Escalation factors affecting expenditure forecasts

A report for Country Energy

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Executive Summary

1. CEG has been commissioned by Country Energy to estimate cost escalation factors in order to project forward the costs of its operating and capital expenditure for the 2010-11 to 2014-15 regulatory period. Country Energy has requested that cost escalation factors be developed for:

   - aluminium;
   - steel;
   - polyethylene; and
   - concrete.

2. The terms of reference for this engagement stipulate that these cost escalation factors should be consistent with the National Gas Rules, and in particular Rule 74(2), which states that any forecast or estimate:

   (a) must be arrived at on a reasonable basis; and

   (b) must represent the best forecast or estimate possible in the circumstances.

3. We consider that the estimates presented in this report and the methodologies that we use to derive them are consistent with these requirements.

4. In order to estimate a set of escalation factors to extend forward Country Energy's costs, it is necessary to form a view about the future movements of wages and commodity prices. The methodology that we have adopted in this report is to source predictions of future prices for these inputs, whether in the form of futures prices or expert forecasts, and to rely on these data to develop escalation factors. Where futures prices are available and are sufficiently liquid, we have used these in preference to forecasts on the basis that these represent the best forecast of prices by informed market participants.

5. Issues of consistency in timing are crucial to the development of escalation factors, because their function is to project forward prices or costs from one period to another. Due to the way that spending forecasts are used in regulatory modelling, the escalation factors required to project forward operating and capital expenditure must be made on a different basis. Operating expenditure must be projected forward to the mid-point of each financial year, using the forecast change in average costs between financial years, or 'financial year' escalators. On the other hand capital expenditure must be projected forward to the end of each financial year, using the change in average costs over each calendar year, or 'calendar year' escalators. Our understanding is that all of Country Energy's operating and capital costs are based on prices prevailing over the 2008-09 financial year.

6. In general, the methodology applied in this report to estimate escalation factors is characterised by a high degree of transparency over the use of input data to estimate escalation factors and is consistent with the methodology applied by the Australian Energy Regulator (AER) in its calculation of escalation factors for its Final Determinations for the New South Wales and Tasmanian electricity businesses.

7. CEG's estimates of Country Energy's escalation factors are set out in Table 1 below.

Table 1: Escalation factors for Country Energy, real

Financial year	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Aluminium	-8.2%	9.4%	8.3%	7.6%	6.6%	5.9%
Steel	-18.3%	7.9%	5.6%	1.4%	0.9%	0.8%
Polyethylene	0.6%	1.9%	1.0%	0.3%	0.2%	0.2%
Concrete	2.8%	1.0%	2.9%	2.8%	1.8%	0.9%
Crude oil	1.8%	10.7%	5.0%	1.6%	1.4%	0.7%
Construction	-2.1%	-0.3%	-0.4%	0.3%	-1.1%	-2.1%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Aluminium	-14.2%	12.1%	8.6%	8.1%	7.0%	6.2%
Steel	-21.6%	9.5%	5.9%	3.4%	1.0%	0.9%
Polyethylene	-2.6%	4.5%	1.4%	0.6%	0.2%	0.2%
Concrete	2.5%	0.4%	2.2%	3.1%	2.3%	1.3%
Crude oil	-11.8%	22.4%	7.5%	2.9%	1.2%	1.5%
Construction	-0.9%	-1.5%	-0.3%	0.0%	-0.2%	-1.7%

1. Introduction

8. Country Energy has engaged CEG to provide advice on the development of annual escalation factors for its operating and capital expenditure programs.

9. Escalation factors, properly derived, can be used to project forward the value of base objects into the future. An example of a base object may be the average wages of a full time employee in the electricity, gas and water sectors over the 2007/08 financial year. Planning of future projects may be conducted on the basis that a certain number of such employees may be required over a period of time during the next regulatory period. Escalation factors for EGW wages can be used to determine the expected cost of the labour input to this project.

10. The methodology for determining escalation factors has become significantly refined over the course of the South Australia, New South Wales and Tasmanian electricity network determinations. Although there are still areas where the businesses are in dispute with the AER, at a high level there is general agreement as to the best approach to calculate escalation factors for:

- aluminium;
- steel; and
- crude oil.

11. In this report, we review the foundations for the methodology that has been applied in the context of the electricity determinations and re-estimate escalation factors based on the most recently available data. Furthermore, we propose methodologies for calculating escalation factors for additional inputs relevant to the gas context, including:

- concrete; and
- polyethylene.

2. Description of methodology

12. In order to escalate forward Country Energy's operating and capital expenditure it is necessary to obtain or develop forecasts of either:

    a. the price of goods and services directly purchased by Country Energy; or

    b. the price of inputs used in the production of goods and services directly purchased by Country Energy for the purpose of delivering its expenditure programs.

13. This task would best be achieved by examining forecasts of prices for all inputs purchased by Country Energy (ie, category a) above). Unfortunately, with the exception of labour costs, such forecasts generally do not exist. For example, while there are forecasts for labour costs in the New South Wales electricity, gas and water sector, there are few if any forecasts of the cost of equipment purchased by Country Energy (such as pipes, meters and regulators, etc).

14. The lack of such forecasts for most goods and services purchased by Country Energy reflects the specialised and heterogeneous nature of these goods and services – such that there is insufficient demand for forecasts of these prices and no active trading in 'futures' for these goods and services. For example, there is no formal 'futures market' for plastic pipes.

15. However, for many of these inputs used in the production of equipment/services purchased by Country Energy there are raw material forecasts and/or futures prices that can inform forecasts for the prices of the inputs themselves. Specifically:

    c. futures prices and forecasts for aluminium and crude oil can be used to inform forecasts for the value of these materials as components of Country Energy's expenditures;

    d. forecasts of the price of steel, concrete and labour can be used to project forward the value of these components of Country Energy's expenditures; and

    e. forecasts of general cost movements (eg, consumer price index or producer price index) can be used to derive changes in the cost of other inputs used by Country Energy or its suppliers that not captured above (eg, energy costs and equipment leases etc).

16. This high-level approach has previously been proposed by CEG in its reports for electricity businesses[1] and has been accepted by the AER in its Final Determinations for ElectraNet, Transend and the New South Wales electricity network businesses.

17. The necessary steps required to develop a forecast for the escalation of an expenditure program are as follows.

- Step 1- break down the expenditure program into different cost categories for which there are cost forecasts (or for which cost forecasts can be derived);
- Step 2 – source/derive the relevant cost forecasts;
- Step 3 – calculate a weighted average escalation factor using weights derived in Step 1 and forecasts from Step 2.

18. In order to complete Step 2 where there are no futures or forecasts available for a particular good or service (eg, gas regulators) it may be necessary to derive a forecast for that good or service from other forecasts. The methodology taken in deriving a forecast for, say, gas meters is similar to the above – the only difference being the starting point is not a breakdown of the costs of the overall capex program but a breakdown of the costs of gas meters. It can be described as follows:

- Step 2A – breakdown the cost of production for that good/service into component inputs parts for which there are forecasts available (eg steel, aluminium and labour);
- Step 2B – source the relevant input cost forecasts;
- Step 2C – calculate a weighted average escalation factor using weights derived in Step 2A and forecasts from Step 2B.

19. The remainder of this section sets out a number of considerations that guide the approach set out above.

2.1. Preference of futures over forecasts

20. Consistent with the approach approved by the AER in its recent New South Wales and Tasmanian electricity Final Determinations, in coming to our estimates of Country Energy's future escalation factors we have had regard to various predictions of how prices may change in the future. These predictions have been obtained from two general sources: futures market prices and expert forecasts.

[1] See: CEG, *Escalation factors affecting capital expenditure forecasts: a report for ElectraNet*, January 2008; CEG, *Escalation factors affecting expenditure forecasts: a report for NSW electricity businesses*, April 2008; and CEG, *Escalation factors affecting expenditure forecasts: a report for NSW and Tasmanian electricity businesses*, January 2009.

21. In CEG's opinion the most reliable forecast for input prices is provided by prices determined in the futures market – provided that the relevant market is sufficiently liquid. That is, the most reliable predictor of prices on a particular date in the future is the price at which market participants are willing to commit to trading on that day. If there were a better estimate of future prices then investors could expect to profit by buying/selling futures until today's futures price reflected the best estimate of spot prices on the relevant future date.

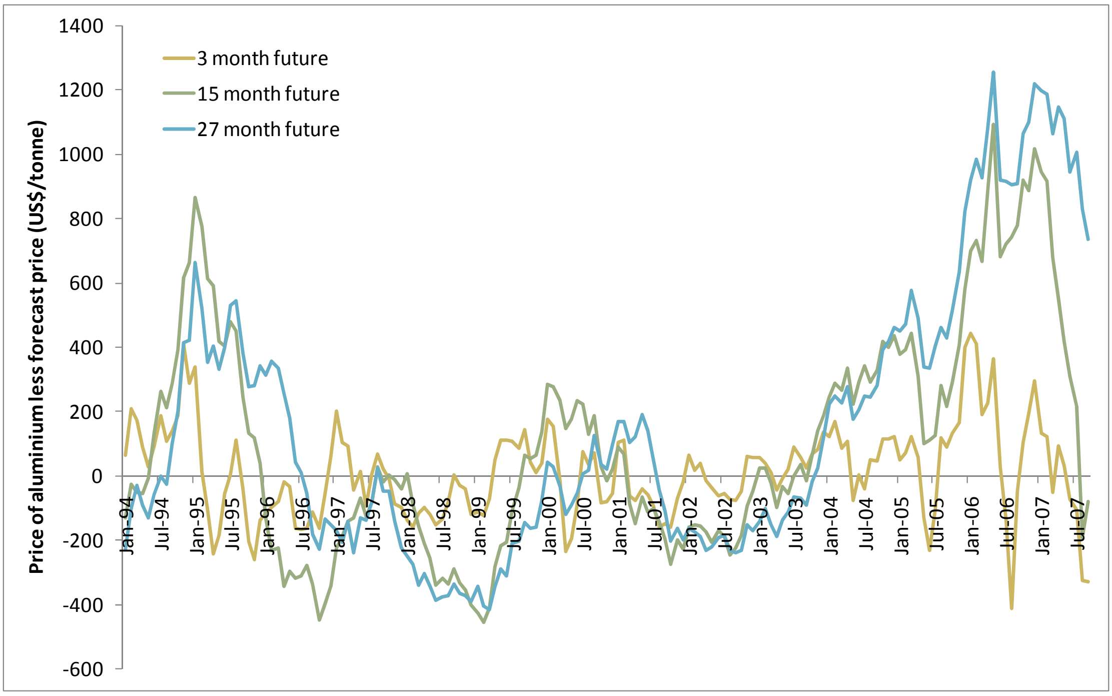
22. Of course, futures prices will be very unlikely to exactly predict future spot prices given that all manner of unexpected events can occur. In fact, futures prices have spectacularly underestimated refined aluminium prices in the last few years (see below graph). However, they nonetheless provide the best estimate of future spot prices. An important reason why futures markets are more reliable than professional forecasters is that in order to participate in a futures market (and help set the price in that market) you must be willing to risk real money.

23. This is a standard proposition in finance theory not just limited to futures markets for base metals and oil. The International Monetary Fund also makes the same point when it states:

> *"While futures prices are not accurate predictors of future spot prices, they nevertheless reflect current beliefs of market participants about forthcoming price developments. Bowman and Husain (2004) find that futures-prices-based models produce more accurate forecasts than the models based on historical data or judgment, especially at long horizons."*[2]

[2] IMF, *World Economic Outlook*, April 2007, p.8

Figure 1: Actual prices less prices predicted by LME futures (nominal, US$/tonne)



24. The graph above shows that, over most of the 1990's, futures prices were a reasonable predictor of aluminium spot prices. However, during the first half of the current decade futures prices have systematically underestimated spot prices (ie, failed to anticipate the increase in spot prices and overestimated the rate at which they would subsequently fall).

2.2. Real versus nominal escalation

25. It is our understanding that the escalation factors that are to be applied to both operating and capital expenditure must escalate the real price of the underlying good or service, not the nominal price. This is because the future costs of Country Energy are expressed in real terms in the AER's regulatory modelling and are re-inflated in the context of that model. However, it is not always possible to obtain forecasts of future price movements that are expressed in real terms.

26. For wage, construction and concrete costs we have relied on professional forecasters' opinions of the future level of price escalation. Where the forecaster is also an acknowledged macro-economic forecaster we have used its forecasts of inflation to derive an associated real forecast from its nominal forecast. Where the forecaster is a sectoral specific forecaster (rather than a macro-economic forecaster) we have used

our own estimate of expected inflation derived on the basis of the Reserve Bank of Australia's (RBA) forecasts. The derivation of this forecast is very simple, aligns with the method utilised in the AER's spreadsheet modelling for the New South Wales and Tasmanian Final Determinations, and is explained in Box 1 below.

27. For example, in the following section we utilise constuction cost forecasts from Econtech. Econtech has acknowledged expertise in macro-economic forecasts and we have derived real construction cost forecasts by deflating their nominal wage forecasts by the forecasts of inflation that it has made on a consistent basis.

28. By contrast, where we have relied on futures markets to derive forecasts of particular prices (eg, for aluminium) we have deflated these by a inflation forecast based on RBA data. This is because futures contracts tend to be written in nominal terms and it is not possible to 'see' the inflation expectations of the parties to that contract.

Box 1: Derivation of forecast CPI index based on RBA forecasts

The RBA issues a Statement on Monetary Policy four times a year. Since February 2007, the RBA has released as part of these statements its forecast of CPI changes over the next two to three years. An example of February 2009 forecast is shown below.

Table 14: Output and Inflation Forecasts[(a)]

Percentage change over year to quarter shown

	Sep 2008	Dec 2008	June 2009	Dec 2009	June 2010	Dec 2010	June 2011
GDP	1.9	1	¼	½	1¼	2½	3¼
Non-farm GDP	1.7	1	0	¼	1¼	2½	3¼
CPI	5.0	3.7	1¾	2½	2¾	2½	2
Underlying inflation	4.7	4.3	3½	3	2¾	2½	2

(a) Actual GDP data to September 2008 and actual inflation data to December 2008. Underlying inflation refers to the average of trimmed mean and weighted median inflation. For the forecast period, technical assumptions include A$ at US$0.65, TWI at 54, cash rate at 3.25 per cent, and WTI crude oil price at US$55 per barrel and Tapis crude oil price at US$57 per barrel.

Sources: ABS; RBA

In combination with the historical Australian Bureau of Statistics (ABS) series for CPI, the RBA forecasts naturally lend themselves to the creation of a forecast index, based on the following steps:

- obtain historical CPI from the ABS, currently available up to and including the March quarter 2009;
- estimate the June and December 2009 forecast index numbers based on the

actual index numbers for June and December 2008 and the change in CPI forecast by the RBA;

- estimate subsequent June and December forecast index numbers based on the forecast index numbers for the previous June and Decembers and the change in CPI forecast by the RBA;
- beyond the horizon of the RBA forecasts, estimate June and December forecast index numbers based on the forecast index numbers for the previous June and December, increased by 2.50%; and
- calculate all forecast March and September quarter indices by interpolating between the relevant June and December quarters.

The use of 2.50% as a long-term forecast of inflation is selected as being the mid-point of the RBA's target range of 2-3%. We note that the entirety of this methodology is consistent with the approach utilised in the AER's spreadsheet modelling for the New South Wales and Tasmanian Final Determinations.

2.3. Forecasting foreign exchange movements

29. An important determinant of future equipment prices is the future value of the Australian dollar. This is clearly true of imported equipment but is also true in relation to the purchase of domestically produced equipment that may nonetheless be sold on a world market and in relation to the input costs for domestic suppliers (eg, the cost of aluminium and steel for Australian producers of gas meters and regulators).

30. In the context of Country Energy's escalation factors, it is normally the case that commodities traded on international markets are priced in terms of United States dollars, and generally futures and forecasts of these commodities are also based in these terms. This means that we must establish a forecast of the value of the Australian dollar, in terms of the United States dollar, over the relevant horizon so that forecasts of commodity prices can be expressed in Australian dollar terms.

31. The fact that there is a recognised link between commodity prices and the value of the Australian dollar is particularly important to this project as it means that cost reductions associated with falling commodity prices can be expected to be at least partially offset by concurrent depreciation in the Australian dollar. This link between the Australian dollar and commodity prices is accepted by both the RBA and in academia. The RBA has recently sought to explain record high Australian dollar values in relation to high levels of commodity prices.

"The continued strength in commodity prices, together with higher interest rates in Australia than abroad, helped underpin the Australian dollar's rise to multi-year highs against the US dollar and on a trade-weighted basis in July, before the currency depreciated somewhat following the disturbances in credit markets. It has also contributed to the larger increase in the Australian stock market than in other major markets, as the share prices of resource companies have been particularly strong."[3]

32. Similarly, the link between the Australian dollar and commodity prices has been confirmed in academic studies such as that by Hatzingkolaou and Polasek (2005) who state that their empirical results:

"…strongly supports the widely held view that the floating Australian dollar is a 'commodity currency'."[4]

33. On this basis it is important to use a forecast for the Australian dollar that is consistent with the forecast for commodity prices used. Certainly, it would be inconsistent to adopt an assumption of dramatic falls in commodity prices without also forecasting a similarly dramatic reduction in the value of the Australian dollar.

34. However, it is notoriously difficult to forecast even short term movements in exchange rates, let alone long-term movements. Futures markets for the Australian dollar are relatively thin beyond a few months and these short dated futures are, in any event, driven by differences in risk-free interest rates across countries.[5] It is not possible to use futures markets to forecast out the value of the Australian dollar in 2015.

35. Although a number of organisations provide forecasts of the Australian dollar over a short horizon, the only long term forecasts of the Australian dollar we are aware of are provided by Econtech in its ANSIO reports. For the purpose of this report we adopt the Econtech forecasts to convert United States dollar forecasts for commodity prices to the Australian dollar price of those commodities.

2.4. Timing of escalation factors

36. Issues of timing are critical to determining escalators that can consistently be applied for this purpose. An escalator provides an estimate for the increase in price for an input from one period to another. For consistency it is important that the escalation factors that are applied to the base planning objects must:

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3 RBA, *Statement on Monetary Policy*, August 2007, p.2

4 Hatzinkolaou, D., and Polasek, *Journal of Applied Economics*, Vol VIII, No. 1, May 2005, pp.81-99.

5 That is, futures reflect the difference in those interest rates such that it is possible for bond holders to 'lock in' the same risk free rate in their home currency by holding foreign bonds. This phenomenon is known as covered interest parity.

i. be derived in a way that is consistent with the base period in which these costs have been measured;

ii. be derived in a way that is consistent with their intended use in forecasting future costs in specific periods; and

iii. avoid overlapping periods or 'gaps' such that escalation is either not properly accounted for or is double counted.

37. It is our understanding that escalation factors are used for two purposes:

- to inflate the base planning objects for capex to the end of each financial year in the next regulatory period; and
- to inflate the base planning objects for opex to the mid-point of each financial year in the next regulatory period.

38. Furthermore, it is our understanding that Country Energy's base planning objects for capital and operating expenditure have been costed as an average over the 2008-09 financial year. Given these considerations, the escalators that take these objects forward must be based in the periods consistent with the costing of the objects that they take forward, as is required by i above.

39. Consistent with the base period for costing and the purpose for escalation, escalation factors that take forward operating expenditure must escalate from average costs over a financial year to average costs over the next financial year – in the sense that inflating opex to the mid-point of a financial year is intended to be representative of the entire financial year. We refer to this type of escalator as a 'financial year' escalation factor.

40. For similar reasons, capex must be taken forward using escalation factors that measure the differences in average costs between calendar years. This is because regulatory modelling typically treats capex as an amount that is added to an asset base at the end of the financial year, and so financial year escalators cannot be used to project these forward. We refer to escalators that project forward objects from average costs over a calendar year into the next calendar year as 'calendar year' escalators.

41. We understand that this methodology and the terminology associated with it has already been accepted by the AER in the context of its Final Determinations for the New South Wales and Tasmanian electricity businesses.

42. Finally, it is important that escalation factors do not either omit or double-count price changes over a particular period of time. Whilst all these criteria may seem trivial, it is our experience that achieving timing consistency is one of the most difficult and contentious issues in the development of escalation factors.

2.5. Quarterly indexation using annual escalators

43. Many of the forecasts that we have regard to in deriving escalation factors, such as those provided by Econtech and Macromonitor, express forecast changes as *change in average prices from one financial year to the next*. These lend themselves naturally to use as financial year escalation factors, as described above.

44. However, sometimes forecasts expressed in this way cannot be so readily used. For example, the methodology used by the AER in its Final Determinations for the New South Wales and Tasmanian electricity businesses assumed that Econtech forecasts for EGW wages would only be applied after the expiry of each firm's enterprise bargaining agreement (EBA). In some cases, this transition was made at the start of the calendar year, which meant that the Econtech forecasts could not straightforwardly be applied to the data in order to project it forward.

45. In the context of these Final Determinations, the AER accepted the views of its consultant, Econtech, that its forecasts could be used to construct a quarterly index that could then be used to estimate forecasts or escalators based on alternative timing assumptions. Econtech proposed a four-part equation,[6] an example of which is:

- Index for September 09 = (2 * Index(07-08) + 7 * Index(08-09) – Index (09-10))/8
- Index for December 09 = (9 * Index(08-09) – Index (09-10))/8
- Index for March 09 = – (Index(07-08) + 9 * Index(08-09))/9
- Index for February 09 = – (Index(07-08) + 7 * Index(08-09) +2 * Index (09-10))/8

46. The main rationale behind the choice of these formulae was that the quarterly index derived by their use was consistent with the annual forecasts from which they were estimated. We note that that this set of formulae is not the only method by which such an index could be constructed, but we regard it as reasonable for its purpose.

47. The AER used these formulae in its Final Determinations in respect of Econtech forecasts for EGW wages, general labour and construction. However, the formulae are not specific to use with Econtech forecasts, and in this report we apply them generally to any forecast expressed in this way. We also employ these formulae, translated by two quarters, to convert forecasts expressed in average calendar year terms into a quarterly index. For example, United States inflation forecasts from the Congressional Budget Office are expressed in these terms.

[6] Econtech, *Updated labour cost growth forecasts*, 25 March 2009, pp.23-4

2.6. Precision and accuracy

48. There is always a high degree of uncertainty associated with predicting the future. Although we consider that we have obtained the best possible estimates of Country Energy's future costs at the present time, the actual magnitude of these costs at the time that they are incurred may well be considerably higher or lower than we have estimated in this report. This is a reflection of the fact that while futures prices and forecasts today may well be a very precise estimate of current expectations of the future, they are at best an imprecise estimate of future values.[7]

49. This lack of precision of forecasts is recognised in our methodology in at least two ways. Firstly, when we estimate future costs at times between estimates obtained from futures prices or forecasts, these are always calculated using linear interpolation, rather than fitting a more complicated functional form. Secondly, all escalation factors recommended are reported to one decimal place only.

50. Although the spreadsheet modelling underling the calculation of these escalation factors may, in some cases, predict quarterly or even monthly values of commodity prices in the future, we do not represent that it is possible to generate precise estimates for these values. Rather, this modelling approach is used because futures prices and forecasts often themselves make predictions for a particular quarter in the future, so we must adopt a similar structure to incorporate these predictions.

51. Finally, we note the distinction between precision and accuracy. Although there is considerable imprecision in predicting the future, this is not a reason to estimate escalation factors that are artificially biased upward or downward, even if this bias is relatively small.

[7] See, for example, Figure 1 above.

3. Forecasts of component cost inputs

52. The following section sets out the specific considerations that have been made regarding the derivation of escalators for Country Energy's expenditure programs. These considerations guide the data sources and methodology that have been selected in each case.

3.1. Aluminium

53. It is important to be clear when we talk about movements in 'the' price of aluminium that we are really talking about movements in the price of aluminium at a particular stage in its production process – namely refined metal to a particular specification. The prices quoted in this section are prices for aluminium traded on the London Metals Exchange that meet the specifications of that exchange. Specifically, prices are per tonne for 25 tonnes of aluminium with a minimum purity of 99.7%.[8]

54. The prices quoted are not necessarily the prices paid for aluminium by equipment manufacturers. For example, producers of meters purchase fabricated aluminium to be used in their manufacturing processes. This fabricated aluminium has gone through further stages of production than the refined aluminium that is traded on the LME. Its price can be expected to be influenced by refined aluminium prices but these prices cannot be expected to move together in a 'one-for-one' relationship.

55. The absence of a one-for-one relationship between the prices of refined aluminium traded on the LME and the price paid by manufacturers for fabricated metals as inputs to their production process does not mean that the use of LME prices to estimate escalation factors is invalid. The correct application of Step 2A, the assignation of component weights to the escalation factors derived from the forecast LME prices, can ensure that these escalation factors are used in a way that is consistent with the underlying objects that they represent.

56. We have obtained LME prices for aluminium averaged over the month of April 2009. The LME's longest dated future for these products is 27 months, allowing us to forecast prices out to and including July 2011 by interpolating between futures prices. However, available futures prices do not extend out to the end of Country Energy's regulatory period (ie, to the year ended June 2015). In this case we have two choices. We can assume that aluminium prices will remain constant in real terms from July 2011 onwards or we can have regard to professional forecasts.

[8] See the London Metals Exchange website for more details of contract specifications.

57. Consensus Economics surveys professional forecasters on a range of economic variables. They regularly perform surveys of forecasters' opinions on future commodity prices, the most recent of which was conducted in April 2009.[9] In relation to aluminium prices there is a wide variety of forecasts. These forecasters provide quarterly forecasts out to September 2011 in nominal United States dollar terms.

58. Consensus Economics also provides a 'long-term' forecast in real United States dollar terms. Unlike with the shorter term forecasts, Consensus does not disclose how many or which institutions contributed to the forecasts nor does it give any information on the range of forecasts. Moreover, it is unclear what the definition of 'long term' is – Consensus Economics only states *"long term 5-10 year forecasts in real (inflation adjusted) 2008 dollar terms"*.[10] For these reasons we must treat these forecasts with some caution.

59. Consistent with the methodology employed previously by the AER, we have assumed that these long-term forecasts apply to a horizon of 7.5 years from the month in which they were made. That is, for forecasts made in April 2009, we assume that the long-term forecasts are for the month of October 2016.

60. Forecasts of the price of aluminium between the end of the LME forecasts in July 2011 and the Consensus Economics forecast in October 2016 can be generated by interpolating between these price points. However, as described above, the escalation factors beyond 2011 must be treated with caution due to their reliance on the Consensus Economics mean forecast.

61. We use the approach described above to produce a monthly series of aluminium prices, which may then be averaged to estimate financial year escalators out to 2015. These escalators are shown in Table 2 below.

Table 2: Escalation factors for aluminium, real

Financial year	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Aluminium	-8.2%	9.4%	8.3%	7.6%	6.6%	5.9%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Aluminium	-14.2%	12.1%	8.6%	8.1%	7.0%	6.2%

9 Consensus Economics, *Energy & Metals Consensus Forecasts: Minerals Monitor*, 27 April 2009.

10 Ibid, p.5

3.2. Steel

62. A component of Country Energy's costs is associated with the purchase of products using steel. For example, valves and some facility component incorporate significant amounts of steel.

63. Again, it is important to draw a distinction between the steel products used by Country Energy and the steel 'at the mill gate'. Just as is the case with aluminium, the steel used by Country Energy has been fabricated and, as such, embodies labour, capital and other inputs (eg, energy).

64. While there is not necessarily a one-for-one relationship, it is still relevant to consider what is expected to happen to 'mill gate' steel prices. The LME has recently developed a futures market for steel billet, with futures trading to a horizon of 15 months. This market is increasing in volume and is gaining some acceptance within the industry as a measure of price. However, we do not consider that these prices are as representative of the overall market for steel as LME prices for aluminium. That is, we consider that this market may not be sufficiently liquid to use LME steel prices in preference to expert forecasts.

65. Consensus Economics also provides forecasts for hot-rolled coil (HRC) for Europe and the United States – Consensus does not publish forecasts for Asian steel prices. These forecasts are in an identical format to those for aluminium, with quarterly short term nominal forecasts and a long term real forecast. It is important to note that HRC is a more processed form of steel than billet, and commands a premium over the prices reported on the LME.

66. We understand that it is likely to be the case that suppliers of equipment to Country Energy may not necessarily purchase HRC as an input to their manufacturing processes, and that steel pipe is more commonly used as a benchmark in this industry. However, there is significantly better price information available for HRC, in the form of the Consensus forecasts, than there is for steel pipe. We regard the use of HRC price forecasts to estimate escalation factors as a reasonable alternative to prices for steel pipe on the basis that, over time, the costs of producing these products are likely to move together. Although there may be short-term variance caused by factors specific to the production of steel pipe, we regard it as reasonable to forecast steel prices on this basis and that this is the best available forecasting methodology in the circumstances.

67. The escalation factors derived on the basis of the short term and long term Consensus forecasts are shown in Table 3 below.

Table 3: Escalation factors for steel, real

Financial year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Steel	-18.3%	7.9%	5.6%	1.4%	0.9%	0.8%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Steel	-21.6%	9.5%	5.9%	3.4%	1.0%	0.9%

3.3. Crude oil

68. In order to derive estimates of historical and forecast changes in crude oil prices we have followed largely the same approach used for aluminium. Historical data on crude oil prices have been sourced from the US Department of Energy (DoE).[11] Crude oil futures (NYMEX Crude Oil Light) have been sourced from the Chicago Mercantile Exchange. We have averaged NYMEX prices over the 20 days to 24 April 2009 for use in the estimation of escalation factors.

69. NYMEX futures are available up to December 2017 and, consequently, these can be relied on to develop forecasts of future prices without the use of forecasts from Consensus Economics or other professional forecasters. We have combined forecasts calculated on the basis of linear interpolation between each average futures price with the historical data sourced from DoE. These calculations give rise to the escalators for crude oil shown in Table 4 below.

Table 4: Escalation factors for crude oil, real

Financial year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Crude oil	1.8%	10.7%	5.0%	1.6%	1.4%	0.7%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Crude oil	-11.8%	22.4%	7.5%	2.9%	1.2%	1.5%

3.4. Polyethylene

70. Polyethylene is an important input into Country Energy's expenditure programs and we understand most gas piping purchased by Country Energy are made using this material.

[11] http://tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_d.htm. Consistent with the approach used by the AER, we have used monthly prices for West Texas Intermediate crude.

71. Internationally, we are unaware of significant futures trading in polyethylene. The LME has established futures prices for thermoplastics, including polyethylene, but these extend only to a horizon of two months, making them unhelpful for the purpose of calculating escalation factors. Whilst we are aware of limited futures trading of polyethylene elsewhere, no market appears to offer the degree of liquidity or long term pricing horizon to be useful.

72. Similarly, we have been unable to locate reliable forecasts of plastics prices from professional forecasters. For example, Consensus Economics does not cover polyethylene in its Minerals Monitor.

73. However, we understand that there is a pricing relationship between crude oil and plastics, to the extent that crude oil is an important component in the manufacture of thermoplastics such as polyethylene. We have obtained a long term monthly pricing history for crude oil and thermoplastic resins from the United States Bureau of Labor Statistics from July 1991 to February 2009[12] and have used this history to obtain econometric estimates of the relationship between these commodities. A discussion of the methodology used is discussed in Appendix A to this report.

74. The relationship estimated in Appendix A has been used to generate an index of future polypropylene prices on the basis of the index of crude oil prices that underlies the crude oil escalation factors discussed at section 3.3. The nature of this relationship, in broad terms, is that approximately 17% of the variation in the price of crude oil is passed over a period of three months to polypropylene. This is unlikely to be an accurate measure at any particular point in time due to other factors, such as specific market conditions, that also affect the price of polyethylene. However, it represents the best representation of the longer term data that we have obtained. In this sense, we regard it as reasonable to forecast average polyethylene prices on this basis, and that this is the best available forecast in the circumstances.

75. Table 5 below shows the escalation factors derived on the basis of this relationship.

Table 5: Escalation factors for polyethylene, real

Financial year	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Polyethylene	0.6%	2.0%	1.1%	0.3%	0.2%	0.2%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Polyethylene	-2.6%	4.5%	1.5%	0.7%	0.2%	0.2%

12 See www.bls.gov. The series we used are 0662 and 056, available from the commodity prices component of the BLS's producer price index.

3.5. Concrete

76. Concrete is used extensively in the installation and maintenance of gas pipelines, primarily through the restoration of road and pavement surfaces following work on pipelines themselves.

77. We have commissioned a forecast for the future prices of concrete from Macromonitor. This forecast has been provided as the year-ending price of concrete, up to and including 2016. Deflating these forecasts using RBA inflation and using linear interpolation between these points, we have created a real index of concrete prices up to June 2016. The escalation factors derived from this forecast are set out in Table 6 below.

Table 6: Escalation factors for concrete, real

Financial year	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Concrete	2.8%	1.0%	2.9%	2.8%	1.8%	0.9%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Concrete	2.5%	0.4%	2.2%	3.1%	2.3%	1.3%

3.6. Construction

78. CEG is aware of a set of forecasts for construction costs in Australia by Econtech, available at the Constructing Forecasting Council website.[13] Our understanding is that these forecasts were last updated in February 2009.

79. Consistent with the practice previously proposed by CEG and accepted by the AER in its Final Determinations for the New South Wales and Tasmanian electricity businesses, we consider that the most relevant forecasts for use in this context are 'total engineering' construction forecasts. That is, because construction forecasts likely contain a significant labour component, it is likely to be double counting to obtain a forecast of construction costs specific to the EGW sector, even if such a forecast were available.

80. Although the Econtech forecasts are in nominal terms, they are packaged together with a set of forecasts for a range of economic indicators, including inflation. We have use this forecast of inflation, rather than a subsequent Econtech forecast of inflation, derive a real forecast of construction costs from the Econtech data. We understand that the Econtech forecasts are expressed in terms of the average price movement

[13] See http://www.cfc.acif.com.au/analysis2.asp.

between financial years, so we have converted these to a quarterly index using the formulae set out at section 2.5 above.

81. This index gives rise to the following financial year and calendar year escalation factors for construction costs.

Table 7: Escalation factors for construction, real

Financial year	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**
Construction	-2.1%	-0.3%	-0.4%	0.3%	-1.1%	-2.1%
Calendar year	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Construction	-0.9%	-1.5%	-0.3%	0.0%	-0.2%	-1.7%

Appendix A. Relationship between crude oil and polyethylene pricing

82. We have obtained an extensive monthly price history of crude oil and polyethylene, as represented in Bureau of Labor Statistics commodity statistics. This dataset extends from July 1991 to February 2009, or 212 observations. These data may be downloaded from the BLS website using produce price index codes 056 (Crude petroleum – domestic production) and 0662 (thermoplastic resins and plastics materials).

83. In order to establish the extent of any historical relationship between movements in the prices of crude oil and polyethylene that can be extended into the future, we investigated a number of hypotheses and selected the regression that provided the best fit based on the BLS data.

84. All of the tests that we undertake assumed a linear relationship between changes in the price of polyethylene (the dependent variable) and changes in the price of crude oil, including lagged changes, as the dependent variable. We did not seek to adopt an alternative functional form and we did not seek to introduce other variables to control for other factors, such as economic growth.

85. Amongst the factors that were investigated were:

- whether or not an intercept term was suggested by the data; and
- whether there was any contemporaneous relationship between changes in crude oil and polyethylene prices and if not, what the lag was in the transmission of changes in the crude oil price to changes in the polyethylene price.

86. *A priori*, we did not expect an intercept to be statistically significant, and this was confirmed by the data in a number of tests.

87. We did not find any significant relationship between contemporaneous changes in the price of crude oil and polyethylene. This is consistent with expectations since, as crude oil is an input to the production of polyethylene, one would expect price changes to follow crude oil, rather than occur simultaneously.

88. Having investigated the statistical significance of including lagged changes to the price of crude oil to explain changes to the price of polyethylene, the results suggest that the best fit is obtained with three months of lagged price changes. That is, using an iterated inclusion of lagged crude oil price changes, the coefficients on the lags are

statistically significant up to (but not including) the fourth lag. The full results of the statistical tests that were conducted are included in the spreadsheet that accompanies this report.

89. The relationship between changes in the price of crude oil and polyethylene that provided the best fit is described by the equation below.

$$\Delta PE_t = \alpha_1(\Delta PE_{t-1}) + \alpha_2(\Delta PE_{t-2}) + \alpha_3(\Delta PE_{t-3}) + u_t$$

where *t* indexes a month from 1 to 208, representing October 1991 to February 2009.

90. An abbreviated summary of the results of estimating this equation are set out in Figure 2 below.

Figure 2: Results of regression between prices changes for polyethylene and crude oil

Regression Statistics	
R Square	0.156
Adjusted R Square	0.143
Standard Error	0.025
Observations	208

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Crude oil lag 1 month	0.052	0.018	2.835	0.005
Crude oil lag 2 month	0.064	0.019	3.441	0.001
Crude oil lag 3 month	0.053	0.019	2.812	0.005

91. The interpretation of these results is that movements in the price of crude oil explains approximately 16% of the variation in the price changes of polyethylene, and that this relationship is significant at lags of 1, 2 and 3 months.[14] We have used the coefficients as estimated in the figure above to estimate changes to the price of polyethylene on the basis of past and future changes to the price of crude oil.

[14] Estimating the same equation with a fourth lag returns a coefficient on the fourth lag with an associated p-value of 0.59 – a statistically insignificant result.