already obtain the basis on which these values are determined by liaising directly with AEMO so changes to facilitate this should not be considered a high priority. As a result, we recommend that as soon as is reasonably practicable, AEMO should publish the value of negative IRSRs within a current trading interval in real time.

4.4 Metered versus target interconnector flow to estimate negative IRSRs

4.4.1 Recommendation

We recommend no change to AEMO's current practice of using metered interconnector flow from the previous dispatch interval (in MW) to estimate the negative IRSR within the current trading interval.

4.4.2 Description of the issue

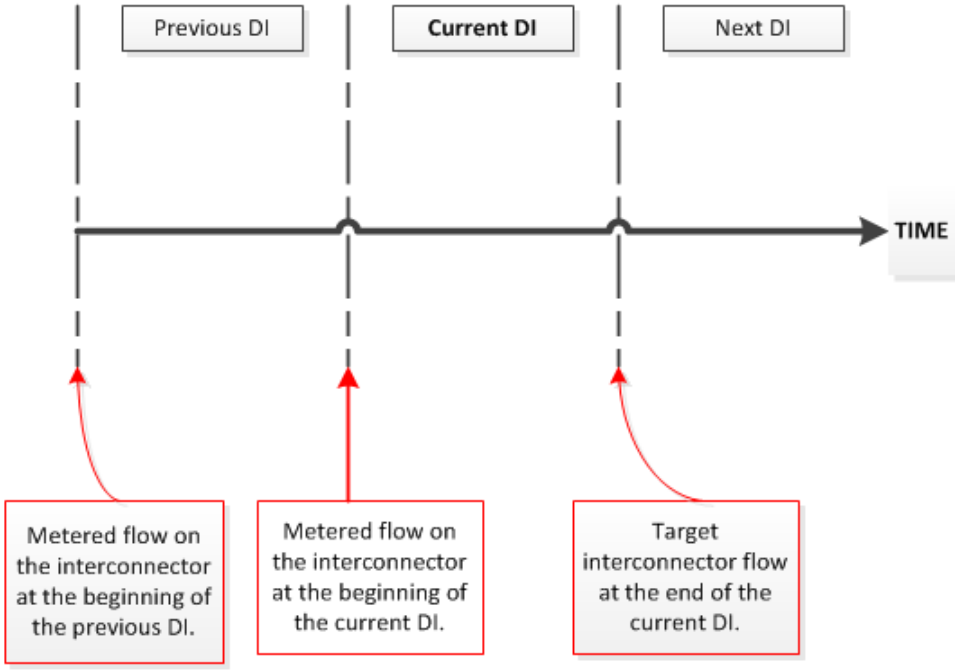
As noted in chapter 2, the IRSR is equal to the flow on the associated interconnector multiplied by the difference in price between the regions (the actual calculation of the IRSR includes adjustments for the inter-regional losses attributed to each of the two regions associated with the interconnector). AEMO can manage excessive negative IRSR by reducing the flow on the interconnector by the application of a clamp on the interconnector flow.

62 AEMO, submission on draft report, p. 4. Alinta Energy, submission on draft report, p. 4.

The clamp on the interconnector flow is achieved by invoking a constraint on the interconnector flow that is equal to the current interconnector flow less a prescribed increment (see section 4.2). As depicted in Figure 4.2, the current interconnector flow can be taken as:

- the metered flow on the interconnector measured at the beginning of the previous dispatch interval;
- the metered flow on the interconnector measured at the beginning of the current dispatch interval; or
- the target interconnector flow at the end of the current dispatch interval.

Figure 4.2 Values of interconnector flow for possible use to estimate negative IRSRs



AEMO uses the metered interconnector flow measured at the beginning of the previous dispatch interval to estimate negative IRSRs within a current trading interval.

4.4.3 Stakeholder views

Issues Paper submissions

The National Generators Forum stated that the NRM constraint equation uses the metered interconnector flow rather than the target interconnector flow when calculating the value of the negative IRSR for a trading interval.[63] The National Generators Forum considered that this makes the NRM equation difficult to

63 National Generators Forum, submission on issues paper, p.3.

understand from a dispatch and trading perspective because the clamp is applied to the metered flow which can vary considerably from the target flow.[64]

AEMO stated that metered interconnector flow at the beginning of the previous dispatch interval is used because this represents the actual trading data that is used to calculate negative IRSRs and there is a risk that this target flow can diverge from actual trading data. Due to the high amount of generator non-conformance (where generators bids do not follow AEMO's dispatch instructions) tending to occur during times when there are network constraints, target interconnector flow can differ markedly from actual trading data. This means that it would be inaccurate to use target interconnector flow to calculate actual negative IRSRs.

Draft Report submissions

The National Generators Forum questioned AEMO's use of the metered interconnector flow from the beginning of the previous dispatch interval and considered that the current system is difficult for participants to manage.[65] In its submission, Alinta Energy supported the AEMC's draft recommendation and stated that it would be supportive of additional methods that improve the accuracy of IRSR measurement.[66]AEMO supported the AEMC's draft recommendation.[67]

4.4.4 Analysis

Given the divergence between target flow and actual trading data, we consider that the use of metered interconnector flow from the beginning of the previous dispatch interval is appropriate because this would provide a more accurate estimation of the quantity of negative IRSR produced. While we acknowledge that market participants may wish to forecast negative IRSRs using target interconnector flow, we consider that ensuring the accuracy of the negative IRSR data is important.

In discussions with AEMO, it indicated that using the metered interconnector flow from the beginning of the current dispatch interval is not possible within the current NEMDE design as the data is not available and it is unlikely that changing it would yield significant benefits. We consider that using the metered interconnector flow from the beginning of the previous dispatch interval is reasonable.

We therefore support AEMO's operational practice and recommend no change to the current arrangements.

64 ibid.

65 National Generators Forum, submissions on draft report, p. 2.

66 Alinta Energy, submission on draft report, p. 4.

67 AEMO, submission on draft report, p. 4.

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CMR	Congestion Management Review
IRSR	inter-regional settlements residue
MWh	megawatt hour
NEL	National Electricity Law
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NEMMCO	National Electricity Market Management Company
NEO	National Electricity Objective
NER	National Electricity Rules
NRM	Negative Residue Management
RRN	Regional Reference Node
RRP	Regional Reference Price
SCADA	Supervisory Control and Data Acquisition
SRA	Settlements Residue Auction
TFR	Transmission Frameworks Review
TNSP	Transmission Network Service Provider
TUOS	Transmission Use of System

A Terms of reference

A.1 Introduction

Under clause 3.8.10(g) of the National Electricity Rules (NER or Rules), the Australian Energy Market Commission (AEMC or Commission) is required to review the efficiency of the management of negative inter-regional settlements residues (IRSRs) by the Australian Energy Market Operator (AEMO).

This obligation stems from recommendations developed in the AEMC's Congestion Management Review, and implemented through rule changes completed in 2009. Amongst other things, these rule changes altered the arrangements through which negative IRSRs were funded. This allowed AEMO to modify its policies regarding the management of negative IRSRs. In particular, the value of accumulated negative IRSRs that would trigger AEMO's intervention into the market by 'clamping' such negative IRSRs was changed from $6,000 to $100,000. The rule changes required that these arrangements for managing negative IRSRs be reviewed by the AEMC after three years, and it is this requirement which forms the basis of this review.

A.2 Scope of the Review

The Commission is reviewing AEMO's management of negative IRSRs to consider, as a minimum:

- the efficiency of AEMO's current policy and practice of managing negative IRSRs, including the 'clamping' of negative IRSRs when their value reaches $100,000; and
- the appropriateness of the $100,000 intervention threshold, including consideration of alternative thresholds.

A.3 Process and Timing

Under section 45 of the National Electricity Law (NEL), the Commission is conducting this review into the efficiency of AEMO's management of negative IRSRs as required by clause 3.8.10(g) of the NER.

The Commission intends to publish an issues paper to identify the range of issues to be considered in this review and seek stakeholder comments about:

- whether the issues we have identified are appropriate; and
- potential ways to address these issues.

The Commission also intends to publish a draft report (which will be subject to public consultation) and a final report for this review.

In accordance with section 45(4) of the NEL, a copy of the final report will be provided to the Ministerial Council on Energy (now the Standing Council of Energy and Resources) and published on the AEMC's website.

B Summary of submissions

This appendix summarises and provides responses to key points raised by stakeholders in submissions on the Issues Paper and Draft Report.

B.1 Summary of submissions on the Issues Paper

Table B.1 Summary of submissions on the Issues Paper

Issue	Stakeholder	Comment	AEMC Response
Scope	AER	As Optional Firm Access (OFA) model unlikely to be implemented for several years, the AER supports broadening the scope of this review to cover the causes of negative IRSRs, in particular disorderly bidding (p. 1).	The scope of this review is limited to the terms specified in the NER, which focuses on AEMO's management of negative IRSRs.
	AEMO	AEMO supports scope of the review and suggests that any procedural improvements be made through AEMO's procedure change processes (p. 2).	Agreed.
	Alinta Energy	Alinta Energy considers that the AEMC's approach should go beyond reviewing current approach but also consider more efficient alternative approaches (p. 1).	Agreed. The Commission has reviewed current approach in light of the NEO, which may include alternative approaches.
Causes of negative IRSRs	AEMO	AEMO considers that this review provides an opportunity to examine causes of negative IRSRs for the purpose of removing the need for market intervention (p. 3).	The scope of this review is limited to the terms specified in the NER, which focuses on AEMO's management of negative IRSRs. This will include examining whether clamping remains necessary but does not include determining the causes of negative IRSRs.
	National Generators Forum	NGF consider that negative IRSRs are a symptom of intraregional constraints and considers that the exporting region's TNSP should pay for negative IRSRs rather than importing region's TNSP (p. 3).	The importing region's TNSP pays for negative IRSRs because market customers in that region obtain the likely benefit of relatively lower electricity prices during times when counter-price flows are occurring.
	EnergyAustralia	EnergyAustralia considers that the root cause of negative residues is network congestion and not the bidding behaviour in response to that (p. 1).	The scope of this review is limited to the terms specified in the NER, which focuses on AEMO's management of negative IRSRs.

Issue	Stakeholder	Comment	AEMC Response
	Alinta Energy	Alinta Energy considers that the drivers of counter priced flows to be disorderly bidding at times of intra-regional constraints (p. 2).	The scope of this review is limited to the terms specified in the NER, which focuses on AEMO's management of negative IRSRs. This will include examining whether clamping remains necessary but does not include determining the causes of negative IRSRs.
Paying for negative IRSRs	Delta Electricity	Delta Electricity considers that importing regions paying for negative IRSRs is inefficient/unfair (p. 1).	The importing region's TNSP pays for negative IRSRs because market customers in that region obtain the likely benefit of relatively lower electricity prices during times when counter-price flows are occurring.
	Alinta Energy	Alinta Energy submits that the present arrangements mean that the savings not to build out a constraint are enjoyed by consumers in that region while the costs of not building out a constraint are borne by consumers in the adjacent region. Therefore suggests that TNSPs in the region with the constraint should bear a share of the costs (p. 3).	Funding arrangements for negative IRSRs are not within the scope of this review.
Effectiveness of clamping	AEMO	AEMO explained that managing negative IRSRs is inherently difficult as prices/residues are an output of a dispatch process while AEMO can only observe input conditions (p. 4).	Discussed in section 2.4.1 of this final report.
	Alinta Energy	On balance, Alinta Energy supports clamping given the limitations of the current market design (p. 5).	The Commission outlines its views on the need for clamping in chapter 3.
	Origin Energy	Origin broadly endorses AEMO's current NRM policy as has been conducted transparently and efficiently to date (p. 1). Considers that the use of NRM is not to address inefficient market outcomes or inefficient congestion so it is not a market design flaw. Rather NRM is used to address the financial consequences of efficient flows occurring in the presence of	The Commission outlines its views on the need for clamping in chapter 3.

Issue	Stakeholder	Comment	AEMC Response
		congestion (p. 1).	
Clamping threshold	AEMO	AEMO considers that lowering the threshold could still result in a high volume of negative residues. Therefore the question of lowering the threshold is not a significant issue (p. 5).	Agreed. Discussed in section 3.4 of this final report.
	Macquarie Generation	Given AEMO's NRM automated system, Macquarie Generation consider it is appropriate to return to the $6000 threshold which would balance customer exposure to large and variable IRSR costs and allow generators to respond to dispatch price signals. It provides an example of how lowering the threshold would result in savings to the consumer (p. 2).	This is discussed in section 3.4 of this final report.
	Delta Electricity	Delta Electricity considers that the clamping threshold should be ideally set to zero or, if not possible, $6000 so that counter price flows are dealt with more promptly (p. 2).	
	Alinta Energy	Alinta Energy states that in the absence of qualitative analysis, supports increasing the threshold as it may reduce intervention and provide certainty to affect parties, but suggests AEMC work with AEMO to analyse the effects of different threshold levels (p. 5).	
	Snowy Hydro	Snowy Hydro supports the current threshold (p. 1).	Agreed.
Alternatives to clamping	AER	AER supports a range of interim measures to address disorderly bidding: 1) a simplified congestion pricing mechanism prior to introducing OFA; 2) AER considers that AEMC should assess whether the Rules are a barrier to AEMO changing its network constraint formulation guidelines to address inefficient dispatch while maintaining system security; and 3) amend the NER to prevent generators from submitting ramp rates that prolong the effects of disorderly	The scope of this review is limited to the terms specified in the NER, which focuses on AEMO's management of negative IRSRs.

Issue	Stakeholder	Comment	AEMC Response
		bidding with a possible rule change from the AER (p. 2).	
	Alinta Energy	Alinta Energy claims that clamping creates a distortion that does not provide certainty of outcomes for generators (p. 3). Therefore supports a congestion pricing mechanism (p. 4). It suggests that a congestion pricing scheme is a proportionate response to disorderly bidding, particularly given the costs of addressing price risk due to the presence of congestion (p. 5).	The scope of this review is limited to the terms specified in the NER, which focuses on AEMO's management of negative IRSRs. This does not include consideration of alternative congestion pricing mechanisms.
Issues associated with the current application of the clamp	AEMO	Given the success of the system automation experience, AEMO suggests that future enhancements to the negative IRSR management should be implemented through an automated system (p. 6).	The implementation of changes to the management of negative IRSRs is an operational matter for AEMO.
	AEMO	To aid transparency of operations, AEMO is investigating the real-time publication of negative IRSR values which would enable traders to anticipate clamping actions (p. 7).	This is discussed in section 4.3 of this final report.
	NGF	NGF suggests making the following minor changes to AEMO's management of negative IRSRs: publish the NRM_DI_AMT in dispatch, 5 min pre-dispatch and 30 minute pre-dispatch; adjust the NRM constraints in a symmetrical fashion with positive IRSRs; apply the increments to targets for the interconnectors and allow the ramping constraints on the interconnectors to control targets and Constraint Violation Penalty factors to apply (p. 4).	These issues are discussed in section 4.2 of this final report.
	Macquarie Generation	Macquarie Generation has noticed a pattern of 'cycling' behaviour where the intervention trigger is breached an reset over a period of hours or sometimes over trading days. The higher threshold allows for much higher negative IRSRs, which are borne by customers of importing region TNSP (p. 1).	This issue is discussed in section 4.1 of this final report.
	Macquarie	Macquarie Generation propose changes to the current	This issue is discussed in section 4.2 of this

Issue	Stakeholder	Comment	AEMC Response
	Generation	management by AEMO such as making the relaxation and tightening of the constraints symmetrical for positive and negative IRSRs; introducing a new threshold above $10 000 per dispatch interval for positive and negative IRSRs and increase the steps in interconnector flows for dispatch intervals above $10,000 (p. 4).	final report.
	Delta Electricity	Delta Electricity considers that the issue of cycling has led to the accumulation of significant and unnecessary costs that the importing regions' customers had to pay (p. 1).	This issue is discussed in section 4.1 of this final report.
	Delta Electricity	Delta Electricity considers that a symmetrical response in the management of negative IRSRs should be considered (p.2).	This is discussed in section 4.2 of this final report.
	Delta Electricity	Delta Electricity considers that AEMO should publish NR_DI_AMT in MMS (p. 2).	This issue is discussed in section 4.3 of this final report.
	Alinta Energy	Alinta Energy suggests that should clamping continue, then publication of negative residue management equations in real-time, and reviewing the constraint increments and methods for applying negative residue constraints in a manner which impacts both regions in more balanced manner, should occur (p. 6).	This issue is discussed in chapter 4 of this final report.

B.2 Summary of submissions on the Draft Report

Table B.2 Summary of submissions on the Draft Report

Issue	Stakeholder	Comment	AEMC Response
General	AEMO	Managing negative IRSRs is an inherently difficult task for AEMO as negative IRSRs are an outcome of the dispatch process rather than a dispatchable variable that can be constrained (p. 2).	Acknowledged. This is noted in section 2.4 of this final report.
	AEMO	AEMO suggested engaging directly with consumer groups as negative IRSRs are paid ultimately by consumers (p. 2).	The AEMC has conducted this review in a consultative manner that is open to all stakeholders, including consumers.
	Origin Energy	Origin Energy supported the AEMC's draft findings and recommendations.	Noted.
Clamping threshold	AEMO	AEMO supported the AEMCs draft recommendation (p. 3).	Noted.
	Alinta Energy	While supporting the AEMC's draft recommendation, Alinta Energy expressed its disappointment that no further assessment of increasing the intervention threshold to over $100,000 had been made (p. 2).	As noted in section 3.4.3 of this final report, the AEMC considered the option of increasing the intervention threshold but decided this was not appropriate.
Cycling	Alinta Energy	Alinta Energy supported clamping which covers a set 3 hour time period and recommends AEMO implement such a reform within 6 months (p. 3).	We consider that it is up to AEMO to determine the appropriate operational response in accordance with its work program.

Issue	Stakeholder	Comment	AEMC Response
	AEMO	AEMO requested a clearer instruction from the AEMC as to whether a measure to address cycling should be introduced (p. 4).	The AEMC has reviewed its final recommendation accordingly.
	NGF	NGF considered that a better process should be introduced rather than fiddling with the existing process (p. 3)	Given the available evidence, the AEMC considers its recommendations in section 4.1 of this final report remain sound.
Increments in applying the clamp	AEMO	AEMO accepted the AEMC's draft recommendation (p. 4).	Noted.
	Alinta Energy	Alinta Energy supported the AEMC's draft recommendation and suggested that AEMO should explore methods for a symmetrical application of the clamp (p. 3).	As discussed in section 4.2 of this final report, AEMO should explain its rationale for using asymmetry in applying the clamp.
Real time publication of negative IRSRs within a current trading interval	AEMO	AEMO supported the AEMC's draft recommendation (p. 4).	Noted.
	Alinta Energy	Alinta Energy supported the AEMC's draft recommendation (p. 4).	Noted.
Use of metered initial interconnector flow	AEMO	AEMO supported the AEMC's draft recommendation (p. 4).	Noted
	NGF	The NGF questioned AEMO's use of the initial metered interconnector flow from the previous dispatch interval and considered that the current system is unpredictable for	This issue is discussed in section 4.4 of this final report.

Issue	Stakeholder	Comment	AEMC Response
		participants to manage (p. 2).	
	Alinta Energy	Alinta Energy supported the AEMC's draft recommendation and stated that it would be supportive of additional methods that improve the accuracy of IRSR measurement (p. 4).	Noted.
Further issues	NGF	NGF suggested alternative methods of managing NRM constraints (p. 2-3).	We consider that the NGF could raise these technical issues directly with AEMO.
	NGF	NGF described two instances when negative IRSRs occur and sought clarification from the AEMC as to whether AEMO's negative residue management should apply in these instances (p. 3).	Transitory occurrences of negative IRSRs within a trading interval would likely not result in application of AEMO's clamp. However, situations such as that described in Figure 2.1 of this final report, could result in negative IRSRs that trigger the application of AEMO's clamp.
	AEMO	AEMO provided procedural clarification of its negative residue management process (p. 4).	The AEMC appreciates and has incorporated AEMO's clarification of its negative residue management process in section 2.4 of this final report.