Response to the Economic Regulation Authority on the cost of equity

REPORT FOR GOLDFIELDS GAS TRANSMISSION PTY LTD

January 2016

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Contents

1 Introduction

1.1 Context

1 We have been asked to respond to a draft decision[1] by the Economic Regulation Authority of Western Australia (ERA) in relation to the Goldfields Gas Pipeline (GGP). The GGP is owned by Goldfields Gas Transmission (GGT). Specifically, we have been asked to consider the beta estimate. The beta estimate is used, in part, to estimate the cost of equity capital which flows through to the regulated rate of return.

2 In the Capital Asset Pricing Model (CAPM),[2] which is adopted by the ERA (2015), the cost of equity is estimated as the sum of the risk free rate of interest (r_f) and the equity risk premium. The equity risk premium is the product of the beta estimate (β) and the market risk premium ($r_m - r_f$).[3] So the equity risk premium can be computed as $\beta \times (r_m - r_f)$ and the cost of equity can be computed as $r_f + \beta \times (r_m - r_f)$.

3 In its draft decision, the ERA (2015) made an indicative estimate[4] of the cost of equity of 8.04%, based upon estimates for the risk free rate of 1.96%[5], beta of 0.8[6] and market risk premium of 7.6%.[7][8] The basis for the ERA's estimate of beta is as follows.

a. The ERA states that the beta estimate will be drawn from within the range of 0.3 to 0.8.[9] The range is derived from running regressions of stock returns on market returns over a five year period, for energy network businesses listed in Australia.[10]

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[1] ERA (2015).

[2] Sharpe (1964), Lintner (1965) and Mossin (1966).

[3] r_m is the expected return on the market portfolio of all risky assets. The market risk premium is the difference between the expected return on the market portfolio and the risk free rate.

[4] The cost of equity estimate is indicative because parameters can be updated for the ERA's final decision based upon movements in interest rates. In particular the estimate for the risk free rate will be based upon the yield to maturity on government bonds with five years to maturity over 20 trading days to be determined at a future point in time.

[5] ERA (2015), para. 550.

[6] ERA (2015), para. 653.

[7] ERA (2015), para. 743.

[8] The computation for the estimated cost of equity is $r_f + \beta \times (r_m - r_f) = 0.0196 + 0.8 \times 0.0760 = 0.0196 + 0.0608 = 8.04\%$.

[9] ERA (2015), para. 813.

[10] ERA (2015), para. 600.

b. The ERA selected a beta estimate at the upper end of this range for the GGP according to two rationale. First, the ERA made a judgement that the beta estimate for a typical energy network would be 0.7. The figure of 0.7 is above the mid-point of the range of 0.3 to 0.8 because of a lack of empirical support for regression-based beta estimates.[11] Second, the ERA made a judgement that the GGP should have a beta estimate above the 0.7 estimate for the typical energy network on the basis of firm-specific comparison of risks compared to other firms. This comparison was made on the basis of accounting metrics.[12]

4 In analysis performed for the GGP in 2014[13] we made an estimate of beta for use in a regulatory model[14] of 1.10.[15] As a practical matter, if the ERA (2015) used the same inputs for the risk free rate (1.96%) and market risk premium (7.60%) as appear in the draft decision, the cost of equity would be 2.28%[16] higher under a beta estimate of 1.10 versus 0.80, and the weighted average cost of capital would be 0.91% higher.[17]

5 The basis for our analysis was that there is a difference between the *expected return on equity* and the cost of equity input into a regulatory model. The CAPM is a model of expected returns. The term *expected returns* has a statistical meaning. It means the average outcome across all possible situations. For example, if the CAPM estimate of the cost of equity is 10% this means that the average return to equity holders if we consider the full distribution of possible returns is 10%.

6 Our view is that the regulatory model represents the average outcome across the range of outcomes for which default does not occur. For example, suppose there was a 5% chance that a regulated business defaults on its debt. Our view is that the regulatory model represents the average outcome across the best 95% of scenarios. Another possibility is that the regulatory model represents the most likely single scenario or an average outcome across most scenarios, which would also be outcomes in which default does not occur.

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[11] ERA (2015), para. 650,

[12] ERA (2015), para. 633 to 653.

[13] SFG Consulting (2014). The current report is prepared by Frontier Economics. The earlier report was prepared by SFG Consulting. Professor Stephen Gray and Dr Jason Hall from SFG Consulting joined Frontier Economics in November 2014.

[14] By *regulatory model* we mean the spread sheet or other computational tool used to estimate the allowed revenue stream.

[15] SFG Consulting, para. 120.

[16] (1.10 – 0.80) × 7.60% = 0.30 × 7.60% = 2.28%.

[17] According to the ERA (2015), there is 40% equity finance and 60% debt finance in the weighted average cost of capital. So the overall difference in the weighted average cost of capital is 0.40 × 2.28% = 0.91%.

7 We also consider that, in comparison to what is presented in the regulatory model, shareholders in the GGP face more downside risk than upside risk. Pipeline utilisation is high and this utilisation is incorporated into volume projections used in the regulatory model. There are risks that, due to the downturn in demand for commodities that volumes are lower than forecast and at the extreme end there is the chance of default. This leads to low shareholder returns. There is less chance of shareholders receiving correspondingly high shareholder returns.[18] This asymmetry means that for the expected returns to shareholders to be equal to the cost of equity implied by the CAPM, the cost of equity used in the regulatory model needs to be above the expected return.

8 We performed analysis to estimate the cost of equity based upon the average return to shareholders across all possible outcomes, and the average return to shareholders across a set of outcomes excluding default. The reason the two cost of equity estimates are different is because of the asymmetry in returns to equity holders. If our view on the regulatory model is correct – that is represents an average outcome across the no default outcomes – then the appropriate input into the model would be the average shareholder return across the no default outcomes.

9 The first shareholder return (the average return across all outcomes) corresponded to an equity beta estimate of 0.82.[19] The second shareholder return (the average return across no default outcomes) corresponded to an equity beta estimate of 1.10.[20]

1.2 Assessment by the ERA

10 In its draft decision, the ERA (2015) elected to have no regard to our analysis.[21] The ERA's assessment is that, on a theoretical basis, our report is fundamentally flawed because it not driven by economic principles and does not follow standard finance theory.[22] On a practical level the ERA considers that our approach is not well established[23], is untested[24] and is unduly sensitive to input parameters.[25]

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[18] SFG Consulting (2014), Sub-section 3.3, para. 50 to 57.

[19] SFG Consulting, para. 20.

[20] SFG Consulting, para. 20.

[21] ERA (2015), para. 568.

[22] ERA (2015), para. 568.

[23] ERA (2015), para. 595.

[24] ERA (2015), para. 595.

[25] ERA (2015), para. 593.

11 The ERA (2015) draws substantially from a review by Lally (2015). Lally's opinion on the theoretical basis for our analysis is that it is not an application of option pricing theory[26], as we claimed, but rather is an application of state pricing theory[27] which Lally states is not standard finance theory.[28] On a practical basis Lally considers that our modelling is overly simplistic[29] (we do not pay annual dividends or repay debt each year), we have not correctly accounted for the liquidity compensation in corporate bond yields[30] (part of the return required by debt investors is compensation for the lack of liquidity associated with debt) and that our analysis is overly sensitive to assumptions.[31] Lally states that the output prices implied by our model are likely to be too high compared to the idea that the net present value of expected cash flows should equal zero.[32]

12 Lally (2015) also makes the point that our characterisation of the regulatory model – that it is an average outcome across no default situations – is a very strong assumption about regulatory behaviour and that we do not present evidence in support of this assumption.[33] This point is made in response to one of the questions posed to Lally by the ERA, which is whether it is "true that regulators estimate the cost of capital conditional upon no default occurring, and therefore it is appropriate to estimate the cost of capital sans default for GGP?"[34]

1.3 Our task and conclusions

13 Our task in this report is to respond to the critiques of our analysis prepared by the ERA (2015) and Lally (2015). We briefly summarise that response below.

14 In this report we make several statements to the effect that the assessments by the ERA (2015) and Lally (2015) are not reasonable. We form this overall view for two reasons.

a. On a conceptual level there is a characterisation that the work is outside the realm of standard finance theory. We constructed a model to answer a specific question, and relied upon the standard frameworks that (a) equity is a call option on the value of assets

[26] Lally (2015), p. 9.

[27] Lally (2015), p. 10.

[28] Lally (2015), p. 10.

[29] Lally (2015), p. 15.

[30] Lally (2015), p. 13.

[31] Lally (2015), p. 21.

[32] Lally (2015), p. 17.

[33] Lally (2015), p. 22.

[34] Lally (2015), p.

which is exercised by repaying debt; (b) changes in firm value are correlated with market movements; and (c) defaults are more likely to occur in bad market conditions.

We constructed a specific application of these theories using a binomial option pricing model. The assessment that our work is not standard finance theory is not reasonable because it is not a replication of a model previously used, and is re-labelled as state pricing theory, a label with which we disagree with. We have used binomial models to value projects (oil and gas, mining, pharmaceuticals), to estimate regulated profit margins (retail electricity and gas), and to value executive performance shares (mining services, food). In each case the binomial model was tailored to match the case at hand. But in neither situation was the basic framework outside the realm of standard finance theory. The key issue is whether we have presented a model which adequately captures the risks faced by the GGP.

b. On a practical level there is a characterisation that our work is deficient because outcomes change due to changes in assumptions. There is the view that our assumptions are made without sufficient justification. On neither point do we consider this characterisation to be reasonable. On sensitivity to assumptions, we have previously presented extensive commentary on sensitivity to assumptions, demonstrating that the results change in the anticipated direction and by a reasonable magnitude.

   The ERA (2015) knows that beta estimates are imprecise, having relied upon ranges of 0.80 to 1.33 (ERA, 2005), 0.80 to 1.00 (ERA 2010) and 0.30 to 0.80 (ERA, 2015). Our implied beta estimates change by magnitudes that are not inconsistent with these ranges. On the assumptions themselves, there is the characterisation that the work cannot be relied upon because interest rates are different now, and that our assumptions regarding asset risk exposure and default risks are not justified. These assumptions were, respectively, justified on the basis of GGP-specific information and the high debt spreads that continue to prevail on corporate debt.

   In aggregate there is the characterisation that accounting for the very risks raised by the GGP (concentrated customer base and industry) cannot be relied upon because we need to make assumptions to reach conclusions. All analysis in regulation is based upon assumptions and models so that we can make progress towards the most reliable estimate of an allowed revenue

stream. The ERA believes that the GGP has not made the link between the customer and industry risk and what this means for the cost of equity.[35] The work we presented makes this link.

1.4 Outline of our report

15 In our report we present the following sections. First, we consider the overall question over what is represented by a regulatory model and, in particular, whether the equity holders in the GGP are likely to be exposed to more downside risk than upside potential. This issue is discussed in Section 2. This is followed by two separate sections, 3 and 4 in which we respond to concerns over theory and practical implementation. In Section 5 we present concluding comments.

2 What is embedded within the regulatory model for the GGP?

2.1 The regulatory model needs an interpretation

16 A premise that underlies our analysis is that we need to understand what is represented by the regulatory model used to set the allowed revenue stream for the GGP. The ERA (2015) posed the following question to Lally (2015).

> Is it true that regulators estimate the cost of capital conditional upon no default occurring, and therefore is it appropriate to estimate the cost of equity sans default for GGP?[36]

17 It is unclear to us why the ERA (2015) has posed the question about what is effectively embedded in a regulatory model. In our view, this is a question that the ERA can address as the regulator. The ERA does not consider the issue in its draft decision.

18 Lally's (2015) answer to that question is that:

> [T]he cost of capital estimates used by regulators clearly allow for the probability of default.[37]

19 There is no disagreement between ourselves and Lally (2015) about what is estimated by regulators in general, and by the ERA (2015) in particular, in respect of the cost of debt and equity. They estimate the cost of debt as the yield to maturity and they estimate the cost of equity as an expected return.

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[35] ERA (2015), para. 602.

[36] Lally (2015), p. 5.

[37] Lally (2015), p. 4.

20 The important question is, "What are the implications of the two types of return inputs for setting the regulated revenue stream?" It is in the answer to this question that Lally (2015) takes issue with our report.

21 Our view is that the cost of equity input into the regulatory model is understated, in the case of the GGP, because there is more potential for adverse impacts on the equity returns compared to events leading to above-normal returns. This is because the projected pipeline volume is close to capacity, there is a small number of customers and those customers are concentrated in mining. Some customers' profitability is marginal and commodity prices have fallen.

22 The key issue to be addressed is whether, in reality, there is more downside risk than upside potential for equity holders. In our view this asymmetric risk to equity holders is established by the model encompassing a cost of debt equal to the yield to maturity (rather than the expected return) and the limited potential for equity holders to earn very high returns (due to capacity constraints). There is more potential for very low returns.

23 Lally's (2015) perspective is directionally opposite and he makes two points.

a. **The returns in the model are too high.** Lally is of the view that the regulated revenue stream over-compensates equity holders as the model embeds the yield to maturity on debt rather than the expected return on debt.[38]

b. **We don't know what the model captures.** Lally notes that returns could be symmetrically distributed[39] and that, even if there are adverse events, the regulator might provide compensation for those events after the fact.[40] He considers our view, that the regulatory model represents an average across no default outcomes, is a very strong assumption about regulatory behaviour for which we do not provide evidence.[41]

2.1.1 Allowed returns in the model are not too high, they are too low

24 The regulator has two feasible options for a cost of debt assumption – the yield to maturity on debt or an expected return. If the regulator uses the expected return on debt and also includes an expected cost of equity this can be labelled an *expected returns model.*

[38] Lally (2015), pp. 4 and 25.

[39] Lally (2015), p. 22.

[40] Lally (2015), p. 22.

[41] Lally (2015), p. 22.

25 The use of an expected returns model would allow the regulator to solve for a series of expected cash flows and ultimately an expected revenue stream. But even with this model the regulator still needs to work out what is a fair revenue stream for the business to earn in a normal, or business as usual, situation over the regulatory period.

26 If the allowed revenue stream were set so that the cash flows are only sufficient to meet the lower expected return on debt, and the business pays the yield to the debt holders, then the equity return actually received will be less than the expected return. This would be the outcome if volumes and operating costs were exactly what is embedded in the model's projections. So unless the regulator works out what revenue stream to set in a business as usual case, then most of the time the equity holders would earn below average returns. The key point is that an expected returns model, without further analysis, doesn't get to the answer of what revenue stream the regulator should allow in a normal situation.

27 An alternative approach adopted in practice, including by the ERA (2015), is for the regulator to incorporate the yield to maturity on debt, but retain the cost of equity input as an expected return. We can label this as a *hybrid returns model.*

28 In the hybrid returns model the regulator estimates a series of cash flows and revenue that, if the volume and cost assumptions in the model turn out as projected, allow the equity holders to earn the expected return. This means that, if there was equal upside potential and downside risk for equity holders then the revenue stream is appropriate. The equity holders would have a projected revenue stream in a normal situation that, on average, allows the shareholders to earn the expected return.

29 The problem is that the hybrid model also doesn't, by itself, lead to the appropriate revenue stream in a normal situation if there is relatively more potential for equity holders to earn below-average returns. In this instance the average return across all possible outcomes would lie below the expected return estimate that is input into the model.

30 So we still have a situation in which the regulator needs to determine what revenue stream to allow in a normal case such that, on average, equity holders receive a return equal to the expected return. In short, this is what our analysis represents.

2.1.2 Interpretation of the regulatory model

31 If we are to answer the question of what allowed equity return should be embedded into the regulatory model we need to form a view as to what the regulatory model represents. We think it represents a hybrid returns model in which the business case relating to volume projections, operating costs, and capital expenditure can be considered an average outcome across the situations in which the debt holders are repaid.

What is embedded within the regulatory model for the GGP?

32 Lally's (2015) view is that neither we, nor Lally, know for sure what the regulatory model represents. Alternative views he puts forward are that returns to equity holders might be symmetrically distributed or that, if adverse events occur, that the regulator might provide compensation for those events. We do not consider it reasonable for our analysis to be dismissed simply on the basis that something else might be represented by the regulatory model, when neither Lally, nor the ERA (2015), forms a view on the issue.

33 We put forward a business case in relation to the GGP which was that there was limited upside potential for equity holders due to capacity constraints, but more downside risk because of a concentration of mining customers, lack of alternative customers and potential for default. It is not reasonable to simply say that returns might be symmetrically distributed, or that the regulator can make the returns symmetrically distributed by providing ex-post compensation. If the ERA planned to provide such compensation in the event of severe adverse events, and was legally able to make such an allowance, then the ERA could write this in the draft decision.

34 The second point that underpins our analysis is a view of what is actually embedded in the regulatory model. It is on this point that Lally (2015) states that we have made a strong assumption about regulatory behaviour without providing evidence.

35 This characterisation of our analysis is unreasonable. If we are to work out what is an appropriate revenue stream then we need to understand what projections are actually incorporated into the regulatory model. We need to make an educated assessment of the model's implications based upon the way the projections are used.

36 The ERA (2015) has compiled a lengthy decision relating to allowances for volume, capital expenditure, operating costs, depreciation and taxes. There is no implication from the ERA that these projections, flowing through to equity returns, represent the average from all outcomes. Further, there is no discussion from the ERA relating to the likely return to shareholders in the event of default.

37 We are not implying that the ERA (2015) has not been diligent in making projections, and are not stating that the ERA needs a granular description of every scenario. Our point is that the model embeds a scenario and we need to understand the implications of that scenario for pricing. We consider it a reasonable assessment that what appears in the regulatory model is most likely the ERA's best assessment of a business as usual case.

What is embedded within the regulatory model for the GGP?

2.2 Implications for setting the regulated revenue stream

38 Our view is that the regulatory model needs an interpretation and this interpretation has implications for the regulated revenue stream. Our analysis was predicated on what we consider to be the most appropriate interpretation of the regulatory model. Based upon that interpretation, and the likelihood that equity holders face downside risk, we arrived at an estimate of the allowed equity return. The response presented by Lally (2015) is in two parts, neither of which provides information for setting the revenue stream allowed by the ERA.

a. On the first part – what the discount rates mean – we agree that the cost of debt in the model (the yield) allows for default and we agree that the cost of equity input into the model is an expected return. This does not answer the question of what the regulator does with these two inputs to set the allowed revenue stream.

b. On the second part – what is represented by the model – Lally (2015) suggests that equity holders could face equal upside potential and downside risk, or that downside could be corrected by the regulator ex post. We agree that our analysis is based upon an asymmetry in equity holders' returns. The issue for the regulator is whether the asymmetry is true. This requires a view by the regulator on the potential impact on equity returns from different events and whether this impact is embedded in the regulatory model.

39 In summary, we consider that regulatory models need interpretation, the most likely interpretation of the model used by the ERA (2015) is an average across no default scenarios (which allows debt holders to earn the yield across those scenarios), and that there is an asymmetry in equity holders' returns. This leads to an input to the regulatory model for the cost of equity which is above the expected return. Our quantitative analysis allows this cost of equity input to be measured.

3 Response to issues regarding theory

3.1 Option pricing theory and state pricing theory

40 The ERA's (2015) assessment of the theoretical grounds for our work, based upon Lally's (2015) review of theory, is a mischaracterisation. There are two standard finance theories that underpin our analysis.

a. Equity in a business can be valued as a call option on the assets of the firm.[42] If the value of the firm is more than the value of debt, equity holders can exercise the option to repay the debt. In our analysis the underlying asset is the value of the firm and the exercise of the option is the decision to repay the debt.

b. Value of the firm is affected by market returns. In periods when market returns are high then firm returns, on average, are likely to be high. In periods when market returns are low then firm returns, on average, are likely to be low. This is the concept of systematic risk, which is the source of risk incorporated into the CAPM.[43]

41 There is no disagreement by the ERA (2015) or Lally (2015) that these two theories form the basis for our analysis. The disagreement between us and the ERA & Lally is whether our analysis follows standard finance theory, as we claim. Lally's view is that, because the value of the firm in different situations is determined by market returns we cannot claim that firm value is the underlying asset[44] and that the repayment of debt is an exercise of an option. So according to Lally we have not invoked an option pricing theory but rather a theory of state pricing, which Lally states is not a standard finance theory.

42 Lally (2015) cites examples from the literature which he does consider to be examples of option pricing theory. One example is the paper by Brennan and Schwartz (1985) in which the underlying asset is a natural resource and the owners have options to commence production, expand production, shut down and re-start. The decisions to exercise all of those options are triggered by movements in commodity prices. Commodity price movements alter the value of the natural resource leading to the exercise of options.

a. The underlying asset is the discounted cash flow valuation of the natural resource and we can value the option to commence production. The value of the underlying asset is correlated with commodity prices.[45]

b. In our analysis, movements in market prices alter the value of the firm leading to the exercise of the option to repay debt. The underlying asset is the value of the firm and we can value the

[42] Black and Scholes (1973), pp. 649 to 650.

[43] Sharpe (1964), Lintner (1965) and Mossin (1966).

[44] Lally (2015), p. 9.

[45] In the copper mine example presented by Brennan and Schwarz (1985, pp. 147 to 150) the present value of the expected cash flows from operating the mine changes at different commodity prices. These movements in the present value of expected cash flows trigger the decision to exercise options to open or close the mine.

option to repay the debt. The value of the underlying asset is correlated with market movements.

43 Another example in the real options literature is the work by Paddock, Siegel and Smith (1988) who value offshore petroleum leases. Movements in oil prices alter the decision as to whether to begin production. This is important because project value is materially affected by whether there is high production early in the project life when oil prices are high. The underlying asset is the developed petroleum reserve.[46] We can value the option to begin production based upon potential movements in the value of the project. Project value is correlated with movements in the oil price, just as the value of the GGP is correlated with movements in market values.

44 There is no reason that, merely because we model firm value as a result of different market outcomes, our analysis needs to be relabelled as something other than option pricing theory. In our view, the assessment by Lally (2015) is not a reasoned assessment of the theoretical validity of the analysis. It is not reasonable because it relies upon debate over labels, rather than the actual analysis done (namely, to model movements in asset value and then the value of an option to retain ownership by repaying debt).

45 Lally (2015) uses the word "radical" to describe our approach and draw a contrast to our statement that the underlying theory we have used is based on standard finance theory.[47] This is not a reasoned assessment. We performed an application of option pricing analysis to a real situation. This a central motivation underlying the publication of papers like Brennan and Schwarz (1985) and Paddock, Siegel and Smith (1988), to actually use corporate finance theory in practice to make better investment choices.

3.2 Continuous time and binomial models

46 The ERA (2015) devotes a section of its report to ruling out the idea that our analysis is an application of the Black-Sholes-Merton[48] option pricing model.[49] The common reference to the Black-Scholes-Merton option pricing model is to an equation derived in continuous time, used to value call options on non-dividend paying stocks. We do not use this equation and never claimed to use it. We always claimed that we were using a binomial option pricing model, which is a way of incorporating option pricing theory into discrete time periods (like months or years).

[46] Paddock, Siegel and Smith (1988).

[47] Lally (2015), p. 9.

[48] Black and Scholes (1973), and Merton (1973).

[49] ERA (2015), para. 76 to 79.

47 We said in our paper that we use the same framework which is to value an asset based upon the movements in value of some other asset, like the Black-Scholes-Merton model for valuing a call option. As mentioned above, we have the same theory – that equity is a call option on firm value – and use a binomial model for computational purposes.

48 The ERA (2015) has a view that our approach "does not follow the popular binomial option pricing model."[50] The ERA notes the contrast between our analysis (which is used to estimate an allowed return) versus a model used to value a call option.[51]

49 We think it is clear that we adopt a binomial option pricing model as the basis for our analysis. There is no one particular binomial option pricing model. This approach can be used to value call options, equity, and individual projects. We have used binomial models to value projects in oil and gas, mining, and pharmaceuticals, and to value executive stock options. All we have done in the current application is construct a model for a pipeline which faces risks associated with market movements and a small customer base in mining.

50 The benefits of a binomial model, in contrast to an equation, is that a binomial model is much more flexible to adapt to the particular events affecting payoffs to an asset and to equity holders. In our analysis, asset returns affect payoffs to equity holders and we can make specific assumptions about what asset returns might be in different market conditions.

51 The ERA (2015) is also concerned that our analysis might not necessarily converge to a specific answer if we move closer to continuous time. We have increments of one month and if we had increments of one week or one day the computational answer might be different. We consider this concern to be overstated because it is based upon the difference in outcomes from a very simple case to a much more detailed case. We consider that 60 months of returns, leading to 61 possible asset values at the end of five years, is a reasonable basis for drawing conclusions. The selection of the number of steps needs to meet the objective of having a reasonably low probability associated with each potential outcome. The highest probability outcome in our analysis is 10% so we consider 60 periods to be a descriptive enough view of the potential asset returns and equity returns.

3.3 Implications of theoretical considerations

52 In short, the assessment by the ERA (2015) and by Lally (2015) is to characterise our analysis as relying upon theories that are novel in corporate finance. This

[50] ERA (2015), para. 86.

[51] ERA (2015), para. 81.

characterisation is incorrect. We perform an application in which we rely upon two well-accepted finance theories.

4 Response to issues regarding implementation in practice

4.1 Sensitivity to key assumptions

4.1.1 Discussion of sensitivity to key assumptions

53 With regard to the practical assessment of our analysis, we consider the assessments by the ERA (2015) and by Lally (2015) to be unreasonable. A point raised by both the ERA and by Lally is that our analysis was contingent upon assumptions and that the analysis varies when those assumptions are altered.[52]

54 The assumptions we adopted required judgement, as do all assumptions that underpin analysis conducted in regulation, and we documented the rationale behind our assumptions. However, the characterisation of our assumptions, procedures and sensitivity analysis by Lally (2015) and the ERA (2015) is that our analysis would be markedly different depending upon small variation in assumptions. Both Lally and the ERA draw a comparison with the assumptions that underpin the use of the CAPM to estimate the cost of equity. They suggest that the use of two inputs (beta and the market risk premium) makes the analysis less contingent upon assumptions and that regulators know much more about the range of possible outcomes for those two parameter inputs than which underpins our analysis.[53]

55 There is an implication from this commentary that we have very precise estimates of the cost of equity from the ERA's (2015) assessment of beta and the market risk premium, but highly imprecise estimates of the cost of equity from our binomial model. This implication is not a reasonable assessment. In prior decisions, the ERA has estimated the range for equity beta on the GGP at 0.80 to 1.33 (ERA, 2005), 0.80 to 1.00 (ERA, 2010), 0.50 to 0.70 (ERA, 2013) and 0.30 to 0.80 (ERA, 2015). The equity beta range has fluctuated markedly over a decade, and remains wide, because it is difficult to estimate beta with precision by regressing stock returns on market returns.

56 Yet the analysis we put forward is considered to be unreasonably sensitive to assumptions. The variation in beta estimates that we presented in sensitivity analysis was not much different to the ranges presented by the ERA (2015) at

[52] Lally (2015), pp. 3 and 17 to 21; ERA (2015) para. 592.

[53] Lally (2015), pp. 3 and 21; ERA (2015), para. 593 to 594.

different points in time (the range has been 0.53, 0.20 and 0.50), nor was it much different to the movement in the ERA's estimated ranges over time (0.80 to 1.33, 0.80 to 1.00, 0.50 to 0.70, and 0.30 to 0.80).

57 Consider also the potential estimate of the market risk premium. The ERA (2015) estimates a range for the market risk premium, at the time of the draft decision, within a range of 5.5% to 9.7%.[54] There is an estimated range of 5.5% to 8.9% based upon analysis of past returns, and a range of 5.6% to 9.7% based upon estimates of the market return from dividends and share prices, using the dividend discount model.[55] Ultimately, the ERA arrived at an estimate of expected market returns of 9.56% based upon a market risk premium of 7.60%[56] and a risk free rate of 1.96%.[57]

58 In short, in the draft determination the ERA (2015) decided that the equity beta estimate could lie within a range of 0.3 to 0.8 and the market risk premium could lie within a range of 5.5% to 9.7%. If the beta estimate is completely independent of the estimate of the equity risk premium (which appears to be the case given that all the evidence used to estimate beta is different to all the evidence used to estimate the market risk premium) the composite range for the equity risk premium is 1.65% to 7.76%[58], and the composite range for the cost of equity is 3.61% to 9.72%.[59]

59 The ERA (2015) does consider a constraint on this analysis, which is that the return on debt should generally be lower than the return on equity[60] (5.172%).[61] So applying this constraint, we have the following ranges relevant to the current draft decision:

a. Cost of equity within the range of 5.17% to 9.72%; and

b. Equity risk premium within the range of 3.21% to 7.76%.

60 We consider the assessment of the sensitivity of our analysis to assumptions by the ERA (2015) and Lally (2015) to be unreasonable because our results have been either misunderstood (so that sensitivity appears higher than it is) or the actual sensitivity has not been considered. In performing sensitivity analysis we

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[54] ERA (2015), para. 738.

[55] ERA (2015), para. 738.

[56] ERA (2015), para. 743.

[57] ERA (2015), para. 753.

[58] 0.3 × 0.055 = 1.65%; 0.8 × 0.097 = 7.76%.

[59] 1.96% + 1.65% = 3.61%; and 1.96% + 7.76% = 9.72%.

[60] ERA (2015), para. 134.

[61] ERA (2015), p. 65.

considered scenarios of different assumptions (in line with three ERA decisions over eight years) and sensitivity to changing one input at a time.[62]

61 We generated economically sensible estimates of the cost of equity and the cost of equity estimates moved in a direction that makes sense given the change in inputs. For changes in input assumptions one at a time, for each change in input assumption the change in the cost of equity from our base case was within a range of −1.58%[63] to +1.73%.[64] There is no reason to think that the sensitivity analysis leads to implausible outcomes.

62 The ERA (2015) focuses on the implied beta estimates to suggest that they move too far. The cost of equity changes mentioned above (–1.58% to +1.73%) lead to changes in the implied beta estimates of −0.23 to +0.26. These beta estimate changes have a width that is similar to what the ERA has determined is a range the represents the imprecision in beta estimates. But more importantly, this is simply an artefact of sensitivity analysis that allows the yield on debt to go up or down but without any corresponding change to the expected market return.

63 This point is illustrated by our consideration of joint assumptions made by the ERA at three points in time. In comparison to our base case, the cost of equity increases by 3.11% (when the cost of debt rises by 2.52% and the market return rises by 2.25%)[65] and decreases by 1.60% (when the cost of debt falls by 0.61% and the market return falls by 2.10%)[66].

64 The implication of the analysis summarised above, and which appeared in our earlier report, is that the estimated cost of equity shifts by a magnitude and direction that is consistent with expectations.

65 The reason the ERA (2015) appears to be very concerned with sensitivity is that there is a difference between the cost of equity associated with the average outcome, and the average outcome across situations of no default. The ERA performs analysis which shows the following results, based upon the simpler, version of our analysis in which there are two market outcomes. The base case analysis has:

a. An average return to equity holders across all scenarios of 8.97% and associated equity beta of 0.77;

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[62] SFG Consulting (2015), Tables 6 and 7, pp. 46 to 47.

[63] This occurred when we decreased the yield on debt by 1.00%, so the cost of debt falls by 1.00% and the cost of equity falls by 1.58%.

[64] This occurred when we increased the yield on debt by 1.73%, so the cost of debt increased by 1.00% and the cost of equity increased by 1.73%.

[65] These computations refer to the 2010 scenario of yield on debt of 8.75% and expected market return of 12.79%. The cost of equity estimate is 14.35%.

[66] These computations refer to the 2013 scenario of yield on debt of 5.62% and expected market return of 10.44%. The cost of equity estimate is 10.69%.

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b. An average return to equity holders across no default scenarios of 10.93% and associated equity beta of 1.06.[67]

66 The ERA changes the risk free rate assumption from 3.87% to 1.96%. This has the following impacts:

a. The estimated equity beta implied by the average of all outcomes increases from 0.77 to 0.94, an increase of 0.17. This means that the average return to equity holders across all scenarios is estimated at 10.03%.[68]

b. The estimated equity beta implied by the average of no default outcomes increases from 1.06 to 1.31, an increase of 0.25. This means that the average return to equity holders across no default scenarios is estimated at 13.20%.[69]

67 The ERA's (2015) interpretation of this change is that:

> [W]ith the change in only one input assumption, the range of equity beta varies significantly. For example, when the risk free rate of 1.96 per cent is adopted, equity beta falls within a range of 0.94 to 1.31.

68 With the decrease in the risk free rate assumption to 1.96%, and holding constant the cost of debt and expected market return assumptions at 6.23% and 10.54%, the debt spread is 4.27% and the market risk premium is 8.58%. We have a business that is exposed to default risk – we have already established that it is the asymmetry in exposure to market conditions that matters. Now, in a scenario in which default risk is very high, average returns have increased. Those average returns have not increased to implausibly high levels, as the average equity return is 10.03%. But for equity holders to earn that average return means that, in the circumstances in which default does not occur, the return would need to be higher. In this circumstance the average return in the absence of default is 13.20%.

69 When it comes to the other scenarios considered by the ERA (2015) we also see movements in the estimated cost of equity that are in the anticipated direction and of reasonable magnitude. For instance, as the cost debt falls by 1.07%, the cost of equity falls by 1.80%.[70]

70 Another assumption we made relates to asset payoffs in good and bad markets, compared to normal market outcomes. Our base case analysis relied upon an

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[67] ERA (2015), Table 105, p. 447.

[68] $0.0196 + 0.94 \times (0.1054 - 0.0196) = 0.0196 + 0.94 \times 0.0858 = 0.0196 + 0.0807 = 10.03\%$.

[69] $0.0196 + 1.31 \times (0.1054 - 0.0196) = 0.0196 + 1.31 \times 0.0858 = 0.0196 + 0.1124 = 13.20\%$.

[70] The equity beta estimate across no default outcomes decreased by 0.27, from 1.06 to 0.79. With a market risk premium of 6.67% the cost of equity falls by 1.80%.

assumption of 85% to 115%. This means that bad markets imply asset payoffs that are 85% of what occurs in a normal market.

71 In the simpler case in which we consider just an up or down market, our assumption is that the down market asset payoff is 80% of the up market payoff. The ERA is concerned that under the assumption of a 70% ratio the beta estimate could be 0.56 or 0.83 (depending upon whether we are considering all outcomes or no default outcomes), and that under the assumption of a 90% ratio the beta estimate could be 0.98 from considering all outcomes or 1.27 across no default outcomes.[71] For clarity this means that:

a. The beta estimate could decrease from 0.77 to 0.56, if all outcomes are considered, or increase to 0.98. This represents a change of –0.21 to +0.21. This means that the average return equity holders receive across all scenarios could lie within the range of 7.61% to 10.41%.

b. The beta estimate could decrease from 1.06 to 0.83, if only no default outcomes are considered, or increase to 1.27. This represents a change of −0.23 to +0.21. This means that the cost of equity lies within the range of 9.41% to 12.34%.

72 We do not consider the ERA's (2015) of this sensitivity to be reasonable. The ERA presents these changes as very large compared to what can be relied upon. Yet the changes are not materially different to variations in cost of equity estimates that have been made in the past, or in comparison to the parameter ranges adopted by the ERA. Changes in the cost of equity estimates are not an artificial result of an unstable estimation method. The cost of equity estimates move because economic events affect equity holders' returns.

73 All that our analysis does is model, explicitly, what economic events lead to different payoffs to equity holders. The uncertainty over these economic events exists, regardless of whether beta is estimated by regressing stock returns on market returns, or using some other technique. Consider the beta estimates associated with the average equity return, which in the discussion immediately above lie within the range of 0.56 to 0.98. There is no reason to characterise this range as unreasonable for decision-making, when the regression-based beta estimates imply a beta range, according to the ERA (2015), of 0.3 to 0.8. Now consider the range of beta estimates associated with the cost of equity, 0.83 to 1.27. We have a similar sensitivity to the change in assumption.

74 The gap between the two sets of beta estimates (0.56 to 0.98, versus 0.83 to 1.27) is attributable to the asymmetry in equity returns. What is needed for

[71] ERA (2015), para. 154.

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interpretation of the beta estimates is a view on what is represented by a regulatory model.

4.1.2 Implications of sensitivity to key assumptions

75 In summary, we do not consider that the ERA (2015) or Lally (2015) have made a reasonable assessment of the sensitivity of our analysis to key assumptions. The focus of the analysis by the ERA and Lally has been on the magnitude of shifts in the beta estimates under different assumptions and how the beta estimates vary between the average outcome and the average no default outcome, regardless of what inputs cause changes in outputs. The outputs change in a direction and a magnitude which is consistent with the input assumptions.

76 The ERA's own assessment of beta estimates over time, and at each point in time, is wide because of imprecision in measurements of risk. Yet the wording of the assessment by the ERA (2015) and Lally (2015) implies that regression based estimates of beta give reliable cost of equity estimates, and modelling in which risks are accounted for explicitly are entirely unreliable. In our view the modelling presented provides useful information to the ERA for assessing the risk of the GGP.

4.2 Reasonableness of assumptions and results

4.2.1 Discussion on the reasonableness of assumptions and results

77 We first consider the review of our assumptions presented by the ERA (2015), considered individually. Throughout the ERA's discussion of our assumptions there is an overriding theme that we have a set of assumptions that might be different in reality (they are not directly observable, they are estimates) or might be different at a different point in time. The overall assessment by the ERA is not a reasonable assessment. We consider assumptions in the order considered by the ERA.

78 **Risk free rate.** When we performed our analysis the 10 year government bond yield was 3.87% and the ERA (2015) compares this to a risk free rate estimate of 2.90% from June 2015. The ERA notes that this will lead to a change in the return on debt and equity.[72] This critique would apply to any cost of capital analysis performed in a prior period and we provided a thorough analysis of the sensitivity of our analysis to changes in the risk free rate.

79 **Expected market return and variation.** The ERA (2015) questions our estimate of the expected market return of 10.54% on the basis of how we arrived

[72] ERA (2015), para. 139.

at the estimate. The ERA disagrees with the process for assigning weight to different market return estimates and the assumptions which underpin our dividend discount model analysis. In the current decision the ERA adopted an expected market return of 9.56%. Based upon the market risk premium range of 5.5% to 9.7%, the range for the expected market return is 7.46% to 11.66%. In prior analysis from 2005, 2010 and 2013 the ERA has used market return estimates of 10.45% to 12.45%, 10.79% to 12.79% and 8.44% to 10.44%. We do not consider it reasonable to place less weight on the analysis because we used a market return estimate that is close to the ERA's own estimates over a 10 year period, purely because we used a different dividend discount model approach, and a quantitative weighing scheme to arrive at our conclusions. Applying judgement to reach a conclusion based upon different estimates is the same as a weighting scheme, but without writing down the weights.

80 Lally (2015) takes issue with the manner in which we have considered the variation in market movements from one month to the next. Specifically, he takes issue with the up and down factors which underpin the binomial tree analysis. He considers that we have not appropriately calibrated our model to our assumed market standard deviation.[73] The key assumption we made is that the market could either rise by 5.14% (with probability of 57.11%) or fall by 4.89% (with probability 43.89%).

81 Lally's (2015) issue is that we have a mixture of discrete time returns assumptions and continuously compounded returns assumptions in our analysis, such that the standard deviation of market returns assumed is too high. The assumption we made is that in a good market month, returns will be one standard deviation above the mean, with the standard deviation computed as the annual standard deviation multiplied by the square root of 1/12. The standard deviation assumption is an approximation for the monthly standard deviation. It is not inherently incorrect to form a binomial tree in which the returns in a good market is one standard deviation greater than the average return.

82 In our earlier work we commented that the historical annual standard deviation of Australian equity returns was 16.6%. Over a five year period, if returns are independent year to year, the standard deviation of portfolio returns will be 60%. The standard deviation of market returns over a five year period that results from the model is 65%. So there is small difference in standard deviation of returns over five years, based upon our approximation of the monthly standard deviation and the construction of the up and down factors. The higher standard deviation implicit in our model decreases the beta estimates.

83 We maintain the view that any critique of work needs to be a reasoned critique. The concern over the market variation assumption is overstated.

[73] Lally (2015), pp. 11 to 13.

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84 **Cost of debt, defaults and liquidity.** We used a cost of debt in our analysis which was 6.23%. The ERA (2015) questions the relevance of our analysis when the cost of debt is now 5%. As with the discussion of the risk free rate, the assessment is unreasonable and implies that any cost of equity analysis performed at periods of different interest rates has no relevance.

85 Lally (2015) criticises our cost of debt assumption because he notes that part of the yield on debt is due to its lower liquidity than equity.[74] Lally draws strong conclusions from our use of the yield on debt, including the label of an egregious mistake.[75] We understand that, all else equal, an illiquid asset will be worth less than a liquid asset and so offer a higher yield. But it is also the case that if there are no defaults and the debt is held until maturity, the debt holders are likely to earn the yield over the life of the asset.[76]

86 Lally (2015) also makes a strong criticism of our analysis because the default rate implied by our analysis is higher than the historical default rate on bonds of similar credit rating.[77] Lally makes the statement that we brush off this discrepancy.[78] This assessment is unreasonable because we do not brush off the default rate comparison. We evaluated the mean and range of default rates for Moody's Baa-rated debt and Ba-rated debt and noted that our default rate estimate lied between default rates for the two types of debt. In addition, we are in a period of high debt risk premiums. Baa-rated debt has typically traded on much lower debt risk premiums than were assumed in our analysis and which have been used by the ERA (2015) in the current decision. The above-average debt risk premium implies above average default rates.

87 **Asset return assumptions.** Our analysis is sensitive to estimates of asset returns under different market conditions. The specific assumption we make is that asset returns could be 15% better or worse than normal under different market outcomes. The ERA (2015) states that this assumption has not been justified and that we have not provided any reference to justify this assumption. The ERA then devotes two pages of its decision to quoting part of the section from our report which we used to justify our assumption.

88 The analysis we performed showed that the GGP faces risks associated with volume shortfalls and changes in capacity charges and that a revenue shortfall of 6.21%[79] leads to asset returns being 15% below normal. This computation was

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[74] Lally (2015), p. 13.

[75] Lally (2015), p. 14.

[76] The return will be equal to the yield for a zero coupon bond and could differ from the yield if interest rates change, such that coupon payments are reinvested at different rates.

[77] Lally (2015), p. 13.

[78] Lally (2015), p. 13.

[79] SFG Consulting (2015), para. 252 to 253.

made with specific consideration of the financial characteristics of the GGP, and the break-up of capacity and throughput charges.

89 As part of its accounting benchmarking the ERA (2015) constructed a pro forma income statement for the GGP based upon a past regulatory model and realised volume. Revenue and earnings figures in the model are stable from 2009 to 2013. In 2014, revenue falls by 5.9% to $77 million, earnings before interest and tax falls by 16.8% to $34 million and net profit after tax falls by 34.5% to $9 million.

90 In confidential information provided to the ERA we documented risks associated with customers of the GGP who have substantial exposure to commodity price movements which could affect demand.[80] Further, the ERA (2015) noted that GGT has submitted information showing difficulties in contracting replacement demand,[81] and that in the past five years reserved capacity in each year was 3% to 10% below forecast (2014 being the lowest shortfall year) and throughout was 6% to 10% below forecast (2014 being the lowest shortfall year).[82]

91 This means that we made an assumption about asset returns that would result from revenue being about 6% below normal, and that:

a. GGT has told that ERA that replacing existing capacity is challenging;

b. the ERA has performed modelling which shows a 17% decline in earnings before interest and tax for a 6% decline in revenue;

c. capacity and throughput in the last five years was below projections to the magnitude of 3% to 10% with the last year of data representing the biggest shortfall; and

d. we presented the ERA with an assessment of potential low profitability customers who might represent risks.

92 The response by the ERA (2015) is simply to say that our assumption is not justified. We do not consider this to be a reasonable assessment of the analysis.

93 **The overall conclusion and the net present value question.** In our earlier work we reached the conclusion that, on average, equity holders would expect to earn a return that was consistent with an equity beta of 0.82. We also made the point that a regulatory model that invokes an average no default scenario would need a higher equity return as an input, consistent with a beta estimate of 1.10.

[80] SFG Consulting (2015), para. 256 to 266.

[81] ERA (2015), para. 599.

[82] ERA (2015), Table 43, p. 143.

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94 One reason the ERA (2015) questions the reliability of the analysis is that the implied beta estimate of 1.10 is greater than the market level of 1.00 and is not the same beta estimate we have used in other jurisdictions.[83]

With respect to the market beta of one versus the estimate of 1.10, the ERA acknowledges that systematic risk increases with operating leverage and financial leverage.[84] The view that beta cannot be greater than one is based upon the premise that, regardless of the level of operating leverage and financial leverage, leverage will not be high enough to offset low variation in revenue. It is not reasonable to question any piece of analysis that generates a beta estimate above one, which could suggest that operating leverage and financial leverage, in aggregate, lead to equity holders facing above-market risk.

95 With respect to the advice we have given in other jurisdictions, it is also not reasonable to question the analysis because of differences in beta estimates based upon entirely different quantitative analysis, for a different business, and when the beta estimates themselves are not particularly different in those different pieces of advice. The comment by the ERA (2015) has the implication that our analysis fluctuates from one jurisdiction to another without reasonable basis and that assessment by the ERA is unreasonable.

96 The key point for the analysis of the GGP is that there is the potential for large, adverse impacts on equity returns. The ERA's (2015) view is that our advice would be relevant to all energy networks. The assumption which could lead to different beta estimates for different energy networks is the asset returns assumption of ±15%, which was based upon the risks to revenue for the GGP (concentrated customer base in mining heading to the end of the mining boom) and the GGP-specific regulatory model. Another network could face different risks.

97 Lally (2015) takes issue with our overall analysis because he states that we have not considered the requirement for the net present value of expected cash flows to equal zero. He labels this concern as decisive.[85] The conclusion of Lally – that we have failed to satisfy the $NPV = 0$ test – is not a valid representation of the analysis. Our entire analysis was predicated on the need for the present value of expected cash flows to equal zero. From the outset, our objective was to answer the question of what cost of equity, used in the regulatory model, sets the present value of expected cash flows to zero. This is the basis for the beta estimate of 1.10, which on average results in equity holders earning a lower return.

[83] ERA (2015), para. 108 to 109.

[84] ERA (2015), para. 613 to 616 and 641 to 643.

[85] Lally (2015), pp. 3 and 17.

4.2.2 Implications of the reasonableness of results and assumptions

98 In assessing our suite of assumptions and our overall conclusions, we do not believe that the ERA (2015) and Lally (2015) have made a reasonable assessment. It is not reasonable to suggest that the results are unreliable because assumptions are made and different assumptions lead to different answers.

99 The issue is whether our results stem from a set of inappropriate assumptions and that is not the case. The ERA's (2015) concerns included the fact that the risk free rate changes over time, the cost of debt changes over time, and we used a weighting scheme to estimate the expected market return (rather than simply stating we used our judgment). The ERA raises this concern even though our market return estimate is consistent with what the ERA has used before. There are statements by the ERA and Lally (2015) suggesting that our asset returns assumptions have no basis, despite the specific analysis of customers and the quantitative analysis of the GGP's exposure to changes in revenue. Lally's concerns include the statement that our analysis over-compensates equity investors, when the analysis is directly made to answer the question of what is a fair return.

100 We consider that our analysis has merit and that the ERA should have regard to it in the ERA's final decision.

5 Conclusion

101 Our overall response to the ERA (2015) and Lally (2015) is that there has not been a reasonable assessment of the theory and practical work submitted. Most importantly, our analysis relies upon the idea that a regulatory model needs an interpretation. That interpretation fundamentally affects what inputs are embedded in the model.

102 We made an interpretation of the regulatory model that it represents an average scenario across no default outcomes. We were also presented with information which suggests defaults are more likely in periods of adverse market conditions. There are specific features of the GGP (customer base and industry exposure) that lead to this conclusion. Based upon these two ideas we needed to work out what this means for setting the allowed return to equity holders.

103 This over-riding objective is not the central question addressed in the assessment of our work by the ERA (2015). The ERA does not address the question of what is embedded in a regulatory model, and does not consider whether our overall premise makes sense – that defaults on the pipeline are more likely in a downturn and what this means for equity beta. The ERA performs a benchmarking exercise to see whether, based upon past accounting metrics, the GGP appears more risky

than other energy networks.[86] But this is incomplete because the risk faced by the GGP will not show up in a period of relatively good times for mining companies.

104 In summary, we believe that our analysis has merit and provides an estimate of systematic risk which addresses the risks faced by the GGP.

[86] ERA (2015), para. 609 to 653. See our companion report for a separate discussion of this issue.

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