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Estimating the Escalation Factors for the 2019 Benchmark Reserve Capacity Price

Final report

AEMO

2019 Benchmark Reserve Capacity Price Debt Risk Premium and Escalation Factors for the South West Interconnected System

August 2018

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Executive summary

Overview

The Australian Energy Market Operator (AEMO) has engaged PricewaterhouseCoopers Consulting (Australia) Pty Limited (PwC) to determine appropriate cost escalation factors related to the construction of a 160 MW open cycle gas turbine (OCGT) generation facility for five consecutive financial years, with the first year being the year ending June 2019. The cost escalation factors comprise:

- steel and copper prices;
- AUD/USD exchange rate;
- labour cost escalation factors specific to labour cost for building and maintaining a power plant in the South West interconnected System (SWIS).

The cost escalation factors will be used by AEMO in the development of the Benchmark Reserve Capacity Price (BRCP), which includes a technical bottom-up cost evaluation of the entry of a new 160 MW OCGT into the SWIS in 2021.

Approach

For prices of steel and copper, and the AUD/USD exchange rate, we drew on price data and a wide variety of forecasts from leading investment banks and forecasting institutions. This was supplemented by analysis of high-level commodity market trends, policy events affecting the AUD/USD rate and macro-economic information on production, exports and industry drivers (national and global).

For labour costs, we analysed the level and trajectory of construction labour costs separately from operation and maintenance costs, while applying the trajectory of the Western Australia Treasury forecast of Wage Price Index growth, revised downwards by lower-than-expected wage growth and higher-than-expected underutilisation in recent months.

Proposed escalation factors

The proposed escalation factors reflect expected economic growth in Western Australia over the next five years, labour market dynamics (including the persistence of labour underutilisation), the impact of international developments on the AUD/USD exchange rate and expected price outcomes for steel and copper which may be sourced from relevant international markets for the construction of the 160 MW OGCT. The table below provides a summary of the cost escalation factors produced by PwC for the 2019 BRCP, compared with the cost escalation factors produced by GHD for the 2018 BRCP.

Escalation factors – 2018 BRCP (GHD) and 2019 BRCP (PwC)

Financial Year Ending		2018	2019	2020	2021	2022	2023
WPI – EWGGS	GHD	2.14%	2.32%	2.41%	2.43%	2.44%	
	PwC	2.10%	1.85%	2.85%	3.10%	3.35%	3.35%
WPI – Constr.	GHD	1.42%	1.71%	1.85%	1.88%	1.92%	
	PwC	2.00%	1.75%	2.75%	3.00%	3.25%	3.25%
AUD/USD ($)	GHD	0.7755	0.7721	0.7673	0.7620	0.7573	
	PwC	0.7736	0.7304	0.7363	0.7513	0.7650	0.7628
Steel Price	GHD	-4.1%	0.0%	2.3%	1.4%	1.4%	
	PwC		9.03%	-10.70%	-1.98%	-1.29%	0.48%
Copper Price	GHD	1.75%	1.83%	1.04%	0.96%	0.00%	
	PwC		4.14%	5.27%	-0.33%	-1.56%	0.53%

Contents

1 Project overview

1.1 Background

The Australian Energy Market Operator (AEMO) has engaged PricewaterhouseCoopers Consulting (Australia) Pty Limited (PwC) to determine appropriate cost escalation factors related to the construction of a 160 MW open cycle gas turbine (OCGT) generation facility for five consecutive financial years, with the first year being the year ending June 2019. The cost escalation factors comprise:

- steel and copper prices;
- AUD/USD exchange rate;
- labour cost escalation factors specific to labour cost for building and maintaining a power plant in the South West interconnected System (SWIS).

The cost escalation factors will be used by AEMO in the development of the Benchmark Reserve Capacity Price (BRCP), which includes a technical bottom-up cost evaluation of the entry of a new 160 MW OCGT into the SWIS in 2021.

1.2 Approach

PwC identified and analysed the expected movements in the relevant costs to develop escalation forecasts. For each cost category we:

- outlined the nature and key components of each cost factor;
- evaluated the materiality of the spread of publicly available forecasts for each cost factor (tailoring increased analytical effort towards factors that exhibit a large spread and may therefore be susceptible to conjecture or potentially unique market characteristics in WA);
- assessed wider market and economic trends which may impact cost component movements;
- reviewed alternative escalation measures which may be applicable, including a review of precedents from other Australian regulatory agencies.

For prices of steel and copper, and the AUD/USD exchange rate, we drew on price data and a wide variety of forecasts from several leading investment banks and forecasting institutions. This is informed by high-level commodity market trends, policy events affecting the AUD/USD rate and macro-economic information on production, exports and industry drivers (national and global).

For labour costs, we analysed the level and trajectory of construction costs separately from operation and maintenance costs, while applying the trajectory of the Western Australia Treasury forecast of Wage Price Index growth, revised downwards by lower-than-expected wage growth and higher-than-expected underutilisation in recent months.

We have also included last year's cost escalation factors in our analysis, and explained any shifts in market conditions and differences in methodology that may account for differences in the cost escalation factors produced this year.

1.3 Limitations

PwC has prepared this report for AEMO in accordance with the terms of our consultancy agreement with AEMO.

This report is not intended to be utilised or relied upon by any persons other than AEMO, nor for any purpose other than that articulated above. PwC accept no responsibility in any way whatsoever for the use of this report by any other persons or for any other purpose.

The information, statements, statistics and commentary (together the "Information") contained in this report have been prepared by PwC from publicly available material and from material provided by AEMO. PwC has not sought any independent confirmation of the reliability, accuracy or completeness of this information. It should not be construed that PwC have carried out any form of audit of the information which has been relied upon.

Accordingly, whilst the statements made in this report are given in good faith, PwC accept no responsibility for any errors in the information provided by AEMO or other parties nor the effect of any such errors on our analysis, suggestions or report

This analysis is based on best available data as of 17 August 2018 which may be subject to change over time. PwC is not responsible for any changes to the data around each cost component and the impact those changes may have on the forecast escalation factors.

The analysis also assumes that a new OCGT entrant is able to access labour, currency markets, steel and copper at average market rates. Should the OCGT entrant be able to access rates that are different from the market, the appropriate escalation factors for the entrant may be different to those provided in this report.

This report is not intended to provide guidance on the total cost of building a 160 MW OCGT, which is dependent on technical specifications and technological changes that are outside the scope of this engagement.

2 Labour

We recommend that AEMO escalate labour costs using separate series for construction and operation/maintenance. Construction wages are expected to grow between 1.75% to 3.25% per annum over the five years while operation/maintenance wages are expected to grow between 1.85% and 3.35% per annum over the five years.

2.1 Overview

2.1.1 Indices and data sources

The ABS publishes a range of data sets and indices that could form the basis of labour cost escalation, including the wage price index (WPI) and average weekly earnings (AWE).

WPI measures the weighted average change in the labour cost per hour of all jobs performed in an industry, independently to changes in the quantity or quality of work performed. The determining characteristics, such as changes in the location where work is performed, changes in the composition of the labour force and changes in the nature of work performed, are held constant to ensure these changes do not influence index movements.

AWE is the sum of regular cash payments made to employees divided by the total number of employees. Unlike WPI indices, AWE estimates are sensitive to changes in the quality or quantity of work performed in a given period as well as compositional changes in the workforce, including changes in the mix of full-time, part-time, contract and/or casual staff, staff seniority and changes in hours worked.

Our analysis of regulatory submissions indicates that regulators have expressed a preference for labour cost escalation factors to be based on long-run historical growth or forecasts of WPI, as opposed to AWE-based estimates. For instance, regulators such as the Australian Energy Regulator (AER) and Queensland Competition Authority (QCA) have expressed a preference for WPI over AWE to estimate labour cost inflation because of its ability to measure pure price changes in wages independent of workforce composition factors. Regulatory determinations for both Energex[1] and Ergon[2] applied the mid-point of PwC and Deloitte estimates that were both based on WPI (either historical growth or forecasts). In the case of Ergon, a proposed approach based on a forecast of AWE was rejected in favour of escalation in line with WPI.

In our analysis, we have considered:

- ABS Series: 6345.0; Total hourly rates of pay excluding bonuses; Western Australia; Private and Public compensation of employees[3] (WPI – WA). This reflects wage growth in Western Australia and forms the basis of the WA Treasury's forecast[4] (WPI – WA [WA

[1] AER (2015) Final Decision - Energex Determination 2015-16 to 2019-20 - Attachment 7 – Operating expenditure, available at: https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/energex-determination-2015-2020/final-decision

[2] AER (2015) Final Decision - Ergon Energy Determination 2015-16 to 2019-20 - Attachment 7 – Operating expenditure, available at: https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/ergon-energy-determination-2015-2020/final-decision

[3] ABS (2018) Australian Bureau of Statistics Cat. 6345.0 Wage Price Index, Australia - Table 2b - Total hourly rates of pay excluding bonuses ; Western Australia ; Private and Public ; All industries ; available at: http://www.abs.gov.au/ausstats/abs@.nsf/mf/6345.0

[4] Western Australia Treasury (2018), Economic Forecasts, available at: https://www.treasury.wa.gov.au/Treasury/Economic_Data/Economic_Forecasts

Treasury]), the Western Australian Chamber of Commerce and Industry's forecast (WPI – WA [CCI]), and GHD's forecast (WPI – WA [GHD]);

- ABS Series: 6345.0; Total hourly rates of pay excluding bonuses; Australia; Private and Public; Electricity, gas, water and waste services[5] (WPI – EGWWS). This reflects wage growth in the electricity, gas, water and waste services sector generally and forms the basis of GHD's forecast (WPI – EGWWS [GHD]);

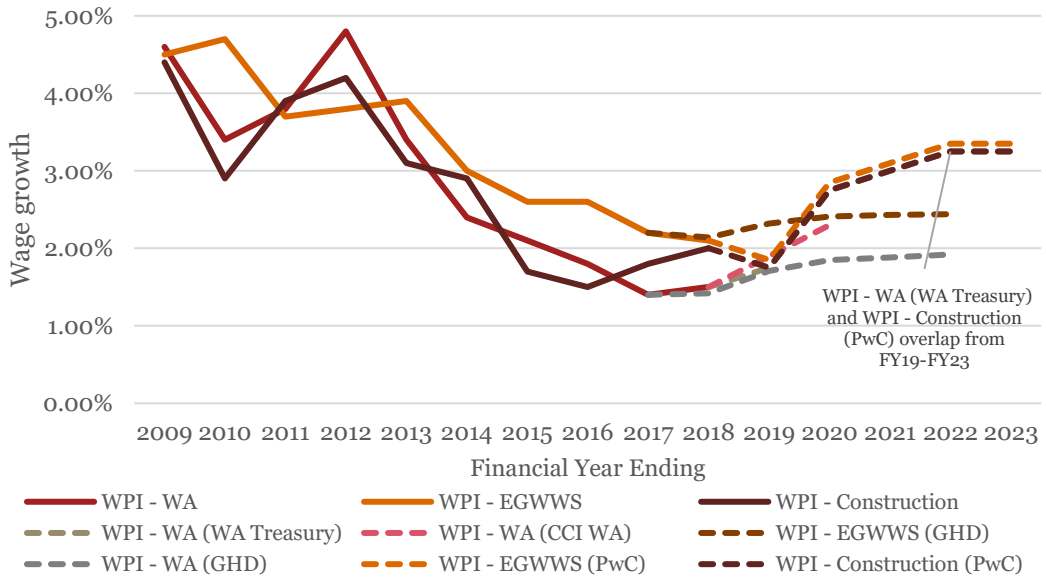
- ABS Series: 6345.0; Total hourly rates of pay excluding bonuses; Australia; Private and Public; Construction[6] (WPI - Construction). This reflects wage growth in the construction sector generally.

The selected series exclude bonuses, we have chosen these series because they better reflect the underlying cost of labour, rather than the fluctuating aspects of labour affected by the quantity and quality of work performed.[7] Similarly, we have used separate series for construction and operations/maintenance work as the two series measure separate components of the labour force which rely on different sets of skills, experience nuanced labour market dynamics and may be subject to different enterprise agreements.

2.1.2 Market trends

The WA Treasury have forecast wage growth in Western Australia to increase from 1.75% per annum in FY19 to 3.25% per annum in FY22. The forecasted lift in wage growth was attributed by the WA Treasury to improving conditions in the labour market.[8]

Figure 1. Labour cost escalation



[5] ABS (2018) Australian Bureau of Statistics Cat. 6345.0 Wage Price Index, Australia - Table 3b - Total hourly rates of pay excluding bonuses ; Western Australia ; Private and Public ; All industries ; available at: http://www.abs.gov.au/ausstats/abs@.nsf/mf/6345.0

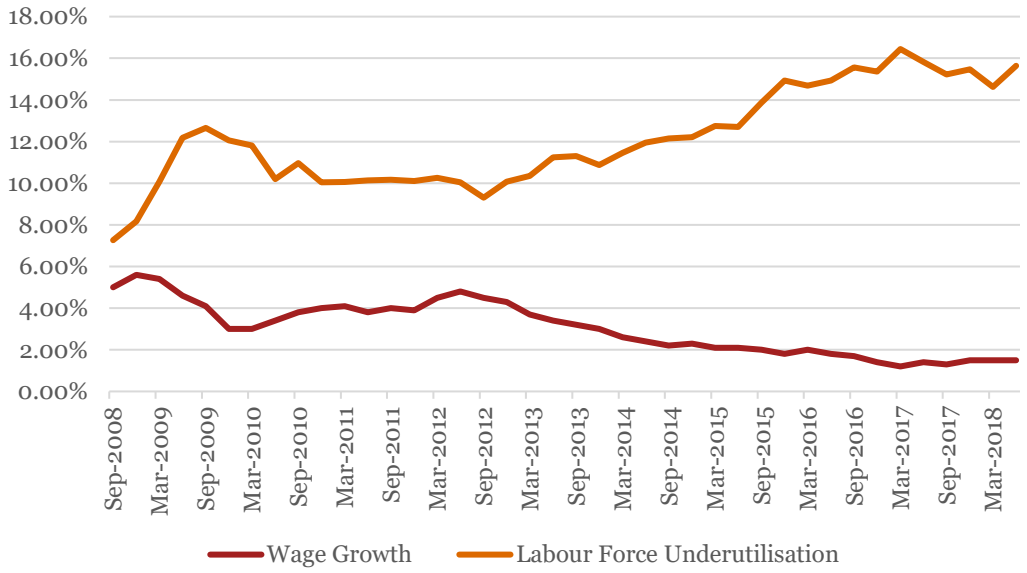
[6] ABS (2018) Australian Bureau of Statistics Cat. 6345.0 Wage Price Index, Australia - Table 5b - Total hourly rates of pay excluding bonuses ; Australia ; Private and Public ; Construction ; available at: http://www.abs.gov.au/ausstats/abs@.nsf/mf/6345.0

[7] ABS (2012) Wage Price Index – Concepts, Sources and Methods, available at: http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/15D88F6F38AEEE2FCA257AC30014D1BB/$File/6351055001_2012.pdf

[8] Western Australia Government (2018) Budget Paper No.3 – Economic and Fiscal Outlook; available at: https://www.ourstatebudget.wa.gov.au/2018-19/budget-papers/bp3/2018-19-wa-state-budget-bp3.pdf

Since the WA Treasury forecasts were produced, however, ABS data for May showed seasonally adjusted labour force underutilisation growing by more than one percentage point quarter-on-quarter.[9] As shown in Figure 2, an inverse relationship exists between underutilisation and wages. Increased labour force underutilisation means that the total of unemployment and underemployment of workers is rising, and that the gap between total labour supply and total labour demand is widening. This would be expected to exert downward pressure on wages, which is more pronounced in the immediate term (FY19) but expected to continue to limit wage growth in the forecast horizon to FY23. Relative to the 2018 BRCP, the FY19 forecast for WPI - EGWWS growth is lower. However, drawing on the rising trend of WA Treasury WPI forecasts, our forecasts for FY20 to FY22 are higher.

Figure 2. Wage growth and labour force underutilisation in Western Australia



2.2 *Projections of the wage price index*

We recommend adopting the WPI-EGWWS series below for labour costs specific to the operation and maintenance of the power plant, and the WPI-Construction series below for the construction of the power plant.

Wage growth for each factor is expected to trend upwards, following the trajectory of the WA Treasury's forecasts. Given the recent increase in labour underutilisation, however, we recommend applying a 0.5 percentage downward revision on the trajectory of the WA Treasury's forecast growth for each FY. This reflects the most recent revisions applied by the WA Chamber of Commerce and Industry which reflect the loosening labour market in WA.

Employing the WA Treasury's trajectory for both the WPI-EGWWS and WPI-Construction wage growth series means that the two series will escalate along the same year-on-year differentials, with wage growth for operations and maintenance 0.1 percentage points higher than wage growth for construction.

[9] ABS (2018) Australian Bureau of Statistics Cat. 6202.0 Labour Force, Australia - Table 23 - Western Australia; Underutilisation rate; Persons; Seasonally adjusted; available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6202.0Jun%202018?OpenDocument

The following escalation factors are proposed for the five year period:

Table 1: Labour cost projections

Financial Year Ending	2018*	2019**	2020**	2021**	2022**	2023**
WPI - EGWWS (% change)	2.10%	1.85%	2.85%	3.10%	3.35%	3.35%
WPI - EGWWS (ABS Index)	134.0	136.5	140.4	144.8	149.7	154.7
WPI - Constr. (% change)	2.00%	1.75%	2.75%	3.00%	3.25%	3.25%
WPI - Constr. (ABS Index)	128.7	131.00	134.60	138.60	143.10	147.80

*Note: actual (national series) **Note: PwC projections (WA specific)
PwC has not forecasted the series at the national level. PwC has forecasted the series for Western Australia only.

3 AUD/USD exchange rate

We recommend that AEMO adopt the average of the most recent forecasts of the domestic Big Four Banks for FY19 to FY22 and use the average long-run exchange rate of 0.7628 in FY23.

3.1 Overview

3.1.1 Indices and data sources

There are a range of data sets and indices that could form the basis of AUD/USD exchange rate projections.

In our analysis, we have considered:

- RBA historical AUD/USD monthly exchange rate data[10] from December 1983, when the dollar was floated, until July 2018, allowing the calculation of the Long Run Average (LRA) exchange rate;
- WA Treasury's forecast exchange rates;
- Forecasts from Bloomberg for FY19 - FY22 from July and August 2018, reflecting the best current estimates of global financial institutions. We have then segmented this data based on its source, Big Four domestic (ANZ, CBA, NAB and Westpac) or international, to account for differences in currency exposure, trading portfolio, purpose and timing of forecasts.

We have converged each series to the long run average of the exchange rate for FY23.

3.1.2 Market trends

An average of the most recent forecasts by ANZ, the Commonwealth Bank, the National Australia Bank, and Westpac show a gradual rise in the exchange rate from 0.7300 in FY19 to 0.7600 in FY22.[11] This closely reflects the exchange rate forecasting model recommended by the WA Treasury which is based on the reversion of the exchange rate to the long run average.[12] Economic forecasts offered in the RBA's August 2018 Statement on Monetary Policy are predicated on exchange rates remaining at their current levels until December 2020,[13] similar to the 2018/19 Federal Budget[14] which assumes an exchange rate of 'around 77 US cents,' the recent average level.

Over the past 10 years, the exchange rate has fluctuated from a yearly average low of 0.7272 in FY16 to a yearly average high of 1.0362 in FY10. Among the July and August 2018 forecasts of the exchange rate compiled on Bloomberg, there are wide variances among international financial institutions from 0.7000 to 0.8400 in FY19. The most recent forecasts

[10] Reserve Bank of Australia (2018), Historical Data; available at: https://www.rba.gov.au/statistics/historical-data.html#exchange-rates

[11] Australian Dollar / US Dollar Exchange Rate (2018), Bloomberg Terminal

[12] Department of Treasury and Finance (2009), Forecasting Review, available at: https://www.treasury.wa.gov.au/uploadedFiles/_Treasury/Publications/exchange_rate_forecasting_review.pdf

[13] Reserve Bank of Australia (2018), Statement on Monetary Policy – August 2018, available at: https://www.rba.gov.au/publications/smp/2018/aug/pdf/statement-on-monetary-policy-2018-08.pdf

[14] Commonwealth Government (2018) Budget 2018-19 Budget Strategy and Outlook, available at https://www.budget.gov.au/2018-19/content/bp1/download/BP1_full.pdf

published on the Bloomberg have trended downward, indicating lowered expectations for the exchange rate.

Figure 3: AUD/USD exchange rate (Financial Year Ending 2009 - 2023)

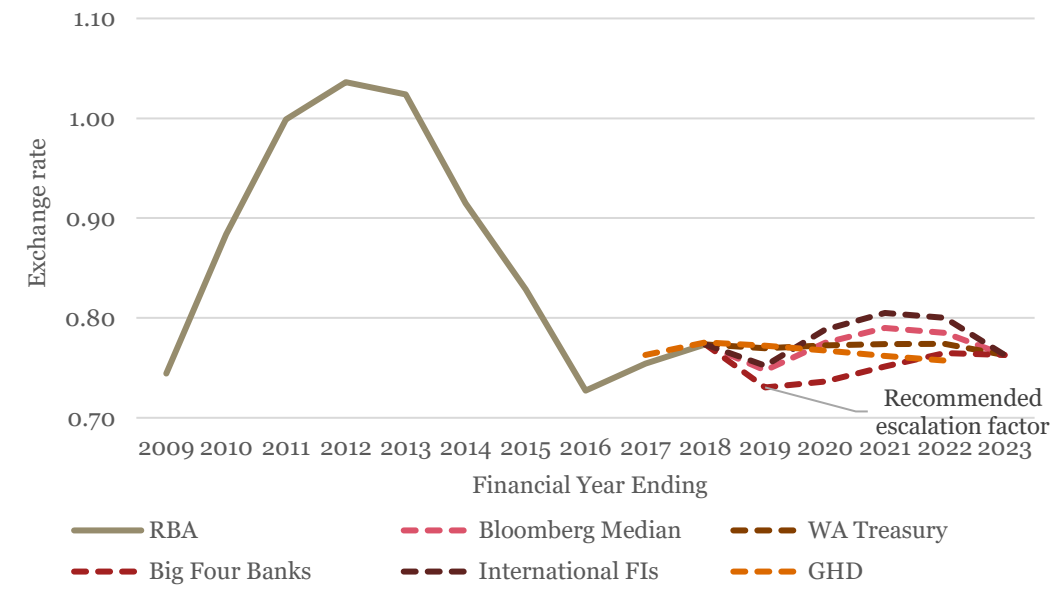
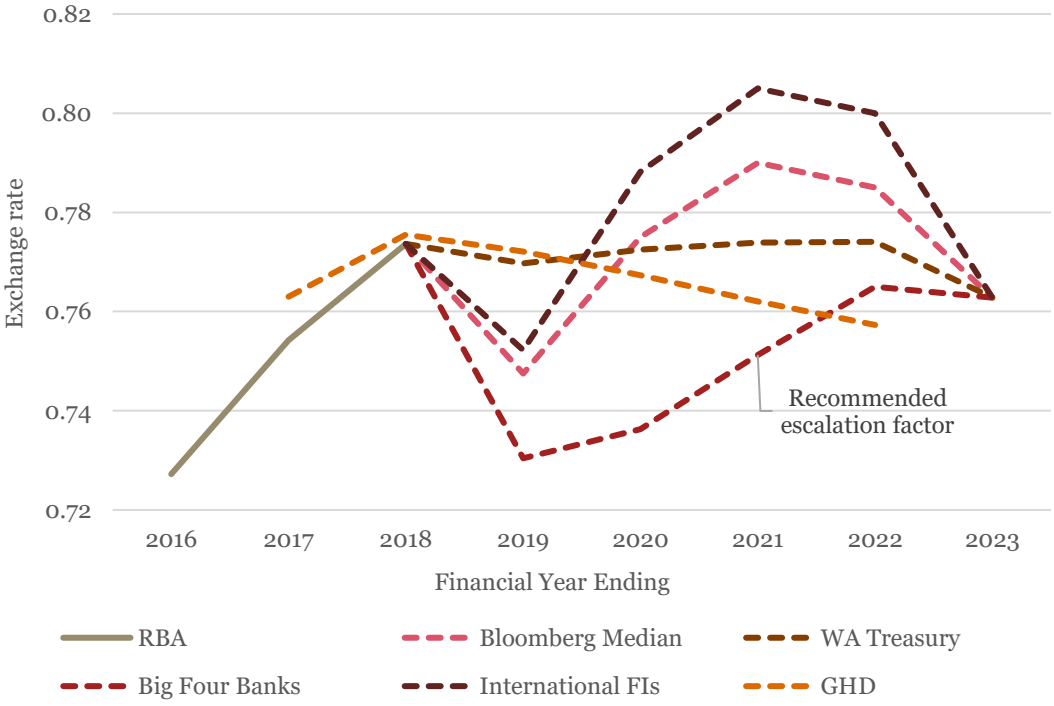


Figure 4: AUD/USD exchange rate (Financial Year Ending 2016 - 2023)



3.2 Projections of the AUD/USD exchange rate

We recommend adopting the average of the most recent forecasts of the Big Four Banks for FY19 to FY22 and adopting the long run average of the exchange, 0.7628 in FY23.

In comparing exchange rate forecast models in 2009, the WA Department of Treasury and Finance found the model which performed best was the Long Run Average (LRA) model. This model assumes that the exchange rate will return to its long-run average in a linear fashion.[15] Since the dollar was floated in 1983, the average exchange rate has been 0.7628. This figure is just 0.0022 from the average of the forecasts of Westpac and CBA in FY22. The forecasts provided by the Big Four Banks are more recent than those offered by the WA Treasury and arguably better reflect the current downward trajectory of the Australian Dollar than those of the international financial institutions.

A number of downside risks exist for the Australian Dollar. As the dollar is heavily linked to the commodity exports, a potential economic slowdown in China, exacerbated by the current trade stand-off between China and the United States, perhaps provides the greatest risk. Similarly, expectations for the United States Federal Funds Rate and the Australian Cash Rate continue to diverge. The Federal Funds Rate is currently 25 to 50 basis points greater than the cash rate, the median of forecasts provided by Bloomberg[16] suggest that this gap will increase to 150 basis points by the end of FY19.

The following exchange rates are proposed for the five year period:

Table 2: AUD/USD exchange rate projections

Financial Year Ending	2018*	2019**	2020**	2021**	2022**	2023**
AUD/USD	0.7736	0.7304	0.7363	0.7513	0.7650	0.7628

*Note: actual **Note: projections

[15] Department of Treasury and Finance (2009), Forecasting Review, available at: https://www.treasury.wa.gov.au/uploadedFiles/_Treasury/Publications/exchange_rate_forecasting_review.pdf

[16] Federal Funds Rate Target Rate Expectations (2018), Bloomberg Terminal; Australian Cash Rate Expectations (2018), Bloomberg Terminal

4 Steel prices

We recommend that AEMO adopt the weighted average of Chinese, European and US HRC steel spot prices for FY19 to FY21, as publicly available. We recommend escalating the weighted average price for FY22 and FY23 using the HRC steel index produced by IBISWorld.

4.1 Overview

4.1.1 Indices and data sources

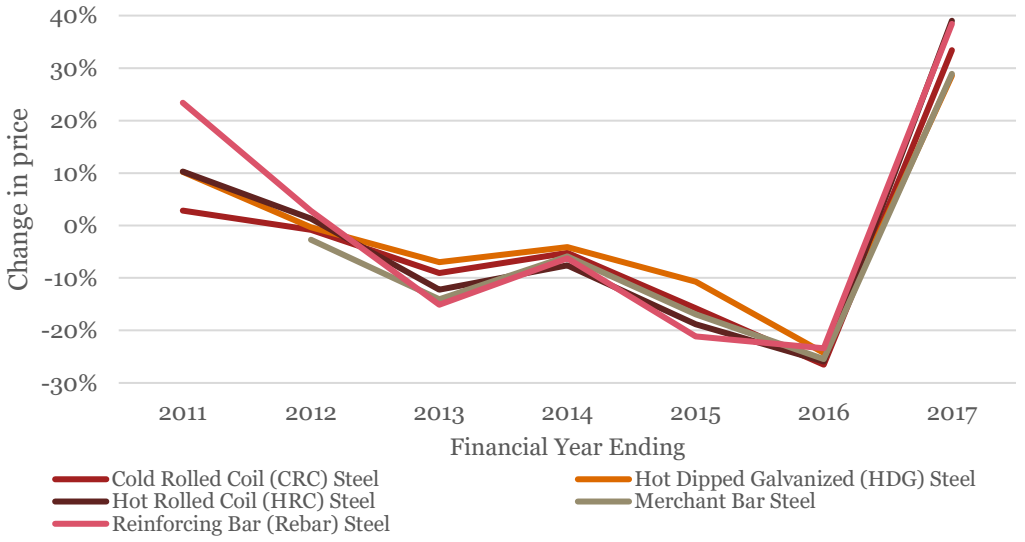
There are a range of data sets and indices that could form the basis of steel price escalation. In our analysis, we have considered:

- IHS Markit historical and forecast (up to FY21) spot price data[17] for 33 different categories of steel across China, Europe and the United States;
- IBISWorld's forecast price index.[18]

We have used hot rolled coil (HRC) steel as the basis of our projections and used IBISWorld's weighted HRC steel price index to escalate the spot price projections in FY22 and FY23. In comparing these projections to those in the 2018 BRCP, we note that those figures were projected on a calendar year basis, with the 2017 value a point in time figure from October 2017. We also note that in the 2018 report, steel forecasts were in relation to rebar steel.

Our cost escalation is based upon the price of HRC steel, which our analysis has found is a robust indicator of the general price of different types of steel used in power plant construction. There is a strong correlation among price movements for different grades of steel, particularly in recent years. While these different grades are priced differently, their year on year price movements have followed similar trajectories.

Figure 5: Change in Chinese steel prices



[17] IHS Markit (2018), Pricing and Purchasing Forecasts

[18] IBISWorld (2018), World Price of Steel

Figure 6: Change in European steel prices

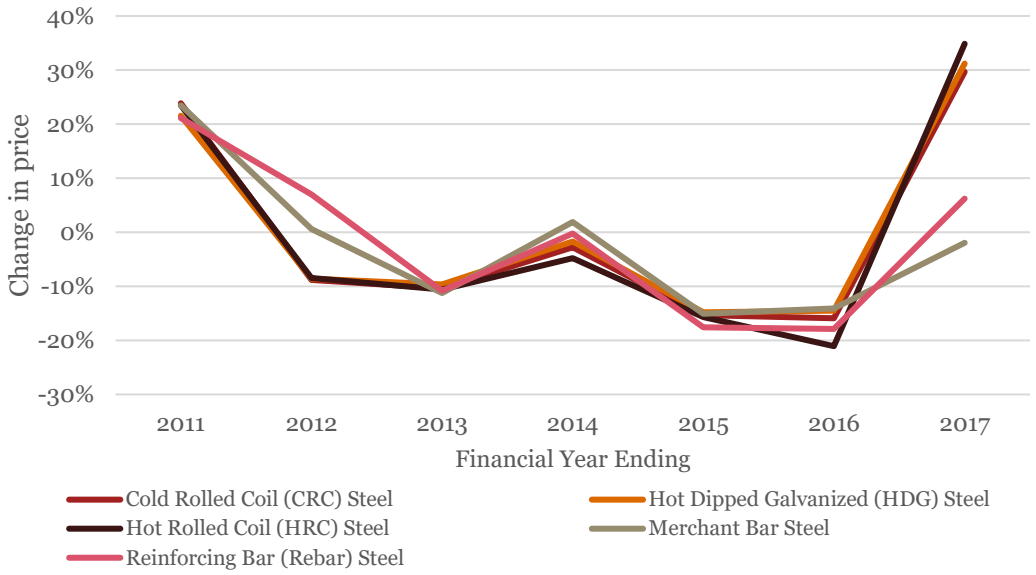
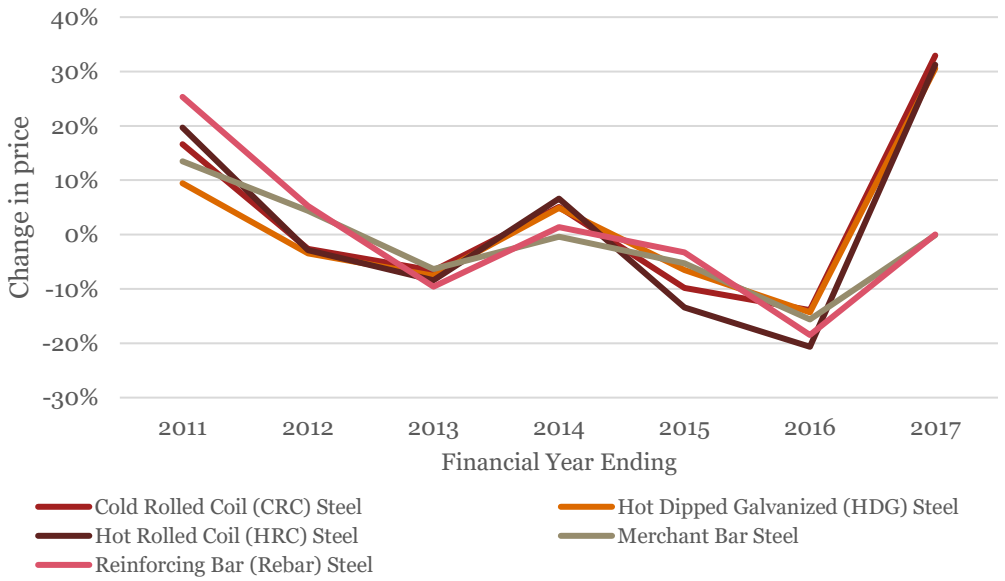


Figure 7: Change in United States steel prices



4.1.2 Market trends

The weighted spot price (based on the average price across China, Europe and the United States) for HRC steel closely resembles that of the European spot price and a mid-point between the Chinese and US spot prices.

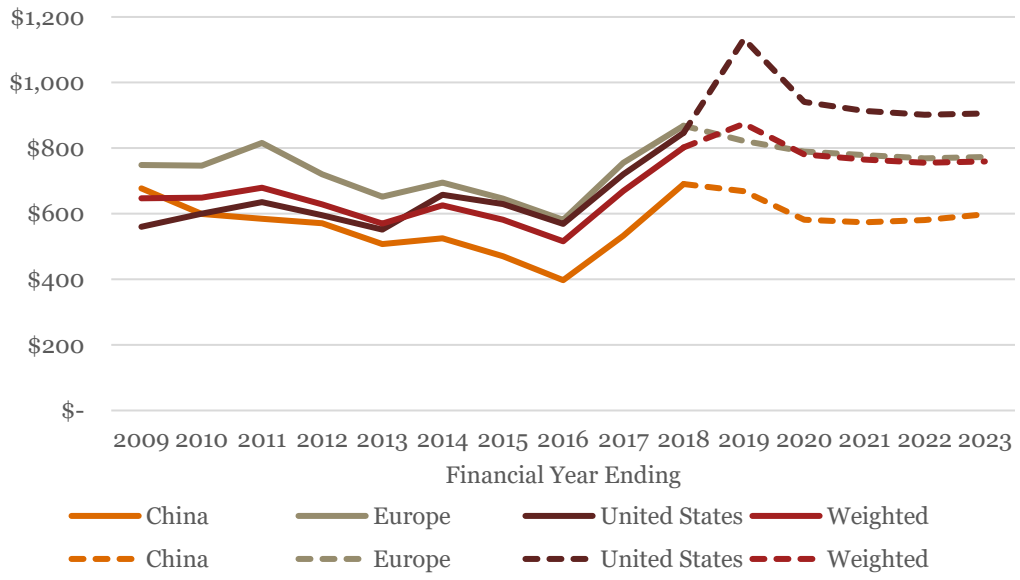
As shown in Figure 8 and Table 3, spot prices in FY19 ($AUD) show a slight decrease in China and Europe prices, but, a marked increase in the United States. The price of steel is very volatile and currently the subject of political tensions amid global overcapacity[19] and

[19] OECD (2017), Capacity Developments in the World Steel Industry, available at: dhttp://www.oecd.org/industry/ind/CapacityDevelopmentsWorldSteelIndustry_FINAL.pdf

accusations of dumping[20,21]. In response, the US has imposed tariffs on steel, curbing the price impact of global oversupply and temporarily raising the price of imported steel especially for FY19.

IBISWorld point to strong construction levels in the developing world amid continued urbanisation as another key driver of the world steel price in the coming years. Data from the World Steel Association shows that two-thirds of steel used in 2017 was in Asia, with China accounting for 70 per cent of that.[22] Leading indicators on Chinese steel demand show mixed signals, though. While residential construction activity looks strong, growth in government infrastructure investment has slowed. On the supply side, Chinese environmental policies have forced many firms to cease production and consolidation in the sector have placed upward pressure on prices.[23]

Figure 8: Price of hot rolled coil steel - AUD



4.2 Projections of steel prices

We recommend adopting the weighted average of Chinese, European and United States HRC steel spot prices for FY19 to FY21. We recommend using this weighted average as it negates the effect of country specific supply and demand events on steel prices and reflects the global nature of steel.

The granular view of steel forecasts by source market (Chinese, European and United State) for FY19 to FY21 is important as the new OCGT entrant may source its steel from any one or combination of the markets. As this granular view by source market is not available from FY22, we recommend escalating the prices using the HRC steel price index produced by IBISWorld for FY22 and FY23.

[20] Department of Industry, Innovation and Science (2018), Anti-Dumping Commission Report No. 419, available at: https://www.adcommission.gov.au/cases/EPR%20351%20%20450/EPR%20419/056%20-%20Report%20-%20Final%20Report%20REP%20419.pdf

[21] European Commission (2018), Commission extends anti-dumping measures on Chinese steel products, available at: http://trade.ec.europa.eu/doclib/press/index.cfm?id=1807

[22] World Steel Association (2018), World Steel in Figures 2018, available at: https://www.worldsteel.org/en/dam/jcr:f9359dff-9546-4d6b-bed0-996201185b12/World+Steel+in+Figures+2018.pdf

[23] Reserve Bank of Australia (2018), Statement on Monetary Policy – August 2018, available at: https://www.rba.gov.au/publications/smp/2018/aug/pdf/statement-on-monetary-policy-2018-08.pdf

The price of steel has been converted from USD to AUD using the exchange rate projections in Table 2. If the exchange rate for FY19 was 2.99% higher, in line with the expectations of International FIs, the projected price of HRC steel would be $849 in FY19, a more measured year on year increase of 5.87%.

The following steel prices are projected for the five year period:

Table 3: Steel price projections (AUD)

Financial Year Ending	2018*	2019**	2020**	2021**	2022**	2023**
Steel Price (AUD)	802	874	781	765	755	759
Steel Price (% change)		9.03%	-10.70%	-1.98%	-1.29%	0.48%

*Note: actual **Note: projections

5 Copper prices

We recommend that AEMO adopt the LME copper spot prices for FY19 to FY21. We recommend escalating the spot price for FY22 and FY23 using the percentage increases in price forecast by the World Bank.

5.1 Overview

5.1.1 Indices and data sources

There are a range of data sets and indices that could form the basis of copper price escalation. In our analysis, we have considered:

- The World Bank's historical[24] and forecast[25] copper spot price data;
- IHS Markit historical and forecast data (from FY 10 to FY21) which reflect the LME spot price.[26]

We have used IHS Markit's world copper LME spot price data as the basis of our projections and used the World Bank's price index to escalate the copper spot price in FY22 and FY23.

Our projections vary from those in the 2018 BRCP as those figures were projected on a calendar year basis. The 2017 value was a peak value from October, which was above the average price for FY18. Table 4 below shows the spot price of copper for FY17 and FY18, converted using historical RBA exchange rate data.

Table 4: Copper Price (Financial Year Ending 2017 - 2018)

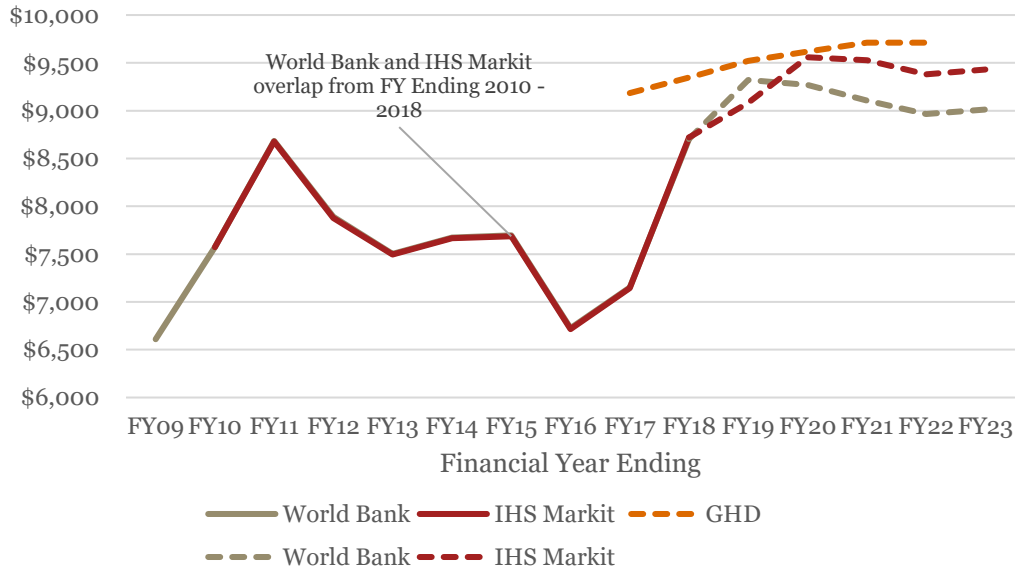
	Q1 17	Q2 17	Q3 17	Q4 17	Q1 18	Q2 18	Q3 18	Q4 18
USD	4,773	5,280	5,833	5,663	6,346	6,808	6,959	6,871
AUD	6,329	7,001	7,734	7,508	8,203	8,800	8,995	8,881

[24] The World Bank (2018), Commodity Markets, available at: http://www.worldbank.org/en/research/commodity-markets

[25] The World Bank (2018), World Bank Commodities Price Forecast, available at: http://pubdocs.worldbank.org/en/458391524495555669/CMO-April-2018-Forecasts.pdf

[26] IHS Markit (2018), Pricing and Purchasing Forecasts

Figure 9: Price of copper - AUD



5.1.2 Market trends

Research published by the European Central Bank has found that almost a third of the variance in copper price movements are driven by 'global factors,' which closely follow global business cycles. This implies a level of linkage between economic output and the demand for copper and is a major reason for the prominence of copper in commodity price indices.[27] Global economic growth in 2017 reached its highest level since 2012, both the Commonwealth Budget[28] and the RBA's August 2018 Statement on Monetary Policy forecast[29] continued strong growth across major global economies.

Copper is most commonly used in construction as well the manufacturing of electronics and machinery. As the largest consumer of copper, and the world's second largest economy, Chinese demand is a major determinant of copper prices.[30] As noted above, the construction outlook in China, the world's largest consumer of copper, is mixed.[31]

Successful contract negotiations at South American copper mines have eased the prospect of production cutbacks[32]. Data released by The International Copper Study Group shows global production up 6.1% for the period January to April 2018 year on year as a result of the resolution of production and export constraints in Chile and Indonesia.[33] Given the

[27] Chiaie, Ferrera and Giannone (2017), Working Paper Series – Common factors of commodity prices, available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2112.en.pdf?b5182c4253e7386089 25a443ebcdd409

[28] Reserve Bank of Australia (2018), Statement on Monetary Policy – August 2018, available at: https://www.rba.gov.au/publications/smp/2018/aug/pdf/statement-on-monetary-policy-2018-08.pdf

[29] Commonwealth Government (2018), Budget 2018-19 Budget Strategy and Outlook, available at https://www.budget.gov.au/2018-19/content/bp1/download/BP1_full.pdf

[30] Alvarez and Skudelny (2017), What is driving metal prices?, available at: https://www.ecb.europa.eu/pub/pdf/other/ebbox201708_01.en.pdf?d349e8891e79b01732c5188a21fd7803

[31] Reserve Bank of Australia (2018), Statement on Monetary Policy – August 2018, available at: https://www.rba.gov.au/publications/smp/2018/aug/pdf/statement-on-monetary-policy-2018-08.pdf

[32] Reuters (2018), Chile's Escondida says deal reached with union on new contract, available at: https://www.reuters.com/article/us-chile-copper-escondida/chiles-escondida-says-deal-reached-with-union-on-new-contract-idUSKBN1L00GZ

[33] The International Copper Study Group (2018), Copper: Preliminary Data for April 2018, available at: http://www.icsg.org/index.php/component/jdownloads/finish/114/2849?Itemid=

extremely energy intensive nature of copper mining, the prospect of stronger environment policies poses a threat to production costs and global supply.[34]

5.2 Projections of copper prices

We recommend adopting the spot prices provided by IHS Markit. In lieu of spot prices for FY22 and FY23, we proposed escalating their FY21 forecast using the percentage increases in price forecast by the World Bank. IHS Markit's data reflects more recent information and market sentiment, being current as of August 2018, whereas the World Bank's forecasts were published in April 2018.

The price of copper has been converted from USD to AUD using the exchange rate projections in Table 2. The fall in copper prices in FY21 and FY22 is reflective of the depreciation of the Australian dollar rather than a fall in global copper prices, which see a slight uptick in USD. If the exchange rate for FY19 was 2.99% higher, in line with the expectations of international financial institutions, the projected price of copper would be $8817 in FY19, a more measured year on year increase of 1.12%.

The following copper prices are projected for the five year period:

Table 5: Copper price projections (AUD)

Financial Year Ending	2018*	2019**	2020**	2021**	2022**	2023**
Copper Price (AUD)	8,720	9,080	9,559	9,527	9,379	9,429
Copper Price (% change)		4.14%	5.27%	-0.33%	-1.56%	0.53%

*Note: actual **Note: projections

[34] Rankin (2012), Energy use in metal production, available at: https://publications.csiro.au/rpr/download?pid=csiro:EP12183&dsid=DS3

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