Advice on cost escalation rates for materials inputs

A REPORT PREPARED FOR TASNETWORKS

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Frontier Economics (Frontier) has been engaged by TasNetworks to assess the reasonableness of the Australian Energy Regulator's (AER's) decision to adopt a materials real cost escalator of zero per cent in recent draft and final regulatory determinations.

In the past, the AER has accepted the co-called 'input cost' approach. This approach combines expected changes in the real price of key inputs (e.g. commodities), and the proportions in which they are used, to predict changes in the price of end products (e.g. physical equipment) that the Network Service Providers (NSPs) procure. To project the real prices of commodity inputs, the NSPs relied on futures market prices, independent expert forecasts, or some combination of the two.

Recently, however, the AER has changed its view on the validity of this approach for the derivation of real materials cost escalators. The AER's new approach is based on the assumption that the best predictor of nominal commodity prices is the current price, adjusted for inflation. The AER has adopted the so-called 'no-change' forecasting approach.

To assess the reasonableness of the AER's decision to adopt a materials real cost escalator of zero per cent we have examined the evidence provided in the draft decision for TransGrid.

We have identified the following key issues with the AER's approach:

- **The AER focuses on the areas of disagreement amongst the experts and ignores the areas of agreement.** The AER cites 'considerable variation' between the NSPs' experts' year to year forecasts as the reason for rejecting them. While it is correct that there are year to year disparities in the forecast commodity price changes, we show that there is substantial agreement amongst the experts on the overall movement of the real price of aluminium, copper and steel over the five-year forecasting horizon. In particular, there is agreement among the consultants that the current expectations about aluminium, copper and steel prices are:
  - Substantial real price increases for aluminium over the five-year period
  - Small real price decreases for copper over the five-year period
  - Medium real price increases for steel over the five-year period.

  Furthermore, we show that what the AER interpreted to be large differences in opinion regarding real price change forecasts is more disagreement over future exchange rate movements.
- **The AER seems to confuse accuracy and bias with disagreement.** The AER has used apparent forecast divergences among the NSP's consultants as

evidence that those forecasts cannot be used to reliably and accurately estimate prices of goods/materials sourced by the NSPs. The AER's simplistic approach (i.e. mere comparison of different forecasts) does not tell us anything about accuracy or bias of consultants' forecasts. One way to evaluate consultants' forecasts would have been to assess how well these consultants predicted commodity price movements in the past. The AER has performed this type of analysis in past decisions but has not done so in this case.

- **The AER's no-change assumption may be inferior compared to price change assumptions based on combining forecasts.** The AER did not provide any empirical analysis showing that the price of materials inputs is expected to be flat (in real terms) over the five-year forecasting horizon. Rather, findings from selected empirical studies, which assessed performance of futures prices as predictors of spot prices, were used by the AER in support of its no-change assumption. The studies cited by the AER do question forecasting performance of futures models, and, for that matter, many other models which have frequently been used to forecast commodity prices. The emerging consensus in the forecasting community, however, is not that the no-change forecasts should be favoured over other forecasting methods as one may be led to conclude from a selection of studies that the AER chose to cite. Rather, the emerging consensus is on combining forecasts from different forecasting models.

  The merits of combining forecasts have long been established and the AER itself has endorsed and used that approach in past decisions. Although the AER's forecast combinations have been limited to labour price indices, there is no reason for the AER to favour forecast combinations for one set of inputs (i.e. labour) and completely ignore that approach for another set of inputs (i.e. materials). When faced with divergent forecasts and uncertainty over the accuracy of any individual forecasts, the AER should adopt the approach it has used previously in respect of labour costs and combine these forecasts, as a means of reducing the scope for forecast error.

- **The AER makes vague and unsubstantiated claims on risk.** The AER has provided no evidence or analysis that either the NSPs or producers of capital goods used by the NSPs can hedge away the movements in commodity prices. The AER makes no interpretation of futures prices, rejecting both the interpretation of an unbiased estimate of the spot price and the interpretation of the price required to mitigate risk. The AER also assumes that the NSPs, having projected a series of materials price changes, could seamlessly operate differently to offset those materials changes. Yet the input mix and operating cost projections have already been made by the NSPs on the basis of the best efforts, in the pursuit of efficiency. Further, the changes in commodity prices are driven by global macro factors (e.g. global

demand and supply of commodities and exchange rate movements) that are beyond the control of NSPs. The AER has not offered any practical means by which NSPs could reorganise their operations so as to offset exogenous changes in the price of key inputs.

1 Introduction

Frontier Economics (Frontier) was engaged by TasNetworks to assess the reasonableness of the Australian Energy Regulator's (AER's) decision to adopt a materials real cost escalator of zero per cent in recent draft and final regulatory determinations.

1.1 Background

TasNetworks is currently preparing a regulatory proposal to the AER as part of the process to determine its regulated revenue for the forthcoming regulatory control period (1st July 2017 to 30th June 2019).

As a regulated Network Service Provider (NSP), TasNetworks is entitled to recover a risk adjusted return on the efficient costs of service provision. In order to achieve this, it must form a view on how costs of the physical equipment and assets installed on the network are expected to change over the coming regulatory period.

In the past, the AER had accepted the co-called 'input cost' approach. This approach combines expected changes in the real price of key inputs, and the proportions in which they are used, to predict changes in the price of end products (e.g. physical equipment) that the NSPs procure. To project the real prices of commodity inputs[1], the NSPs relied on futures market prices, independent expert forecasts, or some combination of the two.

Recently, however, the AER has changed its view on the validity of this approach for the derivation of real materials cost escalators. In 2012, in its review of the Victorian gas businesses, the AER raised concerns regarding the use of futures market prices for calculating escalation factors for crude oil. Instead, the AER based its calculations on the assumption that the best predictor of the nominal price of crude oil is the current price of crude oil, adjusted for inflation.[2] It adopted the so-called 'no-change' forecasting approach. This shift in the AER's approach appears to have been motivated at the time by a 2011 empirical study by the US Federal Reserve which found:

> 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 [mean squared prediction error] relative to the no-change

1 These are usually taken to be steel, aluminium, copper, and crude oil.

2 AER, '*Access arrangement draft decision: SPI Networks (Gas) Pty Ltd, 2013–17 Part 3 Appendices*', September 2012, p. 131.

> forecast at short horizons, and long-term futures prices often cited by policymakers are distinctly less accurate than the no-change forecast.[3]

At that time, the AER did not impose the no-change forecasts for aluminium, copper, and steel; rather, it accepted the earlier methodology based on futures market prices and independent expert opinion. Furthermore, the AER used that same methodology itself as a check on an electricity NSP's approach, stating

> The AER developed its own forecasts of materials price changes for material escalation. Where possible it forecast price changes from prices traded in futures markets, such as contracts traded on the London Metal Exchange (LME). Where these were unavailable it took forecasts from Consensus Economics, which provides forecasts derived from an average of forecasts from a number of economic forecasters.[4]

In 2013, the AER indicated that its concerns were not only with the use of futures prices to predict commodity spot prices but also with the weights that the NSPs attach to individual material cost escalators when deriving the total price of an asset. In its 2013 *Expenditure Forecast Assessment Guideline* the AER stated that it

> had seen limited evidence to demonstrate that the commodity input weightings used by NSPs to generate a forecast of the cost of material inputs have produced unbiased forecasts of the costs the service providers paid for manufactured materials.[5]

In 2014, in its draft decision for TransGrid, the AER found TransGrid's cost input methodology to be unacceptable and adopted a zero per cent real cost escalator across all commodities. The AER stated that its decision was based on the following three factors:[6]

- the degree of the potential inaccuracy of commodities forecasts is such that it considers that zero per cent real cost escalation is likely to provide a more reliable estimation for the price of input materials used by TransGrid
- there is little evidence on how accurately the price forecasts produced by TransGrid's input cost models reflect changes in prices paid by TransGrid for physical assets in the past, making it difficult for the AER to assess the reliability and accuracy of TransGrid's forecasting models
- TransGrid has not provided any supporting evidence to show that it has considered whether there may be some material exogenous factors that

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3 Alquist, R., Kilian, L., and Vigfusson, J., '*Forecasting the Price of Oil*', Board of Governors of the Federal Reserve System, International Finance Discussion Papers, Number 1022, July 2011, p. 69.

4 AER, *'ElectraNet Transmission Determination – Draft decision 2013-14 to 2017-18',* November 2012, p. 77.

5 AER, '*Better Regulation - Explanatory Statement Expenditure Forecast Assessment Guideline',* November 2013, pp. 50-51.

6 AER, *'Draft decision TransGrid transmission determination 2015–16 to 2017–18 Attachment 6: Capital expenditure'*, November 2014, p. 6-69.

impact on the cost of physical inputs that are not captured by the material input cost models used by TransGrid.

1.2 Scope of our engagement

The scope of our engagement is to assess the reasonableness of the AER's decision to adopt a materials real cost escalator of zero per cent in recent draft and final regulatory determinations.

It is beyond the scope of our engagement to develop an alternative materials real cost escalator. We have been informed that TasNetworks has engaged Jacobs Engineering Group to develop a materials real cost escalator that TasNetworks would use in its regulatory proposal to the AER.

The Appendix to this report describes our relevant expertise in relation to this scope of work.

2 Assessment of the AER's no-change assumption

Frontier was engaged to assess the reasonableness of the AER's recent decision to adopt a materials real cost escalator of zero per cent. We have done this based on the evidence provided in the draft decision for TransGrid.

We have identified the following key issues with the AER's approach:

- The AER focuses on the areas of disagreement among the experts and ignores the areas of agreement;
- The AER seems to confuse accuracy and bias with disagreement;
- The AER's no-change assumption may be inferior compared to price change assumptions based on combining forecasts; and
- The AER makes vague and unsubstantiated claims on risk.

We discuss each of these issues below.

2.1 The AER focuses on the areas of disagreement among the experts and ignores the areas of agreement

The AER's current approach to determining the appropriate escalation rates for materials inputs is to abandon the use of commodity price forecasts by various independent experts in favour of assuming zero per cent real cost escalation. The AER cites 'considerable variation' between the experts' commodities escalation forecasts as the reason for rejecting them.[7]

Specifically, to assess the reasonableness of TransGrid's commodity price forecasts, the AER compared them to forecasts provided by ActewAGL, Ausgrid, Essential Energy, TasNetworks and Jemena Gas Networks in their recent submissions. All NSPs engaged independent experts/consultants to derive escalation rates for materials inputs. The AER presented consultants' forecasts in Table D-2 of the TransGrid draft decision. For convenience, we reproduce those annual forecasts in Table 1 below, columns 2 to 6.

7 AER, *'Draft decision TransGrid transmission determination 2015–16 to 2017–18 Attachment 6: Capital expenditure'*, November 2014, p. 6-79.

Table 1: Real material input cost escalation forecasts, percentage change

	2015	2016	2017	2018	2019	Per year
Aluminium						
CEG	4.20	5.80	5.00	4.20	3.60	**4.56**
SKM	4.69	4.88	3.09	4.42	2.97	**4.01**
BIS Shrapnel	1.40	5.60	3.90	11.00	-6.50	**2.92**
Range						**2.92 to 4.56**
Copper						
CEG	-0.90	1.10	0.30	-0.30	-0.70	**-0.10**
SKM	-0.17	0.17	-1.15	-0.16	-1.45	**-0.55**
BIS Shrapnel	-0.90	-1.50	0.30	9.30	-8.70	**-0.46**
Range						**-0.55 to -0.10**
Steel						
CEG	0.60	3.20	0.60	0.30	-0.10	**0.91**
SKM	2.84	2.45	-0.35	0.38	-1.11	**0.83**
BIS Shrapnel	5.10	1.00	-0.20	8.00	-8.90	**0.83**
Range						**0.83 to 0.91**
Oil						
CEG	-0.50	2.80	2.60	2.10	1.80	**1.75**
SKM	-5.11	-0.79	0.74	1.85	0.51	**-0.59**
BIS Shrapnel	1.40	-1.10	-0.20	6.50	-6.20	**0.00**
Range						**-0.59 to 1.75**

Notes: SKM prepared forecasts for TransGrid. Competition Economists Group (CEG) prepared forecasts for ActewAGL, Ausgrid, Essential Energy, and TasNetworks. BIS Shrapnel prepared forecasts for Jemena Gas Networks.

Source: AER, 'Draft decision TransGrid transmission determination 2015–16 to 2017–18 Attachment 6: Capital expenditure', November 2014, Table D-2, p. 6-79. Frontier analysis.

In its decision for TransGrid, the AER interpreted the forecasts from the NSPs' consultants in a manner that highlights the areas of disagreement between consultants, rather than the areas of agreement. This is evident from the following AER statement:

> . . . there is considerable variation between the [consultants'] commodities escalation forecasts. The greatest margin of variation is 10.1 per cent for aluminium in 2018–19, where CEG has forecast a real price increase of 3.6 per cent and BIS Shrapnel a real price decrease of 6.5 per cent. BIS Shrapnel's forecasts exhibit the greatest margin of variation but there also considerable variation between CEG and SKM's forecasts.

If we consider consultants' forecasts summarised in Table 1 above, it is correct that there are year to year disparities in the forecast commodity price changes. However, if one considers the projected trend over the five-year forecasting horizon, there is substantial agreement amongst the experts on the movement of the real price of aluminium, copper and steel.

To show this we have used consultants' real price change forecasts by year to calculate average annual price changes over the five-year period. The results are presented in the last column in Table 1. It can be seen that all three consultants expect the real price of aluminium to increase annually, on average, between 2.9 and 4.6 per cent over the period 2015 to 2019. For the same period, the consultants expect the real price of copper to decrease annually, on average, between 0.1 and 0.5 per cent, and the real price of steel to increase annually, on average, between 0.8 and 0.9 per cent.

These results indicate that there is agreement among the consultants that the current expectations about aluminium, copper and steel prices are:

1. Substantial real price increases for aluminium over the five-year period;
2. Small real price decreases for copper over the five-year period; and
3. Moderate real price increases for steel over the five-year period.

Differences in exchange rate assumptions explain most of the variation in consultants' commodity price forecasts

The largest difference between the NSPs' consultants' annual forecasts is in the last two years of the forecasting horizon. As can be seen in Table 1, BIS Shrapnel forecasts significant increase in real prices for all four commodities in 2018 (with price increases ranging from 6.5 per cent for oil to 11.0 per cent for aluminium). In comparison, price increases projected by SKM and CEG are much more moderate, and in the case of copper, the two consultants project real prices to decline. For 2019, BIS Shrapnel forecasts a significant decrease in real prices for all four commodities (ranging from -8.9 per cent for steel to -6.2 per cent for oil). Again, price decreases projected by SKM and CEG for copper and steel are much more moderate, and they project the real price of aluminium and oil to increase.

Our review of the SKM, CEG and BIS Shrapnel approaches to forecasting commodity prices indicates that differences in consultants' exchange rate assumptions account for most of the variation in their commodity price forecasts.

To convert commodity prices from United States dollars (USD) to Australian dollars (AUD), SKM and CEG sourced forward rates from Bloomberg, while BIS Shrapnel used an econometric model to forecast exchange rates.[8] In Figure 1, we present the forecast exchange rates used by SKM and BIS Shrapnel, which

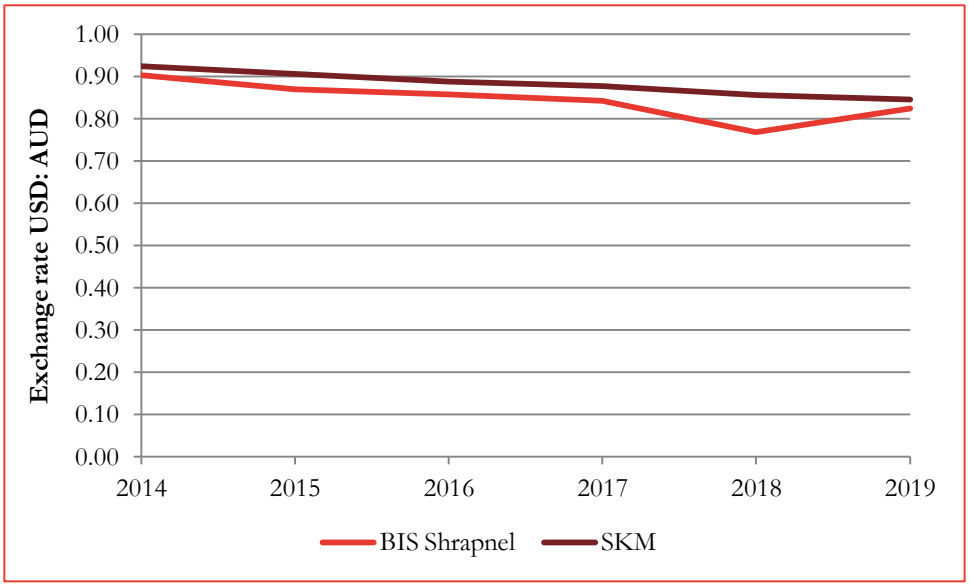
8 SKM, *'Commodity Price Escalation Forecast',* Report for TransGrid, December 2013, pp. 9-10; CEG, *'Material Escalation Factors - Attachment 5.19',* Report for Ausgrid, December 2013, p. 9; BIS Shrapnel, *'Real Labour and Material Cost Escalation Forecasts to 2019/20 - Australia and New South Wales',* Report for Jemena, April 2014, p. A-5.

Assessment of the AER's no-change assumption

the two consultants provided in their respective reports.[9] It can be seen that, over the five-year period, the two time series have broadly similar trends, with the AUD expected to depreciate against the USD.

The two series track each other closely until 2018, when BIS Shrapnel's forecasts diverge sharply from SKM's. While SKM continues to project a gradual decline in the AUD, BIS Shrapnel forecasts a significant depreciation of the AUD in 2018, followed by its recovery (appreciation) in 2019. This sharp depreciation of the AUD in 2018 and its recovery in 2019 largely explains why BIS Shrapnel expects commodity prices (expressed in AUD) to first increase significantly in 2018 and then decline significantly in 2019.

Figure 1: Exchange rate USD:AUD



Source: Frontier analysis.

To show that differences in consultants' commodity price forecasts are mainly driven by different assumptions regarding exchange rate movements, we have undertaken the following exercise. We first converted each consultant's forecasts from nominal AUD to USD using exchange rates provided in their respective reports.[10] We then converted consultants' forecasts back to real AUD using the

9 In its report to Ausgrid, CEG states that it sourced forward rates from Bloomberg but does not provide the actual exchange rate forecasts it used in its analysis. For the purpose of this exercise, we have assumed that the exchange rate forecasts used by CEG are the same as those provided by SKM in its report, since the two consultants used the same primary data source.

10 As explained in the previous footnote, we applied exchange rates provided by SKM to CEG forecasts.

exchange rates provided by SKM and assuming the annual inflation rate of 2.5 per cent.[11]

We present the results of our analysis in Table 2, in the rows labelled 'Reconciled'. We summarise the results by showing only the ranges of adjusted (i.e. reconciled) real price change forecasts and, in parenthesis, the difference between the maximum and the minimum price change forecasts. For comparison, in the rows labelled 'Original', we present consultants' unadjusted real price change forecasts (i.e. the same forecasts presented in Table 1).

For example, for aluminium for 2019, CEG has forecast a real price increase of 3.6 per cent, SKM has forecast a real price increase of 3.0 per cent, and BIS Shrapnel has forecasts a real price decrease of 6.5 per cent. Hence the range of real price change forecasts for aluminium for 2019 is -6.5 per cent to 3.6 percent. The margin of variation between the forecasts is 10.1 per cent (calculated as 3.6 – (–6.5)). These results are presented in the row labelled 'Original' for the year 2019.

After accounting for the difference in the expected exchange rates, CEG and SKM forecasts are unchanged, while BIS Shrapnel forecasts now indicate a real price increase for aluminium of 1.8 per cent. Hence the range of real price change forecasts for aluminium for 2019 is now 1.8 per cent to 3.6 percent, with the margin of variation between the forecasts of 1.8 per cent. These results are presented in row labelled 'Reconciled' for year 2019.

Table 2: Comparison of real material input cost escalation forecasts

	2015	2016	2017	2018	2019	Per year
Aluminium						
Original	1.4 to 4.7 (3.3)	4.9 to 5.8 (0.9)	3.1 to 5.0 (1.9)	4.2 to 11.0 (6.8)	-6.5 to 3.6 (10.1)	**2.9 to 4.6 (1.6)**
Reconciled	-0.3 to 4.7 (5.0)	4.6 to 6.1 (1.5)	3.1 to 5.0 (1.9)	3.4 to 4.4 (1.1)	1.8 to 3.6 (1.8)	**2.8 to 4.6 (1.8)**
Copper						
Original	-0.9 to -0.2 (0.7)	-1.5 to 1.1 (2.6)	-1.2 to 0.3 (1.5)	-0.3 to 9.3 (9.6)	-8.7 to -0.7 (8.0)	**-0.6 to -0.1 (0.5)**
Reconciled	-2.5 to -0.1 (2.4)	-0.9 to 1.1 (2.0)	-1.1 to 0.3 (1.4)	-0.3 to 1.8 (2.1)	-1.5 to -0.5 (0.9)	**-0.6 to -0.1 (0.5)**
Steel						
Original	0.6 to 5.1 (4.5)	1.0 to 3.2 (2.2)	-0.4 to 0.6 (1.0)	0.3 to 8.0 (7.7)	-8.9 to -0.1 (8.8)	**0.8 to 0.9 (0.1)**
Reconciled	0.6 to 3.3 (2.7)	1.6 to 3.2 (1.6)	-0.8 to 0.6 (1.4)	0.3 to 0.6 (0.3)	-1.1 to -0.1 (1.0)	**0.8 to 0.9 (0.1)**
Oil						
Original	-5.1 to 1.4 (6.5)	-1.1 to 2.8 (3.9)	-2.0 to 2.6 (2.8)	1.9 to 6.5 (4.7)	-6.2 to 1.8 (8.0)	**-0.6 to 1.8 (2.3)**
Reconciled	-5.0 to -0.3 (4.8)	-1.0 to 2.8 (3.8)	-0.8 to 2.6 (3.4)	-0.7 to 2.1 (2.8)	0.5 to 2.1 (1.6)	**-0.6 to 1.8 (2.4)**

[11] The choice of the SKM exchange rates is not an endorsement; rather they are used for illustrative purpose only to show the effect a specific assumption about the USD:AUD exchange rate trajectory can have on the commodity price change forecasts.

Assessment of the AER's no-change assumption

Source: AER, 'Draft decision TransGrid transmission determination 2015–16 to 2017–18 Attachment 6: Capital expenditure', November 2014, Table D-2, p. 6-79. Frontier analysis.

Our analysis indicates that what the AER interpreted to be large differences in opinion regarding real price change forecasts is more disagreement over future exchange rate movements.

2.2 The AER seems to confuse accuracy and bias with disagreement

In the draft decision for TransGrid, the AER dismisses the evidence put forward by independent experts on the basis that the forecasts from different experts do not agree precisely. The AER states:

> forecast divergences between consultants further demonstrate the uncertainty in the modelling of material input cost escalators to reliably and accurately estimate the prices of intermediate outputs used by service providers to provide network services.[12]

The AER's simplistic approach (i.e. mere comparison of different forecasts) does not tell us anything about the accuracy or bias of consultants' forecasts. One way to evaluate consultants' forecasting approaches would have been to assess how well these consultants have predicted commodity price movements in the past (i.e. by comparing their forecasts to outturns).

The AER has undertaken this type of analysis in past decisions. For example, in its 2012 draft decision for SP AusNet, the AER, using a mean absolute error measure, assessed past Labour Price Index forecasts produced by two independent experts.[13] Finding one consultant's forecasts too optimistic and the other's too pessimistic, the AER found that averaging consultants' forecasts led to more precise estimates stating that:

> [t]his result is consistent with a significant body of literature concluding forecast accuracy can be improved by combining multiple individual forecasts.

We discuss the benefits of combining individual forecasts in the next subsection.

12 AER, *'Draft decision TransGrid transmission determination 2015–16 to 2017–18 Attachment 6: Capital expenditure'*, November 2014, p. 6-79.

13 AER, *'Access arrangement draft decision SPI Networks (Gas) Pty Ltd 2013-17 Part 3 Appendices'*, September 2012, pp. 120-121.

2.3 The AER's no-change assumption may be inferior compared to price change assumptions based on combining forecasts

In the draft decision for TransGrid, the AER did not provide any empirical analysis showing that the price of materials inputs is expected to be flat (in real terms) over the five-year forecasting horizon. Rather, findings from selected empirical studies, which assessed the performance of futures prices as predictors of spot prices, were used by the AER in support of its assumption that the appropriate rate of change for materials inputs is zero per cent. The AER states:

- recent studies which show that forecasts of crude oil spot prices based on futures prices do not provide a significant improvement compared to a 'no-change' forecast for most forecast horizons, and sometimes perform worse
- evidence in the economic literature on the usefulness of commodities futures prices in forecasting spot prices is somewhat mixed. Only for some commodities and for some forecast horizons do futures prices perform better than 'no change' forecasts.[14]

The studies cited by the AER do question forecasting performance of futures models and, for that matter, many other models that have been used frequently to forecast commodity prices. The emerging consensus in the forecasting community, however, is not that the no-change forecasts should be favoured over other forecasting methods as the above quotes from the AER may imply. Rather, the emerging consensus is on combining forecasts from different forecasting models as a means of improving the reliability of final forecasts.

The key intuition for combining forecasts is the following: all forecasts are subject to some error; the accuracy of forecasts is increased by reducing these errors; as long as the errors associated with different forecasts are independent, combining forecasts will act to reduce forecast errors because errors from competing models will to some extent cancel each other.

Baumeister and Kilian (2013), for example, show that combining forecasts from a suite of models – including econometric models, the no-change forecasts, and forecasts based on oil futures prices – systematically produce more accurate forecasts of the real price of oil than the no-change forecasting method at all horizons up to 24 months.[15]

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14 AER, *'Draft decision TransGrid transmission determination 2015–16 to 2017–18 Attachment 6: Capital expenditure'*, November 2014, p. 6-74.

15 Baumeister, Christiane, and Lutz Kilian, *'Forecasting the Real Price of Oil in a Changing World: A Forecast Combination Approach'*, Bank of Canada Working Paper 2013-28, August 2013. Available at http://www.bankofcanada.ca/wp-content/uploads/2013/08/wp2013-28.pdf

The International Monetary Fund, in its 2014 *World Economic Outlook* publication, featured a special report on commodity prices and forecasts.[16] The authors of the report assessed forecasting performance of a number of models. They show that vector autoregression (VAR) forecasting models outperform (i.e. have the lowest forecasting error compared to) a number of alternative models, including the model based on futures prices. Despite finding that the VAR forecasts perform better than forecasts of other competing models, the IMF offers the following advice to policymakers:

> In view of the considerable forecast uncertainty for oil prices irrespective of the underlying models, it could be useful to employ several forecasting methods to hedge . . . the merits of combination forecasts have long been established . . . [m]ore recently, it has been argued that the forecasting model with the lowest [root mean squared error] may potentially be improved by incorporating information from other models or macroeconomic factors.

We note that, in the draft decision for TransGrid, the AER chose to cite the IMF study in support of the AER's statement that forecasts of crude oil spot prices based on futures prices do not consistently outperform the no-change forecasts. The AER, however, ignored completely the main recommendation of the IMF study which urges policymakers to consider forecast combinations.

It is important to understand that the principle of combining forecasts is a universal one – it is not unique to a specific commodity or a field of study. Timmermann (2005) states that:

> forecast combinations have been used successfully in empirical work in diverse areas such as forecasting Gross National Product, currency market volatility, inflation, money supply, stock prices, meteorological data, city populations, outcomes of football games, wilderness area use, check volume and political risks.[17]

Clemen (1989), based on a comprehensive review of empirical literature on forecast combinations, concludes that:

> The results have been virtually unanimous: combining multiple forecasts leads to increased forecast accuracy . . . in many cases one can make dramatic performance improvements by simply averaging the forecasts.[18]

The AER has used forecast combinations in past decisions

The AER has used forecast combinations in past decisions, and the AER's approach has been corroborated by Professor Jeff Borland. In the context of

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16 International Monetary Fund, *'World Economic Outlook — Recovery Strengthens, Remains Uneven'*, Washington, April 2014, pp. 25-31.

17 Timmermann, A.G., *'Forecast Combinations'*, Centre for Economic Policy Research, Discussion Paper No. 5361, November 2005.

18 Clemen, R.T., 'Combining forecasts: A review and annotated bibliography', *International Journal of Forecasting* 5, 1989.

assessing forecasts of labour cost escalation rates by two independent forecasters — Deloitte Access Economics (DAE) and BIS Shrapnel (BIS) — Professor Borland submitted to the AER the following:[19]

> Each forecast of the change in [Wage Price Index] WPI made by DAE and BIS can be thought of as being equal to the actual change in WPI plus a forecast error. Suppose that the forecast error associated with any forecast made by DAE and BIS is regarded as being 'independent'; that is, knowing the forecasts error made by DAE does not provide information about what the forecast error made by BIS is likely to be (and vice versa). Then it follows that a forecast that is the average of the two forecasts will have a lower expected absolute prediction error than using either of the DAE or BIS forecasts. One way to think of this result is that, because the forecast errors are independent, taking the average of the DAE and BIS forecasts will tend to reduce the average size of the forecast error; that is, the forecast errors offset each other. Hence, the average of the DAE and BIS forecasts will be a better estimate of the actual change in WPI. The approach of taking an average, putting equivalent weight on the forecasts made by DAE and BIS, is optimal where it is considered that those forecasts are likely to be associated with equal-sized forecast errors (Bates and Granger, 1969, pages 452-53).

In its final decision on access arrangements in relation to SPI Networks, the AER accepted Professor Borland's advice regarding the combination of independent forecast:[20]

> The AER considers a LPI adjusted for SP AusNet's PFP represents the best forecast of labour cost escalations. The AER considers the best labour price measure in the circumstances is an average of DAE and BIS Shrapnel's LPI forecasts.
>
> To this extent, the AER agrees with SP AusNet and Professor Borland that the average of the two forecasts produces a better forecast of the labour price than using either BIS Shrapnel's or DAE's forecast exclusively. This is consistent with the AER's own analysis of six forecast series of LPI where the average had the lowest mean absolute error on three occasions, DAE on two occasions and BIS Shrapnel once.

The AER has applied this approach in a number of subsequent decisions, including the following:

- In the preliminary decision for Ergon Energy, the AER applied an average of PricewaterhouseCoopers' wage price index (WPI) forecast and its own consultant's (DAE's) WPI forecast.[21]
- In the draft decisions for the NSW and ACT electricity distribution network service providers (DNSPs), the AER averaged Independent Economics'

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19 Professor Jeff Borland '*Recommendations for methodology for forecasting WPI: report for Envestra Limited, SP AusNet, APA GasNet and Multinet Gas*', October 2012.

20 AER, '*Access arrangement final decision SPI Networks (Gas) Pty Ltd 2013–17 Part 3: Appendices*', March 2013, p.11.

21 AER, '*PRELIMINARY DECISION Ergon Energy determination 2015-16 to 2019-20 Attachment 7-Operating expenditure*', April 2015, pp. 7-29, 7-289 to 7-290.

Assessment of the AER's no-change assumption

labour price forecasts (produced on behalf of the DNSPs) and DAE's labour price forecasts.[22]

- In the final decision for SP AusNet, the AER averaged labour cost escalators produced by DAE and by BIS Shrapnel, SP AusNet's consultant.[23]

Notwithstanding that the AER has combined forecasts in the past, in relation to certain inputs used by NSPs, the AER has not done so in relation to materials inputs. There is no good reason for the AER to favour forecast combinations for one set of inputs (i.e. labour) and ignore that approach when forecasting changes in the cost of other inputs (i.e. materials). When faced with discrepant and uncertain forecasts, from a range of sources, the AER should adopt the approach it has used in the past in respect of labour price forecasts and combine those forecasts.

2.4 The AER's claims on risk are vague and unsubstantiated

It is unclear from the AER's draft decision for TransGrid which of the following considerations drives the AER's assumption that the appropriate rate of change for materials inputs is zero per cent:

1. Commodity prices are expected to rise in real terms and this increase will flow through to rises in capital input costs; however, this can be somehow mitigated by the NSPs; or
2. Commodity prices are not expected to rise in real terms, but even if they did rise in real terms this would not actually flow through to rises in input costs (for example, because producers of capital goods could hedge these price movements effectively); or
3. The AER does not have a view on the likely movements in commodity prices but forming any view on individual commodities is unnecessary because any positive or negative change in individual commodity price inputs would likely net out, leaving the overall impact on capital costs neutral (because, in the AER's view, if the price of one commodity rises

22 AER, '*Draft decision Ausgrid distribution determination 2014-19 Attachment 7: Operating expenditure*', November 2014, p. 7-143; AER, '*Draft decision Endeavour Energy distribution determination 2014-19 Attachment 7: Operating expenditure*', November 2014, p. 7-210; AER, '*Draft decision Essential Energy distribution determination 2015-16 to 2018-19 Attachment 7: Operating expenditure*', November 2014, p. 7-30; AER, 'Draft decision *ActewAGL distribution determination 2014-19 Attachment 7: Operating expenditure*', November 2014, p. 7-192.

23 AER, '*Final Decision SP AusNet Transmission Determination 2014-15 to 2016-17*', January 2014, pp. 69-71.

then another commodity might be a substitute, and the NSPs also might be able to change the mix of capital and operating costs).

The AER's rationale does not appear to rely upon any interpretation of what futures prices actually represent. Either the futures price is an unbiased estimate of the future spot price, which would support the use of futures prices as an input to forecasting materials prices. Alternatively, there is some reason why the futures price differs from an unbiased estimate of the future spot price, because there is a pressing need for suppliers or purchasers to hedge their risks. Under this latter interpretation, if a procurer of aluminium wanted to hedge the risk of aluminium price rises, the buyer needs to buy at the futures price. This is at a premium to today's spot price.

The AER's interpretation of futures prices is that they should not be used as an estimate of the future spot price and that the NSPs can hedge the risk of commodity price increases at prices different to the futures prices. These statements are inconsistent. If the futures price is not an unbiased estimate of the future spot price, it is distorted by the pressing need to hedge risk, and the premium or discount is the amount paid to hedge the risk of commodity price changes. The AER is making the assumption that today's commodity prices can somehow be locked in, despite the different prices observed in the futures market.

The AER's rationale about changing the mix of capital and operating costs is unsubstantiated and is impossible to evaluate. The AER is making an assertion that, faced with one set of materials cost increases, a NSP can seamlessly operate its business in a different way to offset those increases. The NSPs already optimise their mix of capital and operating costs, and seek efficiency over materials inputs.

The AER's rationale is based upon shocks to input costs that lead a business (whether that be an NSP or any other business) to operate in some other way. But what is at issue here is not a shock to a business over a five year period. The question is whether the NSP's plans are somehow sub-optimal, given the projected set of materials price increases. The AER rationale appears to be that, if commodity prices really are projected to increase in this pattern, a NSP should change its operations in an offsetting manner. Neither the NSPs, nor the AER, know of a more efficient way to operate their businesses, given this particular set of commodity price projections.

In short, the AER has provided no evidence or analysis that either the NSPs or producers of capital goods used by the NSPs can hedge away the movements in commodity prices. The AER makes no interpretation of futures prices, rejecting both the interpretation of an unbiased estimate of the spot price and the interpretation of the price required to mitigate risk. The AER also assumes that the NSPs, having projected a series of materials price changes, could seamlessly operate differently to offset those materials changes. Yet the input mix and

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operating cost projections have already been made by the NSPs on the basis of the best efforts, and the AER has not suggested how the businesses should remedy an inefficiency in those projections. It is not credible to simply assume that input costs are unresponsive to changes in underlying commodity prices.

Appendix – Frontier Economics' relevant expertise

Frontier Economics is a microeconomics consulting firm, specialising in utility reform and regulation, trade practices, competition analysis and public policy evaluation. We have offices in Melbourne, Sydney and Brisbane, with close links to our sister company of the same name based in Europe, which has offices in London, Cologne, Madrid, Dublin and Brussels.

We have worked extensively in all regulated sectors in all Australian states, New Zealand and in Asia. The regulated industries in which we have relevant expertise include electricity transmission and distribution networks, gas pipelines, telecommunications networks, airports, water networks, rail and port infrastructure.

We have advised regulated electricity networks and regulators on the full range of regulatory issues that typically arise within a building-block based framework for incentive regulation, including:

- procedures for developing forecasts of cost escalation rates;
- estimation of scale escalation rates for opex forecasting;
- top-down and bottom-up approaches for forecasting capex;
- opex and capex investment tests;
- cost benchmarking and efficiency analysis;
- estimation of the weighted average cost of capital (WACC);
- valuation of the regulatory asset base (RAB);
- treatment of regulatory depreciation;
- incentive mechanisms;
- quality of service regulation;
- demand forecasting; and
- tariff modelling.

Recent experience on forecasting input cost escalation rates

Below is a selection of recent projects in which we advised clients on the forecasts of input cost escalation rates:

- **CitiPower and Powercor Australia.** Frontier recently developed forecasts of labour cost escalation rates for two distribution networks in Victoria. In doing so, Frontier developed a methodology for forecasting future labour

costs using historical enterprise (collective) bargaining agreements which, by definition, are more reflective of distributors' negotiated labour costs than broad labour cost indices that have historically been used by the AER. Frontier showed, using official Census data, that the labour cost indices used by the AER represent very poorly the labour costs of electricity networks. Instead, these indices capture the labour costs of a wide range of unrelated industries, including water networks, waste services firms, electricity generators and retailers. We also showed that the labour requirements of these unrelated industries correspond very poorly to the labour mix typically found within electricity distribution networks. Finally, Frontier showed that its proposed approach to determining labour cost escalation rates created strong incentives for networks to improve efficiency over time. Frontier undertook this assignment with Prof. Jeff Borland of the University of Melbourne. Prof. Borland is one of Australia's most eminent labour economists (2014-15).

- **SA Power Networks.** Frontier developed forecasts of labour cost escalation rates applicable to SA Power Networks. SA Power Networks used this advice to inform its proposal to the AER on expenditure forecasts, as part of the regulatory process to set the business's revenue allowances over the period 2015-2020. Subsequently, SA Power Networks has engaged Frontier and Prof. Jeff Borland to review and provide an expert opinion on the AER's Preliminary Decision on labour cost escalation rates (2014, 2015).
- **Electricity Networks Association of New Zealand.** Frontier advised the ENA on techniques for forecasting the costs of Electricity Distribution Businesses (EDBs) in New Zealand for the purposes of setting allowances under a Default Price-Quality Path (DPP) regime. Amongst other things, Frontier advised on ways in which the Commerce Commission's approach to forecasting input cost escalation rates may be improved. The New Zealand Commerce Commission uses these forecasts to determine cost allowances, when setting the maximum allowable revenues the EDBs are permitted to earn. We surveyed in detail the range of official input price indices produced by Statistics New Zealand. We showed that the general (i.e. non-industry-specific) indices used by the Commission represented poorly the growth in EDBs' input costs. By engaging directly with Statistics New Zealand, we compiled evidence on the constituents of the indices used by the Commission, the survey and sampling techniques used by Statistics New Zealand, and on the practical difficulties associated with forecasting various input price indices. We recommended an alternative approach to the Commission's existing approach, which involved use of composite price escalators by effectively employing a weighted average of forecasts of different price indices to reflect EDBs' cost structures, and the combination of forecasts derived by different independent forecasters (2013-14).

Appendix – Frontier Economics' relevant expertise

Selected experience in relation to electricity transmission networks

The following assignments are examples of projects in which we have assisted clients on a wide range of regulatory matters related to electricity transmission networks.

- **TransGrid.** Frontier advised TransGrid on a range of rate of return related matters arising from the AER's latest final decision for NSW NSPs, including the following issues: the AER's approach to estimating the return on equity; the AER's application of transitional arrangements to the trailing average approach to the return on debt; and the AER's approach to estimating gamma (2015).
- **Transpower New Zealand.** Frontier Economics was engaged by Transpower New Zealand to review the major capex efficiency adjustment (MCEA) mechanism that the New Zealand Commerce Commission intends to apply in relation to large capital expenditure projects undertaken by Transpower, and to provide our views on the incentives that the MCEA provides for Transpower to pursue efficiencies in the delivery of these projects. Our review identified two principal concerns: Firstly, the Commission's proposed application of the MCEA would introduce considerable uncertainty over the size of payoffs to Transpower associated with any efficiencies achieved. Secondly, the MCEA has to potential to interact with another capex efficiency mechanism applied by the Commission in such a way as to double-count overspend amounts, thus penalising Transpower twice for any inefficiencies. We recommended an alternative way of applying the MCEA that would overcome these two problems and strengthen the incentives for the business to pursue efficiency savings (2015).
- **TransGrid.** Frontier provided advice on the appropriate regulatory treatment of TransGrid's Major Operating Projects (MOPS). In particular, we advised TransGrid on whether the Australian Energy Regulator (AER) had correctly applied to TransGrid the framework we developed when advising the AER on a different business's regulatory proposal (2014).
- **Transpower New Zealand.** Frontier supported Transpower New Zealand through the Commission's 'Further work on WACC' review. In December 2010 the Commission published IMs for setting allowed rates of return for businesses regulated under Part 4 of the Commerce Act. Various aspects of the Input Methodologies were appealed in the High Court. The Major Electricity Users' Group appealed the Commission's practice of matching the allowed rate of return to the 75th percentile of the estimated WACC range. The Court did not uphold MEUG's appeal, but expressed doubt over the evidence base for the Commission's practice. At the request of a number of parties, the Commission commenced a review on the appropriate

methodology for choosing a point estimate from its WACC range. Frontier produced a number of reports setting out the conceptual, empirical and regulatory evidence for choosing a WACC value above the midpoint of the range, and has also undertaken loss function modelling on behalf of Transpower (2014).

- **Mighty River Power.** Frontier prepared a report for Mighty River Power reviewing the New Zealand Electricity Authority's proposed Transmission Pricing Methodology. The Authority proposed introducing two new transmission charges – a 'beneficiaries-pay charge' and a 'residual charge' (2012-13).
- **Australian Energy Regulator.** Frontier advised the AER on the appropriate drafting of the Regulatory Investment Test for Transmission (RIT-T), which replaced the Regulatory Test, and the accompanying RIT-T Application Guidelines (2009 – 2010).
- **TransGrid.** Frontier advised TransGrid on issues related to regional interconnection of the National Electricity Market (NEM), including the Regulatory Test, Basslink and alternative network planning arrangements and constraint risks to new generators associated with network connection. Frontier also undertook a cost/benefit analysis of interconnection of the high voltage South Australian and New South Wales electricity grids including consultation with market participants, development of a supply reliability framework, review of generation and demand side management options, and an assessment of market power implications (1999-2003).
- **Powerlink.** Frontier provided an assessment of the economics of proposed projects to upgrade the high voltage transmission network in Queensland on behalf of Powerlink (2000).

Selected recent experience on wider network regulation issues

The following assignments are recent examples of assignments that demonstrate Frontier's breadth of experience in network regulation, particularly in relation to electricity networks:

- **Ergon Energy.** Frontier Economics was engaged by Ergon Energy's legal counsel to review the AER's first application of benchmarking analysis to set cost allowances for regulated electricity distribution network service providers (DNSPs) in Australia. Frontier Economics demonstrated, using econometric modelling, that the AER had failed to account for large differences in operating circumstances between Ergon Energy and other DNSPs. These circumstances included: the sparsity of Ergon Energy's service area; the provision of significant subtransmission services (which are not provided by many other DNSPs in Australia); and harsh climate. Frontier

Economics illustrated how the AER could account for these factors either directly within its benchmarking model, or through 'special factor adjustments' outside the benchmarking model. Frontier Economics provided a survey of how European regulators apply special factor adjustments and recommended that the AER consider similar approaches when setting allowances for DNSPs (2015).

- **TransGrid, Networks NSW, Jemena.** Frontier is currently advising several electricity networks in NSW on a range of cost of capital issues including: estimation of cost of equity parameters; the AER's proposed transitional arrangements for moving from an 'on-the-day rate' approach to the cost of debt to a 'trailing average' cost of debt approach; estimation of alternative cost of equity models (e.g. Black CAPM, Fama-French, Dividend Discount Model); and valuation of imputation credits. All of these issues have proved contentious within the AER's recent price determination for NSW networks (2014-ongoing).
- **Networks NSW.** Frontier was engaged by Networks NSW (the collective name for three distribution networks, Ausgrid, Endeavour Energy, and Essential Energy) to review the benchmarking analysis undertaken by the AER when assessing the relative efficiency of Australian distribution networks (2014-15).
- **CitiPower, Powercor Australia, AusNet Services.** Frontier developed for three distribution networks in Victoria a set of econometric models that can be used to forecast opex scale escalation. The models were developed using the benchmarking Regulatory Information Notices data collected by the AER (2014).
- **Wellington Electricity Lines.** Frontier Economics was engaged by Wellington Electricity Lines to review the New Zealand Commerce Commission's model for forecasting constant price revenue growth for EDBs in New Zealand, and subsequently investigate the development of an alternative model specification (2014).
- **Electricity Networks Association of New Zealand.** Frontier advised the ENA on techniques for forecasting the costs of EDBs in New Zealand for the purposes of setting allowances under a DPP regime. This assignment involved two key tasks: First, we advised on possible top-down models for forecasting costs that are independent of the forecasts that EDBs must provide the Commerce Commission under New Zealand's regulatory information disclosure regime. Second, we advised on ways in which EDBs' forecasts may be used by the Commission when setting allowances under a DPP framework. As part of this task, we explored the possible application of a menu regulation scheme, such as the Information Quality Incentive mechanism used by Ofgem and Ofwat in Great Britain (2013-14).

Appendix – Frontier Economics' relevant expertise

- **Australian Energy Regulator.** Frontier advised the AER on ways in which regulatory incentive mechanisms for more efficient capital and operating expenditures by energy network businesses can be improved (2013).
- **Australian Energy Regulator.** Frontier advised the AER on the risks that Australian energy networks are exposed to and how these should be reflected in the AER's determination of the cost of capital. This work fed into the AER's work on defining the "benchmark efficient entity", an important part of its regulatory framework and element of its 2013 rate of return guidelines, which the AER will use going forward to estimate the Weighted Average Cost of Capital (WACC) for regulated energy networks (2013).
- **Australian Energy Regulator.** Frontier advised the AER on the appropriate drafting of the Regulatory Investment Test for Distribution (RIT-D), which replaced the Regulatory Test, and the accompanying RIT-D Application Guidelines. The RIT-D is a cost-benefit test applied to significant distribution augmentations (2013).
- **Australian Energy Regulator.** Frontier advised the AER on the implications of APA GasNet's proposed approach to depreciation of their Victorian gas transmission assets as part of APA GasNet's 2013-17 access arrangement. In particular, Frontier advised the AER on whether APA GasNet's proposed approach was likely to lead to reference tariffs that would vary, over time, in a way that promotes efficient growth in the market for reference services. APA GasNet applied for a review of the AER's decision (which was based on our report) at the Australian Competition Tribunal. The AER was successful at the appeal (2012-13).
- **Victorian gas distributor.** Frontier Economics prepared a report for a Victorian gas distributor challenging the AER's approach to forecasting the distributor's level of efficient operational expenditure in the next access arrangement period. Our report was submitted as part of the distributor's response to the AER's Draft Decision (2012).
- **Australian Energy Regulator.** Frontier advised the AER on the appropriate regulatory treatment of the costs incurred by APT Petroleum Pipelines Ltd in the buyout of a contract for services from Agility. Our advice was cited by the AER in its Final Decision (2012).

FRONTIER ECONOMICS
MELBOURNE | SYDNEY | BRISBANE
Frontier Economics Pty Ltd 395 Collins Street Melbourne Victoria 3000
Tel: +61 (0)3 9620 4488 Fax: +61 (0)3 9620 4499 www.frontier-economics.com.au
ACN: 087 553 124 ABN: 13 087 553 124