SETTLEMENTS RESIDUE AUCTION RULES – SECONDARY TRADING

CONSULTATION PAPER 2

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EXECUTIVE SUMMARY

The publication of this Consultation Paper commences the first stage of the Rules consultation process conducted by AEMO to consider proposed amendments to the Settlements Residue Auction Rules (Auction Rules). These amendments are to clarify definitions and clauses that have been identified while developing the systems to implement secondary trading in the Settlements Residue Auction (SRA) under the National Electricity Rules (NER).

On 10 October 2017, in response to an NER Rule change proposal submitted by Westpac Banking Corporation (Westpac), the Australian Energy Market Commission (AEMC) made a final determination to change the NER to enable AEMO, with the approval of the Settlements Residue Committee (SRC), to provide a platform for secondary trading of settlements residue distribution units (units). The AEMC's determination considered secondary trading will improve liquidity in units, which in turn is likely to increase interstate trade of electricity, improve risk management, and increase competition in retail and wholesale markets.[1]

Throughout 2018, in conjunction with the SRC, AEMO developed the design and required amendments to the Auction Rules and associated agreements to implement secondary trading, and consulted on these with industry. On 30 January 2019, AEMO published the final report and determination, with the SRC's approval, to amend the Auction Rules to implement secondary trading.[2] Implementation of secondary trading will allow participants to offer units that they have previously purchased in an auction for sale in a subsequent auction.

AEMO has now progressed system changes to implement secondary trading. As a consequence, AEMO has identified amendments to be made to the Auction Rules to clarify clauses and terms for the avoidance of doubt. In summary, key amendments proposed to the Auction Rules involve:

- Clarifying that the clearing price of an auction should only be set to $0 where there are more primary units available than the total quantity bid (that is, by explicitly excluding Offered Units from Available Units in Clause 13.2),

- Ensuring consistent use of positive and negative have been used throughout the definitions and calculation of the trading margin, trading limit and prudential exposure in Clauses 7.3 and 7.4,

- Clarifying definitions of terms used in equations, and

- Amending some typographical errors that have been found in this review of the Auction Rules.

No additional implementation costs are identified as a consequence of this consultation. Although the implementation of secondary trading is now targeted to be October 2019, where this was previously advised as July 2019, this is not a consequence of this additional consultation. Instead, the implementation has been delayed to October 2019, as discussed with the SRC in February 2019, to ensure a quality system can be delivered and is not compromised by compressed timeframes.

AEMO invites stakeholders to suggest alternative options where they do not agree that AEMO's proposals would achieve the objective of implementing secondary trading. AEMO also asks stakeholders to identify any unintended adverse consequences of the proposed changes.

Stakeholders are invited to submit written responses on the issues and questions identified in this paper by 5.00 pm (AEST) on 30 May 2019, in accordance with the Notice of First Stage of Consultation published with this paper.

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[1] AEMC, 2017, "Secondary trading of settlement residue distribution units rule change". Available: https://www.aemc.gov.au/rule-changes/secondary-trading-of-settlement-residue-distributi Viewed: 19 September 2018

[2] AEMO, 2019, "SRA Secondary Trading Consultation". Available: http://aemo.com.au/Stakeholder-Consultation/Consultations/SRA-Secondary-Trading-Consultation?Convenor=AEMO%20NEM Viewed: 21 March 2019

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1.   STAKEHOLDER CONSULTATION PROCESS

As required by the NER, AEMO is consulting on amendments to the Auction Rules in accordance with the Rules consultation process in rule 8.9.

Note that there is a glossary of terms used in this Consultation Paper at Appendix A. References in this paper to 'rule x' is a reference to an NER rule; the word 'clause' has been used to refer to specific clauses in the amended Auction Rules.

AEMO's indicative timeline for this consultation is outlined below. Dates may be adjusted depending on the number and complexity of issues raised in submissions and any meetings with stakeholders.

Deliverable	Indicative date
Consultation Paper published	23 April 2019
NEM Wholesale Consultative Forum Presentation	30 April 2019
Submissions due on Consultation Paper	30 May 2019
Draft Report published	18 June 2019
Submissions due on Draft Report	3 July 2019
Final Report published	19 July 2019
Effective date of the Auction Rules	1 October 2019

The SRC[3] is ultimately responsible for approving the amendments to the proposed version of the Auction Rules. AEMO will continue to work with the SRC during the consultation to understand concerns and assess proposals raised by stakeholders.

2.   BACKGROUND

2.1.   NER requirements

Under rule 3.18.3 of the NER, AEMO is responsible for developing and amending the Auction Rules that set out the procedures and mechanisms for operating the SRA. Rule 3.18.3(d)(1) stipulates that AEMO may amend the Auction Rules with the approval of the SRC and in accordance with the Rules consultation process outlined in rule 8.9.

2.2.   Context for this consultation

2.2.1.   Implementation of Secondary Trading

On 10 October 2017, in response to an NER Rule change proposal submitted by Westpac Banking Corporation (Westpac), the Australian Energy Market Commission (AEMC) made a final determination to change the NER to enable AEMO, with the approval of the Settlements Residue Committee (SRC), to provide a platform for secondary trading of settlements residue distribution units (units). The AEMC's determination considered secondary trading will improve liquidity in units, which in turn is likely to increase interstate trade of electricity, improve risk management, and increase competition in retail and wholesale markets. [4]

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[3] The SRC is an industry committee, formed under rule 3.18.5 and chaired by AEMO. The SRC is responsible for approving amendments to the Auction Rules, monitoring the auction, and approving costs and expenses incurred by AEMO for the SRA.

[4] AEMC, 2017, "Secondary trading of settlement residue distribution units rule change". Available: https://www.aemc.gov.au/rule-changes/secondary-trading-of-settlement-residue-distributi Viewed: 19 September 2018

AEMO developed a high-level design in conjunction with the SRC, incorporating all necessary requirements of the final NER determination. In May 2018, based on this design, initial estimates and implementation timelines, the SRC endorsed secondary trading to be implemented in the SRA. The SRC provided guiding principles for the implementation of secondary trading to deliver the desired benefits, while limiting consequential changes for those currently participating in SRA.

AEMO initiated consultation with industry on the proposed changes to the Auction Rules in September 2018. On 30 January 2019, AEMO published the final report and determination, with the SRC's approval, to amend Auction Rules to implement secondary trading. Implementation of secondary trading will allow participants to offer units that they have previously purchased in an auction for sale in a subsequent auction. AEMO has also begun design and development work to update the SRA systems required for these changes. Through the development of the design, AEMO has identified clauses and definitions in the Auction Rules that warrant clarification; these are the subject of this consultation.

2.2.2. Related consultations and processes

This consultation does not impact the Auction Participation Agreement (APA) that was approved in January 2019, allowing for participants who wish to engage in secondary trading to progress updating their registration prior to the conclusion of this consultation.[5] Information regarding this process will be made available on the project page on AEMO's website. [6]

Previously, implementation of secondary trading was targeted to be from 1 July 2019, as communicated with the publication of the previous version of the Auction Rules that was approved by the SRC in January 2019. This has now been delayed to 1 October 2019 to ensure a quality system can be delivered that is not compromised by compressed timeframes. As such, the version of the Auction Rules to implement secondary trading currently approved is not intended to be made effective, instead the amended version with clarifications will be made effective once this consultation has been concluded.

AEMO is also simultaneously conducting a consultation on amendments to the APA to update clause 16.5 of the APA to limit the scope for auction participants to terminate settlement residue distribution agreements (SRDAs) as a result of the introduction of changes to introduce Five-Minute Settlement in the National Electricity Market. It was agreed by the SRC that the amendment to clause 16.5 will only be made effective after SRA secondary trading is implemented. This will provide a limited window for existing participants to execute a new APA that includes the changes to allow secondary trading without the amendment to clause 16.5. The indicative date for the amendment to clause 16.5 to be effective in the APA is November 2019. AEMO will work with existing auction participants wishing to execute a new APA to participate in secondary trading prior to implementation of the new Auction Rules.

3. DISCUSSION

This section discusses the proposed amendments to the Auction Rules that seek to correct and clarify definitions and clauses that have been identified while developing the systems to implement secondary trading in the Settlements Residue Auction (SRA). These amendments do not change the intent of any clauses compared to those in the final Auction Rules amended for secondary trading approved in January 2019. Material consequences may have arisen without these changes, were they not identified prior to implementation of secondary trading.

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[5] Note that the clause cross references in the definition of "cancelled units" and clause 9.4(b) of the APA were obvious drafting errors and have been corrected.

[6] http://aemo.com.au/Electricity/National-Electricity-Market-NEM/Settlements-and-payments/Settlements/Settlements-Residue-Auction/SRA-Secondary-Trading-Project

3.1. Amendments to the definition of the Auction LP

The SRA is solved via a linear programming problem (LP) which is set out in Schedule 2 of the Auction Rules, and is referred to as the Auction LP. The Auction LP determines the purchase price for all allocated units (and also the cancellation price for all cancelled units). To implement secondary trading, the Auction LP was updated to include Offered Units, and the solver engine has also been redeveloped to include these changes. Clause 13.2a of the Auction Rules, which sets out the principles by which the Auction LP will determine the purchase price, was not amended, as the overarching principles to set the purchase price was not required to change.

However, the first sub-clause of 13.2a states 'where, in respect of a Unit Category and a Relevant Quarter the number of Units for which Bids are submitted is less than the number of Available Units the purchase price for that Unit Category for that Relevant Quarter will be zero'. With the introduction of secondary trading, Available Units is defined as the number of Units to be made available at an auction, and has been amended to include Offered Units. Clause 13.2a is therefore not strictly correct as when the number of Units for which Bids are submitted is less than the number of Available Units, but greater than the number of primary units available, the Auction LP should set the purchase price as the clearing price, as demonstrated in Figure 1.
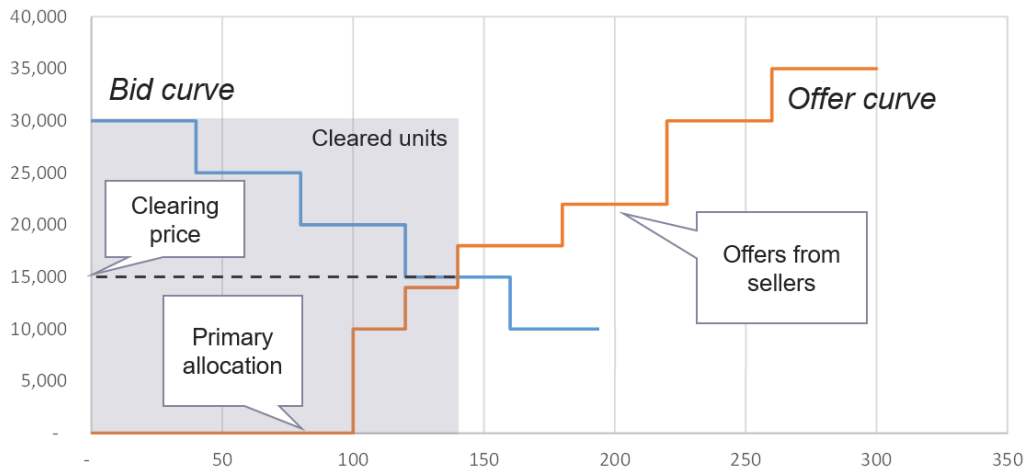
Figure 1: Purchase price set at Market Clearing Price if bid quantity less than Available Units

As such, clause 13.2a is proposed to be amended to explicitly exclude Offered Units from Available Units to only set the purchase price at zero when the number of Units for which Bids are submitted is less than the primary units available. This is demonstrated in Figure 2.

Figure 2: Purchase price set to zero if bid quantity less than primary allocation of units

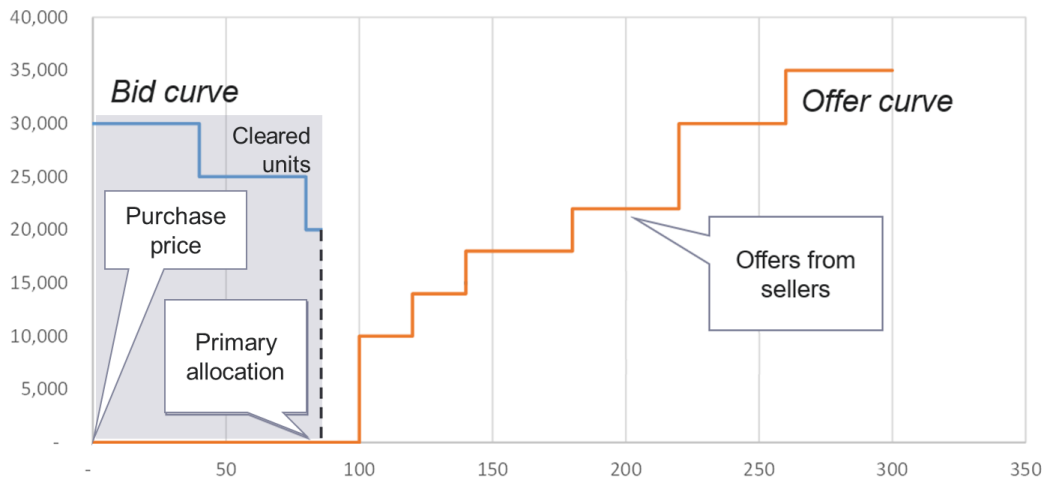## 3.2. Amendments to the calculation of prudential exposure

3.2.1. Amendments to sign convention

With the introduction of secondary trading, the NER requires a participant to provide margin to AEMO at the same time as it offers a unit (3.18.4A(b)) and for the mechanism for calculating and determining the required margin to be set out in the Auction Rules (3.18.3(a1)(5)). To this end, new clauses were introduced into the Auction Rules to determine the required margin to cover the participant's prudential exposure. The relevant calculations are located in clause 7.3 of the Auction Rules and were described in the original consultation paper to amend the Auction Rules to implement secondary trading.

Through development of the systems required for implementing secondary trading, including the margin provisions, inconsistencies have been identified in the convention used for positive and negative values when representing amounts owed to a participant or amounts owed by participant.

To correct this inconsistency, AEMO proposes to amend the definition of the Prudential Exposure of an Auction Participant to reverse the sign of the aggregate of the trading positions, with the calculation to also be amended. The following explains the current issue and the proposed amendment:[7]

- Prudential Exposure is defined as "the amount of an Auction Participant's actual or contingent liability in respect of Units that are or may be allocated in an auction including but not limited to Cancelled Units as calculated by AEMO under clause 7.3(d)".

- Under clause 7.3(d), Prudential Exposure is currently calculated to be the aggregate of the trading positions of an Auction Participant, calculated under 7.3(d)(i). This calculation allows for money owed by the participant to AEMO due to cancelling units in one unit type (Unit Category and Relevant Quarter) to be offset by money owed to the participant due to cancelling units in another unit type.

- Under 7.3(d)(i), the trading position (TP(p,q,u)) of an Auction Participant for each Unit Category and Relevant Quarter (unit type) is calculated as follows:

$$TP(p,q,u) = CV(p,q,u) \times (ACP(p,q,u) - AAP(p,q,u))$$

Where

CV(p,q,u) is the 'Cancelled volume' or the sum of the number of units cancelled for Unit Category "u" and Relevant Quarter "q" with the number of units that are offered for a price less than APP(p,q,u),

ACP(p,q,u) is the "Average cancellation price' or the average weighted price of units cancelled for Unit Category "u" and Relevant Quarter "q" with the number of units that are offered for a price less than APP(p,q,u), and

APP(p,q,u) is the 'Average purchase price' or the average weighted price of units that have been allocated to participant "p" for Unit Category "u" in or before the last quarter in which units were cancelled.

- As such, the trading position for each Unit Category and Relevant Quarter is calculated to be positive when the participant has had units cancelled at profit compared to the purchase price at which they were allocated, and negative when the units have been cancelled at a loss.

- To align with the NER, the Prudential Exposure (for which the Auction Participant is required to provide margin) should be set at the potential amount the participant owes due to the difference in price between when the participant was allocated a unit and had this unit cancelled. The intent of the margin is to offset any losses a participant has made in secondary trading to protect the network

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[7] The variables and definitions used in the calculations in the new version of the Auction Rules have also been amended further for clarification, as described in Section 3.2.2 in this paper. This section uses the calculations as they were set out in the previous version.

service provider in the case of default. However, by aligning the Prudential Exposure directly with the aggregate trading position, an error has been identified that it is currently aligned with payment owed to the participant.

- As such, AEMO proposes to amend clause 7.3(d)(iv) for the Prudential Exposure to reverse the sign of the aggregate of the trading positions.

An associated amendment is required to the calculation of the aggregate trading position (ATP) itself. The calculation of the ATP is currently defined in clause 7.3(d)(iv) as:

$$\text{ATP}(p) = \text{Max}\left(0, \sum_{q=1} \sum_{u} \text{TP}(p,q,u)\right) + \sum_{q=2\ to\ n} \sum_{u} \text{TP}(p,q,u)$$

Where q=1 is the next Relevant Quarter to be settled.

The first term in this calculation is intended to remove any profits due to the participant for cancelling units in the next quarterly settlement. The purpose of this is to avoid a situation where a payment is due to a participant but paying this will result in the participant having lodged insufficient cash security to keep their trading margin above zero following settlement. With this calculation, the participant will have already adjusted the cash security they have lodged with AEMO and be able to receive payments due at settlement without breaching their trading limit.

However, by using a 'maximum', this first term currently removes payments due from the participant in the next quarter, leaving the market exposed if that participant was to default on that payment. As such, AEMO proposes to amend the calculation from using 'maximum' to 'minimum'.

$$\text{ATP}(p) = \text{Min}\text{ax}\left(0, \sum_{q=1} \sum_{u} \text{TP}(p,q,u)\right) + \sum_{q=2\ to\ n} \sum_{u} \text{TP}(p,q,u)$$

For clarity, an additional expression has also been included to define the Prudential Exposure of a participant as PE(p), calculated as follows:

$$\text{PE}(p) = -\text{ATP}(p)$$

3.2.2. Variable clarifications

Additional clarifications have also been made to the definitions and labels of the variables used in the equations to determine the average trading position of the participant (ATP(p)). These changes do not change the intent of the calculations.

Average Purchase Price

It is intended that the average purchase price (APP) used in this calculation will only take into account units that have been purchased prior to the cancellation of those units. The current definition of the average purchase price in clause 7.3 reads "Average weighted price of units that have been allocated to participant "p" for Unit Category "u" and Relevant Quarter "q" in or before the last quarter in which units were cancelled", and the calculation is as follows:

$$\text{APP}(p,q,u) = \frac{\sum_{Tp=1\ to\ Max(Tc)} (AllocatedUnits(p,q,u,PP,Tp) \times PP)}{\sum_{Tp=1\ to\ Max(Tc)} (AllocatedUnits(p,q,u,PP,Tp))}$$

Where

- AllocatedUnits(p,q,u,PP,Tp) is the number of units participant "p" has been allocated for Unit Category "u" and Relevant Quarter "q", at a purchase price "PP" and in tranche "Tp", and

- Max(Tc, p) is the maximum tranche "Tc" in which units have been cancelled for participant "p".

This means that the trading position calculation in each unit type does not consider units that have been purchased in tranches following when the last units were cancelled.

However, cash security must be provided for units to be offered where those units, if cancelled at the offer price, will bring the participant's trading margin below zero. Once additional units are cancelled, any units that have been purchased in intervening auctions will be considered in the calculation. As such, when an offer is made, the calculation of APP should be considered as the APP as if those units are cancelled.

The definition of the Average Purchase Price is thus proposed to be amended to explicitly describe the treatment of Offered Units, and better describe the variables used to calculate APP.

APP is now defined as explicitly dependent on an additional variable, MTc(p,q,u) (which has replaced the use of Max(Tc,p)). MTc(p,q,u) is defined as

> The most recent tranche prior to the time of calculating the trading position in which the participant "p" has had units cancelled for Unit Category "u" and Relevant Quarter "q".

> If the participant has Offered Units for Unit Category "u" and Relevant Quarter "q" which are less than the average purchase price of all units the participant has previously had allocated for Unit Category "u" and Relevant Quarter "q", MTc(p,q,u) is set to the tranche in which the offer is being made, "To".

The calculation of APP(p,q,u,MTc(p,q,u)) is now expressed as follows:[8]

$$APP(p, q, u, MTc(p, q, u))) = \frac{\sum_{Ta=1\ to\ MTc-1}(AllocatedUnits(p, q, u, Ta) \times PP(q, u, Ta))}{\sum_{Ta=1\ to\ MTc-1}(AllocatedUnits(p, q, u, Ta))}$$

Put together, this means that when an offer submitted in tranche "To" for Unit Category "u" and Relevant Quarter "q", the average purchase price will be calculated setting "MTc" to "To" to validate whether or not the offer can be made. If the participant has sufficient cash security to submit this offer, the subsequent trading position for that unit type will be calculated as follows:

- If the offer price of an Offered Unit is less than the average purchase price just calculated, the APP used to calculate the trading position for Unit Category "u" and Relevant Quarter "q" will be that calculated including all units purchased prior to the offer being made.

- If there are no Offered Units less than the APP just calculated, the APP used to calculate the trading position for Unit Category "u" and Relevant Quarter "q" will be calculated including all purchased units prior to the most recent tranche in which the participant has had units cancelled for Unit Category "u" and Relevant Quarter "q".

As such, the Trading Position calculation becomes

$$TP(p, q, u) = CV(p, q, u) \times (ACP(p, q, u) - AAP(p, q, u, MTc(p, q, u)))$$

An example is provided in Appendix A.

Offered Units

With this change to APP, the terms to include offered units in the Cancelled Volume and Average Cancellation price can now be expressed with explicit reference to the APP calculated with all previously purchased units (ie. all units up to the tranche in which the offer is made, "To"):

$$CV(p, q, u) = \sum_{Tc} CancelledUnits(p, q, u, Tc)$$
$$+ \sum_{\substack{o \\ where\ OP(q,u,o)<APP(p,q,u,MTc=To)}} OfferedUnits(p, q, u, o, To)$$

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[8] Additional changes to the variables are described below.

$$ACP(p,q,u)$$
$$= \frac{\sum_{Tc}(CancelledUnits(p,q,u,Tc) \times CP(q,u,Tc)) + \sum_{where\ OP(q,u,o)<APP(p,q,u,MTc=To)}^{o}(OfferedUnits(p,q,u,o,To) \times OP(q,u,o))}{CV(p,q,u)}$$

Definition clarifications

Note, additional clarifications have been made to the variables to define the variables in these equations:

Variable or definition	Use	Amendment
Tranche of allocation (Tp)	Denote tranche in which units have been allocated	Replaced with "Ta"
AllocatedUnits	Denote the number of units a participant has been allocated in a tranche	No longer dependent on the purchase price, as this will be the same for all allocated units of Unit Category "u" in Relevant Quarter "q" in Tranche "Ta"
Purchase Price (PP)	Denote the purchase price for a unit	Specifically defined as the purchase price for Unit Category "u" and Relevant Quarter "q" in tranche "Ta", and is denoted as a function of the same. PP(q,u,Ta)
CancelledUnits	Denote the number of units a participant has had cancelled in a tranche.	No longer dependent on the cancellation price, as this will be the same for all allocated units of Unit Category "u" in Relevant Quarter "q" in Tranche "Tc"
Cancellation Price (CP)	Denote the cancellation price for a unit	Specifically defined as the cancellation price for Unit Category "u" and Relevant Quarter "q" in tranche "Tc", and is denoted as a function of the same. CP(q,u,Tc)
OfferedUnits	Denote the number of units in an offer	Defined as a function of the specific offer "o", and not a function of the Offer Price OP. A note has also been added to the definition of OfferedUnits: offers will only be valid in one tranche "To" for Unit Category "u" and Relevant Quarter "q" at a time
Offer Price (OP)	Denote the offer price for a unit	Specifically defined as the offer price for Unit Category "u" and Relevant Quarter "q" in offer "o", and is denoted as a function of the same. OP(q,u,o)
Average Cancellation Price	Used in the calculation of the trading position	The definition has been expanded to explicitly describe the treatment of offered units.
Average Cancellation Price and Average Purchase Price	Used in the calculation of the trading position	Amended to clarify the weighting of the average is volume-weighted
Trading Position	Used to calculate the prudential exposure of a participant	A note has been added to the definition to clarify the convention of the sign.

3.3. Fee and billing payments

As discussed in the initial consultation paper, a cancellation fee has been introduced as an additional type of auction expense fee with the implementation of secondary trading. In accordance with the NER, all auction expense fees are to be recovered from settlements residue. As such, the Auction Rules were amended to adjust the calculation for residue distribution to take into account total residue owed to a participant in a weekly payment and offset this by the total fees accrued by a participant. These changes were set out in clause 15.2.

In order to clarify the intention of each calculation included in this clause, AEMO is proposing amendments to describe each formula, and further clarification in the definitions of each term. To that end, the following amendments have been made to Clause 15.2:

- Definitions have been amended for consistency of variables and additional explanation has been added where warranted.
- Specification of the average price to be used for calculating the cancellation fee when there were no cancelled units in the last settled quarter to be the average purchase price of allocated units.
- Updating the number of cancelled units to be used in the calculation where there have been zero in the last settled quarter to be '1', rather than 0.01, to avoid distorting the cancellation transaction fee if there are no cancellations in a particular directional interconnector.
- Consistent use of purchase price rather than clearing price when describing the price used in the calculation, and
- Additional notes to explain when each formula is to be applied.

A change-marked version of the Auction Rules is available with this consultation.

3.4. Other minor amendments

AEMO has identified additional typographical errors and areas warranting clarification, and has amended these as follows:

- Clause 2.1 – definition of Cancelled Units is in reference to clause 12.2. This has been amended to clause 12.
- Clause 14.2 - duplication of the word 'offered' has been removed.

4. DRAFTING FOR PROPOSED CHANGES

To help stakeholders and other interested parties respond to this Consultation Paper, AEMO has published a draft of the Auction Rules incorporating the changes AEMO proposes for consultation. A change-marked version is available on AEMO's website on the consultation page.

5. SUMMARY OF MATTERS FOR CONSULTATION

In summary, AEMO seeks comment and feedback on the clarification amendments that have been made to the Auction Rules. AEMO also invites stakeholders to suggest if any additional clarifications are required to the Auction Rules.

Submissions on these and any other matter relating to the proposal discussed in this Consultation Paper must be made in accordance with the Notice of First Stage of Consultation published with this paper by 5.00 pm (AEST) on 30 May 2019.

APPENDIX A - EXAMPLE PRUDENTIAL CALCULATIONS

The following example uses the new proposed calculations and variables for a participant in two different Unit Categories and Relevant Quarters.

Let these unit types be Unit A (for example C2022Q1, V-SA/SA) and Unit B (for example C2022Q4, VIC-NSW/NSW).

Activity	Prudential Exposure Calculation	Comment
Bid for 3 units at $60 in auction for tranche 1 of Unit A. Eg. In early March 2019 before the auction, bid for 3 units at $60 in auction for C2022Q1T01 of [V-SA/SA]	N/A	No trading position is calculated as no units have been offered / cancelled.
Allocated all 3 units of Unit A at a clearing price of $50. Eg. after the auction in March 2019, allocated all 3 units at $50 of [V-SA/SA]	N/A	No trading position is calculated as no units have been offered / cancelled.
Offers 2 units of Unit A at $10 in tranche 2. AEMO to validate these	1. Determine if there are offered units less than the average purchase price when all units previously allocated are included in the calculation, ie. set MTc = To, and calculate the APP. $$APP(p,q,u,MTc = To) = \frac{\sum_{Ta=1\,to\,To-1}(AllocatedUnits(p,q,u,Ta) \times PP(q,u,Ta))}{\sum_{Ta=1\,to\,To-1}(AllocatedUnits(p,q,u,Ta))}$$	Offers will be accepted if a minimum of $80 cash security has

offers against trading margin.	$$APP(p,q,u,MTc = 2) = \frac{\sum_{Ta=1\ to\ (2-1)} (AllocatedUnits(p,q,u,Ta) \times PP(q,u,Ta))}{\sum_{Ta=1\ to\ (2-1)} (AllocatedUnits(p,q,u,Ta))}$$	been provided.

$$APP(p,q,u,MTc = 2) = \frac{AllocatedUnits(p,q,u,Ta = 1) \times PP(q,u,Ta = 1)}{AllocatedUnits(p,q,u,Ta = 1)}$$

$$APP(p,q,u,MTc = To) = \frac{3 \times 50}{3}$$

$$APP(p,q,u,MTc = To) = 50$$

The offered units are at \$10, so less than APP(p,q,u,MTc=To) of \$50.

2. Calculate Trading Position terms

Let the offer for 2 Units of Unit A at \$10 be offer o = A1.

2.1 Cancelled volume

$$CV(p,q,u) = \sum_{Tc} CancelledUnits(p,q,u,Tc) + \sum_{where\ OP(q,u,o)<APP(p,q,u,MTc=To)}^{o} OfferedUnits(p,q,u,o,To)$$

$$CV(p,q,u) = \qquad\qquad 0 \qquad\qquad + \sum_{where\ OP(q,u,o)<50}^{o} OfferedUnits(p,q,u,o,To = 2)$$

$$CV(p,q,u) = \qquad\qquad 0 \qquad\qquad + \qquad OfferedUnits(p,q,u,o = A1,To = 2)$$

$$CV(p,q,u) = \qquad\qquad 0 \qquad\qquad + \qquad\qquad 2$$
$$CV(p,q,u) = 2$$

Cancellation volume is 2 units

2.2 Average cancellation price

$$ACP(p,q,u) = \frac{\sum_{Tc} (CancelledUnits(p,q,u,Tc) \times CP(q,u,Tc)) + \sum_{where\ OP<APP(p,q,u,MTc=To)}^{o} (OfferedUnits(p,q,u,o,To) \times OP(q,u,o))}{CV(p,q,u)}$$

$$ACP(p,q,u) = \frac{0 \qquad\qquad + \quad (OfferedUnits(p,q,u,o = A1,To = 2) \times OP(q,u,o = A1))}{2}$$

$$ACP(p,q,u) = \frac{0 \qquad + \qquad (2 \times 10)}{2}$$

$$ACP(p,q,u) = 10$$

Average cancellation price is $10.

2.3   Average purchase price

Since there are offers that are less than APP when MTc = To, as calculated under step 1, the APP is calculated with MTc = To.

$$APP(p,q,u,MTc = To) = \frac{\sum_{Ta=1\ to\ To-1}(AllocatedUnits(p,q,u,Ta) \times PP(q,u,Ta))}{\sum_{Ta=1\ to\ To-1}(AllocatedUnits(p,q,u,Ta))}$$

$$APP(p,q,u,MTc = To) = \frac{3 \times 50}{3}$$

$$APP(p,q,u,MTc = To) = 50$$

2.4   Trading position

$$TP(p,q,u) = CV(p,q,u) \times \big(ACP(p,q,u) - AAP(p,q,u,MTc(p,q,u))\big)$$

$$TP(p,q,u) = \qquad 2 \quad \times (\qquad 10 \quad - \qquad 50 \qquad)$$

$$TP(p,q,u) = -80$$

3.   Calculate aggregate trading position

$$ATP(p) = \mathrm{Min}\left(0, \sum_{q=1}\sum_{u} TP(p,q,u)\right) + \sum_{q=2\ to\ n}\sum_{u} TP(p,q,u)$$

$$ATP(p) = \mathrm{Min}(0, \qquad 0 \qquad) + (-80)$$

$$ATP(p) = -80$$

4.   Determine prudential exposure
   Prudential exposure is the negative of the aggregate trading position.

$$PE(p) = -ATP(p)$$

$\text{PE}(p) = 80$

5. Determine trading margin
Trading margin is the trading limit less the prudential exposure, required to remain above $0.
Assume the participant has not submitted any cash security (trading limit = $0)
$\text{TM}(p) = \text{TL}(p) - \text{PE}(p)$
$\text{TM}(p) = \quad 0 \quad - 80 \quad = -80$

Negative trading margin – the participant must submit cash security of at least $80 to make this offer.

Offered units of Unit A are cancelled at clearing price of $10. Eg. In June 2019, after the auction, the offered units become cancelled units at a clearing price of $10.	1. Determine if there are offered units less than the average purchase price when all units previously allocated are included in the calculation. The auction has just closed, so there are no valid offered units. 2. Calculate Trading Position terms 2.1 Cancelled volume $$\text{CV}(p,q,u) = \sum_{Tc} CancelledUnits(p,q,u,Tc) + \sum_{\substack{o \\ where\ OP<APP(p,q,u,MTc=To)}} OfferedUnits(p,q,u,o,OP,To)$$ $\text{CV}(p,q,u) = CancelledUnits(p,q,u,Tc=2) + \qquad\qquad\qquad 0$ $\text{CV}(p,q,u) = \qquad\qquad 2 \qquad + \qquad\qquad 0$ $\text{CV}(p,q,u) = 2$ Cancellation volume is 2 units 2.2 Average cancellation price $$\text{ACP}(p,q,u) = \frac{\sum_{Tc}(CancelledUnits(p,q,u,Tc) \times CP(q,u,Tc)) + \sum_{\substack{o \\ where\ OP<APP(p,q,u,MTc=To)}}(OfferedUnits(p,q,u,o,OP,To) \times OP(q,u,o))}{CV(p,q,u)}$$ $$\text{ACP}(p,q,u) = \frac{(CancelledUnits(p,q,u,Tc=2) \times CP(q,u,Tc=2) + \qquad\qquad 0}{CV(p,q,u)}$$ $$\text{ACP}(p,q,u) = \frac{(2 \times 10) \qquad\qquad + \qquad\qquad 0}{2}$$ $\text{ACP}(p,q,u) = 10$	Prudential exposure remains the same.

Average cancellation price is $10.

2.3 Average purchase price

The last time units were cancelled is in Tranche 2, so purchased units should be calculated for all tranches up to Tranche 2.

$$APP(p, q, u, MTc) = \frac{\sum_{Ta=1\ to\ (2-1)} (AllocatedUnits(p, q, u, Ta) \times PP(q, u, Ta))}{\sum_{Ta=1\ to(2-1)} (AllocatedUnits(p, q, u, Ta))}$$

$$APP(p, q, u, MTc = To) = \frac{3 \times 50}{3}$$

$$APP(p, q, u, MTc = To) = 50$$

2.4 Trading position

$$TP(p, q, u) = CV(p, q, u) \times (ACP(p, q, u) - AAP(p, q, u, MTc(p, q, u)))$$

$$TP(p, q, u) = \qquad 2 \quad \times (\qquad 10 \quad - \qquad 50 \qquad)$$

$$TP(p, q, u) = -80$$

3. Calculate aggregate trading position

$$ATP(p) = Min\left(0, \sum_{q=1} \sum_{u} TP(p, q, u)\right) + \sum_{q=2\ to\ n} \sum_{u} TP(p, q, u)$$

$$ATP(p) = Min(0, \qquad 0 \qquad) + (-80)$$

$$ATP(p) = -80$$

4. Determine prudential exposure
   Prudential exposure is the negative of the aggregate trading position.

$$PE(p) = -ATP(p)$$
$$PE(p) = 80$$

5. Determine trading margin
   Trading margin is the trading limit less the prudential exposure, required to remain above $0.

	The participant submitted \$80 to submit the offers. $\text{TM}(p) = \text{TL}(p) - \text{PE}(p)$ $\text{TM}(p) = \quad 80 \; - 80 \quad = 0$ Trading limit (cash security) of 80 provided at offer time keeps trading margin at zero 0.	
Bids for additional 5 units of Unit A at \$20 in tranche 3. Eg. In early September 2019 before the auction bids for additional 5 units of [V-SA/SA] at \$20 in C2022Q1T03	As above	Bids are not included in Prudential Exposure calculations so no change.
5 Units allocated of Unit A at \$10 Eg. In September 2019, after the auction, the units are allocated units at a purchase price of \$10.	As above	Calculation does not change since allocated units are only included in prudential equations when units are cancelled or offered afterwards.
Offers 3 units of Unit A at \$40 in tranche 4	1. Determine if there are offered units less than the average purchase price when all units previously allocated are included in the calculation, ie. set MTc = To and calculate the APP. $APP(p,q,u,MTc = To) = \dfrac{\sum_{Ta=1 \, to \, To-1}(AllocatedUnits(p,q,u,Ta) \times PP(q,u,Ta))}{\sum_{Ta=1 \, to \, To-1}(AllocatedUnits(p,q,u,Ta))}$	Offers can be submitted with no additional cash security.

AEMO to validate these offers against trading margin. Eg. in early Dec 2019 before the auction, offer 3 units [V-SA/SA] at \$40 in C2022Q1T04.	$$APP(p,q,u,MTc=4) = \frac{\sum_{Ta=1 \, to \, (4-1)} (AllocatedUnits(p,q,u,Ta) \times PP(q,u,Ta))}{\sum_{Ta=1 \, to \, (4-1)} (AllocatedUnits(p,q,u,Ta))}$$ $APP(p,q,u,MTc=4)$ $= \dfrac{AllocatedUnits(p,q,u,Ta=1) \times PP(q,u,Ta=1) + AllocatedUnits(p,q,u,Ta=2) \times PP(q,u,Ta=2) + AllocatedUnits(p,q,u,Ta=3) \times PP(q,u,Ta=3)}{AllocatedUnits(p,q,u,Ta=1) + AllocatedUnits(p,q,u,Ta=2) + AllocatedUnits(p,q,u,Ta=3)}$ $$APP(p,q,u,MTc=To) = \frac{3 \times 50 \quad + \quad 0 \quad + \quad 5 \times 10}{3 \quad + \quad 0 \quad + \quad 5}$$ $$APP(p,q,u,MTc=To) = 25$$ The offered units are at \$40, so greater than APP(p,q,u,MTc=To) of \$25. 2. Calculate Trading Position terms Let the offer for 4 Units of Unit A at \$40 be offer o = A2. 2.1 Cancelled volume $$CV(p,q,u) = \sum_{Tc} CancelledUnits(p,q,u,Tc) + \sum_{where \, OP(q,u,o)<APP(p,q,u,MTc=To)}^{o} OfferedUnits(p,q,u,o,To)$$ $$CV(p,q,u) = CancelledUnits(p,q,u,Tc=2) + \sum_{where \, OP(q,u,o)<25}^{o} OfferedUnits(p,q,u,o,To=4)$$ $$CV(p,q,u) = \qquad\qquad 2 \qquad\qquad + \qquad 0$$ $$CV(p,q,u) = \qquad\qquad 2 \qquad\qquad + \qquad 0$$ $$CV(p,q,u) = 2$$ Cancellation volume is 2 units 2.2 Average cancellation price $$ACP(p,q,u) = \frac{\sum_{Tc}(CancelledUnits(p,q,u,Tc) \times CP(q,u,Tc) + \sum_{where \, OP<APP(p,q,u,MTc=To)}^{o}(OfferedUnits(p,q,u,o,To) \times OP(q,u,o))}{CV(p,q,u)}$$ $$ACP(p,q,u) = \frac{(CancelledUnits(p,q,u,Tc=2) \times CP(q,u,Tc=2) \quad + \qquad\qquad 0}{2}$$	

$$\text{ACP}(p,q,u) = \frac{(2 \times 10) \qquad + \qquad 0}{2}$$

$$\text{ACP}(p,q,u) = 10$$

Average cancellation price is \$10.

2.3 Average purchase price

Since there are no offers that are less than APP when MTc = To, as calculated under step 1, the APP for the trading position is calculated with MTc set to the last time units were cancelled.

The last time units were cancelled is in Tranche 2.

$$APP(p,q,u,MTc) = \frac{\sum_{Ta=1\ to\ (2-1)} \left(AllocatedUnits(p,q,u,Ta) \times PP(q,u,Ta)\right)}{\sum_{Ta=1\ to(2-1)} \left(AllocatedUnits(p,q,u,Ta)\right)}$$

$$APP(p,q,u,MTc = To) = \frac{3 \times 50}{3}$$

$$APP(p,q,u,MTc = To) = 50$$

2.4 Trading position

$$TP(p,q,u) = CV(p,q,u) \times \left(ACP(p,q,u) - AAP(p,q,u,MTc(p,q,u))\right)$$

$$TP(p,q,u) = \qquad 2 \quad \times (\qquad 10 \quad - \qquad 50 \qquad)$$

$$TP(p,q,u) = -80$$

3. Calculate aggregate trading position

$$ATP(p) = \text{Min}\left(0, \sum_{q=1}\sum_{u} TP(p,q,u)\right) + \sum_{q=2\ to\ n}\sum_{u} TP(p,q,u)$$

$$ATP(p) = \text{Min}(0, \qquad 0 \qquad)\ + (-80)$$

$\text{ATP}(p) = -80$

4. Determine prudential exposure
Prudential exposure is the negative of the aggregate trading position.

$\text{PE}(p) = -\text{ATP}(p)$
$\text{PE}(p) = 80$

5. Determine trading margin
Trading margin is the trading limit less the prudential exposure, required to remain above $0.
$\text{TM}(p) = \text{TL}(p) - \text{PE}(p)$
$\text{TM}(p) = \quad 80 \quad - 80 \quad = 0$

Trading limit (cash security) of 80 provided at earlier auction keeps trading margin at zero 0.
The offers can be made without additional cash security.

Offers for Unit A clear at $70. Eg. Mid-Dec 2019 after the auction, offered units of {V-SA/SA] are cancelled at a clearing price of $70.	1. Determine if there are offered units less than the average purchase price when all units previously allocated are included in the calculation, ie. set MTc = To. The auction has just closed, so there are no valid offered units. 2. Calculate Trading Position terms 2.1 Cancelled volume $$CV(p,q,u) = \sum_{Tc} CancelledUnits(p,q,u,Tc) + \sum_{where\ OP<APP(p,q,u,MTc=To)}^{o} OfferedUnits(p,q,u,o,OP,To)$$ $$CV(p,q,u) = CancelledUnits(p,q,u,Tc=2) + CancelledUnits(p,q,u,Tc=4)\ + \qquad\qquad 0$$ $$CV(p,q,u) = \qquad\qquad 2 \qquad + \qquad 3 \qquad + \qquad\qquad 0$$ $$CV(p,q,u) = 5$$ Cancellation volume is 5 units 2.2 Average cancellation price $$ACP(p,q,u) = \frac{\sum_{Tc}(CancelledUnits(p,q,u,Tc) \times CP(q,u,Tc) + \sum_{where\ OP<APP(p,q,u,MTc=To)}^{o}(OfferedUnits(p,q,u,o,OP,To) \times OP(q,u,o))}{CV(p,q,u)}$$	AEMO will return cash security to the participant as is no longer required.

$ACP(p, q, u)$

$$= \frac{(CancelledUnits(p,q,u,Tc=2) \times CP(q,u,Tc=2) + (CancelledUnits(p,q,u,Tc=4) \times CP(q,u,Tc=4) + \quad\quad 0}{CV(p,q,u)}$$

$$ACP(p,q,u) = \frac{(2 \times 10) \quad + \quad (3 \times 70) \quad + \quad\quad\quad 0}{5}$$

$$ACP(p,q,u) = 46$$

Average cancellation price is $46.

2.3   Average purchase price

The last time units were cancelled is in Tranche 4.

$$APP(p,q,u,MTc) = \frac{\sum_{Ta=1\,to\,(4-1)}(AllocatedUnits(p,q,u,Ta) \times PP(q,u,Ta))}{\sum_{Ta=1\,to(4-1)}(AllocatedUnits(p,q,u,Ta))}$$

$APP(p,q,u,MTc=4)$

$$= \frac{AllocatedUnits(p,q,u,Ta=1) \times PP(q,u,Ta=1) + AllocatedUnits(p,q,u,Ta=2) \times PP(q,u,Ta=2) + AllocatedUnits(p,q,u,Ta=3) \times PP(q,u,Ta=3)}{AllocatedUnits(p,q,u,Ta=1) + AllocatedUnits(p,q,u,Ta=2) + AllocatedUnits(p,q,u,Ta=3)}$$

$$APP(p,q,u,MTc=To) = \frac{3 \times 50 \quad + \quad 0 \quad + \quad 5 \times 10}{3 \quad + \quad 0 \quad + \quad 5}$$

$$APP(p,q,u,MTc=To) = 25$$

2.4   Trading position

$$TP(p,q,u) = CV(p,q,u) \times \big(ACP(p,q,u) - AAP(p,q,u,MTc(p,q,u))\big)$$

$$TP(p,q,u) = \quad 5 \quad \times (\quad 46 \quad - \quad 25 \quad)$$

$$TP(p,q,u) = 105$$

3.   Calculate aggregate trading position

$$ATP(p) = Min\left(0, \sum_{q=1}\sum_{u} TP(p,q,u)\right) + \sum_{q=2\,to\,n}\sum_{u} TP(p,q,u)$$

$$\text{ATP}(p) = \text{Min}(0, \qquad 0 \qquad) \ + \ 105$$

$$\text{ATP}(p) = 105$$

4. Determine prudential exposure
   Prudential exposure is the negative of the aggregate trading position.

$$\text{PE}(p) = -\text{ATP}(p)$$
$$\text{PE}(p) = -105$$

5. Determine trading margin
   Trading margin is the trading limit less the prudential exposure, required to remain above $0.
$$\text{TM}(p) = \text{TL}(p) - \text{PE}(p)$$
$$\text{TM}(p) = \quad 80 \quad - (-105) \quad = 185$$

No cash deposit required anymore $80 to be returned as part of the next settlement – January 2020.
After settlement:
$$\text{TM}(p) = \quad 105$$

Activity	Calculation	Comment
Unit A is now two quarters away from being settled, aggregate trading position remains at 105.	1. Calculate the aggregate trading position $$\text{ATP}(p) = \text{Min}\left(0, \sum_{q=1}\sum_{u}\text{TP}(p,q,u)\right) + \sum_{q=2\ to\ n}\sum_{u}\text{TP}(p,q,u)$$ $$\text{ATP}(p) = \text{Min}(0, \qquad 0 \qquad) \ + \ 105 + (-90)$$ $$\text{ATP}(p) = 15$$	Participant does not need to provide cash security.
Participant also has a trading position in Unit B of -90. Unit B will be settled in four quarters' time. Eg. September 2021, after the auction in Q3 2021.	2. Determine prudential exposure Prudential exposure is the negative of the aggregate trading position. $$\text{PE}(p) = -\text{ATP}(p)$$ $$\text{PE}(p) = -15$$ 3. Determine trading margin Trading margin is the trading limit less the prudential exposure, required to remain above $0.	

Participant has a trading position of 105 in C2022Q1, V-SA/SA and a trading position of -90 in C2022Q4, VIC-NSW/NSW	$\text{TM}(p) = \text{TL}(p) - \text{PE}(p)$ $\text{TM}(p) = \quad 0 \quad - (-15) = 15$ Trading margin is positive, no cash security required – no change.	
Unit A is now the next unit to be settled. Eg. After settlement occurs for 2021Q4 units in October 2021, C2022Q1 are the next units to be settled.	1. Calculate the aggregate trading position $\text{ATP}(p) = \text{Min}\left(0, \sum_{q=1}\sum_{u}\text{TP}(p,q,u)\right) + \sum_{q=2\,to\,n}\sum_{u}\text{TP}(p,q,u)$ $\text{ATP}(p) = \text{Min}(\quad 0, \qquad 105 \qquad) + (-90)$ $\text{ATP}(p) = -90$ 2. Determine prudential exposure Prudential exposure is the negative of the aggregate trading position. $\text{PE}(p) = -\text{ATP}(p)$ $\text{PE}(p) = 90$ 1. Determine trading margin Trading margin is the trading limit less the prudential exposure, required to remain above \$0. $\text{TM}(p) = \text{TL}(p) - \text{PE}(p)$ $\text{TM}(p) = \quad 0 \quad - 90 \qquad = -90$ Additional cash security of \$90 must be provided.	Participant must provide \$90 of cash security to bring trading margin back to above \$0. Eg. after settlement occurs for 2021Q4 units in October 2021, AEMO will run prudentials and determine a negative trading margin for the participant. The participant has 2 business days to ensure their trading margin is returned above zero prior to being issued a margin call.

APPENDIX B - GLOSSARY

Term or acronym	Meaning
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
APA	Auction Participation Agreement. The template agreement is an appendix to the Auction Rules.
Auction Rules	Settlements Residue Auction Rules
IRSR	Inter-regional Settlements Residue. Also referred to as 'residue'
NER	National Electricity Rules
SRA	Settlements Residue Auction
SRC	Settlements Residue Committee
SRDA	Settlements Residue Distribution Agreement. The form of this agreement is stipulated in the APA.
TNSP	Transmission Network Service Provider
units	Settlements Residue Distribution units.