

Minimum STEM price review 2021

Issues paper and preliminary findings

4 March 2021

Economic Regulation Authority

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Invitation to make submissions

Submissions are due by 4:00 pm WST, Thursday, 1 April 2021

The ERA invites comment on this paper and encourages all interested parties to provide comment on the matters discussed in this paper and any other issues or concerns not already raised in this paper.

We would prefer to receive your comments via our online submission form <https://www.erawa.com.au/consultation>

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Please note that submissions provided electronically do not need to be provided separately in hard copy.

All submissions will be made available on our website unless arrangements are made in advance between the author and the ERA. This is because it is preferable that all submissions be publicly available to facilitate an informed and transparent consultative process. Parties wishing to submit confidential information are requested to contact us at info@erawa.com.au.

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1. Introduction

The minimum Short Term Electricity Market (STEM) price is the lowest price that electricity can be offered at in the Wholesale Electricity Market's balancing market.¹ Following changes to the Wholesale Electricity Market (WEM) Rules in August 2020, the Economic Regulation Authority is required to review the minimum STEM price annually following a two-step process.² First, the ERA must determine whether the minimum STEM price is appropriate. Secondly, if the ERA determines that the minimum STEM price is not appropriate, then it must calculate a new minimum STEM price.

This is the ERA's first review of the minimum STEM price.

This issues paper considers the first step of the review process to determine whether the minimum STEM price is appropriate when assessed against the criteria specified in the WEM Rules.³ These criteria include evaluating the trading intervals where the market settled at the minimum STEM price, considering the Australian Energy Market Operator's (AEMO) dispatch for trading intervals that were forecast to settle at the minimum STEM price and assessing changes in the generation fleet during the review period.

The ERA's analysis and preliminary findings for these criteria are presented in sections 5 to 8 of this paper.

The ERA invites submissions on the questions in this issues paper and any other matters stakeholders consider relevant to assessing whether the minimum STEM price is appropriate. Information received during the consultation process will inform the ERA's draft determination.

Disclaimer

This issues paper has been published with links to documents on the Rule Change Panel's webpage that is currently hosted on the ERA's website. With the transfer of the Rule Change Panel's functions to Energy Policy WA, the location of those documents will change after 1 July 2021. It is anticipated that these documents will be accessible through Energy Policy WA's website from that date.

¹ The balancing market also has maximum price limits referred to as the maximum STEM price for non-liquid fuelled generators, and the alternative maximum STEM price for liquid fuelled generators. The maximum and minimum price limits also apply to the Wholesale Electricity Market's day-ahead short-term energy market.

² Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.13

³ Ibid, Rule 6.20.14

2. Review scope

There are two price caps for the WEM's balancing market.⁴ The price caps are:⁵

- A maximum price cap:
 - For non-liquid fuel generators, known as the maximum STEM price (currently \$267 per Megawatt-hour (\$/MWh)).
 - For liquid fuel generators, known as the alternative maximum STEM price (currently \$145.28/MWh + 19.808 times the net ex-terminal distillate fuel cost in \$/GJ).⁶
- The minimum price cap, or floor price, known as the minimum STEM price (currently -\$1,000/MWh).

This review considers the minimum STEM price only. For the first review, the ERA is required to consider the period from at least 1 October 2019 to 31 January 2021.⁷

This review does not consider whether there is a reason to have a floor price in the WEM's balancing market as it is not within the review scope specified in the WEM Rules.⁸ Clause 6.20.13 of the WEM Rules defines the scope of the review.

- 6.20.13. The Economic Regulation Authority must annually review the value of the Minimum STEM Price and must:
- (a) determine whether the Minimum STEM Price is appropriate in accordance with clause 6.20.14; 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.

To determine whether the minimum STEM price is appropriate, the ERA is required to assess the criteria in clause 6.20.14 of the WEM Rules. Sections 5 to 8 of this paper specifies each criterion.

If the ERA determines that the minimum STEM price is not appropriate, then the ERA is required to determine a new value for the minimum STEM price (clause 6.20.13(b)). The determination of a new minimum STEM price is only required if the ERA concludes that the current minimum STEM price is not appropriate.

If the ERA is required to determine a new minimum STEM price, the WEM Rules require the ERA to set the new price so that it meets the objectives specified in clause 6.20.16. These objectives are discussed in section 3 of this paper.

⁴ The price caps also apply to the WEM's day-ahead short-term energy market. The WEM Rules require this review to only consider the operation of the minimum STEM price for the balancing market.

⁵ Wholesale Electricity Market Rules (WA), 1 February 2021, Chapter 11 definition of Price Caps

⁶ Economic Regulation Authority, 2020, *2020 Energy price limits decision*, p. 1.

⁷ Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 1.35.2

⁸ 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.

The WEM Rules specify how the ERA must determine a new minimum STEM price.

- 6.20.17. When revising the value of the Minimum STEM Price in accordance with clause 6.20.13(b), the Economic Regulation Authority must:
- (a) determine for credible scenarios of low demand, the price at which the operator of the Facility with the highest cycling costs per MW in the scenario would, acting reasonably, decommit the Facility should the Balancing Price equal or fall below that price for a single Trading Interval; and
 - (b) revise the Minimum STEM Price to be the highest price determined under those scenarios that is lower than 95 percent of all of the prices determined under clause 6.20.17(a).

The WEM Rules require the ERA to prepare a draft determination on the appropriateness of the minimum STEM price.⁹ If the ERA finds that the price is not appropriate, the draft determination will also contain the ERA's determination of a new minimum STEM price. The ERA will prepare its draft determination following consideration of all submissions to this paper.

Following stakeholder consultation on the draft determination the ERA will prepare its final determination. Indicative dates for these determinations are set out in Table 1.^{10,11}

Table 1: 2021 minimum STEM price review indicative timeline

Milestone	Indicative timeline
Issues paper	March 2021 (with a 4-week consultation period)
Draft determination	June 2021 (with a 6-week consultation period)
Final determination	August / September 2021

⁹ Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.26

¹⁰ Ibid, Rule 6.20.27

¹¹ Ibid, Rule 6.20.29

3. Objectives of the minimum STEM price

The WEM Rules state the objectives of the minimum STEM price:¹²

- 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.

The clause 6.20.16 objectives for the minimum STEM price must be considered when determining the appropriateness of the minimum STEM price. The objectives must also be considered if the ERA is required to determine a new minimum STEM price.

In the review period, the balancing market settled above the minimum STEM price 99.96 per cent of the time. This is indicative that, in most circumstances, the balancing price cleared above the minimum STEM price.

The balancing market is more likely to settle at the minimum STEM price when demand for electricity is low and there is a surplus of generators offering at the minimum STEM price to avoid the costs of shutting down and restarting.

The ERA's interpretation of the clause 6.20.16(a) objective is that for low demand scenarios, the minimum STEM price must be set at a level low enough to allow generators to bid at negative prices according to the value these generators place on being dispatched. A generator would be willing to pay to continue generating (that is, sell its minimum generation quantity at negative prices) as long as the expected payment is less than the cost of shutting down and restarting, subject to any technical limitations such as minimum down times.¹³

The costs of shutting down and restarting a generator include fuel, maintenance, and opportunity costs. For example, the opportunity cost of the time that it takes for a generator to shut down and come back online is the lost revenue from those trading intervals where the plant is lying idle. The longer the shutdown and restart times for a generator, the larger the opportunity cost. The WEM Rules refer to these costs as cycling costs.¹⁴

The minimum STEM price must allow generators to be dispatched in the most efficient manner. This is important because the entrance of cheap renewable energy such as windfarms, which compete with conventional generation, and the penetration of rooftop solar lowering daytime demand, means there could be periods when baseload generators are not the most cost-effective source of electricity and therefore must shut down.

However, if the minimum STEM price is too high, this may restrict the market process to discover the lowest balancing price because it will limit the extent to which generators with high cycling costs can differentiate themselves from other generators. Generators that may have bid at a lower price will be competing with other generators also priced at the floor to remain dispatched where the market settles at the minimum STEM price.

¹² Ibid, Rule 6.20.16

¹³ The minimum level of generation is the minimum amount of electricity that a generator must generate for stable operations. The minimum down time is the amount of time that a generator must remain offline between shutdowns and restarts.

¹⁴ Cycling costs include start-up and shut down costs, any expected losses or gains, opportunity costs and cost savings. Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.19

This may also result in inefficient dispatch outcomes, 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.¹⁵ The tie-break process results in a random order dispatch outcome, rather than a competitive market outcome. This situation may also require AEMO to manually intervene in the dispatch process. 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 (purple tranches in Figure 59).

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. 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.¹⁶

Conversely, if the minimum STEM price is too low, it may be the case that some generators, such as those that provide ancillary services, are exposed where the market clears at this price because these generators must offer quantities at the minimum STEM price to provide these services (section 5.2 explains the requirements to bid at the minimum STEM price in these circumstances). The secondary objective of the minimum STEM price in clause 6.20.16(b) is to limit participants' exposure to this financial risk.

There may also be system operation consequences. If the minimum STEM price is set too low, generators may decide to turn off because it is not economical for them to remain on. Generators with longer restart times that have chosen to turn off (for example, base load coal generators) may be unable to restart when electricity demand increases. In these circumstances, AEMO may not have enough cheaply priced electricity supply to match the demand and may therefore need to use more expensive generators.

Questions

- Do stakeholders consider that the current minimum STEM price meets the objectives:
 - To allow the balancing market to clear above the minimum STEM price in most circumstances?
 - To limit market participants' exposure to balancing prices that would threaten their financial viability?

¹⁵ 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.

¹⁶ Australian Energy Market Operator, 2020, *Quarterly Energy Dynamics Q4 2019*, p.39.

4. Criteria for determining whether the minimum STEM price is appropriate

Step 1 of the review process requires the ERA to determine whether the minimum STEM price is appropriate by considering the following criteria specified in the WEM Rules:¹⁷

- Whether the balancing market clearing price 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.
- Whether AEMO dispatched facilities during the review period downwards below the quantities that were forecast to clear at the minimum STEM price because the price was too high. This criterion requires consideration of trading intervals where the balancing market was forecast to clear at the minimum STEM price (but did not necessarily clear at the floor price), and in such circumstances, whether AEMO decommitted a generator priced at the floor because another generator also priced at the floor did not decommit.
- Changes in the generation fleet in the South West Interconnected System (SWIS) during the review period, such as increased or decreased generator start-up and shutdown costs. 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 set higher.

The ERA must also consider whether any market participant informed the ERA during the review period that they considered the minimum STEM price is not appropriate.

The ERA has used market data to analyse the matters specified above. Sections 5 to 8 of this paper contains the ERA's analysis and preliminary conclusions for each criterion. The ERA seeks feedback from stakeholders on the analysis presented in sections 5 to 8 to assist the ERA in preparing its draft determination on whether the minimum STEM price is appropriate.

¹⁷ Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.14

5. Criterion 1 - Trading intervals when the balancing market settled at the minimum STEM price

The ERA is required to consider trading intervals within the review period where the balancing market price settled at the minimum STEM price:

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;

The ERA has:

1. Identified each trading interval where the balancing market settled at the minimum STEM price.
2. Identified the reasons that contributed to the balancing market settling at the minimum STEM price for each of the relevant trading intervals.
3. Considered whether the market settled at the minimum STEM price because the price was too high or for other reasons.

5.1 Trading intervals during the review period

For the ERA's first review, the WEM rules require the ERA to consider the period from at least the 1 October 2019 to the 31 January 2021. The balancing market settled at the minimum STEM price for the first time in October 2019, so the ERA has not considered any earlier periods in its analysis.

There were 23,472 30-minute trading intervals in the review period, 1 October 2019 to 31 January 2021.¹⁸ Table 2 shows the nine trading intervals where the final balancing price settled at the minimum STEM price. The final balancing price settled above the minimum STEM price for the remaining 99.96 per cent of trading intervals in the review period.

Table 2: Trading intervals which settled at the minimum STEM Price

Calendar date	Interval starting	Final demand RDQ ¹⁹ (MW)
12 October 2019	1:00pm	1,200.28
13 October 2019	12:00pm	1,157.15

¹⁸ The ERA has interpreted the review period start date to be the half-hour interval starting at 12:00am on 1 October 2019 and ending at the interval starting 11:30pm on 31 January 2021 as clause 1.35.2 of the WEM Rules specifies that the first review period does not distinguish between a trading day which commences at 8:00am compared to a calendar day which commences at 12:00am.

¹⁹ 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 MW. Forecast RDQ is representative of forecast demand and final RDQ is representative of final demand.

Calendar date	Interval starting	Final demand RDQ ¹⁹ (MW)
13 October 2019	1:00pm	1,167.29
15 August 2020	10:00am	1,434.75
15 August 2020	11:30am	1,270.06
15 August 2020	12:00pm	1,261.65
12 September 2020	12:30pm	1,030.01
12 September 2020	1:30pm	1,052.87
12 September 2020	2:00pm	1,117.77

Source: ERA analysis of market data.

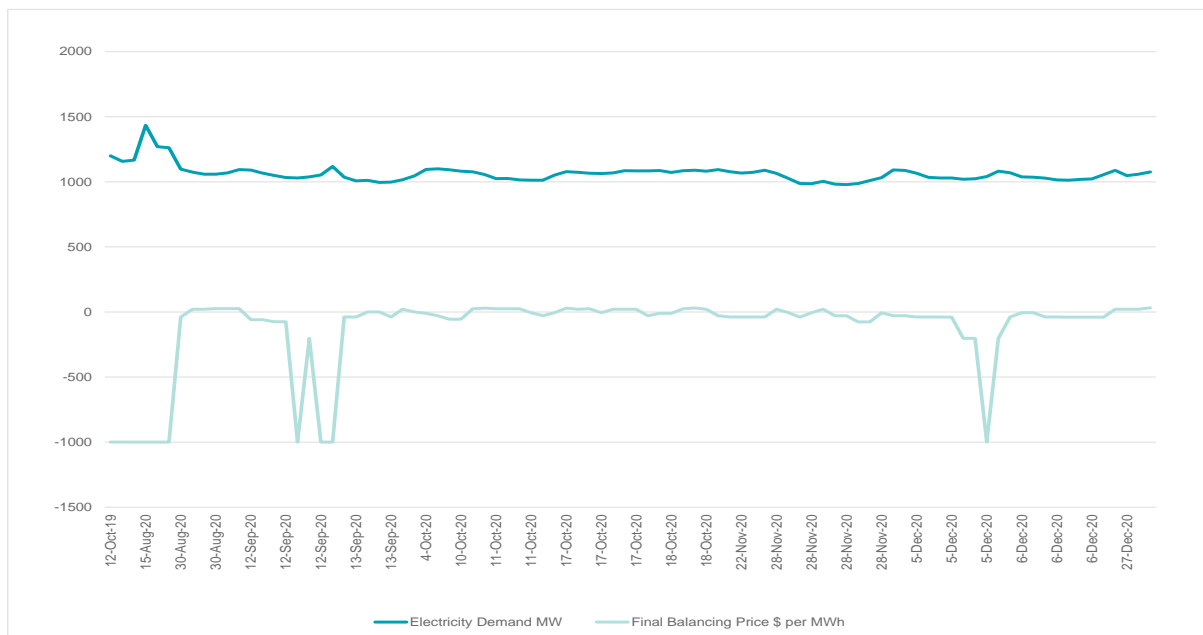
The balancing market is likely to settle at the minimum STEM price when the demand for electricity is low and there is a surplus of generators offering cheap electricity (albeit matters other than the level of the demand may need to be considered when assessing why the final balancing price settled at the minimum STEM price).²⁰

The lowest ever demand in the WEM of 978.59 MW was recorded over the weekend for the trading interval starting at 12:30pm on 28 November 2020 in the review period.²¹ However, the final balancing price for this trading interval settled at -\$28.75/MWh and not -\$1,000/MWh (the minimum STEM price).

There were an additional 80 trading intervals during the review period where demand ranged from approximately 979 MW to 1,100 MW. This range of demand was lower than the demand that occurred for seven of the nine minimum STEM price trading intervals, with the final balancing price not settling at the minimum STEM price for any of these intervals (Figure 1).

²⁰ Due to the continuous uptake of residential solar panels, the demand for electricity in the WEM has been low around midday, particularly on weekends.

²¹ This was the end of interval RDQ used by the AEMO to calculate the final balancing price for the 12:30pm interval, however AEMO has stated lowest operational demand, which is different to RDQ, was 985 MW for the 1:00pm interval in its Quarterly Energy Dynamics – Australian Energy Market Operator, 2020, *Quarterly Energy Dynamics Q4 2020*, p. 37.

Figure 1: Final balancing price for low demand intervals during review period

Source: ERA analysis of market data.

5.2 Generators bidding quantities of electricity at the minimum STEM price

The WEM Rules require generators that intend to provide ancillary services and those conducting approved commissioning tests to offer these quantities at the minimum STEM price to ensure these generators are dispatched to provide these services and perform these activities.²²

The WEM Rules also require non-balancing active generators to offer their quantities at the minimum STEM price.²³

Generators may also offer quantities at the minimum STEM price for commercial reasons. For example:

- Baseload and cogeneration plants may seek to avoid shutting down for short periods of time so that they do not incur large shutdown and restart costs.
- Contractual agreements may incentivise a generator to offer its quantities at the minimum STEM price.

Generators also bid at the minimum STEM price to ensure that they are dispatched when they expect prices will exceed their reasonable expectation of their Short Run Marginal Cost and they do not expect to have market power.²⁴ In these circumstances, generators may bid their minimum generation quantities at the minimum STEM price to secure dispatch.²⁵

²² Wholesale Electricity Market Rules (WA), 1 February 2021, Rules 7A.2.3 (commissioning test quantity) and 7A.3.5 (LFAS quantity).

²³ Australian Energy Market Operator, 'Balancing Market Participation', ([online](#)) [accessed 5 February 2021].

²⁴ Wholesale Electricity Market Rules (WA), 1 February 2021, Rules 7A.2.17

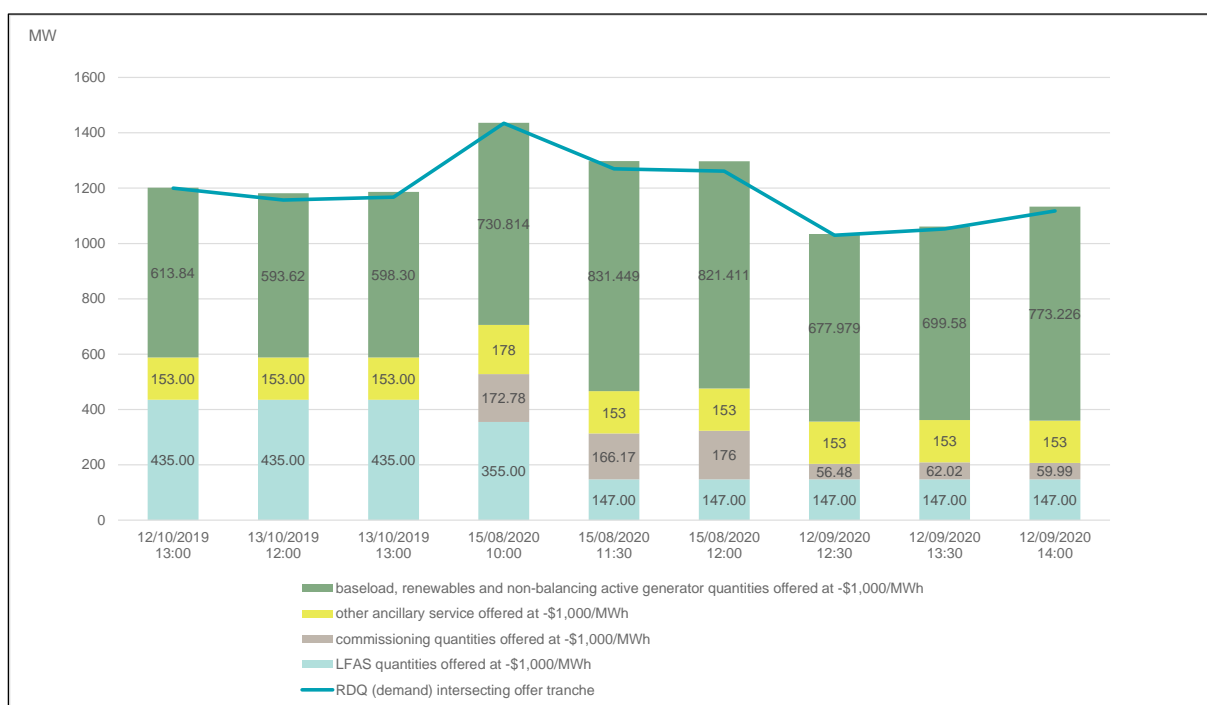
²⁵ Thermal generators have a 'minimum generation' level, below which their production is not stable.

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

Under clause 6.20.14(a) of the WEM Rules, the ERA is required to consider whether the balancing market cleared at the minimum STEM price because the price was too high. The ERA has analysed the nine trading intervals during the review period to consider whether the market settled at the minimum STEM price because the price was too high or for other reasons. Detailed analysis for each of the nine trading intervals is contained in Appendix 3. A summary of the ERA's observations is presented below.

Figure 2 shows the quantities offered at the minimum STEM price by various generator categories for the nine trading intervals when the balancing market cleared at the minimum STEM price.

Figure 2: Generator offer categories for the nine minimum STEM price trading intervals



Source: ERA analysis of market data.

Figure 2 shows that between 23 per cent and 50 per cent of the total offer quantities submitted at the minimum STEM price were from Load Following Ancillary Services (LFAS) and spinning reserve generators for the trading intervals that settled at the minimum STEM price. This included offer quantities from Synergy generators and non-Synergy generators.

The WEM Rules require generators that are cleared in 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. While the WEM requirement for LFAS was 85 MW for all nine intervals, up to 435 MW was offered at the minimum STEM price from LFAS generators. There was also up to 178 MW submitted at the minimum STEM price for spinning reserve.

The total quantity of LFAS and spinning reserve offers at the minimum STEM price created a surplus supply of cheaply priced generation in all the nine trading intervals.

Forecast demand was materially higher than the final demand for eight of the nine trading intervals where the market cleared at the minimum STEM price in October 2019, August 2020, and September 2020. Generators may not have expected the market to clear at the minimum STEM price for these intervals and made no change to their ancillary services offers or their balancing market offers.

The 1:00pm 12 October 2019 trading interval was the only interval where, at the time of gate closure for non-Synergy facilities, the market was forecast to clear at the minimum STEM price. At the time of LFAS gate closure, the balancing market was forecast to clear at a positive price (\$27.96/MWh). LFAS generators may not have expected the balancing market to clear at the minimum STEM price as there was no change in their balancing market offers.

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 these activities. From August 2020, quantities of up to 176 MW were required to be offered at the minimum STEM price for commissioning activities. This also contributed to the oversupply of cheaply priced generation in the August and September trading intervals where the balancing market cleared at the minimum STEM price.

Renewable generators have an incentive to be dispatched at negative prices that typically reflect the value of renewable subsidies and any contractual incentives for selling their energy in the balancing market.²⁶ For all nine trading intervals when the balancing market cleared at the minimum STEM price, renewable generators consistently offered between 103 MW and 156 MW at the minimum STEM price, which is likely to have been lower than the value of these incentives.

WEM generators 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. Some generators have, since August 2020, started using the offer range between -\$400/MWh and -\$999/MWh (see Table 68 in Appendix 4) indicating that generators are choosing to differentiate themselves from other generators and that their bidding behaviour is changing.

5.4 Preliminary findings

The ERA's preliminary findings for all nine trading intervals where the balancing market cleared at the minimum STEM Price is that:

- Demand forecasts did not signal to generators that the balancing market would clear at the minimum STEM price for eight of the nine trading intervals. Therefore, generators may not have expected the market to clear at the minimum STEM price for these intervals and made no change to their balancing market offers.
- The large quantity of energy offered by ancillary services generators and for commissioning activities at the minimum STEM price created a surplus of cheaply priced generation.

²⁶ 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.

- Generators did not submit offers in the range between -\$250/MWh and -\$999/MWh to price differentiate themselves from others for any of the nine trading intervals.
- Generators may have commercial incentives in their contractual arrangements to offer at the minimum STEM price, contributing to oversupply in low demand intervals.

These factors led to the oversupply in the nine intervals and led to the balancing market clearing at the minimum STEM price.

Questions

- How significant were AEMO's demand forecasts in participants' bidding decisions for the nine trading intervals when the market cleared at the minimum STEM price? Do market participants rely on their own forecast data and did this data indicate similar outcomes for these nine trading intervals?
- Why did generators choose not to use the offer range between -\$250/MWh and -\$999/MWh until recently? Do stakeholders agree that generators are more willing to use this range now?
- Do stakeholders agree with the ERA's observations that factors other than the level of the minimum STEM price, including over-forecasting of demand and quantities for ancillary services and commissioning, led to the balancing market clearing at the floor price for the nine trading intervals during the review period? If stakeholders disagree, please provide reasons.

6. Criterion 2 - AEMO's dispatch

The ERA is required to consider trading intervals where AEMO dispatched generators downwards 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 and 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) 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. The ERA does not need to consider trading intervals where generators were dispatched down out of merit or dispatched in connection with the provision of ancillary services.²⁷ To analyse this criterion, the ERA has:

1. Identified each trading interval where the balancing market was forecast to settle at the minimum STEM price. The ERA also examined trading intervals where the balancing market settled at the minimum STEM price.
2. For each of the intervals, considered whether AEMO did or did not dispatch 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 under the WEM Rules. Instead, the ERA has published representative examples of AEMO's dispatch where relevant.

6.1 Balancing market dispatch process

Market generators submit price and quantity offers into the WEM's balancing market to supply electricity for each 30-minute trading interval. These offers are called balancing submissions.

AEMO orders the balancing submissions in ascending price to create a forecast balancing merit order for each trading interval. AEMO is required to dispatch in accordance with the forecast balancing merit order quantities. AEMO uses electricity demand forecasts and non-scheduled generation data for each trading interval to determine which facilities in the forecast balancing merit order will be dispatched.

²⁷ 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.

The last forecast balancing merit order for a trading interval is published approximately 30 minutes before that trading interval commences.²⁸ AEMO calculates the quantities required for generation and issues dispatch instructions to each market participant. Dispatch instructions are issued prior to the commencement of the trading interval for generators to respond when the trading interval commences. AEMO calculates the quantities for these dispatch instructions approximately 10 to 15 minutes before the trading interval commences using the most recent available data including forecast demand and non-scheduled generation output.²⁹ AEMO may also issue intra-interval dispatch instructions to generators after the commencement of the trading interval in response to updated forecast information.

AEMO's dispatch for a trading interval may deviate from the forecast balancing merit order quantities for that trading interval, either in an upwards or downwards direction. This may occur due to changes in forecast demand, fluctuations in renewable 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 demand forecast approximately 30 minutes before the relevant trading interval, then less generation is required to be dispatched. 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 as it was produced 30 minutes prior to that trading interval commencing.

Clause 6.20.14(b) requires the ERA to consider trading intervals where the balancing price was forecast to clear at the minimum STEM price and AEMO dispatched a generator for a quantity less than its forecast cleared quantity because the minimum STEM price was too high. Downward dispatch instructions in response to falling demand are not due to the level of the minimum STEM price and the ERA has taken this into account when assessing relevant trading intervals where AEMO issued downwards dispatch instructions.

AEMO may be required to dispatch down a generator because the minimum STEM price is too high where there may be 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 based on their random assigned number, rather than a competitive market outcome.³⁰ This random outcome may require AEMO to manually intervene in the dispatch process to ensure that a scheduled generator remains on, and AEMO must therefore dispatch another generator to a lower quantity. The ERA has assessed whether there were any trading intervals of this kind in the review period.

6.2 Relevant trading intervals

To assess clause 6.20.14(b), 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 3.

²⁸ Australian Energy Market Operator, 2019, *Market Procedure: Balancing Market Forecast*, p7.

²⁹ 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.

³⁰ 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.

Table 3: 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 ³¹
12 October 2019 1:00pm	-213.65	1,202.762	-1,000.00	1,200.282	A
13 October 2019 12:00pm	-9.94	1,246.387	-1,000.00	1,157.152	A
13 October 2019 1:00pm	-195.98	1,205.215	-1,000.00	1,167.289	B
15 August 2020 10:00am	-202.41	1,511.534	-1,000.00	1,434.749	B
15 August 2020 11:30am	-1,000.00	1,240.599	-1,000.00	1,270.064	B
15 August 2020 12:00am	-1,000.00	1,264.455	-1,000.00	1,261.653	B
12 September 2020 12:30pm	-59.06	1,083.115	-1,000.00	1,030.014	B
12 September 2020 1:30pm	-38.97	1,119.389	-1,000.00	1,052.872	B
12 September 2020 2:00pm	-59.06	1,175.703	-1,000.00	1,117.77	B
13 September 2020 10:30am	-1,000.00	1,046.838	-38.88	1,035.836	C
13 September 2020 1:30pm	-1,000.00	999.102	0.01	1,045.336	C
13 September 2020 2:00pm	-1,000.00	1,067.841	-5.09	1,108.086	C
17 September 2020 12:00pm	-1,000.00	1,260.638	26.37	1,246.713	C
17 September 2020 12:30pm	-1,000.00	1,231.056	-202.41	1,241.523	C
17 September 2020 1:00pm	-1,000.00	1,211.969	20.74	1,259.013	C
5 November 2020 8:30am	-1,000.00	1,360.822	175.12	1,382.957	C

³¹ The trading intervals have been categorised as A, B, or C to assist the analysis in sections 6.3 and 6.4. 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 ³¹
5 November 2020 9:30am	-1,000.00	1,266.364	24.83	1,259.549	C
5 November 2020 10:00am	-1,000.00	1,238.69	29.42	1,245.344	C
5 November 2020 10:30am	-1,000.00	1,274.952	43.84	1,242.545	C

Source: ERA analysis of market data.

6.3 Trading intervals where the balancing market was forecast to settle at the minimum STEM price

The ERA reviewed the dispatch instructions for the 10 category C trading intervals in Table 3 that were forecast to settle at the minimum STEM price. The final balancing price for these trading intervals settled at a price higher than the minimum STEM price as shown in Table 3.

For one of these trading intervals, AEMO dispatched three generators (including the forecast marginal generator) priced at the minimum STEM price below their forecast balancing merit order cleared quantities (12:30pm 17 September 2020 trading interval).³² The final demand was slightly higher when compared to the forecast demand. The ERA reviewed this interval to consider the reason the generators were dispatched for the lesser quantities.

While AEMO initially dispatched down the marginal and two other generators before the commencement of the trading interval, it subsequently dispatched up all three generators during the interval to meet the rising demand. The ERA's observation is that the changes in electricity demand, after the determination of the forecast balancing merit order, led to the lower dispatch instructions. The lower dispatch instructions were not because the minimum STEM price was too high.

For the remaining intervals, AEMO's dispatch instructions and Synergy's dispatch were consistent with the forecast balancing merit order.³³

6.4 Trading intervals when the balancing market settled at the minimum STEM price

The ERA reviewed the nine intervals (categories A and B in Table 3) when the balancing market settled at the minimum STEM price.

³² Two intermittent non-scheduled generators were consistently dispatched down at a smaller amount (less than 1 MW) than the amount they were cleared for in the forecast balancing merit order across the 10 trading intervals. The dispatch instruction values were equivalent to the facility's maximum capacity amount. The dispatch deviations were considered of no consequence to this analysis given the small deviation.

³³ Synergy bids as a portfolio and does not receive dispatch instructions. The ERA compared the forecast balancing merit order, the final balancing merit order and the average energy produced by Synergy during all the trading intervals that were forecast to settle at or did settle at the minimum STEM price to analyse if AEMO dispatched down the Synergy portfolio.

For two of the nine trading intervals (category A) when the balancing price settled at the minimum STEM price, AEMO dispatched up the two forecast marginal units for quantities greater than the amount the forecast balancing merit orders indicated were required. The upward dispatch of these facilities is not within scope of clause 6.20.14(b) because it refers to downwards dispatch only (that is, dispatch of a facility below the sum of the MW quantities at the minimum STEM price). None of the remaining facilities priced at the minimum STEM price were dispatched down for these two trading intervals.

For the remaining seven trading intervals (category B), AEMO dispatched some facilities that were in merit, including the forecast marginal unit, for amounts lower than the values the forecast balancing merit orders indicated was required from these facilities.

For six of the seven trading intervals, electricity demand was falling. A simple example of AEMO dispatching down some facilities in these circumstances is shown in Table 4.³⁴ This example is representative of all six trading intervals.³⁵

Table 4: Dispatch instructions compared to forecast balancing merit order

Trading Interval	Balancing merit order position	Generator name	Forecast balancing merit order cleared quantity (MW)	Dispatch instruction (MW)
15 August 2020 1:00pm	In-merit	Other generators	1,027	1,027
15 August 2020 1:00pm	In-merit	Coal B	130	120
15 August 2020 1:00pm	Marginal unit	Windfarm A	70	65
Electricity demand (MW)			1,227 (forecast)	1,212 (final)

Source: Example based on ERA analysis of market data.

As observed in Table 4, the intermittent non-scheduled generator, Windfarm A, is the marginal unit in the forecast balancing merit order. AEMO dispatched down the scheduled generator, Coal B, as well as the marginal unit Windfarm A, for amounts lower (120 MW and 65 MW) than the forecast balancing merit order demand indicated was required (130 MW and 70 MW). The final demand also ended up being less than the forecast demand (1,212 MW). This means that less energy (15 MW) was required to be dispatched to meet the final demand than the amount originally forecasted.

For these six trading intervals, the ERA's preliminary finding is that falling electricity demand led to these downwards dispatch instructions.

In the remaining interval (11:30am 15 August 2020) final demand was higher than forecast demand. While AEMO initially dispatched down the marginal generator before the commencement of the trading interval, it was subsequently dispatched up during the trading

³⁴ The simple example does not include any intra-interval dispatch instructions that may have been issued by AEMO or updated renewable generation data that may be considered by AEMO when calculating dispatch instruction quantities.

³⁵ The ERA has not published the actual data because dispatch instructions are confidential.

interval to meet rising demand. The ERA's preliminary finding is that changes in electricity demand led to these dispatch instructions being issued.

6.5 Consultation with AEMO

The ERA consulted with AEMO on its analysis of the 19 trading intervals that either were forecast to settle or settled at the Minimum STEM Price. AEMO confirmed the ERA's observations and preliminary findings and informed the ERA that its dispatch decisions are guided by demand and power system security rather than the minimum STEM price being too high.³⁶

6.6 Preliminary findings

The ERA's analysis of the 19 trading intervals and consultation with AEMO 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 were due to changes in forecast demand and renewable generation output requiring generation to be dispatched down at the time these instructions were issued.

Question

- Do stakeholders agree with the ERA's preliminary findings that AEMO did not dispatch any generators down during the review period because the minimum STEM price was too high? If stakeholders disagree, please provide reasons and evidence.

³⁶ 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.

7. Criterion 3 - Changes in the generation fleet

The ERA must consider changes in the generation fleet under clause 6.20.14(c) of the WEM Rules:³⁷

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.

The ERA's assessment under this criterion is to:

1. Identify any changes to the generation fleet over the review period. The changes in the generation fleet that fall within scope of this review include new entrants, plant retirements, upgrades to or deterioration of plants.
2. Assess whether those identified changes mean that relevant generators' cycling costs have changed such that the minimum STEM price may be too low or too high.^{38, 39, 40} This assessment must specifically consider the objective that the balancing price must clear above the minimum STEM price in most circumstances.⁴¹

7.1 Generator cycling costs

Part of the commercial considerations of running a generator is comparing the cost of a shut down and subsequent restart of a plant against the cost of keeping the plant running at its minimum level of generation (known as mingen) over that same period.⁴² An example is for base load generators that continue to operate even when electricity demand and forecast balancing prices are low as the costs of shutting down the plant are large:⁴³

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

³⁷ Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.14(c)

³⁸ For the ERA's determination on whether the minimum STEM price is appropriate, the set of 'relevant generators' are the generators with high cycling costs that generally bid some of their electricity at the minimum STEM price. These are predominantly base load fuelled generators.

³⁹ Cycling costs include start-up and shut down costs, any expected losses or gains, opportunity costs and cost savings. Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.19

⁴⁰ For example, where a high cycling cost generator's costs have gone down but another high cycling cost generator's costs have gone up, the ERA's assessment will consider how those generators' changing costs will affect the amount of electricity that is likely to be bid by those generators at the minimum STEM price.

⁴¹ Wholesale Electricity Market Rules (WA), 1 February 2021, Rules 6.20.14(c) and 6.20.16(a)

⁴² The minimum level of generation is the minimum amount of electricity that a generator must generate for stable operations.

⁴³ Economic Regulation Authority, 2008, *Portfolio Short Run Marginal Cost of Electricity Supply in Half Hour Trading Intervals – Technical Paper*, pp. 16-17.

plant up again when it is required.⁴⁴ 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.

If a generator's cycling costs change, for example, due to an upgrade that reduces the cost and/or time of a generator's shut down and restart, during low demand trading intervals the generator may be more willing to bid at a less negative price higher than the level of the current minimum STEM price. The minimum STEM price may therefore not be appropriate if most of the high cycling cost generators have undergone upgrades that have reduced their cycling costs.

If cycling costs for relevant generators have increased (for example, due to an increase in start-up and shut-down costs), then the current minimum STEM price may be set too high as the balancing price may settle at the minimum STEM price more often as generators cannot bid low enough to differentiate their willingness to shut down.

7.2 Method for assessing changes to the generation fleet

The WEM Rules require the ERA to consider changes to the generation fleet during the review period, 1 October 2019 to 31 January 2021. The state of the generation fleet at the beginning of the review period will be used as the reference point for assessing changes to the fleet up to 31 January 2021.

The primary consideration is if there have been material changes to generator start-up and shut down costs and the associated shut down, offline and restart times. The ERA requests short run marginal cost data from generators quarterly, which includes cycling costs information.

The ERA has used the latest cycling cost information that market participants have provided for its preliminary assessment of changes to the generation fleet.⁴⁵ The ERA examined relevant generators (those with high cycling costs) that typically bid some of their electricity at the minimum STEM price over the review period. The ERA also considered changes to generator shutdown and restart times.

The ERA assumes that there have been no changes to a generator's costs since the last date the data was made available to the ERA, unless advised otherwise. Market participants may wish to provide updated cycling cost information in response to this issues paper.

7.3 Preliminary findings

A total of 622 MW of new generation capacity connected to the SWIS during the review period. This generation capacity was made up entirely of renewable generators. Renewable generators have an incentive to be dispatched at negative prices that can reflect the value of renewable subsidies and contractual incentives from selling their energy in the balancing

⁴⁴ 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.

⁴⁵ The ERA receives short run marginal cost data from generators quarterly.

market, rather than to avoid cycling costs.⁴⁶ Therefore, this additional 622 MW of new renewable 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 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, which can result in more wear and tear and higher maintenance needs.⁴⁷ Consequently, cycling costs would increase for these generators and these increases would be assessed under this criterion. However, entry of renewable generation capacity was only recent and no updated information has been received from relevant generators that shows increased cycling costs due to the entry of more renewable capacity.⁴⁸

During the review period the ERA received updated information from a small number of generators. Most of the generators with high cycling costs have not reported any change to their costs.

In the absence of further updated information, the ERA's preliminary findings in this issues paper under this criterion are that there has not been a material change in the generation fleet that is likely to mean the minimum STEM price is too high or too low because the set of generators with the highest cycling costs have remained largely unchanged during the review period.⁴⁹ The ERA encourages generators to provide updated cycling cost information in response to this issues paper.

7.4 New technologies

The reforms to the WEM will encourage new technologies such as storage to enter the market. Generally, storage technologies do not have high cycling costs and are designed to take advantage of cheap electricity and resupply it to the grid when there is higher demand (shown through higher prices). The development of storage technology is not expected to significantly affect the assessment of the minimum STEM price in this review but may need to be considered in future reviews.⁵⁰

The likely effect of storage is to lessen the dips and peaks of electricity demand and supply during the day. Storage may decrease the likelihood of minimum STEM price trading intervals occurring because the more negative the electricity price, the greater the incentive to store that electricity. Since storing electricity equates to more demand, this additional demand lessens the likelihood that total demand will fall low enough to equal the electricity quantities bid at the minimum STEM price. As storage becomes more prevalent in the WEM, future reviews will examine the effect on minimum STEM price occurrences.

⁴⁶ An example of these incentives is the Renewable Energy Certificates that are an alternative energy revenue source for renewable generators.

⁴⁷ Since renewable 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 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.

⁴⁸ 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.

⁴⁹ Due to the confidentiality of short run marginal cost data (which includes start-up and shutdown costs), this information is not published.

⁵⁰ Storage technology may be considered in future review when assessing clause 6.20.14(a) criterion - Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.14(a)

Questions

- To allow the ERA to make a more informed assessment of changes to generators' cycling costs, relevant generators are requested to provide:
 - Cycling cost information, including the time requirements for shutting down and restarting their generator.
 - The date/s that the updated cost information became effective from.^{51,52}
- The ERA will respect the confidentiality of any information provided.
- Do stakeholders agree with the ERA's interpretation of this criterion and support the ERA's method of assessment? If stakeholders disagree, please provide reasons.

⁵¹ For the ERA's determination on whether the minimum STEM price is appropriate, the set of 'relevant generators' are the generators with high cycling costs that generally bid some of their electricity at the minimum STEM price. These are predominantly base load generators.

⁵² Cycling cost information includes start-up and shut down costs, any expected losses or gain, opportunity costs and cost savings. Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.19

8. Criterion 4 - Stakeholder requests to review the minimum STEM price

The ERA is required to consider stakeholders' views on whether the minimum STEM price is appropriate:⁵³

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:

...

- (d) a Market Participant has notified the Economic Regulation Authority that it considers the Minimum STEM Price is not appropriate or requested the Minimum STEM Price be revised or amended and provided reasons for the basis of its consideration or request.

8.1 Market participants' opinions on the Minimum STEM Price

The ERA has not received any notifications from market participants that the minimum STEM price is not appropriate, nor has it received any requests to amend or revise the minimum STEM price during the review period.

The ERA is aware that in 2019, market participants made submissions on the appropriateness of the minimum STEM price in response to Synergy's rule change proposal to implement an interim floor price and an annual review process.⁵⁴

Bluewaters Power 1 Pty Ltd and NewGen Power Kwinana considered that the minimum STEM price was unfit for purpose, citing that the price of -\$1,000/MWh was arbitrary and did not reflect any generator's operational expectation of decommitment costs and therefore led to perverse market bidding behaviour.^{55,56} Perth Energy considered that there was no problem with the minimum STEM price itself but that the issue was with the bidding behaviour amongst the market generators bidding at the minimum STEM price.⁵⁷

Questions

- Do market participants consider the minimum STEM price of -\$1000/MWh to be appropriate? Please provide reasons and evidence in support of your opinion.
- Are there any other matters not raised in this issues paper that the ERA should consider in its assessment of the appropriateness of the minimum STEM price?

⁵³ Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.14(d)

⁵⁴ Rule Change Panel, 2020, *Final Rule Change Report: Amending the Minimum STEM Price definition and determination (RC_2019_05)*, pp. 14-23.

⁵⁵ Bluewaters Power 1 Pty Ltd, 18 December 2019, Submission to *Amending the Minimum STEM Price definition and determination – Rule Change Notice*, p. 1.

⁵⁶ NewGen Power Kwinana, 18 December 2019, Submission to *Amending the Minimum STEM Price definition and determination – Rule Change Notice*, p. 1.

⁵⁷ Perth Energy, 18 December 2019, Submission to *Amending the Minimum STEM Price definition and determination – Rule Change Notice*, p. 2.

9. Summary of preliminary findings

The ERA has completed its analysis of the four criteria specified in the WEM Rules.⁵⁸ The ERA's preliminary findings for these criteria are:

- Criterion 1 - Trading intervals when the balancing market settled at the minimum STEM price (Chapter 5).
 - This criterion requires the ERA to consider whether the balancing market settled at the minimum STEM price because the minimum STEM price was too high.
 - The balancing market cleared at the minimum STEM price in nine trading intervals in the review period. The factors that led to the balancing market clearing at the minimum STEM price in all nine trading intervals included:
 - Demand forecasts that did not signal to generators that the balancing market would clear at the minimum STEM price in eight of the nine trading intervals. Generators may not have expected the balancing market to clear at the minimum STEM price for these intervals and made no change to their balancing market offers.
 - The large quantity of electricity offered by ancillary services generators and for commissioning activities at the minimum STEM price. This created a surplus of cheaply priced electricity.
 - Generators not submitting negative offers in the range between -\$250/MWh and -\$999/MWh to price differentiate themselves from others during periods of low demand.
 - Generators having commercial incentives (for example, through contractual arrangements) to offer at the minimum STEM price which contributed to an oversupply of cheaply priced electricity in low demand intervals.
- Criterion 2 - AEMO's dispatch (Chapter 6).
 - This criterion requires the ERA to consider whether AEMO dispatched generators downwards when compared to the forecast balancing merit order because the minimum STEM price was too high.
 - There were 19 trading intervals in the review period that were either forecast to settle or settled at the minimum STEM price. AEMO dispatched generators downwards in eight of these trading intervals.
 - The reasons AEMO dispatched generators downwards were due to changes in forecast demand and renewable generation output.
- Criterion 3 - Changes in the generation fleet (Chapter 7).
 - This criterion requires the ERA to consider whether there have been changes to the generation fleet in the SWIS that makes the current minimum STEM price to be either too high or too low.
 - In the review period, 622 MW of renewable electricity capacity entered the SWIS. The entrance of this capacity is not directly relevant to the assessment of changes in the generation fleet.⁵⁹

⁵⁸ Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.14

⁵⁹ Renewable generators have an incentive to be dispatched at negative prices that can reflect the value of renewable subsidies and contractual incentives from selling their energy in the balancing market, rather than to avoid cycling costs. Therefore, this additional 622 MW of new renewable 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.

- Most generators with high cycling costs that typically bid at the minimum STEM price have not reported a change to their cycling costs over the review period.
- Criterion 4 - Stakeholder requests to review the minimum STEM price (Chapter 8).
 - This criterion requires the ERA to consider whether any market participant notified the ERA that it considered the minimum STEM price is not appropriate.
 - The ERA did not receive any notifications from market participants that the minimum STEM price is not appropriate, nor did it receive any requests to amend or revise the minimum STEM price during the review period. The ERA will consider any submissions in response to the issues paper for this criterion.

10. Next steps

The ERA will consider all submissions received in response to this issues paper. The ERA will then complete its assessment of the appropriateness of the minimum STEM price. This will be detailed in the draft determination.

If the ERA concludes that the minimum STEM price is not appropriate, then the ERA will determine a new value.⁶⁰ The analysis for the determination of the new value will be included in the draft determination.⁶¹

Stakeholders will have six weeks to provide submissions on the ERA's draft determination.⁶² The ERA will then prepare and publish its final determination. If the final determination contains a revised minimum STEM price, AEMO must implement the price from the commencement date set in that determination.⁶³ Indicative dates for these determinations are set out in Table 1.

⁶⁰ The criteria for determining if the minimum STEM price is appropriate is in clause 6.20.14 of the WEM Rules. Clauses 6.20.16 to 6.20.20 describe what the ERA must do when determining a revised minimum STEM price.

⁶¹ Wholesale Electricity Market Rules (WA), 1 February 2021, Rule 6.20.26

⁶² Ibid, Rule 6.20.27

⁶³ Ibid, Rule 6.20.29. The commencement date of a revised minimum STEM price must be at least five business days after the publication of the ERA's final determination.

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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 5.

Table 5: October 2019 - Final vs AEMO's forecast balancing price and demand⁶⁴

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	-1,000.00	1,200.28	-1,000.00	1,193.67	27.96	1,314.85
13 October 2019	12:00pm	-1,000.00	1,157.15	-15.13	1,234.39	-15.13	1,230.93
13 October 2019	1:00pm	-1,000.00	1,167.29	-5.21	1,289.59	-15.13	1,247.60

Source: ERA analysis of market data.

The reasons that contributed to the market clearing 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 clear 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 clear 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.⁶⁵ 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 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

⁶⁴ 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 5. These arrangements were revised to shorter timeframes from 1 December 2020 onwards.

⁶⁵ The LFAS market gate closure closes before the balancing market's gate closure.

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 5. Four generators were cleared to provide a total 85 MW of LFAS for these trading intervals.⁶⁶

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 2 in section 5.2). 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.^{67,68} 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 2 in section 5.2.
- **Renewable generators:** Renewable 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.⁶⁹ Renewable 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 5.

⁶⁶ NEWGEN_KWINANA_CCG1, ALINTA_PNJ_U2, ALINTA_PNJ_U1 and PORTFOLIO (Synergy's Portfolio is treated as a single generator).

⁶⁷ Muja_G5, Muja_G7, BW1_BLUEWATERS_G2 and BW2_BLUEWATERS_G1

⁶⁸ The ERA assumed that some Portfolio offers at the minimum STEM price reflect coal fuelled generators.

⁶⁹ An example of these incentives is the Renewable Energy Certificates that are an alternative energy revenue source for renewable 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 6.

Table 6: 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	-1,000.00	1,434.75	-10.08	1,716.54	-10.08	1,674.59
15 August 2020	11:30am	-1,000.00	1,270.06	-115.00	1,422.83	-38.97	1,499.14
15 August 2020	12:00pm	-1,000.00	1,261.65	-202.41	1,399.94	-38.97	1,472.43

Source: ERA analysis of market data.

The reasons that contributed to the market clearing 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 clear 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 6.
- **New generators undertaking commissioning activities:** New renewable 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 generators:** About 144 MW from renewable 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 6.

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 7.

Table 7: 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	-1,000.00	1,030.01	-59.06	1,088.84	-38.88	1,200.52
12 September 2020	1:30pm	-1,000.00	1,052.87	-38.97	1,149.93	-10.08	1,259.68
12 September 2020	2:00pm	-1,000.00	1,117.77	-38.97	1,206.24	-10.08	1,258.73

Source: ERA analysis of market data.

The reasons that contributed to the market clearing 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 clear 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.⁷⁰ 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 7.
- **Renewable generators:** The quantity of electricity offered by renewable 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 7.

⁷⁰ 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

Table 8: Sample of balancing market offers between -\$400/MWh and -\$999/MWh

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.