EVANS & PECK
think through the future

ElectraNet

Capital Program Estimating Risk Analysis

May 2012

Table of Contents

1 EXECUTIVE SUMMARY

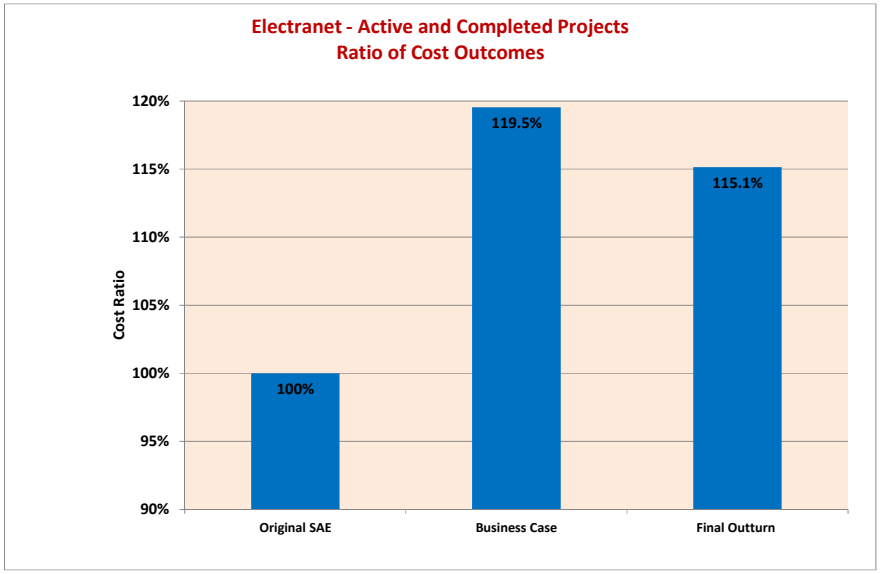
ElectraNet has engaged Evans & Peck to provide an independent estimate of the cost estimation risk factors to apply to the capital project forecast for the forthcoming 2013/14 to 2017/18 regulatory period. This analysis builds on work that has previously been completed by Evans & Peck for ElectraNet and other TNSP's in relation to their current regulatory decisions. In the most recent ElectraNet decision, the AER approved a portfolio cost estimation risk factor of 2.6%.

Evans & Peck understands that the AER places significant emphasis on historical data in justifying cost estimate risk factors. As a consequence, this report has focused analysis on data for network capital projects completed in the current regulatory period. We have sought to undertake a detailed comparison of the observed variation in delivered project costs compared with original cost estimates. To that end, we have examined 59 projects for which ElectraNet has provided the following information:

- Out-turn cost to Escalated Regulatory Allowance
- Business Case (Level 2 Estimate) to Estimated Regulatory Allowance
- Out-turn cost to Business Case (Level 2 Estimate)

The projects analysed by Evans & Peck are a mixture of Completed and Active Projects. ElectraNet chose to include Active projects that it believes have progressed to a level where a more reliable bottom-up cost to complete can be determined to both increase the sample size, and represent projects that come later in the regulatory period. The time elapsed between regulatory submission and project delivery can be up to 7 years. E&P has examined cost changes in two steps – the first is the change in cost between the time the AER determination is made, and the Business Case is prepared within ElectraNet. The second is the change in cost between Business Case and Completion. Figure 1.1 shows that overall, the projects analysed have a cost overrun of 15.1%.

Figure 1.1 – Ratio of Cost Outcomes – 59 Active or Complete Projects



The average cost variance from regulatory determination to business case presentation is 19.5%, whilst overall, projects have been observed to come in 3.7% below the detailed Level 2 estimate associated with the Business Case.

It is generally accepted that even with the application of best practice estimating techniques, there is an expectation that across a large portfolio of projects, individual outcomes will vary from the initial cost estimate. Some projects will cost more, some will cost less. It is commonly observed that in infrastructure projects there is a greater chance that the overall outcome will be skewed to over expenditure, rather than under expenditure[1]. In a commercial environment, project bidders normally protect their commercial interests by forecasting projects to the so called "P70" – "P80" level. Project contingency is often set based on the "P90" estimates. In its previous determinations, the AER has generally established an expectation that TNSP's will forecast projects at the "P50" value. This has been presented as a reasonable balance of risks between TNSP's and their customers.

The establishment of an estimating risk allowance on a portfolio of projects recognises the asymmetric nature of project outcomes. It is inappropriate to simply add up the contingency assigned to each project. Instead, an allowance is made across the entire portfolio recognising a diversity of outcomes. This allowance is controlled at a corporate, rather than project level as this provides a more efficient outcome.

This report provides an analysis of the cost data provided by ElectraNet for the 59 Active / completed Projects. Based on this data, Evans & Peck has concluded that a portfolio wide Cost Estimation Risk Factor of approximately 4.9% is appropriate to ElectraNet and represents a reasonable reflection of expected costs.

[1] See for example the study by *B. Flyvberg, M. S. Holm, and S. Buhl, "Underestimating Costs in Public Works Projects: Error or Lie?" Journal of the American Planning Association, 68/3 (Summer 2002): 279-295*. In relation to infrastructure projects across 20 countries they found "*Costs are underestimated in almost 9 out of 10 projects. For a randomly selected project, the likelihood of actual costs being larger than estimated costs is 86%. The likelihood of actual costs being lower than or equal to estimated costs is 14%".*

2 INTRODUCTION

ElectraNet has engaged Evans & Peck to provide an estimate of the appropriate risk factors to apply to the capital program associated with the forthcoming 2013/14 to 2017/18 regulatory period. The intent of the cost estimate risk factor is to recognise the asymmetric nature of risk associated with delivering capital projects. The risk factor recognises that even though estimates are made to determine the most likely cost of a project, there is a greater probability that the cost will increase than it will decrease.

In ElectraNet's 2008/09 to 2012/13 regulatory proposal the AER concluded that:

> *…recognising the reasonableness of providing a cost estimation risk factor for risks outside ElectraNet's control, the AER allowed a 2.6 per cent risk factor. This was based on a more general approach undertaken by EP for Powerlink during its revenue reset and accepted by the AER.[2]"*

Given Evans & Peck's experience in establishing cost estimation risk factors, and outcomes from previous AER decisions on this matter, the analysis performed on this occasion has focussed on the out-turn cost performance to date of ElectraNet's projects during the 2008/09 to 2012/13 regulatory period.

The most recent AER decision relating to a TNSP is the "*Powerlink Transmission determination 2012-13 to 2016-17*" handed down on 30 April 2012. In this decision, the AER determined to:

> *"…accept Powerlink's three per cent cost estimation risk factor because the AER is satisfied that Powerlink has demonstrated asymmetric risk which is not accounted for elsewhere"[3].*

3 OUT-TURN TO REGULATORY ALLOWANCE COST PERFORMANCE – CURRENT REGULATORY PERIOD

Due to the comparatively long period between project inception and financial close out, and the lead time associated with the regulatory process, Evans & Peck has observed that TNSP's usually have a limited number of projects that:

- Have a "self-contained" estimate in the current regulatory period
- Have been completed and financially "closed out"

In order to obtain a statistically "rich" set of data on which to base analysis, ElectraNet has provided data on:

- 27 projects that have been "closed" (i.e. completed)
- 32 projects that are currently "active", but which are sufficiently advanced to enable, in ElectraNet's view, a reasonable estimate to be made of the completion cost.

[2] AER Final Decision Appendix A P51
[3] Powerlink 2012-2017 final decision P137

This provides a data set of 59[4] projects in total. Of these:

- 38 are Substations projects
- 15 are "Telecommunications" projects
- 3 are "Lines" projects
- 3 are "Easements" projects.

Projects ranged in size from a regulatory allowance of $100,000 to $149 million. Evans & Peck has accepted the data provided by ElectraNet in good faith, and has not independently checked the data back to source values.

ElectraNet has provided the original project cost estimate that formed the basis of the regulatory capital expenditure allowance on two bases, with the project set representing around 75% of the total capex allowance for the period:

- The capital expenditure allowance in $2007/08 real (with a project set total of $586.1m)
- The capital expenditure allowance escalated by CPI to reflect the projects commissioning year (with a project set total $648.6 m).

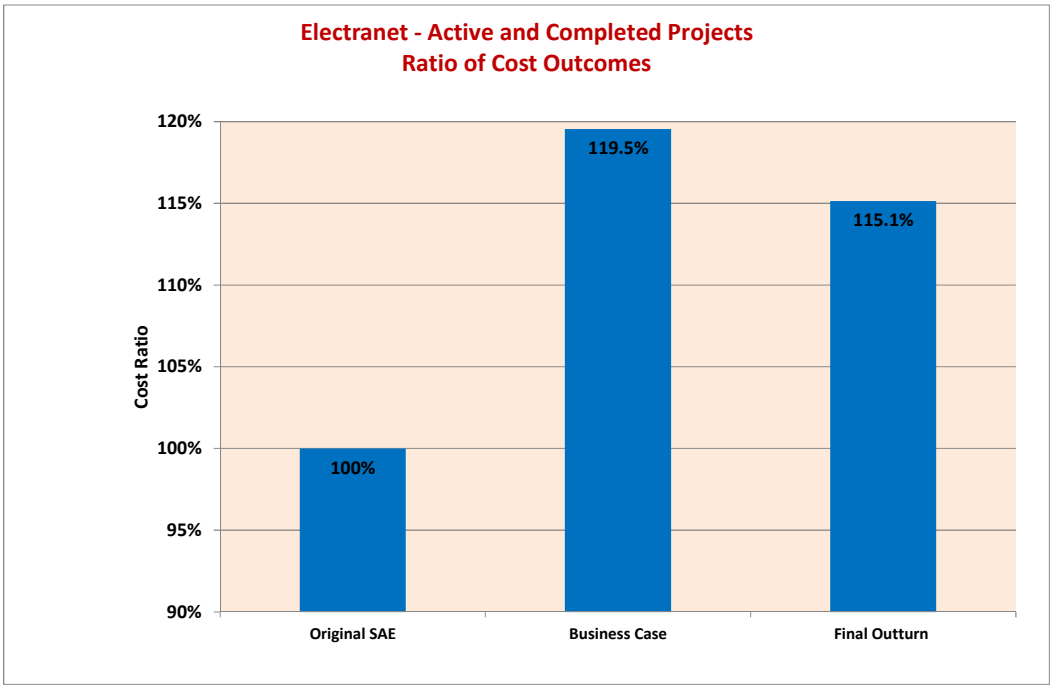
The latter value has been used as the basis of comparison in this analysis. Data has also been provided on an intermediate step between the establishment of the regulatory allowance and project completion. This is known as the "Business Case Value" which is based on more detailed (bottom-up) "Level 2" estimates than the concept "Level A" estimates associated with many of the regulatory case values. Given the timeframes of the regulatory process, project estimates can be up to 7 years in advance of expenditure, with a mean period of around 4 – 4.5 years. Such time frames are considered long by most commercial standards. In our view, it is also reasonable to conclude that the risks associated with this time lag would be higher for projects at the later years of the regulatory period than for those in the early years. The increased risk associated with these projects supports the view that inclusion of active projects where a reasonable assessment of the cost to complete can be made in the data analysis is reasonable.

Figure 3.1 demonstrates a range of cost ratios for this set of projects. These ratios are:

- Out-turn to Escalated Regulatory Allowance
- Business Case (Level 2 Estimate) to Estimated Regulatory Allowance
- Out-turn to Business Case (Level 2 Estimate)

[4] A total of 4 projects were removed from the sample set following initial identification as unrepresentative by Evan & Peck and subsequent discussion with ElectraNet regarding certainty of ability to compare on a like for like basis against regulatory allowance. These projects included "Strategic Land Acquisition", "IEC61850 Technology Development", and "Waterloo Transformer Replacement". The other reduction resulted from the combination of two parts of a project into one.

Figure 3.1 – Ratio of Cost Outcomes – 59 Active / Complete Projects



Across this portfolio of projects, which ElectraNet believes to be representative of its overall portfolio, the cost overrun is 15.1%. The increase between the regulatory allowance and the Level 2 estimate used in determining the "Business Case Allowance" is 19.5%. Project delivery however has been coming in at 3.7% below the Business Case Value, consistent with projects not all using the contingency allowance usually included (as part of normal commercial practice) when obtaining internal authority for expenditure.

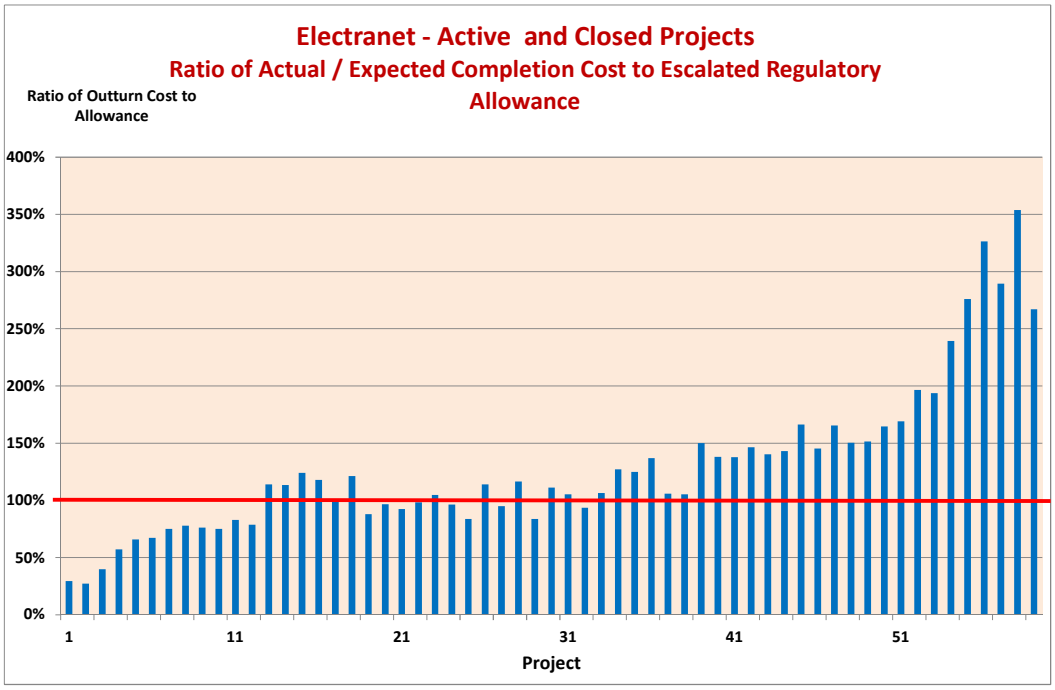
ElectraNet's 2008/09 to 2012/13 regulatory budgets were based on an adaption of Powerlink Queensland's "Base Planning Object" estimation process. ElectraNet has advised Evans & Peck that it is of the view that there were deficiencies in both the way this system was applied, and in the applicability of some of the BPO rates to the South Australian situation. A revised estimating process using US Cost's Success Enterprise application has been established for the 2013/14 to 2017/18 regulatory period. This in itself presents some risk to ElectraNet.

Evans & Peck's charter in relation to this analysis does not include a review of the replacement estimating system. Our charter is to determine if there is an asymmetric risk that the out-turn costs, when considered on a portfolio basis, will differ from the sum of project costs when estimated on a "most likely" (i.e. exclusive of contingency) cost basis. Our approach to assessing the "asymmetry" is outlined in the following section.

4 RISK IMPLICIT IN HISTORICAL DATA

Portfolio risk is based on the assumption that there will be a diversity of risk between projects. Some projects will exceed their budget by a considerable amount, while others will come in under budget. Figure 4.1 demonstrates the range of outcomes that ElectraNet has achieved on the 59 projects summarised in Section 3.

Figure 4.1 – Project Actual Cost to Escalated Regulatory Cost



Out-turn to Regulatory Allowance ratios range from 27% to over 200%. Consistent with our approach in Section 3, we have broken this into the Business Case (Level 2 Estimate) to Regulatory Allowance Ratio (Figure 4.2) and the out-turn to Business Case (Level 2 Estimate) Ratio (Figure 4.3).

Figure 4.2 – Project Business Case Cost to Escalated Regulatory Cost

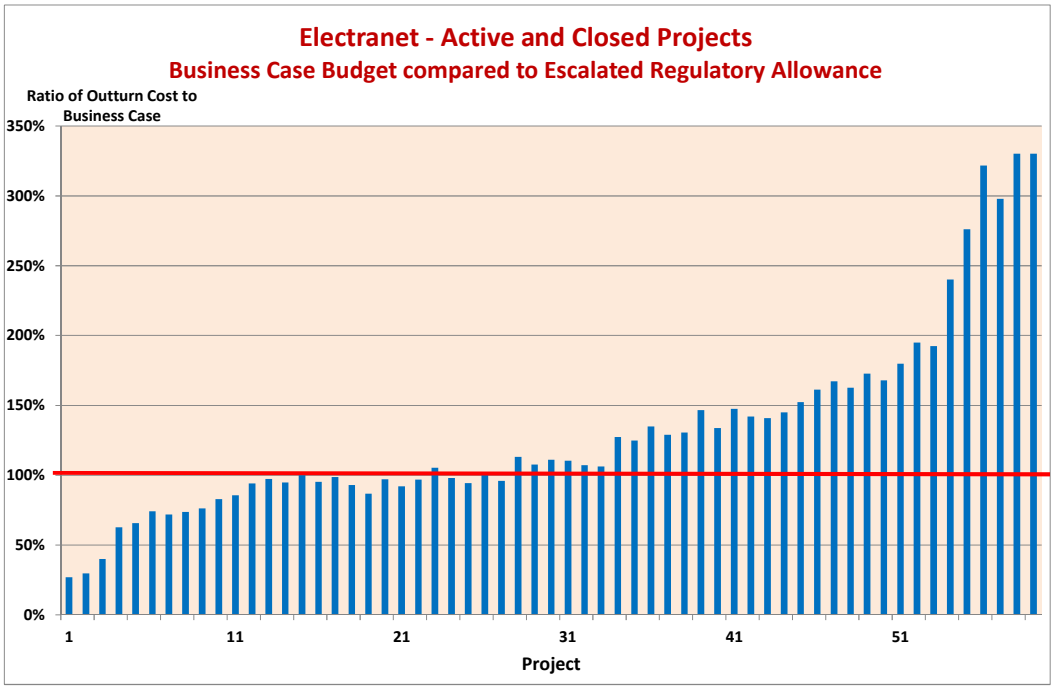
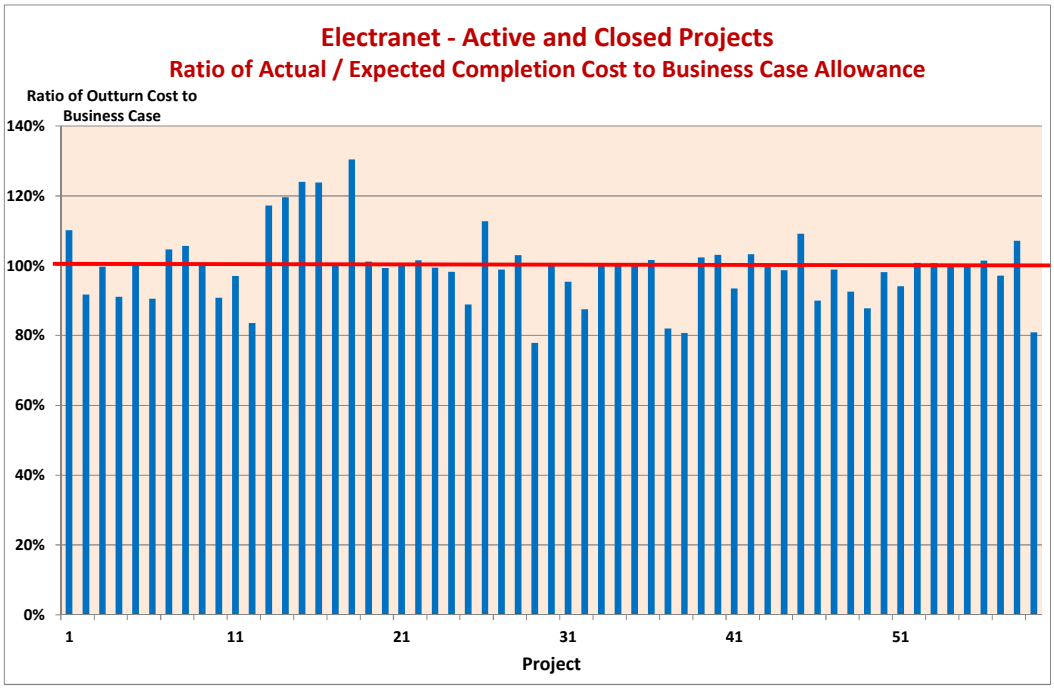


Figure 4.3 – Project Actual Cost to Business Case Cost



Clearly the range of out-turn to Business Case (Level 2 estimate) ratios shown in figure 4.3, with a minimum of 78% and a maximum of 130% is much tighter than in those in figure 4.1 and 4.2. Notwithstanding, as this figure demonstrates, even with the more accurate bottom up Level 2 estimates there is a diversity of outcomes.

5 CALCULATION OF COST ESTIMATION RISK FACTOR

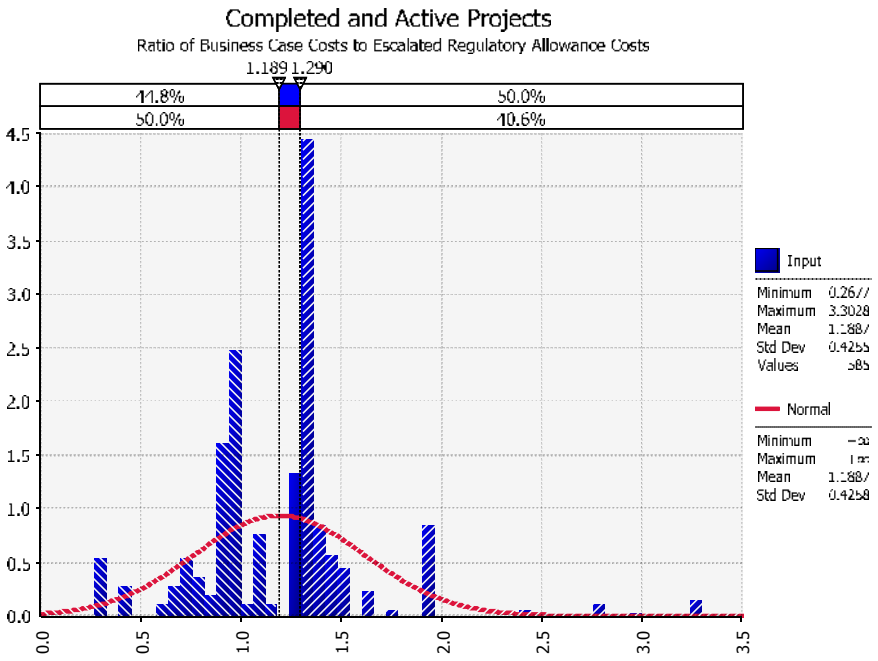
In order to assess the asymmetric risk factor implicit in these outcomes on a portfolio basis that takes into account relative project value, we have developed a statistical approach that allows us to weight projects according to value. In essence, we normalise projects to $1 million, and provide multiple entries in the data set to reflect the appropriate value weighting. Thus, a $1 million dollar project appears once, a $10 million project appears as 10 x $1million projects and so on. This results in a data set with 585 values. Weighting is based on regulatory allowance. A data set of this size is sufficiently "rich" to enable statistical parameters such as the P50 value to be inferred directly.

To assess the implicit asymmetry in the portfolio, we have compared the ratio of out-turn ratios in the expanded data set, to a normal distribution which has a symmetrical distribution, and determined the shift in the "P50" value. Whilst not generally used in commercial practice as a basis of bidding work, the "P50" level estimate has historically been accepted by the AER as representing a reasonable allocation of risk between the TNSP and the customer.

Figure 5.1 demonstrates the "P50 shift" in the ratio of Business Case (Level 2 Estimates) to Escalated Regulatory Allowance. Inspection shows that whilst the mean Regulatory Case to Business Case (Level 2 estimates) ratio is 118.9% (1.189), the median P50 value is 129% (1.29). This implies considerable asymmetry in the outcomes (with a bias towards over expenditure over and above the mean outcome).

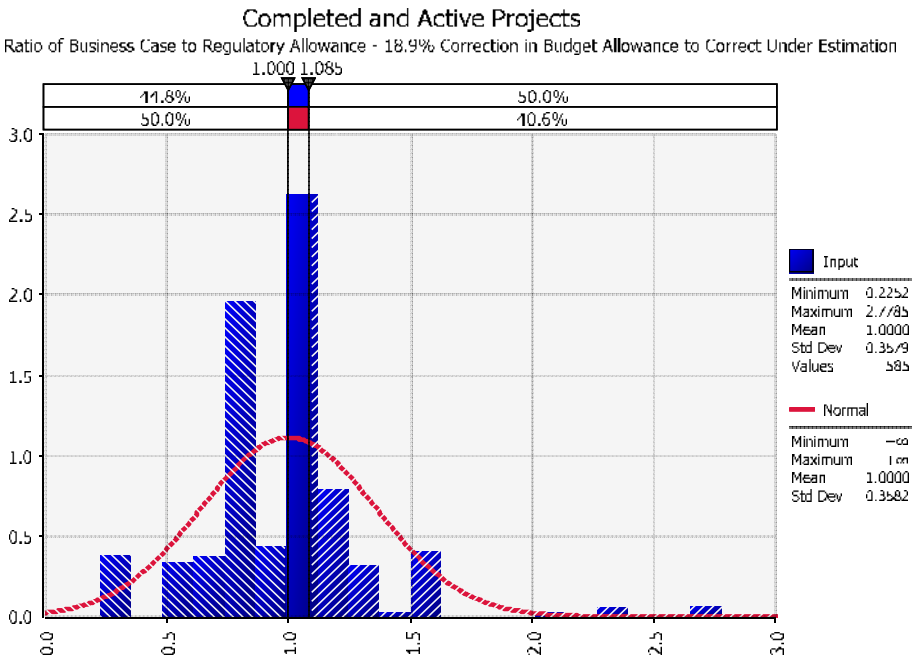
Clearly, Electranet will adjust its estimating process in the next regulatory period in order to eliminate much of this deficiency. Project estimates normally seek to achieve the most likely outcome. Notwithstanding this objective, asymmetric risk remains at a portfolio level given the inherent uncertainties.

Figure 5.1 – Project Business Case Cost to Escalated Regulatory Cost - Value Weighted According to Original Regulatory Estimate



In order to reflect the expected change in estimates, Evans & Peck has increased all estimates by 18.9% (the mean shift) and re-examined the shape of the resultant Business Case to Escalated Regulatory Allowance Ratios – that is we have normalised Figure 4.4 to a mean value of 100% (1) by dividing all values by 1.189. The resultant curve is shown in Figure 5.2. The P50 value for a symmetrical curve would also be 1, as shown by the Normal Distribution overlayed on the same graph.

Figure 5.2 – Project Business Case Cost to Escalated Regulatory Cost - Value Weighted According to Original Regulatory Estimate and Normalised to Remove Implicit Underestimation.



For the projects analysed, the P50 value is 1.085, indicative of asymmetry to the right. Evans & Peck is of the view that this value overstates the risk factor that should be applied to the extent that, as shown in Figure 3.1, the Out-turn to Business Case (Level 2 Estimate) ratio is 0.967 – that is, the Business Case Values appear to contain some contingency.

Multiplying 1.085 x 0.967 results in a "P50" shift of 1.049, which we believe provides a reasonable estimate of the portfolio risk allowance that ElectraNet should include in its capital expenditure forecast. This is not materially different to the value previously determined and applied to ElectraNet, and is reflective of actual risks observed in the current period.

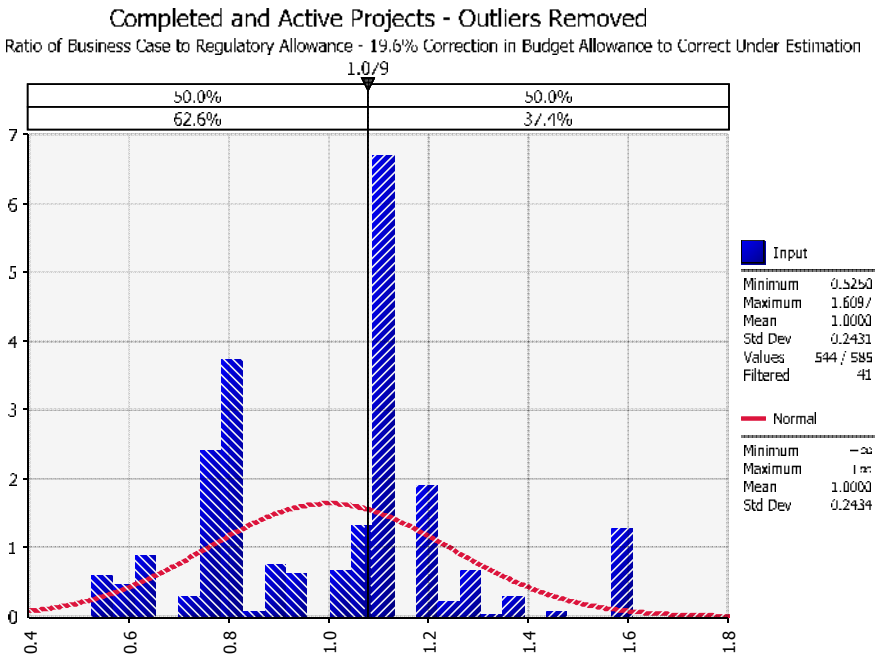
We would also make the observation that this factor is applied only to forecast projects that have not progressed to a "Business Case" Level 2 estimate.

6 IMPACT OF STATISTICAL OUTLIERS ON RESULTS

Close inspection of Figure 4.3 shows that there are a number of projects at the extreme range of outcomes, both low and high. In order to assess the robustness of our analysis against the impact of these outliers, we have repeated the steps outlined in Section 5, but removed those projects Business Case to Escalated Regulatory Allowances of less than 50%, and greater than 200%. Figure 6.1 is equivalent to Figure 5.2, but with these outliers removed[5]. These ranges have been selected on the basis of inspection of Figure 5.1 above.

[5] In addition to those unrepresentative projects removed from the initial analysis.

Figure 6.1 – Project Business Case Cost to Escalated Regulatory Cost - Value Weighted According to Original Regulatory Estimate and Normalised to Remove Implicit Underestimation – Outliers Removed



In this case, the P50 "shift" is 1.079, compared to 1.086 in the original data set. This would result in a net cost estimation risk factor of 1.043 in lieu of 1.049 after adjustment for the out-turn to Business Case factor of 0.967. Evans & Peck's strong recommendation is to retain the higher value as in our opinion this is the value that is most representative of ElectraNet's risk profile.