APPENDIX 20

Material cost escalation factors
Jacobs SKM

Support for 2015/20 Regulatory Submission

ENERGEX LIMITED

Material Cost Escalation Factors

QH10530-O-SR-RP-E4-0001 | 1.0

02 Oct 2014

JACOBS

Support for 2015/20 Regulatory Submission

Project no:	QH10530
Document title:	Material Cost Escalation Factors
Document no:	QH10530-O-SR-RP-E4-0001
Revision:	1.0
Date:	02 Oct 2014
Client name:	ENERGEX Limited
Project manager:	Jeff Butler
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File name:	QH10530-O-SR-RP-E4-0001 ver 1.0

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Document history and status

Revision	Date	Description	By	Review	Approved
A	31/01/2014	Draft report to client for comment	J Butler	J Reddel	31/01/14
B	11/02/2014	Updated report including client feedback	J Butler	J Reddel	11/02/14
C	19/02/2014	Amended report including client comments and wood costs	J Butler	J Reddel	19/02/14
D	14/03/2014	Updated report	J Butler	J Reddel	14/03/14
E	18/03/2014	Updated report	J Butler	J Reddel	18/03/14
F	06/08/2014	Updated report	J Butler	J Reddel	07/08/14
G	12/08/2014	Amended report including client comments and PwC analysis	J Butler	J Reddel	12/08/14
H	26/09/2014	Inclusion of historic escalation factor commentary	J Butler	S Hinchliffe	26/09/14
1.0	02/10/2014	Final report	J Butler	S Hinchliffe	02/10/14

Contents

Executive Summary

In previous decisions for electricity network service providers, the Australian Energy Regulator (AER) has allowed for costs related to capital and operational expenditure provisions to be escalated in real terms. Prior to these decisions the Australian Consumer Price Index (CPI) was used by the AER to represent cost escalation in relation to network material costs. The method currently accepted by the AER involves the modelling of the change in equipment prices through combining independent forecast movements in the real price of input commodities, with weightings for relative contribution of each commodity to the final equipment cost. This in turn generates real cost forecasts for the regulatory control period under review.

Jacobs was engaged by ENERGEX on 16 December 2013 to forecast the annual real material cost escalation indices over the period 2015 to 2020 for ENERGEX's forthcoming electricity regulatory determination.

In developing the cost escalation factors, Jacobs has applied methodology consistent with the accepted approach for the AER's most recent electricity utility regulatory decisions including SP AusNet, Powerlink and the then Aurora Energy. The real material annual cost escalation indices presented in this report are specific to the asset categories provided by ENERGEX, and are based on the most recent information available.

Material cost drivers

The following tables present the forecast results of Jacobs's analysis and modelling of underlying cost drivers and economic indicators, aggregated to ENERGEX's standard asset classes respectively. The forecasted annual time period referenced in all the tables in this report runs from 1 July to 30 June in the following year. The base annual period for the real dollar values of commodities is the 2012/13 financial year.

These real indices therefore constitute Jacobs's calculated opinion of appropriate materials cost escalation rates that can reasonably be expected to affect ENERGEX over the upcoming revenue regulation period. The results of Jacobs's modelling for cost escalation factors for the various cost drivers are presented in Table 1.

Table 1 Real annual cost escalation of cost drivers[1]

Cost driver	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Aluminium	0.994	1.055	1.041	1.023	1.019	1.019	1.023
Copper	0.997	0.926	0.990	0.991	0.999	1.001	1.006
Steel	1.076	0.987	1.009	0.982	0.996	1.003	1.010
Oil	1.197	0.978	0.920	0.995	0.982	0.990	1.012
Wood	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Construction Cost Index	1.013	1.022	1.022	1.022	1.021	1.021	1.021
Trade Weighted Index	0.997	1.000	1.000	1.000	1.000	1.000	1.000
CPI	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Material cost escalation by asset category

In order to aggregate the input cost drivers for the network asset categories, Jacobs assigned appropriate weightings for the relative contribution of each of the input cost drivers and economic indicator to each asset category. Table 2 presents the real annual material cost escalation indices based on the movements in underlying cost drivers and economic indicators, aggregated at common standard asset class level used by ENERGEX.

[1] Cost escalation factors have been based on commodity forecasts in AUD

Table 2 Real annual cost escalation of asset categories

Cost driver	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Overhead Subtransmission Lines	1.031	1.013	1.014	1.005	1.008	1.010	1.014
Underground Subtransmission Cables	1.023	0.977	0.993	1.000	1.002	1.003	1.007
Overhead Distribution Lines	1.044	1.003	1.000	0.998	1.000	1.003	1.008
Underground Distribution Cables	1.031	1.011	1.000	1.006	1.004	1.005	1.009
Distribution Equipment	1.029	0.995	0.995	0.998	0.999	1.000	1.004
Substation Bays	1.023	1.002	1.001	1.004	1.004	1.005	1.008
Substation Establishment	1.013	1.022	1.022	1.022	1.021	1.021	1.021
Distribution Substation Switchgear	1.029	0.995	0.995	0.998	0.999	1.000	1.004
Zone Transformers	1.038	0.993	0.997	0.996	0.999	1.002	1.007
Distribution Transformers	1.034	0.997	1.000	1.000	1.002	1.004	1.008
Low Voltage Services	1.005	1.027	1.021	1.010	1.009	1.010	1.013
Metering	1.020	0.995	0.992	0.999	0.998	0.999	1.002
Communications - Pilot Wires	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Street Lighting	1.013	0.998	0.998	0.998	0.999	1.000	1.001
Control Centre - SCADA	1.000	1.000	1.000	1.000	1.000	1.000	1.000
System Buildings	1.013	1.022	1.022	1.022	1.021	1.021	1.021

Operational expenditure cost escalation

In generating material component escalation factors for operational expenditure, Jacobs has relied upon the projected activities in the ENERGEX Network Asset Management Program (NAMP) and calculated the relative contribution of each asset category to the projected expenditures.

Based on this breakdown of contribution by asset category, the real annual material cost escalation factors for operational expenditure are shown in the following table.

Table 3 Real annual material cost escalation for operational expenditure

Asset category	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Operational expenditure	1.005	1.004	1.003	1.004	1.006	1.010

Limitations Statement

Forecasts are by nature uncertain. Jacobs has prepared these projections as an indication of what it considers the most likely outcome in a range of possible scenarios. These forecasts represent the author's opinion on what is considered to be reasonable forecasts, as at the time of production of this document and based on the information set out in this report.

Jacobs has used a number of publicly available sources, other forecasts it believes to be credible, and its own judgement and estimates as the basis for developing the cost escalators contained in this report. The actual outcomes will depend on complex interactions of policy, technology, international markets, and behaviour of multiple suppliers and end users, all subject to uncertainty and beyond the control of Jacobs, and hence Jacobs cannot warrant the projections contained in this report.

Expert Witness Compliance Statement

In providing material cost escalators, Jacobs has read and agreed to be bound by the guidelines for expert witnesses in proceedings in the Federal Court of Australia, as published by Chief Justice M.E.J. Black on 5 May 2008[2].

In providing consultative service in other assignments, Jacobs acknowledges a pre-existing relationship with ENERGEX, but is confident such relationships do not compromise Jacobs's objectivity in defending its professional opinion based on specialised knowledge and capabilities held in the area of developing cost escalation rates for the Australian Energy Industry.

2 Available to download from http://www.fedcourt.gov.au/how/prac_direction.html#current

1. Introduction

Jacobs was engaged by ENERGEX on 16 December 2013 to forecast the annual real material cost escalation indices over the period 2015 to 2020 for ENERGEX's forthcoming electricity Regulatory Determination. The terms of engagement required Jacobs to provide its service to ENERGEX in several stages, including:

- Generation of cost escalation factors in January 2014 for initial modelling undertaken by ENERGEX for the development of their regulatory determination proposal
- Update of the cost escalation factors in July 2014 and April 2015

This report has been prepared in response to the first stage of Jacobs's engagement, with ENERGEX currently developing their initial proposal to submit to the Australian Energy Regulator (AER) in 2015. An integral step to developing annual expenditure forecasts is the production of a set of reasonable assumptions with respect to the likely rate of annual material cost escalation.

Jacobs has been actively researching the capital costs of electricity network infrastructure works for some time. It has developed a material cost escalation modelling process which captures the likely impact of expected movements of specific input cost drivers on future electricity networks infrastructure equipment pricing, providing robust material cost escalation rates.

The annual real material escalation indices presented in this report represent Jacobs's calculated best estimate of likely cost escalation components to account for the predicted movement in underlying drivers affecting the cost of undertaking capital and operating expenditure work relative to the Australian Consumer Price Index (CPI), being the base inflation factor used by the regulatory authorities.

The annual real material escalation indices presented are specific to the asset categories provided by ENERGEX, and are based on the most up-to-date information available at the time of compilation.

1.1 Objective and scope of work

Jacobs understands the objective of this assignment is to provide the real annual material cost escalation factors that will assist ENERGEX in the preparation of their regulatory proposal. This delivery will be provided through the production of a report which can be submitted to the AER and published in the public domain.

Jacobs is to address the specific requirements documented in the consultancy brief provided by ENERGEX:

- Provision of annual real material cost escalation indices for the electrical network infrastructure such as overhead lines and switchgear, zone and distribution substations, underground cables and control equipment including the following individual cost drivers:
  - Aluminium
  - Copper
  - Steel
  - Oil
  - Wood
  - Construction costs
  - Market indices and foreign exchange rates
- Forecast the annual real material cost escalation indices aggregated at common Jacobs standard asset classes and mapping to the nominated ENERGEX asset categories

1.2 Deliverables

The primary deliverable for this assignment is a clear and concise independent consultancy report which supports the real cost escalation factors for materials only for nominated asset categories, including an explanation of the approach adopted in developing the annual real material cost escalation indices and how this approach is consistent with recent electricity network decisions. The report will:

- Follow the approach approved by the AER in recent final decisions
- Describe the annual material escalation factor developed for relevant direct inputs into standard electricity distribution network assets for the next regulatory control period
- Describe the forecasting methodology used by Jacobs including the key drivers likely to impact on material cost escalation over the next regulatory control period
- Highlight forecasts that will be derived from appropriately sourced independent data and forecasts
- Describe Jacobs's relevant expertise in relation to the scope of works

2. Method

In past decisions for electricity network service providers, the AER has allowed the costs related to capital and operational expenditure provisions to be escalated in real terms. Prior to these decisions, the Australian CPI was generally used as a proxy to account for the escalation expected in relation to these network costs.

The methods more recently accepted by the AER sought to better characterise the likely escalation in price of equipment/project costs through combining independent forecast movements in the price of input components, with 'weightings' for the relative contribution of each of the components to final equipment/project costs. This in turn generates real cost forecasts for the regulatory control period under review.

In its final decision for the NSW Electricity Distribution Businesses, the AER stated:

> *In light of these external factors, it was considered that cost escalation at CPI no longer reasonably reflected a realistic expectation of the movement in some of the equipment and labour costs faced by electricity network service providers (NSPs). It was also communicated by the AER at the time of allowing real cost escalations that the regime should systematically allow for real cost decreases. This was to allow end users to receive the benefit of real cost reductions as well as facing the cost of real increases.*[3]

Jacobs confirms that its method for modelling the forecast changes in the cost escalation factors of materials used in ENERGEX's capital and operating expenditure forecasts is consistent with the approach recently accepted by the AER.

This section of the report provides a step-by-step description of the method employed by Jacobs in modelling real material cost escalation forecast.

The opportunity to develop an enhanced understanding of the drivers of network asset costs originally presented itself to Jacobs during a 2006 multi-utility strategic procurement assignment. It was from this study that Jacobs was able to demonstrate that prices were increasing with a rate higher than Australian CPI, and was able to develop and calibrate a model that described this escalation.

As part of this strategic procurement study, a number of network asset equipment manufacturers and/or suppliers were surveyed to provide a greater understanding of the cost drivers underlying equipment pricing.

Jacobs also drew on information within studies undertaken on contract cost information for a number of turnkey and contracted construction projects (including plant equipment, materials, construction, testing, and commissioning). Jacobs's knowledge base of network management, operation, and asset procurement experience was also drawn upon during this establishment of cost drivers.

The results of Jacobs's research indicated that there are a number of common factors driving the changes in networks' capital infrastructure costs.

The primary factors (in no particular order) influencing material cost movements are considered to be changes in the market pricing position for:

- Metals – copper, aluminium and steel
- Oil – as a material in itself, as a proxy for energy costs, and as a proxy for plastics (primarily High Density Polyethylene HDPE, Cross Linked Polyethylene XLPE)
- Construction costs
- Foreign exchange rates – primarily the USD to AUD relationship to convert commodities in international market quoted in USD
- Foreign price inflation index – primarily the US Consumer Price Index (CPI) to convert price quoted in nominal USD terms into real USD term (and vice versa)

[3] AER, NSW DNSP Final Decision 2009, p. 478. Report is available at http://www.aer.gov.au/content/index.phtml/itemId/728076

- Australian Trade Weighted Index (TWI) – as weighted average purchasing power of Australian dollar in overseas market and as a proxy for imported manufactured goods
- Australian Consumer Price Index (CPI) – as a general price inflation index in itself to convert real AUD quotes into nominal AUD term and as a proxy for local manufacturing costs

Having identified these key cost drivers, Jacobs examined each of the main items of plant equipment and materials within its database, in order to establish a suitable percentage contribution, or weighting, by which each of these underlying cost drivers were considered to influence the total price of each completed item.

While there are benefits in maintaining consistency, particularly with past precedents, Jacobs has incorporated improvements to its modelling method when there was a clear need, particularly in response to regulatory precedents and as improved cost information becomes available. The information and modelling method was further updated during the 2010 multi-utility strategic procurement assignment.

The cost drivers with relevant economic indicators used in the Jacobs's Model, their major application, and their reference sources are shown in Table 4.

Table 4 Data sources

Cost Drivers	Application (mostly used for)	Sources
Aluminium, copper, steel and oil prices	Primary equipment, structures, overhead conductors, cables etc.	London Metal Exchange, Consensus Economics, MEPS, Bloomberg, US-Energy Information Administration and NYMEX
Foreign exchange rates and Australian TWI	Imported goods in Australian currency (e.g. secondary, switchgear, insulators etc.) and for non-metallic and non-oil based items	Bloomberg future contracts and Reserve Bank of Australia
Construction index	Civil, foundation, building, establishment etc.	Australian Construction Industry Forum
Australian CPI	All (to convert nominal to real terms) and manufacturing	Australian Bureau of Statistics and Reserve Bank of Australia
US CPI	All imports (to convert nominal to real terms quoted in USD)	US Bureau of Labor Statistics and US Congressional Budget Office

3. Key cost drivers

In order to ensure all forecasts incorporate current and recent market information, Jacobs updates key cost drivers and economic indicators within our internal model for each assignment. This ensures the most recent practical current date information is used.

The following sections present a discussion of the methods by which the forecast movements of each cost driver and economic indicators are updated.

3.1 Australian Consumer Price Index

The Australian Consumer Price Index (CPI) is used as a proxy for the local manufacturing price index. Jacobs acknowledges that while the historic Australian Producer Price Index (PPI) for electrical equipment manufacturing is available[4], this index is more relevant to the manufacture of electrical goods and as such is not considered appropriate for what is largely a construction/equipment maintenance industry; that is, electricity utilities are not electrical goods manufacturers. Jacobs has therefore relied on the Australian CPI, for which credible forecast is readily available, to represent the forecast trend of the manufacturing activity (manufacturing labour) price index.

The Australian CPI is also used to account for those materials or cost items in equipment whose price trend cannot be rationally or conclusively explained by the movement of commodities price.

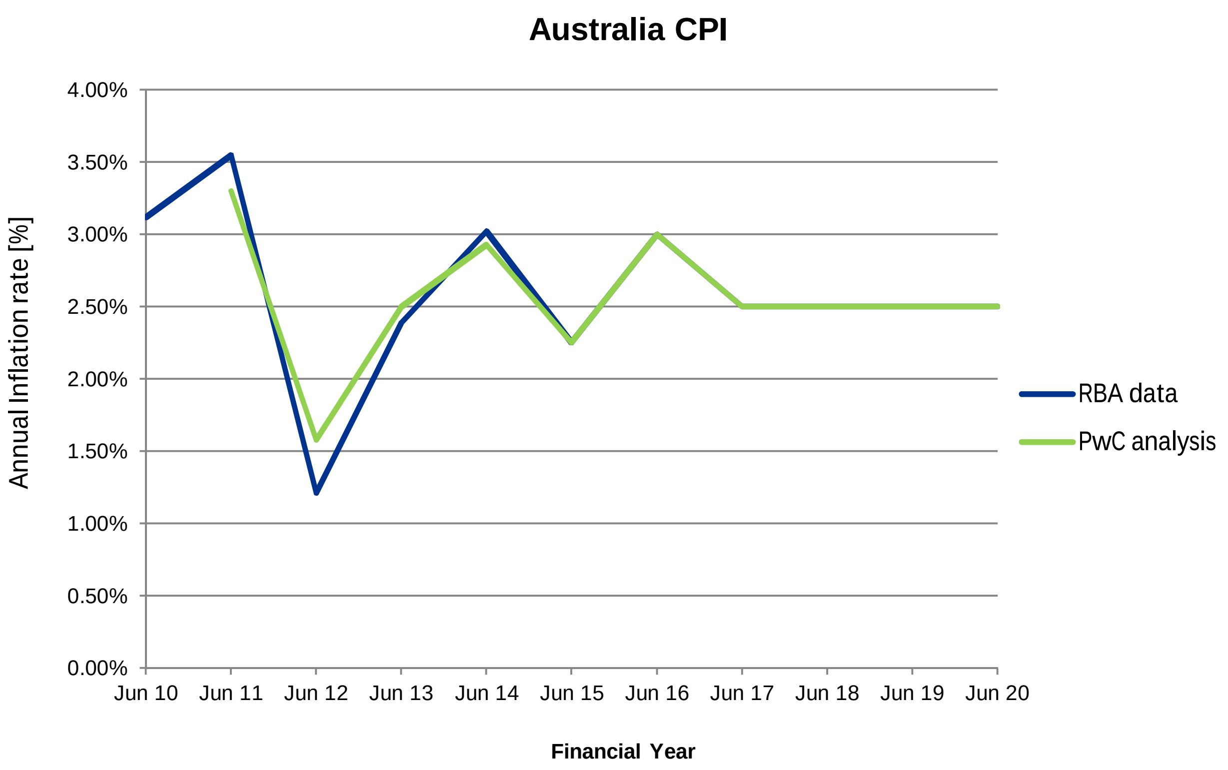
Finally, the Australian CPI is used to convert the Australian based input data from nominal to real term and vice versa.

Jacobs has chosen to adopt the method of forecasting Australian CPI used by the AER in recent electricity network decisions. This method uses the following process:

- Plot the most recent actual/ historical quarterly Australian CPI data from the Australian Bureau of Statistic (ABS) record and determine the annual Australian CPI % change by comparing with past historical data
- Plot two and half years of annual Australian CPI % change forecasts from the most recent Reserve Bank of Australia (RBA) Statement on Monetary Policy (August 2014), with forecasts out to December 2015
- Plot the annual Australian CPI % change as the RBA's inflation target midpoint of 2.5% in long term
- Apply linear interpolation between the above plotted annual % change points to form a continuous monthly set of data points for the entire duration of the forecast period
- Since this index data is annual measurements and take into account the movements over the previous 12 months, the data point from the last month (i.e. the 12th month data) of the annual period is considered to represent the index level for that year. Also, these data are fairly steady and constant, and generally moves in one predictable direction. Therefore, 'picking' the end 12th month data form an annual period and comparing it with the previous annual period's end 12th month data yields almost the same result as the comparison between the 12 month average from one annual period to 12 month average from the previous annual period

[4] Australian Bureau of Statistics, PPI Table 12.

Figure 1 Historic and forecast annual CPI for period 2009/10 to 2019/20



The annual Australian CPI % forecast is presented in Table 5. This table also shows the results from analysis undertaken by PricewaterhouseCoopers (PwC) for ENERGEX, which are historical values and the latest RBA CPI forecast. The variations between 2010-11 and 2013-14 result from ENERGEX basing its annual CPI on the March to March pricing year cycle. The PwC CPI forecast does not require any particular treatment to account for the pricing year and follows the RBA's forecasts.

Table 5 Australian CPI % forecast

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
RBA CPI factor	1.0312	1.0355	1.0121	1.0239	1.0302	1.0225	1.0300	1.0250	1.0250	1.0250	1.0250
RBA Annual CPI %	3.12%	3.55%	1.21%	2.39%	3.02%	2.25%	3.00%	2.50%	2.50%	2.50%	2.50%
PwC CPI analysis	-	1.0330	1.0158	1.0250	1.0293	1.0225	1.0300	1.0250	1.0250	1.0250	1.0250

It should be noted that Jacobs has **not** included consideration of CPI in the generation of real material cost escalation factors.

CPI is used in converting the real material cost escalation factors to nominal indices for use in escalating future expenditure forecasts. Jacobs considers that the methodology outlined above which includes both the midpoint of the RBA target range and short term forecasts provides a reasonable estimate of this network cost pressure on nominal cost indices that can be anticipated during the next regulatory period.

3.2 Australian Trade Weighted Index

The Australian Trade Weighted Index (TWI) is a multilateral weighted average exchange rate index. It is the weighted average of exchange rates of Australian dollar against currencies of its most important trading countries, weighted to reflect the importance or the volume of trade with those countries. Therefore, the movement in the currencies of those countries with greater share of Australian's trade has greater effect on the index. The weightings of the various foreign currencies which make up the Australian TWI is annually updated or revised by the RBA based on the actual or new Australian-international trading data.

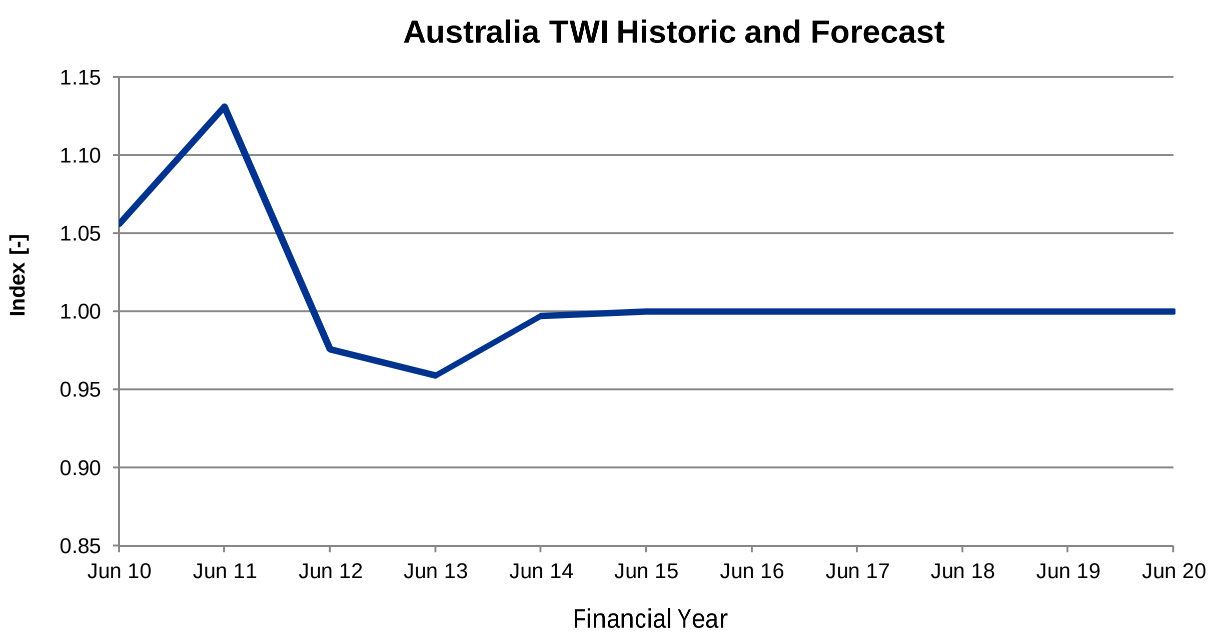
Jacobs uses the combination of Australian CPI and Australian TWI to describe the manufacturing activity for any imported good or equipment. The Australian TWI is also used to account for those materials or cost items in imported equipment whose price trend cannot be rationally or conclusively explained by the movement of commodities price.

In order to forecast the Australian TWI, Jacobs has assumed that the latest actual Australian TWI data as determined by the RBA to continue at the same level in the foreseeable future. This is considered prudent because one of the variables influencing the Australian economic outlook, including the Australian CPI forecast, is the volume of Australian international trade and the relative position of the Australian currency against the currencies of its major trading economies, which is summarised by the Australian TWI indicator. The underlying fiscal policy of the RBA periodically published in the Statement of Monetary Policy requires the TWI to remain in the same present level in the foreseeable future. Therefore this forecast aligns with the RBA's assumption as documented in its August 2013 Statement on Monetary Policy.

The following steps are performed to forecast this economic indicator:

- Plot the most recent actual/ historical monthly average Australian TWI data from the RBA record
- Extend the forecast Australian TWI going forward at the same level as the most recent actual data for every month of the forecast period
- Apply linear interpolation between the above plotted index to form a continuous monthly data points for the entire duration of the forecast period
- Since this index data is annual measurements and take into account the movements over the previous 12 months, the data point from the last month (i.e. the 12th month data) of the annual period is considered to represent the index level for that year. Also, these data points are fairly steady and constant, and generally moves in one predictable direction. Therefore, 'picking' the end 12th month data form an annual period and comparing it with the previous annual period's end 12th month data yields almost the same result as the comparison between the 12 month average from one annual period to 12 month average from the previous annual period.

Figure 2 Historic and forecast annual TWI for period 2009/10 to 2019/20



This Australian TWI forecast used during Jacobs modelling is presented in Table 6.

Table 6 Australian Trade Weighted Index

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Annual Trade Weighted Index	0.959	0.997	1.000	1.000	1.000	1.000	1.000	1.000

The Trade Weighted Index, together with the foreign exchange rate (refer section 3.3), is included in the Jacobs modelling to consider the impact of importing assets in Australian currency.

3.3 Australian dollar to USD exchange rate

The Jacobs cost escalation modelling process uses the forecast USD/AUD exchange rates, to restate USD based forecast market prices of commodities, namely copper, aluminium, steel and oil, into their comparable AUD pricing movements. This is undertaken in order to account for any potential movements of base currency commodity market price movements through a strengthening or weakening of the AUD.

The following steps are performed to forecast this economic indicator:

- Plot the most recent actual/ historical monthly average USD/AUD exchange rate from the RBA record
- Thereafter, Jacobs as adopted the longer term historical average of 0.80 USD/AUD exchange rate as the long term forecast from December 2021
- Apply linear interpolation between the months without forward contract and long term average data point to form a continuous monthly data points for the entire duration of the forecast period

The annual average of the twelve monthly USD/AUD exchange rate forecast data points as formed in the above steps is presented in the following Figure 3.

Figure 3 AUD/USD Exchange rate forecast

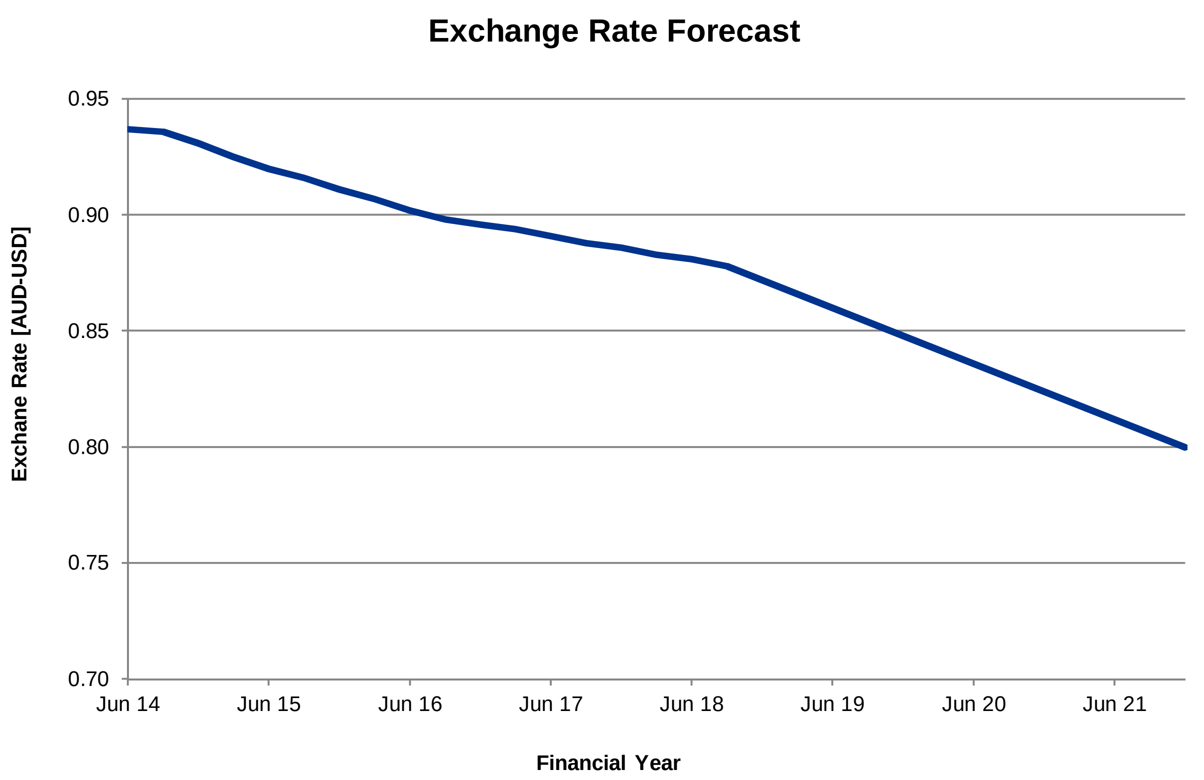


Table 7 Forecast annual average USD/AUD exchange rates

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Average annual exchange rate	1.027	0.937	0.920	0.902	0.891	0.881	0.860	0.836

All forecast input pricing data quoted in USD at a future point in time is converted into AUD by using the USD/AUD exchange rate forecast from the same point in time.

3.4 US Consumer Price Index

The “USA All Urban Consumer CPI-U” trend is referred as the US CPI to convert the US based input data from nominal to real term and vice versa.

The following steps are performed to forecast this economic indicator:

- Plot the most recent actual/ historical monthly US CPI data from the US Bureau of Labor Statistics record (September 2013 data for this modelling exercise)
- Plot the ten calendar years of US CPI forecast data from the most recent Budget and Economic Outlook publication of the US Congressional Budget Office
- Apply linear interpolation between the above plotted data to form a continuous monthly data points for the entire duration of the forecast period

All forecast pricing data quoted in USD in nominal terms at a future point in time is converted into real term (or vice versa) by using the US CPI data from the same point in time.

3.5 Construction Cost Index

Construction costs are included in the model as a key driver underlying network project construction costs, in order to account for price movements in materials elements of the civil works.

The Australian Construction Industry Forum (ACIF)[5] is the peak consultative organisation of the building and construction sectors in Australia. The ACIF has established the Construction Forecasting Council (CFC)[6] through which it provides a tool kit of analysis and information.

In commenting on the construction industry as a whole, the ACIF noted the following:

> *“The ACIF Forecasts reflect a series of turning points in the construction industry across Australia, within the different parts of the construction industry and within the different states. The turning points reflect key macro-economic changes and industry developments.*
>
> *Falling commodity prices has narrowed the pipeline of new major development projects or deferred other major projects — the engineering construction boom is projected to taper off. Meanwhile historic lows in interest rates and improved housing affordability are expected to encourage an uplift in housing starts and an increase in residential construction spending.*
>
> *A recent recovery in investor sentiment as well as lower interest rates is expected to encourage an improvement in commerce that will be reflected in an upturn in non-residential construction spending.*
>
> *ACIF views that a fall in construction activity in some sectors of the industry will be offset by increases in others. Total construction activity is projected to amount to around $229 billion next year, roughly the same as it was in 2012-13. The total amount of construction building work to be done in 2013-14 is projected to be around 75 per cent larger than it was a decade ago. This is in real terms (that is, taking out the impact of inflation).*

5 http://www.acif.com.au
6 http://www.acif.com.au/aboutus/about-acif/construction-forecasting-council

More than ever this sanguine BIG picture hides considerable variation, swings and troughs in construction spending in specific construction sub-sectors and in different states and cities. Those interested in gaining a full understanding of patterns and the outlook for construction should review the macro projections and construction aggregates as well as the detailed picture provided in the ACIF Forecasts.

Events since the release of May 2013 ACIF Forecasts that affect the outlook for our industry include:

- *ongoing concerns about the stability of the Eurozone.*
- *signs that China is managing to sustain economic growth and price stability.*
- *continued economic recovery in the US raising concern about the tapering off of quantitative easing and increases in interest rates.*
- *fall in Australian interest rates to record lows and a fall in the $A/$US exchange rate*
- *outlook for Australian growth has moderated although investor sentiment is improving"*

For engineering construction, the ACIF forecasts indicated *"… spending has peaked in real terms in 2012-13 at around $124 billion per year. This is higher than previously expected and represents an historic achievement that will be difficult to exceed or repeat in the next few years.*

The updated ACIF Forecasts shows that the engineering construction sector continues to be dominated by mining. Global uncertainties over demand for energy and minerals has seen some major projects put on hold. However, the resource projects still in the pipeline, and major nation building infrastructure projects in the ports, roads and railways sectors are expected to keep the broad category of engineering construction at relatively high levels.

Government policy plays a strong hand in the engineering construction and there is also some risk from changes in Government policy. Delays in the National Broadband Network (NBN) have induced a volatile spending pattern in telecommunications which may be unwound through a review which is currently underway."

In commenting on the energy sector, the ACIF noted that activity was falling away from the local peak that occurred during 2013. Expenditure in the electricity sector may increase as regulatory decisions permit the necessary investment in network augmentations. However, the ACIF suggested that some renewable projects may be at risk depending upon the legislative reform agenda of the new Federal Government. For the Queensland market, the ACIF forecasts a reduction in growth and then a decline. Investments in ports, railways and bridges are expected to be shored up in 2014, with a moderation in spending into the medium term.

The following steps are performed to forecast this economic indicator:

- Plot the most recent actual/ historical and forecast annual 'Engineering' construction price index from the CFC's toolkit
- Apply linear interpolation between the above plotted index to form a continuous monthly data points for the entire duration of the forecast period
- Since this index data is annual measurements and take into account the movements over the previous 12 months, the data point from the last month (i.e. the 12th month data) of the annual period is considered to represent the index level for that year. Also, these data are fairly steady and constant, and generally moves in one predictable direction. Therefore, 'picking' the end 12th month data form an annual period and comparing it with the previous annual period's end 12th month data yields almost the same result as the comparison between the 12 month average from one annual period to 12 month average from the previous annual period.

Figure 4 CFC Engineering annual construction cost index forecast

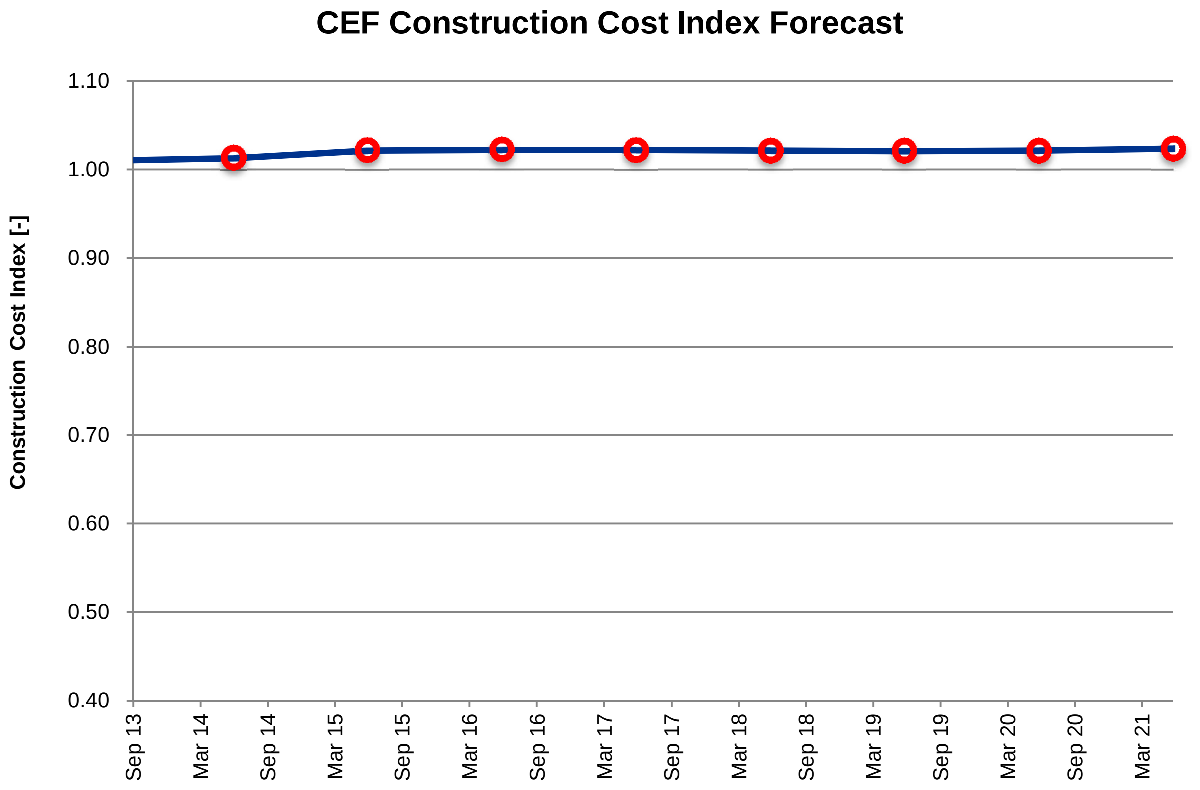


Table 8 provides the relative excerpt of the CFC engineering construction real price index, based on the most recent data available on April 2014.

Table 8 CFC forecast of engineering construction cost index

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Annual Construction Cost Index	1.010	1.013	1.022	1.022	1.022	1.021	1.021	1.021

3.6 Commodity prices

This section of the report presents the methodology employed by Jacobs in updating the commodity price inputs to its cost escalation model.

Commodity prices have been known to be volatile in recent times as they are influenced by several economic factors, such as overall levels of demand and supply as well as hedging and investment activity, each of which was effected by the 2008 Global Financial Crisis (GFC). Even outside of the period now known as the GFC, prices over a lengthy forward period such as the five year regulatory cycle can be difficult to pin down. It is therefore imperative to model these aspects of cost escalation using recent and credible data.

In seeking to develop appropriate cost escalation rates that effectively characterize the underlying infrastructure asset cost pressures faced by network service providers within Australia, the Jacobs modelling methodology incorporates the use of commodity futures contract prices into cost escalation rate computations.

3.6.1 Commodities and the use of futures contract pricing

The inclusion of future contracts pricing, as a means to predict likely market pricing positions of the various commodities going forward, is generally considered suitable, as these contracts represent the firm position of market participants who have actively placed money behind their predictions.

Jacobs believes that the AER has a strong preference for the future contract market as the basis for forecasts.

Jacobs has thus adopted available futures prices into its forecast method, except where expressly noted. This is discussed in further detail in section 3.6.3.

3.6.2 Credible views of a range of professional forecasters

The future price position in the case of copper and aluminium are only available for three years out to December 2016 (prompt dates) from the London Metal Exchange (LME) futures contracts. In order to estimate prices beyond this latest prompt date point, it is necessary to revert to economic forecasts as the most robust source of future price expectations. Jacobs considers this to be superior to "trend" based analysis approaches. This is because economic forecasts consider the changes in global market supply (additional production capacity and/or retirement of excess/old infrastructure) as well as changes in global demand.

This methodology reflects the approach accepted by the AER in the most recent Powerlink Revenue Determination in utilising Consensus Economics'[7] quarterly publication "Energy and Metals Consensus Forecasts" as the source from which the long-term position of the copper and aluminium market prices were obtained. These quarterly reports provide details of the price forecasts, of each professional analyst surveyed, for the next 10 quarters. "Energy & Metals Consensus Forecasts" also provides the "mean" or "consensus" of these various individual market predictions. In doing so, the publication allows the user to gather an overall market perception, without the need to apply a weighting to individual predictions in terms of gauging the organisation's perceived strength in forecasting, historical accuracy or such.

In developing annual price movements for copper and aluminium, Jacobs uses a method of linear interpolation between the relevant December prompt date LME contract prices and the Consensus Economics long term predictions of price movements, as described in Section 3.6.3.

3.6.3 Jacobs's application of futures contracts and long-term forecasts

When updating the future position of the key cost drivers, Jacobs employs various combinations of futures contract prices and a range of views from credible forecasting professionals to develop the likely year to date June average price positions of specific key cost components.

3.6.4 Aluminium and copper

The price trends of aluminium and copper are used to account for those materials or cost items in equipment which are made from it or/and whose price trend can be clearly explained by the movement of these commodity prices.

Jacobs employs an eight step approach to produce specific data points between which linear interpolation is applied in order to arrive at the year-to-March average future pricing positions for aluminium and copper. Due to the volatility in daily spot and futures market prices, Jacobs uses 12 months annual average prices within its modelling process.

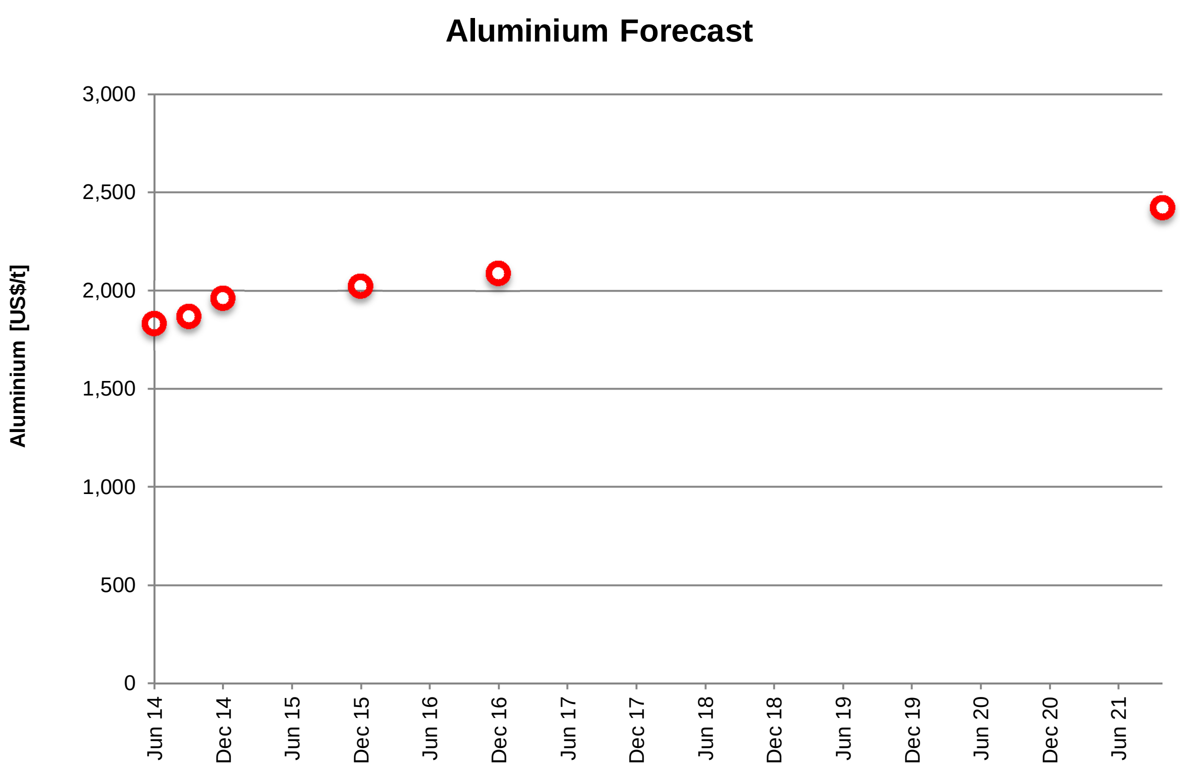
The steps involved are:

- Plot the daily average of the latest available complete month of LME spot prices
- Plot the daily average of the LME 3 month prices

[7] Consensus Economics Inc. is a leading international economic survey organization based in the United Kingdom. Its publication "Energy & Metals Consensus Forecasts" is a subscription based comprehensive quarterly survey of over 30 of the world's most prominent commodity forecasters.

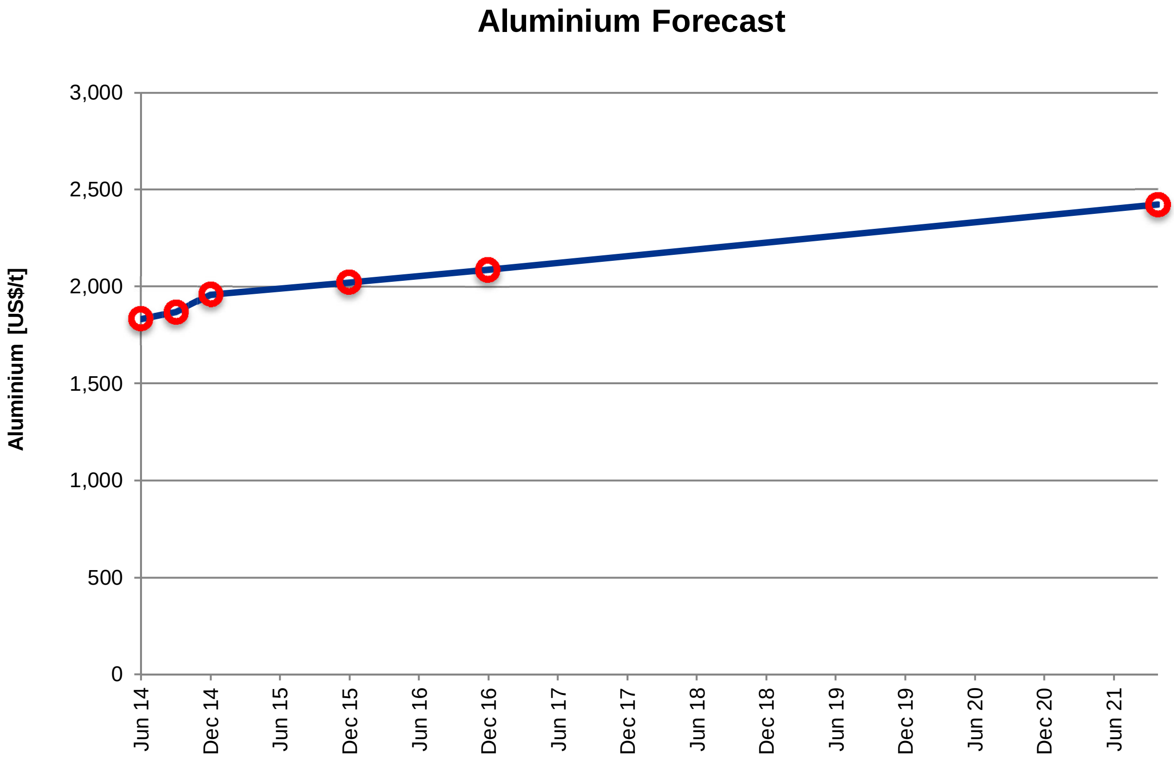
- Plot the daily average of the LME December year 1 prices
- Plot the daily average of the LME December year 2 prices
- Plot the daily average of the LME December year 3 prices
- Plot the Consensus Economics Long Term forecast position (taken as 7.5 years from the survey date)[8]
- Apply linear interpolation between the plot points
- Since this price data trend fluctuate frequently and in both directions (increase or decrease), the year-to-March average (i.e. 12 months average) price data is considered to represent the price level for that April to March annual period

Figure 5 Aluminium USD price forecast data points out to 2021



[8] The Consensus Long-term forecast is listed in the publication as a 5 – 10 year position. In an attempt to apply this in a reasonable manner, Jacobs consider the position to refer to the mid-point of this range, being 7.5 years, or 90 months hence.

Figure 6 Aluminium USD price forecast with interpolation between data points



The Consensus forecasts in USD and the average year from July to June input numbers in AUD used during Jacobs's modelling of the aluminium market prices are presented in Table 9.

Table 9 Real cost movements in aluminium[9]

	1/06/2014	1/09/2014	1/12/2014	1/12/2015	1/12/2016	1/10/2021
Consensus USD forecast shown in charts	1,834.15	1,868.55	1,959.36	2,022.36	2,085.98	2,422.92

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Average AUD annual price	1,894.56	1,883.74	1,987.40	2,068.06	2,115.90	2,157.07	2,199.09	2,250.27
Annual escalation factor	0.880	0.994	1.055	1.041	1.023	1.019	1.019	1.023

[9] The forecasts for aluminium are provided by Consensus Economics in USD per tonne, and Jacobs converts these to AUD using foreign exchange rates provided by the Reserve Bank of Australia. The escalation factors shown are based on year-on-year cost movements.

Figure 7 Copper USD price forecast data points out to 2021

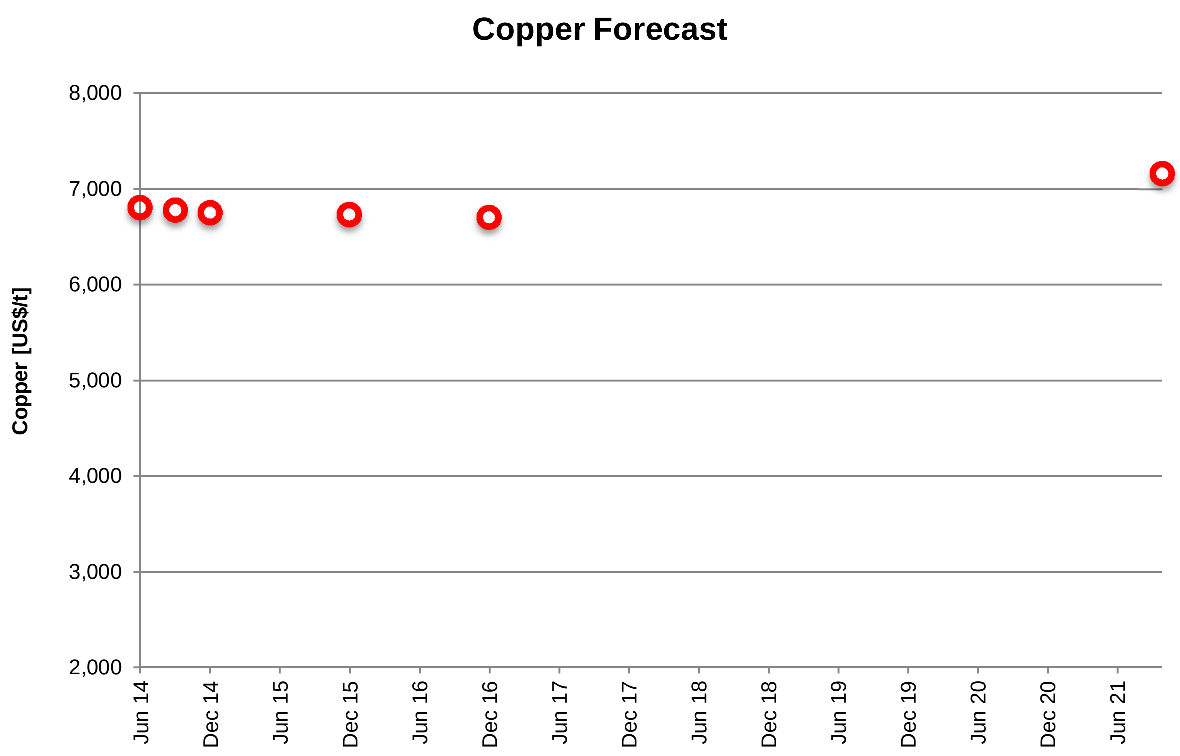
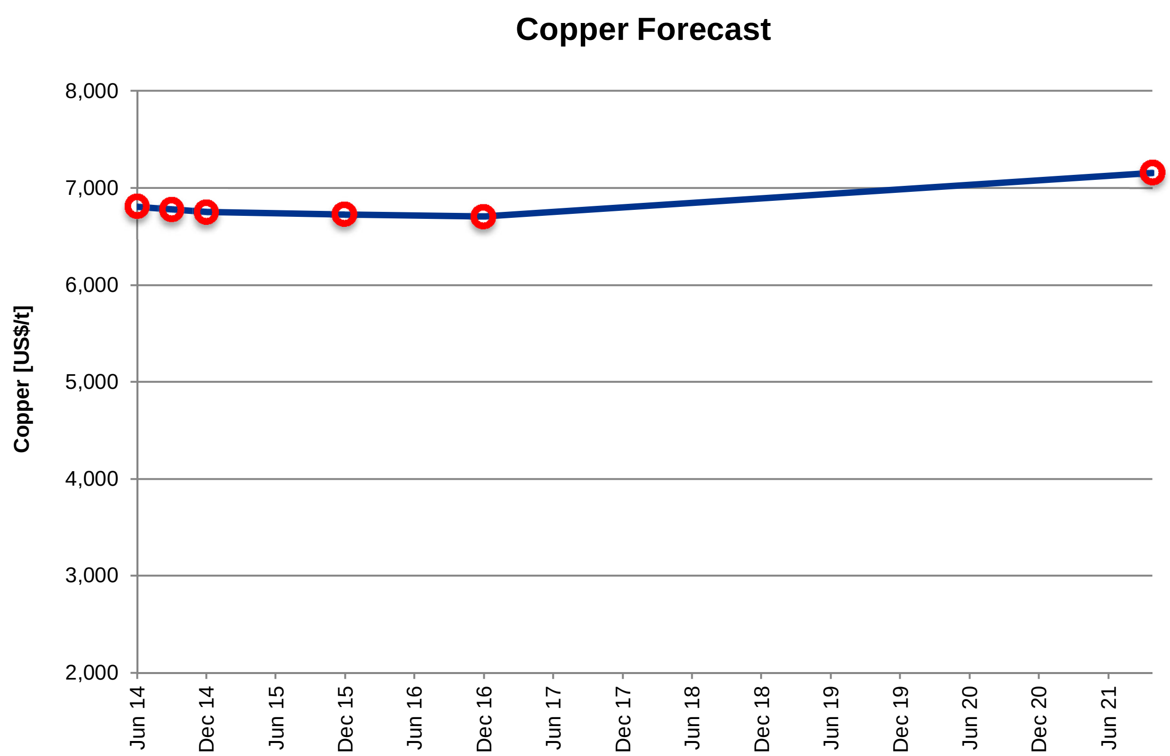


Figure 8 Copper USD price forecast with interpolation between data points



The Consensus forecasts in USD and the average year from July to June input numbers in AUD used during Jacobs's modelling of the copper market prices are presented in Table 10.

Table 10 Real cost movements in copper[10]

	1/06/2014	1/09/2014	1/12/2014	1/12/2015	1/12/2016	1/10/2021
Consensus USD forecast shown in charts	6,805.80	6,777.36	6,750.95	6,728.10	6,704.05	7,156.40

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Average AUD annual price	7,518.70	7,498.41	6,940.86	6,869.83	6,805.23	6,796.99	6,804.98	6,843.66
Annual escalation factor	0.924	0.997	0.926	0.990	0.991	0.999	1.001	1.006

3.6.5 Steel

The methodology utilised for aluminium and copper cannot be applied for the assessment of steel due to the lack of a liquid steel futures market. Jacobs notes that the LME commenced trading in steel futures in February 2008; however, the LME steel futures are still not yet sufficiently liquid to provide a robust price outlook. The current global production of steel averages 1,400 million tonnes per annum and the LME steel billet futures have a traded volume of approximately six million tonnes per annum, less than 0.5% of the global market.

Jacobs has therefore selected the Consensus Economics forecast to be the best currently available outlook for steel prices. Consensus provides quarterly forecast prices in the short term, and a "long term" (5-10 year) price. The most recent Consensus Economics survey available at the time of compiling this report was the April 2014 Survey. This publication provided quarterly forecast market prices for steel till January 2016, as well as year 3 (August 2016), year 4 (August 2017), year 5 (August 2018), and a long-term forecast pricing position. Jacobs undertakes a seventeen step approach to produce specific data points between which linear interpolation is applied in order to arrive at the year-to-June average future pricing positions for steel. The steps involved are:

- Plot the latest available CE spot prices
- Plot the CE 2 month prices
- Plot the CE 5 month prices
- Plot the CE 8 month prices
- Plot the CE 11 month prices
- Plot the CE 14 month prices
- Plot the CE 17 month prices
- Plot the CE 20 month prices
- Plot the CE 23 month prices
- Plot the CE 26 month prices
- Plot the CE 29 month prices
- Plot the CE 36 month prices
- Plot the CE 48 month prices
- Plot the CE 60 month prices
- Plot the Consensus Economics long term forecast position (taken as 7.5 years from the survey date)
- Apply linear interpolation between the plot points

[10] These forecasts and escalation factors have been developed in a similar way to those for aluminium

- Since this price data trend fluctuate frequently and in both directions (increase or decrease), the year-to-March average (i.e. 12 months average) price data is considered to represent the price level for that April to March annual period

Consensus Economics provides two separate forecasts for steel, both being for the Hot Rolled Coil (HRC) variety, with the first being relative to the USA domestic market and the other the European domestic market. Both forecasts are quoted in US$.

The Consensus Economics US HRC price forecasts are presented US$ per *Short Ton*. As historical prices are all quoted in US$ per *Metric Tonne*, it is necessary to convert these prices into their Metric Tonne equivalent. This is a simple operation with the US HRC prices multiplied by a factor of 1.1023, being the standard conversion rate for the number of short tons per Metric Tonne. Once converted to their Metric Tonne pricing position, Jacobs uses the average of these two forecasts (US HRC and EU HRC) as its steel price inputs to the cost escalation modelling process.

Figure 9 Hot rolled coil steel USD price forecast data points out to 2021

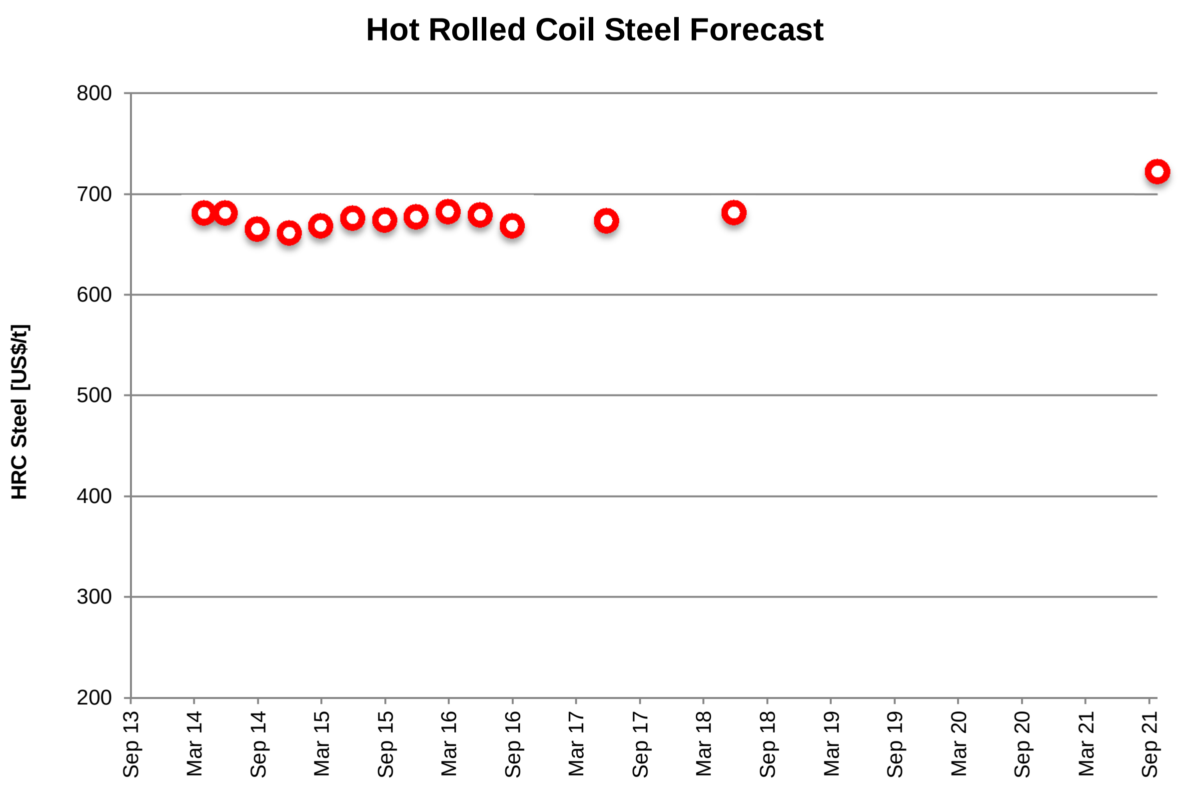
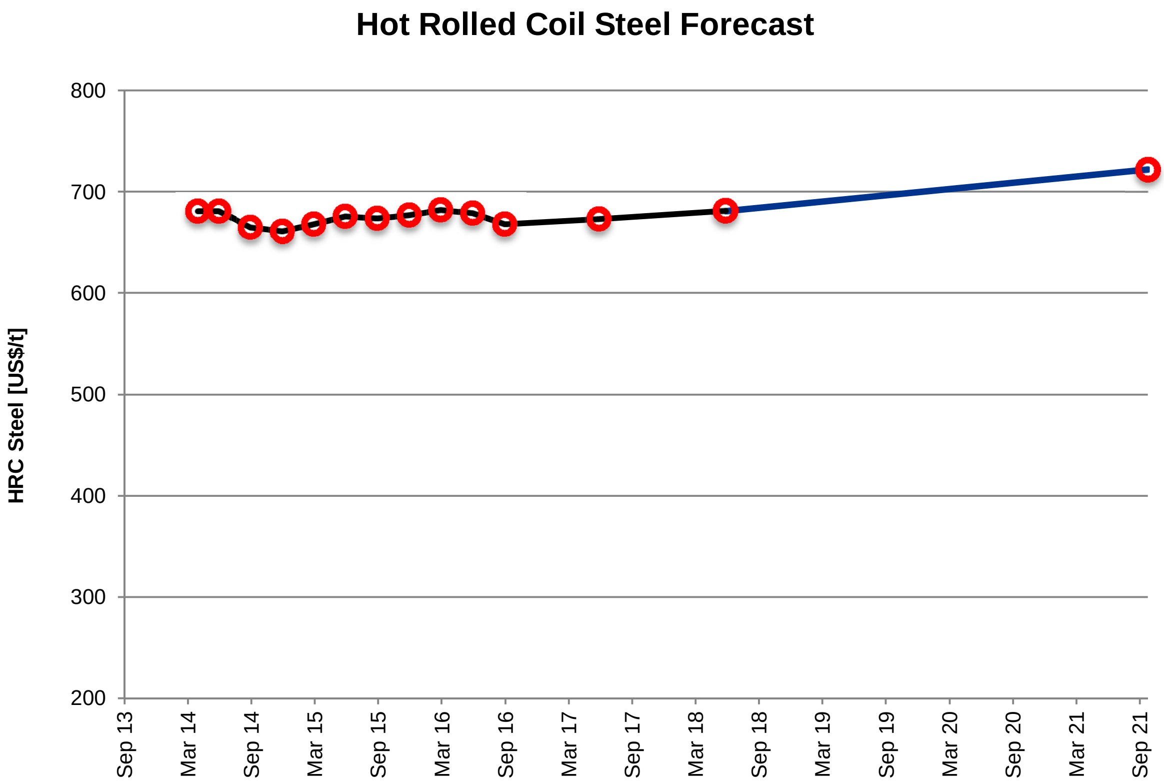


Figure 10 Hot rolled coil steel USD price forecast with interpolation between data points



The Consensus forecasts in USD and the average year from July to June input numbers in AUD used during Jacobs's modelling are presented in Table 11, and are consistent with the method accepted by the AER in recent electricity network decisions.

Table 11 Real cost movements in steel

	1/06/2014	1/12/2014	1/06/2015	1/12/2015	1/06/2016	1/06/2017	1/06/2018	1/10/2021
Consensus USD forecast	680.90	661.24	675.74	676.72	678.73	673.03	681.20	721.84

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Average AUD annual price	644.29	693.05	686.02	691.93	679.48	677.02	678.83	685.47
Annual escalation factor	0.883	1.076	0.987	1.009	0.982	0.996	1.003	1.010

3.6.6 Oil

The world oil markets provide future contracts with settlement dates sufficiently far forward to cover the duration of ENERGEX's upcoming regulatory control period. Various professional forecasts of oil prices from credible organisations to cover the duration of ENERGEX's upcoming control period are also available.

Jacobs has researched[11] the reliability of oil future contracts as a predictor of actual oil prices, and has formed the view that futures markets solely are not a reliable predictor or robust foundation for future price forecasts.

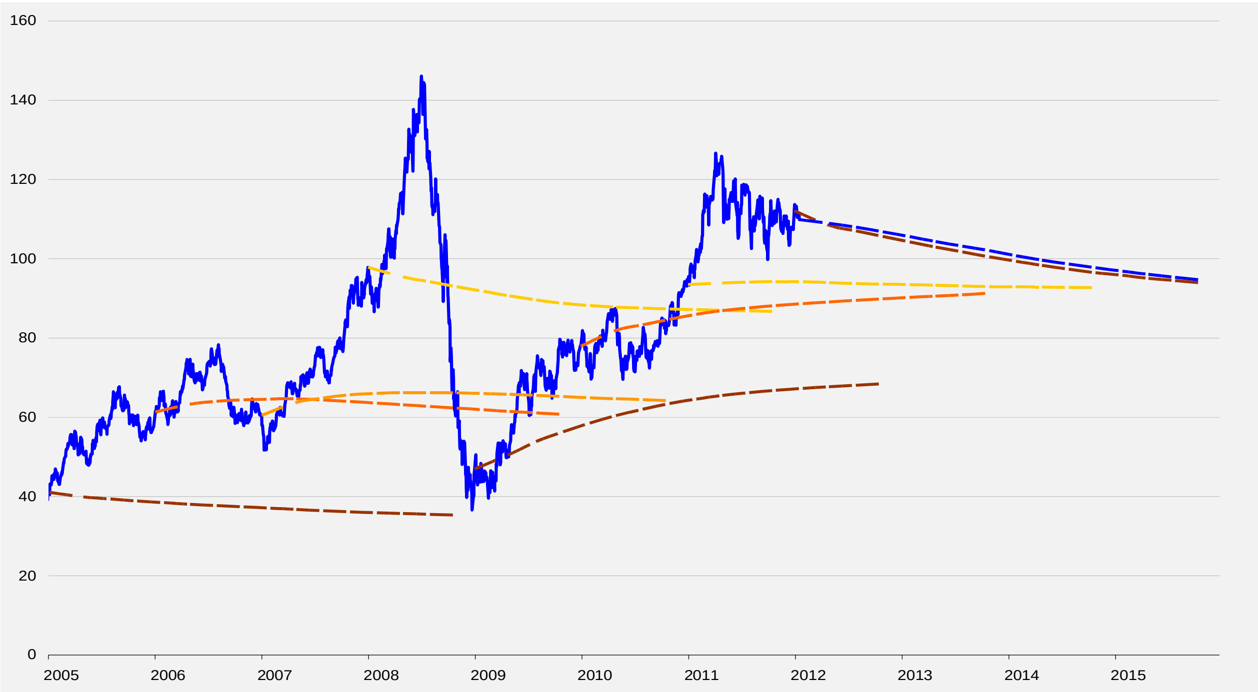
[11] Refer *What do we learn from the price of crude oil futures?,* Alquist & Kilian, Journal of Applied Econometrics, February 2010, and *Forecasting the Price of Oil*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers, July 2011

For example, the US Federal Reserve concluded that,

> *"… more commonly used methods of forecasting the nominal price of oil based on the price of oil futures or the spread of the oil futures price relative to the spot price cannot be recommended. There is no reliable evidence that oil futures prices significantly lower the MSPE[12] relative to the no-change forecast at short horizons, and long-term futures prices often cited by policymakers are distinctly less accurate than the no-change forecast."*[13]

Futures contracts tend to follow the current spot price up and down, with a curve upwards or downwards reflecting *current* (short term) market sentiment. This is illustrated in the Figure 11, with the blue trend line showing the spot price, with 4 years of futures prices shown at annual intervals. The "flat" nature of the futures price curve is clearly seen, with only a small upward or downward trend in the early period, and with the *current* spot price clearly shown to be the primary determinant of futures prices as far as 4 years ahead.

Figure 11 Oil (Brent[14]) futures compared to spot (blue trend line) 2005–2012



Source: Morgan Stanley Commodities

Future contract volumes beyond one year are low and the market is relatively illiquid, further highlighting the unsuitability of using futures prices as the basis of long term price expectations. As the chart in Figure 12 illustrates, beyond 3-to-6 months volumes and liquidity are very low.

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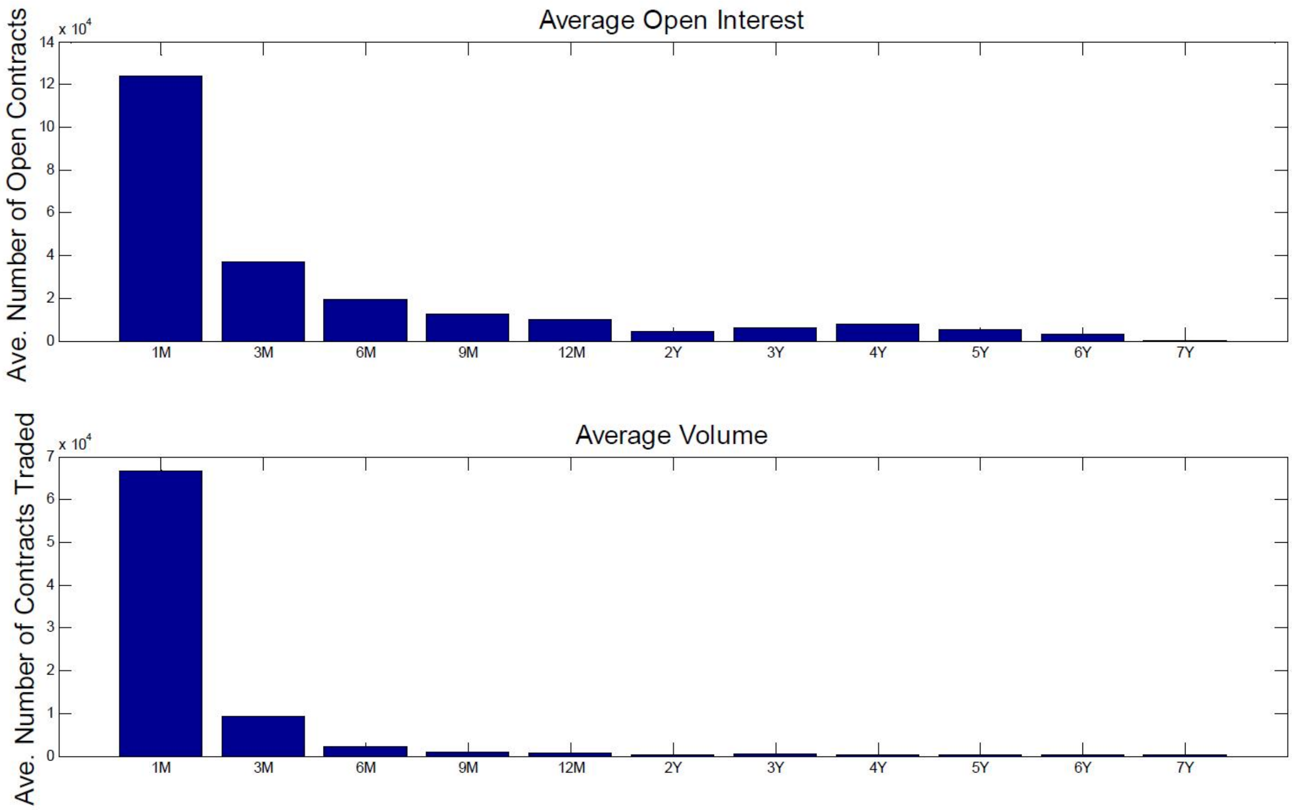
[12] **M**ean-**S**quared **P**rediction **E**rror which measures the expected squared difference between what a predictor predicts for a specific value and what the true value is. It is thus a measurement of the quality of a predictor.

[13] *Forecasting the Price of Oil*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers, July 2011

[14] While the chart refers to Brent futures, arbitrage opportunities ensure price disparities between West Texas Intermediate (WTI), Brent and other indices are low or with short term deviations related to specific supply constraints.

Figure 12 Future oil market volumes showing open contracts and traded volumes



In order to find a more reliable and robust source of future oil prices, Jacobs compared the actual prices against the historical predictions of oil-WTI price using three sources from recent (2011 – 2013) years:

- NYMEX futures contracts
- The US Energy Information Administration (EIA) Annual Energy Outlook
- Consensus Economics' "*Energy and Metals Consensus Forecasts*"

While none of these sources can claim to be wholly reliable, Jacobs has found that generally, the economic forecast were consistently least inaccurate than the other two sources.

Table 12 Average error in predicting future spot price (2011-2013)

Time forward from base date	Futures	EIA	CE
1 year	4%	17%	7%
2 year	10%	25%	7%
3 year	16%	28%	9%

Based on the least amount of error between the historical actual prices and the various types of historical available predictions (future contracts and forecasts), Jacobs has selected the Consensus Economics forecast to be the best currently available outlook[15] for oil prices throughout the duration of the ENERGEX's forecast period. Consensus provides quarterly forecast prices in the short term, and a "long term" (5-10 year) price.

The most recent Consensus Economics survey available at the time of compiling this report was the April 2014 Survey. This publication provided quarterly forecast market prices for oil till January 2016, as well as year 3 (August 2016), year 4 (August 2017), year 5 (August 2018), and a long-term forecast pricing position. Jacobs undertakes a seventeen step approach to produce specific data points between which linear interpolation is applied in order to arrive at the year-to-March average future pricing positions for oil.

The steps involved are:

- Plot the CE 2 month prices
- Plot the CE 5 month prices
- Plot the CE 8 month prices
- Plot the CE 11 month prices
- Plot the CE 14 month prices
- Plot the CE 17 month prices
- Plot the CE 20 month prices
- Plot the CE 23 month prices
- Plot the CE 26 month prices
- Plot the CE 29 month prices
- Plot the CE 36 month prices
- Plot the CE 48 month prices
- Plot the CE 60 month prices
- Plot the Consensus Economics Long Term forecast position (taken as 7.5 years from the survey date)
- Apply linear interpolation between the plot points
- Since this price data trend fluctuate frequently and in both directions (increase or decrease), the year-to-June average (i.e. 12 months average) price data is considered to represent the price level for that July to June annual period

[15] In their July 2013 draft report "*Escalation factors affecting expenditure forecasts"* for NSW, ACT and Tasmanian electricity utilities, Competition Economists Group (CEG) noted that the AER had changed its position on the use of future prices for the purpose of predicting oil prices (section 4.3.1, p. 26). AER rejected the use of the Consensus Economics forecast, stating that *"… Consensus Economics and EIA forecasts were both included in the discussion paper's data set and found that, for horizons beyond several years, the nominal price of oil adjusted for expected inflation is the best forecast of nominal oil prices*." Therefore, the AER stated it preferred zero real escalation for crude oil.

CEG questioned the AER logic, suggesting that the analysis the AER had relied upon was based in US dollars (USD), and referred to real prices in USD terms. A constant real price in USD is not equivalent to a constant real price in Australian dollars due to changing foreign exchange rates between US and Australian dollars, and difference in expected inflation between Australia and the United States. CEG presented two alternative cost escalation tables - one based on a zero real escalation for US prices, and another on Consensus Economics forecasts as proposed by Jacobs (then SKM).
Jacobs noted the results generated by CEG relying upon the Consensus Economics forecasts were conservative in comparison with the alternative approach based on zero escalation on USD based prices.

Figure 13 Oil USD price forecast data points out to 2021[16]

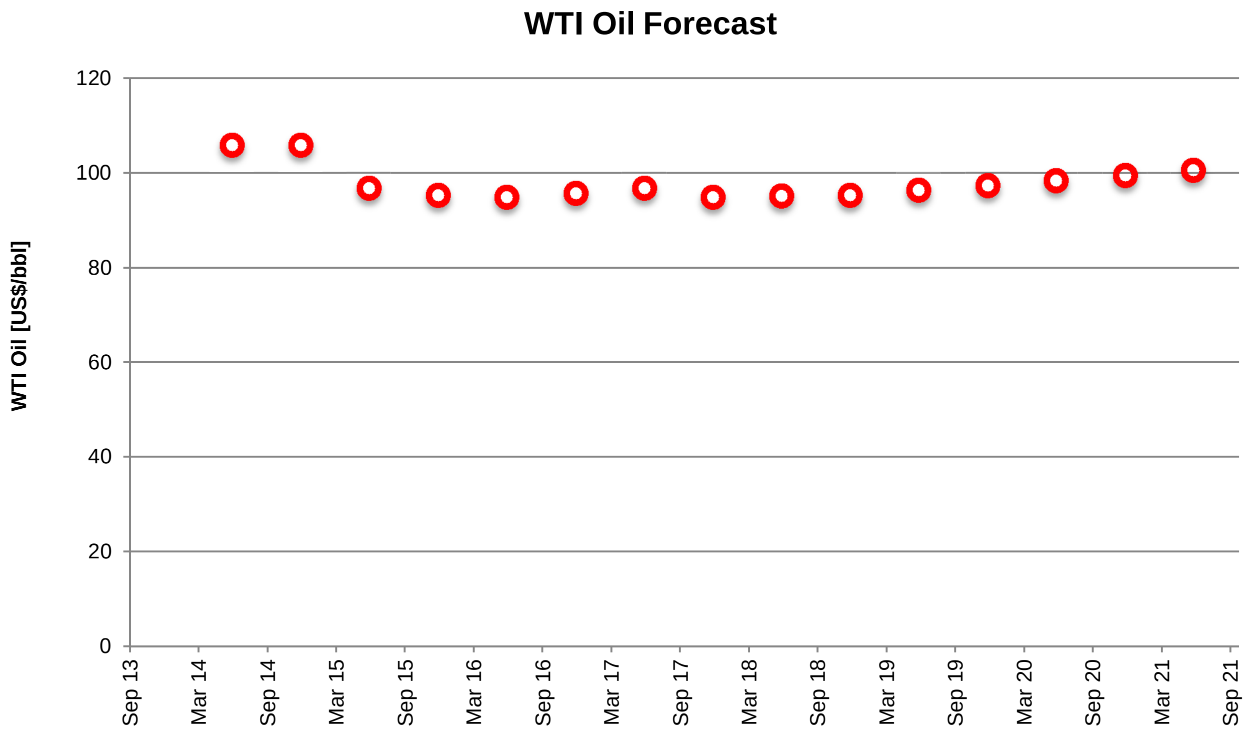
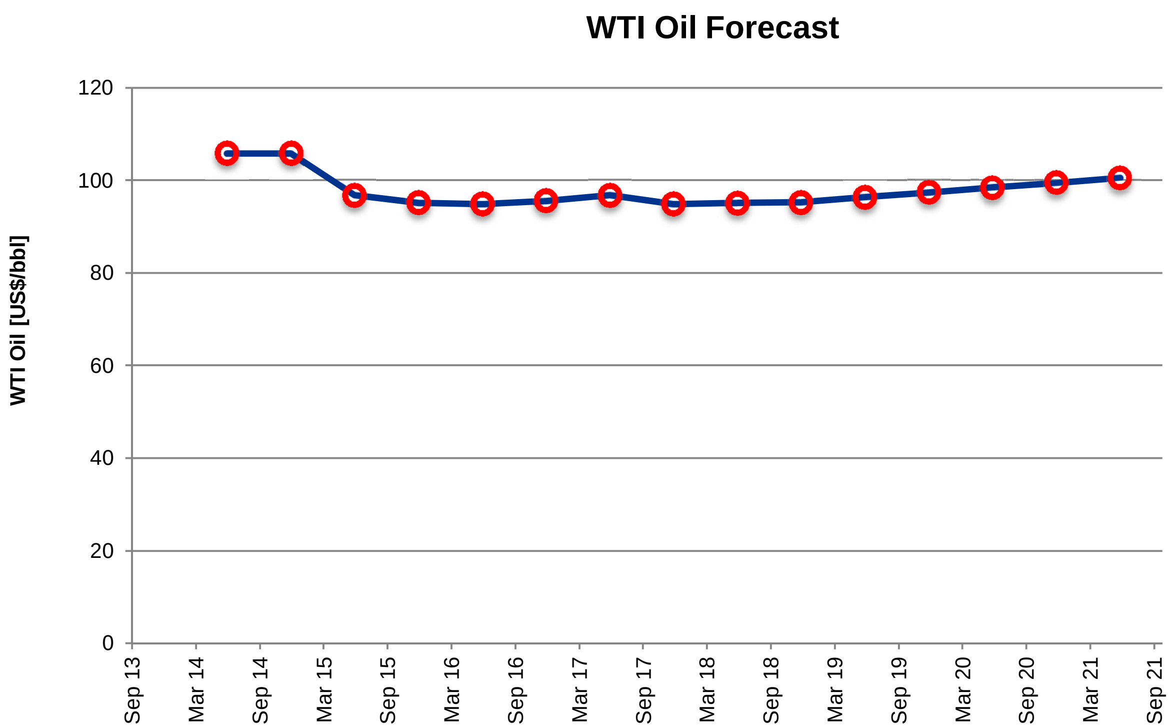


Figure 14 Oil USD price forecast with interpolation between data points



[16] Based on West Texas Intermediate crude oil forecasts in nominal US$/barrel

The Consensus forecasts in USD and resultant forecast in AUD for real oil prices used as the basis for calculating escalation are shown in Table 13.

Table 13 Real cost movements in oil

	1/06/2014	1/06/2015	1/06/2016	1/06/2017	1/06/2018	1/06/2019	1/06/2020	1/06/2021
Consensus USD forecast	105.79	96.76	94.91	96.77	95.07	96.31	98.40	100.49

	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Oil – WTI AUD/bbl	90.47	108.27	105.94	97.47	97.02	95.26	94.29	95.42
Annual escalation factor	0.955	1.197	0.978	0.920	0.995	0.982	0.990	1.012

3.6.7 Wood

Jacobs has previously addressed the potential impact of movements in wood prices may have on cost escalation factors for overhead lines. In 2008, Jacobs developed cost escalation for an electricity distribution utility with reference to a CEG report entitled "*Escalation factors affecting expenditure forecasts: a report for NSW electricity businesses*" dated April 2008. Whilst the report does not directly address the impact of wood costs, the modelling at that time relied upon CPI as a proxy for movements in wood prices.

From its standard reference estimates for overhead lines on wood poles, Jacobs noted that it is reasonable to assume that wood poles typically represent approximately 30% of the total material costs.

Historical Australian raw wood prices have been based on the KPMG Australian Pine Log Price Index (APLPI). The APLPI is based on data provided from various Australian softwood growers in eastern and southern Australia and documents changes in pine log prices achieved by large-scale commercial plantation owners selling common grades of plantation softwood logs to domestic processors. The APLPI is updated biannually based on two six month periods commencing on January and July with a nominal base period of the first six month period in 1998 (i.e. Jan-Jun 1998 = 100). The most recent publically available update is the June 2012 version of the index.

The APLPI considers the following specifications of raw wood products:

- Small sawlog with a diameter less than 240mm small end under bark
- Intermediate sawlog with a diameter between 240mm and 320mm small end under bark
- Medium sawlog with a diameter between 320mm and 440mm small end under bark
- Large sawlog with a diameter greater than 440mm small end under bark
- Preservation for use as poles, rails and posts
- Pulplog for use in pulp and paper, fibre-based panels and other such products
- Salvage log – all logs excluded from the other log classes on the basis of price and wood quality

Jacobs has used the preservation product component of the APLPI to ascertain the historical trend of softwood pole raw material nominal price movements.

Figure 15 Historical APLPI nominal data for preservation poles with long term trend – June 1995 to June 2012

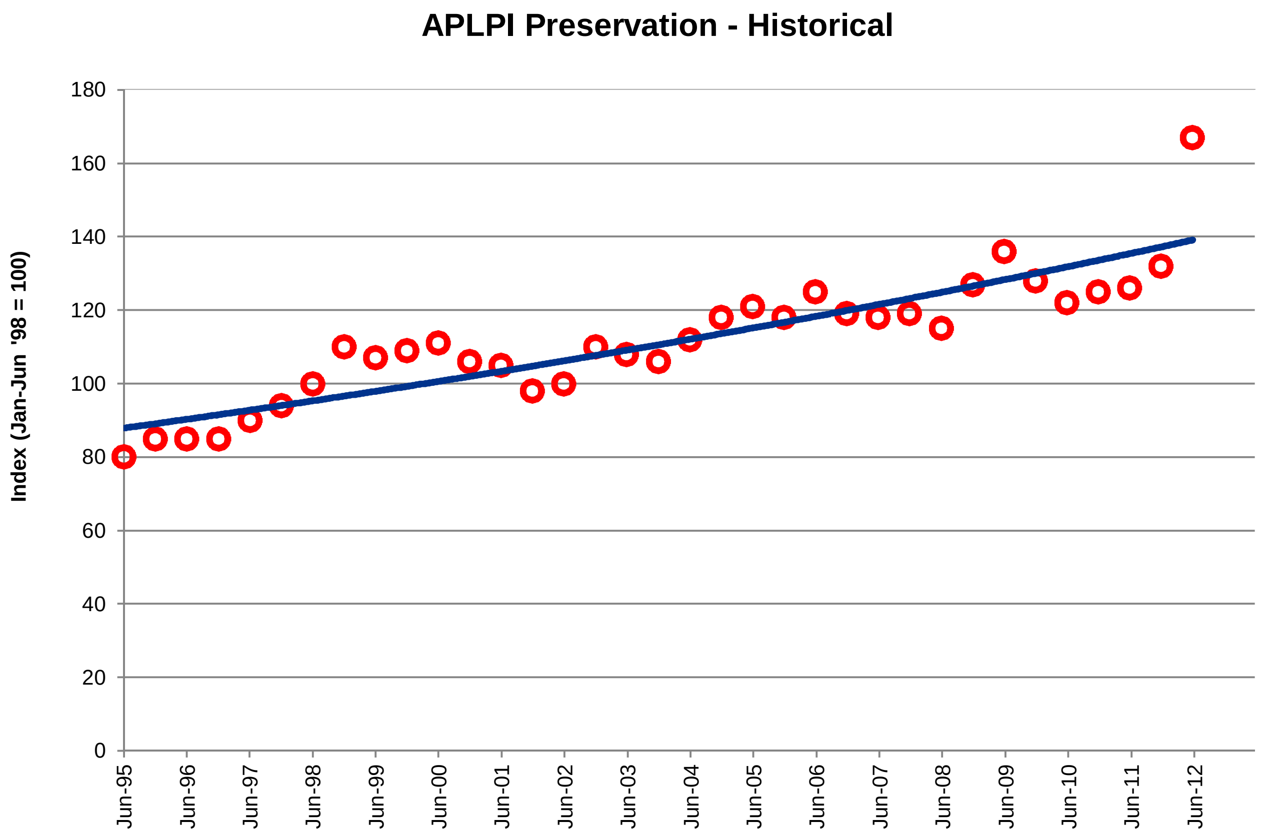


Table 14 Historical APLPI nominal data for preservation

	Jun 1995	Jun 1996	Jun 1997	Jun 1998	Jun 1999	Jun 2000	Jun 2001	Jun 2002	Jun 2003
Annual index	80	85	90	100	107	111	105	100	108
Annual escalation factor	-	1.063	1.059	1.111	1.070	1.037	0.946	0.952	1.080

	Jun 2004	Jun 2005	Jun 2006	Jun 2007	Jun 2008	Jun 2009	Jun 2010	Jun 2011	Jun 2012
Annual index	112	121	125	118	115	136	122	126	167
Annual escalation factor	1.037	1.080	1.033	0.944	0.975	1.183	0.897	1.033	1.325

KPMG note the following reported reasons for the volatility experienced in the Jan-Jun 2012 APLPI:

- Changes in product mix taken by customers
- New contracts
- Change in source area
- Small volumes of varied products making reported price volatile

Based on the data shown in Table 14, the average long term trend nominal price increase for preservation wood products is approximately 2.74 per cent per annum over the 17 year record of the APLPI. Jacobs notes that this is consistent with the long term CPI trend assumption that has been used in the April 2008 CEG report.

Jacobs is not currently aware of any publically available projections of wood costs. A recent ABARE[17] report entitled "*Preliminary long-term forecasts of wood product demand in Australia*" of May 2013 highlights the anticipated increase in future consumption for wood products, which is largely driven by identifiable scenarios such as increased building activity in detached and multi-dwelling construction, but does not project any associated projected price movements. The anecdotal evidence that Jacobs has found from the United States suggests that costs will generally track general price movements in the US economy, with a possible decrease in 2017.

Whilst the Jacobs acknowledges that any material change in the projected cost for wood in the future that is not comparable to CPI could potentially have an impact on the escalation factor for overhead lines, Jacobs considers that the anecdotal evidence found to date has not suggested the wood prices are expected to increase sharply in the future, and therefore CPI remains a reasonable proxy to use for projected wood costs.[18]

[17] Australian Bureau of Agricultural and Resource Economics and Sciences

[18] This means that in the calculation of the real material cost escalation factor for overhead line asset categories, the portion of the cost movements associated with the poles in the model is set to 1.00

4. Repeal of carbon price mechanism

On 17 July 2014, the Australian Parliament passed legislation to repeal the carbon pricing mechanism that had been in place since 2011.

As a result, Jacobs has ceased modelling any impact of carbon pricing on the material cost escalation factors.

5. Asset categories

ENERGEX provided the list of asset categories to be used in generating real material annual cost escalation factors. These are shown in Table 15, and include Jacobs's understanding of the assets included in each category.

Table 15 ENERGEX asset categories

Category	Assets
Overhead Subtransmission Lines	Overhead 132/110kV and 33kV lines on towers, concrete and wood poles
Underground Subtransmission Cables	Underground 132/110kV and 33kV cables and terminations
Overhead Distribution Lines	Overhead 22/11kV, SWER and Low Voltage lines on concrete and wood poles
Underground Distribution Cables	Underground 22/11kV and Low Voltage cables
Distribution Equipment	Air break switches, reclosers, sectionalisers, regulators
Substation Bays	Indoor and outdoor zone substation bays including circuit breakers, instrument transformers, isolators, earth switches, surge arrestors and capacitors
Substation Establishment	Area and facilities associated with zone substations including indoor and/or outdoor bays, control room, earthing, earthing systems, fence, oil containment, all auxiliary circuits and wiring, AC and DC boards, fire protection / indication systems, and security
Distribution Substation Switchgear	Circuit breakers and other switchgear associated with distribution substations
Zone Transformers	Power transformers located in zone substations
Distribution Transformers	Pole mounted, ground mounted and kiosk/pad mounted transformers
Low Voltage Services	Single phase and 3-phase low voltage service connections
Metering	High Voltage and Low Voltage metering
Communications - Pilot Wires	Overhead and underground pilot wires
Street Lighting	Suburban and traffic lighting on wood and steel poles
Control Centre - SCADA	Control Centre SCADA equipment
System Buildings	Substation buildings, mobile substations

The following asset categories have been excluded from this assignment:

- Communications
- IT systems
- Office equipment and furniture
- Motor vehicles
- Plant and equipment
- Buildings
- Land and easements

6. Asset category material cost escalation

The Jacobs cost escalation modelling methodology provides a rigorous and transparent process through which reasonable and appropriate cost escalation indices are able to be developed in relation to the prices of electricity distribution network plant and equipment.

The real escalation factors established during this assignment were based on the most up-to-date information available at the time of compilation.

These real indices therefore constitute Jacobs's calculated opinion of appropriate materials cost escalation rates that can reasonably be expected to affect ENERGEX over the upcoming revenue regulation period. The results of Jacobs's modelling during this assignment are presented in Table 16.

Table 16 Real annual cost escalation of cost drivers[19]

Cost driver	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Aluminium	0.994	1.055	1.041	1.023	1.019	1.019	1.023
Copper	0.997	0.926	0.990	0.991	0.999	1.001	1.006
Steel	1.076	0.987	1.009	0.982	0.996	1.003	1.010
Oil	1.197	0.978	0.920	0.995	0.982	0.990	1.012
Wood	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Construction Cost Index	1.013	1.022	1.022	1.022	1.021	1.021	1.021
Trade Weighted Index	0.997	1.000	1.000	1.000	1.000	1.000	1.000
CPI	1.000	1.000	1.000	1.000	1.000	1.000	1.000

In order to aggregate the input cost drivers at this level, Jacobs assigned appropriate weightings for the relative contribution of each of the input cost drivers and economic indicator to the final asset or project costs.

Table 17 presents the real annual asset cost escalation indices forecast based on the movements in underlying cost drivers and economic indicators, but aggregated at common standard asset class level used by ENERGEX.

Table 17 Real annual cost escalation of asset categories

Cost driver	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Overhead Subtransmission Lines	1.031	1.013	1.014	1.005	1.008	1.010	1.014
Underground Subtransmission Cables	1.023	0.977	0.993	1.000	1.002	1.003	1.007
Overhead Distribution Lines	1.044	1.003	1.000	0.998	1.000	1.003	1.008
Underground Distribution Cables	1.031	1.011	1.000	1.006	1.004	1.005	1.009
Distribution Equipment	1.029	0.995	0.995	0.998	0.999	1.000	1.004
Substation Bays	1.023	1.002	1.001	1.004	1.004	1.005	1.008
Substation Establishment	1.013	1.022	1.022	1.022	1.021	1.021	1.021
Distribution Substation Switchgear	1.029	0.995	0.995	0.998	0.999	1.000	1.004
Zone Transformers	1.038	0.993	0.997	0.996	0.999	1.002	1.007
Distribution Transformers	1.034	0.997	1.000	1.000	1.002	1.004	1.008
Low Voltage Services	1.005	1.027	1.021	1.010	1.009	1.010	1.013

[19] Cost escalation factors have been based on commodity forecasts in AUD

Cost driver	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Metering	1.020	0.995	0.992	0.999	0.998	0.999	1.002
Communications - Pilot Wires	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Street Lighting	1.013	0.998	0.998	0.998	0.999	1.000	1.001
Control Centre - SCADA	1.000	1.000	1.000	1.000	1.000	1.000	1.000
System Buildings	1.013	1.022	1.022	1.022	1.021	1.021	1.021

7. Operational expenditure

In generating material component escalation factors for operational expenditure, Jacobs has relied upon the projected activities in the ENERGEX Network Asset Management Program (NAMP) and calculated the relative contribution of each asset category to the projected expenditures. This breakdown is shown in Table 18.

Table 18 Relative contributions by asset category

Asset category	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Communications - Pilot Wires	0.49%	0.48%	0.48%	0.49%	0.48%	0.48%
Distribution Equipment	4.39%	3.69%	3.71%	3.74%	3.71%	3.69%
Distribution Substation Switchgear	6.52%	7.48%	6.60%	6.70%	7.27%	7.23%
Distribution Transformers	0.12%	0.11%	0.12%	0.12%	0.12%	0.11%
Low Voltage Services	5.19%	5.15%	5.17%	5.21%	5.17%	5.15%
Overhead Distribution Lines	47.68%	47.01%	47.47%	47.86%	47.46%	47.27%
Overhead Subtransmission Lines	7.10%	7.03%	7.06%	7.12%	7.06%	7.04%
Plant & Equipment	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Substation Bays	2.89%	2.95%	3.01%	3.10%	3.13%	3.16%
Substation Establishment	11.69%	12.26%	12.50%	11.77%	11.83%	12.16%
Underground Distribution Cables	4.48%	4.44%	4.46%	4.50%	4.46%	4.44%
Underground Subtransmission Cables	3.00%	2.97%	2.98%	2.89%	2.86%	2.85%
Zone Transformers	6.46%	6.40%	6.43%	6.48%	6.43%	6.40%
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Based on this breakdown of contribution by asset category, the real annual material cost escalation factors for operational expenditure are shown in Table 19.

Table 19 Real annual material cost escalation for operational expenditure

Asset category	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Operational expenditure	1.005	1.004	1.003	1.004	1.006	1.010

8. Comparison with historical cost escalation

The AER recently published assessment guidelines for expenditure forecasts[20] which now require electricity utilities to demonstrate how historic price rises have compared with the forecast cost escalation factors. The Jacobs modelling is based on forward looking forecasts only, and does not rely upon historical data.

To support the reasonableness of the projected cost escalation factors, Jacobs has reviewed the escalation factors that are generated using historic cost driver values to determine their consistency with the cost escalation factors based on the forward looking market forecasts, and whether these historic values reflect any known market conditions.

This modelling has been done in lieu of reviewing actual historic asset prices, as any trends in such prices may be distorted by many external market variables, and breaking historic project costs down into the nominated asset categories is problematic.

8.1 Global movements in commodity prices

After nearly three decades of low and declining commodity prices, a reversal of the trend with steadily increasing prices for most commodity prices occurred during the decade of the 2000s (2000-2009). Commodity exporting economies were boosted when commodity prices increased sharply in 2006-08 and again in 2010-11.

The boom was largely due to the rising demand from emerging markets such as the BRIC[21] countries and the former Yugoslavia, as well as the result of concerns over long-term supply availability. There was a sharp down-turn in prices during 2008 and early 2009 as a result of the Global Financial Crisis (GFC), but prices began to rise as demand recovered from late 2009 to mid-2010. The commodities super-cycle peaked in 2011 driven by a combination of strong demand from emerging nations and low supply growth. Prior to 2002, only 5-10% of trading in the commodities market was attributable to investors. Since 2002, 30% of trading is attributable to investors in the commodities market which has caused higher price volatility.

8.1.1 Commodity price surge

The Global Economic Outlook publication[22] reported that a key economic characteristic of the 2000s was the steady rise in commodity prices especially over the period 2000-08. This was the result of a number of factors:

- prolonged period of strong global growth
- restricted supply
- sharp rise in demand from the emerging BRIC markets

For example, China and India accounted for 2 percent of global fuel and mining imports in 1990, rising to 12 percent by 2008 and further to 18 percent by 2012.

Whilst these basic market fundamentals have played a key role in commodity price movements, the price surges seen during the 2000s were, in part, driven by excess liquidity and speculation. That is, a lot of “new” money as a result of a low interest rate environment found its way into the commodity markets, together with commodities being considered as an investment alternative, contributed to a speculative surge in some commodity prices contrary to the conventional supply-demand pressures. In addition, political events have contributed to marked price fluctuations for crude oil.

Central to most of the price-related analysis of commodity prices has been the price of crude oil which increased by 244 percent between 2000 and 2008, in contrast to declines of 52 percent in the decade 1980-89 and 22 percent between 1990 and 1999. Other commodity prices demonstrated comparable volatility, with copper prices almost tripling during 2000-08 having falling by 41 percent during the decade 1990-99.

[20] *Better Regulation: Expenditure Forecast Assessment Guideline for Electricity Distribution*, Nov 2013
[21] Brazil, Russia, India, China
[22] Deloitte University Press, *Global Economic Outlook: 1st Quarter 2014*, pp 52-62

8.1.2 Recent global market conditions

Commodity prices slumped in 2009 due to the effects of the GFC, and although worldwide stimulus programs briefly allowed prices to recover in 2010-11, they appear to have stalled again in 2012.

Constrained global growth is a primary reason for the current period of commodity price weakness, with slowing growth in the emerging BRIC economies and in China where Gross Domestic Product (GDP) growth for the beginning of 2013 was 7.3 percent compared to 12.1 percent in 2010. The decline in growth for India, who is a large commodity consumer, has been greater. China's annual growth is unlikely to return to the double-digit levels of recent years, with GDP growth forecast to remain below 8 percent through to 2018. In addition, commodity prices will be subject to any changes in China's commodity consumption as the country moves away from its investment-orientated economic model. There has also been slowing growth in other large commodity importers such as the United States and the European Union which has adversely affected commodity prices.

There have also been significant changes in the supply situation, with many of the mines started during the boom period in Africa and Asia likely to satisfy demand in the short to medium term. The International Monetary Fund (IMF) expects metal prices to remain nearly flat over 2013-18.

8.2 Australian market

As an industrialised economy, Australia is both a user and a supplier of energy and raw materials. Typically, a persistent rise in the price of raw materials or energy represents a negative shock to supply. The capacity of the economy to supply goods and services at a given price has diminished. By itself, this will reduce output and push up prices, resulting in a fall in aggregate demand.

However, as a commodity producer, Australia benefits from increases in commodity prices. The RBA explained this as "*… whereas for a net commodity importer a rise in commodity prices acts analogously to a tax paid to foreigners, we are, or are among, those foreigners to whom these payments are made. That impact is expansionary. It raises real income and … aggregate demand ... So … the case of an industrialised, commodity producer like Australia has more complex dynamics. Potential supply in some areas of the economy falls, but the aggregate demand will probably rise rather than fall, due to the terms of trade gain, and it is more likely that there will be a problem of inflation*"[23]

8.2.1 Market conditions prior to GFC

In its July 2008 analysis[24], the RBA highlighted the sharp increases in commodity prices from 2000 to 2008 as shown:

Index	Year 2000	Year 2008
RBA Index of Commodity Prices	100	231
London Metals Exchange Index	100	249
IMF Commodity Price Index	100	234

For many commodities, the main driver of higher prices was strong growth in demand, not reduced supply. In the case of oil, the growth in demand came almost entirely from outside of OECD countries, with Chinese demand representing about one-third of the increase and the balance from developing countries around the world. Similarly, much of the increase in global demand for aluminium and copper was attributed to growing Chinese usage.

As a supplier, Australian companies made large exports of natural gas and thermal coal, whose prices were highly correlated with oil prices at that time. In 2008, contract prices for iron ore were anticipated to double. One of the primary challenges for the RBA in 2008 was understanding whether the change in commodity prices was temporary or permanent, recognising that it would be very difficult to identify a permanent, but one-time, shift in

[23] Reserve Bank of Australia, *Reserve Bank Bulletin: Commodity Prices and Macroeconomic Policy: An Australian Perspective*, July 2008
[24] ibid.

the level of prices and a persistent increase in the rate of change of prices. Had the RBA deemed that the changes were driven by persistent demand factors, then monetary policy adjustments would have been considered.

8.2.2 Recent Australian market conditions

For the March quarter 2013, the RBA stated that "*… Strong growth in Asia is expected to continue to provide significant benefits for the Australian economy. Most notable so far has been the resources boom. This boom is characterised by three overlapping phases. The first saw commodity prices and hence Australia's terms of trade rise significantly over a period of a number of years, and this was accompanied by a sizable appreciation of the exchange rate. The phase of strongly rising commodity prices has passed, with the terms of trade having peaked in late 2011; although they still remain at a high level. The surge in investment in the resources sector has been in progress for some years and still has some way to run, with resource investment expected to peak as a share of GDP sometime over the course of this year (2013), but remain quite high for a time. The third phase of increased production and export of resources has also commenced but has much farther to run … Looking further ahead, there will come a time when the demand for commodities will ease as development of economies in the Asian region continues and the focus of consumption shifts away from goods and towards services.*"[25]

Not all parts of the Australian economy benefited from the resources boom. Wage pressures in industries or regions experiencing strong conditions associated with the resources boom did not spill over to parts of the economy experiencing weaker conditions. Some industries experienced a reduction in competitiveness due to the exchange rate appreciation, and all faced increased domestic cost pressures.

8.3 Modelled historic cost escalation

To examine the effects of the various market conditions on the cost escalation factors, Jacobs has used the actual average annual commodity prices and market indices to calculate the material only cost escalation factors for the previous 5 years between 2008/09 and 2012/13. That is, these calculations represent what the cost escalations would have been had the now known commodity prices had existed at the time of modelling the cost escalation factor forecasts.

Table 20 shows the historic annual real cost escalation for the primary commodity cost drivers for the period 2008/09 to 2012/13 and the forecast annual real cost escalation to 2019/20. It should be noted that during the period following the GFC, there was considerable volatility which translated to varying costs for assets.

Jacobs has used historic values for commodity prices and market indices in its modelling to generate real material cost escalation factors for the period 2008/09 to 2012/13 as shown in the shaded portion of Table 21. These have been compared with cost escalation factors based on forward-looking market forecasts for the period 2013/14 to 2019/20 to illustrate the effects of the changing economic conditions as discussed in the previous section (refer section 8.1). For example, the marked annual increases in 2010/11 are due to the volatility in particularly the steel and oil markets. The relatively smaller cost escalation factors in 2009/10 are due to the severe market impacts of the GFC.

Table 20 Comparison with annual historic real cost escalation for cost drivers

Commodity	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Aluminium	0.813	0.901	1.020	0.852	0.880	0.994	1.055	1.041	1.023	1.019	1.019	1.023
Copper	0.727	1.143	1.119	0.886	0.924	0.997	0.926	0.990	0.991	0.999	1.001	1.006
Steel	1.071	0.708	1.061	0.914	0.883	1.076	0.987	1.009	0.982	0.996	1.003	1.010
Oil	0.827	0.912	1.023	1.003	0.955	1.197	0.978	0.920	0.995	0.982	0.990	1.012

[25] Reserve Bank of Australia, *Reserve Bank Bulletin: The Resources Boom and the Australian Economy - A Sectoral Analysis*, March Quarter 2013

Table 21 Comparison with annual historic real material cost escalation for asset categories

Asset category	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Overhead Subtransmission Lines	0.991	0.900	1.048	0.959	0.975	1.031	1.013	1.014	1.005	1.008	1.010	1.014
Underground Subtransmission Cables	0.900	1.032	1.059	0.966	0.985	1.023	0.977	0.993	1.000	1.002	1.003	1.007
Overhead Distribution Lines	0.962	0.894	1.033	0.950	0.939	1.044	1.003	1.000	0.998	1.000	1.003	1.008
Underground Distribution Cables	0.934	0.962	1.026	0.968	0.973	1.031	1.011	1.000	1.006	1.004	1.005	1.009
Distribution Equipment	0.905	0.980	1.094	0.961	0.946	1.029	0.995	0.995	0.998	0.999	1.000	1.004
Substation Bays	0.939	0.996	1.085	0.984	0.990	1.023	1.002	1.001	1.004	1.004	1.005	1.008
Substation Establishment	1.046	1.011	1.060	1.038	1.110	1.013	1.022	1.022	1.022	1.021	1.021	1.021
Distribution Substation Switchgear	0.905	0.980	1.094	0.961	0.946	1.029	0.995	0.995	0.998	0.999	1.000	1.004
Zone Transformers	0.949	0.925	1.038	0.951	0.945	1.038	0.993	0.997	0.996	0.999	1.002	1.007
Distribution Transformers	0.961	0.936	1.041	0.963	0.966	1.034	0.997	1.000	1.000	1.002	1.004	1.008
Low Voltage Services	0.908	0.924	1.023	0.916	0.926	1.005	1.027	1.021	1.010	1.009	1.010	1.013
Metering	0.905	1.020	1.090	0.980	0.965	1.020	0.995	0.992	0.999	0.998	0.999	1.002
Communications - Pilot Wires	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Street Lighting	1.001	0.971	1.006	0.992	0.988	1.013	0.998	0.998	0.998	0.999	1.000	1.001
Control Centre - SCADA	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Buildings	1.046	1.011	1.060	1.038	1.110	1.013	1.022	1.022	1.022	1.021	1.021	1.021

8.4 Comparison with previous forecasts

To highlight the volatility of forward forecasts for commodity prices, Table 22 illustrates the changing real annual cost escalation rates for the four main commodities for forecasts based in November 2010, March 2011 and December 2011 for the period between 2011/12 and 2016/17.

Table 22 Changing of commodity forecasts 2011/12 to 2016/17

Forecast	Commodity	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
November 2010	Aluminium	1.129	0.989	0.994	0.978	0.981	0.987
	Copper	1.093	0.931	0.925	0.907	0.906	0.907
	Steel	1.131	0.987	0.962	0.963	0.965	0.972
	Oil	1.131	0.960	0.963	0.982	1.008	0.991
March 2011	Aluminium	1.170	0.989	0.989	0.970	0.973	0.979
	Copper	1.178	0.940	0.923	0.896	0.892	0.891
	Steel	1.133	0.975	0.986	0.970	0.972	0.979
	Oil	1.087	0.952	1.087	0.967	0.911	1.011
December 2011	Aluminium	0.876	1.021	1.045	1.039	1.037	1.032
	Copper	0.874	0.982	0.999	0.984	0.980	0.975
	Steel	1.026	1.043	1.010	1.009	1.013	1.009
	Oil	1.019	1.019	0.972	0.984	1.007	1.045

These variations in forecasts demonstrate the uncertainties in global markets at the time, and the associated variability in any forecast movements in material costs for different asset types.

Table 23 shows the changes in the forecast of material only cost escalation factors for a sample of asset categories, based on the volatility of the commodity price forecasts between November 2010 and December 2011 for the period 2011/12 to 2016/17.

Table 23 Changes in forecast real material only cost escalation factors 2011/12 to 2016/17

Forecast	Asset category	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
November 2010	OH distribution lines	1.070	0.990	0.982	0.983	0.991	0.989
	Distribution equipment	1.041	0.990	0.985	0.987	0.993	0.991
	Distribution transformers	1.065	0.984	0.977	0.977	0.984	0.983
March 2011	OH distribution lines	1.074	0.985	1.004	0.982	0.977	0.992
	Distribution equipment	1.046	0.987	1.001	0.984	0.980	0.991
	Distribution transformers	1.077	0.980	0.994	0.974	0.970	0.983
December 2011	OH distribution lines	0.990	1.018	1.007	1.007	1.011	1.013
	Distribution equipment	0.993	1.009	1.001	1.001	1.004	1.006
	Distribution transformers	0.984	1.013	1.004	1.003	1.006	1.007

8.5 Comments

Given the difficulty in deriving meaningful historical materials price changes from one-off purchase contracts, ENERGEX elected to use the Jacobs cost escalation model as the best approach to meet the AER expenditure assessment requirements. In requesting historical price changes, the AER's intent would appear to be to establish the reasonableness of forecast escalation rates based on historical price trends. Using the Jacobs model for both historical and future price changes creates some continuity in the approach.

The Jacobs model is only intended to be used as forward looking, and not for calculating previous years' cost escalation as a means of justifying, or otherwise, actual price movements that may have been experienced. There are a number of specific influences that may affect the procurement of assets for an electricity utility such as the performance of suppliers, outsourcing strategies used by utilities, tender processes, pre-existing purchasing agreements, service agreements, scales of economy due to either the size of the utility, supply/demand dynamics (e.g. during and immediately after severe weather events), or the nature of a capital expenditure program, or revised asset specifications due to amended asset management practices. Each of these influences will be particular to a utility, and may vary between regulatory periods depending upon the utility's operational focus and general market conditions.

In reviewing the asset category material only cost escalation factors from the previous 5 years, Jacobs has briefly examined at a high level the prevailing global and Australian market conditions of the time, and has illustrated the modelled impact of these conditions on the material only costs. As would be anticipated, these cost escalation factors reflect the market cycles discussed in sections 8.1 and 8.2; however, these "actual" cost escalation factors do not consider any external market or utility-specific influences that may have impacted on actual asset prices, and are therefore not intended to represent actual price movements experienced by ENERGEX between 2008/09 and 2012/13.

The review of the forecasts of commodity costs and a sample of asset specific material only cost escalation factors that were developed in November 2010, March 2011 and December 2011 in section 8.4 is solely intended to highlight the volatility of commodity price forecasts. It is not intended to be used as a means of a direct comparison of the reasonableness of those forecasts with actual out turns. In the Limitations Statement to this report, Jacobs highlights that forecasts are by nature uncertain and that any projections presented are an indication of what it considers the most likely outcome in a range of possible scenarios. The forecasts developed in November 2010, March 2011 and December 2011 represented Jacobs' opinion on what was considered to be reasonable forecasts, as at the time of production of the document and based on the information that was set out in the accompanying report.

The Limitations Statement continues "*… Jacobs has used a number of publicly available sources, other forecasts it believes to be credible, and its own judgement and estimates as the basis for developing the cost escalators contained in this report. The actual outcomes will depend on complex interactions of policy, technology, international markets, and behaviour of multiple suppliers and end users, all subject to uncertainty and beyond the control of Jacobs, and hence Jacobs cannot warrant the projections contained in this report.*"

Jacobs therefore does not contend that the historic cost escalation factors shown for 2008/09 to 2012/13 in Table 21 represent actual movements in costs incurred by utilities in procuring assets on an annual basis. For example, equipment manufacturers during this period would have had to consider whether changes in raw material costs were one-off events or more permanent changes, and suppliers would have had to evaluate the extent to which any fluctuations in equipment costs were passed on to their customers; in this case, the electricity utilities.

Therefore, Jacobs considers the historic cost escalation factors for 2008/09 to 2012/13 presented in Table 21 are indicative only of movements in material costs based on known values for the identified cost drivers, and do not represent definitive annual price movements for assets as it is not the role of a forecasting model to back forecast actual costs.

Appendix A. Jacobs recent experience

Jacobs has assisted several electricity utilities, both at the transmission and distribution level, in analysing the impact of movements in commodity prices and labour on the costs of network assets, as well as in providing independent validation of their capex and opex modelling processes.

These projects have included:

ActewAGL Distribution (2013)

Develop installed real and nominal cost escalation factors for various types of electricity distribution assets, including consideration of cost movements in both materials and labour (commodity and labour cost escalators provided by others).

Power Water Corporation (2013)

To provide cost escalation factors support the Power and Water Corporation regulatory submission for its 2014-19 Determination. The escalators are to be provided at both the commodity level (with labour cost escalators provided by others) and at asset class level.

SP AusNet (2012)

To undertake the development of forecast capital and operational material cost escalators for SPA's transmission business to be used in the forthcoming Transmission Revenue Reset (TRR) 2014-19 (but actually wants Apr 2014 to Mar 2020).

SP AusNet Gas Network (2012)

Jacobs was engaged by the Victorian Gas Distribution Business' (VGDBs) to review factors likely to affect price escalation in their material costs over the period 2013-2017, using a 2011 base date for cost forecasts, and propose suitable materials cost escalation rates.

Powerlink (2011/12)

As part of their Revenue Proposal to the AER for 2012/13-2016/17, Powerlink is considering the application of commodity escalation factors to the modelling of future capex and opex. Project is to provide an independent recommendation of the escalation factors to be applied. Cost escalation factors updated upon request during 2011 and 2012.

Aurora Energy (2010/11)

Aurora engaged Jacobs to develop cost escalators for their capex program as part of their 2012-2017 regulatory reset with the AER. These cost escalators were updated upon request during 2010 and 2011.

Joint VIC DNSPs - JEN, UED, SP AusNet, CP & PC (2010)

Jacobs provided updates of cost escalation rates modelled for the Victorian Distribution companies. These updated rates were included in revised submissions to the AER.

Country Energy Gas Networks (2010)

Jacobs was engaged to provide a Due Diligence of the Country Energy regional Gas network in Wagga Wagga (NSW). A section of this study involved reviewing the modelling undertaken to develop cost escalation rates for plant and equipment within the Gas industry.

Ergon Energy (2010)

Jacobs was engaged to provide an update of cost escalation rates developed the previous year. The effect of rapid movements in a number of underlying cost drivers was required to be modelled in order to provide a more recent set of outputs.

Ergon Energy (2010)

Jacobs was engaged to provide a set of suitable cost escalation rates for Ergon Energy's capex and opex programs of work. Ergon Energy had received an unsatisfactory response from the AER in relation to the cost escalation rate modelling proposed by its consultants during its initial regulatory submission, and engaged Jacobs to provide modelling for its revised submission. The Jacobs rates were received favourably by the AER.

CitiPower/PowerCor (2009)

In a separate engagement, Jacobs developed materials cost escalation rates for the CP / PAL opex programs.

Joint VIC DNSPs - JEN, UED, SP AusNet, CP & PC (2009)

Jacobs was engaged by the Joint Victorian Distribution Network Service Providers to provide capex escalation rates for their regulatory submissions. The outputs were tailored to individual asset categories nominated by each of the participants.

TransCo Philippines (2009)

Jacobs was engaged to apply its cost escalation modelling experience to escalate TransCo's internal asset unit rates to current pricing levels

ETSA Utilities (2009)

Jacobs was engaged to provide an independent review of the cost escalation rates within the South Australian DNSP's opex models. This project was initiated as part of ETSA Utilities' preparation for the submission of its revenue proposal to the AER.

In a separate assignment, Jacobs was engaged to provide inputs to the development of materials cost escalation rates within the South Australian DNSP's capex model, as part of ETSA Utilities' preparation for the submission of its revenue proposal to the AER.

Transend Networks (2009)

Jacobs was engaged to investigate the long-term average transmission network materials and labour cost escalation rates in Tasmania.

ElectraNet (2009)

Jacobs was engaged to apply its cost escalation modelling experience to escalate ElectraNet's internal opex model unit rates to current pricing levels.

Ergon Energy (2009)

Jacobs was engaged to provide an update of cost escalation rates developed the previous year. The effect of rapid movements in a number of underlying cost drivers was required to be modelled in order to provide a more recent set of outputs. The resulting cost escalation rates are to be included as part of Ergon Energy's official revenue proposal to the AER.

Ergon Energy (2008)

Jacobs was engaged to map key cost drivers within its model, to internal opex cost estimation unit rates within Ergon Energy models.

Ergon Energy (2008)

Jacobs undertook Stage 2 of the Ergon Energy assignment relating to Electricity Industry Labour, Commodity and Asset Price & Cost Indices. During this period the Jacobs cost escalation model underwent extensive enhancements.

Transend (2008)

Jacobs were engaged to provide cost escalators factors in order to promote Transend's most recent asset valuation , having been based in June 2006 AUD$ terms, to June 2008 amounts as part of the TNSP's regulatory proposal.

TransGrid (2008)

During this assignment, Jacobs reviewed TransGrid's capex model, corrected errors in their methodology, and provided an independent validation for use during TransGrid's revenue proposal to the AER.

ActewAGL (2008)

Jacobs provided an independent assessment of the escalation factors that apply to ActewAGL's capital works programmes and projects going forward over the period 2007/8 to 2013/14. This was included in ActewAGL's submission to the AER.

Ergon Energy (2008)

Jacobs undertook Stage 1 of the Ergon Energy assignment relating to Electricity Industry Labour, Commodity and Asset Price & Cost Indices.

AER (2007/2008)

In July 2007, Jacobs was engaged by the Australian Energy Regulator (AER) to review the regulatory revenue proposal submitted by ElectraNet for their next regulatory reset period 2008 to 2013. During this assignment the Jacobs model was both updated and enhanced through consideration of elements presented by ElectraNet. The AER again accepted the Jacobs view to cost escalation index design.

SP AusNet (2007)

Jacobs was engaged by SP AusNet to analyse the likely drivers of cost escalation on capital expenditure forecasts over the remaining two years of their current determination (2006/07 and 2007/08), and for the next regulatory reset period (2008/09 to 2012/13, commencing 1 April 2008).

The Jacobs SP AusNet assignment set the precedent for above CPI escalation of capex costs. The AER accepted the Jacobs methodology noting that it produced robust figures.