2019 Energy Price Limits Decision

July 2019

Economic Regulation Authority
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1. Decision

Under clause 2.26 of the Wholesale Electricity Market Rules the Economic Regulation Authority approves:

- the proposed revised value for the maximum Short-Term Energy Market (STEM) price of $235/MWh; and
- the proposed price components for the alternative maximum STEM price:
  - $120.72/MWh + 21.2297 multiplied by the net ex-terminal distillate[1] fuel cost in $/GJ.

The approved revised values for the maximum STEM price and the alternative maximum STEM price will apply with effect from the time specified in a notice to be published on the Australian Energy Market Operator's website.[2]

[1] Distillate is another term used for diesel fuel and its price is currently based on the Perth Terminal Gate Price (less excise and GST).

[2] Clause 6.20.11 of the Market Rules.

2. Background

In the Wholesale Electricity Market (WEM), market participants offer energy and ancillary services to meet real-time demand for energy. Supply offers in the energy markets (short term energy market (STEM) and balancing market) are based on the cost of supply and are subject to a set of energy price limits to mitigate the exercise of market power.[3] The energy price limits comprise:

- The maximum STEM price: this applies to the generation of electricity from all facilities except those using distillate as the fuel source. The maximum STEM price is determined by the cost of gas-fired generation.[4]
- The alternative maximum STEM price: this applies to generators that use distillate as a fuel source and who typically have a higher cost of supply.[5]
- The minimum STEM price: this is fixed by the Market Rules at negative $1,000/MWh.[6]

Using the method described in the Market Rules[7], the Australian Energy Market Operator (AEMO) annually reviews the energy price limits and may propose revised values for the maximum STEM price and the alternative maximum STEM price.

AEMO estimates the maximum STEM price and alternative maximum STEM price based on the average variable cost of the highest cost generating works in the South West Interconnected System[8] (SWIS) using the following formula:

$$(1 + risk\ margin) \times \frac{variable\ O\&M + (heat\ rate \times fuel\ cost)}{loss\ factor} \qquad (1)$$

where,

- $risk\ margin$ is a measure of uncertainty in the assessment of the mean short-run average cost of a 40 MW open cycle gas turbine generating station, expressed as a fraction.
- $variable\ O\&M$ is the mean variable operating and maintenance (O&M) cost of a 40 MW open cycle gas turbine generating station, expressed in $/MWh, and includes, but is not limited to, start-up related costs.
- $heat\ rate$ is the mean heat rate at minimum capacity of a 40 MW open cycle gas turbine generating station, expressed in GJ/MWh.
- $fuel\ cost$ is the mean unit fixed and variable fuel cost of a 40 MW open cycle gas turbine generating station, expressed in $/GJ.
- $loss\ factor$ is the marginal loss factor of a 40 MW open cycle gas turbine generating station relative to the reference node.[9]

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3 Other market power mitigation mechanisms in the WEM include mandatory provision of capacity in the STEM and balancing markets (based on expected SRMC) and ex post market monitoring/screening.

4 Clause 6.20.2 of the Market Rules

5 Clause 6.20.3 of the Market Rules

6 Clause 7A.2.4 of the Market Rules.

7 Clause 6.20.7 of the market rules.

8 The highest cost generating works in the SWIS are the open-cycle gas turbine generators close to 40 MW in capacity, such as the Pinjar, Parkeston and Mungarra units. Mungarra is no longer participating in the wholesale energy market.

9 Under the Market Rules, the reference node is defined as the Muja 330kV busbar (relative to which loss factors are defined).

The Market Rules specify using the mean of variable O&M cost, fuel cost and heat rate to determine the mean short-run marginal cost. These parameters or inputs are subject to variability, and the formula for determining both the maximum STEM price and the alternative maximum STEM price includes risk margin to account for the variability.

In practice, AEMO's consultant generates distributions for the uncertain parameters in the calculation and determines a distribution for the short-run average variable cost.

Historical practise has derived the energy price limits from the mean of the short-run average cost distribution plus a risk margin. The difference between the mean and the 80^{th} percentile of the distribution is used as the risk margin, which is an output of the distribution calculation. The resulting energy price limit is therefore equal to the 80^{th} percentile of the distribution based on the mean plus risk margin.

The maximum STEM price limit is reviewed annually by AEMO is accordance with the Market Rules and remains constant until AEMO proposes a revised value and the value is subsequently approved by the ERA.

The alternative maximum STEM price is indexed to the distillate price:

- AEMO uses the calculation method explained above and annually determines a regression equation that calculates the alternative maximum STEM price based on a fuel independent ("non-fuel") component plus a fuel cost component that is proportional to the net ex-terminal distillate price.
- Each month AEMO determines the alternative maximum STEM price by substituting the current net ex-terminal distillate price into the regression equation.

AEMO publishes a draft report on its review of the energy price limits and requests submissions from stakeholders, including end-users, within six weeks of the date of publication.[10] AEMO considers the submissions on the draft report and proposes final energy price limits in its final report to the ERA for approval.[11]

The ERA reviews AEMO's final report and decides whether to approve or reject the proposed energy price limits. In approving or rejecting the energy price limits proposed by AEMO, the ERA must follow the process set out in clause 2.26.1 of the Market Rules which requires the ERA to:

- review the report provided by AEMO, including all submissions received by AEMO in preparation of the report;[12] and
- in making its decision, only consider:
    i. Whether the proposed revised value for the energy price limit proposed by AEMO reasonably reflects the application of the method and guiding principles described in clause 6.20 of the Market Rules.

    ii. Whether AEMO has carried out an adequate public consultation process.[13]

10 Clause 6.20.9 of the Market Rules.

11 Clause 6.20.10 of the Market Rules. AEMO must also provide the ERA with any submissions it receives during its consultation process.

12 Clause 2.26.1(a) of the Market Rules.

13 Clause 2.26.1(c) of the Market Rules.

3. AEMO's process and results

This year AEMO engaged consultants Marsden Jacob Associates (Marsden Jacob) to do its energy price limits review modelling and report. In prior years AEMO used Jacobs Group Australia (Jacobs).

AEMO's consultant Marsden Jacob prepared a draft report, which AEMO released for public consultation on 12 April 2019.[14] AEMO published a revised draft report on 21 May 2019 updated in response to early stakeholder comments, including from the ERA.[15] The consultation period was extended from 24 May 2019 to 31 May 2019. AEMO did not receive any submissions.

On 12 June 2019, AEMO provided the ERA with its final proposed values for the energy price limits and suggested that the proposed energy price limits could take effect on 1 July 2019.[16]

3.1 Maximum STEM price

The maximum STEM price is based on AEMO's estimate of the average variable cost of the highest cost generating works fuelled by natural gas.[17] It is based on the annual forecast gas price and is fixed during the period it effects. Table 1 shows the existing and proposed maximum STEM price.

Table 1. Existing and proposed Maximum STEM Price

Effective date	Maximum STEM price ($/MWh)
1 July 2018 (approved)	302
1 July 2019 (proposed)	235

Figure 1 shows the main factors contributing to the change in the proposed maximum STEM price from 2018/19.

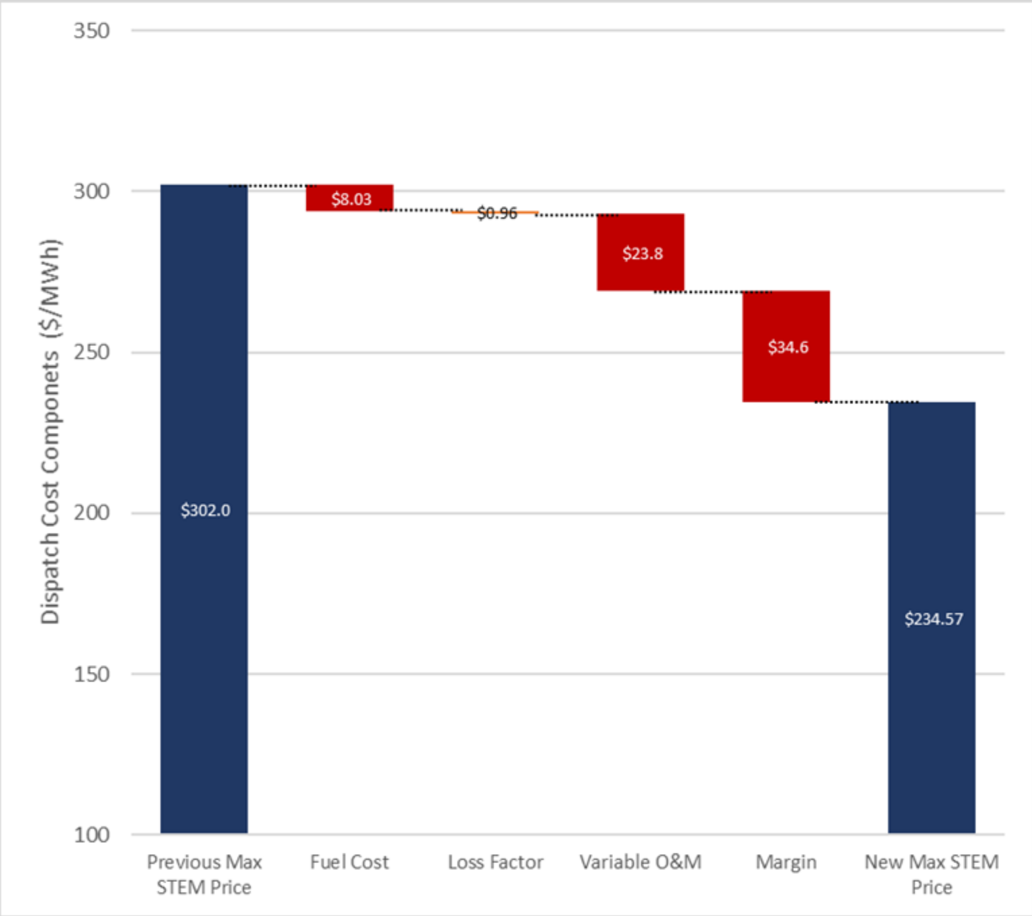
14 AEMO website, 2019 Energy Price Limits Review, (online)

15 Ibid, version 2

16 Marsden Jacob report (online)

17 Clause 6.20.7(a)(i) of the Market Rules.

Figure 1: Factors contributing to the change in the proposed Maximum STEM Price compared to 2018/19 [18]



Source: Marsden Jacob analysis 2019

Notes: The changes in Mean Fuel Cost and Mean Variable O&M have been loss factor adjusted, and so are slightly different to the values discussed immediately below.

Dispatch cost is equivalent to short-run average cost.

The main factors contributing to the decrease in the proposed maximum STEM price are summarised below and explained in more detail in section 4:

- Lower mean variable O&M cost ($104.98 per MWh compared to $129.59 per MWh last year). The average variable O&M cost per start (based on overhaul costs) increased slightly from last year, but was offset by the significantly higher quantity of energy generated per start (38.5 MWh compared to 26 MWh last year), based on five years of Pinjar unit dispatches for events of six hours duration or less. This was the dominant cause of the reduction in the mean variable O&M cost. The use of factored starts this year also reduced the mean variable O&M cost slightly.[19]
- The calculations of the mean variable O&M cost for the Pinjar units have been highly variable in past years. To a large extent this has resulted from changes in underlying

18 Source: Marsden Jacob report (online)

19 Factored starts are estimated based on the following: low loads (less than 60 per cent of maximum capacity of a unit) represent 0.5 of a normal start; whereas all other starts represent 1.2 actual starts. Based on historical operations, 69 per cent of actual starts for the Pinjar Units are low load starts. This implies that factored starts are 40.2 when actual starts are 58 for the Pinjar Units. Factored starts are used to determine Type A and B overhauls, while actual starts are used to determine Type C overhauls.

modelling and does not reflect any changes to the actual costs of maintaining the Pinjar Units.

- Lower mean fuel cost ($8.29 per MWh lower in 2019/20) resulted from lower gas commodity prices. The delivered cost (including transport) of spot gas is forecast by Marsden Jacob to be $5.445 per GJ for 2019/20.[20] The mean delivered gas cost was forecast to be $6.31 per GJ in 2018/19. The lower delivered spot price for gas has resulted from the continued high level of gas supply in the domestic market, which caused average source (excluding transport) spot gas price forecasts to decrease to $3.41 per GJ in 2019/20, compared to average source spot prices of $4.00 per GJ for 2018/19. The underlying source mean spot gas price forecast used in the 2018/19 energy price limits review was $4.02 per GJ.
- Reduced risk margin value (11.6 per cent compared to 24.2 per cent) due to a smaller variation in the distribution of maximum STEM price input components, which is mainly a function of the reduced variation in variable O&M costs and delivered (spot) gas prices. This is explained in more detail in section 4.8.

3.2 Alternative maximum STEM price

Each month, AEMO calculates the alternative maximum STEM price using a linear equation and a monthly forecast of distillate price:

$$\begin{aligned}&alternative\ maximum\ STEM\ price\\&= fuel\ coefficient\ \times\ Net\ Ex\ Terminal\ distillate\ fuel\ cost\ in\ \$/GJ\\&+ non - fuel\ coefficient\end{aligned}$$

As part of its annual review of energy price limits, AEMO estimates the fuel coefficient and non-fuel coefficient to apply for the determination of the alternative maximum STEM price for the next year:

- The fuel coefficient for the alternative maximum STEM price is multiplied by the distillate fuel price to estimate the contribution of fuel price to the alternative maximum STEM price.
- The non-fuel coefficient for the alternative maximum STEM price captures the contribution of variable O&M costs and fuel transport costs.

Table 2 shows the existing and proposed components of the alternative maximum STEM price.

Table 2. Existing and proposed components of the Alternative Maximum STEM Price

Effective date	Non-fuel coefficient of the Alternative Maximum STEM Price ($/MWh)	Fuel coefficient of the Alternative Maximum STEM Price
1 July 2018 (approved)	189.27	19.211
1 July 2019 (proposed)	120.72	21.2297

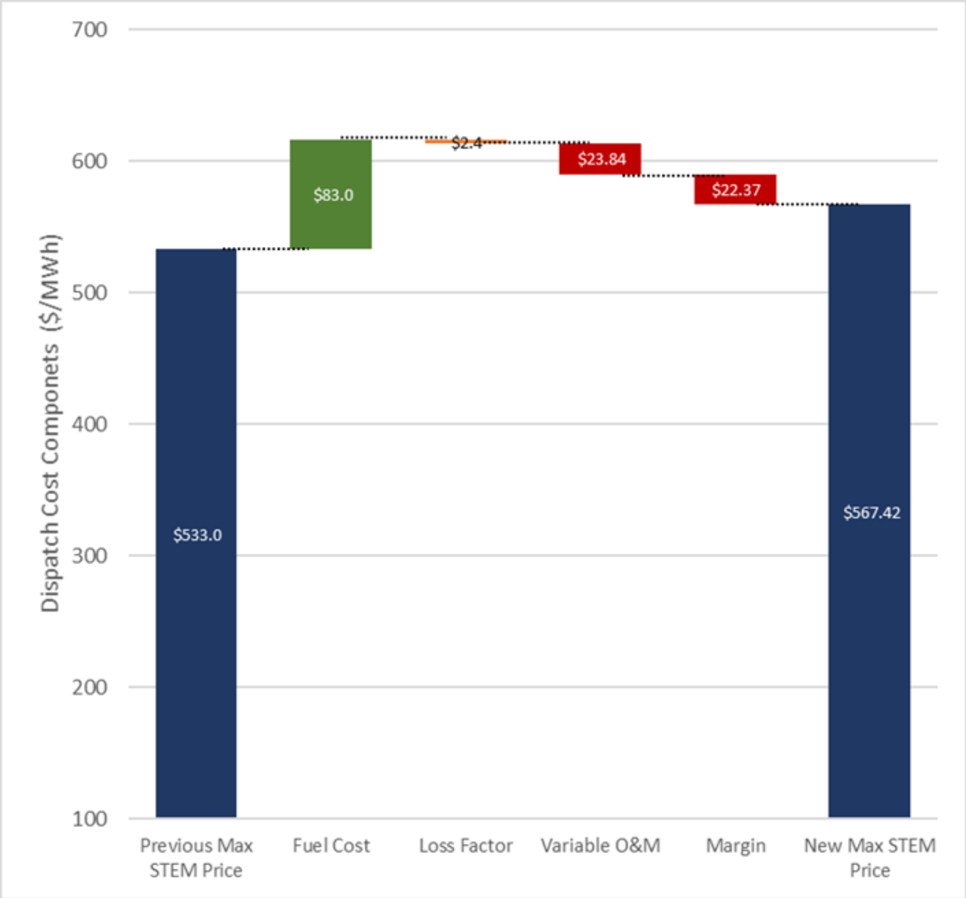
Using the proposed components in Table 2 and a projected distillate price of $21.10/GJ (81.3 c/litre), Marsden Jacob estimated the alternative maximum STEM price of $567.42/MWh. This compares with an estimated alternative maximum STEM price of $533/MWh in July 2018.

The alternative maximum STEM price has increased compared to last year. The lower mean variable O&M cost component has been offset by a higher mean fuel cost due to higher

20 Section 3.3 of the Marsden Jacob report (online) gives more detail on the derivation of the forecast.

distillate prices. The risk margin is also lower due to the reduced variation of the distribution of alternative maximum STEM price.

Figure 2: Factors contributing to the change in the Alternative Maximum STEM Price compared to 2018/19[21]



Source: Marsden Jacob analysis 2019

Notes: The changes in Mean Fuel Cost and Mean Variable O&M Cost above have been loss factor adjusted.

Dispatch cost is equivalent to short-run average cost.

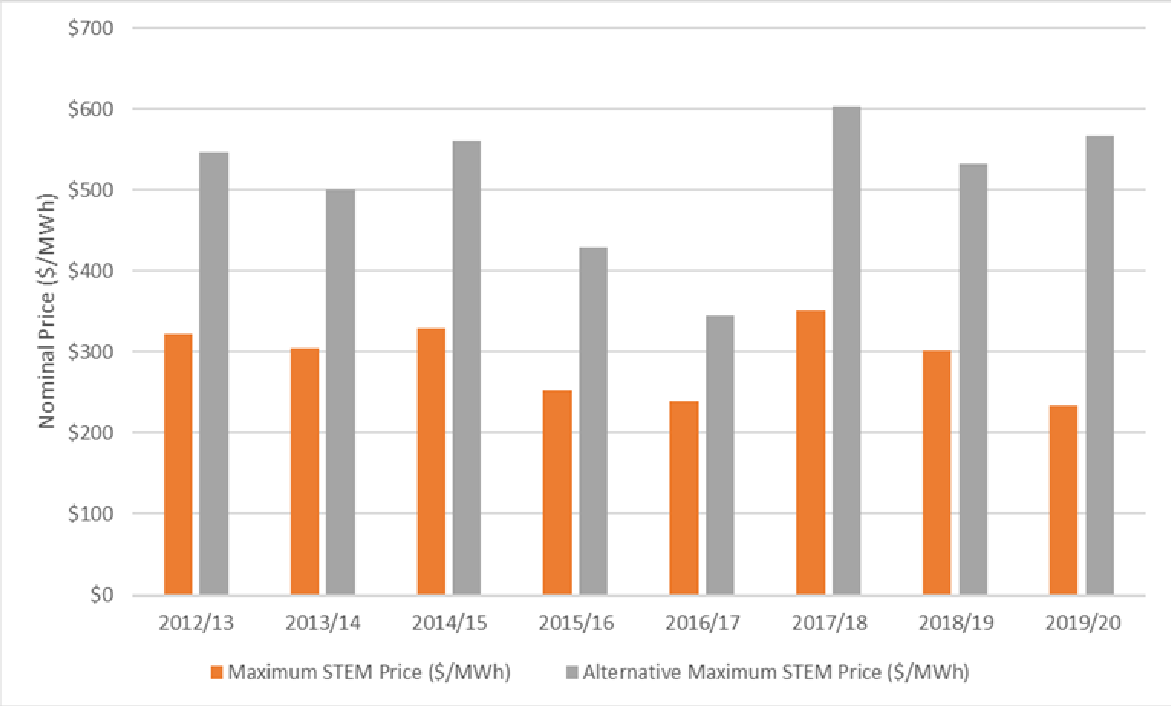
Compared to last year, the main factors contributing to the change in the alternative maximum STEM price are as follows (loss factor adjusted):

- An increase in the projected distillate price, due to projected increases in crude oil prices in 2019 and 2020, which increased the proposed alternative maximum STEM price by $83/MWh.
- Changes in the calculation of the variable O&M cost significantly decreased the non-fuel coefficient of the alternative maximum STEM price and contributed to a decrease of $24/MWh in the proposed alternative maximum STEM price.
- A reduction in the applied risk margin of $22/MWh.

Figure 3 shows historical upper energy price limits and the proposed revised energy price limits for 2019/20 for comparison.

[21] Source: Marsden Jacob report (online)

Figure 3: Comparison of assessed and historical upper energy price limits



Source: Marsden Jacob report (online)

Note: Alternative maximum STEM prices in figure 3 are based on forecast prices for a month at the beginning of each year shown, as they vary each month based on distillate prices.

4. The ERA's assessment

4.1 Background

The ERA must consider whether AEMO's proposed revised energy price limits reasonably reflect the application of the method and guiding principles for calculating the energy price limits described in the Market Rules.[22]

Although not assessed in these annual price limit determinations, the method review specified in the Market Rules aims to achieve the purpose of the energy price limits to mitigate the exercise of market power and considers trade-offs in setting a price cap in the market as follows. To be effective, the energy price limits must be:

- Low enough to limit the ability of generators with market power to charge price mark-ups above their reasonable expectation of the short-run marginal cost of the electricity supplied.
- High enough so that the high-cost generators in the SWIS and new entrants can recover their costs of electricity supply.
- High enough so that short-term gas price variation does not contribute to a regular switching of dual fuel capability units to liquid fuel.[23]

The calculation (or re-calculation) of the energy price limits is intended to provide a maximum benchmark for the market. This is why it is based on a mean variable O&M cost, mean fuel cost and mean heat rate and includes a risk margin.

This decision report provides detail on the main points and changes in respect of the proposed revised values when compared to last year's review. Those parts of the review that are relatively unchanged from previous years are only summarised.

Under clause 2.26.1(c) of the Market Rules, the ERA is not required to model the input values used in the method to determine the maximum STEM price and alternative maximum STEM price. Rather, the ERA must determine, among other things, whether the proposed revised value of the energy price limit "reasonably reflects" the application of the method and guiding principles in section 6.20 of the Market Rules. This is a less stringent test than if the ERA was required to approve the particular input values used for the method in clause 6.20.7(b) of the Market Rules.

4.2 Main parameters

Marsden Jacob's review generally followed the same method and approach to setting energy price limits that Jacobs used last year. Table 3 sets out the proposed values for the main

[22] In its annual assessment of energy price limits, the ERA does not consider the suitability of the method specified in the Market Rules for calculating energy price limits. The ERA has a separate obligation under the Market Rules, to review the method for determining energy price limits every five years. The ERA published its last review of the method in January 2013 and made recommendations it considered would improve the arrangements for determining the energy price limits, but the method specified in the Market Rules has not changed since then. Outstanding recommendations and any new findings will be addressed in the ERA's next review of the energy price limits method, which has recently commenced.

[23] For instance, if the maximum STEM price is set too low and during a trading interval gas price peaks at excessively high prices, a gas generator may not be able to recover its supply cost. Under such conditions, the generator (with dual fuel capability) may run the machine with the liquid fuel to be able to recover its costs, noting that the alternative maximum STEM price is generally greater than the maximum STEM price.

parameters used in the calculation of the maximum STEM price in the formula shown in section 2.

Table 3. Main parameters used for the calculation of the Maximum STEM Price

Parameter	Unit	Approved (took effect from 1 July 2018)	Proposed (to take effect on 1 July 2019)
Mean variable O&M	$/MWh	129.59	104.98
Mean heat rate	GJ/MWh	19.225	20.62
Mean fuel cost	$/GJ	6.31	5.445
Loss factor	-	1.0322	1.0369
Mean of average variable cost	$/MWh	243.07	210.24
Risk margin added	$/MWh	58.93	24.33
Implied risk margin value*	%	24.2	11.57
Price cap	$/MWh	302	234.57

* Based on the model developed, risk margin value added is an output of the calculation rather than an input in determining the energy price limit.

Except for fuel cost and heat rate, the parameters required to calculate the alternative maximum STEM price are the same as those used for the maximum STEM price as shown in Table 4.

Table 4. Main parameters used for the calculation of the Alternative Maximum STEM Price

Parameter	Unit	Approved (took effect on 1 July 2018)	Proposed (to take effect on 1 July 2019)
Mean variable O&M	$/MWh	129.59	104.98
Mean heat rate	GJ/MWh	19.277	20.62
Mean fuel cost	$/GJ	18.23	21.10
Loss factor		1.0322	1.0369
Mean of average variable cost	$/MWh	466.00	522.79
Risk margin added	$/MWh	67.00	44.63
Implied risk margin value[1]	%	14.4	8.54
Price cap	$/MWh	533[2]	567.42[3]

[1] Based on the model developed, risk margin value added is an output of the calculation rather than an input in determining the energy price limit.

[2] Based on a projected distillate price of $17.88/GJ for the month of July 2018.

[3] The ERA approves the components of the alternative maximum STEM price only. AEMO estimated this price cap by substituting the projected distillate price of $21.1/GJ (81.3 c/litre) in the relevant linear equation.

4.3 Changes in the main parameters

Table 5 describes in general terms the changes to the main parameters since last year's review.

Table 5: Summary of main parameter changes since last year's review

Parameter	Change	Modelling method
Variable O&M, including start-up costs ($/MWh)	Reduced due to shorter remaining life of selected generators, lower numbers of starts, more energy generated per start, lower gas prices	Similar to last year
Heat rate (GJ/MWh)	Slight increase due to generator operation at lower average loads	Similar to last year
Fuel cost ($/GJ)	Gas prices have decreased, distillate prices have increased	Slightly different ARIMA[24] modelling approach and more recent input data
Loss factor	Slight change upwards for Pinjar units, downwards for Parkeston units	Values provided by Western Power and validated by AEMO
Risk margin ($/MWh)	Reduced due to narrower distributions of input variables	Similar to last year

4.4 Selection of the highest cost generating works

As required by the Market Rules, AEMO estimates the energy price limits based on the average variable cost of the highest cost generator in the SWIS.[25] Three candidate generators were considered to possibly have the highest generation cost:

- Mungarra gas turbines GT1 to GT3 (Mungarra units);
- Pinjar gas turbines, units 1 to 5 and 7 (Pinjar units); and
- Parkeston aero-derivative gas turbine units 1 to 3 (Parkeston units).

However, Mungarra gas turbines can no longer be dispatched into the WEM due to a Ministerial direction and so were excluded as candidates for this price limits review. [26]

Marsden Jacob calculated estimates of average variable cost for the Pinjar and Parkeston units and determined that the Pinjar units would be the highest cost generators, on gas or distillate fuel, in the SWIS.

Table 6 compares the implied energy price limits for the Pinjar and Parkeston units on gas and distillate fuels, given differing assumptions on maintenance and variable O&M costs as provided by Synergy and Goldfields Power Pty Ltd respectively.

[24] Auto Regressive Integrated Moving Average (ARIMA) model of historical maximum monthly prices

[25] The Market Rules also require the use of parameters for a 40MW open cycle gas turbine generator in the calculation of energy price limits.

[26] The Ministerial direction specifies that the Mungarra units cannot be dispatched in the wholesale energy market, except by AEMO when the SWIS is in an emergency operating state (the balancing price is paid for the energy), or following a direction from Western Power to provide network control services under a contract to support the network. Western Power pays for this service.

Table 6. Comparison of energy price limits for Pinjar and Parkeston units

Unit	Price limit, $/MWh on gas	Price limit, $/MWh on distillate
Pinjar units assuming a full maintenance cycle	235	567
Parkeston units assuming a full maintenance cycle	156	349

On this basis the ERA agrees with the selection of the Pinjar units as the highest cost generators in the SWIS for the calculation of the maximum STEM price and alternative maximum STEM price.

4.5 Variable O&M costs

Marsden Jacob estimated variable O&M costs as follows:

- Marsden Jacob obtained data from Synergy and Goldfields Power and used other cost and engineering data available to Marsden Jacob including from past reports for the review of energy price limits. Marsden Jacob also used observed market data from AEMO, obtained cost data, data on the number of starts, the duration of each dispatch event, and the amount of energy generated in each dispatch event up to six hours long.
- Marsden Jacob calculated the present value of maintenance expenditures during the expected remaining life of each generator and subsequently calculated a discounted maintenance cost per start for the generator.
- Marsden Jacob converted the discounted cost per start to a discounted cost per MWh of electricity generated.

Marsden Jacob used a six-step process to determine the modelling input variable O&M costs for the Pinjar and Parkeston units. This process is described in detail in section 3.2 of the Marsden Jacob report[27].

In summary, the six steps were:

1. Determine a point estimate of maintenance costs per start based on confidential data provided by both Synergy and Goldfields Power Pty Ltd.
2. Create a distribution of start costs ($ per start) given that the number of starts can vary and so change the overhaul maintenance cycle and hence the variable O&M costs per start.
3. Determine the relationship between the number of starts, which is the driver for maintenance overhauls of the Pinjar units, and overhaul costs.
4. Determine the distribution of dispatch event MWh (generation) for events equal to or less than six hours duration.
5. Using the distribution of start costs, and the distribution of dispatch event MWh, a Monte Carlo simulation was undertaken to develop a distribution of variable O&M costs ($ per MWh).

[27] Marsden Jacob report (online)

6. To ensure that variable O&M costs include all cost components, the above (primarily maintenance) costs have been increased by $1.50 per MWh to include costs of other inputs such as water, labour and lubricants. This is based on Marsden Jacob's assessment of these costs for an open-cycle gas turbine plant.

These steps produce a distribution of variable O&M costs which are input into the Monte Carlo simulation. The simulation produces the mean variable O&M cost as required by clause 6.20.7(b)(ii) in the Market Rules.

4.6 Heat rate

Heat rate curves for the benchmark open-cycle gas turbine units were sourced from Synergy (Pinjar) and Goldfields Power Pty Ltd (Parkeston) as owners of the respective units. The heat rate curves show how unit heat rates vary with generation output.

Fuel start-up costs have been factored into the plant heat rates.

Marsden Jacob used heat rates based on the average dispatch generation output which was based on historic generation from 2014-2018 for the Pinjar units and 2018 for Parkeston. The primary driver of the higher heat rate in this year's review is the change in Pinjar unit operation towards lower output (decreasing efficiency) in recent years.

4.7 Fuel cost

4.7.1 Gas price

Marsden Jacob's analysis of natural gas prices is similar to that provided in the previous Jacobs review of the energy price limits. It used the July 2012 to February 2019 maximum monthly spot prices in the gasTrading platform in a standard Autoregressive Integrated Moving Average (ARIMA) model. It developed a forecast for the distribution of monthly maximum spot gas prices for the period from April 2019 to June 2020. The analysis also considered expected developments in the gas market in Western Australia and expressed some doubt about future gas prices remaining at such historically low levels for another 15 months.

Marsden Jacob stated that expected growth in mining and mineral process, such as iron ore, in Western Australia could increase demand for gas and consequently domestic gas prices. Conversely, new gas supplies in the domestic market could lower spot gas prices further. Hence the range of outcomes (standard deviation for gas prices) has been increased beyond historical levels to account for such possibilities.

Marsden Jacob's approach to estimating delivered spot gas prices for use in determining the maximum STEM price is reasonable. Its use of historical monthly maximum gas prices in developing forecasts for the gas price is a conservative assumption. The use of maximum gas prices, instead of average gas prices, increases the level of energy price limits.

4.7.2 Distillate price

Under the Market Rules, AEMO calculates the alternative maximum STEM price based on the Singapore gas-oil price, or any other published price that AEMO considers suitable, each month.[28] AEMO does not use the Singapore gas-oil price as it is no longer widely used and instead uses the Perth Terminal Gate Price (net of Goods and Services Tax and excise). To

[28] Clause 6.20.3 of the Market Rules.

match AEMO's current practice, Marsden Jacob based its estimate on the Perth Terminal Gate Price of distillate.

Like the approach taken last year by Jacobs, Marsden Jacob developed a forecast distribution model for the distillate price. It used this model to determine a price ceiling for the distribution of gas prices of $21.10/GJ, so that modelled gas prices did not exceed the distillate price.

Marsden Jacob developed a distillate price model based on the US Energy Information Administration March 2019 projections for the Brent crude price, and then examined Brent Crude's correlation with Tapis Crude and Tapis Crude with the distillate price. Marsden Jacob also accounted for the transport cost from the Kwinana refinery to the candidate power stations.

4.8 Loss factor

Marsden Jacob used the latest value of loss factors for the Pinjar and Parkeston units, as determined by Western Power and provided to AEMO on 1 June 2019. For the 2019-20 financial year, the loss factor for the Pinjar units is 1.0369, and for Parkeston is 1.1633. These are around 0.5 per cent different to those applicable for the 2018-19 financial year, which were 1.0322 for the Pinjar units and 1.1686 for Parkeston.

4.9 Risk margin

As specified in the Market Rules, the risk margin used in the formula to determine the maximum STEM price "is a measure of uncertainty in the assessment of the mean short-run average cost of a 40 MW open cycle gas turbine generating station."[29]

The Market Rules do not specify the method for calculation of the risk margin.

The Market Rules specify that for the purposes of the formula in clause 6.20.7(b) the mean variable O&M cost, mean unit fixed and variable fuel cost and mean heat rate are used to determine the mean short-run average cost. These input cost components are uncertain, and the formula prescribes using the risk margin to account for the uncertainty in the calculation. In practice, AEMO's consultant generates distributions for the variable parameters in the calculation and determines a distribution for the short-run average variable cost.

Since 2007, the practise has been that the consultant takes the mean of the resulting short-run average variable cost distribution and adds on the risk margin to determine the price limit. The difference between the mean and the 80th percentile of the distribution is used as the risk margin, which is an output of the distribution calculation. The resulting energy price limit is therefore equal to the 80th percentile of the distribution - based on the mean plus risk margin.

The risk margin is determined by the shape of the calculated short-run average cost distribution that is calculated using a Monte Carlo simulation from the distributions of the variable input parameters.

This year changes in the input parameters for the calculation of the variable O&M cost and fuel cost resulted in a narrowed short-run average variable cost distribution and so a smaller risk margin.

29 Clause 6.20.7(b)(i) of the Market Rules.

The ERA will consider the use and application of the risk margin in its upcoming review of the method for determining the energy price limits.[30]

4.10 Monte Carlo simulation

In last year's decision on energy price limits, the ERA stated:

> The ERA recommends that AEMO reviews the application of Monte Carlo analysis in its next review of energy price limits to ensure that samples drawn from underlying distributions (for heat rate, gas price, and variable O&M) are drawn and combined randomly to produce the average variable cost distribution.

The final AEMO report proposing the revised values submitted to the ERA this year states:

> Some of the input distributions (e.g. gas price) used in the Monte Carlo simulations were truncated. If a normal curve is used to produce an input distribution, then this can result in negative values (depends on mean and standard deviation of the distribution) which may be impossible for input variables (e.g. gas price, MWh per start etc). In these cases, the truncation of the input variable distribution may be required to yield sensitive results. Some truncation of the gas commodity and transport price distributions was required in this study to avoid negative (and extremely) low price outcomes.

The ERA considers this approach to be reasonable.

4.11 Coefficients for the alternative maximum STEM price

The alternative maximum STEM price is revised monthly according to changes in the distillate price.

The ERA has determined in previous energy price limit reviews that it is more appropriate to approve the coefficients for the alternative maximum STEM price, rather than to approve a single revised value. Marsden Jacob has calculated the coefficients in line with the method used in previous reviews.

5. Public consultation

AEMO published two versions of Marsden Jacob's draft reports on the AEMO Market Website and invited stakeholders to provide feedback. The first draft was published on 12 April 2019 with a feedback deadline of 24 May 2019. Following early feedback on the first draft and modelling adjustments, a revised draft was published on 21 May 2019 with an extended feedback deadline to 31 May 2019. AEMO also published a notice in The West Australian newspaper on 23 April 2019. AEMO did not receive any submissions.

The ERA considers the public consultation undertaken by AEMO was adequate.

6. Conclusion

For the reasons set out in this decision report, the ERA approves AEMO's proposed revised values for the maximum STEM price and the components of the alternative maximum STEM price. The ERA considers that AEMO's calculation of the energy price limits reasonably reflects

[30] As required under clause 2.26.3 of the Market Rules.

the application of the method and guiding principles described in clause 6.20 of the Market Rules and that AEMO has carried out an adequate public consultation process.

Appendix 1 List of Tables

Appendix 2 List of Figures