MARKET PROCEDURE: BALANCING MARKET FORECAST

PREPARED BY:	AEMO | Western Australia | WA Market Operations
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VERSION RELEASE HISTORY

Version	Effective Date	Summary of Changes
1.0	Balancing Market Commencement Day	Market Procedure for Balancing Market Forecasts
2.0	30 November 2015	Changes resulting from transfer of functions from the IMO to AEMO
3.0	18 April 2017	Changes resulting from the transfer of System Management functions to AEMO
4.0	1 July 2019	Changes resulting from Procedure Change Proposal AEPC_2019_06 related to: • the Rule Change Proposal RC_2014_06: Removal of Resource Plans and Dispatchable Loads; • AEMO's obligations with determining forecast spare capacity now included in section 2.6; resulting from changes to the definition of Balancing Forecast, resulting from the *Wholesale Electricity Market Rules Amending Rules 2016* made by the Minister under regulation 7(4) of the *Electricity Industry (Wholesale Electricity Market) Regulations 2004* regarding the provision of spare capacity for a trading interval; and • the transfer of the Procedure to the new AEMO Procedure template, formatting amendments and minor administrative changes to align to WEM Rule clauses referencing and wording
5.0	XX May 2020	Changes from Procedure Change Proposal AEPC_2020_01 related to revision of the Balancing Merit Order tie-break methodology

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1 INTRODUCTION

1.1 Purpose and scope

1.1.1 This Market Procedure: Balancing Market Forecast (**Procedure**) has been developed in accordance with AEMO's functions under clause 2.1A.2(h) of the Wholesale Electricity Market Rules (**WEM Rules**). This Procedure has also been developed~~is made~~ under clauses 7A.3.3 and 7A.3.4 of the WEM~~Wholesale Electricity Market (WEM)~~ Rules.

1.1.2 This Procedure applies to AEMO in relation to the processes it must follow in preparing and publishing the Forecast BMO, the Balancing Forecast and the Balancing Quantities expected to be provided by each Market Participant.

~~1.1.3 This Procedure has effect only for the purposes set out in the WEM Rules and the WEM Rules prevail over these Procedures to the extent of any inconsistency.~~

~~1.1.4~~1.1.3 The purpose of this Procedure is to describe the processes AEMO must follow **[clause 7A.3.3]** when:

(a) determining Forecast BMOs and providing them to System Management;

(b) preparing and publishing Balancing Forecasts; and

(c) assigning priority to Facilities in the case where there is a tie in a Forecast BMO or Forecast LFAS Merit Order.

~~1.1.5~~1.1.4 AEMO must develop the Balancing Forecast Market Procedure in accordance with the following principles [~~{~~**clause 7A.3.4]**:

(a) to the extent reasonably practicable, Balancing Forecasts must use the latest information available to AEMO; and

(b) Balancing Forecasts must provide Market Participants with information upon which to make an assessment regarding their Balancing Submissions and whether to update a Balancing Submission.

~~1.1.6~~1.1.5 In this Procedure where obligations are conferred on a Rule Participant, that Rule Participant must comply with the relevant obligations in accordance with clauses 2.9.7, 2.9.7A, 2.9.7B, 2.9.7C and 2.9.8 of the WEM Rules, as applicable.

~~1.1.7~~1.1.6 Reference to particular WEM Rules within the Procedure in bold and square brackets **[clause XX]** are included for convenience only, and are not part of this Procedure.

~~1.1.8~~1.1.7 All interactions between AEMO and Market Participants referred to in this Procedure will be conducted through the Wholesale Electricity Market Systems (WEMS).

1.2 Definitions and interpretation

1.2.1 Glossary

Terms defined in the WEM Rules have the same meanings in this Procedure unless otherwise specified in this clause.

The words, phrases and abbreviations in the table below have the meanings set out opposite them in the table when used in this Procedure.

Term	Definition
Balancing Merit Order (BMO)	Means, for a Trading Interval, the ordered list of Balancing Facilities, and associated quantities, used by System Management for issuing Dispatch Instructions for the Trading Interval, determined as: a) the last Forecast BMO for the Trading Interval received by System Management under clause 7A.3.1(b) of the WEM Rules; or b) if no Forecast BMO is received, the Balancing Merit Order that was used by System Management for issuing Dispatch Instructions for the same Trading Interval on the most recent Business Day if the Trading Interval occurs on a Business Day, or the most recent non-Business Day if the Trading Interval occurs on a non-Business Day.
Downwards Load Following Service	An Ancillary Service provided by a Facility with a Downwards LFAS Enablement for the relevant Trading Interval.
Energy Category	A category that includes all relevant Balancing Price-Quantity Pairs not related to the Upwards or Downwards Load Following Service Category, Other Ancillary Services Category, Minimum Generation Category, or Non-active Balancing Facilities Category.
Forecast BMO	Means the ordered list of Balancing Facilities, and associated quantities, determined by AEMO under clause 7A.3.1(a) of the WEM Rules.
Market Participant Interface	An application within the WEMS which provides a user interface, and B2B interfaces, for Market Participants to participate in the WEM. This application includes functionality that enables: • maintenance of Market Participant and Facility registration data; • submissions into the WEM markets systems; • user management; and • market data reports; Access to settlement and prudential information.
Minimum Generation Category	A category that includes all relevant Balancing Price-Quantity Pairs provided in accordance with step 2.1.5 of the Market Procedure: Balancing Facility Requirements;
Non-active Balancing Facilities Category	A category that includes all relevant Balancing Price-Quantity Pairs provided for a Facility that is a Non-active Balancing Facility.
Non-active Balancing Facility	A Facility which AEMO has determined does not meet the Balancing Facility Requirements as specified in section 2.1 of the Market Procedure: Balancing Facility Requirements. See the Market Web Site[1] for further information.
Other Ancillary Services Category	A category that includes all relevant Balancing Price-Quantity Pairs resulting from the Facility providing a relevant Ancillary Service in accordance with the document published under clause 7A.2.4(a) of the WEM Rules.
Upwards Load Following Service	An Ancillary Service provided by a Facility with an Upwards LFAS Enablement for the relevant Trading Interval.
Upwards Load Following Service Category	A category that includes all relevant Balancing Price-Quantity Pairs resulting from the Facility providing Upwards Load Following Service in accordance with the document published under clause 7A.2.4(a) of the WEM Rules.
Upwards or Downwards Load Following Service Category	A category that includes all relevant Balancing Price-Quantity Pairs resulting from the Facility providing Upwards Load Following Service or Downwards Load Following Service in accordance with the document published under clause 7A.2.4(a) of the WEM Rules.
WEMS	The market systems maintained by AEMO for the purpose of enabling interactions between Market Participants and AEMO.

[1] Available at https://aemo.com.au/energy-systems/electricity/wholesale-electricity-market-wem/participate-in-the-market/information-for-current-participants/balancing-market-participation.

1.2.2 Interpretation

The following principles of interpretation apply to this Procedure unless otherwise expressly indicated:

(a) references to time are references to Australian Western Standard Time.

(b) terms that are capitalised, but not defined in this Procedure, have the meaning given in the WEM Rules;

(c) to the extent that this Procedure is inconsistent with the WEM Rules, the WEM Rules prevail to the extent of the inconsistency;

(d) a reference to the WEM Rules or Market Procedures includes any associated forms required or contemplated by the WEM Rules or Market Procedures; and

(e) words expressed in the singular include the plural and vice versa.

In this Procedure the conventions specified in sections 1.3 to 1.5 of the WEM Rules apply.

1.3 Related documents

The following Market Procedures, Power System Operation Procedures (PSOPs) and market documents (available on the Market Web Site[2]) provide background information to this Procedure:

(a) Market Procedure: Notices and Communications;

(b) Market Procedure: IMS Interface; ~~and~~

(c) PSOP: Dispatch; and.

(d) WEMS Submissions Specification.[3]

2 FORECAST BMO

2.1 Background

2.1.1 AEMO must, to the extent that is reasonably able, as soon as practicable during the first 15 minutes of each Trading Interval, for each future Trading Interval in the Balancing Horizon **[clause 7A.3.1]**:

(a) determine the Forecast BMO in accordance with clause 7A.3.2 of the WEM Rules using the most recent, valid Balancing Submissions available to it;

(b) provide System Management with the Forecast BMO determined under clause 7A.3.1(a) of the WEM Rules; and

(c) provide each Market Participant with the EOI Quantities expected to be provided by each of that Market Participant's Balancing Facilities in the Forecast BMO determined under clause 7A.3.1(a) of the WEM Rules.

[2] Available at http://aemo.com.au/Electricity/Wholesale-Electricity-Market-WEM/Procedures.

[3] Published in accordance with xlause &A.2.4(a) of the WEM Rules. Available at: https://aemo.com.au/-/media/files/electricity/wem/participant_information/guides-and-useful-information/5-aemo--wems-submission-specifications.pdf.

2.1.2 The Forecast BMO for a Trading Interval is the BMO determined from the latest Balancing Submissions available to AEMO for the Trading Interval, as determined by AEMO in accordance with this Procedure. The purpose of the Forecast BMO is to enable:

(a) AEMO to develop and assess the implications, including system security and system constraints, of likely generation dispatch schedules in future Trading Intervals of the Balancing Horizon;

(b) Market Participants, in preparing their Balancing Submissions, to take account of the quantities expected to be dispatched in future Trading Intervals of the Balancing Horizon, in accordance with clauses 7A.2.8(a) and 7A.2.9(a)(i)) of the WEM Rules;

(c) Market Participants, in preparing their Balancing Submissions, to take account of aggregated Balancing Price-Quantity supply curves for future Trading Intervals of the Balancing Horizon, in accordance with clauses 7A.2.8(a) and 7A.2.9(a)(i)) of the WEM Rules;

(d) AEMO, for a Trading Interval for which the BMO is not available, to determine the appropriate levels of dispatch for Balancing Facilities from the latest available Forecast BMO generated in accordance with clause 7A.3.1(a) of the WEM Rules; and

(e) AEMO, for a Trading interval for which the Balancing Price and the BMO are not available, to determine the Balancing Price from the most recent Forecast BMO **[clause 7A.3.13]**.

2.2 Preparation of the Forecast BMO

2.2.1 As soon as practicable during the first 15 minutes of each Trading Interval, AEMO must determine the Forecast BMO for each future Trading Interval in the Balancing Horizon by **[clause 7A.3.2]**:

(a) converting the price in each Balancing Price-Quantity Pair for a Balancing Facility that is not in the Balancing Portfolio to a Loss Factor Adjusted Price, for all Balancing Facilities except the Balancing Portfolio;

(b) where AEMO (in its capacity as System Management) prepares a forecast End of Interval (EOI) Quantity in accordance with clause 7A.3.15 of the WEM Rules for a Non-Scheduled Generator that is the subject of a Facility Balancing Submission, altering the quantity in that Balancing Submission to the most recent forecast value determined by AEMO;

(c) creating a table of all of the quantities from Balancing Submissions in steps 2.2.1(a) and 2.2.1(b) of this Procedure, with corresponding Loss Factor Adjusted Prices, and all of the quantities and corresponding prices from Balancing Portfolio Balancing Submissions;

(d) sorting the table of quantities and corresponding prices created in step 2.2.1(c) of this Procedure in order of lowest to highest price; and

(e) where any Balancing Price-Quantity Pairs in the table created in step 2.2.1(d) of this Procedure have an identical price, breaking the tie in accordance with section 4.2 of this Procedure.

2.2.2 In preparing the Forecast BMO, AEMO must to the extent reasonably practicable use the most recent valid Balancing Submissions available to it **[clause 7A.3.1]**.

2.3 Publication of Forecast BMO to Market Participants

2.3.1 AEMO must publish the Forecast BMO prepared in section 2.2 of this Procedure in the form of anonymous Price-Quantity supply curves based on information in the WEMS for each future Trading Interval in the Balancing Horizon.

2.3.2 AEMO must, to the extent it is reasonably possible, within the Trading Interval publish the information outlined in section 2.3.1 of this Procedure by the end of every half hour for each future Trading Interval in the Balancing Horizon.

3 BALANCING FORECAST

3.1 Background

3.1.1 AEMO is required to determine and publish the Balancing Forecast for each Trading Interval in the Balancing Horizon **[clause 7A.3.4]**, using, to the extent practicable, the latest information available to AEMO **[clause 7A.3.4(a)]**.

3.1.2 The Balancing Forecast includes forecasts, for each Trading Interval during the Balancing Horizon, of the:

(a) Relevant Dispatch Quantity, in MW, at the end of the Trading Interval as determined by AEMO in its capacity as System Management under clause 7A.3.15 of the WEM Rules;

(b) aggregate EOI Quantity, in MW, at the end of the Trading Interval, of all Non-Scheduled Generators which are Balancing Facilities under clause 7.2.2(a) of the WEM Rules;

(c) Balancing Price; and

(d) spare capacity for the Trading Interval.

3.1.3 The purpose of the Balancing Forecast is to provide Market Generators with information upon which to make an assessment regarding the making or updating of a Balancing Submission **[clauses 7A.2.8(a) and 7A.2.9(a)(i)]**.

3.2 Forecast Relevant Dispatch Quantities

3.2.1 AEMO (in its capacity as System Management) will prepare and publish forecast Relevant Dispatch Quantities for each future Trading Interval in the Balancing Horizon in accordance with the PSOP: Dispatch **[clause 7A.3.15]**.

3.3 Forecast Non-Scheduled Generation Quantities

3.3.1 AEMO (in its capacity as System Management) will prepare and publish forecast EOI Quantities of Non--Scheduled Generators for each future Trading Interval in the Balancing Horizon in accordance with the PSOP: Dispatch **[clause 7A.3.15]**.

3.4 Preparation of Forecast Balancing Prices and Quantities

3.4.1 AEMO must determine the forecast Balancing Price for each future Trading Interval in the Balancing Horizon by **[clause 7A.3.10]**:

(a) calculating the forecast marginal dispatch quantity by increasing by 1 MW the most recent forecast Relevant Dispatch Quantity determined by AEMO (in its capacity as System Management);

(b) iterating through the Forecast BMO from the lowest Balancing Price-Quantity Pair upwards, summing the MW quantities until the total equals or exceeds the forecast marginal dispatch quantity determined in accordance with step 3.4.1(a) of this Procedure; and

(c) setting the forecast Balancing Price to the price of the last Balancing Price-Quantity Pair in the Forecast BMO determined in step 3.4.1(b) of this Procedure or, if the forecast marginal dispatch quantity exceeds the MW sum of all the Balancing Price-Quantity Pairs, the highest price in the Forecast BMO.

3.4.2 AEMO must determine forecast quantities for each future Trading Interval in the Balancing Horizon by **[clause 7A.3.10]**:

(a) iterating through the Forecast BMO from the lowest Balancing Price-Quantity Pair upwards, summing the MW quantities, or part thereof, until the total equals the most recent forecast Relevant Dispatch Quantity determined by AEMO (in its capacity as System Management); and

(b) calculating a forecast quantity for each Balancing Facility by summing the Balancing Price-Quantity Pairs, or part thereof, from step 3.4.2(a) of this Procedure for the relevant Facility; or

(c) where in step 3.4.2(a) of this Procedure, the MW sum of all the Balancing Price-Quantity Pairs in the Forecast BMO is less than the forecast Relevant Dispatch Quantity, setting the forecast quantity to the sum of all of the Facility's quantities within the Forecast BMO.

3.4.3 AEMO must exclude Ramp Rate Limits and SOI Quantities from the calculations described in steps 3.4.1 and 3.4.2 of this Procedure.

3.5 Forecast spare capacity

3.5.1 AEMO must determine a forecast spare capacity value (in MW) for each future Trading Interval.

3.5.2 AEMO must determine the forecast spare capacity for a Trading Interval by[4]:

(a) iterating through the Scheduled Generator Facilities and summing the MW quantities of their Capacity Credits;

(b) iterating through the Demand Side Program Facilities and summing the MW quantities of their Reserve Capacity Obligation Quantities (RCOQ);

(c) summing the values determined in step 3.5.2(a) and 3.5.2(b);

(d) from the value determined in step 3.5.2(c), subtracting the forecast load (excluding Non-Scheduled Generator Facilities); and

(e) from the value determined in step 3.5.2(d), subtracting the ex-ante Outages.

The formula for forecast spare capacity is defined as:

[4] AEMO has developed the calculation for the spare capacity value on the basis of the Spare (f,t) value used for the calculation of the dynamic refund factor as outlined in clauses 4.26.1(d) and 4.26.1(e) of the WEM Rules.

$$Forecast\ Spare\ Capacity\ (t) = \left(\sum_{f \in F} Capacity\ Credits\ (f,t)\right) + \left(\sum_{d \in D} RCOQ\ (d,t)\right) - Forecast\ load\ (Excl\ NSG)\ (t) - Ex\text{-}ante\ Outages\ (t)$$

Where:

F is the set of Scheduled Generator Facilities for which Market Participants hold Capacity Credits in the Trading Interval t and f is a Facility within that set.

D is the set of Demand Side Program Facilities for which Market Participants have Reserve Capacity Obligation Quantities in the Trading Interval t and d is a Facility within that set.

$Forecast\ load\ (Excl\ NSG)$ *is the notional unit of Reserve Capacity of a Scheduled Generator where Facility f in a Trading Interval t assigned by AEMO as defined in the Glossary of the WEM Rules.*

$RCOQ\ (f,t)$ *is the amount of capacity required to be provided by a Demand Side Program Facility f in a Trading Interval t as part of a Reserve Capacity Obligation Quantity set by AEMO in accordance with clause 4.12.3 of the WEM Rules.*

$Forecast\ load\ (Excl\ NSG)$ *is the forecasted system load in the Trading Interval t which excludes forecasted load to be supplied by Non-Scheduled Generator Facilities.*

$Ex\text{-}ante\ Outages\ (t)$*are the schedule of Planned Outages, Forced Outages and Consequential Outages in the Trading Interval t and published prior to the Trading Day in accordance with clause 7.3.4 of the WEM Rules.*

3.5.3 In addition to the forecast spare capacity value determined in step 3.5.2 of this Procedure, AEMO may determine and publish a provisional spare capacity value after the Trading Day to reflect more up to date information. For example, the provisional spare capacity value is calculated by substituting SCADA data for the forecast load or substituting ex-post Outages for ex-ante Outages.

3.6 Publication of Balancing Forecast information to Market Participants

3.6.1 AEMO must publish the following information in WEMS for each future Trading Interval in the Balancing Horizon:

(a) the most recent forecast Relevant Dispatch Quantity determined under section 3.2 of this Procedure by AEMO (in its capacity as System Management);

(b) the most recent forecast EOI Quantity for Non-Scheduled Generator Facilities determined under section 3.3 of this Procedure by AEMO (in its capacity as System Management) or, if no forecasts have been provided, the sum of all Non-Scheduled Generator Facility quantities in applicable Balancing Submissions;

(c) the forecast Balancing Price determined in section 3.4 of this Procedure;

(d) the forecast quantities determined in section 3.4 of this Procedure for Facilities owned or operated by the Market Participant; and

(e) the forecast spare capacity determined in section 3.5 of this Procedure.

3.6.2 AEMO must, to the extent it is reasonably possible within the Trading Interval publish the information outlined at step 3.6.1 by the end of every half hour for each future Trading Interval in the Balancing Horizon.

3.7 Unavailable information

3.7.1 AEMO must determine and publish a Balancing Forecast for each Trading Interval in the Balancing Horizon if it has sufficient information available **[clause 7A.3.1(d)]**.

3.7.2 In the event that AEMO (in its capacity as System Management) does not determine a forecast Relevant Dispatch Quantity for a Trading Interval, AEMO must continue to publish forecasts of Balancing Prices and quantities based on previously issued forecasts for the Trading Interval. If no previously issued forecasts are available for the relevant Trading Interval, then AEMO must cease publication of forecast Balancing Prices and quantities.

4 TIE BREAK PROCESS

4.1 Background

4.1.1 In circumstances where there is either:

(a) a tie in the ranking of Balancing Facilities under clause 7A.3.2 in the BMO **[clause 7A.3.2(c)]**; or

(b) a tie in the ranking of LFAS Facilities under clauses 7B.3.1 or 7B.3.2 in the LFAS Merit Order **[clause 7B.3.2(c)]**,

AEMO must assign priority to break the tie for the Trading Interval in ~~which the tie occurred in~~ accordance with this section 4~~the priority specified, as per the priorities outlined in clauses 7A.3.2 and 7B.3.2~~ of this Procedure~~the WEM Rules~~.

4.2 Process

4.2.1 Prior to the start of each Trading Day, AEMO must assign a unique random number to each Balancing Facility, including the Balancing Portfolio, for the entire Trading Day.~~,~~ AEMO must use this number as described in step 4.2.2 of this Procedure to determine the order of identically priced Balancing Price-Quantity Pairs in the Forecast BMO or in step 4.2.5 for identically priced Upwards LFAS Price-Quantity Pairs or Downwards LFAS Price-Quantity Pairs in the Forecast LFAS Merit Order.

4.2.2 When AEMO is required to assign priority to break a tie for a Trading Interval in which a tie occurred, AEMO will:

(a) where that price equals either the Alternative~~Alternate~~ Maximum STEM Price or the Maximum STEM Price, sort the affected Balancing Price-Quantity Pairs in accordance~~as if the Facility~~ with step 4.2.3 of this Procedure~~the highest random number had the highest price~~;

(b) where that price equals the Minimum STEM Price, sort the affected Balancing Price-Quantity Pairs in accordance~~, as if the Facility~~ with step 4.2.4 of this Procedure~~the lowest random number had the lowest price~~; and

(c) where that price does not equal the Minimum STEM Price, the Maximum STEM Price or the Alternative~~Alternate~~ Maximum STEM Price, sort the affected quantities in ascending order,

using the random number assigned to the Facility by AEMO in step 4.2.1 of this Procedure, as if the Facility with the lowest random number had the lowest price.

4.2.3 To break a tie at the Alternative Maximum STEM Price or the Maximum STEM Price, AEMO must:

(a) assign each Balancing Price-Quantity Pair to a category as follows:

(i) Upwards Load Following Service Category;

(ii) Other Ancillary Services Category; and

(iii) Energy Category;

(b) sort the affected Balancing Price-Quantity Pairs within each category such that the Facility with the highest random number, assigned under step 4.2.1 of this Procedure, had the highest price; and

(c) sort each category such that the Balancing Price-Quantity Pair with the highest random number in the Upwards Load Following Service Category had the highest price overall and:

(i) all Balancing Price-Quantity Pairs in the Upwards Load Following Service Category had higher prices than the Balancing Price-Quantity Pair in the Other Ancillary Services Category with the highest price; and

(ii) all Balancing Price-Quantity Pairs in the Other Ancillary Services category had higher prices than the Balancing Price-Quantity Pair in the Energy Category with the highest price.

4.2.4 To break a tie at the Minimum STEM Price, AEMO must:

(a) assign each Balancing Price-Quantity Pair to a category as follows:

(i) Upwards or Downwards Load Following Service Category;

(ii) Other Ancillary Services Category;

(iii) Minimum Generation Category;

(iv) Non-active Balancing Facilities Category,; and

(v) Energy Category;

(b) sort the affected Balancing Price-Quantity Pairs within each category such that the Facility with the lowest random number, assigned under step 4.2.1 of this Procedure, had the lowest price; and

(c) sort each category such that the Balancing Price-Quantity Pair with the lowest random number in the Ancillary Services category had the lowest price overall and:

(i) all Balancing Price-Quantity Pairs in the Upwards or Downwards Load Following Service Category had lower prices than the Balancing Price-Quantity Pair in the Other Ancillary Services category with the lowest price; and

(ii) all Balancing Price-Quantity Pairs in the Other Ancillary Services Category had lower prices than the Balancing Price-Quantity Pair in the Minimum Generation Category with the lowest price; and

(iii) all Balancing Price-Quantity Pairs in the Minimum Generation Category had lower prices than the Balancing Price-Quantity Pair in the Non-active Balancing Facilities Category with the lowest price; and

(iv) all Balancing Price-Quantity Pairs in the Non-active Balancing Facilities Category had lower prices than the Balancing Price-Quantity Pair in the Energy Category with the lowest price.

4.2.5 When AEMO is required to assign priority to break a tie for LFAS Price-Quantity Pairs in a Trading Interval in which a tie occurred, AEMO will sort the affected quantities in ascending order, using the random number assigned to the Facility by AEMO in step 4.2.1 of this Procedure, as if the Facility with the lowest random number had the lowest price and the Facility with the highest random number had the highest price.