Appendix E

Escalation and ElectraNet Infrastructure Projects

ElectraNet

Escalation and ElectraNet Infrastructure Projects

May 2007

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1 EXECUTIVE SUMMARY

ElectraNet engaged Evans & Peck to investigate and research escalation trends from past infrastructure projects, as a basis to predict future rates of escalation for plant, equipment and materials as input to the development of ElectraNet's Revenue Proposal to the Australian Energy Regulator (AER) for the 1 July 2008 to 30 June 2013 regulatory period. The objective of this process is to provide logical and demonstrable evidence to establish appropriate rates for escalation to be applied to capital expenditure forecasts, which reflect market conditions.

The Consumer Price Index (CPI) has sometimes been used as the basis for determining escalation. CPI measures the quarterly change in the price of a basket of goods and services which accounts for a high proportion of the expenditure by metropolitan households. However, the broad range of the 'basket' and the high proportion of imported goods within that 'basket' appears to be masking the real growth in the cost of using Australian products and labour. CPI is appropriate for measuring the change in household spending, but not the change in the cost of delivering infrastructure projects.

Drawing on recent Access Economics data:

"the additional money being directed at infrastructure is not actually buying more roads, railways and hospitals, but rather compensating for a significant run-up in engineering construction costs. These have increased by 16% over 3 years, compared with CPI growth of 8%. All up the investment agenda remains healthy, though still heavily slanted towards the resources sector, with the problems with supply of skilled labour in regional areas that results."

Source: Access Economics – Investment Monitor June 2006

Based on this evidence we have investigated alternative and more appropriate Australian Bureau of Statistics' indices which more accurately reflect the cost of delivering infrastructure projects. These include the Producer Price Index – General Construction, and related sub-indices.

Based on the relative movement in various Australian Bureau of Statistics and industry indices over recent years and the various trends that can be drawn from this information, Evans & Peck has developed and modelled the trends to assist in predicting the rates of escalation for ElectraNet projects. The outcome from this exercise has identified a distribution for escalation in each of the years through to the end of the 1 July 2008 to 30 June 2013 regulatory period as shown in Figure 1 overleaf.

Figure 1 shows the expected range of escalation for each year from 2006/07 through to 2012/13 as a percentage increase over and above the previous year. This is shown in the form of an S-curve, where each point on the curve represents the probability that the cost will not exceed a certain value.

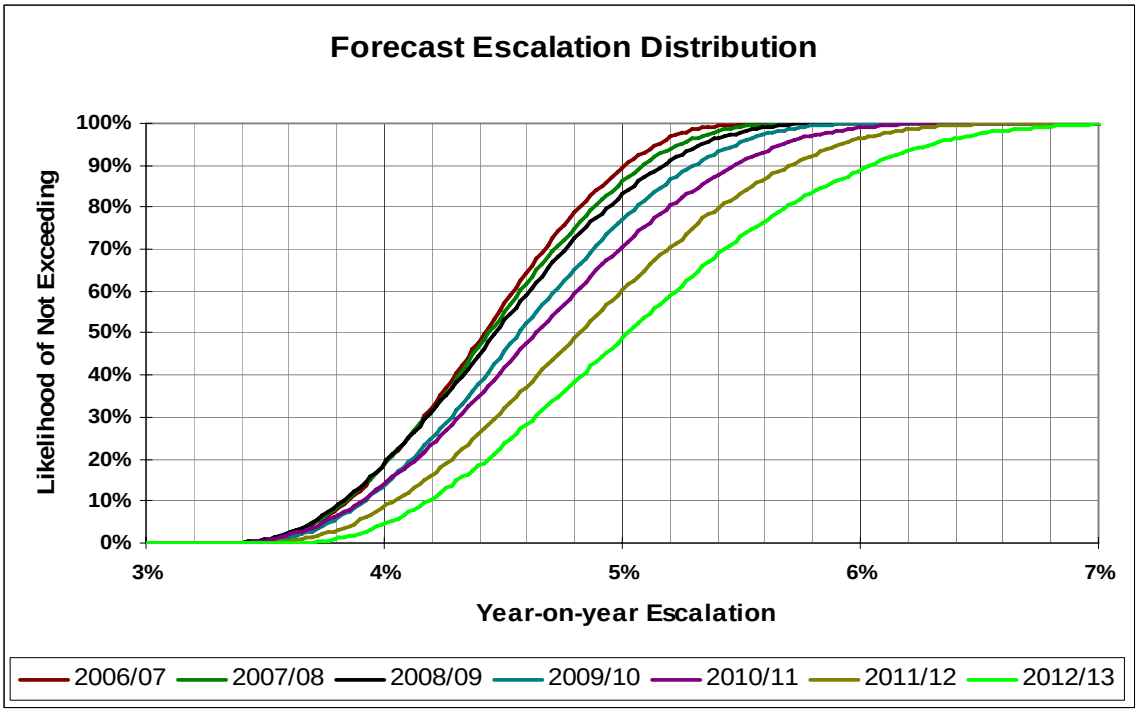

Figure 1 - Modelled Escalation Output

Based on the modelled escalation distributions, the rate of escalation may be summarised as follows:

Year	Forecast Range	P50	P80
2006/2007	3.3% – 5.6%	4.4%	4.8%
2007/2008	3.4% – 5.7%	4.4%	4.9%
2008/2009	3.3% – 6.0%	4.5%	4.9%
2009/2010	3.4% – 6.1%	4.6%	5.1%
2010/2011	3.4% – 6.4%	4.6%	5.2%
2011/2012	3.4% – 6.6%	4.8%	5.4%
2012/2013	3.6% – 7.5%	5.0%	5.7%

Table 1 - Summary of Escalation Output

These values represent the percentage **increase** on the previous year's escalation.

The **Forecast Range** identifies the forecast boundaries that could reasonably be expected based on our understanding of the future environment.

P50 - Represents a 50% chance that escalation will not exceed the value identified; conversely there is a 50% chance that escalation will exceed the value identified.

P80 – Represents an 80% chance that escalation will not exceed the value identified; conversely there is a 20% chance that escalation will exceed the value identified.

2 BRIEF

ElectraNet has requested that Evans & Peck draw on its recent experiences in developing and reviewing construction prices, tenders and estimates to prepare a paper to support ElectraNet's Revenue Proposal to the AER in accordance with the following:

- Consolidate Evans & Peck's recent research into current and forecast rates of escalation in infrastructure projects based on known and predicted market conditions;
- Undertake such additional research as is necessary to provide particular focus on construction costs in the electricity industry;
- Discuss reasons behind construction cost increases in the electricity industry; and
- Provide a projection of the future rates of escalation for projects identified to be undertaken in the 1 July 2008 to 30 June 2013 regulatory period.

3 SOURCE DATA

This paper represents a consolidation of recent information gathered by Evans & Peck, and includes recent experiences in reviewing several large infrastructure projects. Information has been collected from:

- Australian Bureau of Statistics;
- Australian Industry Group;
- Construction Forecasting Council;
- Access Economics;
- Australian Construction Industry Forum;
- BIS Shrapnel; and
- Evans & Peck's internal resources.

4 COMPARISON OF KEY INDICES

A comparison of the key Australian Bureau of Statistics indices over the past nine years reveals a significant variance between the Consumer Price Index (CPI) and the Producer Price Index for the General Construction Industry and the Labour Price Index for Construction. This difference is shown in Table 2 and Figure 2 below.

% Change	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	Total 97/06
Consumer Price Index	0.7	1.0	3.4	5.9	2.9	2.9	2.1	2.1	3.9	24.9
Labour Price Index - Construction	3.1	2.8	3.5	4.2	2.7	3.8	4.4	4.9	5.5	34.9
Producer Price Index – General Construction	1.8	3.5	4.9	-0.6	3.5	5.8	7.9	6.5	4.4	37.7

Table 2 - Comparison of Indices

To demonstrate the variance we have normalised the indices based on CPI (1997/98). The graph below depicts the variance.

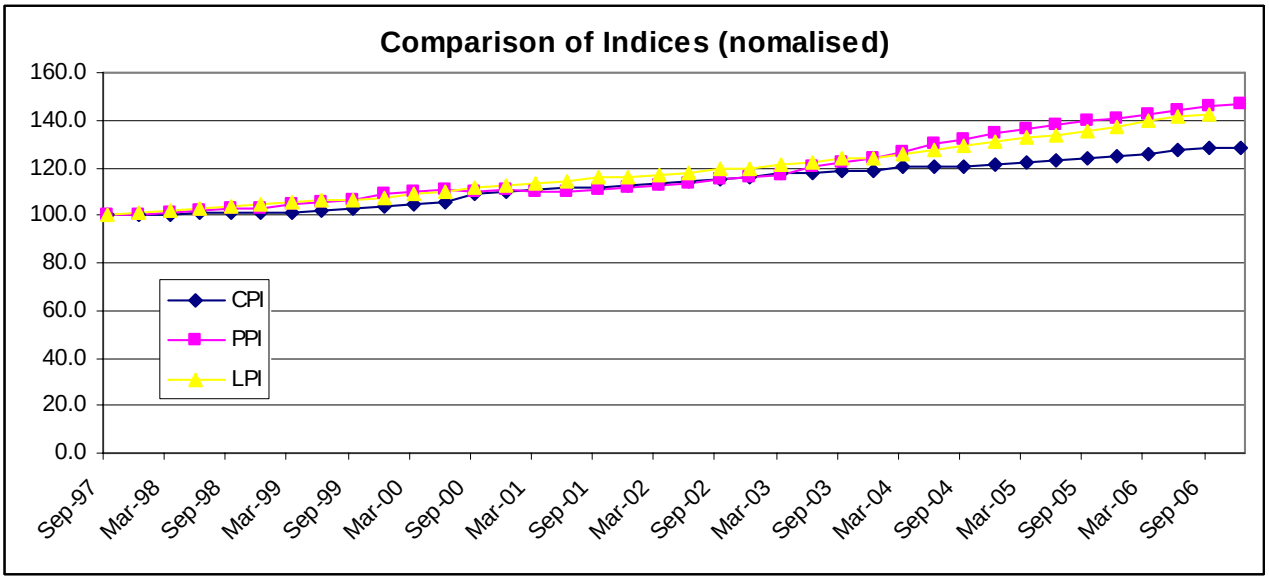

Figure 2 - Comparison of Key Indices

Over the past three years Figure 2 indicates a significant variance between the Consumer Price Index and the Producer Price Index (for the General Construction Industry) and the Labour Price Index (for Electricity, Gas and Water Supply Workers). This variance demonstrates that CPI has not been a historically accurate reflection of the costs of infrastructure projects.

5 REASONS FOR INCREASING CONSTRUCTION COSTS

Through our research and experience Evans & Peck has identified a number of reasons for the increase in the cost of infrastructure projects:

- Volume of Construction Activity:
  - All sectors of the construction industry are currently experiencing a peak in the level of activity;
  - The increasing scarcity of labour resources (including design resources), and the premiums being paid to these resources, is being reflected in contractor pricing;
  - Contractors are being more selective in which projects are pursued;
  - Contractors are viewing public sector projects as unattractive, and are pricing public sector tenders accordingly. This view is due to protracted durations between Registration of Interest and contract award, and the effort and cost required to win these tenders. Contractors are also pricing in an allowance for onerous contractual conditions, which have in the past have led to protracted and costly project settlements;
  - Contractors are viewing privately funded projects with increased favour, as the reduced probity constraints on these projects reduces the time to contract award, and often involves the direct negotiation of price and allocation of risk between the parties;
  - Contractors are also favouring the alternative contractual frameworks such as Alliance Contracting being offered by many private projects, as the Contractor is often able to achieve exceptional results and rewards; and
  - The resources boom is resulting in the price of materials increasing significantly above CPI.
- Scale of Projects
  - The scale of projects has increased significantly over the past fifteen years, with projects valued in excess of $100 million now common. This expansion has required the major construction companies to get bigger with financial support from parent companies with strong balance sheets, requiring additional project rewards to cover the parent company costs;
  - There has also been a consolidation of the larger construction companies or the establishment of joint ventures for particular projects, resulting in an overall decrease in competition within the construction market;
  - Corporate accountability, increased bureaucracy, and a risk-focused culture (at the expense of opportunity identification) have resulted in higher risk premiums being factored into contract prices; and
  - Contractor expectations of the rewards to be realised from these larger scale projects have also increased.
- Other Factors

- The preparation and thoroughness of the initial risk-adjusted project estimate and project funding envelope can prove inadequate when tested in the market place, leading to actual project costs exceeding budget costs;
- The manipulation of the scope to match a budget, or budget to match a scope, which when tested in the market place proves inadequate, leading to higher project development costs;
- Delays between the establishment of the funding envelope and the award of the contract, resulting in increased costs;
- Uncertainty in the project scope and interface with existing operations at time of preparation of the budget, which are redefined during the tender or project delivery resulting in increased costs;
- The assumptions and associated risk which form the basis of the project funding envelope are often not being identified, resulting in higher than expected project delivery costs;
- The requirement to establish a single budget figure for projects, irrespective of the implications of any assumptions or risks contained within the scope of the budget estimate, ignores the opportunity to manage changes in the scope, assumptions, or risk as knowledge of the project increases (particularly for multi-stage budget development), and limits potential cost savings;
- Productivity decreases due to employment of inexperienced resources as a result of the decreased availability of skilled resources; and
- The open book approach of Alliance Contracting has resulted in an increased examination of productivity of the labour force, which has been reflected in the pricing of subsequent infrastructure projects.

6 FUTURE ESCALATION FORECAST

6.1 SUPPLY & DEMAND

Evans & Peck's forecast has considered the following supply and demand factors in relation to future trends in the construction industry:

- Supply
  - Based on the Engineering Construction Activity Index (ABS 8762), the volume of work in hand (all construction sectors) in South Australia as at December 2006 is significant. This is similarly reflected for the Electricity Generation, Transmission and Pipeline sector. A significant value of work yet to be undertaken shows little sign of any decrease in supply of work, and is likely to continue to put pressure on the available resources;
  - BIS Shrapnel forecast 16% growth in 2006 and 7% growth in 2007 (measured in 2005 prices) which is followed by a reduction of 5% in 2008. This forecast includes non-residential buildings and engineering construction. This indicates that the increase in demand experienced in 2004 and 2005 is sustainable for another two years. Evans & Peck's experience with such industry reports over recent years has tended to suggest that similar downturns have been predicted but have not eventuated;
  - The demand is consistent across all Australian sectors including resources, oil and gas, transport infrastructure, other infrastructure and building. This sustained demand across all sectors has not been previously experienced in the Australian market;
  - The global demand economic indicators do not forecast any downturn in activity that will affect the construction sector either globally or in the Asia- Pacific region;
  - Recent commodity price increases are not forecast to suffer any major correction in the foreseeable future. This is likely to underpin the price increases in materials and equipment at least over the next three years; and
  - The labour market shortage of skilled trades is not likely to be corrected in the short term and demand appears to be sustainable.
- Demand
  - The supply of all the base component inputs to the construction industry is already capacity limited and is unlikely to be able to provide the increased volume to satisfy the growth in demand in the short term; and
  - Heavy demand is causing a supply shortage of raw materials, equipment, and skilled labour in the Australian market, which is likely to be sustained for a period in excess of two years.

6.2 LEVEL OF CONSTRUCTION ACTIVITY

The level of construction activity undertaken can be measured with the Engineering Construction Activity report published, by the Australian Bureau of Statistics.

The Australian Bureau of Statistics advises that this report is based on a survey of private and public sector businesses, and aims to measure the value of all engineering construction work undertaken in Australia. The level of construction activity excludes the cost of land and repair and maintenance activity; the value of any transfers of existing assets; the value of installed machinery and equipment not integral to the structure; and the expenses for relocation of utility services. However, contracts for the installation of machinery and equipment which are an integral part of a construction project are included. Where projects include elements of both building and engineering construction (for example, electricity generation, and heavy industrial plant) every effort is taken to exclude the building component from these statistics.

An examination of the Engineering Construction Activity index over recent years, for the construction industry in South Australia, identifies both an increase in the value of work undertaken and an increase in the value of work outstanding:

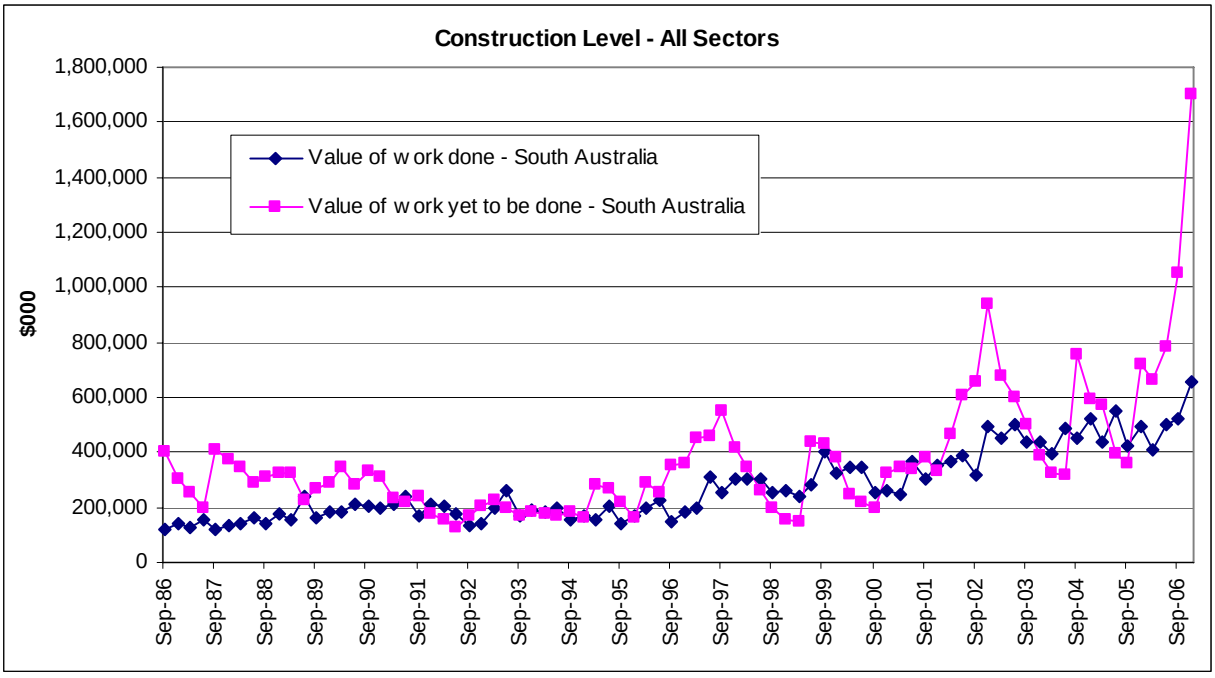

Figure 3 - ABS 8762: Engineering Construction Activity Index – South Australia

The increase in the overall Engineering Construction Activity index is replicated in the Electricity Generation and Transmission Sectors within South Australia. After a slight downturn in the value of work undertaken in the past two years, the overall trend indicates a significant increase in both the value of work predicted to be undertaken and the value of work outstanding, as shown in Figure 4 overleaf.

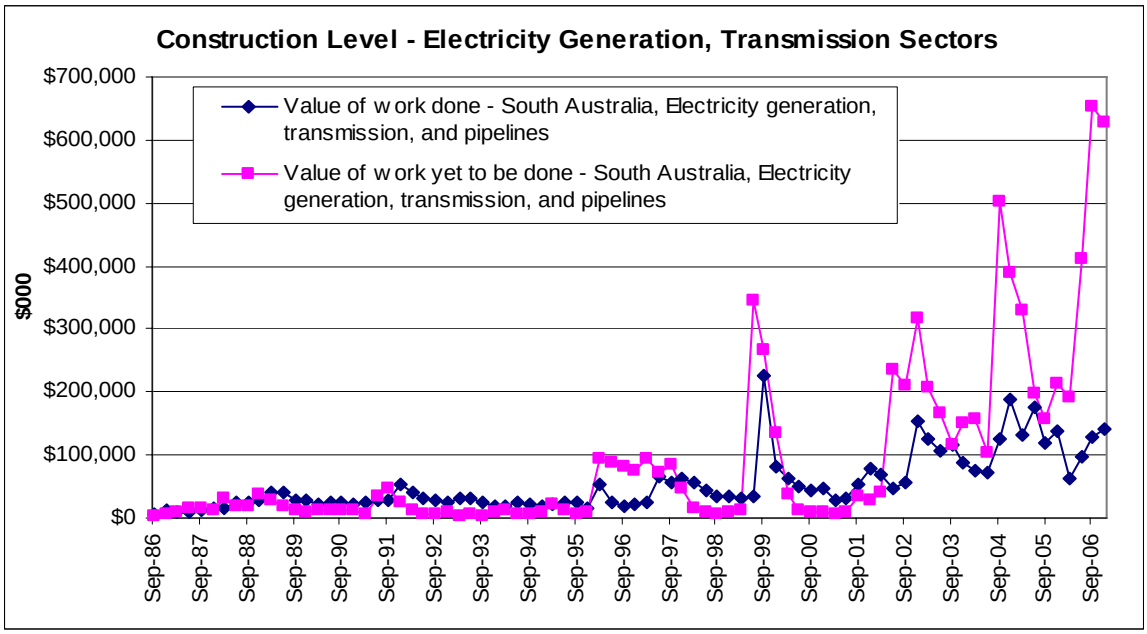

Figure 4 - ABS 8762: Engineering Construction Activity Index - South Australia

Supporting the historical evidence from the Australian Bureau of Statistics, the Construction Forecasting Council is predicting sustained growth in expenditure in the Electricity and Pipeline sector.

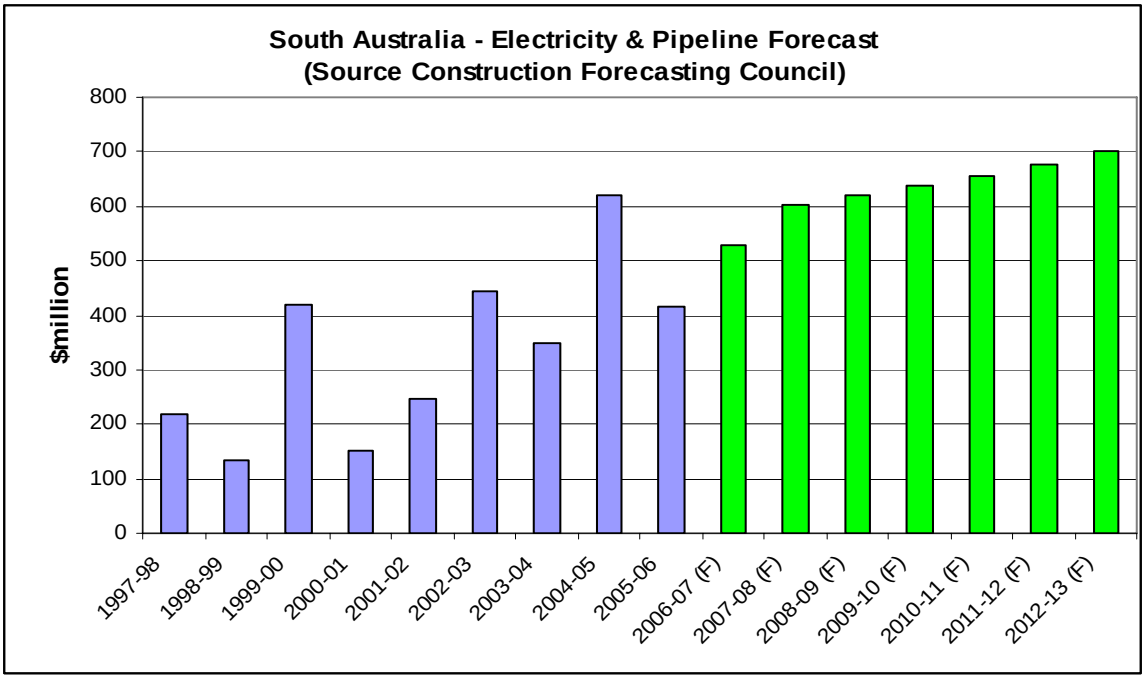

Figure 5 - CFC Long Term Forecast Activity - Electricity & Pipelines - South Australia

Collectively this indicates that there will be sustained supply of work in the electricity and transmission sector with demand for workers outstripping the availability, particularly given the competition from other states and industries for resources.

7 RELEVANT INDICES

7.1 CONSUMER PRICE INDEX

The Consumer Price Index (CPI) measures quarterly changes in the price of a 'basket' of goods and services which account for a high proportion of expenditure by the CPI population group (i.e. metropolitan households). This 'basket' covers a wide range of goods and services, arranged in eleven groups and includes housing and household goods, health, transport and education amongst others, but does not include construction or construction related services.

Due to the broad nature of CPI, and its household consumer focus, CPI is not an appropriate benchmark to link to escalation within the construction industry for the delivery of infrastructure projects. Many of the consumer goods used in making up this index are imported and are masking the real growth in the cost of using Australian products and labour.

7.2 PRODUCER PRICE INDEX

The Producer Price Index (PPI - Australian Bureau of Statistics index 6427) measures the change in the price of outputs (eg. buildings) and the inputs (eg. materials used) of establishments classified within the following sectors:

- Building Construction;
- House Construction;
- Residential Building Construction;
- Non-Residential Building Construction; and
- Road and Bridge Construction.

Road & Bridge construction is the sole contributor to the index for non-building construction and it does not consider railways, communications, electricity infrastructure, etc. As such its relevance, whilst providing a strong indicator of changes in price, should be treated with caution. This index as a measure for electricity infrastructure should be used in conjunction with others, depending on the makeup of materials required to deliver a project and their susceptibility to price movements. We have extracted from the various tables within the Producer Price Index those most relevant to the electricity and the construction industry:

- PPI – Iron and Steel (Table 30);
- PPI – Copper used in the manufacture of Electrical Equipment – Power Transformers (Table 47); and
- PPI – General Construction (Table 16).

7.2.1 Projected Escalation for Iron and Steel

The Iron and Steel index (PPI – Table 30 Iron & Steel) has increased on average by 3.5% over the past nine years. However, Figure 6 below shows that the long term trend is moving in an upwards direction. To establish the predicted range of future movement in the PPI Index for Iron & Steel we have tempered the nine-year average with both the linear trend and the two-year moving average over this period. Our predictions of the likely range of future escalation parameters are shown on the graph as Projected Minimum, Projected Most Likely, and Projected Maximum values.

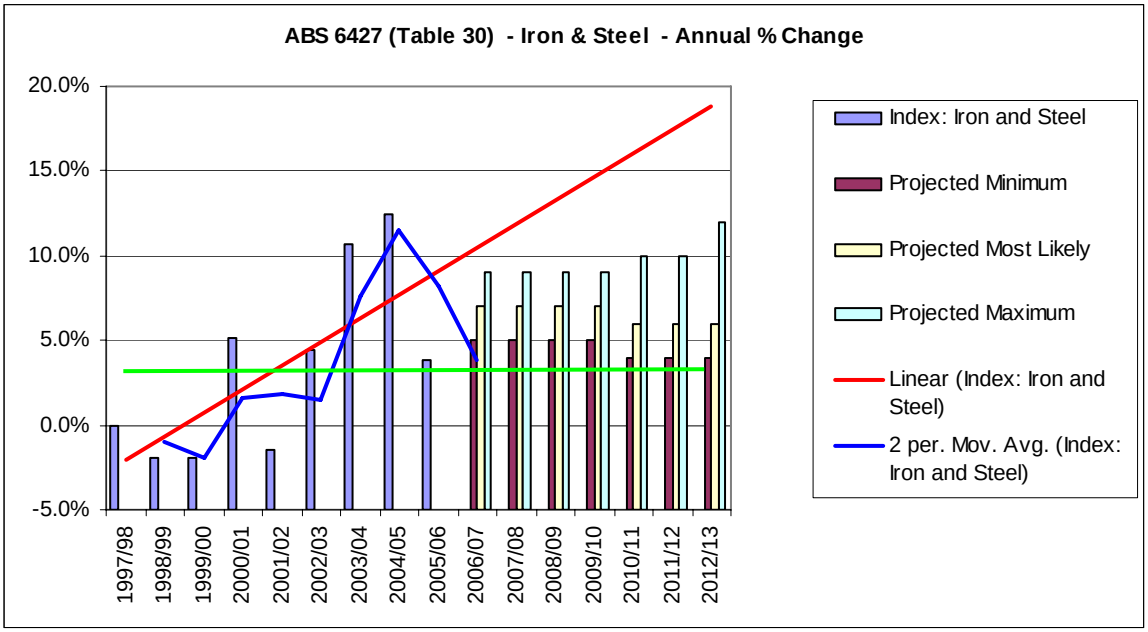

Figure 6 - ABS 6427: Historical and Predicted Movement in PPI – Iron & Steel

It can be seen from Figure 6 that the predicted escalation range (the difference between the minimum and maximum values) increases over time, reflecting the increase in uncertainty as the prediction timeframe increases. Generally the most likely value represents the long term average after accounting for the trend. This forecast for change in PPI (Iron & Steel) is summarised in Table 3:

Projected Increase in Steel Price			
	Minimum	**Most Likely**	**Maximum**
2006/07	5%	7%	9%
2007/08	5%	7%	9%
2008/09	5%	7%	9%
2009/10	5%	7%	9%
2010/11	4%	6%	10%
2011/12	4%	6%	10%
2012/13	4%	6%	12%

Table 3 – Forecast PPI - Iron & Steel Projections

7.2.2 Projected Escalation for Copper (in Power Transformers)

The historical price of copper, as measured by PPI - Table 47 (Copper used in the Manufacture of Electrical Equipment – Power Transformers), has been subject to volatile increases and decreases over the past nine years, as shown in Figure 7 below. These changes have generally been between +/- 15%, however in 2005/6 a spike in the price of copper resulted in an increase of 90%. Over the past 23 years, since the index was first established, the index has increased on average by 6.2% per annum.

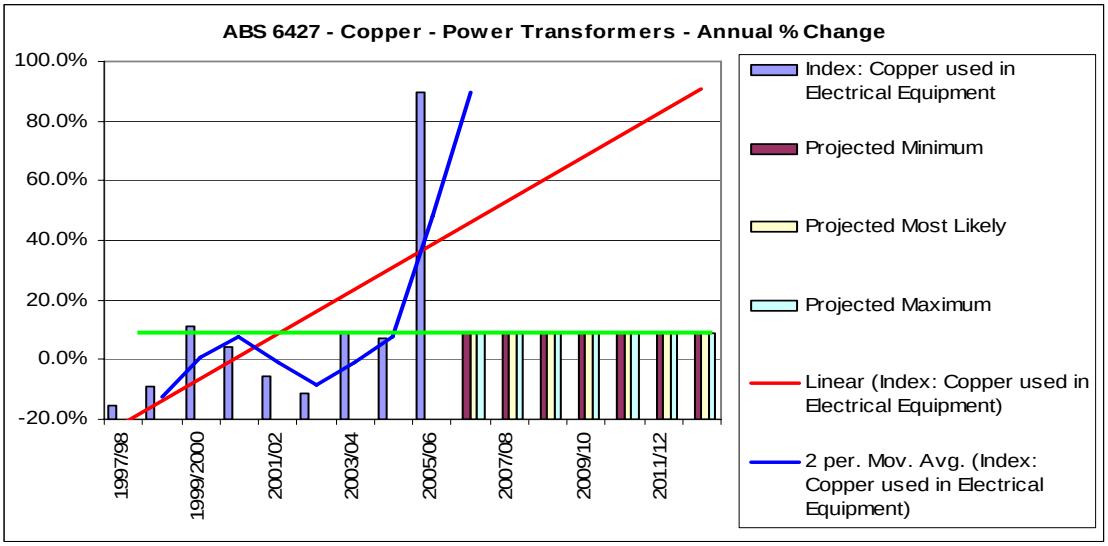

Figure 7 - ABS 6427: Historical and Predicted Movement in PPI – Copper used in Power Transformers

Due to the difficulty in accommodating and forecasting spikes in the index as witnessed in 2005/06 we have assumed the long term average as a reasonable basis for the most likely forecast for the regulatory period. Due to the relatively small contribution copper has to the overall cost this is unlikely to distort the output. The forecast range PPI (Copper used in the manufacture of Electrical Equipment – Power Transformers) is summarised as follows:

Projected Increase in Copper Price			
	Minimum	**Most Likely**	**Maximum**
2006/07	0.0	6.2	6.2
2007/08	0.0	6.2	6.2
2008/09	0.0	6.2	6.2
2009/10	0.0	6.2	6.2
2010/11	0.0	6.2	6.2
2011/12	0.0	6.2	6.2
2012/13	0.0	6.2	6.2

Table 4 – Forecast PPI – Copper: Power Transformer Projections

7.2.3 Projected Escalation for General Construction

PPI (Table 16 General Construction) over the past nine years has increased on average by 4.2%. To establish the predicted range of future movement in the PPI Index for Iron & Steel we have tempered the nine-year average with both the linear trend and the two-year moving average over this period. The historical PPI (General Construction) values and trends are shown in Figure 8 below. This graph shows our predictions of the likely range of future escalation parameters as Projected Minimum, Projected Most Likely, and Projected Maximum values.

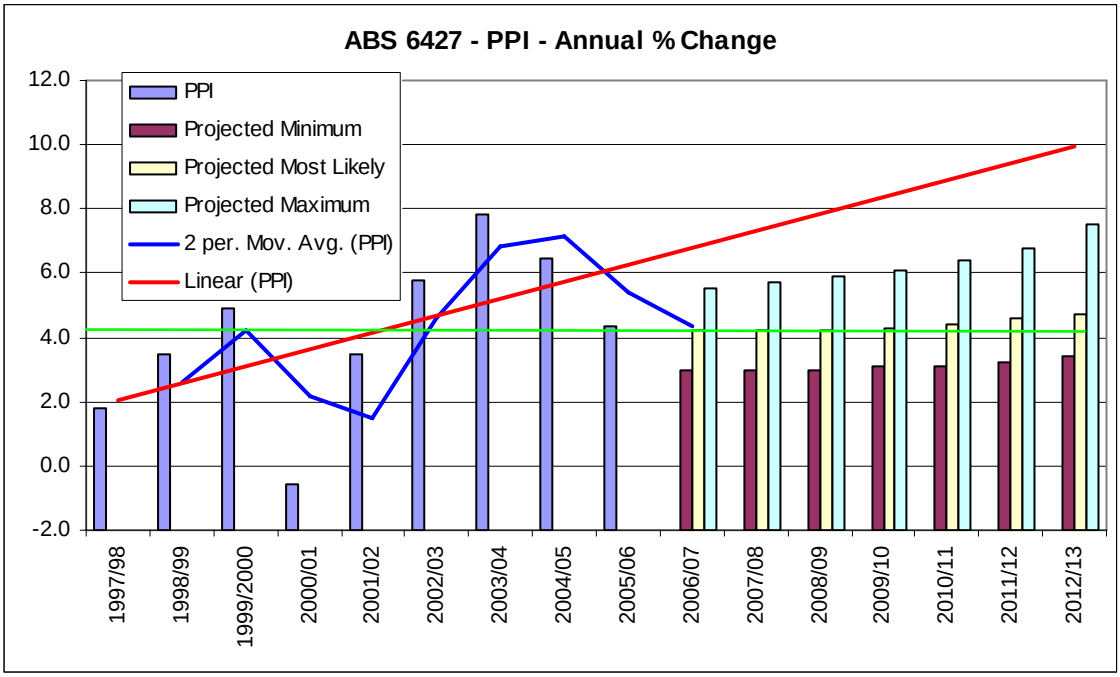

Figure 8 - ABS 6427: Historical and Predicted Movement in PPI – General Construction

This forecast for change in PPI (General Construction) is summarised in the table as follows.

	Minimum	Most Likely	Maximum
2006/07	3	4.2	5.5
2007/08	3	4.2	5.7
2008/09	3	4.2	5.9
2009/10	3.1	4.3	6.1
2010/11	3.1	4.5	6.4
2011/12	3.2	4.6	6.8
2012/13	3.4	4.7	7.5

Table 5 – Forecast PPI – General Construction Projections

This forecast reflects the continued growth and pressure on supply in the construction and electricity markets, and is in line with predictions of sustained growth by the Construction Forecasting Council.

8 ESCALATION MODEL

8.1 INPUTS

In developing a model to predict the future rates of escalation for ElectraNet projects, Evans & Peck has examined the relative contribution of each of the discrete plant, equipment and labour elements that form the basis of the project estimates. Each of these has been examined in terms of their sensitivity to price rises and the impact that this has on the overall price. An appropriate benchmark market index that is representative of the movement in cost was selected for that element of the project.

The breakdown of the various elements making up the plant, equipment and materials elements, as provided by ElectraNet, is provided below. This analysis does not include labour or land escalation, as we understand these are being separately assessed.

Element	**Relative Contribution**
Aluminium	1.2%
Copper	1.7%
Steel	6.9%
Plant & Equipment	42.0%
Other, Buildings, Clearing Access and Environmental, Concrete Poles, Establishment and Foundations	48.3%
Total	**100%**

Table 6 - Base Planning Object (BPO) Elemental Breakdown

Based on our experience the most appropriate and transparent criteria to base escalation on would be as follows:

Index	**Index**
Aluminium	ABS 6427 - Producer Price Index
Copper	ABS 6427 Producer Price Index - Table 47. Copper Materials Used in the Manufacture of Electrical Equipment (Power Transformers)
Steel	ABS 6427 Producer Price Index - Table 30. Iron & Steel Used in the Fabricated Metal Products Industry
Other	ABS 6427 - Producer Price Index
Plant & Equipment	ABS 6427 - Producer Price Index
Other, Buildings, Clearing Access and Environmental, Concrete Poles, Establishment and Foundations	ABS 6427 - Producer Price Index

Table 7 - Index Allocation

Based on the allocation of the discrete elements into the three indices identified in Table 7, the contribution of each index is as follows:

Index	Contribution
ABS 6427 - Producer Price Index - Table 16 – General Construction	68.2%
ABS 6427 Producer Price Index - Table 47. Copper Materials Used in the Manufacture of Electrical Equipment (Power Transformers)	1.7%
ABS 6427 Producer Price Index - Table 30. Iron & Steel Used in the Fabricated Metal Products Industry	6.9%

Table 8 - Contribution of Index to overall Escalated Value

8.2 METHODOLOGY

The model calculates escalation by applying a Monte Carlo simulation to the weighted escalation range of the three PPI indices (as per Table 8 above) to determine the likely range of escalation for each year. The model is developed by:

1. Determining inputs. To provide rigour and transparency in establishing appropriate levels of escalation we have utilised the historical trend information from the previous nine years to predict the minimum, most likely and maximum escalation values for each of the indices for each year through to 2012/13.

2. A Pert distribution is assigned to each distribution for each year, using the forecast range (minimum, maximum and most likely).

3. A Monte Carlo analysis of the Pert distributions is conducted using the @RISK software package to determine the likely range of escalation parameters for each year.

4. The P50 and P80 results for each year are determined from the Monte Carlo analysis, and tabulated for use as escalation results.

5. While industry would typically use the P80 figures for budgeting purposes, it is possible to use the P50 results as more optimistic figures.

9 OUTPUT OF ESCALATION MODEL

Based on the relative movement in various Australian Bureau of Statistics and industry indices over recent years and the various trends that can be drawn from this information, Evans & Peck has developed and modelled the trends to assist in predicting the rates of escalation for ElectraNet projects. The outcome from this exercise has identified an expected range of escalation values as follows:

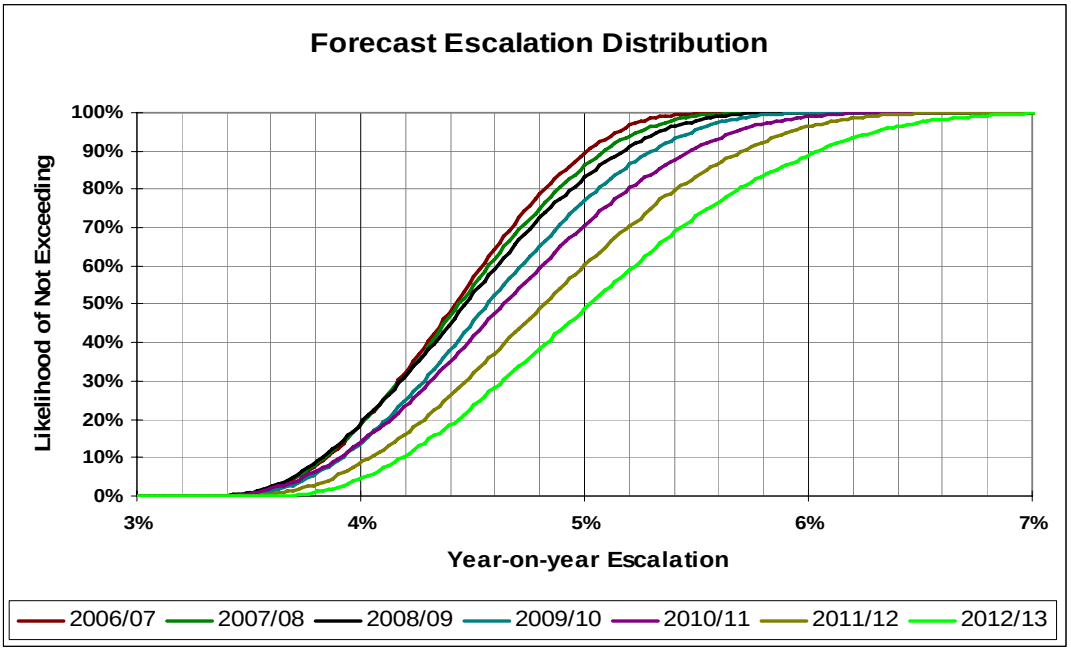

Figure 9 - Output of Escalation Model

Based on this information, the rate of escalation may be summarised as follows for the Regulatory Reset Period:

Year	Forecast Range	P50	P80
2006/2007	3.3% – 5.6%	4.4%	4.8%
2007/2008	3.4% – 5.7%	4.4%	4.9%
2008/2009	3.3% – 6.0%	4.5%	4.9%
2009/2010	3.4% – 6.1%	4.6%	5.1%
2010/2011	3.4% – 6.4%	4.6%	5.2%
2011/2012	3.4% – 6.6%	4.8%	5.4%
2012/2013	3.6% – 7.5%	5.0%	5.7%

Table 9 - Summary of Escalation Output

These values represent the percentage **increase** on the previous year's escalation.

The **Forecast Range** identifies the forecast boundaries that could reasonably be expected based on our understanding of the future environment.

P50 - Represents a 50% chance that escalation will not exceed the value identified; conversely there is a 50% chance that escalation will exceed the value identified.

P80 – Represents an 80% chance that escalation will not exceed the value identified; conversely there is a 20% chance that escalation will exceed the value identified.