EXTERNAL PROCEDURES BALANCING MARKET FORECAST

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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	Amendments to Market Procedure resulting from AEPC_2019_06 relating to: 1. Rule Change Proposal RC_2014_06 Removal of Resource Plans and Dispatchable Loads. 2. Amendments to the Procedure under section 2.6 to include AEMO's obligations with determining Forecast spare capacity. Changes to the Chapter 11 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 3. Transfer to new AEMO Procedure template, formatting amendments and minor administrative changes to align to WEM Rule clauses referencing and wording.

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1. PROCEDURE OVERVIEW

1.1. Relationship with the Market Rules

1.1.1. This Balancing Market Forecast Procedure (Procedure) should be read in conjunction with sections 7A.3.15 to 7A.3.21 of the Wholesale Electricity Market (WEM) Rules (Market Rules).

1.1.2. Reference to particular Market Rules within the Procedure in bold and square brackets [Clause XX] are current as of 10 December 2016. These references are included for convenience only, and are not part of this Procedure.

1.2. Purpose of this Procedure

1.2.1. This Procedure sets out the processes the Australian Energy Market Operator (AEMO) must follow in:

(a) Preparing the Forecast Balancing Merit Order (BMO) in accordance with clause 7A.3.16;

(b) Assigning priority to Facilities in the case where there is a tie in the Forecast BMO; and

(c) Preparing and publishing the Balancing Forecast in accordance with clauses 7A.3.19 to 7A.3.21 including the Balancing Quantities expected to be provided by each Market Participant [Clause 7A.3.17(a)].

1.3. Application of this Procedure

1.3.1. 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.

1.3.2. In this Procedure where obligations are conferred on a Rule Participant, as outlined in step 1.3.1, that Rule Participant must comply with the relevant obligations in accordance with clauses 2.9.6, 2.9.7, 2.9.7A, 2.9.7B, 2.9.7C and 2.9.8, as applicable.

Note that prior to the Balancing Market Commencement Day, AEMO will have regard to the specific transition provisions for the new Balancing and Load Following markets, outlined in clause 1.10 of the Market Rules, with respect the processes outlined in this Procedure, as applicable.

1.4. Associated Market Procedures

1.4.1. The following AEMO Market Procedures are associated with this Procedure:

(a) IMS Interface Market Procedure.

1.5. Conventions Used

1.5.1. In this Procedure the conventions specified in clauses 1.3 – 1.5 of the Market Rules apply.

1.6. Terminologies and Definitions

1.6.1. A word or phrase defined in the Market Rules, the Electricity Industry Act or the Regulations has the same meaning when used in this Procedure. In addition the following defined terms have the meaning given.

~~Term~~	~~Definition~~
~~Market Participant Interface~~	~~The Market Systems maintained by AEMO for the purpose of enabling interactions between Market Participants and AEMO systems~~

~~1.6.2. For clarity throughout this Procedure the:~~

~~(a) Forecast BMO refers to the BMO for future Trading Intervals in the Balancing Horizon; and~~

~~(b) BMO refers to the last Forecast BMO generated for a Trading Interval before the Trading Interval commences, using the most recent valid Balancing Submissions available.~~

1. INTRODUCTION

1.1. Purpose and scope

1.1.1 This is the Balancing Market Forecast Procedure made under clauses 7A.3.3 and 7A.3.4 of the Wholesale Electricity Market Rules (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 In this Procedure where obligations are conferred on a Rule Participant, as outlined in step 1.3.1 of this Procedure, that Rule Participant must comply with the relevant obligations in accordance with clauses 2.9.6, 2.9.7, 2.9.7A, 2.9.7B, 2.9.7C and 2.9.8, as applicable.

Note that prior to the Balancing Market Commencement Day, AEMO will have regard to the specific transition provisions for the new Balancing and Load Following markets, outlined in clause 1.10 of the Market Rules, with respect the processes outlined in this Procedure, as applicable.

1.1.4 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 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~~s~~ 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~~s~~.

Term	Definition
~~Market Participant Interface~~	~~The Market Systems maintained by AEMO for the purpose of enabling interactions between Market Participants and AEMO systems~~
BMO	See Balancing Merit Order.

Term	Definition
Balancing Merit Order	Balancing Merit Order: 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); 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.
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; Market data reports; • Access to settlement and prudential information.
WEMS	The Market Systems maintained by AEMO for the purpose of enabling interactions between Market Participants and AEMO.

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.

~~(a)~~(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;

~~(b)~~(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

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

(f) In this Procedure the conventions specified in clauses 1.3 – 1.5 of the Market Rules apply.

1.3 Related documents

The following Market Procedure (available on the Market Web ~~-~~Site[1]) provides background information to this Procedure:

Reference	Title
A	~~Market Procedure:~~ IMS Interface Market Procedure – Network Operators and AEMO

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

B	Power System Operation Procedure

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 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);

(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); and

(d) If AEMO has sufficient information available to it, determine the Balancing Forecast and publish it on the Market Web –Site.

~~(a) determine a Forecast BMO for each future Trading Interval in the Balancing Horizon [Clause 7A.3.16];~~

~~(b) determine the Balancing Quantities expected to be provided by each Market Participant for each future Trading Interval in the Balancing Horizon whenever it prepares a Forecast BMO [Clause 7A.3.17];~~

~~(c) determine the Balancing Forecast for each Trading Interval in the Balancing Horizon, where sufficient information has been made available [Clause 7A.3.19];~~

~~(d) update the Balancing Forecast using, to the extent practicable, the latest information available to AEMO [Clause 7A.3.20(a)];~~

~~(e) by the end of every half hour, publish on the Market Website a Balancing Forecast for each future Trading Interval in the Balancing Horizon [Clause 7A.3.21(b)]; and~~

~~(f) as soon as practicable, publish any aggregate forecast output of Non-Scheduled Generators which is determined by AEMO (in its capacity as System Management) [Clause 7A.3.21(c)].~~

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. 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 ~~Balancing~~Qquantities expected to be dispatched in future Trading Intervals of the Balancing Horizon, ~~(including to meet their obligations~~ 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, (including to meet their obligations 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 [Clause 7.6.2B] 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.; and

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

The2.1.3 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 Quantityoutput, in MW, at the end of the Trading Interval, of all Non-Scheduled Generators which are Balancing Facilities; and

(c) Balancing Price.

2.1.4 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 in accordance with clauses 7A.2.8(a) and 7A.2.9(a)(i).

2.2 Preparation of the Forecast BMO

2.2.1 Each half hour, Asas soon as practicable during the first 15 minutsminutes of each Trading Interval, AEMO must determine the Forecast BMO for each future Trading Interval in the Balancing Horizon by [Clause 7A.3.1]:

(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 [Clause 7A.3.2(a)];

(b) where AEMO (in its capacity as System Management) prepares a forecast End of Interval (EOI) Quantity in accordance with clause 7A.3.15 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; [Clause 7A.3.2] and

(e) where any 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 clause 7A.3.23 of the WEM Rules as follows:

(i) where that price equals either the Alternate Maximum STEM Price or the Maximum STEM Price, sorting the affected Price-Quantity pairs ~~in the order shown in Figure 1~~ as if the Facility with the highest random number, as assigned in section 2.8.1 of this Procedure, had the highest price;

(ii) where that price equals the Minimum STEM Price, sorting the affected Price-Quantity pairs ~~in the following order shown in Figure 2~~ as if the Facility with the lowest random number, ~~-~~as assigned in section 2.8.1 of this Procedure, had the lowest price;

(iii) where that price does not equal the Minimum STEM Price, the Maximum STEM Price or the Alternate Maximum STEM Price, sorting the affected quantities in ascending order using the random number assigned to the Facility by AEMO in step 0~~2.8~~ of this Procedure, as if the Facility with the lowest random number had the lowest price.

~~**Figure 1 Ranking Quantities priced at the [Alternate] Maximum STEM Price2**~~

~~[2] Random numbers in this table are assigned as per section 2.8 of this Market Procedure.~~

~~Figure 2 Ranking Quantities priced at the Minimum STEM Price3~~

~~1.1.1~~1.2.1 In preparing the Forecast BMO, AEMO must to the extent practical use the most recent valid Balancing Submissions available to ~~it~~ it [Clause 7A.3.21] ~~[Clause 7A.3.20(a)].~~

~~[3] Random numbers in this table are assigned as per section 2.8 of this Market Procedure.~~

2.3 Forecast Non-Scheduled Generation Quantities

2.3.1 AEMO (in its capacity as System Management) will prepare forecast EOI Quantities of Non-Scheduled Generators for each future Trading Interval in the Balancing Horizon in accordance with the Power System Operation Procedure ~~with~~ [C~~c~~lause 7A.3.15].

2.4 Forecast Relevant Dispatch Quantities

2.4.1 AEMO (in its capacity as System Management) will prepare forecast Relevant Dispatch Quantities for each future Trading Interval in the Balancing Horizon in accordance with the Power System Operation Procedure [~~c~~Clause 7A.3.15.]

2.5 Preparation of Forecast Balancing Prices and Quantities

2.5.1 AEMO must determine the forecast Balancing Price for each future Trading Interval in the Balancing Horizon by:

(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 P~~p~~air upwards, summing the MW quantities until the total equals or exceeds the forecast marginal dispatch quantity determined in accordance with step 2.5.1(a)~~(a)~~ of this Procedure; and

(c) setting the forecast Balancing Price to the price of the last Balancing Price-Quantity ~~p~~Pair in the Forecast BMO determined in step 2.5.1(b) of this Procedure or, if the forecast marginal dispatch quantity exceeds the MW sum of all the Price-Quantity P~~p~~airs, the highest price in the Forecast BMO.

2.5.2 AEMO must determine forecast ~~Balancing Quantities~~ quantities for each future ~~Trading Interval~~Trading Interval in the Balancing Horizon by:

(a) iterating through the Forecast BMO from the lowest Price-Quantity P~~p~~air 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 ~~Balancing Quantity~~ quantity for each Balancing Facility by summing the Price-QuantityP-pairs, or part thereof, from step 2.5.2(a) of this Procedure for the relevant Facility; or

(c) where in step 2.5.2(a) of this Procedure, the MW sum of all the Price-Quantity ~~p~~Pairs in the Forecast BMO is less than the forecast Relevant Dispatch Quantity, setting the forecast ~~Balancing Quantity~~ quantity to the sum of all of the Facility's quantities within the Forecast BMO.

2.5.3 AEMO must exclude Ramp Rate Limits and SOI Quantities from the calculations described in steps 2.5.1 and 0~~2.5.2~~ of this Procedure.

2.-6 ~~[Blank]~~ Forecast spare capacity

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

2.5.3 AEMO determines 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 (a) and (b);

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

(e) from the value determined in (d), subtracting the Ex-Ante Outages.

(f) The formula for forecast spare capacity is defined as:

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

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~~are~~ 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.*

$RCOQ\ (\cancel{d}f,t)$ *is the amount of capacity required to be provided by a Demand Side Program Facility ~~d~~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.*

[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) & (e) of the WEM Rules.

2.5.4 In addition to the forecast spare capacity value determined in step 2.5.3~~2.6.2~~ 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 ~~o~~Outages for ex-ante ~~o~~Outages.

2.7 Publication of Balancing Forecast Information to Market Participants

2.7.1 AEMO must publish the following information in the WEMS ~~on the Market Participant Interface~~ for each future Trading Interval in the Balancing Horizon:

(a) the Forecast BMO prepared in s~~S~~ection 2.2 of this Procedure in the form of anonymous Balancing Price-Quantity Pairs ~~supply curves~~;

(b) the most recent forecast Relevant Dispatch Quantity determined by AEMO (in its capacity as System Management) in accordance with clause 7A.3.15;

(c) ~~the sum of~~ the most recent forecast EOI ~~Quantities~~ Quantity for Non-Scheduled Generator Facilities determined by AEMO (~~in its capacity as System Management~~) in accordance with clause 7A.3.15 or, if no forecasts have been provided, the sum of all Non-Scheduled Generator Facility quantities in applicable Balancing Submissions ~~;~~

(d) the forecast Balancing Price determined in s~~S~~ection 2.5 of this Procedure; and

(e) the forecast ~~Balancing Quantities~~ quantities determined in ~~S~~section 0~~2.5.2~~ of this Procedure for Facilities owned or operated by the Market Participant. ~~in accordance with clause 7A.3.17(a).~~

2.8 Random number assignment

2.8.1 Prior to the start of each Trading Day, AEMO must assign a unique random number to each individual Balancing Facility~~,~~ including the and the Balancing Portfolio. AEMO must use this number, as described in step 2.2.1(e) of this Procedure, to determine the order of identically priced Price-Quantity P~~p~~airs in the Forecast BMO.

2.9 Unavailable information

2.9.1 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 ~~Balancing~~ q~~Q~~uantities 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 ~~Balancing~~ q~~Q~~uantities.