Escalation factors affecting expenditure forecasts

A report for ElectraNet

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Executive Summary

1. CEG has been commissioned by ElectraNet to estimate cost escalation factors in order to assist it in forecasting future operating and capital expenditure based on changes in unit costs. ElectraNet has requested that cost escalation factors be developed for:

   - aluminium;
   - copper;
   - steel;
   - crude oil; and
   - construction.

2. In order to estimate a set of escalation factors to extend forward ElectraNet'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.

3. Issues of consistency in timing are important to the development of escalation factors, because their function is to project forward prices or costs from one period to another. We report escalation factors based on escalation to both:

   - the mid-point of each financial year, using the forecast change in average costs between financial year (which we call 'financial year' escalators); and
   - the end of each financial year, using the change in average costs over each calendar year (which we call 'calendar year' escalators).

4. We understand that the base period applying to the objects to be escalated by ElectraNet is June 2011. We have developed full sets of financial year and calendar year escalators based in this period.

5. 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 regulated energy network businesses.

6. The following two tables reflect cost escalators in real and nominal terms respectively. Within each table there are effectively two sub-tables which report escalation factors

depending on whether one wishes to escalate costs to the middle (i.e. average over) of the financial year or the calendar year.

Table 1: Base period June 2011, real escalators

Financial year	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Aluminium	-11.3%	2.5%	5.3%	3.9%	2.9%	2.5%	2.0%
Copper	-5.9%	1.2%	0.4%	-1.5%	-3.4%	-3.9%	-4.5%
Crude oil	3.9%	7.5%	-2.2%	-3.4%	-2.4%	-1.5%	-1.2%
Steel	-3.8%	-4.1%	3.5%	1.8%	0.3%	-0.1%	-0.6%
Construction	-0.5%	-1.8%	-0.6%	-0.3%	0.1%	0.6%	0.9%
Calendar year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Aluminium	-11.7%	5.1%	5.0%	3.3%	3.0%	2.5%	2.1%
Copper	-5.3%	-0.2%	-0.1%	-3.1%	-3.7%	-4.3%	-4.8%
Crude oil	10.5%	0.1%	-3.5%	-2.8%	-1.7%	-1/2%	-0.9%
Steel	-8.2%	2.8%	2.2%	1.1%	0.2%	-0.2%	-0.6%
Construction	-1.4%	-1.7%	-0.4%	-0.1%	0.4%	0.8%	1.1%

Table 2: Base period June 2011, nominal escalators

Financial year	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Aluminium	-10.7%	5.4%	8.1%	6.6%	5.5%	5.1%	4.6%
Copper	-5.2%	4.1%	3.1%	1.0%	-1.0%	-1.5%	-2.1%
Crude oil	4.7%	10.5%	0.4%	-0.9%	0.1%	1.0%	1.3%
Steel	-3.1%	-1.3%	6.3%	4.5%	2.8%	2.4%	1.9%
Construction	0.4%	1.1%	2.0%	2.3%	2.6%	3.1%	3.4%
Calendar year	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Aluminium	-10.0%	8.6%	7.8%	5.9%	5.5%	5.0%	4.6%
Copper	-3.5%	3.1%	2.6%	-0.7%	-1.3%	-1.9%	-2.5%
Crude oil	12.6%	3.3%	-0.9%	-0.4%	0.7%	1.2%	1.5%
Steel	-6.4%	6.2%	5.0%	3.6%	2.7%	2.3%	1.9%
Construction	0.7%	1.8%	2.5%	2.6%	3.1%	3.5%	3.8%

1. Introduction

7. ElectraNet has engaged CEG to provide advice on the development of annual escalation factors to be applied to forecast operating and capital expenditure based on changes in unit costs.

8. 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 (EGW) sectors over the 2010/11 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. We note that labour escalation factors have been provided separately by BIS Shrapnel.

9. 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.

2. Description of methodology

10. In order to escalate forward ElectraNet'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 ElectraNet; or

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

11. This task would best be achieved by examining forecasts of prices for all inputs purchased by ElectraNet (i.e. category a) above). However, with the exception of labour costs, bespoke forecasts for individual items (e.g. transformers, copper cable, switch gear) are difficult to procure. For example, while there are forecasts for labour costs in the South Australian electricity, gas and water sector, there are few, if any, forecasts of the cost of equipment purchased by ElectraNet.

12. The lack of such forecasts for most goods and services purchased by ElectraNet 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 transformers.

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

    a. futures prices and forecasts for aluminium, copper and crude oil can be used to inform forecasts for the value of these materials as components of ElectraNet's expenditures;

    b. forecasts of the price of steel, construction and labour can be used to project forward the value of these components of ElectraNet's expenditures; and

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

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

[1] These reports are for Electranet, NSW and Tasmanian electricity distribution and transmission businesses, Western Power and Jemena Gas Networks.

15. 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 relevant cost forecasts; and

Step 3 calculate a weighted average escalation factor using weights derived in Step 1 and forecasts from Step 2.

16. In order to complete Step 2 where there are no futures or forecasts available for a particular good or service (e.g. transformers) it may be necessary to derive a forecast for that good or service from other forecasts. The methodology taken in deriving a forecast 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 the equipment in question. 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 (e.g. steel, aluminium and labour);

Step 2B source the relevant input cost forecasts; and

Step 2C calculate a weighted average escalation factor using weights derived in step 2A and forecasts from step 2B.

17. 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

18. In coming to our estimates of ElectraNet'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. This is consistent with AER precedent.

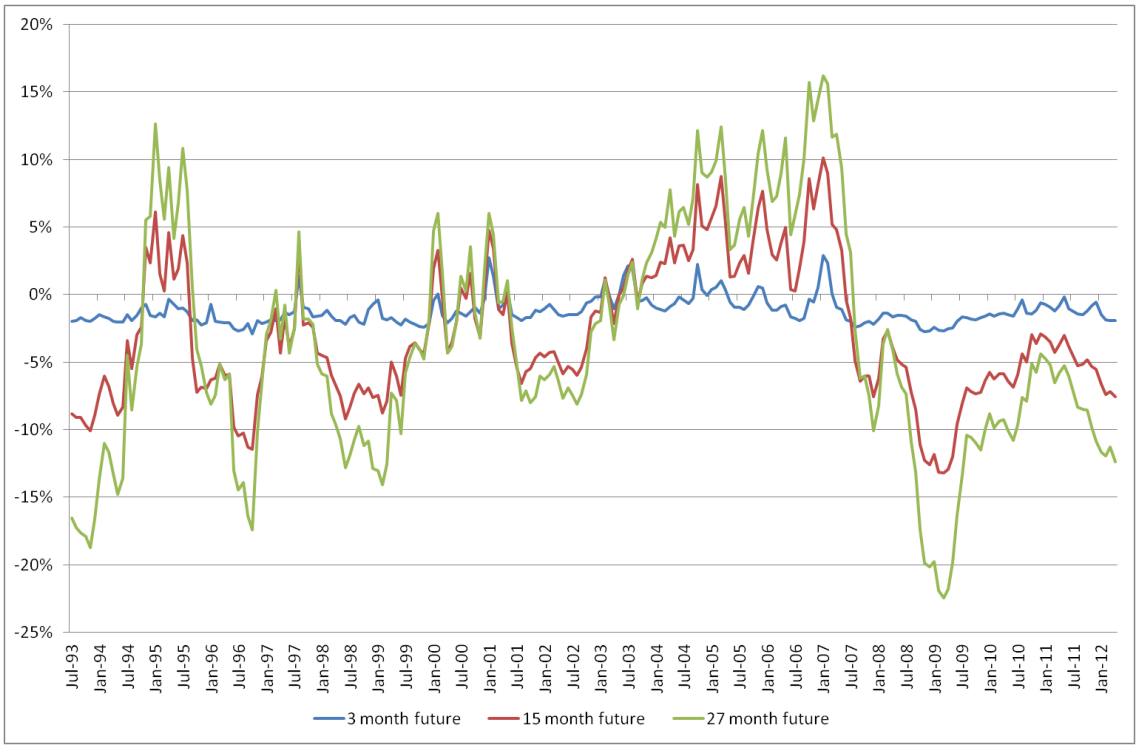
19. In CEG's opinion the most reliable forecast for input prices is provided by prices determined in the futures market – provided that the relevant market is sufficiently liquid. That is, the most reliable predictor of prices on a particular date in the future is the price at which market participants are willing to commit to trading on that day. If there was 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.

20. Of course, as with any forecasts, futures prices will be very unlikely to exactly predict future spot prices for volatile commodities because all manner of unexpected events can occur. For example, futures prices underestimated refined aluminium prices in the last few years (see below graph). However, we consider that they nonetheless provide the best estimate of future spot prices.

21. 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. 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]

Figure 1: Actual prices less prices predicted by LME futures – Aluminium



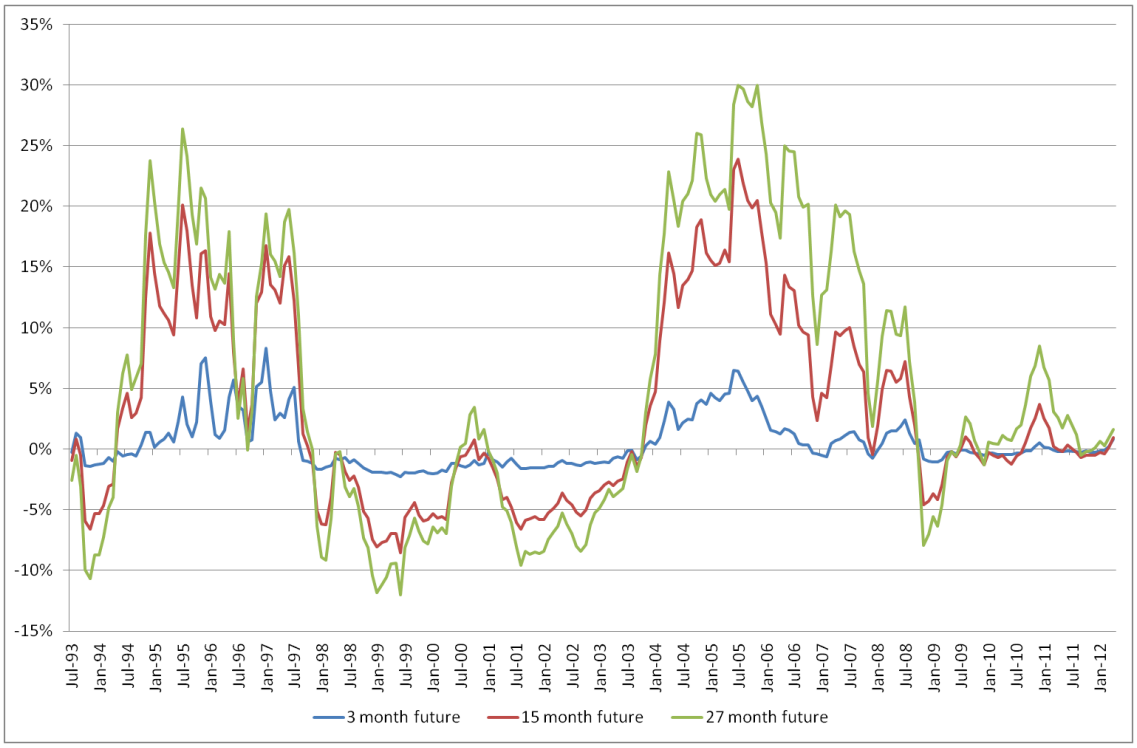
Source: Bloomberg

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

22. As described above, over most of the 1990's, futures prices were a reasonable predictor of aluminium spot prices – sometimes over-estimating and sometimes under-estimating actual future spot prices. However, between 2002 and 2007 15 and 27 month futures prices systematically underestimated spot prices (i.e. failed to anticipate the increase in spot prices and overestimated the rate at which they would subsequently fall). Between 2008 and 2010 the opposite is true and futures prices systematically overestimated spot prices.

23. In the following graph, it is evident that futures prices of copper have at times underestimated spot prices, particularly at 15 and 27 months.

Figure 2: Actual prices less prices predicted by LME futures – Copper



Source: Bloomberg

2.2. Real versus nominal escalation

24. 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 as outlined in the terms of reference, and not the nominal price. However, it is not always possible to obtain forecasts of future price movements that are expressed in real terms.

25. Where we have relied on futures markets to derive forecasts of particular prices (e.g. aluminium) we have deflated these by an inflation forecast based on Reserve Bank of Australia (RBA) data for Australian dollar prices. 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 of that contract.[3] The derivation of this forecast is explained in Box 1 below.

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

The RBA issues a Statement on Monetary Policy four times a year, the most recent in February 2012. 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 the most recent forecasts is shown below.

Table 6.1: Output Growth and Inflation Forecasts[(a)]
Per cent

	Year-ended					
	Dec 2011	June 2012	Dec 2012	June 2013	Dec 2013	June 2014
GDP growth	2¾	3½	3–3½	3–3½	3–4	3–4
CPI inflation	3.1	1¾	3	3¼	2½	2½–3
Underlying inflation	2½	2¼	2¾	2¾	2½	2½–3
CPI inflation (excl carbon price)	3.1	1¾	2½	2½	2½	2½–3
Underlying inflation (excl carbon price)	2½	2¼	2½	2½	2½	2½–3
	Year-average					
	2011	2011/12	2012	2012/13	2013	2013/14
GDP growth	2	3¼	3½	3–3½	3–3½	3–4

(a) Technical assumptions include A$ at US$1.07, TWI at 78, Tapis crude oil price at US$125 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 December quarter 2011;
- estimate the June 2012 and December 2012 forecast index numbers based on the actual index numbers for June 2011 and December 2011 and the change in CPI forecast by the RBA;
- estimate subsequent June and December forecast index numbers based on the

[3] For the purpose of calculating real escalation factors monthly nominal forecasts have been converted to annual real forecasts by way of first converting the nominal forecasts to real forecasts in each month (i.e. the monthly nominal forecast divided by the monthly inflation forecast). Annual real forecasts have then been calculated by averaging 12 months of monthly real forecasts.

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 to 3 percent. We note that the entirety of this methodology is consistent with the approach utilised in the AER's modelling of escalation factors.

2.3. Forecasting foreign exchange movements

26. 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 (e.g. the cost of copper and aluminium for Australian producers of electrical cable).

27. In the context of ElectraNet'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.

28. For the purpose of this report, we have sourced forward rates from Bloomberg until 2022. To ensure accuracy, we have averaged daily historical FX forward forecasts from one to 10 years into the future over the month of March 2012, which is the most recently available data.

2.4. Timing of escalation factors

29. 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 are:

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

ii. 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.

30. It is our understanding that escalation factors are used for the purpose of forecasting operating and capital expenditure based on changes in unit costs, to form part of ElectraNet's Revenue Proposal for the 2013-14 to 2017-18 regulatory period.

31. Furthermore, it is our understanding that ElectraNet's costs that it is escalating are expressed in dollars of June 2011.

32. Consistent with the base period for costing and the purpose of the escalation, escalation factors that take forward operating and capital expenditure must escalate from average costs over a financial year to average costs over the next financial year – in the sense that inflating opex and capex 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 'financial year' escalation factor.

33. This methodology, and the terminology associated with it, has been accepted by the AER in the context of its determinations on energy network businesses, including those for South Australia.

34. 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. Precision and accuracy

35. 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 ElectraNet'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.[4]

36. 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.

[4] See, for example, Figures 1 and 2 above.

37. 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.

38. 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.

39. At Appendix A we provide a review of the forecasts we previously provided Electranet compared to actual outcomes.

3. Forecasts of labour cost inputs

40. Electranet has commissioned forecasts from BIS Shrapnel for the growth of average annual wages in the EGW sector in South Australia.

41. We consider that, following the AER's approach in its Final Determinations for the New South Wales and Tasmanian electricity businesses and also the approach of the Australian Competition Tribunal in Energex,[5] it is reasonable to use actual measures of changes in staff costs where these are available in preference to the much broader measures that are available for the entire EGW sector

3.1. LPI versus AWOTE

42. The AER has expressed a preference for use of the forecasts based on the labour price index (LPI) to escalate labour costs. The AER reasoning for using LPI rests on the assumption that any increase in total labour costs resulting from promoting existing employees or employing more highly skilled workers is automatically offset by reductions in the number of employees needed. This is a form of 'task based' productivity – where a smaller number of more skilled workers are able to perform the same tasks as a larger number of less skilled workers.

43. The AER's reasoning will only be valid if the reason that businesses are promoting/hiring more skilled workers is because they are able to displace workers who are less skilled. In reality, firms may engage in training/hiring a more skilled workforce for reasons other than displacing less skilled workers.

44. For example, technological change in the industry may mean that more skilled workers are required to operate equipment.. The benefits of this need not be reflected in fewer less skilled labour resources being needed but might be reflected in lower expenditure on capital equipment or simply in increases in the quality of output (eg, the safety and reliability of the network).

45. A business may also be pushed by market forces to promote existing staff in order to retain them in a tight labour market. That is, higher wages associated with a promotion need not reflect the promoted employees' ability to displace less skilled staff, but will at least sometimes simply reflect labour market realities about the external employment options those employees have. Similarly, the increased wages paid when hiring employees at a higher job classification need not reflect the fact that the hired wrokers can displace more workers at lower job classifications – it may simply reflect the fact that market forces are pushing firms to recruit at higher job classifications because the number/quality of applicants at lower job classifications is low.

[5] Tribanul decision available at http://www.austlii.edu.au/au/cases/cth/ACompT/2010/11.html

3.2. Productivity adjustment

46. Until its recent final decision for Powerlink the AER has been adjusting forecast wages downwards by an estimate of EGW sector productivity as estimated by its consultants. We consider that the AER was right to abandon this approach in its Powerlink final decision.

47. This is because the measure of productivity developed was an output based measure of productivity (ie, output (such as GWh delivered) delivered divided by total workforce). However, the prices that result from the combined building block and demand modelling process already take into account any such productivity gains that a regulated business will benefit from.

48. For example, any gain or loss of economies of scale are already incorporated into this process. Moreover, this process gives rise to an ElectraNet specific estimate of total output and the labour force and other costs required to deliver it. Adding to that cost an amount that reflected a measure of output based productivity (and not even an ElectraNet specific estimate at that) would involve double counting of costs already compensated for in ElectraNet's proposal.

49. Finally the AER's justification for using the lower LPI forecasts rather than AWOTE forecasts is that the difference between these two is automatically offset by productivity gains. We do not accept that this is true. However, if this justification did hold then clearly this is already captured in the use of LPI in the building block process.

4. Forecasts of material cost inputs

50. The following section sets out the specific considerations that have been made regarding the derivation of material cost escalation for ElectraNet's expenditure programs. These considerations guide the data sources and methodology that have been selected in each case.

4.1. Aluminium and copper

51. It is important to be clear when we talk about movements in 'the' price of aluminium and copper that we are really talking about movements in the price of the metal in question at a particular stage in its production process.

52. For example, in the case of aluminium, we are referring to a refined metal to a particular specification. The prices quoted in the 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 percent.[6]

53. The prices quoted are not necessarily the prices paid for aluminium equipment by manufacturers. For example, producers of electrical cable 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.

54. 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 materials as inputs to their production process does not mean that the use of the 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.

55. Similarly, the prices quoted for copper are prices traded on the London Metals Exchange that meet the specifications of this exchange. Again, although there is not necessarily a one-for-one relationship between these prices and the price paid for copper equipment by manufacturers, this is the correct application of Step 2A, as explained above.

56. We have obtained LME prices for all of aluminium and copper averages over the month of March 2012. The LME's longest dated future for these products is 27 months, allowing us to forecast prices out to and including June 2014 by interpolating

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

between the future prices. However, available futures prices do not extend out any further than that.

57. In this case we have two choices. We can assume that aluminium and copper prices will remain constant in real terms from June 2014 onwards or we can have regard to professional forecasts.

58. 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 2012.[7] Consensus Economics provide quarterly forecasts out to September 2014 in nominal US dollar terms.

59. Consensus Economics also provides a 'long-term' forecast in nominal and real US 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 that they represent:

> *Long term 5-10 year average estimates (2017-2021) in nominal and real (inflation adjusted) 2011 dollar terms*[8]*.*

60. For these reasons, we must treat the Consensus Economics forecasts with some caution.

61. Consistent with the methodology employed previously by the AER[9], 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 2012, we assumed that long-term forecasts are for the month of October 2019.

62. Forecasts of the price of aluminium and copper between the end of the LME forecasts in September 2014 and the Consensus Economics forecast in October 2019 can be generated by interpolating between these price points. However, as described above, the escalation factors beyond April 2014 must be treated with caution due to their reliance on the Consensus Economics mean forecast.

63. We use the approach described above to produce a monthly series of aluminium and copper prices, which may then be averaged to estimate financial year escalators out to 2017/18. These escalators are shown in Table 3: below.

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7 Consensus Economics, *Energy & Metals Consensus Forecasts,* April 2012.

8 Ibid, p. 5

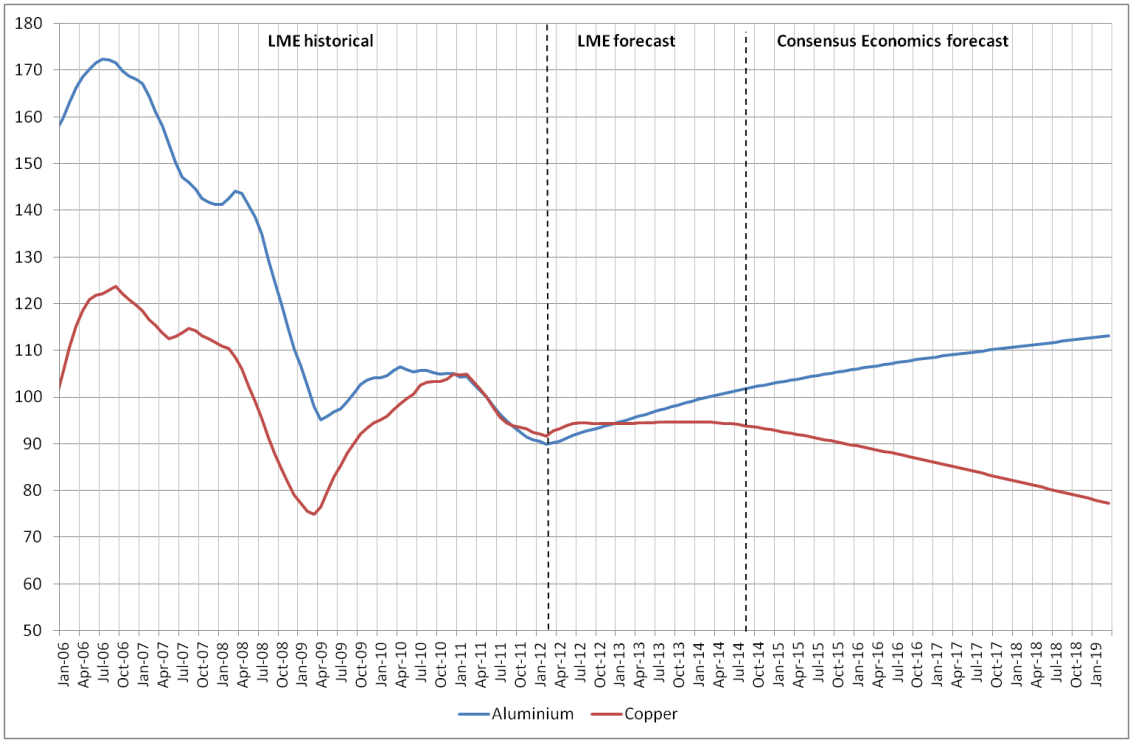
9 See for example AER, *New South Wales distribution determination 2008-09 to 2012-13*, April 2009, Appendix L.

Table 3: Escalation factors for aluminium and copper, real

Financial year	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Aluminium	-11.3%	2.5%	5.3%	3.9%	2.9%	2.5%	2.0%
Copper	-5.9%	1.2%	0.4%	-1.5%	-3.4%	-3.9%	-4.5%

64. Figure 3 below shows the price trend implied by the escalation factors for aluminium and copper respectively.

Figure 3: Price levels for aluminium and copper, real



June 2011 = 100
Source: London Metals Exchange (Bloomberg) & Consensus Economics

4.2. Steel

65. A component of ElectraNet's costs is associated with the purchase of products using steel. For example, construction of transformers and substations.

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

67. 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.

68. Consensus Economics also provides forecasts for hot-rolled coil (HRC) for Asian steel prices[10]. These forecasts are in an identical format to those for aluminium and copper, 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.

69. We have relied on a historical series derived from Bloomberg (MEPS carbon steel products). Although this series is relatively close to the Consensus Economics forecast series, it is not identical. To ensure that this does not affect the escalation factors, we have used a percentage change approach for the forecasts – that is, we have moved the March 2012 price from the MEPS historical series forward in time by the percentage changes implicitly forecasted by Consensus Economics.

70. The escalation factors derived on the basis of short term and long term Consensus Economics forecasts are shown in the table below.

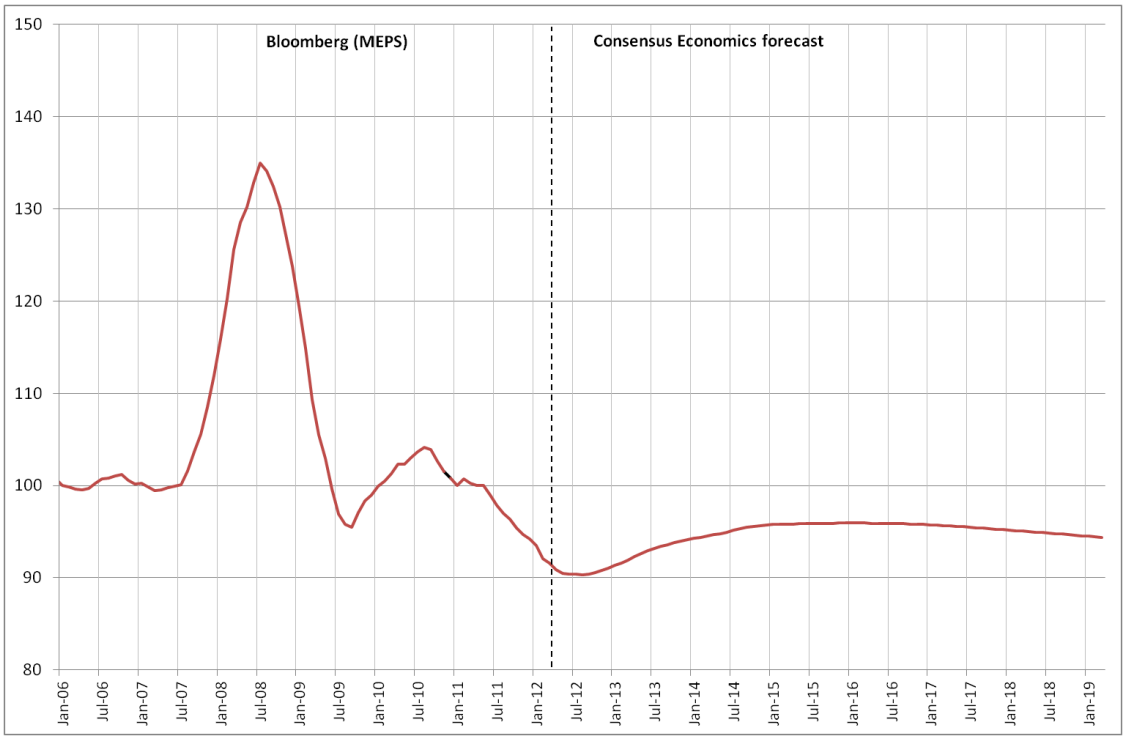
Table 4: Escalation factors for steel, real

Financial year	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Steel	-3.8%	-4.1%	3.5%	1.8%	0.3%	-0.1%	-0.6%

71. Figure 4 below shows the price trend implied by the escalation factors for steel.

[10] Previous analysis conducted by CEG and accepted by the AER has relied on an average of forecasts for Hot Rolled Coil for European and US steel prices. However, Consensus Economics currently also publish forecasts specific to the Asian market, which are more relevant in this context.

Figure 4: Price levels for steel



June 2011 = 100
Source: HRC Asia (Bloomberg) & Consensus Economics

4.3. Crude oil

72. In order to derive estimates of historical and forecast changes in crude oil prices we have followed largely the same approach used for aluminium and copper, but with alternative data sources specific to crude oil. 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 21 March 2012 to 20 April 2012 for use in the estimation of escalation factors.

73. NYMEX futures are available up to December 2020 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 5 below.

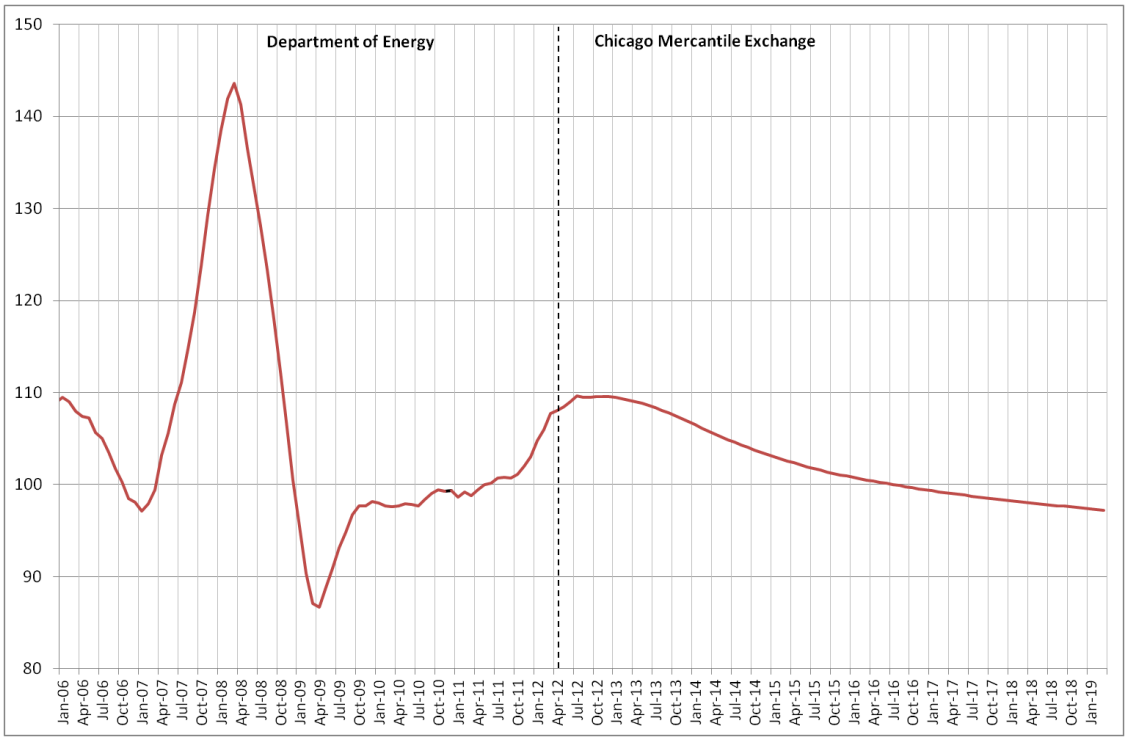
[11] Consistent with the approach used by the AER, we have used monthly prices for West Texas Intermediate crude.

Table 5: Escalation factors for crude oil, real

Financial year	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Crude oil	3.9%	7.5%	-2.2%	-3.4%	-2.4%	-1.5%	-1.2%

74. Figure 5 below shows the price trend implied by the escalation factors for crude oil.

Figure 5: Price levels for crude oil



June 2011 = 100
Source: Department of Energy & Chicago Mercantile Exchange (Bloomberg)

4.4. Construction

75. CEG is aware of a set of forecasts for construction costs in Australia by Econtech, available at the Constructing Forecasting Council website.

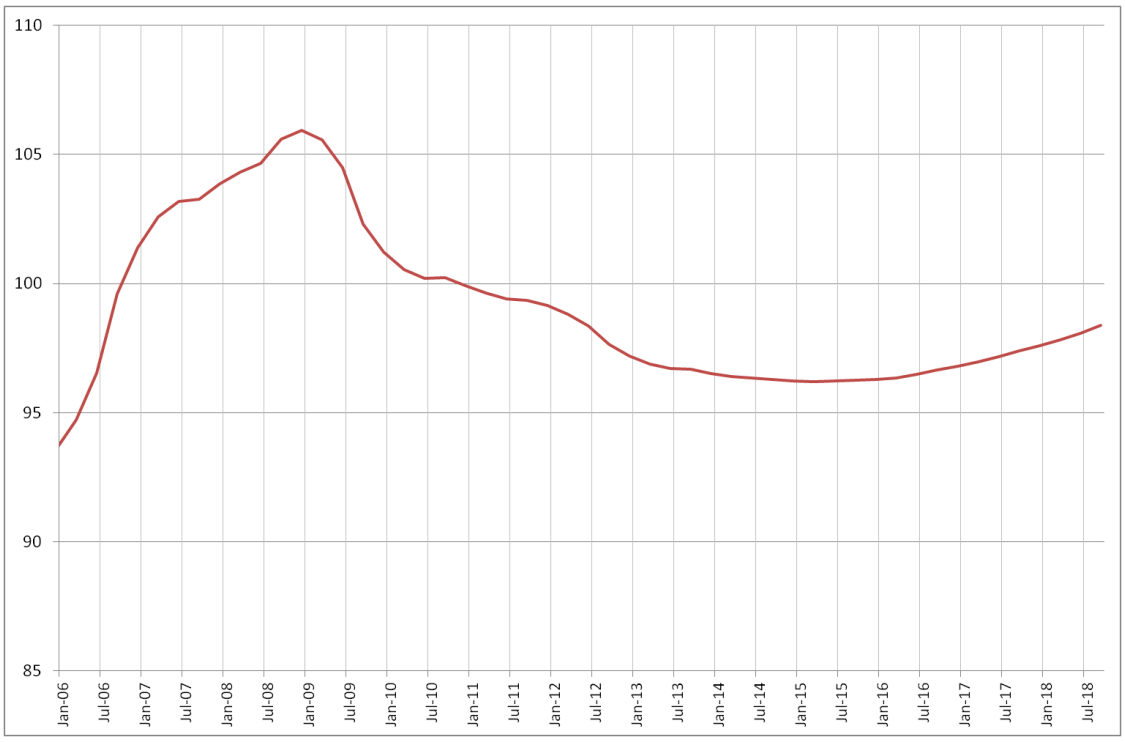
76. Consistent with the practice previously proposed by CEG and accepted by the AER in its Final Determinations for the New South Wales and Tasmanian electricity businesses, we consider that the most relevant forecasts for use in this context are 'total engineering' construction forecasts. That is, because 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. These labour costs have already been adequately measured by the EGW labour cost estimates.

77. The Econtech forecasts are expressed in terms of the average price movement between financial years, so we have converted these to a quarterly index using the formulae set out at section **Error! Reference source not found.** above.

Table 6: Escalation factors for construction, real

Financial year	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Construction	-0.5%	-1.8%	-0.6%	-0.3%	0.1%	0.6%	0.9%

Figure 6: Price levels for construction



June 2011 = 100
Source: Econtech, CFC forecasts

Appendix A. Comparing predicted and actual outcomes

78. The following charts compare the outcomes predicted by way of escalation factors in 2008 with actual outcomes. It should be noted that there were significant reductions in commodity prices in late 2008 and early 2009 associated with the evolving financial crisis. These events were clearly not fully anticipated in the forecasts. However, with the exception of crude oil and aluminium, most commodity prices recovered to be close to (or above) the levels that they were forecast to achieve.

Figure 7: Predicted and actual outcomes, aluminium

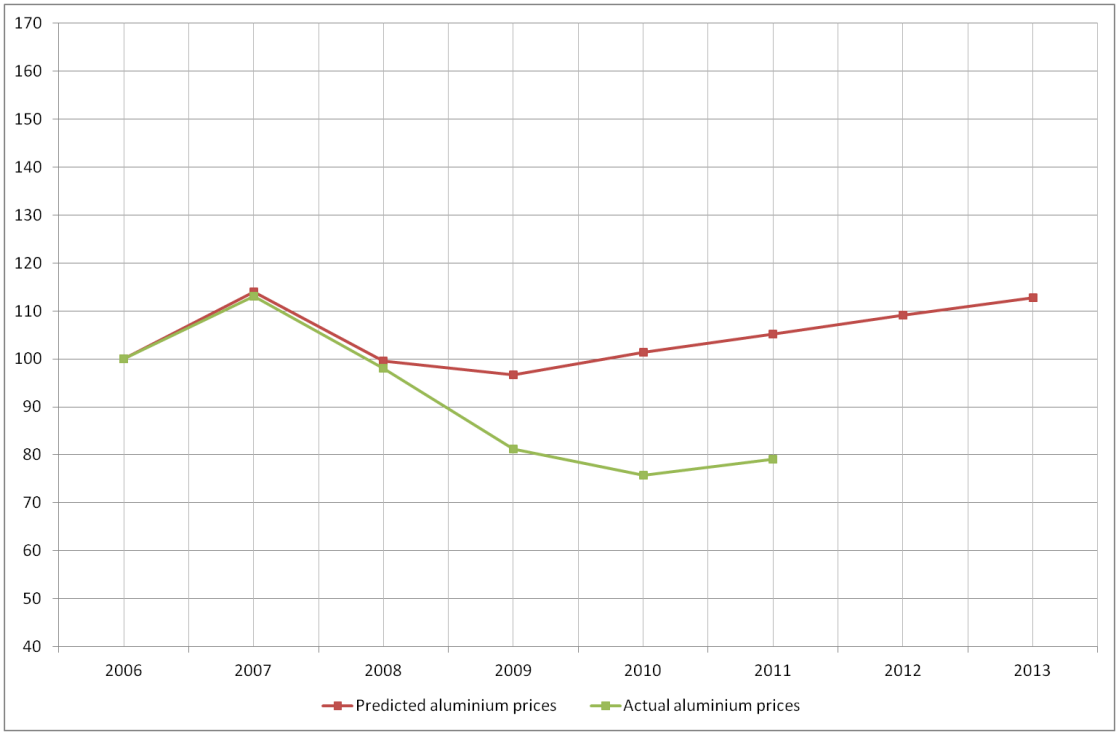


Figure 8: Predicted and actual outcomes, copper

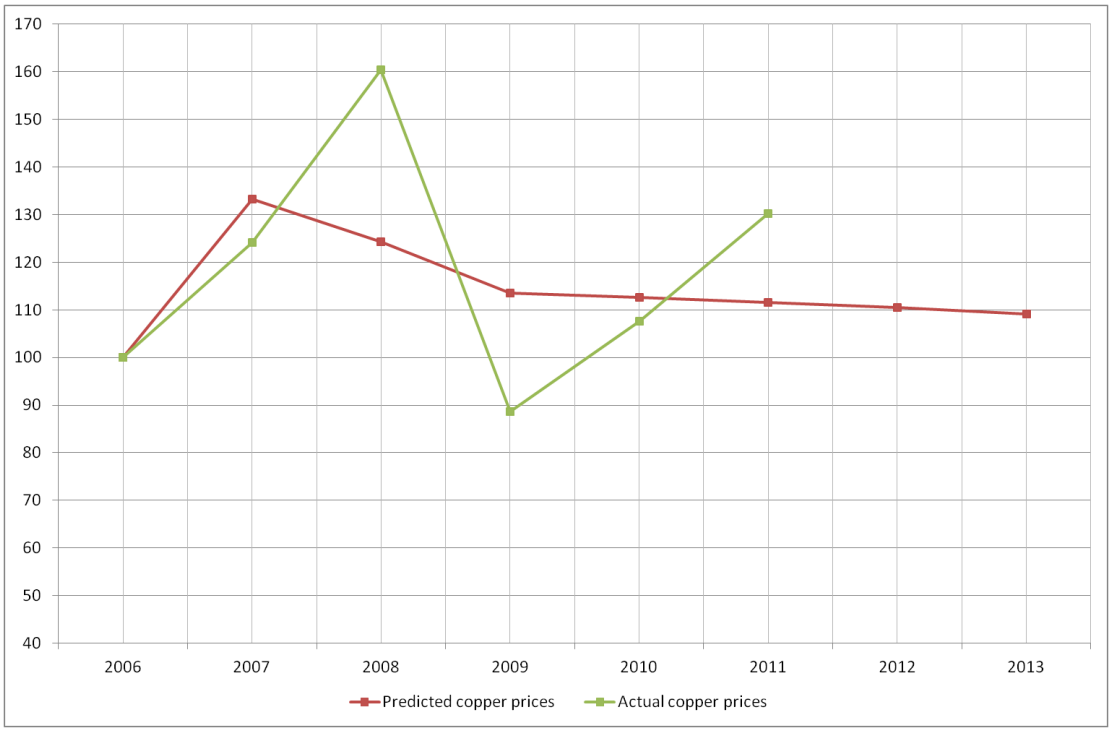


Figure 9: Predicted and actual outcomes, crude oil

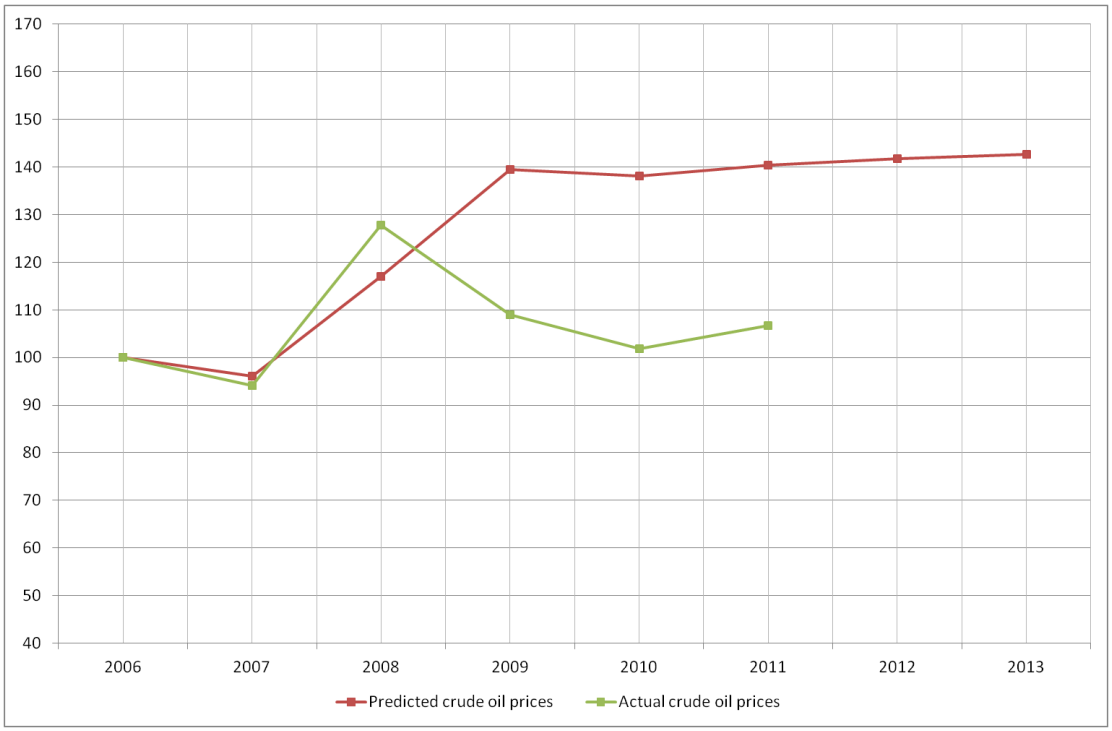


Figure 10: Predicted versus actual outcomes, steel

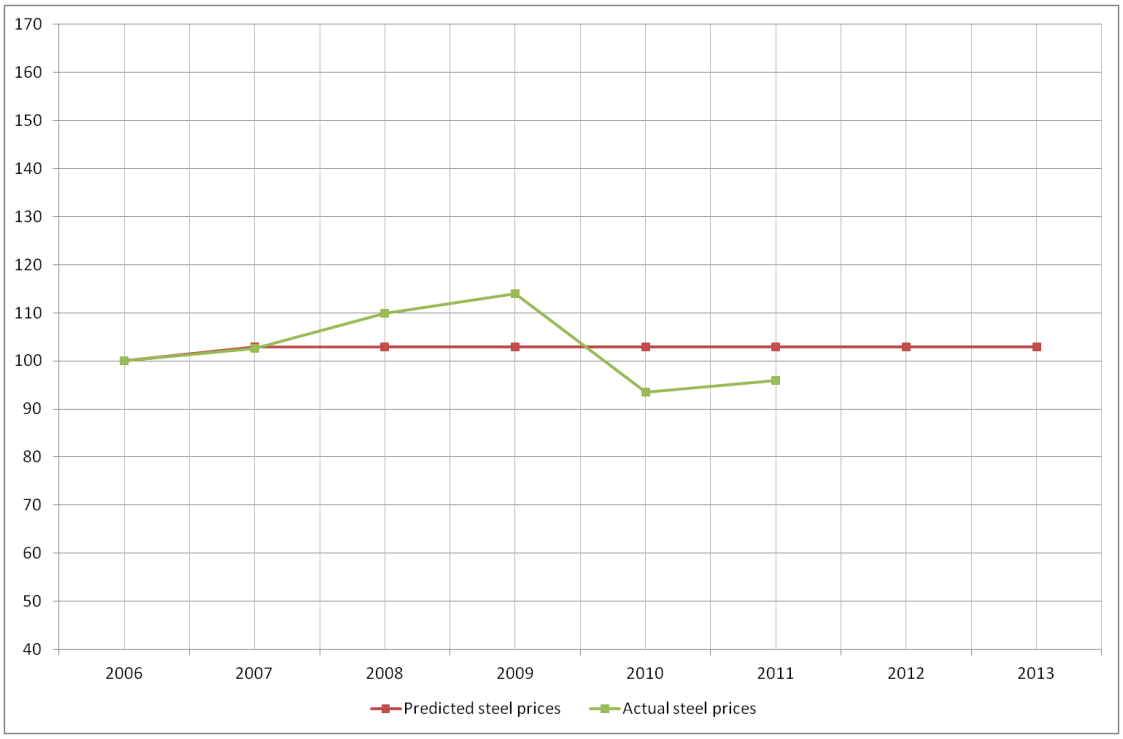


Figure 11: Predicted versus actual outcomes, EGW

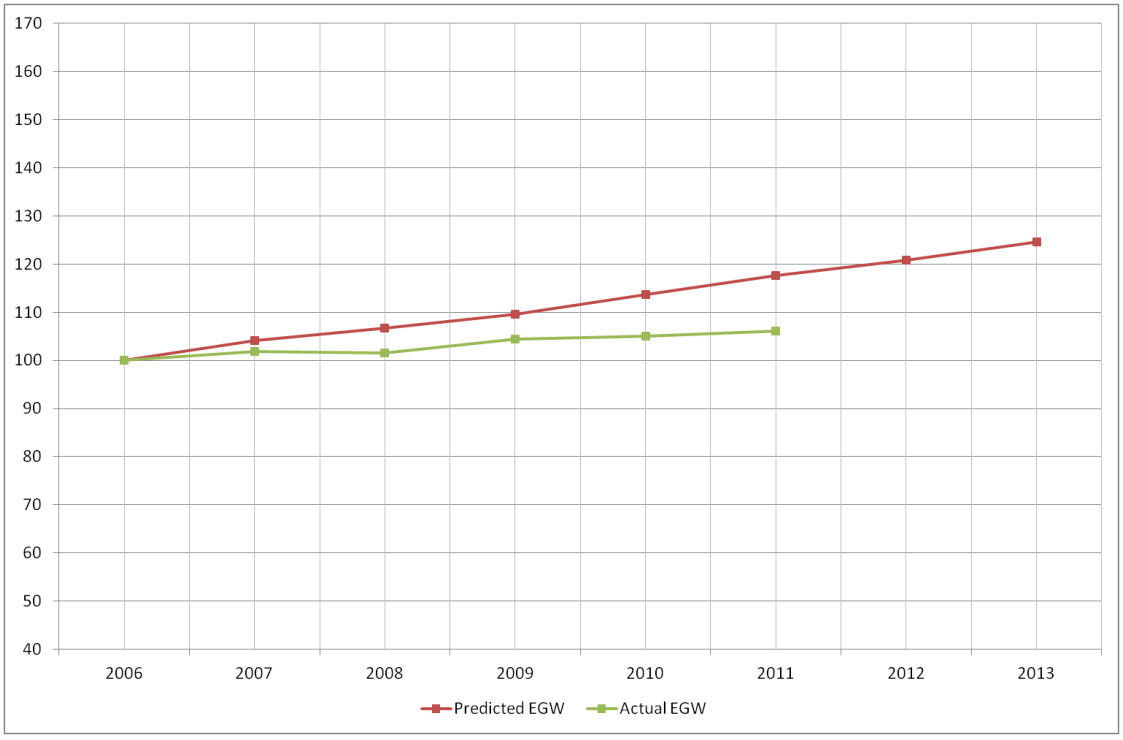


Figure 12: Predicted versus actual outcomes, construction