Minimum STEM price review 2021

Final determination

30 September 2021

Economic Regulation Authority
WESTERN AUSTRALIA

D238934

Economic Regulation Authority

Level 4, Albert Facey House

469 Wellington Street, Perth WA 6000

Telephone 08 6557 7900

Email info@erawa.com.au

Website www.erawa.com.au

This document can also be made available in alternative formats on request.

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Executive summary

The Economic Regulation Authority has completed its first review of the minimum price cap in the Wholesale Electricity Market's balancing market. The minimum price cap is called the minimum Short Term Energy Market (STEM) price and facilitates the dispatch of economically efficient electricity by setting the lowest price that electricity can be offered into the balancing market.[1]

The minimum STEM price was set at -$1,000 per Megawatt-hour (MWh) when the balancing market started in 2012 and has not changed since. The balancing market settled at the minimum STEM price for the first time in October 2019. Following this, the Rule Change Panel approved a rule change that gave the ERA the responsibility to annually review the minimum STEM price. The first review period covers 1 October 2019 to 31 January 2021.

The review requires the ERA to determine if the current value of the minimum STEM price is "appropriate".[2] The ERA has interpreted appropriate to mean that the level of the minimum STEM price must meet the minimum STEM price objectives in the Wholesale Electricity Market (WEM) Rules. These objectives are to:

- Allow the balancing market to clear above the minimum STEM price in most circumstances.
- Limit market participants' financial exposure to balancing prices that would threaten their financial viability.

The balancing market will settle at the minimum STEM price when the quantity of electricity bid at the minimum STEM price is equal to or greater than the total quantity of electricity demanded in a trading interval. This situation can occur when demand for electricity is low and there is a surplus of generators offering electricity at the minimum STEM price.

To date, the balancing market has settled at the minimum STEM price rarely. Since the balancing market started in 2012, the market has settled at the minimum STEM price nine times, with the last occurring in September 2020. This indicates that the minimum STEM price is meeting the above objectives because the market is clearing above the floor price in most circumstances and the rarity of minimum STEM price trading intervals has limited the extent to which market participants have been exposed to the floor price.

However, the frequency at which the balancing market settles at the minimum STEM price is not the only consideration of whether the current minimum STEM price is achieving the above objectives. The ERA must also assess the mandatory criteria in the WEM Rules and stakeholder submissions when making its determination to consider whether the current minimum STEM price is set too high, too low or is meeting the objectives, as discussed below.

To assist the ERA to consider these matters and make its determination, the ERA released an issues paper for consultation in March 2021 and a draft determination report for consultation in July 2021. Submissions received are discussed below.

The ERA's final determination is that the current minimum STEM price of -$1,000/MWh is meeting the minimum STEM price objectives and is therefore appropriate.

If the minimum STEM price is too high, generators that want to offer electricity at a lower price are unable to. Although these generators may be willing to pay to remain generating (for

[1] The minimum STEM price is the minimum price in both the STEM and balancing markets. The WEM Rules require this review to focus on the minimum STEM price and its effect on the balancing market only.

[2] The WEM Rules do not define the term "appropriate".

example, to avoid shutdown and restart costs), they must compete with other generators also offering at the floor price.[3]

If the minimum STEM price is too low, generators that must bid at the minimum STEM price, such as ancillary service providers, may be exposed to financial losses when the balancing market settles at the minimum STEM price. Frequent or sustained exposure to financial losses from the balancing market settling at the minimum STEM price may threaten a participant's financial viability.

To make its determination, the ERA analysed mandatory criteria over the review period and concluded:

- **Criterion 1: Whether the final balancing market settled at the minimum STEM price because the minimum STEM price was too high.**

  The balancing market settled rarely (nine times out of 23,472 trading intervals) at the current -$1,000/MWh minimum STEM price. These minimum STEM price trading intervals occurred due to temporary excess supply factors including ancillary services and commissioning activities, both of which require electricity to be bid at the minimum STEM price.[4] The balancing market did not settle at the floor because the minimum STEM price was too high.

- **Criterion 2: Whether AEMO dispatched generators down because the minimum STEM price was too high.**

  Where there is an oversupply of electricity from generators offering at the minimum STEM price, AEMO may need to dispatch down one of these generators if, for example, another generator could not be decommitted.[5] This may indicate that the minimum STEM price is not low enough to allow generators to price differentiate. This did not occur during the review period.

- **Criterion 3: Whether there have been changes to the generation fleet that makes the current minimum STEM price too high or too low.**

  There have been no changes to the generation fleet that would result in the minimum STEM price being too high or too low. During the review period, the cycling costs of the set of relevant generators did not change materially such that the minimum STEM price would need to change.[6]

The ERA's analysis demonstrates that the current value of the minimum STEM price is not too high or too low within the context of the mandatory review criteria in the WEM Rules.

The ERA also considered submissions from stakeholders on whether the current minimum STEM price is appropriate. Submissions from Bluewaters, NewGen Power Kwinana and Synergy stated that a higher minimum STEM price of -$250/MWh would better meet the minimum STEM price objectives and may be more appropriate.

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3 Due to the costs of shutting down (e.g. fuel, maintenance, and opportunity costs), some generators may be willing to bid at lower prices to ensure that they remain on rather than incurring these costs.

4 The scope of this review as set by the WEM Rules does not include a process for the ERA to propose changes to the WEM design to resolve the ancillary services and commissioning issues. However, the Government's Energy Transformation Strategy will introduce a new WEM design that mitigates some of these concerns through the introduction of co-optimised energy and ancillary services markets in the future.

5 This assumes that the tiebreaker process would decommit a generator that may be required by AEMO for system security reasons. Where offer quantities are tied at the same offer price, a random tiebreaker process is used to decide which generators are dispatched. This is not a market-based outcome.

6 These are predominantly the coal generator fleet in the WEM.

A higher minimum STEM price (-$250/MWh) reduces the financial exposure of generators and may attract more electricity to be bid at this level when compared to the current quantities bid at -$1,000/MWh. Greater quantities of electricity bid at the higher minimum STEM price (-$250/MWh) means there is greater opportunity for the balancing market to settle at the minimum STEM price frequently. If the balancing market is settling frequently at the minimum STEM price, this would be inconsistent with the first objective to allow the balancing market to clear above the floor in most circumstances. As the balancing market does not settle frequently at the current minimum STEM price of -$1,000/MWh (nine out of 23,472 trading intervals), the current price is meeting the first objective to allow the balancing market to clear above the floor in most circumstances.

In the eight months since the end of the review period, the ERA observed that the current minimum STEM price continued to meet the objective for the balancing market to settle above the minimum STEM price in most circumstances. This is because there have been no minimum STEM price trading intervals within this eight-month period despite new record low levels of electricity demand.

The second objective of the minimum STEM price is to limit market participants' financial exposure to balancing prices that would threaten their financial viability.[7] Stakeholders were provided with opportunities to consider this in response to the ERA's issues paper and draft determination report. No evidence was provided that demonstrated a market participant's financial viability had been, or was likely to be, threatened by the current level of the minimum STEM price.

Sustained exposure to the current minimum STEM price may threaten the financial viability of a market participant. However, given how rarely the balancing market has settled at the minimum STEM price, there have not been frequent or sustained periods where participants have been financially exposed. Additionally, no generators indicated that they faced financial distress as a result of the balancing market settling at the minimum STEM price during the review period.

After considering the mandatory criteria and stakeholder submissions, the ERA concludes that the current minimum STEM price is meeting the objectives to allow the balancing market to settle above it in most circumstances and does not expose participants to balancing prices that threatens their financial viability, given the rarity of minimum STEM price trading intervals. Therefore, the ERA's final determination is that the current -$1,000/MWh minimum STEM price is appropriate.

7 Wholesale Electricity Market (WEM) Rules, 1 August 2021, Rule 6.20.16(b)

1. Introduction

This report contains the ERA's final determination on whether the current minimum STEM price of -$1,000MW/h is appropriate.

The review period spans from 1 October 2019 to 31 January 2021 and must follow a two-step process to:[8]

> 6.20.13. …
>
> (a) determine whether the Minimum STEM Price is appropriate in accordance with clause 6.20.14;[9] and
>
> (b) subject to clause 6.20.15, determine the value of the Minimum STEM Price, with reference to clause 6.20.16 and in accordance with clauses 6.20.17 to 6.20.20, where the Economic Regulation Authority determines that the current value of the Minimum STEM Price is not appropriate.

This review does not consider whether a floor price is needed in the WEM's balancing market, as that is not within the scope set by the WEM Rules.[10] Further, when making its determination under clause 6.20.13(a), if the ERA concludes that the current minimum STEM price is not appropriate, the WEM Rules do not permit the ERA to choose a minimum STEM price. Instead, the ERA must follow the process in the WEM Rules for revising the minimum STEM price.[11]

To determine whether the minimum STEM price is appropriate, the ERA must consider the objectives of the minimum STEM price, which are to:[12]

> 6.20.16 …
>
> (a) allow clearance of the Balancing Market without the Balancing Price being equal to the Minimum STEM Price in most circumstances; and
>
> (b) subject to clause 6.20.16(a), limit Market Participants' exposure to Balancing Prices that would threaten the financial viability of a prudent Market Participant.

To consider if the minimum STEM price objectives are being met, the ERA must assess the mandatory criteria in clause 6.20.14 of the WEM Rules, as well as stakeholder submissions.[13] Chapters 3 to 5 of this final determination contain the ERA's findings and conclusions for each mandatory criterion. Chapter 6 contains an assessment of the minimum STEM price objectives and the ERA's consideration of matters raised by stakeholders.

The ERA's final determination is in chapter 7.

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8 The WEM Rules require the ERA to examine the period from at least 1 October 2019 – Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 1.35.2

9 Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 6.20.14 – This clause specifies the mandatory review criteria which require the ERA to evaluate the trading intervals where the market settled at the minimum STEM price (rule 6.20.14(a)), consider AEMO's dispatch for trading intervals that were forecast to settle at the minimum STEM price (rule 6.20.14(b)) and assess any changes in the generation fleet during the review period (rule 6.20.14(c)).

10 The ERA is required to review the Energy Price Limits, including the minimum STEM price once every five years. Matters not within scope of this review may be considered in the five-yearly review of Energy Price Limits. The next Energy Price Limits review is not scheduled to begin until after 1 October 2022.

11 Wholesale Electricity Market Rules (WA), 1 August 2021, Rules 6.20.17 to 6.20.20

12 Ibid, Rule 6.20.16

13 Economic Regulation Authority, 'Minimum STEM price review', (online).

2. Mandatory criteria for determining whether the minimum STEM price is appropriate

The ERA must consider the following criteria, referred to as the mandatory criteria, when determining whether the minimum STEM price is appropriate:[14]

- Criterion 1: Whether the balancing market settled at the minimum STEM price in one or more trading intervals because the minimum STEM price was too high - for example, if the minimum STEM price was not low enough to induce generators to decommit.[15]
- Criterion 2: Whether AEMO dispatched facilities down during the review period because the minimum STEM price was too high.[16] This criterion requires considering trading intervals where the balancing market was forecast to settle at the minimum STEM price (but did not necessarily settle at the minimum STEM price), and whether AEMO decommitted a generator priced at the floor because another generator also priced at the floor did not decommit.
- Criterion 3: Changes in the generation fleet in the South West Interconnected System (SWIS) during the review period, such as the addition or retirement of generators and changes to generator start-up and shutdown costs.[17] For example, a coal generator with high start-up and shutdown costs that has had an upgrade that materially reduces these costs may indicate that the minimum STEM price could be higher.

The ERA must also consider the reasons provided by market participants on whether they view the minimum STEM price as appropriate.

The ERA published an issues paper in March 2021 which contained the ERA's preliminary analysis of the mandatory criteria.[18] Submissions were received from Alinta Energy, Synergy, Bluewaters and NewGen Power Kwinana.[19] All submissions agreed with the ERA's analysis presented in the issues paper. However, Synergy, Bluewaters and NewGen Power Kwinana stated that the current value of the minimum STEM price was not meeting the minimum STEM price objectives in the WEM Rules. These submissions are discussed in chapter 6.

The ERA published its draft determination on 2 July 2021. The ERA received one submission from Alinta, which agreed with the ERA's draft determination that the current minimum STEM price was appropriate.

The analysis for each mandatory criterion is presented in chapters 3 to 5 of this report.

14 Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 6.20.14

15 Ibid, Rule 6.20.14(a)

16 Ibid, Rule 6.20.14(b)

17 Ibid, Rule 6.20.14(c)

18 Economic Regulation Authority, 2021, *Minimum STEM price review 2021 – Issues paper and preliminary findings.*

19 Submissions to the issues paper are available on the review's website: Economic Regulation Authority, 'Minimum STEM Price Review', (online).

3. Criterion 1 – Trading intervals when the balancing market settled at the minimum STEM price

The ERA must determine if the balancing market settled at the minimum STEM price due to the minimum STEM price being too high:

> 6.20.14. In determining whether the Minimum STEM Price is appropriate under clause 6.20.13(a), subject to clause 1.35.2, the Economic Regulation Authority must consider without limitation, if since the last annual review of the Minimum STEM Price under clause 6.20.13:
>
> (a) the Balancing Market has settled at the Minimum STEM Price in one or more Trading Intervals because, in the Economic Regulation Authority's reasonable opinion, the Minimum STEM Price was too high;
>
> …

To assess this criterion, the ERA:

1. Identified all trading intervals where the balancing market settled at the minimum STEM price during the review period.[20]
2. Identified the reasons that the balancing market settled at the minimum STEM price for the identified trading intervals.[21]
3. Determined whether the balancing market settled at the minimum STEM price because the price was too high or for other reasons.

3.1 Trading intervals during the review period

Of the 23,472 trading intervals during the review period, there were nine intervals where the balancing market settled at the minimum STEM price (Table 1).[22, 23]

[20] The review period is from 1 October 2019 to 31 January 2021.

[21] This analysis was expanded to assess other low demand intervals within the review period. Details are in section 3.3 of this report.

[22] The remaining trading intervals in the review period settled above the minimum STEM price (which equated to 99.96 per cent of the 23,472 trading intervals in the review period).

[23] Clause 1.35.2 of the WEM Rules specifies that the first review period commences on 1 October 2019 but does not specify if this refers to a trading day which commences at 8:00am or a calendar day which commences at 12:00am. The ERA has interpreted the review period to start from the 12:00am half-hour interval starting on 1 October 2019 and end at the interval starting 11:30pm on 31 January 2021.

Table 1: Trading intervals that settled at the minimum STEM price

Calendar date	Interval starting	Final demand RDQ[24] (MW)
12 October 2019	1:00pm	1,200
13 October 2019	12:00pm	1,157
13 October 2019	1:00pm	1,167
15 August 2020	10:00am	1,435
15 August 2020	11:30am	1,270
15 August 2020	12:00pm	1,262
12 September 2020	12:30pm	1,030
12 September 2020	1:30pm	1,053
12 September 2020	2:00pm	1,118

Source: ERA analysis of market data.

The balancing market will settle at the minimum STEM price when the quantity of electricity offered at the minimum STEM price is equal to or greater than the quantity of electricity demanded for that trading interval. This occurs when demand for electricity is low and there is a surplus of generators offering their electricity at the minimum STEM price.[25] One reason for this surplus may be a result of generators being required to bid some of their electricity at the minimum STEM price under the WEM Rules where, for example, generators intend to provide ancillary services, are conducting commissioning activities, or are non-active balancing generators.[26,27]

Generators' commercial decisions may also contribute to the surplus of generation offered at the minimum STEM price. For example, generators with high cycling costs may seek to avoid shutting down for short periods of time so that they do not incur these shutdown and restart costs and may choose to bid at the floor. Additionally, generators may offer their minimum generation quantities at the floor when they expect balancing market prices to exceed their reasonable expectation of their short run marginal cost.[28] A further commercial reason for generators to bid at the minimum STEM price may be due to contractual arrangements. For example, a cogeneration plant may have a physical contractual requirement to supply steam to an industrial party where steam is a by-product of the plant's electricity production. To fulfil

[24] Relevant Dispatch Quantity (RDQ) means, for a trading Interval, the sum of the end of interval quantities of electricity (EOI Quantities) for each balancing facility, in Megawatts (MW). Forecast RDQ represents forecast demand and final RDQ represents final demand. These figures have been rounded to the nearest MW.

[25] Due to the continuous uptake of residential solar panels, the demand for electricity in the WEM has been low around midday, particularly on weekends.

[26] Generators providing ancillary services are required to bid at the minimum STEM price to ensure these generators are dispatched ahead of other generators offering electricity at the minimum STEM price – Wholesale Electricity Market Rules (WA), 1 August 2021, Rules 7A.2.3 (commissioning test quantity) and 7A.3.5 (LFAS quantity).

[27] A non-active balancing generator is a generator that AEMO has determined does not meet the Balancing Facility Requirements in the Balancing Facility Requirements Market Procedure – Australian Energy Market Operator, 'Balancing Market Participation', (online) [accessed 5 February 2021]. These are small generators (in terms of capacity) and are required to offer all of their output at the minimum STEM price.

[28] Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 7A.2.17

its contractual obligations, the plant may bid at the minimum STEM price to secure dispatch to provide electricity and therefore supply steam under the contract.

The quantities offered at the minimum STEM price varies from trading interval to trading interval. Understanding the composition of these quantities assists in determining why the balancing market settled at the minimum STEM price. Whether the balancing market settled at the minimum STEM price because it was too high or for other reasons is considered in the remainder of this chapter.

3.2 Observations for the nine trading intervals that settled at the minimum STEM price

The ERA analysed the nine trading intervals that settled at the minimum STEM price. A detailed analysis of the factors affecting each of the nine trading intervals is contained in Appendix 3, with a summary of the ERA's observations presented below.

The composition of the quantities of electricity offered at the minimum STEM price during these nine trading intervals is shown in Figure 1.

Figure 1: Generator offer categories for the nine minimum STEM price trading intervals

Source: ERA analysis of market data.

The Load Following Ancillary Services (LFAS) and other ancillary services categories in Figure 1 equates to between 23 per cent and 50 per cent of the total quantities submitted at the minimum STEM price.[29]

[29] LFAS (or Load Following Service) is the service of frequently adjusting: (a) the output of one or more Scheduled Generators; or (b) the output of one or more Non-Scheduled Generators, within a Trading Interval so as to match total system generation to total system load in real time in order to correct any SWIS frequency variations – Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 3.9.1

Generators that are cleared to provide downwards LFAS quantities (LFAS Down) must offer their LFAS Down quantities and at least their minimum generation quantity into the balancing market at the minimum STEM price.[30] This ensures that a generator is dispatched to provide the LFAS Down service.

The LFAS Down requirement was 85 MW for all nine trading intervals. Up to 435 MW was bid at the minimum STEM price from LFAS generators to meet this requirement.[31]

Separate to the quantities required for LFAS Down, there was up to 178 MW of additional electricity bid at the minimum STEM price to provide spinning reserve. The combined quantities from generators to provide both spinning reserve and LFAS Down services contributed to the large quantities of electricity bid at the minimum STEM price.

The WEM Rules also require generators undertaking commissioning activities to offer their electricity at the minimum STEM price to ensure that they are dispatched to perform these activities.[32] From August 2020, quantities of up to 176 MW were offered at the minimum STEM price for commissioning activities. Generators undergoing commissioning activities contributed to the surplus of generation priced at the floor in the August 2020 and September 2020 trading intervals when the balancing market settled at the minimum STEM price.

Renewable energy generators may choose to bid at negative prices that typically reflect the value of renewable subsidies and any contractual reasons for selling their energy in the balancing market.[33] For all nine trading intervals when the balancing market settled at the minimum STEM price, renewable energy generators consistently offered between 103 MW and 156 MW at the minimum STEM price.

Generators in the WEM can submit negative offers anywhere between $0/MWh and -$1,000/MWh to price differentiate themselves from others. Generators chose not to use the offer range between -$250/MWh and -$999/MWh for any of the nine intervals when the balancing market settled at the minimum STEM price.

Forecast demand was materially higher than the final demand for eight of the nine trading intervals where the balancing market settled at the minimum STEM price. Generators using these forecasts may not have expected the balancing market to clear at the minimum STEM price for these intervals and there was no change to their ancillary services offers or their balancing market offers as price and demand forecasts were updated. Generators may not have been able to update their offers in response to changes in the forecast demand due to gate closure restrictions. The reduction of gate closure times as part of the Energy Transformation Strategy will help mitigate this issue (refer to Appendix 5 for further discussion of this issue).

All of the above factors led to the oversupply of generation priced at the floor in the nine minimum STEM price trading intervals. The ERA performed further analysis to determine

30 Downwards LFAS Quantity: 'Means, for a Trading Interval, the Forecast Downwards LFAS Quantity for that Trading Interval used by AEMO under clause 7B.3.3(b) to determine the Downwards LFAS Enablement Schedule' – Wholesale Electricity Market Rules (WA), 1 August 2021, Chapter 11

31 This 435 MW consisted of 85 MW for LFAS Down and 350 MW of generation so that each generator cleared to provide LFAS Down could operate.

32 Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 7A.2.3.

33 An example of renewable subsidy is the large-scale generation renewable certificates (LGC). One LGC certificate is equal to one Megawatt hour of eligible renewable electricity. The price of the LGC certificate has been falling and traded at $39 on 14 February 2019 which is the lowest price – Clean Energy Regulator, 1 March 2019, 'Large-scale generation certificate market update – February 2019', (online) [accessed 11 February 2021]. In addition to the price of LGC, there are potentially other tax advantages relating to the treatment of income from selling these certificates in the market.

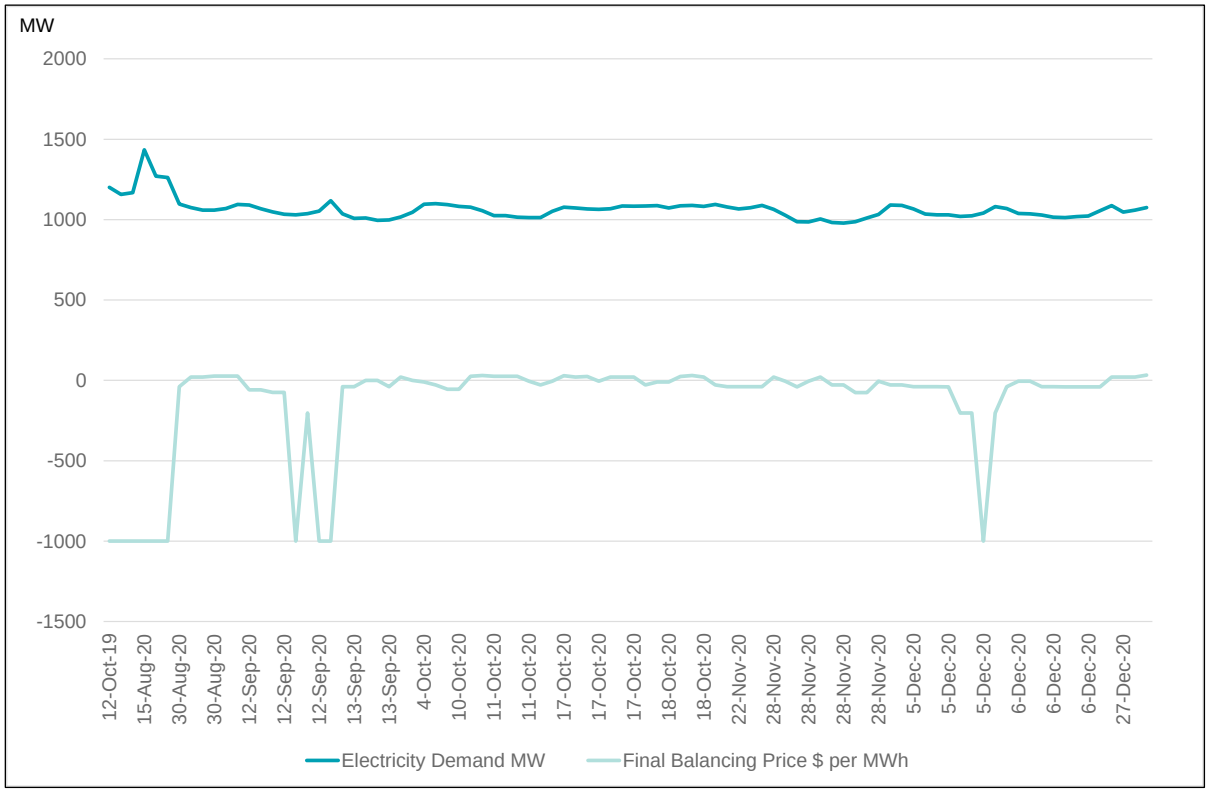
which of these factors were the most influential in causing the balancing market to settle at the minimum STEM price for these nine trading intervals (see section 3.3).

3.3 Factors that caused the balancing market to settle at the minimum STEM price

There were several factors that contributed to the balancing market settling at the minimum STEM price for the nine trading intervals during the review period as discussed in section 3.2. The ERA sought to determine which of these factors were the most influential by considering other low demand trading intervals during the review period that did not settle at the minimum STEM price. This is because there is a greater possibility of the balancing market settling at the minimum STEM price when electricity demand is low.

The ERA reviewed 80 low demand trading intervals to determine what differed between these intervals and the nine trading intervals where the market did settle at the minimum STEM price. These 80 low demand trading intervals during the review period had a final demand of less than or equal to 1,100 MW, which were less than the demand for seven of the nine trading intervals that settled at the minimum STEM price (Figure 2). None of these 80 low demand trading intervals had a relevant forecast which indicated that the balancing market would settle at the minimum STEM price.

Figure 2: Final balancing price and demand for the 80 low demand intervals and -$1,000/MWh trading intervals during the review period



Source: ERA analysis of market data.

When comparing the nine minimum STEM price trading intervals to these 80 low demand trading intervals, the ERA observed that four of these 80 low demand intervals had quantities bid at the minimum STEM price for commissioning and that these quantities were no greater than 60 MW in a single trading interval. However, during the nine trading intervals where the

balancing market settled at the minimum STEM price, all intervals had quantities of up to 176 MW offered at the minimum STEM price for commissioning activities. In addition, most of the LFAS generators' quantities offered into the balancing market in the 80 low demand trading intervals was in the range of 107 MW to 302 MW. This range was materially lower than the LFAS quantities offered during the nine minimum STEM price trading intervals (up to 435 MW).

The ERA concludes that it is highly likely that the balancing market would have cleared above the minimum STEM price had the higher commissioning and LFAS quantities not been present for the nine minimum STEM price trading intervals. The ERA determines that commissioning and ancillary services quantities were the main factors that caused the balancing market to settle at the minimum STEM price for the nine trading intervals during the review period.

Since August 2020, the ERA has observed that a small number of market participants have started using the offer range between -$400/MWh and -$999.47/MWh (see Table 6 in Appendix 4). For example, Alinta's Walkaway windfarm changed its bids from -$1,000/MWh to -$999.47/MWh in October 2020.[34] This change in bidding behaviour reduces the likelihood that the balancing market will settle at the minimum STEM price by reducing the quantities bid at the floor price.

Since September 2020, no new -$1,000/MWh trading intervals have occurred up to 31 August 2021 despite the SWIS experiencing new record low demand trading intervals since the end of the review period. The ERA concludes that the reasons for this are an absence of commissioning quantities and a change in bidding behaviour of LFAS providers and other market participants which means materially less quantities were offered at the minimum STEM price during this period.

3.4 Conclusion

A surplus of generation offered at the minimum STEM price led to the balancing price settling at the minimum STEM price for the nine trading intervals during the review period. This surplus was mostly due to the large quantities of electricity offered by ancillary services generators and for commissioning activities at the minimum STEM price.

Therefore, for all nine trading intervals during the review period, the reason for the market settling at the minimum STEM price was not because the price was too high.

[34] The -$999.47/MWh price is the loss factor adjusted Balancing Merit Order offer price for Alinta's Walkaway windfarm.

4. Criterion 2 - AEMO's dispatch

The ERA is required to consider the trading intervals where AEMO dispatched generators down (that is, reduced a generator's output) because the minimum STEM price was too high:

> 6.20.14. In determining whether the Minimum STEM Price is appropriate under clause 6.20.13(a), subject to clause 1.35.2, the Economic Regulation Authority must consider without limitation, if since the last annual review of the Minimum STEM Price under clause 6.20.13:
>
> …
>
> (b) AEMO dispatched a Facility below the sum of all quantities priced at the Minimum STEM price in the relevant Forecast Balancing Merit Order, for reasons other than Downwards Out of Merit dispatch of LFAS or other Ancillary Services, because, in the Economic Regulation Authority's reasonable opinion, the Minimum STEM Price was too high;

Clause 6.20.14(b) of the WEM Rules requires the ERA to consider trading intervals where there was a forecast oversupply of electricity priced at the minimum STEM price that required AEMO to dispatch down a generator priced at the floor because another generator could not decommit.[35,36] The ERA does not need to consider trading intervals where generators were dispatched down out of merit or dispatched on or off in connection with ancillary services.

To analyse this criterion, the ERA:

1. Identified each trading interval where the balancing market was forecast to settle, or settled, at the minimum STEM price.

2. For each of those trading intervals, identified where AEMO dispatched a generator below the sum of all the MW quantities priced at the minimum STEM price.

3. Where AEMO dispatched a generator below the MW quantities priced at the minimum STEM price, considered why this occurred and whether it was because the minimum STEM price was too high.

The ERA has not published the actual dispatch data in its analysis because this information is confidential. Instead, the ERA has published representative examples of AEMO's dispatch where relevant.

4.1 Balancing market dispatch process

Market generators submit price and quantity offers into the balancing market to indicate their ability to supply electricity for each 30-minute trading interval (called balancing submissions).

AEMO arranges all of the balancing submissions for each trading interval in ascending price order to create a forecast balancing merit order. In general, AEMO is required to dispatch in accordance with the forecast balancing merit order.[37] AEMO uses electricity demand forecasts

[35] Clause 6.20.14(b) refers to the term Downwards Out of Merit dispatch. This not a defined term in the WEM Rules. The ERA has interpreted this term to mean occurrences where AEMO dispatched a generator downwards for a quantity different to that specified in the forecast balancing merit order. This is consistent with the out of merit definition in the WEM Rules referred to earlier.

[36] AEMO can dispatch generators out of merit order to ensure system security, for example, when the SWIS is in a high-risk operating state.

[37] Ibid.

and renewable energy generator data for each trading interval to determine which generators in the forecast balancing merit order will be dispatched.[38]

AEMO calculates the quantities required for generation and issues dispatch instructions to each generator.[39] Dispatch instructions are issued prior to the commencement of the trading interval. These instructions require generators to adjust their output from the commencement of the trading interval so that they are generating the expected quantity of electricity by the end of the trading interval. AEMO calculates the quantities for these dispatch instructions approximately 10 to 15 minutes before the trading interval commences using the most recent available data which includes forecast demand and renewable generation output. AEMO may continue to issue dispatch instructions to generators after the commencement of the trading interval in response to updated forecast information.

AEMO's dispatch instructions for a trading interval may deviate from the forecast balancing merit order quantities for that trading interval. This may occur due to changes in forecast demand, fluctuations in renewable energy generation output and/or generator outages after the forecast balancing merit order is determined. For example, at the time AEMO calculates the dispatch quantities (around 10 to 15 minutes before the relevant trading interval), if the latest forecast electricity demand is lower than the previous demand forecast (approximately 30 minutes before the relevant trading interval) then less generation is needed. In these circumstances, AEMO's dispatch quantities for that relevant trading interval will be different to the quantities indicated in the last forecast balancing merit order to account for this lower demand.

Clause 6.20.14(b) of the WEM Rules requires the ERA to determine whether AEMO dispatched a generator for a quantity less than its forecast cleared quantity because the minimum STEM price was too high. This does not include downward dispatch instructions issued in response to falling demand, as these instructions are unrelated to the level of the minimum STEM price. The ERA accounted for this when assessing relevant trading intervals where AEMO issued downwards dispatch instructions to generators.

AEMO may be required to dispatch down a generator because there are several generators tied at that price but not all their quantities are required to meet the forecast demand. Where there is excess supply at the minimum STEM price, a tie-break process determines which generators priced at the floor will remain on and which generators will get dispatched down. When there is a tie in the balancing merit order, AEMO uses a process that randomly chooses the order of dispatch of the tied generators. This is not a competitive market-based outcome.[40] This random outcome may require AEMO to manually intervene in the dispatch process to ensure that certain generators remain on by dispatching other generators off or to lower quantities.

Clause 6.20.14(b) requires the ERA to consider whether AEMO dispatched in this way because the minimum STEM price was too high, resulting in excess supply at the floor because generators were unable to price differentiate. The ERA has assessed whether there were any trading intervals of this kind in the review period.

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38 The last forecast balancing merit order for a trading interval is published approximately 30 minutes before the start of that trading interval. Australian Energy Market Operator, 2019, *Market Procedure: Balancing Market Forecast*, p 7.

39 A dispatch instruction is an instruction issued by AEMO to a generation or demand side facility, other than Synergy in respect of its balancing portfolio, directing that facility to vary output or consumption.

40 It is possible for offers to be tied in the balancing merit order. To determine the order of these tied quantities in the balancing merit order, AEMO assigns a random number each day to each balancing facility, referred to as the tie-break process or methodology – Australian Energy Market Operator, 2019, *Market Procedure: Balancing Market Forecast*, pp.10-11.

4.2 Analysis of relevant trading intervals

As required by clause 6.20.14(b) of the WEM Rules, the ERA considered each trading interval where the balancing market was forecast to settle at the minimum STEM price at the time the last forecast for that trading interval was generated (approximately 30 minutes before the trading interval). The ERA also examined trading intervals where the balancing market settled at the minimum STEM price. These intervals are shown in Table 2.

Table 2: Relevant trading intervals when forecast and/or final balancing price was equal to minimum STEM price

Trading interval	Forecast price ($/MWh)	Forecast demand (MW)	Final balancing price ($/MWh)	Final demand (MW)	Category[41]
12 October 2019 1:00pm	-213.65	1,203	-1,000	1,200	A
13 October 2019 12:00pm	-9.94	1,246	-1,000	1,157	A
13 October 2019 1:00pm	-195.98	1,205	-1,000	1,167	B
15 August 2020 10:00am	-202.41	1,512	-1,000	1,435	B
15 August 2020 11:30am	-1,000	1,241	-1,000	1,270	B
15 August 2020 12:00pm	-1,000	1,264	-1,000	1,262	B
12 September 2020 12:30pm	-59.06	1,083	-1,000	1,030	B
12 September 2020 1:30pm	-38.97	1,119	-1,000	1,053	B
12 September 2020 2:00pm	-59.06	1,176	-1,000	1,118	B
13 September 2020 10:30am	-1,000	1,047	-38.88	1,036	C
13 September 2020 1:30pm	-1,000	999	0.01	1,045	C

[41] The trading intervals have been categorised as A, B, or C to assist the analysis in this section. Categories A and B are trading intervals when the market settled at the minimum STEM price. Category A refers to trading intervals when AEMO dispatched up generators for quantities greater than the amount the forecast balancing merit orders indicated were required. Category B refers to trading intervals when AEMO dispatched down generators that were in merit, for amounts lower than the values the forecast balancing merit orders indicated were required from these facilities. Category C refers to trading intervals that were forecast to settle at the minimum STEM price 30 minutes before the trading interval, but the final balancing prices settled at prices higher than the minimum STEM price.

Trading interval	Forecast price ($/MWh)	Forecast demand (MW)	Final balancing price ($/MWh)	Final demand (MW)	Category[41]
13 September 2020 2:00pm	-1,000	1,068	-5.09	1,108	C
17 September 2020 12:00pm	-1,000	1,261	26.37	1,247	C
17 September 2020 12:30pm	-1,000	1,231	-202.41	1,242	C
17 September 2020 1:00pm	-1,000	1,212	20.74	1,259	C
5 November 2020 8:30am	-1,000	1,361	175.12	1,383	C
5 November 2020 9:30am	-1,000	1,266	24.83	1,260	C
5 November 2020 10:00am	-1,000	1,239	29.42	1,245	C
5 November 2020 10:30am	-1,000	1,275	43.84	1,243	C

Source: ERA analysis of market data.

The ERA reviewed the dispatch instructions for all trading intervals in Table 2. In two of these trading intervals AEMO dispatched generators upwards (category A). These intervals are not required to be considered by the ERA in this review as AEMO did not dispatch down generators in these two trading intervals. Further details for the category A trading intervals are in Appendix 6.

Category B refers to trading intervals when the market settled at the minimum STEM price and category C refers to trading intervals that were forecast to settle at the minimum STEM price but cleared above the minimum STEM price.

Eight trading intervals were identified where AEMO dispatched a generator down for amounts lower than specified in the forecast balancing merit order. The eight trading intervals consist of all seven category B trading intervals in Table 2 and one category C trading interval (17 September 2020 12:30pm) also in Table 2. For the remaining category C intervals, AEMO's dispatch was consistent with the relevant forecast balancing merit order.

For one of the category B trading intervals (15 August 2020 11:30am) and one of the category C trading intervals (17 September 2020 12:30pm), final demand for the trading interval was slightly higher when compared to the forecasted demand. While AEMO initially dispatched down some generators (including the forecast marginal generator) during these intervals, it subsequently dispatched up the same generators during the interval to meet rising demand. The ERA reviewed both intervals to consider why some generators were initially dispatched down for lesser quantities during these intervals.

For the six other category B trading intervals, electricity demand between forecast and final fell, as seen in Table 2.

The ERA requested more granular data from AEMO to validate its observations for the eight trading intervals.

The example in Table 3 illustrates how the ERA used the data provided by AEMO to further assess AEMO's dispatch for these eight trading intervals.

Table 3: Electricity demand and dispatch instructions for trading interval 15 August 2020 1:00pm

Generator name	Forecast quantity at 12:30pm (MW)	Actual dispatch instruction issued at 12:50pm (MW)[42]	Actual dispatch instruction issued at 1:05pm (MW)[43]	Actual dispatch instruction issued at 1:15pm (MW)[44]
Other generators	1,027	1,027	1,027	1,027
Solar farm B	130	115	130	130
Windfarm A	70	0	36	55
Forecast electricity demand for end of trading interval	**1,227**	**1,142**	**1,193**	**1,212**

Source: Example based on ERA analysis of market data.

Table 3 shows that the renewable energy generator, Windfarm A, is the marginal unit when the forecast balancing merit order is produced for the 1:00pm trading interval (at 12:30pm). At 12:50pm, when AEMO calculates the first dispatch instruction quantities for the 1:00pm trading interval, forecast demand has fallen (to 1,142 MW). Windfarm A no longer needs to be dispatched and Solar farm B also needs to be dispatched for a lower quantity than earlier forecast. For the remaining dispatch times in the 1:00pm trading interval, Windfarm A is the marginal unit and receives dispatch instructions according to changes in forecast demand at 1:05pm and 1:15pm. All these forecasts are lower than the initial forecast at 12:30pm. This change in demand means that less energy was required to be dispatched than was originally forecasted in the balancing merit order.

The example in Table 3 is representative of the eight trading intervals where AEMO dispatched a generator down for amounts lower than specified in the forecast balancing merit order.[45] This analysis concluded that changes in electricity demand led to AEMO's downward dispatch instructions being issued for all eight trading intervals. AEMO's downwards dispatch was not because the minimum STEM price was too high.

42 The 12:50pm dispatch instruction has a response time of 1:00pm.

43 The 1:05pm intra-interval dispatch instruction has a response time of 1:15pm.

44 The 1:15pm intra-interval dispatch instruction has a response time of 1:20pm.

45 Although two of the intervals (15 August 2020 11:30am and 17 September 2020 12:30pm) ended up with a higher level of demand than forecasted, AEMO's dispatch followed the same pattern as for the six intervals where demand ended up lower than forecast.

The ERA consulted with AEMO on its analysis of all 19 trading intervals in Table 2. AEMO confirmed the ERA's findings and informed the ERA that its dispatch decisions were guided by demand and power system security rather than the minimum STEM price being too high.[46]

4.3 Conclusion

The ERA's analysis of the 19 trading intervals where the final balancing price either settled at or was forecast to settle at the minimum STEM price confirms that there were no intervals where AEMO dispatched a generator down because the minimum STEM price was too high. Instead, the reasons for AEMO's downward dispatch in the identified trading intervals were due to changes in forecast demand that required other generators to be dispatched down accordingly.

The ERA's conclusion for this criterion is that there were no trading intervals during the review period where AEMO dispatched down a generator priced at the floor because the minimum STEM price was too high.

[46] When discussing the market data used for the analysis, AEMO informed the ERA that there may be cases where the reason for differences between dispatch instructions and balancing merit order quantities may be more difficult to identify. For example, there may be differences due to the dispatch of LFAS facilities, but this may not necessarily be obvious from the available data. These matters did not affect the outcome of the ERA's analysis or the ERA's conclusions.

5. Criterion 3 - Changes in the generation fleet

The ERA must assess changes in the generation fleet and determine whether the current minimum STEM price is too high or too low to allow the balancing market to clear above the minimum STEM price in most circumstances.[47] The scope of this criterion is defined in clause 6.20.14(c) of the WEM Rules:[48]

> 6.20.14. In determining whether the Minimum STEM Price is appropriate under clause 6.20.13(a), subject to clause 1.35.2, the Economic Regulation Authority must consider without limitation, if since the last annual review of the Minimum STEM Price under clause 6.20.13:
>
> …
>
> (c) there has been a change in the generation fleet in the SWIS, that, in the Economic Regulation Authority's reasonable opinion, is likely to result in:
>
> i. the current Minimum STEM Price being materially lower than necessary to achieve the criterion in clause 6.20.16(a), including but not limited to an upgrade or the retirement of a Facility with high cycling costs; or
>
> ii. the current Minimum STEM Price being too high to achieve the criterion in clause 6.20.16(a), including but not limited to the increase of cycling costs due to deterioration or aging of an existing plant.

To determine whether there were changes in the generation fleet during the review period that would indicate that the minimum STEM price was too high or too low, the ERA:

1. Identified changes to the generation fleet over the review period, which included assessing new entrants, plant retirements and upgrades to, or reported deterioration of, generators.

2. Assessed whether these changes altered the cycling costs for the relevant generators such that the current minimum STEM price is no longer appropriate. [49, 50]

For the ERA's assessment of this criterion, the set of relevant generators are those generators with high cycling costs that generally bid some of their electricity at the minimum STEM price. These are predominantly base load coal-fired generators. Due to the confidentiality of short run marginal cost data (which includes start-up and shutdown costs), this information cannot be published.

5.1 Generator cycling costs

A generator's cycling costs are the costs that a generator incurs to shutdown and restart a generator. These costs are derived from considering:[51]

- The cost of fuel, variable operating costs, and maintenance costs.

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47 Wholesale Electricity Market Rules (WA), 1 August 2021, Rules 6.20.14(c) and 6.20.16(a)

48 Ibid, Rule 6.20.14(c)

49 Cycling costs include start-up and shutdown costs, any expected losses or gains, opportunity costs and cost savings. Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 6.20.19

50 For example, where a generator with high cycling costs have gone down but another generator with high cycling costs have gone up, the ERA's assessment considered how those generators' changing costs would affect the amount of electricity that is likely to be offered by those generators at the minimum STEM price.

51 Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 6.20.19

- The time the generator takes to shutdown, time it must remain out of service before it can be restarted and the time it takes for the generator to ramp back up to a minimum stable level of generation.
- Opportunity costs that a generator would incur during these shutdown and restart times (for example, unearned revenue due to the generator being shutdown) and any associated cost savings.

A generator's cycling costs will influence a market participant's bidding behaviour, particularly the amount of electricity offered at the minimum STEM price. Generators may price some of their electricity at the minimum STEM price even when forecast prices are low as the cycling costs of shutting down a generator can be substantial. For example:

> The opportunity costs of forcing a plant below mingen will include not only the immediate costs associated with taking the plant offline but also the cost of starting the plant up again when it is required.[52] The time that it takes to have such a plant come back into operation can be considerable. If this causes the plant to be unavailable when it is needed there will be an additional opportunity cost associated with lost revenue in future trading intervals while the plant is lying idle. In other words, while within the trading interval it may be cheaper to shut a plant down than to run the plant, it may not be the best decision over the trading day. Therefore, the impact on cost in future trading intervals must be considered in the current decision. For this reason, and for reasons of security and reliability, coal fired plants are, ideally, only shut down for scheduled maintenance.[53]

If generators with high cycling costs experience material changes to their cycling costs, then the current minimum STEM price may not be appropriate. For example, if a generator is upgraded, which reduces the cost and/or time that generator takes to shutdown and restart, then during low-demand trading intervals the generator may be willing to offer electricity at a higher price than the current minimum STEM price to reduce its financial risk. If this happens to generators with high cycling costs that offer at the minimum STEM price, the minimum STEM price may be unnecessarily low. Conversely, if cycling costs for relevant generators have increased (for example, due to an increase in restart and shutdown costs), then the current minimum STEM price may be set too high, as generators cannot bid low enough to demonstrate how willing they are to shutdown. This could lead to the balancing price settling at the minimum STEM price more often.

5.2 Method for assessing changes to the generation fleet

The state of the generation fleet at the beginning of the review period, 1 October 2019, was used as the reference point for assessing changes to the fleet up to 31 January 2021 (the end of the review period).

The ERA's method for assessing this criterion was to consider whether there had been material changes to generator cycling costs – that is, shutdown and restart costs and the associated shutdown, offline and restart times, during the review period.

[52] To avoid costly damage to steam turbines associated with expansion and contraction, venting steam at low demand is not an option for most base-load plants. If this were technologically feasible, it would be cheaper to operate a coal fired based-load plant at minimum generation and vent steam during periods of low demand for electricity rather than shut it down.

[53] Economic Regulation Authority, 2008, *Portfolio Short Run Marginal Cost of Electricity Supply in Half Hour Trading Intervals – Technical Paper,* pp. 16-17.

The ERA examined the relevant generators (those with high cycling costs) that typically bid some of their electricity at the minimum STEM price over the review period and if there had been changes to their cycling costs.

The ERA also considered new generators that were added to the SWIS during the review period and whether these new generators had cycling costs that were relevant to the assessment of this criterion (see section 5.4).

5.3 Analysis of changes in cycling costs

During this review, the ERA received updated information from some generators. However, most of the generators with high cycling costs did not report any material change to their cycling costs over the review period. The ERA concludes that there has not been a material change in the generation fleet that would indicate that the minimum STEM price is too high or too low as the group of generators with high cycling costs have remained largely unchanged during the review period.

5.4 Additional generation in the SWIS

A total of 622 MW of new generation capacity connected to the SWIS during the review period, consisting entirely of renewable energy generators. Renewable energy generators are willing to be dispatched at negative prices as they can receive renewable subsidies and may have contractual incentives to sell their energy into the balancing market.[54] Additionally, since cycling costs for renewable energy generators tend to be significantly lower than for traditional base load generators, renewable energy generators are not bidding at negative prices to avoid cycling costs. Therefore, this additional 622 MW of new renewable energy generation capacity is not directly relevant to the assessment of changes to the generation fleet under the clause 6.20.14(c) criterion of the WEM Rules.

However, renewable energy generation can increase the cycling costs of base load generators by requiring these base load generators to change the amount of electricity they generate frequently. This increase in cycling a generator can result in more wear and tear that, for example, may increase the need for maintenance.[55] Consequently, cycling costs could increase for these generators which would be assessed under this criterion. However, the entry of renewable energy generation capacity was recent and no updated information has been received from relevant generators that shows increased cycling costs due to the entry of more renewable energy capacity.[56] Alinta's submission stated that, if the entry of renewable

[54] An example of these incentives is the Renewable Energy Certificates that are an alternative energy revenue source for renewable energy generators.

[55] Since renewable energy generation has little marginal costs to generate electricity, large amounts can be bid at the minimum STEM price to ensure that those units are dispatched. This can displace base load plants that would have generated more had the renewable energy generators not bid at the minimum STEM price. This then forces those generators to change output more often rather than running at a constant output which increases wear and tear on the plant.

[56] Most of the generators with high cycling costs did not report a change to their shutdown or restart costs or their shutdown, offline and restart times during the review period. Also, the ERA observed that over 2017-18, the increasing penetration of rooftop solar did not materially change base load generator run times that would have resulted in an increase to balancing market bids and prices. – Economic Regulation Authority, 2019, *Report to the Minister for Energy on the Effectiveness of the Wholesale Electricity Market 2018*, pp. 8-9.

energy generation did affect the cycling costs of some generators, it would expect minimum STEM price trading intervals to occur more often.[57]

5.5 New technologies

This review is occurring whilst the WEM is evolving and new technologies, such as storage, seek to enter the market, as evidenced by Synergy's and Alinta's announcements to build batteries in the SWIS.[58,59] The likely effect of storage is to lessen the peaks and troughs of electricity demand and supply during the day. Storage could decrease the likelihood of the balancing market settling at the minimum STEM price because the more negative the electricity price, the greater the incentive for storage technologies to demand and store that electricity. The addition of storage does not affect the assessment of the minimum STEM price in this review because these technologies will not be operational until September 2022 at the earliest. However, it may need to be considered in future reviews.[60]

5.6 Conclusion

There has been no change in relevant generator cycling costs over the review period. Therefore, the ERA's conclusion for this criterion is that there has not been a change in the generation fleet that indicates that the current minimum STEM price is too high or too low.

57 Alinta Energy, Submission to *Minimum STEM price review 2021 – Issues paper and preliminary findings,* p. 3.

58 Renew Economy, 'West Australia to build 100MW big battery – the first on state's main grid', (online) [accessed 18 May 2021]. Synergy's battery is expected around September 2022.

59 Renew Economy, 'Alinta to build second big battery in WA grid, next to Alcoa alumina plant' (online) [accessed 18 May 2021]. Alinta's battery is expected around March 2023.

60 Storage technology may be considered in future reviews when assessing clause 6.20.14(a) criterion - Wholesale Electricity Market Rules (WA), 1 August 2021, Rule 6.20.14(a) and Government of Western Australia, 'Big battery to power 160,000 homes in WA and create 100 local jobs', (online) [accessed 23 May 2021]

6. The minimum STEM price objectives

To determine whether the minimum STEM price is appropriate, the ERA must consider whether the mandatory review criteria and stakeholder submissions indicate that the minimum STEM price objectives are being met. The mandatory criteria were considered in chapters 3 to 5. The minimum STEM price objectives and stakeholder submissions are considered in this chapter.

The objectives of the minimum STEM price are:

> 6.20.16 The Minimum STEM Price must:
>
> (a) allow clearance of the Balancing Market without the Balancing Price being equal to the Minimum STEM Price in most circumstances; and
>
> (b) subject to clause 6.20.16(a), limit Market Participants' exposure to Balancing Prices that would threaten the financial viability of a prudent Market Participant.

To determine whether the minimum STEM price is appropriate, the ERA must consider whether the current value of the minimum STEM price is meeting the objectives in the WEM Rules, after considering the mandatory review criteria (discussed in chapters 3 to 5) and stakeholder submissions.

The ERA is not required to consider whether other values for the minimum STEM price may better meet the minimum STEM price objectives unless the ERA has determined that the current value is not appropriate.

The ERA received submissions from four stakeholders during this review. Submissions from Synergy, Bluewaters and NewGen Power Kwinana stated that a higher minimum STEM price of -$250/MWh would better meet the minimum STEM price objectives because it would limit market participants' exposure to balancing prices that could threaten their financial viability and would still allow the balancing market to clear above it in most circumstances. Alinta's submission supported the ERA's draft determination that the current minimum STEM price is appropriate and does not need to change. The ERA has considered these submissions in this chapter when assessing whether the current minimum STEM price is meeting the clause 6.20.16 objectives.

6.1 Clause 6.20.16(a) - allowing the balancing market to clear above the minimum STEM price in most circumstances

The first objective of the minimum STEM price is to allow the balancing market to clear above the minimum STEM price in most circumstances (clause 6.20.16(a)). If the balancing price is settling at the minimum STEM price often, then the minimum STEM price is not meeting this objective.

During the review period the balancing market settled above the minimum STEM price 99.96 per cent of the time. As this is the ERA's first review of the minimum STEM price, there are no other review periods to compare this review against. Despite this, 99.96 per cent of the time is fractionally less than all of the time and the ERA's conclusion is that, in the absence of comparative review periods, the balancing market settled above the minimum STEM price in most circumstances during the review period.

Further, in the seven months since the end of the review period to 31 August 2021, the balancing market has not settled at the minimum STEM price. The last time the balancing market settled at the minimum STEM price was on 12 September 2020.

Since the balancing market rarely settles at the current minimum STEM price of -$1,000/MWh, it is therefore meeting this objective.

To ensure stakeholder submissions were properly considered, the ERA also analysed the possible market outcomes of a higher minimum STEM price of -$250/MWh, as proposed by Synergy, Bluewaters and NewGen Power Kwinana.

The ERA found that at -$250/MWh, the balancing market would likely settle more often at this higher proposed floor price than at the current -$1,000/MWh level. The ERA's analysis indicates that the balancing market would have likely settled at a -$250/MWh floor price eight times in the seven months since the end of the review period to 31 August 2021. The balancing market did not settle at the minimum STEM price during this period. Where the balancing market settles at the minimum STEM price frequently, this is not consistent with the objective for the balancing market to settle above the minimum STEM price in most circumstances.

The details of the ERA's analysis on the proposed minimum price of -$250/MWh is in Appendix 7.

6.2 Clause 6.20.16(b) – exposure to a minimum STEM price that threatens a participant's financial viability

The second objective of the minimum STEM price is to limit the exposure of market participants' to balancing prices that that would threaten the financial viability of a prudent market participant, where the balancing market settles at the floor (clause 6.20.16(b)).[61]

Bluewaters, NewGen Power Kwinana and Synergy submitted that the current minimum STEM price exposed market participants, particularly providers of ancillary services, to a higher level of financial risk than if the price was set at -$250/MWh. The ERA agrees that a higher minimum STEM price may limit the extent that market participants are financially exposed, but this objective requires that the financial exposure must be to such an extent that it threatens a market participant's financial viability.

Although sustained exposure to the balancing market settling at the minimum STEM price may threaten the financial viability of a market participant (assuming that the generator has no offsets or hedges), the data during and since the review period shows that the balancing market rarely settled at the -$1,000/MWh minimum STEM price (nine trading intervals out of 23,472 in the review period).

The level of the minimum STEM price itself was not a factor that caused the balancing market to settle at the floor. The ERA's analysis found that the large quantities offered at the minimum STEM price from new facilities commissioning and ancillary services quantities bidding at the minimum STEM price were the main factors that led to the nine minimum STEM price trading intervals during the review period (see section 3.3). There are no prospective new generators due to commission during the next review period and some ancillary services generators have changed their bidding behaviour. Given these changes in the market, there may not be any minimum STEM price intervals in the next review period.

[61] This is a second order objective to be considered after the ERA concludes that the current minimum STEM price does not allow the balancing market to clear above that the floor price in most circumstances.

Market participants did not provide any evidence to the ERA to show that their financial viability was threatened or was likely to be threatened by the current minimum STEM price. Additionally, no generators have indicated that they experienced financial distress due to the balancing market settling at the minimum STEM price. Given these factors, and since it is rare for the balancing market to settle at the minimum STEM price, the ERA concludes that it is unlikely that the current -$1,000/MWh minimum STEM price threatens participants' financial viability.

6.3 Conclusion

The ERA's conclusion is that the current minimum STEM price meets the clause 6.20.16 objectives. The current minimum STEM price has allowed the balancing market to settle above it in most circumstances in the review period, and this is likely to continue into the next review period. Further, there is no evidence that the current minimum STEM price resulted in market participants being exposed to balancing prices that threatened their financial viability in the current review period, nor is this likely in the next review period.

7. ERA's final determination

The ERA's final determination is that the minimum STEM price is appropriate at its current level of -$1,000/MWh.[62] To make this final determination, the ERA has considered the mandatory criteria in clause 6.20.14, stakeholder submissions and whether the current minimum STEM price is meeting the objectives in clause 6.20.16.[63]

The ERA's analysis of the mandatory criteria in clause 6.20.14 showed that:

- Factors other than the level of the minimum STEM price, such as commissioning activities and ancillary services quantities priced at the floor, led to the balancing market settling at the minimum STEM price. The balancing market did not settle at the minimum STEM price because the price was too high.[64]
- There were no trading intervals where AEMO dispatched generators down because the minimum STEM price was too high.[65]
- There were no material changes in the generation fleet, in particular those generators with high cycling costs, which would reasonably affect the level of the current minimum STEM price.[66]

The ERA's conclusion for the minimum STEM price objectives is that the current minimum STEM price allows the balancing market to clear above it in most circumstances. The occurrence of the balancing market settling at the minimum STEM price is likely to continue to be rare – there have been no new minimum STEM price trading intervals since the eight months from the end of the review period. In these circumstances, there is no evidence that the current minimum STEM price will result in market participants being exposed to balancing prices that will threaten their financial viability.

The ERA's determination means that the minimum STEM price will remain at -$1,000/MWh.

62 The WEM Rules require the ERA to assess the current minimum STEM price using the mandatory criteria in clause 6.20.14, the objectives of the minimum STEM price in clause 6.20.16 and any other relevant matters including stakeholder submissions.

63 See chapters 3 to 5 for details on each criterion and chapter 6 for a discussion of the minimum STEM price objectives.

64 See chapter 3.

65 See chapter 4.

66 See chapter 5.

Appendix 1 List of Tables

Appendix 2 List of Figures

Appendix 3 Trading intervals when the balancing market settled at the minimum STEM price

Analysis of October 2019 trading intervals

The final balancing price settled at the minimum STEM price for three trading intervals in October 2019, shown in Table 3.

Table 3: October 2019 - Final vs AEMO's forecast balancing price and demand[67]

Trade date	Interval	Final balancing price ($/MWh)	Final demand (MW)	Forecast balancing price prior to gate closure for non-Synergy facilities ($/MWh)	Forecast demand prior to gate closure for non-Synergy facilities (MW)	Forecast balancing price prior to Synergy's gate closure ($/MWh)	Forecast demand prior to Synergy's gate closure (MW)
12 October 2019	1:00pm	-1,000	1,200.28	-1,000	1,193.67	27.96	1,314.85
13 October 2019	12:00pm	-1,000	1,157.15	-15.13	1,234.39	-15.13	1,230.93
13 October 2019	1:00pm	-1,000	1,167.29	-5.21	1,289.59	-15.13	1,247.60

Source: ERA analysis of market data.

The factors that contributed to the market settling at the minimum STEM price were:

- **Generator bidding behaviour**: The forecast demand available to non-Synergy generators two hours ahead of the commencement of the 1:00pm 12 October 2019 trading interval indicated that the market would settle at the minimum STEM price. There was no change in generator offers prior to the offer gate closure for this interval.
  - Forecast demand of 1,234 MW and 1,289 MW was higher than the final demand of 1,157 MW and 1,167 MW for the 12:00pm and 1:00pm trading intervals respectively on 13 October 2019. Generators may not have expected the market to settle at the minimum STEM price for these two intervals and therefore made no change to their offers.
- **Ancillary service generator offers:** LFAS market offers must be submitted before balancing market offers.[68] The generators cleared to provide LFAS must offer at the minimum STEM price in the balancing market so that they can be dispatched first to comply with their LFAS offers. The WEM Rules require generators that are cleared in

[67] Synergy's Portfolio submits its balancing market offers 240 minutes (for a 6-hour bidding block) prior to the start of the trading interval, while other independent power producers (IPPs) submit their offers 120 minutes before the interval on a rolling basis. These different offer timeframes mean that there are different forecasts applicable to when Synergy is last able to submit its offers compared to when IPPs are last able to submit their offer as shown in Table 3. These arrangements were revised to shorter timeframes from 1 December 2020 onwards.

[68] The LFAS market gate closure closes before the balancing market's gate closure.

the LFAS market to offer their LFAS quantities (LFAS Down) along with their minimum generation quantity into the balancing market at the minimum STEM price. This ensures that the generator is dispatched above its minimum generation quantity plus the LFAS Down amount so that it can provide the LFAS Down service. Generators providing spinning reserve ancillary services are also required to bid their minimum generation quantities at the minimum STEM price to ensure they are dispatched and available to provide the service.

The WEM requirement for LFAS was 85 MW for the October 2019 trading intervals identified in Table 3. Four generators were cleared to provide a total 85 MW of LFAS for these trading intervals.[69]

These four generators offered their minimum generation quantities, in addition to their LFAS cleared quantities, at the minimum STEM price, totalling 435 MW (shown as light blue-coloured tranches in Figure 1 in section 3.2). There was also 153 MW submitted at the minimum STEM price by generators providing spinning reserve.

- **Coal generators:** Four coal generators totalling 410 MW offered at the minimum STEM price for the October 2019 trading intervals. [70,71] Generators with high cycling costs, such as coal facilities, decide whether to remain on during low demand periods to avoid incurring cycling costs. These generators decided to remain on. Their offers are in the light green coloured tranche in Figure 1 in section 3.2.
- **Renewable energy generators:** Renewable energy generators have an incentive to be dispatched at negative offer prices that typically reflect the value of renewable subsidies and additional benefits from selling their energy in the balancing market.[72] Renewable energy generators totalling 103 MW offered at the Minimum STEM Price, which is likely to have been a lower offer price than the value of these incentives.
- **Unutilised negative offer range:** The current Minimum STEM Price of -$1,000/MWh means generators can submit negative offers anywhere between $0/MWh and -$1,000/MWh to differentiate themselves from others during periods of low demand. No offers were submitted in the range between -$250/MWh and -$999/MWh for the October 2019 trading intervals in Table 3.

69 NEWGEN_KWINANA_CCG1, ALINTA_PNJ_U2, ALINTA_PNJ_U1 and PORTFOLIO (Synergy's Portfolio is treated as a single generator).

70 Muja_G5, Muja_G7, BW1_BLUEWATERS_G2 and BW2_BLUEWATERS_G1

71 The ERA assumed that some of Synergy's Portfolio offers at the minimum STEM price reflect coal fuelled generators.

72 An example of these incentives is the Renewable Energy Certificates that are an alternative energy revenue source for renewable energy generators.

Analysis of August 2020 trading intervals

The final balancing price settled at the minimum STEM price for three trading intervals in August 2020 shown in Table 4.

Table 4: August 2020 - Final vs AEMO's forecast balancing price and demand

Trade date	Interval	Final balancing price ($/MWh)	Final demand (MW)	Forecast balancing price prior to gate closure for non-Synergy facilities ($/MWh)	Forecast demand prior to gate closure for non-Synergy facilities (MW)	Forecast balancing price prior to Synergy's gate closure ($/MWh)	Forecast demand prior to Synergy's gate closure (MW)
15 August 2020	10:00am	-1,000	1,434.75	-10.08	1,716.54	-10.08	1,674.59
15 August 2020	11:30am	-1,000	1,270.06	-115.00	1,422.83	-38.97	1,499.14
15 August 2020	12:00pm	-1,000	1,261.65	-202.41	1,399.94	-38.97	1,472.43

Source: ERA analysis of market data.

The factors that contributed to the market settling at the minimum STEM price were:

- **Generator bidding behaviour**: Forecast demand was materially higher than final demand for the three trading intervals in August 2020. Again, generators may not have expected the market to settle at the minimum STEM price for these intervals and therefore made no change to their offers.
- **Ancillary service generator offers:** Up to 355 MW was offered at the minimum STEM price by three LFAS generators, while the LFAS market requirement was 85 MW. Generators providing spinning reserve also submitted 153 MW at the minimum STEM price. The total amount of offers from ancillary services generators at the minimum STEM price ranged from 23 per cent to 37 per cent for the August trading intervals in Table 4.
- **New generators undertaking commissioning activities**: New renewable energy generators Merredin solar farm, Yandin windfarm and Warradarge windfarm were conducting commissioning activities in August 2020. The commissioning periods approved by AEMO for these generators coincided with low demand days.
  - The WEM Rules require generators undertaking commissioning activities to offer their electricity at the minimum STEM price to ensure that they are dispatched to perform the scheduled commissioning activities. Quantities ranging from 166 MW to 176 MW were offered by these generators at the minimum STEM price.
- **Renewable energy generators**: About 144 MW from renewable energy generators continued to be offered at the minimum STEM price.
- **Unused negative offer range:** Generators continued not to use the offer range between -$250/MWh and -$999/MWh for any of the August trading intervals in Table 4.

Analysis of September 2020 trading intervals

The final balancing price settled at the minimum STEM price for three trading intervals in September 2020 shown in Table 5.

Table 5: September 2020 - Final vs AEMO's forecast balancing price and demand

Trade date	Interval	Final balancing price ($/MWh)	Final demand (MW)	Forecast balancing price prior to gate closure for non-Synergy facilities ($/MWh)	Forecast demand prior to gate closure for non-Synergy facilities (MW)	Forecast balancing price prior to Synergy's gate closure ($/MWh)	Forecast demand prior to Synergy's gate closure (MW)
12 September 2020	12:30pm	-1,000	1,030.01	-59.06	1,088.84	-38.88	1,200.52
12 September 2020	1:30pm	-1,000	1,052.87	-38.97	1,149.93	-10.08	1,259.68
12 September 2020	2:00pm	-1,000	1,117.77	-38.97	1,206.24	-10.08	1,258.73

Source: ERA analysis of market data.

The factors that contributed to the market settling at the minimum STEM price were:

- **Generator bidding behaviour:** Forecast demand was materially higher than the final balancing price for these three trading intervals in September 2020. Similar to two of the October 2019 trading intervals and all three August 2020 trading intervals, generators may not have expected the market to settle at the minimum STEM price and therefore made no change to their offers.
- **Ancillary service generator offers:** LFAS generator offers in the balancing market were lower (147 MW) compared to October 2019 and August 2020, but still higher than the actual LFAS market requirement of 85 MW.
- **New generators undertaking commissioning activities**: Balancing submission data showed that only one of the three new generators was actively commissioning during these three September trading intervals. However, one of the other new intermittent generators continued to offer all its electricity at the minimum STEM price.[73] This meant new generators made up to 124 MW of the quantities submitted at the Minimum STEM Price for the September trading intervals in Table 5.
- **Renewable energy generators**: The quantity of electricity offered by renewable energy generators at the minimum STEM price was higher (156 MW) than the intervals in the earlier months.

Unused negative offer range: Generators continued not to use the offer range between -$250/MWh and -$999/MWh for any of the September trading intervals in Table 5.

[73] This generator may also have been undergoing commissioning but did not reflect this in its balancing submissions.

Appendix 4 Offers between -$400/MWh and -$999/MWh during the review period

Table 6: Sample of balancing market offers between -$400/MWh and -$999/MWh during the review period

Trade Date	Trading interval	Generator name	Offer MW	Offer price ($/MWh)
8 August 2020	12:00pm	SYNERGY PORTFOLIO	35.48	-537.02
8 August 2020	12:00pm	SYNERGY PORTFOLIO	1.77	-439.38
8 August 2020	12:30pm	SYNERGY PORTFOLIO	21.77	-824.50
8 August 2020	12:30pm	SYNERGY PORTFOLIO	2.23	-674.59
16 August 2020	12:30pm	SYNERGY PORTFOLIO	104.60	-900.00
16 August 2020	12:30pm	SYNERGY PORTFOLIO	2.00	-665.35
26 September 2020	12:00pm	ALINTA_WWF (windfarm)	61.40	-999.47
14 November 2020	12:30pm	ALINTA_WWF (windfarm)	42.90	-999.47
14 November 2020	12:30pm	SYNERGY PORTFOLIO	45.99	-900.00
3 January 2021	12:30pm	ALINTA_WWF (windfarm)	11.10	-999.47
3 January 2021	12:30pm	SYNERGY PORTFOLIO	11.60	-456.21

Source: ERA analysis of market data.

Appendix 5 Forecast accuracy and gate closure

Alinta Energy, Bluewaters Power and NewGen Power Kwinana stated that forecast inaccuracy was the most significant factor that led to the market settling at the minimum STEM price during the review period.

Alinta Energy stated that:[74]

> Alinta Energy considers that AEMO's demand forecasts are generally crucial in informing participants' commitment decisions and are therefore likely to have strongly influenced bidding decisions in these nine trading intervals.
>
> …
>
> Alinta Energy considers that over-forecasting demand is the most influential in causing the market to clear at the minimum.

Bluewaters and NewGen Power Kwinana stated:[75, 76]

> Bluewaters considers that forecasting inaccuracies led to bidding behaviour by generators that was not consistent with the final clearing price in the majority of the intervals in question.

Synergy, Bluewaters and NewGen Power Kwinana stated that forecasts closer to the trading interval were generally more accurate and that gate closure times of up to two hours prior to the trading interval inhibited a generator's ability to reflect the more accurate information in their balancing offers. Bluewaters and NewGen Power Kwinana considered that the gate closure times, combined with inaccurate forecasting at the time of gate closure, prevented generators from being able to respond to minimum STEM price events accordingly.

An example of how gate closure times may affect a participant's ability to respond to more recent forecast information was the 1:00pm trading interval on 12 October 2019. This interval was forecast to clear at $27.96/MWh at the time of LFAS gate closure (8:00am). However, by the time of balancing gate closure for non-Synergy generators (11:00am), the balancing market was forecast to settle at the minimum STEM price.[77] As this was after LFAS gate closure, it was too late for LFAS generators to change their offers.

During the review period, the gate closure times were reduced from 1 December 2020. However, gate closure times still remain at least 1.5 hours ahead of the trading interval.[78, 79]

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74 Alinta Energy, Submission to Minimum STEM price review 2021 – Issues paper and preliminary findings, p. 2.

75 Bluewaters Power, Submission to Minimum STEM price review 2021 – Issues paper and preliminary findings, p. 2.

76 NewGen Power Kwinana, Submission to Minimum STEM price review 2021 – Issues paper and preliminary findings, p. 2.

77 LFAS gate closure is 3.5 hours prior to the commencement of the trading interval.

78 Rule Change Panel, 2020, Final Rule Change Report: Implementation of 30-Minute Balancing Gate Closure (RC_2017_02), p. 14.

79 Changes to gate closure was set out in Rule Change Panel, 2020, Final Rule Change Report: Implementation of 30-Minute Balancing Gate Closure (RC_2017_02):

- LFAS gate closure of 3.5 hours prior to the trading interval (down from 5 hours) and bid in 4-hour blocks (down for 6-hour blocks) commencing from 8:00 am.
- Balancing gate closure for Synergy of 2.5 hours prior to the trading interval (down from 4 hours) with a rolling gate closure instead of requiring Synergy to bid in trading interval blocks.
- Balancing gate closure for non-Synergy generators of 1.5 hours prior to the trading interval (down from 2 hours).

In follow-up consultation, some stakeholders indicated that the revised gate closure times had not made a difference to their bidding.

Changes to the current WEM design to address the above forecasting and gate closure matters, are not within the scope of this review. However, changes to the design of the WEM from the Government's Energy Transformation Strategy will mitigate these concerns through new gate closure timeframes of no more than 15 minutes and as short as five minutes ahead of the trading interval and more frequent forecasts closer to the dispatch interval.

Appendix 6 Category A Trading intervals

The ERA reviewed the nine intervals (all of the category A and B intervals in Table 2) where the balancing market settled at the minimum STEM price.

For two trading intervals when the balancing price settled at the minimum STEM price (category A in Table 2), AEMO dispatched up the two forecast marginal units for quantities greater than the amount than was indicated in the forecast balancing merit orders. The upward dispatch of these generators is not within the scope of this criterion.[80] None of the remaining generators priced at the minimum STEM price were dispatched down for these two trading intervals.

[80] Clause 6.20.14(b) of the WEM Rule refers to downwards dispatch only, which for this criterion is the dispatch of a generator below the sum of the Megawatt quantities at the minimum STEM price.

Appendix 7 Analysis of a higher minimum STEM price

Bluewaters, NewGen Power Kwinana and Synergy all submitted that a higher -$250/MWh minimum STEM price would better meet the minimum STEM price objectives. Although the ERA is not required to consider what other price levels are appropriate for the minimum STEM price, the ERA analysed the implications of a minimum STEM price set at -$250/MWh. The ERA assessed trading intervals both during the review period (1 October 2019 to 31 January 2021) and in a post-review period (s 2021 to 30 June 2021).

Notwithstanding the ERA's analysis, the ERA does not have discretion to change the minimum STEM price to any price level. That is, the ERA cannot choose a price but must follow the process in the WEM Rules to determine the revised minimum STEM price.[81]

Synergy presented analysis that at -$250/MWh, the balancing market during the review period would have settled there 11 times. This is more than the nine times that the balancing market cleared at -$1,000/MWh during the review period.

Apart from the higher price resulting in a greater number of instances of minimum STEM price trading intervals, changes in bidding behaviour needs to be considered also. A higher minimum STEM price reduces the financial risk for participants and generators may be willing to bid greater quantities at this higher floor price. Greater quantities offered at the floor price increases the likelihood of the balancing market settling at the minimum STEM price.

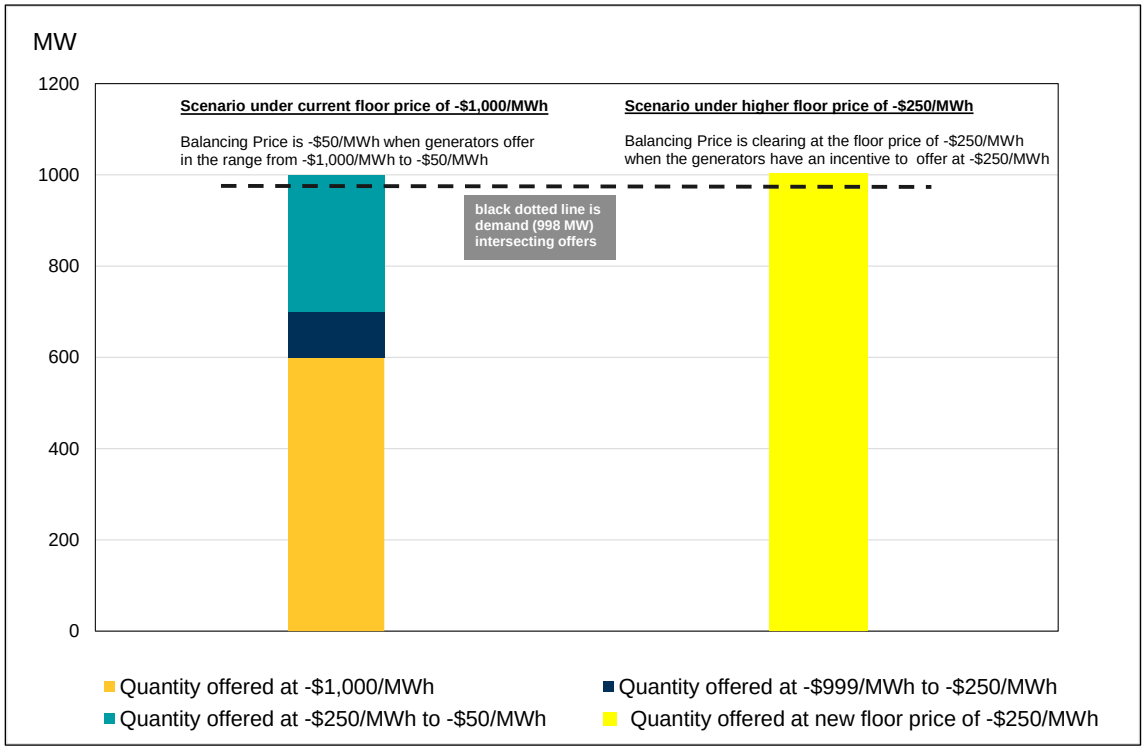
Accordingly, the ERA expanded its analysis to assess a minimum STEM price of -$250/MWh but with additional assumptions to account for possible changes to participants bidding behaviour. The ERA conducted a scenario analysis to assess whether the balancing market, when accounting for behavioural changes, would have settled at a higher -$250/MWh minimum STEM price during the post-review period. The assumptions of this analysis were (see Figure 3):

- Generators that currently offer quantities at the minimum STEM price of -$1,000/MWh would offer their quantities at a higher floor price of -$250/MWh.
- Generators offering quantities between -$999/MWh and -$250/MWh would offer their quantities at the higher floor price of -$250/MWh.
- Generators that currently offer quantities between -$249/MWh and -$50/MWh may decide to offer their quantities at the higher floor price of -$250/MWh. The ERA considered that this could occur for those generators that in the past, have bid at -$1,000/MWh (for example, on low demand days some generators have moved their bids to -$1,000/MWh to maintain or increase their priority for being dispatched).

Based on these assumptions, the simulated bidding scenario shows that the balancing market would have settled at the higher -$250/MWh minimum STEM price eight times in the post-review period. This compares against zero minimum STEM price outcomes under the current minimum STEM price of -$1,000/MWh during the same period.

[81] Wholesale Electricity Market Rules (WA), 1 July 2021, Rules 6.20.17 to 6.20.20

Figure 3: Scenario analysis between floor prices of -$250/MWh and -$1,000/MWh



Source: Example based on ERA analysis of market data.

The analysis demonstrated that a higher minimum STEM price of -$250/MWh is likely to attract greater quantities to be offered at that level. Greater quantities offered at the minimum STEM price will likely lead to the balancing market settling more often at -$250/MWh than at -$1,000/MWh. This outcome is not consistent with the minimum STEM price objective of allowing the balancing price to clear above the minimum STEM price in most circumstances.

As part of this -$250/MWh minimum STEM price assessment, one consequence of having the balancing market settle more often at the minimum STEM price is that AEMO may be required to intervene and dispatch down generators in the manner referred to in criterion 2 (see chapter 4). This is because of the tie-break process that determines which generators priced at the minimum STEM price will remain on, and which generators will be dispatched off.[82] The tie-break process results in a random order dispatch outcome, rather than a competitive market outcome. For example, for the October 2019 trading intervals where the balancing market settled at the minimum STEM price, AEMO stated:

> Generation that is offered at the Minimum STEM Price is ordered in accordance with the tie-break methodology which allocates a random order to all facilities, to apply for the Trading Day. As a result of this methodology the Bluewaters Unit 1, a 229 MW coal generation facility, was the marginal unit on both 12 and 13 October and was dispatched down to accommodate the low operational demand ….
>
> If demand had dropped a further 100 MW between the 12:00 and 1:00 Trading Intervals, Bluewaters Unit 1 would have been dispatched below its minimum stable generation level and therefore would have been de-committed. Large synchronous generators, such as Bluewaters Unit 1, inherently provide voltage support and inertia.

82 To determine the order of tied quantities in the balancing merit order, AEMO assigns a random number each day to each balancing facility, referred to as the tie-break process or methodology – Australian Energy Market Operator, 2019, *Market Procedure: Balancing Market Forecast*, pp. 10-11.

> AEMO must monitor this and may be required to take action in response to the potential de-commitment of a large synchronous generator when demand is low.[83]

If there was a materially higher minimum STEM price, analysis of criterion 2 in future reviews may lead to the conclusion that this higher minimum STEM price is not appropriate where AEMO had to intervene as described above.

[83] Australian Energy Market Operator, 2020, *Quarterly Energy Dynamics Q4 2019,* p.39.