Review of the AER's conceptual analysis for equity beta

REPORT PREPARED FOR ACTEWAGL DISTRIBUTION, AGN, AUSNET SERVICES, CITIPOWER, ERGON, ENERGEX, JEMENA ELECTRICITY NETWORKS, POWERCOR AUSTRALIA, SA POWER NETWORKS AND UNITED ENERGY

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1 Executive Summary

1.1 Authors of this report

1 This report has been authored by Dinesh Kumareswaran and Rajat Sood.

2 Dinesh has nearly 12 years of experience as an industrial economist. He has worked full time as a consulting economist with Frontier Economics (**Frontier**) since 2009. He has advised regulators and regulated businesses in Australia and abroad on matters involving economic regulation, including the principles of best practice regulation, asset valuation, regulatory depreciation, expenditure forecasting, benchmarking and efficiency analysis, and cost of capital estimation. Dinesh has conducted cost of capital analysis for nuclear power generation assets, electricity transmission and distribution businesses, gas networks and petroleum pipeline businesses, telecommunications networks, water companies, and rail and ports infrastructure. Prior to joining Frontier, Dinesh was employed as an Economist and then a Senior Economist at the New Zealand Commerce Commission. During that time he worked in the areas of competition economics and network regulation. Between 2010 and 2012, Dinesh lectured part-time a MSc course on financial economics for regulated industries at the Imperial College Business School, London.

3 Rajat has over 15 year of experience as a consulting economist and is also a qualified solicitor. Rajat has advised state and national governments, regulatory bodies and businesses on issues in a wide range of energy network regulation including: cost of capital; design of incentive mechanisms; tariff structure, and the development and application of regulatory investment tests. In recent years, Rajat has been a key adviser to institutions such as the Australian Energy Market Commission, the Australian Energy Regulator (**AER**), the New Zealand Electricity Commission, the New Zealand Commerce Commission and the Singapore Energy Market Authority. Prior to working as an economist, Rajat was a solicitor at the law firm Freehill Hollingdale & Page in Melbourne

4 Copies of our curriculum vitas are attached as Appendix 2 to this report.

5 We have previously co-authored a July 2013 report commissioned by the AER and titled *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia* and we refer to that as "our previous report" or as the "Frontier 2013 report" in this document.

6 Our opinions set out in this report are based on the specialist knowledge acquired from our training and experience set out above. We have been provided with a copy of the Federal Court's Practice Note CM 7, entitled "Expert Witnesses in Proceedings in the Federal Court of Australia", which comprises the guidelines for expert witnesses in the Federal Court of Australia

(Expert Witness Guidelines). We have read, understood and complied with the Expert Witness Guidelines.

1.2 Context

7 We have been retained by ActewAGL Distribution, AGN, AusNet Services, CitiPower, Ergon, Energex, Jemena Electricity Networks, Powercor Australia, SA Power Networks and United Energy to provide our opinions in relation to the recent decisions of the AER insofar as they relate to conceptual analysis in relation to the beta parameter.

8 Specifically, we have been asked to review:

a. The submissions and supporting material referred to in the submissions made by SA Power Networks concerning the risk arising from disruptive technologies; and

b. The AER's approach to the analysis of risk and in particular the use of the Frontier 2013 report in the Explanatory Statement for the Rate of Return Guidelines, Final Determinations for the NSW distribution businesses and the Preliminary Determination for SA Power Networks.

9 A copy of the terms of reference for this report is attached at Appendix 1.

1.3 Summary of conclusions

10 In relation to equity beta and leverage:

a. Equity beta is a function of two components: the fundamental business risk of a firm's operations and leverage.

b. Other things being equal, higher leverage increases the systematic risk of equity, in which case the equity beta will also be higher.

c. The fact that the precise relationship between leverage and equity beta is not known with certainty does not mean that that the effect of leverage on beta should be disregarded when making comparisons between estimated equity betas. Such an approach would be at odds with accepted finance and regulatory practice.

d. The "financial risks" that we considered in our 2013 report for the AER are not the same as financial leverage and do not substitute for the leverage component of equity beta. The AER appears to have misunderstood this point in our 2013 report.

e. The evidence that the AER presents in relation to US utility betas supports a re-levered equity beta estimate of close to 1. Re-levering is required to ensure that betas are compared on a like-

with-like basis. For example, it would be inappropriate to compare a moderately levered US utility with the highly levered benchmark efficient entity without adjusting for these differences in leverage.

11 In relation to disruptive technologies:

a. There have been developments in the roll-out and adoption of disruptive technologies since our 2013 report. There is more uncertainty about the future of the industry now than there was even two years ago, and it is not unreasonable to think that investors would take this into account when allocating scarce capital to this industry.

b. The AER suggests that any systematic component of disruptive technology risk would be captured in its equity beta estimates. Our view is that this is very unlikely.

c. The AER suggests that to the extent that the risks are non-systematic in nature, those risks would more appropriately be compensated through regulated cash flows (such as accelerated depreciation of assets). However, notwithstanding that the AER recognises that disruptive technologies may increase the risks faced by NSPs, the AER has made no allowances for these risks either through the rate of return or through regulated cash flows.

2 Conceptual analysis and the comparison of levered and unlevered equity betas

2.1 Introduction

12 In its Preliminary Decision (PD) for SA Power Networks, the AER has presented a conceptual analysis of the total quantum of systematic risk of a benchmark efficient entity, relative to the market average firm. The AER's conceptual analysis involved considering whether there are a priori reasons to believe that the equity beta of the benchmark efficient entity is likely to differ from the equity beta of the market average firm, 1.0. The AER concluded that its conceptual analysis "indicates that the equity beta of a benchmark efficient entity will be less than 1.0."[1] The AER reached the same conclusion from its conceptual analysis in various decisions for network service providers (NSPs) in NSW, ACT and Queensland.

13 The AER's conceptual analysis drew principally on advice provided by McKenzie and Partington (in a series of reports) and, to a lesser extent, on a report prepared by Frontier in 2013 that assessed the risks of electricity NSPs.[2] We have been been retained by AGN, AusNet Services, CitiPower, Ergon, Energex, Jemena Electricity Networks, Powercor Australia, SA Power Networks and United Energy to provide our opinions in relation to the recent decisions of the AER insofar as they relate to conceptual analysis in relation to the beta parameter.

14 The remainder of this section of the report is structured as follows:

- First, we provide a brief summary of the key elements of the AER's conceptual analysis.
- Next, we provide our assessment of the AER's conceptual analysis.

2.2 Summary of the AER's conceptual analysis of systematic risk

15 The key elements of the AER's conceptual analysis are the following.

a. The AER's conceptual assessment of equity beta relative to the market average is determined by the direction and relative

1 SA Power Networks Preliminary Decision, p.3-369.

2 Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013.

magnitude of two systematic risk factors: business risk and what it calls "financial risk."[3]

b. The AER argues that it is generally accepted that the benchmark efficient entity has lower business risk (i.e., reflected in its asset beta) than the market average firm.[4]

c. Based on advice from McKenzie and Partington, the AER concludes that intrinsic business risk is the primary, if not sole, driver of the systematic risk of a benchmark efficient entity (i.e., that it is the asset beta that is the primary determinant of the equity beta and that the effect of financial risk, if anything, is small).[5]

d. The AER acknowledges that it is generally accepted that the benchmark efficient entity has higher financial risk (i.e., as a consequence of higher leverage) than the market average firm. The key characteristic causing this higher financial risk is the relatively high financial leverage (gearing) for the benchmark efficient entity, relative to the market average firm.[6]

e. However, the AER concludes that the exact relationship between financial risk and financial leverage is not straightforward, and cannot be known with certainty. The AER considers that this suggests that the high financial leverage of the benchmark efficient entity does not necessarily result in high exposure to financial risk.[7]

f. The AER cites the 2013 Frontier report and claims that Frontier "disaggregated financial risk (arising as a consequence of how the business's activities are funded) into five distinct categories." The AER notes that Frontier assessed the level of most of these financial risks to be low and uses this to support its view that the overall systematic risk of the benchmark efficient entity lies below that of the market average firm.[8]

16 On these bases, the AER considers that there are reasonable conceptual grounds to expect the overall systematic risk for the benchmark efficient entity to be below that of the market average firm (i.e., for its equity beta to lie below 1.0).

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3 SA Power Networks Preliminary Decision, p.3-367.

4 SA Power Networks Preliminary Decision, p.3-364.

5 SA Power Networks Preliminary Decision, p.3-365.

6 SA Power Networks Preliminary Decision, p.3-366.

7 SA Power Networks Preliminary Decision, p.3-366.

8 SA Power Networks Preliminary Decision, p.3-366-367.

2.3 Frontier views on the AER's conceptual analysis of systematic risk

17 This section sets out our assessment of the AER's conceptual analysis.

2.3.1 What does the AER mean when it refers to 'conceptual analysis'?

18 It is difficult to understand what constitutes 'conceptual analysis' of systematic risk in the AER's mind. A normal interpretation of 'conceptual analysis' would be analysis based on non-empirical evidence, which would include theoretical and qualitative evidence. However, the AER clearly draws on some empirical evidence (e.g., evidence on the betas of US utilities) as part of its conceptual analysis.

19 Indeed, the AER states that its conceptual analysis is not restricted to theoretical analysis:[9]

> We note our conceptual analysis is not restricted to pure theoretical analysis. It is analysis based on a concept to be explored, rather than a methodology to provide or determine best outputs (in this case, parameter estimates). Findings from different information sources (including academic empirical literature) can be used to explore the concept and draw conclusions.

20 The fact that some empirical evidence may form part of the AER's conceptual analysis seems inconsistent with a number of statements in the AER's decision that its conceptual analysis is necessarily qualitative in nature. For instance, the AER states that its conceptual analysis:[10]

> Allows us to form a prior expectation of where the equity beta of a benchmark efficient entity sits relative to the market average, but is necessarily qualitative in nature.

2.3.2 The purpose of undertaking a conceptual analysis of systematic risk

21 If indeed the AER's conceptual analysis is "necessarily qualitative in nature," it is unclear to us what value there is to be gained from the conceptual analysis of systematic risk produced by the AER. The question of the level of systematic risk appropriate to attribute to a benchmark efficient entity is, in our view, an empirical one. We know of no reliable way of assessing, on the basis of conceptual considerations alone, the appropriate quantum of systematic risk attributable to regulated network service providers. That question ultimately

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9 SA Power Networks Preliminary Decision, p.3-369.

10 SA Power Networks Preliminary Decision, Table 3-13, p.87.

should be answered using sound empirical evidence on the systematic risks of firms that share the risk characteristics of the benchmark efficient entity.

22 In our view, the AER's conceptual analysis of systematic risk is likely to be counterproductive to good regulatory decisions for two reasons:

- Firstly, the conceptual analysis could potentially be used to rule out sound empirical evidence that suggests that the equity beta of the benchmark entity could be greater than 1.0 by placing an upper limit, in the mind of the AER, on the possible value that the equity beta could take.
- Secondly, the conceptual analysis may be used to support empirical estimates of equity beta below 1.0, even if those estimates are not robust or reliable. Indeed, in its recent decisions the AER derives confidence in its estimated equity beta range by reference to its conceptual analysis, even though there are significant reservations about the reliability of the AER's estimated range:[11]

  > This empirical range of 0.4 to 0.7 is also consistent with our conceptual analysis, which we use to cross check our empirical results (see section D.1). This is because our conceptual analysis suggests the systematic risks of a benchmark efficient entity would be less than the risks of a market average entity (that is, less than 1.0).

23 Moreover, the only conclusion that the AER draws from its conceptual analysis is that the equity beta should be less than 1.0. This conclusion would equally support every estimate that is less than 1.0. Thus, there is no basis for interpreting the conceptual analysis as providing support for one particular estimate or range that is less than 1.0 over any other estimate or range that is less than 1.0.

24 The fundamental problem with the AER's conceptual analysis is that it results in a preconceived view of the equity beta, before any substantive empirical analysis is undertaken. This preconceived view can then be used to rule in or rule out empirical evidence, notwithstanding the robustness of the evidence. This is not appropriate because the task of estimating equity betas is principally empirical in nature.

2.3.3 The AER's decomposition of systematic risk into two forms

25 The AER states that, for the purposes of its conceptual analysis, total systematic risk may be decomposed into two types of systematic risk:

- **Business risk.** The notion of business risk, as used by the AER, corresponds to the concept of the asset beta in the finance literature. The asset beta

11 SA Power Networks Preliminary Decision, p.3-421.

measures the systematic risk associated with the activity in question, assuming that the activity is funded entirely through equity.

- **Financial risk.** Financial risk in the AER's conceptual analysis represents the additional systematic risk (i.e., over and above the risk measured by the asset beta) arising from the operations of the firm being funded through debt. As we explained in our 2013 report, as financial gearing in the business increases, the likelihood of equity holders being repaid falls, all else being equal. Hence, the amount of financial risk in the business scales with the proportion of debt funding within the business. Indeed, even in the absence of any chance of default, financial gearing widens the range of possible returns to equity holders. Other things being equal, a more highly geared asset provides equity holders with higher percentage returns when asset prices increase and larger percentage losses when asset prices fall. This same principle applies equally to houses, commercial property and shares. Gearing up increases systematic risk.

26 The equity beta represents the level of total systematic risk in the business, once financial gearing has been accounted for.

27 This is a standard treatment in the finance literature, and we have no disagreement with this framework for thinking about total systematic risk.

2.3.4 'Financial risk' in our 2013 report

28 In our 2013 report, we identified five specific types of risk that regulated networks may potentially be exposed to and we referred to these five risks collectively as 'financial risks.' It is important to understand that our grouping of these risks (which all have a financial dimension to them) was purely for exposition purposes. We did not intend to give the impression that these five risks collectively make up the systematic risk associated with leverage, which the AER refers to in its conceptual analysis as 'financial risk.'

29 When we used the term 'financial risks' in our 2013 report, we were using that term very differently from the way the AER uses the term in its conceptual analysis. Hence, when the AER states that we "disaggregated financial risk…into five different subcategories," it appears to have misunderstood us. We did not seek to decompose the systematic risk component attributable to leverage into five neat subcategories of systematic risk. Our objective was to enumerate the distinct sources of risk that may potentially contribute to the total risk (i.e., systematic and non-systematic) that regulated energy networks may face.

30 We made clear in our 2013 report that:

Conceptual analysis and the comparison of levered and unlevered equity betas

a. the 14 categories of risk that we identified were risks that potentially contribute towards the total risk faced by regulated energy networks;[12]

b. when implementing asset pricing models, it is not total risk but, rather, non-diversifiable (or systematic) risk that is relevant when determining the allowed return on equity for regulated energy networks;[13]

c. it is not possible to say conceptually which of the 14 risks we identified are systematic in nature, or to what extent they may be systematic;[14] hence

d. it is impossible to say, a priori, and with certainty, which of the 14 risks identified by us really matter for the purposes of determining the allowed rate of return, and by how much they matter;[15] so

e. any assessment of the quantum of systematic risk exposure must be done empirically.[16]

31 We stated in our report that:[17]

> In our view, the question of which risks should be compensated through the allowed rate of return cannot be answered purely analytically; it is largely an empirical question.

32 Furthermore, we made clear in section 2.2 of our 2013 report that financial gearing (i.e., leverage), which is not a risk per se, is a factor that **amplifies** the risks faced by firms (including regulated energy networks).

33 That is, the AER appears to have confused (a) five risks that have a financial dimension to them, with (b) the effect of leverage on overall systematic risk. The latter has a direct effect on equity beta that has long been recognised in the academic literature and in practice (as we show below), whereas the former does not.

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12 Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013, p.1 and section 2.3.

13 Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013, pp.5-6, 42, 107 and 112.

14 Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013, pp.109, 112.

15 Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013, pp.6, 107.

16 Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013, pp.5-6, 42, 107 and 112.

17 Frontier Economics, *Assessing risk when determining the appropriate rate of return for regulated energy networks in Australia*, July 2013, p.109.

34 Therefore, the AER should not interpret our qualitative assessment of energy network businesses' exposure to five risks that have a financial dimension as evidence that the systematic risk arising from financial gearing is low. As we noted a number of times in our 2013 report, the regulated energy networks' exposure to systematic risk must be assessed empirically and not analytically (i.e. through conceptual considerations alone).

2.3.5 The AER's conclusion that the equity beta of the benchmark efficient entity is less than 1.0

35 The AER's starting point in its conceptual analysis is that there is general agreement that the systematic business risk (as measured by the asset beta) of regulated energy networks is lower than that of the average business. We agree that this is a well-accepted proposition. The consensus on this issue derives not from pure conceptual considerations, but from empirical evidence. Broad agreement on this point does not, of course, obviate the need for the AER to undertake its own estimation of asset betas for regulated energy networks, and to also consider the estimates of submitters.

36 The AER goes on from this starting point to conclude that the overall equity beta of the benchmark efficient entity must be less than 1.0. In order to reach this conclusion, the AER relies on two key claims, which do not withstand scrutiny:[18]

- Firstly, although the AER acknowledges that as financial leverage increases, overall systematic risk (i.e., the equity beta) increases, the AER suggests that the exact nature of this relationship cannot be known. Therefore, the AER argues, the high financial leverage usually observed with regulated energy networks does not necessarily result in high equity betas.
- Secondly, the AER (relying on advice from McKenzie and Partington) considers that "for energy network businesses the likelihood of bankruptcy as leverage increases is low (to the extent that the business is able to pass on borrowing costs to consumers)."

37 We deal with each of these points in turn below.

The exact relationship between leverage and systematic risk is unknown

38 The AER, drawing on advice from McKenzie and Partington, says that the exact relationship between leverage and systematic risk is unknown. Therefore, argues the AER, the high financial leverage usually observed with regulated energy networks does not necessarily result in high equity betas. The AER then concludes that the equity beta for the benchmark efficient entity lies below 1.0.

18 SA Power Networks Preliminary Decision, p.3-366.

39 The uncertainty over the relationship between leverage and systematic risk that the AER cites appears to be a reference to the variety of formulae that have emerged in the finance literature to describe precisely how systematic risk changes with leverage. It is true that there are a number of representations of this relationship, which differ according to what is assumed about, for instance, taxes and the systematic risk associated with debt (i.e., the debt beta).

40 The AER suggests that the relationship between leverage and systematic risk is so uncertain, and so complicated that it could not rule out the possibility that even with high leverage, the overall systematic risk of the benchmark efficient entity is low. To support this conclusion, the AER cites McKenzie and Partington, who state:[19]

> In short, there are so many twists and turns that the de-leveraging and re-levering exercise can take you to a range of different destinations depending on what you assume.

41 There are several problems with the AER's (and McKenzie's and Partington's) analysis on this point:

- Firstly, McKenzie's and Partington's assertion over the complexity of the relationship between leverage and systematic risk is overstated. As the AER itself has acknowledged (and is also pointed out by McKenzie and Partington) the various levering and de-levering formulae developed in the finance literature all indicate a strictly positive relationship between leverage and overall systematic risk. None suggest that systematic risk falls as leverage increases, and none suggest that systematic risk is independent of leverage.
- Secondly, neither the AER, nor McKenzie and Partington, demonstrate empirically that possible differences in the relationship between leverage and systematic risk result in such large differences in equity beta estimates as to justify the level of uncertainty implied by the AER. In other words, the problem is claimed to be severe without any evidence to support that proposition.
- Thirdly, having claimed that the exact relationship between leverage and systematic risk cannot be known, the AER goes on to assume that increasing leverage would not push the equity beta above 1.0. Evidently, the AER does not entertain the possibility that the unknown relationship between leverage and systematic risk might be such that increasing leverage would result in equity beta estimates well above 1.0. Hence, the AER's conclusion is effectively assumption driven rather than derived from any sound evidence.

42 Finally, whilst McKenzie and Partington do conclude that the precise relationship between leverage and systematic risk is unknown, they do not actually say that is

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19 McKenzie and Partington, Estimation of equity beta, April 2012, p. 11.

a reason to think that the equity beta of the benchmark efficient entity lies below 1.0. The AER appears to have drawn such an inference and, in doing so, has used McKenzie's and Partington's analysis out of context.

43 The thrust of McKenzie's and Partington's discussion on this issue was that there is disagreement in the finance literature over whether the relationship between leverage and systematic risk is linear or non-linear. McKenzie and Partington do not conclude from their discussion of these relationships (as the AER does) that high leverage does not necessarily imply high systematic risk.

44 Finally, the AER itself acknowledges that:[20]

> It is generally accepted that the benchmark efficient entity has higher financial risk than the market average firm. The key characteristic causing this higher financial risk is the relatively high financial leverage (gearing) for the benchmark efficient entity (60 per cent) relative to the market average firm (roughly 30 to 35 per cent). [Emphasis added]

45 The AER's conclusion that the high leverage does not necessarily imply high financial risk contradicts the AER's statement above.

Bankruptcy risk for regulated energy networks is low to the extent that network businesses can pass on borrowing costs to consumers

46 The AER suggests that for energy network businesses, the likelihood of bankruptcy as leverage increases is low, to the extent that the businesses are able to pass on borrowing costs to consumers. This is a fallacious argument for a number of reasons – including that leverage increases the systematic risk of equity even where there is zero chance of bankruptcy. For example, consider a $100 asset that will increase to $110 in an up market and fall to $90 in a down market. An unlevered equity investment in this asset will produce a return of either +10% or -10%, so the investor bears some risk. Now suppose that the asset is geared by borrowing $50 at 5%, with the other $50 contributed as (levered) equity. At the end of the year, the lenders are paid the $52.50 that they are due, so there is zero chance of default. The equity holders will receive a return of either 15% [(110-52.50)/50] or -25% [(90-52.50)/50]. Thus, leverage has the effect of widening the range of possible outcomes – it increases risk even when there is no chance of default. The reason that leverage must be taken into account when estimating equity betas is because leverage has the effect of widening the range of possible returns (as illustrated above), not simply because leverage might result in the firm's bankruptcy (as the AER appears to believe).

47 In any event:

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20 SA Power Networks Preliminary Decision, p. 3-366.

- The AER does not allow NSPs to pass on, in full, their actual borrowing costs to customers. The return on debt allowance set by the AER reflects the borrowing costs of the benchmark efficient entity, which may not reflect the borrowing costs of individual NSPs.
- Even if NSPs were able to pass on their borrowing costs to consumers, that alone would not be sufficient to protect them against bankruptcy. NSPs' ability to meet their debt obligations depends on the overall regulatory decision, not just one narrow component (i.e., the return on debt). For instance, a NSP's exposure to bankruptcy risk would increase if the AER were to set allowances that were insufficient to meet its operating requirements, even if the return on debt allowance matched perfectly the NSP's actual borrowing costs.[21]
- By the AER's reasoning, the ability to pass through borrowing costs is the mechanism by which a NSP can insulate itself from bankruptcy as leverage changes. This must mean that unregulated businesses that also have the ability to pass through borrowing costs to customers should be protected from the incremental risk of bankruptcy associated with gearing up. But this is evidently not the case.

  Economic theory says that in highly competitive markets firms will eventually pass all cost increases (including borrowing costs) through to customers. If such increases were not passed through, the firms would make subnormal profits and eventually be forced to exit the market. By the AER's reasoning, firms operating in competitive industries would be insulated from the risk of bankruptcy associated with gearing up because those borrowing costs could simply be passed through to customers. If that were true, firms in competitive industries could gear up to any level and remain insulated from bankruptcy risk. If firms could prevent bankruptcy risk from rising as leverage increases, they would have strong incentives to gear up to very high levels because doing so would push down their overall costs of capital. Yet, we do not observe such behaviour in competitive industries. The ability to pass on to customers borrowing costs alone does not protect firms from bankruptcy risk.

21 When determining cost allowances, the AER forecasts the costs that it considers would meet the opex and capex objectives under the National Electricity Rules. The AER's forecasts, like any forecasts of the future, are open to error. Hence, it is possible that the AER's forecasts fall short of the costs that satisfy the opex and capex criteria.

2.3.6 The AER's conclusions from its conceptual analysis of the equity beta in its 2009 WACC review

48 The AER has concluded from its conceptual analysis that the overall equity beta of the benchmark efficient entity is less than 1.0.

49 This is contrary to the view it took in its 2009 review of the weighted average cost of capital parameters. In its 2009 review, it concluded the following:[22]

> The AER maintains its position that due to the nature of the industry and the regulatory regime the asset beta of a benchmark efficient NSP is likely to be significantly less than the market asset beta.
>
> The AER also considers that due to the higher level of gearing the financial risk of a benchmark regulated electricity NSP is likely to be greater than a business with the market average level of gearing.
>
> However, these two effects (i.e. business risk and financial risk) may well act to offset each other, and the AER acknowledges that the net effect on the equity beta of a benchmark efficient NSP is unclear. Accordingly, the AER considers conceptual considerations do not give grounds to form a conclusive view on the equity beta of a benchmark efficient NSP. [Emphasis added]

50 The AER has provided no convincing reasons in its recent decisions why it has departed from the conclusion it reached in the 2009 review. We have seen no compelling analysis by the AER or its advisers that suggests such a departure is appropriate.

51 In our view, the effect of leverage on the equity beta of a benchmark efficient NSP should be assessed empirically, not conceptually.

2.3.7 Evidence on the equity betas of water and energy utilities from the US

52 Referring to estimates of equity beta for US water and energy utilities, presented by McKenzie and Partington, the AER concludes that the evidence:[23]

> …clearly demonstrate that the observed (or raw) equity betas for US utilities are well below the beta of the market (which is 1.0 by definition).

53 The estimates referred to by the AER are reported below in Table 1.

54 When reaching the conclusion that the US evidence points to equity betas of less than 1.0 for water and energy utilities, the AER compared the five equity beta estimates directly, even though it is clear that the leverage levels of the different industries vary considerably.

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22 AER, Electricity transmission and distribution network service providers: Review of the weighted average cost of capital (WACC) parameters – Final decision, May 2009, p.254.

23 SA Power Networks Preliminary Decision, p. 3-371.

55 Comparisons of this kind are very misleading because the equity betas reflect different quantities of systematic risk arising from the particular capital structures found in those industries. By comparing the equity betas of these industries, rather than their asset betas (i.e., with the effect of leverage removed) the AER made comparisons that were not on a like-with-like basis.

Table 1: Damodaran's raw and re-levered US equity beta estimates by industry (as at the end of 2011)

Industry	Observed (or raw) equity beta	Observed D/E (%)	Re-levered equity beta (D/E = 150%)
Water utility	0.66	81	0.91
Natural gas utility	0.66	67	0.99
Electric utility (east)	0.70	66	1.05
Electric utility (west)	0.75	85	1.02
Electric utility (central)	0.75	86	1.01

Source: Table 3-51, SA Power Networks Preliminary Decision, p.3-372.

56 The AER stated in its decision that:[24]

> We note there are views both for and against de-levering and re-levering equity beta estimates. On one hand, the resulting estimates will be more aligned with our benchmark. On the other hand however, the relationship between equity beta, financial leverage and financial risk is complex and uncertain. Making a specific adjustment for leverage imposes a certain assumed relationship that may not necessarily be correct in all circumstances. Therefore, we consider both raw and re-levered equity beta estimates where possible.

57 By stating that "there are views both for and against de-levering and re-levering equity beta estimates" the AER gives the false impression that there is ambivalence over the correct procedure for comparing equity betas. As we demonstrate below, it is well accepted in the academic finance literature, and amongst practitioners, that the correct approach is to express the betas using a common leverage assumption so as to avoid the comparisons being distorted by differences in leverage. This would involve:

- first de-levering the estimated equity betas to asset betas; and then
- re-levering the estimated asset betas using a common leverage assumption.

24 SA Power Networks, Preliminary Decision, p.3-397.

58 The AER suggests that such an approach would be inappropriate because "the relationship between equity beta, financial leverage and financial risk is complex and uncertain." This suggestion may be described as novel at best. There is no serious debate in the academic literature or amongst practitioners about the appropriate approach, and it is misleading and concerning that the AER conveys the impression that making comparisons of equity betas without adjusting for leverage differences is a legitimate approach to follow.

59 The AER states in its decision that:[25]

> We note that, in his 2015 report, Partington cautioned against re-levering equity beta estimates in general. However, he considered the problems associated with re-levering are compounded when re-levering international equity beta estimates to an Australian benchmark gearing level because of institutional differences across countries. Partington considered attempts to re-lever international equity beta estimates to some assumed level of leverage in Australia are likely to be unreliable. We consider this issue highlights the limitations of using international empirical estimates to estimate the equity beta for an Australian benchmark efficient entity.

60 This is an extraordinary statement because it is so at odds with accepted finance and regulatory practice. We could find no finance text that recommends the approach suggested by Partington. By contrast, all standard texts we consulted explain that equity betas increase as leverage increases. The corollary of this is that it is important to express equity betas on a common leverage basis before meaningful comparisons can be made.

61 For example, Damodaran (2001) states that:[26]

> Other things remaining equal, an increase in financial leverage will increase the beta of the equity in a firm. Intuitively, we would expect that the fixed interest payments on debt to [sic] result in high net income in good times and negative net income in bad times. Higher leverage increases the variance in net income and makes equity investment in the firm riskier…Intuitively, we expect that as leverage increases (as measured by the debt to equity ratio), equity investors bear increasing amounts of market risk in the firm, leading to higher betas.

62 Berk and DeMarzo (2014) state that:[27]

> When a firm changes its capital structure without changing its investments, its unlevered beta will remain unaltered. However, its equity beta will change to reflect the effect of the capital structure change on its risk. [The re-levering formula is displayed.] It shows that the firm's equity beta also increases with leverage.

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25 SA Power Networks, Preliminary Decision, pp.3-414 to 3-415

26 Damodaran, A. (2001), Corporate finance: Theory and practice, 2nd edition, John Wiley & Sons: New Jersey, p. 204.

27 Berk, J. and P. DeMarzo (2014), Corporate Finance, 3rd ed., Pearson, p. 493.

Conceptual analysis and the comparison of levered and unlevered equity betas

63 Partington and his co-authors provide an example similar to the one above:[28]

> …the debt-equity choice does amplify the spread of percentage returns. If the company is all-equity financed, a decline of $1,000 in the operating income reduces the return on the shares by 10 per cent. If the company issues risk-free debt with a fixed interest payment of $500 a year, then a decline of $1,000 in operating income reduces the return on the shares by 20 per cent. In other words, the effect of leverage is to double the amplitude of the swings in [the] shares. Whatever the beta of the company's shares before the refinancing, it would be twice as high afterwards.

64 Market practitioner texts are also clear about the need to re-lever equity betas to ensure that comparable quantities are being compared. For example, Copeland, Koller and Murrin of McKinsey Inc. consider a firm seeking to estimate the required return on equity for one if its divisions. They state that the:[29]

> …approach is to identify the publicly traded competitors most similar to the division. You can then look up the betas for those companies, which are presumed to have similar risk. But there is a catch. Beta is a measure of the systematic risk of the levered equity of the comparison companies, and these companies may employ leverage differently from that used by the division you are attempting to value. To get around this problem, you have to un-lever the betas of the comparison companies to obtain their business risk, then re-lever using the target capital structure of the division you are analysing.

65 When deriving Australian equity beta estimates the AER uses the so-called Brealey-Myers formulae to de-lever and then re-lever estimates. Neither the AER, nor its advisers McKenzie and Partington, are explicit about the main alternatives to the Brealey-Myers formulae. The reader is left with the impression that there is a large, unspecified number of alternative approaches. Whilst there are a number of alternative formulae, perhaps one of the most commonly-used alternatives is the so-called Hamada formula, which takes account of the interest tax shield. The Hamada de-levering formula is:

$$\beta_a = \frac{\beta_e}{1 + (1 - t)\frac{D}{E}}$$

where:

- β_a is the estimated asset beta
- β_e is the estimated equity beta
- t is the relevant corporate tax rate

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28 Brealey, R., S. Myers, G. Partington and D. Robinson (2000), *Principles of Corporate Finance*, McGraw Hill, p. 499.

29 Copeland, T., T. Koller and J. Murrin (2000), *Valuation: Measuring and managing the value of companies*, McKinsey & Company Inc., p. 308.

- $\frac{D}{E}$ is the debt-to-equity ratio

66 The Hamada re-levering formula is:

$$\beta_e = \beta_a \left(1 + (1-t)\frac{D}{E}\right).$$

67 Table 2 below compares the de-levered and then re-levered equity betas for the US utility betas from the Damodaran sample using the Brealey-Myers and Hamada formulae. Under both scenarios, a leverage assumption of 60% (consistent with the AER's assumption for the benchmark efficient entity) is employed. When using the Hamada de-levering formula we apply a US corporate tax rate of 40%, and when re-levering using the Hamada formula we apply the Australian corporate tax rate of 30%.[30]

68 As Table 2 shows, the difference in the re-levered equity beta estimates using the two different sets of formulae are negligible.

Table 2: Comparison of de-levered and re-levered betas for US utilities using Brealey-Myers and Hamada formulae

	(1) Betas de-levered and re-levered using Brealey-Myers formulae	(2) Betas de-levered and re-levered using Hamada formulae (using US corporate tax rate of 40%)	Difference (1) – (2)
Water utility	0.91	0.91	0.0005
Natural gas utility	0.99	0.96	0.0223
Electric utility (east)	1.05	1.03	0.0260
Electric utility (west)	1.02	1.02	-0.0040
Electric utility (central)	1.01	1.01	-0.0063

Source: Frontier calculations; KPMG corporate tax rates tables
http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages/corporate-tax-rates-table.aspx

69 We do not claim that either the Brealey-Myers or the Hamada formulae are the 'correct' formulae to use. Nor do we claim that this is an exhaustive comparison of different leverage formulae. However, this illustrative analysis does suggest that the AER's reasons for not presenting the US equity betas using a consistent gearing assumption are unfounded and overstated; the likely errors from choosing the 'wrong' relationship between leverage and systematic risk are very small indeed and likely to be very small relative to the error of assuming that the relationship is unknown.

30 US corporate tax rate obtained from the KPMG corporate tax rates tables.

70 If the AER was concerned that assuming the 'wrong' relationship would give rise to large errors, a sensible exercise would have been to try de-levering and then re-levering the betas using several different formulae found in the literature. This would have allowed the AER to assess if the scope for error from assuming the wrong relationship was likely to be significant. The AER did not do that. It has simply asserted that there is no value in adjusting for (quite substantial) differences in leverage between the industries because the relationship between leverage and systematic risk cannot be known. In doing so, the AER has drawn an erroneous conclusion from the evidence.

71 The analysis above demonstrates that once presented using a gearing assumption consistent with that adopted by the AER for the benchmark efficient entity, the estimated equity betas presented by McKenzie and Partington are very close to 1.0; for electricity utilities, the estimated equity betas surpass 1.0. That is, far away from being conceptual evidence to support an equity beta for the benchmark efficient firm below 1.0, this is empirical evidence that supports an equity beta for the benchmark firm very close to 1.0.

3 Disruptive technologies

3.1 AER analysis of disruptive technologies

72 In the SA Power Networks Preliminary Decision, the AER noted that a number of NSPs had submitted that the AER's conceptual analysis failed to take account of the recent emergence of disruptive technologies (e.g., solar panels, smart technology and power storage).

73 The AER recognised that:[31]

- disruptive technologies may be changing the way that consumers produce and consume electricity; and
- this could have an effect on how consumers make use of network infrastructure and may increase some risks faced by service providers.

74 The AER went on to say that:[32]

- it does not consider that the risk arising from disruptive technologies can be reasonably classified as systematic risk, noting that it considers that systematic risk is risk which affects the market as a whole (such as macroeconomic conditions and interest rate risk);
- if the risk arising from disruptive technologies is systematic in nature, it would be reflected in the AER's empirical equity beta estimates; and
- to the extent that the risks are non-systematic in nature, those risks would more appropriately be compensated through regulated cash flows (such as accelerated depreciation of assets).

3.2 The industry is in a state of change

75 It is clear that over recent years there has been rapid change in the energy industry, which has been driven by improvements in existing, and emergence of new technologies, and increased uptake of some of those technologies (e.g., solar panels). These changes have recently been noted by a number of AER representatives and industry analysts, including:

a. the AER's CEO, Michelle Groves, who warned that networks were potentially at risk of having a significant number of customers 'walk away' from the existing network.[33]

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31 SA Power Networks, Preliminary Decision, p.3-375.

32 SA Power Networks, Preliminary Decision, p.3-376.

33 "Perspectives on regulation in a changing environment", Speech by Ms Michelle Groves, CEO, Australian Energy Regulator, presented at the 2014 Annual Energy Users Association of Australia

b. The AER's former Acting Chairman, Andrew Reeves, who said in respect of grid disconnection that "It is very difficult to say what is going to happen beyond 10 years or so."[34]

c. The CSIRO, whose 2013 report, *Change and choice: The Future Grid Forum's analysis of Australia's potential electricity pathways to 2050*,[35] modelled the prospects of disconnection and concluded that disconnection was "projected to become viable from around 2030 to 2040 when independent power systems are expected to be able to match retail prices".[36]

d. Investment banking analysts such as UBS's Utility analyst David Leitch, who has contended that with the cost of battery storage coming down, "grid defection [is] closer and closer to being an economically sensible proposition."[37]

76 In our 2013 report for the AER, we noted that electricity distribution networks faced some competition from distributed generation, such as domestic solar PV. This could reduce the amount of power customers draw from the grid and, with hindsight, make much past network investment appear unnecessary. However, given the forms of regulation (building block) and control (revenue-cap) applying to distribution networks, networks were likely to be insulated from much of the downside risk of over-investing due to over-estimating demand. This is because networks would be able to rebalance their tariffs through higher fixed charges to ensure they recovered their sunk costs. At the time, we did not consider it realistic that distribution network customers would find it worthwhile to disconnect entirely from the grid, as they would still need to rely on the grid to provide non-daytime and back-up power and/or to export surplus power.

77 Since we wrote our 2013 report, a number of things have occurred:

Conference in Melbourne, 13 October 2014, available at: http://www.aer.gov.au/node/27697 (accessed 25 may 2015).

34 "Perspectives on regulation in a changing environment: What does 'success' look like in energy regulation?", Speech by Mr Andrew Reeves, Acting Chairman, Australian Energy Regulator, presented at the Energy Networks Association's 2014 Regulation Seminar in Brisbane, 6 August 2014 , available at: http://www.aer.gov.au/node/26828 (accessed 25 May 2015).

35 Available at: http://www.csiro.au/en/Research/EF/Areas/Electricity-grids-and-systems/Economic-modelling/Future-Grid-Forum (accessed 25 May 2015) (CSIRO Change and choice); also Graham, P, et al, *Modelling the Future Grid Forum scenarios*, CSIRO and ROAM Consulting, December 2013, available at: http://www.greencrossaustralia.org/media/9964676/modelling%20the%20future%20grid%20forum%20scenarios%20pdf.pdf (accessed 25 May 2015).

36 CSIRO, Change and choice, pp.8 and 62.

37 See ABC TV *7:30* broadcast, "Solar energy shift leaves taxpayers with unwanted power assets", 9 July 2014, available at: http://www.abc.net.au/7.30/content/2014/s4042832.htm (accessed 25 May 2015).

a. Reports have been published by reputable bodies such as the CSIRO (cited above) and the United States Rocky Mountains Institute[38] that have examined the scope for the falling cost of battery storage to make grid defection viable in the future.

b. Solar PV prices have continued to fall, such that the installed price of a 10 kW array (which is the type of size needed for a residential customer to disconnect from the grid) is now less than $15,000.[39]

c. Further, with the winding up of formerly generous feed-in tariffs (FiTs), customers may seek to secure better value for their surplus power than the low FiTs now on offer. In this context, storing surplus PV power generated during the day for later use and thereby avoiding paying retail tariffs for delivered electricity could be an attractive option.

d. The availability and cost of household battery storage units have improved. For example:

    i. ZEN Energy Systems in South Australia has marketed its 20 kWh 'Freedom PowerBank' battery since 2013[40] and is planning to release its 10 kWh 'Urban PowerBank' later this year.[41] It has been reported that ZEN has received enquiries from developers of housing estates to see whether batteries can be used to avoid connecting to the existing grid.[42]

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38 See RMI, *The Economics of Grid Defection*, February 2014, available at: http://www.rmi.org/electricity_grid_defection (accessed 25 May 2015); also RMI, *The Economics of Load Defection*, April 2015, available at: http://www.rmi.org/electricity_load_defection (accessed 25 May 2015).

39 See: http://www.solarchoice.net.au/blog/residential-solar-pv-system-prices-may-2015 (accessed 25 May 2015). Individual company websites offer even lower prices – for example, see: http://sunsaversolar.com/product-range/10-kw-solar-power-systems/ (accessed 25 May 2015).

40 See http://www.zenenergy.com.au/home/news/zen-freedom-powerbank/ and http://www.zenenergy.com.au/home/news/zen-installs-freedom-powerbank-energy-storage-unit-at-badminton-sa/ (both accessed 25 May 2015).

41 See: http://www.zenenergy.com.au/home/news/horizen-summer-2014-15/new-zen-urban-powerbank-coming-in-2015/ (accessed 25 May 2015).

42 See: http://indaily.com.au/news/2015/03/02/developers-want-housing-estates-off-grid/ (accessed 25 May 2015).

ii. US company, Tesla, has announced it will launch its 7kWh and 10kWh 'Powerwall' products in Australia in 2016.[43]

78 Given these recent developments, it does seem that since we wrote our 2013 report, the demand and competition risks faced by electricity networks from distributed generation and storage have increased, particularly at the margin.

79 In the short-to-medium term at least, this increased risk may manifest as lower growth prospects for electricity networks due to small-scale disconnection or peak-load shaving, especially to the extent tariff reform/restructuring leads to higher peak time of use or peak demand charging. This is unlikely to jeopardise the ability of NSP investors to continue to recover a return on and of initial investments in the network. However, it would reduce the trajectory of revenues investors could expect to earn and hence reduce the market value of NSPs.

80 However, over the longer term, if the relative costs of disruptive technologies fall sufficiently, large-scale bypass of the network could potentially occur. This would not only obviate the need for most augex and repex, but could potentially lead to stranding of sunk investments if the customer bases of the networks fall below the level that allows recovery of network costs and/or if rising unit costs (which result from an increasing number of customers leaving the grid) induce an acceleration of disconnections.

81 We cannot say if/when such bypass may occur. However, it is reasonable to say that, given recent developments, the likelihood of such an outcome is greater than it was in 2013 when we wrote our report to the AER. The point is, there is more uncertainty about the future of the industry now than there was even two years ago, and it is not unreasonable to think that investors would take this into account when allocating scarce capital to this industry.

3.3 Classification of risk from disruptive technologies as systematic risk

82 The AER noted in its Preliminary Decision for SA Power Networks that it does not consider that the risk arising from disruptive technologies can be reasonably classified as systematic risk. In our view, this is too strong a claim to make. As we noted in our 2013 report:

a. It is not possible to make reliable binary distinctions between different types of risk as being purely systematic or purely non-systematic; in practice no such bright lines exist.

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43 See: http://www.smh.com.au/environment/energy-smart/tesla-powerwall-home-battery-setting-a-new-standard-for-australian-energy-providers-20150509-ggxhd4.html (accessed 25 May 2015).

b. A more useful way of thinking about the risks that regulated businesses actually face is in terms of points along a spectrum between purely systematic and purely non-systematic risks. Most risks faced by businesses are probably partly systematic and partly non-systematic.

c. It is not feasible to assess every risk one at a time, analytically, to determine if and by how much it should be reflected in the rate of return.

83 The AER has not taken these points from our 2013 report on board. Instead, it has simply assumed that disruptive technologies cannot reasonably be classified as systematic because these technologies are unlikely to have significant effects outside the energy sector. In our view, this is too speculative an assumption to make.

84 The AER ignores the possibility that the underlying factors driving innovation in this industry may actually be fundamental factors that affect the entire economy, for example, macroeconomic changes, population growth placing increasing demands on natural resources, energy scarcity and government energy efficiency policies. This may mean that the risks to NSPs arising from disruptive technologies are at least partly systematic in nature, but it is impossible to say to what extent in a purely conceptual way.

3.4 The likelihood that such risks are reflected in the AER's empirical estimates of beta

85 The AER suggests that to the extent that these risks are systematic in nature, they would be reflected in the AER's empirical beta estimates. This seems very unlikely to us for several reasons:

a. Much of the Australian empirical evidence on equity betas (the evidence the AER uses to form its equity beta range) is derived using data over fairly long historical time horizons. Some estimates are based on data between 2000 and 2013, which is too long a period to isolate the effect of the fairly recent emergence of disruptive technologies.

b. The AER suggests that this problem is mitigated by the fact that it also considers "estimates measured over the last five years".[44] In fact, the estimates to which the AER refers are measured using data from July 2008 to July 2013.[45] As we noted above, there

44 SA Power Networks, Preliminary Decision, p.3-376.

45 Henry, Estimating β: An update, April 2014, Table 27, p.54.

have been many developments related to disruptive technologies since 2013. So, the beta estimates considered by the AER would not reflect very recent developments in the industry.

c. Even if the AER's five-year betas did cover the most recent period of history, the vast majority of the estimates considered by the AER are over much longer periods. So, even if the effect of disruptive technologies were incorporated in its five-year estimates, unless the AER gives prominent weight to the most current estimates, these effects would be unlikely to have any material impact on the AER's overall beta range, let alone its final point estimate.

d. With the exception of Spark Infrastructure, all of the comparators used in the AER's 'last five years' sample are diversified into activities other than the operation of electricity networks, which would be unaffected by disruptive technologies:

    i. APA Group has significant investments in gas pipelines, gas storage assets and electricity generation, but no investment in electricity networks.

    ii. DUET Group owns United Energy but also has significant investments in a gas distribution network, Multinet Gas, and in a transmission pipeline, the Dampier to Bunbury Natural Gas Pipeline.

    iii. Hastings Diversified Utilities Fund only owns one Australian electricity network, Electranet. The bulk of its investments in Australia are in other infrastructure including ports, airports, gas networks, water treatment and desalination plants, and road infrastructure.

    iv. Envestra (now Australian Gas Networks) has no investments in electricity networks.

    v. SP AusNet (now AusNet Services) does have significant investments in electricity networks, but also has significant interests in gas networks.

    In other words, the AER's sample of Australian businesses used for beta estimation purposes is not representative of networks that would be exposed to the risks imposed by the emergence of disruptive technologies. Hence, even if the AER were to update the beta estimates for 'last five years' sample, using the most recent market data, it would still be very unlikely that any effect of disruptive technologies on the systematic risk of NSPs would be reflected in those estimates.

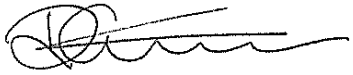
86 For these reasons, it is very difficult to see how the AER's beta estimates would represent properly any systematic risks associated with the disruptive technologies faced by NSPs.

3.5 Treatment of such risks through cash flows

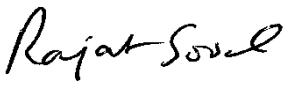
87 The AER suggests that to the extent that the risks are non-systematic in nature, those risks would be more appropriately compensated through regulated cash flows (such as the accelerated depreciation of assets). However, notwithstanding that the AER recognises that disruptive technologies may increase the risks faced by NSPs, the AER has neither attempted to estimate the effect of those risks, nor made any allowances for those risks, through the rate of return or through regulated cash flows.

4 Declaration

88 We confirm that we have made all the inquiries that we believe are desirable and appropriate and no matters of significance that we regard as relevant have, to our knowledge, been withheld from the Court.



Dinesh Kumareswaran



Rajat Sood

Appendix 1: Instructions

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Mr Dinesh Kumareswaran and Mr Rajat Sood
Frontier Economics

TERMS OF REFERENCE

Background

I refer to the 2013 report you have written for the AER that analyses risk in the context of setting the allowed rate of return for energy network businesses under the National Electricity Rules and the National Gas Rules. As you are aware, both cases the rate of return objective requires that the allowances take account the risk of a benchmark efficient firm.

Can you please review:

- the submissions and supporting material referred to in the submissions made by SA Power Networks concerning the risk arising from disruptive technologies; and
- the AER's approach to the analysis of risk and in particular the use of your report in the Explanatory Statement for the Rate of Return Guidelines, Final Determinations for the NSW distribution businesses and the Preliminary Determination for SA Power Networks.

Engagement

1. Provide your views on the AER's approach to the analysis of risk including the use to which it puts your report; and
2. Explain whether there are any significant developments since you prepared your 2013 report that should be taken into account and how that would affect the analysis presented in your report.

You are engaged by Jones Day on behalf of Jemena Electricity Networks, AGN, Ausnet Services, CitiPower, Energex, Ergon, Powercor, SA Power Networks, ActewAGL and United Energy.

JONES DAY

Compliance with the Code of Conduct for Expert Witnesses

Attached as **Annexure 1** is a copy of the Federal Court's Practice Note CM 7, entitled "Expert Witnesses in Proceedings in the Federal Court of Australia", which comprises the guidelines for expert witnesses in the Federal Court of Australia (Expert Witness Guidelines).

Please read and familiarise yourself with the Expert Witness Guidelines, and comply with them at all times over the course of your engagement.

In particular, your report prepared should contain a statement at the beginning of the report to the effect that the author of the report has read, understood and complied with the Expert Witness Guidelines.

Your report must also:

1. contain particulars of the training, study or experience by which the expert has acquired specialised knowledge;
2. identify the questions that the expert has been asked to address;
3. set out separately each of the factual findings or assumptions on which the expert's opinion is based;
4. set out each of the expert's opinions separately from the factual findings or assumptions;
5. set out the reasons for each of the expert's opinions; and
6. otherwise comply with the Expert Witness Guidelines.

The expert is also required to state that each of the expert's opinions is wholly or substantially based on the expert's specialised knowledge.

The declaration contained within the report should be that "[the expert] has made all the inquiries that [the expert] believes are desirable and appropriate and that no matters of significance that [the expert] regards as relevant have, to [the expert's] knowledge, been withheld from the report".

Please also attach a copy of these terms of reference to the report.

Kind regards

Nicolas Taylor

Nicolas Taylor
Partner

AUI-930019237v1

Appendix 2: CVs of authors

Dinesh Kumareswaran

Career

Jan 2009 to date	Consultant, Frontier Economics (London and Melbourne)
2007 – 2008	Senior Economist, New Zealand Commerce Commission
2003 – 2007	Economist, New Zealand Commerce Commission
2000 – 2003	Research Assistant, New Zealand Institute for the Study of Competition and Regulation

Education

2001 – 2003	MA Economics (Distinction), Victoria University of Wellington, New Zealand
1996 – 2001	BCA (Hons) Economics, Econometrics and Finance, Victoria University of Wellington, New Zealand

Selected experience in network regulation

Regulatory finance

- **TransGrid (2015) –** Advised the electricity transmission operator in NSW on the appropriateness of the Australian Energy Regulator's (AER's) proposed transitional arrangements before the full introduction of a trailing average approach to setting the cost of debt allowance for regulated networks. The AER recently revised its rate of return methodology. In doing so, the AER announced that it would adopt a trailing average approach to setting cost of debt allowances (similar to the approach used by Ofgem in Great Britain). However, the AER argued that it should phase this approach in to allow businesses sufficient time to align their debt management practices to the new methodology. Dinesh and Prof. Steven Gray authored a report on behalf of TransGrid explaining the circumstances in which such transitional arrangements would not be appropriate.

- **Commission de régulation de l'énergie (2014) –** Advised the French energy regulator, CRE, on the rate of return that should be applied when setting a third-party access price to nuclear electricity generation assets. In

2010, France introduced the Accès Régulé à l'Electricité Nucléaire Historique (ARENH) mechanism. Under the ARENH, CRE must determine a regulated tariff at which EDF (France's largest electricity utility) must supply a specified quantity of electricity produced by its nuclear power plants to alternative suppliers, if requested. The assignment involved estimating the cost of capital of EDF's nuclear generation assets, taking account of the asymmetric payoffs to EDF imposed by the regulatory arrangements.

- **Transpower New Zealand (2014)** – Supported Transpower New Zealand through a review by the Commerce Commission on the approach to estimating the cost of capital. In December 2010 the Commission published a detailed methodology ('Input Methodologies') for setting allowed rates of return for businesses regulated under Part 4 of the Commerce Act. Various aspects of the Input Methodologies were appealed in the High Court. The Major Electricity Users' Group appealed the Commission's practice of matching the allowed rate of return to the 75th percentile of the estimated WACC range. The Court did not uphold MEUG's appeal, but expressed doubt over the evidence base for the Commission's practice. At the request of a number of parties, the Commission commenced a review on the appropriate methodology for choosing a point estimate from its WACC range. Frontier produced a number of reports setting out the conceptual, empirical and regulatory evidence for choosing a WACC value above the midpoint of the range.

- **E-Control (2014)** – Estimated for the Austrian energy regulator the cost of capital for regulated energy networks.

- **Northern Powergrid (2014) –** Developed a submission on behalf of NPg in response to an Ofgem consultation on possible changes to its approach to estimating the cost of equity for the purposes of setting allowed returns. In November 2013, the UK's Competition Commission published its Preliminary Determination (PD) in relation to Northern Ireland Electricity's appeal against the Northern Ireland Authority for Utility Regulation's (NIAUR's) Final Determination on Northern Ireland's fifth Electricity Transmission and Distribution price controls. In its PD, the Commission departed significantly from the approach taken conventionally by UK regulators when determining allowed returns. The Commission is the UK's appeal body for regulatory decisions and therefore has a major role in influencing regulatory precedent. In light of the Commission's PD, Ofgem consulted on whether it should adapt its approach to setting allowed returns for electricity distribution networks as part of its RIIO ED1 price controls.

- **Australian Energy Regulator (2013) –** Advised the AER on the risks that Australian energy networks are exposed to and how these should be reflected

in the AER's determination of the cost of capital. This work fed into the AER's work on defining the "benchmark efficient entity", an important part of its regulatory framework and element of its rate of return guidelines.

- **Northern Ireland Electricity (2013 – 2014) –** Supported NIE in its appeal to the UK's Competition Commission against the Northern Ireland Authority for Utility Regulation's (NIAUR's) Final Determination on Northern Ireland's fifth Electricity Transmission and Distribution price controls, RP5, particularly on issues related to the cost of capital/allowed rate of return. This work has involved responding to the Commission's information requests, preparation of submissions to the Commission on behalf of NIE, and supporting NIE through hearings before the Commission. Amongst other things, Frontier Economics: (a) estimated the premium that equity-holders would expect in order to invest in NIE rather than regulated energy networks in Britain, based on the observed premium between traded bonds issued by NIE and energy networks in Britain; and (b) conducted an econometric analysis of NIE's bond yields to demonstrate that its borrowing costs had not been influenced adversely by the weak financial position of its parent in Ireland, ESB.

- **Northern Ireland Electricity (2011 – 2012) –** Helped NIE to develop analysis and submissions to NIAUR on NIE's cost of capital in relation to RP5.

- **Sasol Gas (2012) –** Estimated the beta for Sasol's gas pipeline networks in South Africa. Beta is an input into the Capital Asset Pricing Model, which the National Energy Regulator of South Africa uses to set allowed rates of return for regulated networks such as Sasol Gas.

- **National Grid (2012) –** Helped National Grid (the owner of the UK's electricity and gas transmission networks) to develop its submissions to Ofgem on cost of capital issues in relation to the RIIO-T1 price control review.

- **Energiekamer (2011)** – Provided the Dutch energy regulator, EK, a second opinion on the methodology it used to estimate the cost of capital of GTS, the gas transmission operator in the Netherland. Subsequently, advised EK on areas in which to improve its WACC methodology for future price control periods.

- **CRE (2011)** – Advised the French energy regulator on the cost of capital of regulated gas and electricity transmission and distribution networks in France. This assignment involved detailed modeling of WACC for each of these network types.

Appendix 2: CVs of authors

- **Transnet Pipelines (2009 – 2011)** – Advised Transnet, owner of a South African petroleum pipeline network, on best practice for estimating the cost of capital for regulatory purposes. Helped prepare the company's 2010/11, 2011/12 and 2012/13 tariff review applications to NERSA, the economic regulator of South Africa's energy sector.

- **Melbourne Water (2015) –** In preparation for the 2016 Victorian price review, Dinesh advised Melbourne Water on ways in which the rate of return methodology used by the Victorian regulator, the Essential Services Commission (ESC), could be improved, and the likely revenue impact of any methodological changes. At the 2013 price reset, the ESC indicated that it intended to review its rate of return methodology but subsequently had not done so. By comparison, most other Australian regulators have revised their methodologies significantly, in part due to recognition of the need to make their estimation approaches more resilient to the effects of global financial crises. A comparison of the methodologies used by different regulators in Australia suggests that the ESC's methodology is out of line with best regulatory practice. Dinesh's advice identified the areas for improvement and developed the economic arguments that would support the case for change.

- **ACT Industry Panel (2014) –** In June 2013 the Independent Competition and Regulatory Commission (ICRC) made a price direction in relation to water and sewerage services in the Australian Capital Territory (ACT). ACTEW Corporation Limited (ACTEW) sought a review of this price direction. The review process requires an Industry Panel (the Panel), to examine the price direction. The Panel has the power to confirm the original price direction made by the ICRC or substitute a new price direction for the original price direction. One of the issues that the Panel must consider, when conducting the review, is the appropriate WACC to use to calculate the return on capital in its building block model. The Panel undertook some work to estimate ACTEW's WACC and engaged Dinesh to provide a second opinion on this analysis.

- **State Water, New South Wales (2014) –** Drafted State Water's response to the ACCC's Draft Decision on the rate of return that State Water would be permitted to earn as part of the ACCC's decision on regulated charges in the Murray-Darling Basin. The response focused primarily on the need for consistency in treatment of the risk-free rate and the market risk premium, and the use of overseas water networks for the purposes of estimating State Water's beta.

- **State Water, New South Wales (2013) –** Helped State Water prepare its submission to the ACCC in relation to the regulated rate of return. In 2013,

the ACCC assumed responsibility for determining State Water's regulated charges under the Water Charge Infrastructure Rules 2010. We assessed the ACCC's likely approach to, and estimate of, WACC by reviewing in detail the approach to WACC used by the AER (a division of the ACCC). We then developed an independent estimate of State Water's WACC based on finance theory and regulatory precedent from other jurisdictions and sectors. State Water used our WACC estimate in its tariff application to the ACCC.

- **Sydney Catchment Authority (2013) –** Conducted, on behalf of SCA, an appraisal of proposals issued by IPART to alter its approach to estimating the cost of capital (particularly in the face of changing and uncertain financial market conditions). This assignment involved representing SCA at an IPART workshop on WACC, and assisting SCA with the drafting of subsequent submissions to IPART's draft WACC methodology.

- **Welsh Water (2013) –** Welsh Water has a unique capital structure amongst regulated water networks in the UK: it is funded mostly through debt, and through cash reserves from which distributions to customers through rebates may be made. It is essentially customer-owned so has no shareholders. As such, Welsh Water has no recourse to new equity finance. This means that preserving financial flexibility and a high credit rating is vital in order to ensure resilience against economic shocks since it cannot rely on equity injections to buffer against such shocks. Dinesh co-authored a report on behalf of Welsh Water that explained the value of such financial flexibility, and which argued that Ofwat should take this into account when setting its allowed rate of return at the 2014 price review.

- **Water UK (2012 – 2013) –** Developed for Water UK (the industry body that represents regulated water networks in the UK) a series of discussion pieces that on the future of financing of water networks in the UK. These discussion pieces were aimed at stimulating debate between stakeholders in the sector, and with policymakers, on the regulatory arrangements that need to be put in place ahead of PR14 to ensure the effective financeability of UK water networks going forward.

- **Sutton & East Surry Water (2009)** – Supported Sutton & East Surry Water during the 2009 price control review for the UK water industry by estimating the regulatory cost of capital for the business.

- **Institut Luxembourgeois de Régulation (2013) –** Estimated for the telecommunications regulator in Luxembourg, ILR, the cost of capital associated with the NGA telephony network owned by P&T Luxembourg, the incumbent fixed line operator. The assignment involved advising ILR on, among other things, methods (e.g. real options analysis) for quantifying

Appendix 2: CVs of authors

the risk premium to be applied to NGA networks. (The quantification of these risk premia was mandated by the European Commission in 2010.) ILR employed the cost of capital estimates in a bottom-up cost model to assess the cost-reflectiveness of P&T Luxembourg's tariffs.

- **Israel Ministry of Communications (2013) –** Estimated the WACC for Bezeq, the incumbent fixed line telephony operator in Israel. This WACC was used as an input into a LRIC model designed to calculate Bezeq's call termination charges.

- **Fair Trading Commission of Barbados (2011) –** Provided the Utility Regulation Department of the FTC an opinion on a PwC's estimates of Cable & Wireless's cost of capital. The FTC uses the cost of capital as an input into its LRIC model for setting access charges.

- **Telecommunication Authority of Trinidad & Tobago (2010) –** Advised the TATT on the cost of capital of regulated fixed line, mobile, fixed-mobile and cable TV concessionaires operating in Trinidad & Tobago.

- **Utilities Regulation and Competition Authority (2009)** – Advised the Bahamian utilities regulator on the appropriate cost of capital for fixed/mobile telephony and cable television companies.

- **CBH Group (2015) –** Developed, on behalf of CBH (a major Australian grain producer and access seeker to rail infrastructure in Western Australia) and its legal counsel, a submission to the Economic Regulation Authority (ERA) of Western Australia on the regulator's approach to estimating WACC. The submission focused on, amongst other issues, the ERA's approach to estimating the market risk premium, the estimation approach to beta, and the way in which the WACC ought to be used within the negotiate-arbitrate arrangements within the rail access regime.

- **Brockman Mining Australia (2013, 2015) –** Advised Brockman, a potential access seeker to rail infrastructure in Western Australia, on its submission to the Economic Regulation Authority (ERA) of Western Australia in relation to the ERA's approach to WACC under the Railways (Access) Code 2000. Subsequently, the ERA released a Revised Draft Decision on its proposed WACC methodology. Dinesh was engaged again by Brockman to help develop its submission to the ERA on the Revised Draft Decision. The submissions focused on the appropriateness of the beta estimates proposed by the ERA, the methodology used to estimate the market risk premium (and consistency between the methodologies used by the ERA in different sectors), the appropriateness of the ERA's credit rating

assumption for the benchmark efficient entity (which affects the cost of debt allowance under the ERA's methodology).

- **National Ports Authority of South Africa (2011)** – Reviewed the methodology underpinning NPA's cost of capital calculations relating to its 2011/12 tariff application to the South African Ports Regulator. Subsequently assisted NPA to respond to stakeholder submissions to the Ports Regulator on NPA's cost of capital proposals.

- **Office of Transport Regulation, NMa (2011) –** Advised the regulator in the Netherlands on the Dutch Pilotage's cost of capital. Dutch Pilotage is a price-controlled monopoly provider of harbour pilot services. NMa's first determination on the cost of capital for this operator was annulled by the Dutch courts on grounds that NMa had not motivated properly certain aspects of its methodology. The project involved addressing these points of methodology, one of which involved determining an approach to calculate an appropriate allowance for non-systematic risk.

Network utility regulation

- **Ergon Energy (2015) –** Led the Frontier team engaged by Ergon Energy's legal counsel to review the AER's first application of benchmarking analysis to set cost allowances for regulated electricity distribution network service providers (DNSPs) in Australia. Frontier demonstrated, using econometric modelling, that the AER had failed to account for large differences in operating circumstances between Ergon Energy and other DNSPs. These circumstances included: the sparsity of Ergon Energy's service area; the provision of significant subtransmission services (which are not provided by many other DNSPs in Australia); and harsh climate. Frontier illustrated how the AER could account for these factors either directly within its benchmarking model, or through 'special factor adjustments' outside the benchmarking model. Frontier provided a survey of how European regulators apply special factor adjustments and recommended that the AER consider similar approaches when setting allowances for DNSPs.

- **Networks NSW (2014-15) –** Managed a team that carried out a major review, on behalf of three electricity distribution networks in New South Wales (NSW), of the first ever economic benchmarking analysis undertaken by the Australian Energy Regulator (AER). The team brought to bear its extensive experience of undertaking benchmarking analysis in Europe when examining: the appropriateness of including networks from overseas jurisdictions in the Australian benchmarking exercise; the appropriateness of the econometrics techniques employed; the robustness and consistency of the data used by the AER; the extent to which the AER had accounted for

Appendix 2: CVs of authors

large differences between the operating circumstances of the networks; and the way in which the AER applied the results from its benchmarking model to determine cost allowances for the regulated networks. Frontier proposed several ways in which the AER could improve its analysis in future.

- **CitiPower and Powercor Australia (2014-15)**. Dinesh recently led a team that developed forecasts of labour cost escalation rates for two distribution networks in Victoria, Australia. Frontier developed a methodology for forecasting future labour costs using historical enterprise (collective) bargaining agreements which, by definition, are more reflective of distributors' negotiated labour costs than broad labour cost indices that have historically been used by the Australian Energy Regulator (AER). Frontier showed successfully, using official Census data, that the labour cost indices used by the AER represent very poorly the labour costs of electricity networks. Instead, these indices capture the labour costs of a wide range of unrelated industries, including water networks, waste services firms, electricity generators and retailers. We also showed that the labour requirements of these unrelated industries correspond very poorly to the labour mix typically found within electricity distribution networks. Finally, Frontier showed that its proposed approach to determining labour cost escalation rates created very strong incentives for networks to improve efficiency over time.

- **IPART (2014) –** Advised the NSW regulator, IPART, on the regulatory treatment of leased assets. Sydney Water, a water business regulated by IPART, was advised by the NSW Auditor General that it should treat a number of its fixed leased assets as finance leases rather than operating leases. Unlike operating leases, finance leases grant the lessor the risks and benefits of ownership. At present IPART treats all leases held by regulated businesses as operating leases. In light of the Auditor General's opinion, Sydney Water sought clarification from IPART on how it would treat extant and future finance leases within the regulatory framework. Frontier advised IPART on different options for taking account of finance leases when setting allowed revenues. Our advice covered issues such as the valuation of assets under finance leases, the return on these assets, regulatory depreciation, and the internally-consistent treatment of lease-related cash flows.

- **SA Power Networks (2014) –** Produced an expert witness statement that set out forecasts of labour cost escalation rates applicable to SA Power Networks SA Power Networks used this advice to inform its proposal to the AER on expenditure forecasts, as part of the regulatory process to set the business's revenue allowances over the period 2015-2020.

- **Water Services Association of Australia (2014) –** Worked as part of a Frontier team advising WSAA on best practice regulation of urban water businesses in Australia. This involved surveying a wide range of approaches to economic regulation (e.g. incentive regulation using a building blocks framework, benchmarking and yardstick competition, and price monitoring), in a range of jurisdictions, and drawing lessons from these experiences to improve the way urban water businesses are regulated in Australia.

- **Vodafone New Zealand, Telecom New Zealand and CallPlus (2014)** – The New Zealand Commerce Commission is required, under the Telecommunications Act 2001, forward-looking prices for access to an Unbundled Copper Local Loop (UCLL) service using a Total Service Long-run Incremental Cost (TSLRIC) model. We prepared, on behalf of three key access seekers, Vodafone, Telecom and CallPlus, a submission to the Commission on the appropriate methodology for building a TSLRIC model consistent with the overarching objectives of the legislation in New Zealand. Our recommendations covered issues such as the use of bottom-up vs. top-down models, the appropriate level of network optimisation, asset valuation methodologies, regulatory depreciation and the cost of capital.

- **Electricity Networks Association of New Zealand (2013-14)** – Advised the ENA on techniques for forecasting the costs of electricity distribution businesses (EDBs) in New Zealand for the purposes of setting allowances under a Default Price-quality Price-path (DPP) regime. This assignment involved two key tasks: First, we advised on possible top-down models for forecasting costs that are independent of the forecasts that EDBs must provide the Commerce Commission under New Zealand's regulatory information disclosure regime. Second, we advised on ways in which EDBs' forecasts may be used by the Commission when setting allowances under a DPP framework. As part of this task, we explored the possible application of a menu regulation scheme, such as the Information Quality Incentive mechanism used by Ofgem and Ofwat in Great Britain.

- **AGL Energy, Origin Energy and Energy Australia (2013-14) –** Undertook on behalf of the retailers a critical review of current distribution network service provider (DNSP) credit support scheme operating in the National Electricity Market (NEM), and provided recommendations on possible improvements. Australia's National Electricity Rules make provision for electricity retailers to provide credit support to DNSPs to cover losses in the event that retailers default. In 2012 the credit support arrangements were revised in such a way that a greater burden fell on the largest retailers, who also tend to be the least risky businesses. We examined the efficiency consequences of this change, and proposed amendments to

Appendix 2: CVs of authors

the scheme aimed at improving the efficiency outcomes of the arrangements.

- **Vodafone UK (2013)** – Provided advice to Vodafone on Ofcom's proposed methodology for calculating Annual License Fees (ALFs) for radio spectrum. Ofcom proposed to set ALFs equal to the annuitized value (over 20 years) of observed auction-determined prices for 900MHz and 1800MHz spectrum. We reviewed the reasonableness of Ofcom's annuity calculations, including its discount rate assumptions, and made recommendations on possible improvements to its methodology.

- **National Ports Authority of South Africa (2013)** – Authored a report to the NPA on the principles of incentive regulation, and the economic rationale for moving away from the extant rate of return framework under which the NPA is currently regulated. The report also advised on: different approaches for the valuation of the regulatory asset base (including Depreciated Optimised Replacement Cost valuation, Historic Cost valuation and Market valuation); options for rolling forward the initial RAB value; and on the principles of Financial Capital Maintenance and Operating Capital Maintenance.

- **Brockman Mining Australia (2013)** – Reviewed and helped draft Brockman's submission to the Economic Regulation Authority (ERA) of Western Australia in relation to the ERA's determination on 'floor and ceiling' costs submitted by The Pilbara Infrastructure Pty Ltd (TPI). Brockman sought access to TPI's rail infrastructure in Western Australia. Under certain provisions of the Railways (Access) Code 2000, the ERA must determine TPI's the floor and ceiling price of access before TPI beings commercial negotiations with Brockman on the terms of access.

- **National Ports Authority of South Africa (2011)** – Managed a team that advised NPA on preparing a response to a cost benchmarking study produced by the Ports Regulator of South Africa.

- **National Ports Authority of South Africa (2010)** – Advised NPA on issues related the regulated cost of capital, and the treatment of working capital and opex in relation to its 2010/11 tariff review with the Ports Regulator of South Africa. Drafted a methodology for setting NPA's regulated port tariffs, which covered regulatory practice on issues such as RAB valuation, cost of capital and depreciation.

- **Centrica (2009)** – Advised on the implications of smart metering for asset stranding risk and cost of capital.

- **Sutton & East Surry Water (2009)** – Advised Sutton & East Surrey Water (SESW) on a regulatory appeal to the Competition Commission over an Ofwat determination to disallow a claim for an interim adjustment to price limits; assisted SESW on reviewing and responding to certain aspects of Ofwat's Draft Determination on Price Limits for 2010 to 2015.

- **New Zealand Dairy Markets (2008)** – Prepared the New Zealand Commerce Commission's submission to the Ministry of Agriculture and Forestry on the review of provisions under the Raw Milk Regulations.

Appendix 2: CVs of authors

Rajat Sood

Career

1999 to present	Consultant, Frontier Economics
1998 to 1999	Consultant, London Economics
1997 to 1998	Articled clerk, then solicitor, Freehill, Hollingdale & Page

Education

1990 – 1995	LLB (honours), University of Melbourne
1990 – 1993	B.Com (first class honours), University of Melbourne

Rajat maintains an Australian legal practising certificate and is a Barrister and Solicitor of the Supreme Court of Victoria.

Selected experience in network regulation

Electricity network regulation

- **Ergon Energy network pricing:** Rajat is advising Ergon Energy on the development of appropriate network pricing principles and the transition of its existing tariffs to a new structure that is more consistent with those principles. His role included the preparation of a Tariff Implementation Report for Ergon and overseeing the modelling of potential revised tariff structures (2013 – ongoing).

- **Metering competition:** Rajat advised the AEMC on the implications of opening up of metering activities to competition for the competitiveness of retail electricity supply and the supply of energy services. As part of this work, Rajat presented to the AEMC Commissioners and spoke at an AEMC Public Forum (2014).

- **Transpower New Zealand:** Rajat was part of the Frontier team supporting Transpower through a review by the Commerce Commission on the approach to estimating the cost of capital. This included preparing a number of reports setting out the conceptual, empirical and regulatory evidence for choosing a WACC value above the midpoint of the estimated WACC range (2014).

- **New Zealand Default Price-Quality Path distribution reset:** Rajat was part of the Frontier team advising the Electricity Networks Association of New Zealand on:
  - the formulation and testing of econometric models that identify and quantify the drivers of network capital and operating expenditure for the Electricity Distribution Businesses' (EDBs') default price-quality path (DPP) resets; and
  - potential approaches for making use of EDBs' Asset Management Plan forecasts in their DPP resets. This included the scope for adopting innovative 'menu regulation' in New Zealand (2013-2014).

- **SP AusNet controllable opex:** Rajat advised the AER on the appropriateness of the application of a single base year approach to forecasting SP AusNet's total controllable operating expenditure, including SP AusNet's 'asset works' opex (2013-2014).

- **Jemena distribution pricing Rule change:** Rajat prepared a report for Jemena Electricity Networks discussing the pros and cons of alternative means of the recovering distribution network businesses' sunk costs not recovered through charges reflecting long run marginal cost. His report compared and contrasted Ramsey pricing and postage stamp pricing as well as equity-based pricing approaches (2013).

- **AER Expenditure Incentives Guidelines:** Rajat advised the AER on the development of network expenditure incentive guidelines as part of the AER's 'Better Regulation' work program (2013).

- **AER cost of capital:** Rajat helped advise the AER on the nature and extent of risks to which Australian energy networks are exposed. This work fed into the AER's work on defining the "benchmark efficient entity", an important part of its regulatory framework and element of its 2013 Rate of Return Guidelines as part of the AER's 'Better Regulation' work program (2013).

- **AER RIT-D:** Rajat advised the AER on the development of the Regulatory Investment Test for Distribution (RIT-D) and the RIT-D Application Guidelines. The RIT-D is an economic cost-benefit test for assessing distribution network augmentations, which requires augmentation options to be compared against DG and demand-side response options (2013).

- **New Zealand Transmission Pricing Methodology:** Rajat prepared a report for Mighty River Power reviewing the New Zealand Electricity Authority's proposed Transmission Pricing Methodology. The Authority

Appendix 2: CVs of authors

proposed introducing two new transmission charges – a 'beneficiaries-pay charge' and a 'residual charge' (2012-13).

- **Power of Choice Review:** Rajat provided advice to the AEMC on amending the distribution pricing principles in the National Electricity Rules to provide better guidance for businesses to develop efficient and flexible tariff structures that support demand-side participation (2012).

- **Smart meter rollout:** Rajat advised the Victorian Department of Treasury and Finance on the regulatory consequences of halting, suspending or modifying the rollout of smart meters in Victoria. His advice covered issues such as the potential avenues for changing the rollout, cost recovery implications, timing implications and the need to maintain good regulatory practice (2012).

- **Connection Initiatives project:** Rajat assisted the Australian Energy Market Operator on the development of policies for (i) the management of multiple connection applications and (ii) cost-sharing arrangements at terminal station hubs. His advice helped the AEMO to develop connection arrangements that promote economic efficiency, especially in an environment of increasing connection applications, particularly from wind farms. In doing so, he helped AEMO to meet its statutory objectives (2011).

- **Basslink conversion:** Rajat was part of the Frontier team investigating the benefits and costs of converting the Basslink market network service into a prescribed service, on behalf of Hydro Tasmania. This work included calculating the market benefits of Basslink and determining the potential value of the regulated asset base that would apply to Basslink should it be converted. Rajat also advised Hydro Tasmania on the potential Rule changes that may be required to preserve the System Protection Scheme, which helps to maintain the non-firm transfer capacity of Basslink (2011).

- **United Energy Distribution operating expenditure:** As part of the Victorian electricity distribution determination process, the AER examined United Energy Distribution's (UED's) operating expenditure forecasts. UED was implementing a new business model in which it outsourced fewer services and undertook more activities in-house in order to improve the quality and flexibility of its service performance. Frontier was asked to advise Johnson Winter & Slattery about the meaning and interpretation of clause 6.5.6(c) of the National Electricity Rules in relation to how it applied to UED's proposed operational expenditures under its new business model. The AER quoted approvingly from Frontier's report in its Final Determination (2010).

- **Transmission Frameworks Review:** Rajat provided preliminary advice to the Northern Generators in relation to formulating their submission to the AEMC's Transmission Frameworks Review Issues Paper (2010).

- **AER RIT-T drafting:** Rajat advised the AER on the appropriate drafting of the proposed Regulatory Investment Test for Transmission (RIT-T), which replaced the Regulatory Test, and the accompanying RIT-T Application Guidelines (2009 – 2010).

- **Climate Change impacts on transmission:** Rajat assisted a group of NEM participants on the appropriate response to the AEMC's recommended changes to transmission pricing and congestion management in light of climate change policies (2009 – 2010).

- **NERGs advice:** Rajat advised the AER on the economic efficiency and regulatory implications of the AEMC's proposed options for a new regulatory regime for dealing with new generator-serving transmission network extensions (NERGs) (2009).

- **Victorian AMI audit:** Rajat advised the Victorian Auditor-General's Office (VAGO) on VAGO's performance audit of the Victorian Government's decision to mandatorily roll-out smart meters across Victoria from 2009. Frontier's analysis fed into VAGO's report, which was tabled in the Victorian parliament in November 2009 (2009).

- **NZ Transmission pricing:** Rajat prepared a report for the New Zealand Electricity Commission (now the Electricity Authority) on the economics of transmission pricing, international experience and potential 'high-level' options for consideration as part of the Commission's Transmission Pricing Review. Our report is available on the Electricity Authority website (2009).

- **Prescribed and negotiated transmission services:** Rajat advised VENCorp on the interpretation and application of those aspects of the National Electricity Rules that deal with the delineation between regulated (or 'prescribed') and unregulated (or 'negotiated') transmission services (2009).

- **Multi-sector utilities:** Rajat was primary author of a report for the New Zealand Commerce Commission on international approaches to the regulation of multi-sector utilities (2008).

- **Inter-regional transmission charging:** Rajat drafted a report for the AEMC advising on the pros and cons of different approaches to inter-regional transmission charging in the NEM (2008).

Appendix 2: CVs of authors

- **EnergyAustralia Rule Change:** Rajat assisted the AEMC with the analysis of a proposed Rule change from EnergyAustralia concerning the appropriate regulatory treatment of EnergyAustralia's transmission assets. This included preparing a draft of the AEMC's Draft Decision and the Rule change itself (2008).

- **Regulatory Test amalgamation:** Rajat advised the AEMC on the merits of various options for amalgamating the "reliability" and "market benefit" criteria of the Regulatory Test, pursuant to a direction from the Ministerial Council on Energy (MCE). Also advised on aspects of the new "RIT-T" to replace the Regulatory Test (2007-08).

- **Regulatory Test Guidelines:** On behalf of the AER, Rajat developed guidelines for the application of the Regulatory Test by network service providers, as required by a Rule change instituted by the AEMC. Also advised the AER on appropriate revisions to the Regulatory Test following the Rule change (2007).

- **Real options:** Frontier and SFG Consulting is advising the Victorian transmission planner, VENCorp, on how a real options analysis can be used to guide investment decisions in easements in advance of developing network augmentations (2007).

- **Transmission pricing:** Rajat advised the AEMC on its review of transmission pricing in the NEM. This included the preparation of a scoping paper for the review, Working Papers explaining various technical topics, an Issues Paper for stakeholder consultation and leading the development of the Commission's Rule Change Proposal, Draft Determination and Final Determination (2006).

- **Revenue Rule Proposal:** Rajat advised the AEMC on a range of matters relating to the AEMC's Rule Change proposal on the regulation of transmission revenues in the NEM. Specifically, this included advice on the appropriate treatment for network asset depreciation, large 'contingent projects' and transmission incentives (2005-06).

- **ACCC metering:** Analysis of the costs and benefits of maintaining a distributor monopoly over small customer electricity metering services for the ACCC (2004).

- **NZ Grid Investment Test:** Development of a draft "Grid Investment Test" (GIT) for the New Zealand Electricity Commission. The GIT is a cost-benefit test for transmission investment and will be applied to significant economic and reliability transmission investments by Transpower.

Frontier made recommendations on the types of costs and benefits to be included in the GIT assessment, such as generation cost savings, reliability benefits and environmental benefits and taxes – available here (2004).

- **NZ Transmission pricing methodology:** Development of a transmission pricing methodology on behalf of the New Zealand Electricity Commission to apply to the recovery of existing and new investment costs by Transpower – available here. The Board of the Commission used Frontier's work as a basis for consultation with stakeholders on an appropriate pricing methodology (2004).

- **Regulatory Test competition benefits:** Theoretical and empirical report for the ACCC on amendments to the Regulatory Test for transmission augmentations to allow for the inclusion of competition benefits in the assessment of transmission investments. Frontier modelled competition benefits from an actual transmission investment in the National Electricity Market (NEM). Frontier's report is on the AER website here (2003).

- **Transmission policy paper:** On behalf of the NSW jurisdiction, drafted a policy discussion paper for the NEM Ministers' Forum on the role and governance of networks in the NEM examining the economic characteristics of networks and governance models for network service provider incentives (2002).

- **SNI appeal:** Key member of the NSW Minister for Energy's team on the South Australia- New South Wales Interconnector appeal, addressing issues such as:
  - the interpretation and application of the ACCC's Regulatory Test and
  - network governance and revenue regulation, including treatment of capital expenditures and asset optimisation (2001-02).

Gas network regulation

- **Transmission depreciation methodology:** Rajat advised the Australian Energy Regulator on the implications of APA GasNet's proposed approach to depreciation of their Victorian gas transmission assets as part of APA GasNet's 2013-17 access arrangement. In particular, Rajat advised the AER on whether APA GasNet's proposed approach was likely to lead to reference tariffs that would vary, over time, in a way that promotes efficient growth in the market for reference services (2012-13).

- **Services contract buyout:** Rajat advised the Australian Energy Regulator on the appropriate regulatory treatment of the costs incurred by APT

Appendix 2: CVs of authors

Petroleum Pipelines Ltd in the buyout of a contract for services from Agility. Our advice was cited by the AER in its Final Decision (2012).

- **Multinet forecasting efficient operating expenditure:** Rajat helped prepare a report for Multinet Gas in Victoria challenging the AER's approach to forecasting the distributor's level of efficient operational expenditure in the 2013-17 arrangement period. Our report was submitted as part of the distributor's response to the AER's Draft Decision (2012).

- **WA gas access arrangement revisions:** Rajat provided economic advice to the Western Australian Economic Regulation Authority on revisions to the Access Arrangements of the Goldfields Gas Pipeline and the Mid-West and South-West Gas Distribution Systems (2009-2011).

- **VENCorp real options application:** With SFG Consulting, Rajat advised VENCorp on the application of a real options analysis framework to the acquisition of easements for potential future gas pipelines (2007-2009).

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