Jemena Gas Networks (NSW) Ltd

2015-20 Access Arrangement Information

Appendix 9.3

Return on equity proposal

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GLOSSARY

AA	Access Arrangement
AEMC	Australian Energy Market Commission
DDM	Dividend Discount Model
FFM	French Three-factor Model
JGN	Jemena Gas Networks
MRP	Market Risk Premium
NER	National Electricity Rules
NGL	National Gas Law
NGO	National Gas Objective
NGR	National Gas Rules
RPP	revenue and pricing principles
SL CAPM	Sharpe-Lintner CAPM

1. SUMMARY

Return on equity should promote the rate of return objective and have regard to relevant models and other evidence

1. The National Gas Rules (**NGR**) require that the return on equity[1] for an access arrangement (**AA**) period be estimated such that it contributes to the achievement of the rate of return objective, having regard to prevailing conditions in the market for equity funds. The NGR also require that, in determining the allowed rate of return (and therefore, the return on equity), regard be had to (among other things) relevant estimation methods, financial models, market data and other evidence.

Return on equity should promote efficient investment—and our proposal does this

2. Jemena Gas Networks (**JGN**) proposes estimating the return on equity for the next AA period using an approach that has regard to, and properly considers all relevant evidence, models and market data.

3. Our approach is designed to produce outcomes that are consistent with the rate of return objective, and help achieve the National Gas Objective (**NGO**). Our central objective is to estimate the return on equity that reflects prevailing market conditions and is commensurate with the efficient financing costs of a benchmark entity facing a similar degree of risk as that which applies to JGN in respect of the provision of reference services.

4. Thus, our proposed approach is designed to promote efficient investment in the infrastructure that provides reference services for the long-term interests of consumers.

Our proposed approach estimates the return on equity using a range of relevant models and other evidence

5. JGN's proposed approach involves the following steps:

    1. **identify** relevant return on equity models
    2. **identify** relevant evidence that may be used to estimate parameters within each of the relevant return on equity models
    3. **estimate** model parameters for each relevant return on equity model, based on relevant market data and other evidence
    4. separately **estimate** the required return on equity using each of the relevant models
    5. **synthesise** model results to derive an estimate of the required return on equity for JGN.

Applying this approach gives a return on equity of 10.71 per cent

6. Applying this approach based on current market data and other relevant evidence results in an estimate of the return on equity for the next AA period of 10.71 per cent.

7. JGN's proposed estimate of the return on equity reflects a weighting of the results of four relevant return on equity models—the Sharpe-Lintner CAPM (**SL CAPM**), the Black CAPM, the Fama-French three-factor model

[1] In this appendix, and in the supporting expert evidence, the terms 'return on equity' and 'cost of equity' are used interchangeably.

(**FFM**) and the dividend discount model (**DDM**).[2] The proposed weighting is based on the recommendation of Professor Stephen Gray and Dr Jason Hall.[3]

8. The results of each model, and the weighting assigned to each one (as recommended by Professor Gray and Dr Hall), are set out in Table 1–1. Professor Gray and Dr Hall's recommended return on equity estimate is slightly higher than the Black CAPM result, and lower than the results of the FFM and the DDM. The result produced by the SL CAPM is significantly lower than the result from each of the other models, and therefore appears as somewhat of an outlier estimate.

Table 1–1: Return on equity estimates

Model	Return on equity estimate	Weighting
Sharpe-Lintner CAPM	10.01%	12.5%
Black CAPM	10.62%	25.0%
Fama-French three-factor model	10.87%	37.5%
Dividend discount model	10.92%	25.0%
Weighted average	**10.71%**	**100.0%**

Source: SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

Our proposed approach overcomes concerns with the AER foundation model approach

9. Our proposed approach is superior to the 'foundation model approach' set out in the AER's rate of return guideline for several reasons, including that our proposed:

- *approach* has regard to all relevant models and evidence, and uses each piece of material for its proper purpose
- *approach* recognises that each of the relevant return on equity models have different strengths and weaknesses, and therefore gives real weight to each one commensurate with their relative strengths and weaknesses, and
- *estimates* of model parameters reflect the best and most recent market evidence.

10. JGN considers it unreasonable to place 100 per cent weight on the SL CAPM when estimating the return on equity as required under the AER's foundation model approach. It is widely acknowledged that the SL CAPM has significant limitations and performs poorly against empirical data. Other models (including the Black CAPM and FFM) were developed specifically to overcome these limitations, and therefore these other models should be given at least as much weight, if not more.

Minimum amendments to the foundation model approach gives a return on equity of 10.71 per cent

11. However, in the event that the AER uses its foundation model approach to estimate a return on equity for JGN, then there are certain minimum amendments needed for this approach to produce a return on equity that promotes the rate of return objective.

12. With these minimum amendments, the foundation model approach also produces a return on equity estimate for the next AA period of 10.71 per cent.

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[2] The Black CAPM is used in rate of return regulation in other jurisdictions, including the US where it is known as the 'empirical CAPM'.

[3] SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

2. RELEVANT REQUIREMENTS OF THE RULES AND LAW IN RELATION TO THE RETURN ON EQUITY

2.1 RULE REQUIREMENTS

Return on equity key to both the return on capital and tax building blocks

13. Rule 76 of the NGR sets out how to determine total revenue for each regulatory year of the AA period using the building block approach. The building block relevant to this chapter is the building block that provides for a return on the projected capital base for the year. The return on the projected capital base is calculated by applying the allowed rate of return to the projected value of the capital base.

14. The allowed rate of return is the forecast of the cost of funds a network business requires to attract investment in the network. To estimate this cost, consideration is given to the cost of the two sources of funds for investments—equity and debt. This appendix is concerned with the return on equity.

15. Related to the rate of return building block is the building block which provides for the estimated cost of corporate income tax for the year. This is because a deduction is made from the building block allowance for corporate income tax to recognise that part of the value that domestic shareholders receive from equity investments takes the form of imputation credits that may be issued by businesses. Therefore, the value that shareholders are assumed to place on imputation credits has implications for what is considered to be the overall return required by equity shareholders to attract equity investment.

Rate of return should promote efficient investment

16. A good estimate of the rate of return is necessary to promote efficient investment in infrastructure for the long term interests of consumers. As noted by the AER, if the rate of return is set too low, a network business may not be able to attract sufficient funds to make the required investments in the network and reliability may decline.[4] If the rate of return is set too high, this may provide a regulated entity with an incentive to invest "too much" in the network, which may result in inefficiently high prices.

17. SFG similarly observes that an allowed return on equity that is materially above (below) the efficient financing costs of the benchmark efficient entity will create incentives for over (under) investment, neither of which are in the long-term interests of consumers.[5]

18. The determination of the rate of return is undertaken pursuant to rule 87. Rule 87(2) provides that the allowed rate of return is to be determined such that it achieves the "allowed rate of return objective". This objective is:

> *that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services.*

19. Rule 87(6) provides that the return on equity for an AA period is to be estimated such that it contributes to the achievement of the objective.

20. Rule 87(7) provides that in estimating the return on equity, regard must be had to the prevailing conditions in the market for equity funds. Expressed in this way, the rules make clear that the focal point of the determination of

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4 AER, *Overview of the Better Regulation Reform Package*, April 2014, p. 14.

5 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [37], appendix 9.4.

the return on equity is the conditions that are expected to prevail in the market for equity funds over the AA period.

21. Rule 87(5) sets out a number of matters to which regard must be had in determining the allowed rate of return (and therefore, the return on equity), being:

- relevant estimation methods, financial models, market data and other evidence
- the desirability of using an approach that leads to the consistent application of any estimates of financial parameters that are relevant to the estimates of, and that are common to, the return on equity and the return on debt, and
- any interrelationships between estimates of financial parameters that are relevant to the estimates of the return on equity and the return on debt.

Should use the best estimate of the return on equity

22. Also relevant to estimating the return on equity is Rule 74, relating to forecasts and estimates. Rule 74(2) states that a forecast or estimate must be arrived at on a reasonable basis, and must represent the best forecast or estimate possible in the circumstances.

Return on equity should also promote the national gas objective and the revenue and pricing principles

23. The NGO and the revenue and pricing principles (**RPP**) are also relevant to the AER's consideration of the return on equity provided for in JGN's revisions to the AA.

24. Section 28(1)(a) of the National Gas Law (**NGL**) provides that the AER must, in performing an AER economic regulatory function or power[6], perform or exercise that function or power in a manner that will or is likely to contribute to the achievement of the NGO.

25. The NGO provides:[7]

> *The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.*

26. Section 28(2) provides that the AER must also consider the RPP when exercising a discretion in approving or making those parts of an AA relating to a reference tariff, and may consider the RPP when performing or exercising any other AER economic regulatory function of power, if the AER considers it appropriate to do so.

27. Most relevantly, the RPP provides that:[8]

- a reference tariff should allow for a return commensurate with the regulatory and commercial risks involved in providing the reference service to which the tariff relates
- a service provider should be provided with a reasonable opportunity to recover at least the efficient costs the service provider incurs in:
  - (a) providing reference services, and

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6 Defined in section 2 as including a function or power performed or exercised by the AER that relates to an applicable AA decision.

7 NGL, s 23.

8 NGL, s 24.

  - (b) complying with a regulatory obligation or requirement or making a regulatory payment

- a service provider should be provided with effective incentives in order to promote economic efficiency with respect to reference services the service provider provides
- regard should be had to the economic costs and risks of the potential for under and over investment by a service provider in a pipeline with which the service provider provides pipeline services
- regard should be had to the economic costs and risks of the potential for under and over utilisation of a pipeline with which a service provider provides pipeline services.

2.2 AEMC GUIDANCE

Focus on prevailing conditions in the market for equity funds

28. As noted above, the drafting of the NGR makes clear that the focal point of the determination of the return on equity is the prevailing conditions in the market for equity funds. This is confirmed by the relevant secondary materials. In the explanatory material which accompanied the drafting of the current rate of return provisions in the NGR, the Australian Energy Market Commission (**AEMC**) states: "[T]he return on equity must reflect the prevailing conditions in the market as it is a forward-looking financial concept."[9]

Consider a range of methods, models and other evidence

29. It is also clear that the AEMC intended that a range of methods, models and other evidence are considered, so as to ensure the best estimate of the rate of return is arrived at. The AEMC's Final Determination states:

> *The final rule provides the regulator with sufficient discretion on the methodology for estimating the required return on equity and debt components but also requires the consideration of a range of estimation methods, financial models, market data and other information so that the best estimate of the rate of return can be obtained overall that achieves the allowed rate of return objective.*[10]

30. The AEMC recognised the concern expressed by many stakeholders in relation to previous versions of the National Electricity Rules (**NER**), which prescribed using the SL CAPM to determine the return on equity and did not provide sufficient scope to consider all relevant models, market data and other evidence. The AEMC considered that rate of return estimation should not be formulaic, and should not be driven by a single model or estimation method, such as the SL CAPM.[11]

31. The AEMC further observed that all financial models (including the SL CAPM) are based on certain theoretical assumptions and all have varying degrees of weaknesses, and as such, no one model can be said to provide the *right* answer.[12] The AEMC therefore considered that estimates are likely to be more robust and reliable if they are based on a range of estimation methods, financial models, market data and other evidence.[13]

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9 AEMC, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, November 2012, p. 64.

10 AEMC, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, November 2012, p. 8.

11 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 47.

12 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 48.

13 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 48.

32. Moreover, the AEMC went even further to say that 'no one method can be relied upon in isolation to estimate an allowed return on capital that best reflects benchmark efficient financing costs',[14] and that:[15]

> *Achieving the NEO, the NGO, and the RPP requires the best possible estimate of the benchmark efficient financing costs. The Commission stated that this can only be achieved when the estimation process is of the highest possible quality. The draft rule determination stated that this meant that a range of estimation methods, financial models, market data and other evidence must be considered.*

33. The changes made by the AEMC to the rate of return frameworks in the NER and NGR were specifically directed at broadening the range of models and evidence that must be taken into account, and avoiding a narrow focus on a single model and its component parameters.[16]

Evolve return on equity estimation over time

34. The AEMC also recognised that the approach to estimating the return on equity may need to change over time, to adapt to changing market conditions and/or developments in finance theory.[17] The new rules framework was therefore designed to be flexible enough to allow for changes in approach between determinations, by requiring the rate of return to be determined at the time of each determination based on the best evidence available at that time.[18]

35. The AEMC was careful to avoid locking in any particular approach, either through the rules themselves or through the guideline process.

Guideline is a guide and should not lock in a particular approach

36. In relation to the rate of return guideline, the AEMC was clear that these should not provide for 'locking in' of any particular approach to the return on equity, and that there should be flexibility to depart from the guidelines where there are good reasons for doing so (e.g., changes in market conditions, or developments in finance theory).

37. The AEMC stated in its Final Determination:[19]

> *The intention of the rate of return guidelines is not to be binding on either the regulator or the service provider. The role of the guidelines is to be distinctly different to how the existing Statement of Regulatory Intent (SORI) on WACC operates under the current Chapter 6 and 6A rate of return frameworks of the NER. The rate of return guidelines are not intended to explicitly lock-in any parameters or methodologies from which departure would not be permitted. In order for the guidelines to have some purpose and value at the time of the regulatory determination or access arrangement process, they must have some weight to narrow the debate. However, there should not be any "inertia principle" or "persuasive evidence test" applying to the application of the*

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14 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 49.

15 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 43.

16 In particular, rule 87(5) sets out the range of matters to which regard must be had. This includes "all relevant models, market data and other evidence".

17 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, pp. 49–50.

18 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, pp. 49–50.

19 AEMC, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, November 2012, p. 58.

guidelines. Requirements on the regulator (and service providers) of this nature to justify departures from the guidelines would undermine the purpose of them.

Set return on equity during determination, not in the guideline

38. The AEMC established a role and process for the rate of return guideline that is separate and distinct from the process for estimating the return on equity (and overall rate of return) in each individual determination.

39. While the guideline process provides an opportunity for the AER to identify the range of relevant models, data and other evidence, this process clearly does not obviate the need for a proper assessment of the appropriate approach to the return on equity at each determination. The AEMC clearly intended that the rate of return be determined at the time of each determination, based on prevailing market conditions and the best evidence available at that time.[20]

Fundamental overhaul of return on equity setting

40. It is clear from the above discussion that the AEMC intended there to be a fundamental overhaul of the way that the return on equity is determined for regulatory purposes. The AEMC sought to design rules that both avoided formulaic application of a single return on equity model and promoted using a range of models, data and other evidence.

2.3 CONTEXT FOR ESTIMATING THE RETURN ON EQUITY

41. The role of the return on equity in the building block framework is to provide businesses with an allowance that is sufficient to provide equity-holders with a return commensurate with prevailing market conditions and the businesses' exposure to risk. Providing this allowance is necessary to ensure that the business can:

- attract necessary capital to undertake efficient investment—consistent with the NGO, and
- recover at least efficient costs—consistent with the RPP.

42. As noted by the AER, if the rate of return is set too low, a network business may be unable to attract sufficient funds to make the required investments in the network and reliability may decline.[21] Conversely, if the rate of return is set too high, this may provide a regulated entity with an incentive to invest "too much" in the network, which may result in inefficiently high prices.

43. SFG similarly observes that an allowed return on equity that is materially above (below) the efficient financing costs of the benchmark efficient entity will create incentives for over (under) investment, neither of which are in the long-term interests of consumers.[22]

2.4 CONCLUSION

44. In determining the return on equity, the focal point is the prevailing conditions in the market for equity funds. It is through this lens that the exercise required by rule 87(5) is to be undertaken—that is, identifying the relevant estimation methods, financial models, market data and other evidence.

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20 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, pp. 49–50.

21 AER, *Overview of the Better Regulation Reform Package*, April 2014, p. 14.

22 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [37], appendix 9.4.

45. The question to answer is:

> *what estimation methods, financial models, market data and other evidence contain information that is relevant to estimating the required return on equity, which best reflects prevailing conditions in the market for equity funds and the degree of risk faced by JGN when providing reference services?*

46. The NGR require an approach that has regard to all relevant methods, models and evidence, and determines an estimate of the return on equity based on those methods that are most likely to promote the rate of return objective and reflect prevailing market conditions. This implies that if one method or model is clearly superior to others or a combination of others in terms of contributing to the rate of return objective, and no other model (or combination) provides any relevant information, then that method or model may be used alone to estimate the return on equity.

47. However, if there are multiple methods or models that each provide information that is relevant to estimating the return on equity, it is appropriate to apply positive weight to more than one model and may it be appropriate to weight all methods or models equally or similarly.

3. RELEVANT MODELS AND EVIDENCE

3.1 INTRODUCTION

Required equity returns cannot be observed, so must use financial models

48. The return on equity required by investors at any point in time cannot be directly observed from market data. Therefore, the return on equity must be estimated using financial models. The challenge is that each model is based on assumptions that may or may not reflect reality.

49. Several financial models have been developed for the purposes of estimating the return required by equity-holders to invest in a particular asset at any point in time. As discussed below, each of these models takes a different approach to estimating the required return on equity, and each one accounts for the various factors likely to affect the required return on equity in different ways. Due to the different ways in which the various models operate, they each have inherent strengths and weaknesses.

Development (and use) of financial models is a developing area of finance

50. The development and refinement of models for estimating the required return on equity continues to be a an active area of finance theory. Academics and market practitioners continue researching the factors that influence required returns, and in some cases this research leads to refinements to existing models and/or development of new models.

51. Just last year (in 2013), three academics were awarded the Nobel Prize in Economic Sciences, for their contribution to this field (or more specifically, "*for their empirical analysis of asset prices*").[23]

Our proposal recognises that each model is imperfect

52. JGN's approach to estimating the return on equity recognises that there is no one source that one can use to estimate the return on equity, nor can any one model be seen as the ultimate source of truth (as to the true required return on equity). Rather, each of the available models was developed to provide estimates of a parameter that cannot be directly observed.

53. Further, each of the available models has strengths and weaknesses, and in some cases the more recently developed models have been designed so as to overcome identified weaknesses in earlier models.

54. This section addresses two key aspects of JGN's return on equity proposal:

- the relevant return on equity models that can be used to estimate the return on equity, and
- the relevant evidence that can be used to populate these models (i.e., evidence relevant to each of the model parameters).

[23] Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, *Understanding Asset Prices: Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2013*, 14 October 2013.

3.2 RELEVANT RETURN ON EQUITY MODELS

There are a range of relevant models, but no one is superior to the others or incorporates all relevant information

55. In Australia, as in many jurisdictions, there is no one single accepted model or methodology for determining the required return on equity. The NGR recognise this insofar as they require that relevant estimation methods, financial models, market data and other evidence be identified and that regard be had to each of these in determining the allowed rate of return. As noted above, this was also recognised by the AEMC.

56. The measurement of this parameter, and its various components, is a field of ongoing academic and professional pursuit. An overview of developments in this field over the past 50 years is provided by the Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, in the explanatory material accompanying the award of the Nobel Prize for contributions to this field.[24] As explained by the Committee, some of the key work in this field in recent decades involved refining existing models so as to better explain differences in expected returns across assets.

There are at least four relevant models

57. JGN considers that there are at least four relevant return on equity models:

- the SL CAPM
- the Black CAPM (or empirical CAPM)
- the FFM, and
- the DDM.[25]

58. Our view that this set of models is relevant is consistent with that expressed by the AER.[26] It is also consistent with the expert advice of Professor Stephen Gray and Dr Jason Hall.[27]

Each model can provide information on prevailing conditions in the market for equity funds

59. Each of these models is relevant. Each provides information that is relevant to estimating the return required by equity-holders in a benchmark efficient entity, with a similar degree of risk as that which applies to JGN in respect of the provision of reference services, having regard to prevailing conditions in the market for equity funds.

60. Put another way, each model has "probative value" insofar as the outcomes of the models, properly specified and applied, could rationally affect an assessment of the prevailing conditions in the market for equity funds.

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[24] Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, *Understanding Asset Prices: Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2013*, 14 October 2013.

[25] As discussed further below, this model can be used either to produce estimates of the market return on equity, or to provide estimates of the return on equity for the benchmark firm. Thus, the DDM may be used to estimate inputs into other return on equity models, or as a return on equity model in its own right.

[26] AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, p 58. Table 5.1 identifies each of these models as "relevant models".

[27] SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [8], appendix 9.4.

Each model has different strengths and weaknesses

61. Each of the above models provides an estimate of the required return on equity for a benchmark efficient entity as a function of prevailing levels of risk and the particular characteristics of the business (to the extent that these bear on its exposure to risk). However, each model does this in a different way.

62. The different ways that the models estimate the return on equity results in each model having different inherent strengths and weaknesses in the return on equity estimates they produce relative to the others. Moreover, the relative strengths and weaknesses of each model may vary over time and across markets.

63. The key characteristics of each model, in terms of their key assumptions and method of accounting for risk and prevailing market conditions, are summarised in Table 3-1.

Table 3-1: Relevant return on equity models[28]

Model	Model specification	Key assumptions	Method of accounting for risk	Method of accounting for market conditions	Empirical performance
SL CAPM	SL CAPM estimates the return on equity as: $r_e = r_f + \beta_e(r_m - r_f)$ where: • r_e is the required return on equity for the asset or firm in question • r_f is the return on a risk-free asset; • $(r_m - r_f)$ is the market risk premium required for the average firm, and • β_e is the risk of the firm in question relative to the average, known as the equity beta. This model can potentially be applied in different ways. For example, the "Wright approach" is one potential application.	The SL CAPM assumes: (i) that a risk-free asset exists and that investors can borrow or lend as much as they like at the risk-free rate (ii) homogeneous expectations—all investors share the same beliefs about the joint distribution of the returns of all assets, and (iii) perfect capital markets—no investors face taxes or transactions costs of any type. The first of these assumptions leads to a result that the risk-free asset serves as the zero-beta portfolio. The second and third assumptions lead to a result that all investors will want to hold the same efficient portfolio of risky assets, which in the case of the SL CAPM is the market portfolio.	The SL CAPM accounts for risk through the equity beta, which measures covariance of a stock's returns with the market portfolio. Thus, the SL CAPM accounts generally for a stock's exposure to non-diversifiable risk, also termed systematic or market risk. The SL CAPM does not account specifically for risk exposure which may be due to specific business characteristics.	The SL CAPM reflects market conditions through the r_m and r_f parameters. Provided that these parameters are estimated in a way that reflects prevailing market conditions, the SL CAPM is capable of producing estimates of the required return on equity for the average firm that are reflective of prevailing market conditions.	Several studies have found the empirical performance of the SL CAPM to be poor.[29] In particular, it has been found that the SL CAPM systematically under-estimates the required return on equity for low-beta stocks, and over-estimates the return on equity for high-beta stocks. These studies have observed that most likely source of this bias is the assumption that all investors can borrow or lend as much as they like at the risk-free rate. The SL CAPM has also been shown to under-estimate the required return on value stocks.

[28] SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

[29] For further discussion of these studies, refer to: SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [46]–[60], appendix 9.4.

Model	Model specification	Key assumptions	Method of accounting for risk	Method of accounting for market conditions	Empirical performance
Black CAPM	The Black CAPM is similar to the SL CAPM, except that the assumption that the return on a zero-beta stock will be equal to the risk-free rate is relaxed. The relationship assumed by the Black CAPM is: $r_e = r_z + \beta_e(r_m - r_z)$ where r_z represents the return on a zero-beta asset. The return on the zero-beta asset can be expressed as: $r_z = r_f + R_z$ where R_z is known as the zero-beta premium. That is, R_z is the amount by which the intercept in the pricing relationship exceeds the risk-free rate.	Unlike the SL CAPM, the Black CAPM does not assume that the return on a zero-beta stock will be equal to the risk-free rate. Therefore the Black CAPM does not imply that the risk-free asset serves as the zero-beta portfolio. However, the Black CAPM does still assume: (i) homogeneous expectations—all investors share the same beliefs about the joint distribution of the returns of all assets, and (ii) perfect capital markets—no investors face taxes or transaction costs of any type. As for the SL CAPM, these assumptions lead to a result that all investors will want to hold the same efficient portfolio of risky assets, which in the case of the SL CAPM and the Black CAPM is the market portfolio.	The Black CAPM similarly accounts for risk through the equity beta, which measures covariance of a stock's returns with the market portfolio. Thus, the Black CAPM (like the SL CAPM) accounts generally for a stock's exposure to non-diversifiable risk, also termed systematic or market risk. The Black CAPM does not account specifically for risk exposure that may be due to specific business characteristics.	The Black CAPM similarly reflects market conditions through the r_m and r_f parameters. Provided that these parameters are estimated in a way that reflects prevailing market conditions, the Black CAPM is capable of producing estimates of the required return on equity for the average firm that are reflective of prevailing market conditions.	The Black CAPM is superior to the SL CAPM in terms of empirical performance. This is, at least partly because the zero-beta premium is selected to provide the best possible fit between the model and the observed data. SFG notes that it is for this reason that the Black CAPM is referred to as the *empirical CAPM* in its extensive use in US rate of return regulation cases.[30] Like the SL CAPM, the Black CAPM under-estimates the required return of value stocks.

[30] SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [65], appendix 9.4.

Model	Model specification	Key assumptions	Method of accounting for risk	Method of accounting for market conditions	Empirical performance
FFM	The FFM estimates the required return on equity as: $r_e = r_f + \beta_{mkt} \times MRP + \beta_{size} \times SMB + \beta_{value} \times HML$ where: • r_f represents the risk-free rate of interest, as under the SL CAPM; • MRP represents the market risk premium, as under the SL- CAPM; • β_{mkt} represents the equity beta relative to a broad market index, as under the SL CAPM; • SMB represents the difference between the returns on a portfolio of small stocks and the returns on a portfolio of large stocks – "small minus big"; • β_{size} represents the particular firm's sensitivity to the SMB factor; • HML represents the difference between the returns on a portfolio of high book-to-market stocks and the returns on a portfolio of low book-to-market stocks – "high minus low"; and • β_{value} represents the particular firm's sensitivity to the HML factor.	The FFM relaxes the assumption underpinning the SL CAPM and Black CAPM, that the market portfolio is an efficient portfolio. The FFM specification is based on observation of particular types of portfolio out-performing the return implied by a single (market) factor model. This implies that the assumptions that must hold for the market portfolio to be efficient do not hold in practice. Portfolios constructed on the basis of size and book-to-market have been shown to out-perform the return implied by a single (market) factor model. This suggests that their higher average returns are compensation for a component of systematic risk that is not well captured by the market index. The FFM therefore introduces two additional factors that seek to capture the effect of size and book-to-market on exposure to systematic risk.	The FFM incorporates three risk factors. The sensitivity to the market risk factor is captured by β_{mkt} in the SL CAPM and Black CAPM. β_{size} and β_{value} account for exposure to the size and book-to-market factors.	The FFM accounts for market conditions in a similar way to the SL CAPM and Black CAPM. Thus, provided that the relevant parameters are estimated in a way that reflects prevailing market conditions, the FFM is capable of producing estimates of the required return on equity that are reflective of prevailing market conditions.	Fama and French (1993) compare the empirical performance of their three-factor model against the one-factor CAPM. They conclude that the three-factor model provides a materially better fit to the observed data. This finding is supported for Australia by a later study by Brailsford, Gaunt and O'Brien (2012).[31]

Model	Model specification	Key assumptions	Method of accounting for risk	Method of accounting for market conditions	Empirical performance
DDM	In its general form, the DDM can be expressed as: $P_0 = \sum_{t=1}^{\infty} \frac{d_t}{(1+r_e)^t}$ where P_0 represents the current stock price and d_t represents the dividend that is expected to be paid at time *t*. The DDM is comparatively simple in that, unlike the asset pricing models set out above, it does not require the specification and estimation of the set of factors that determine asset returns. Rather, the DDM simply requires an assumption that stock prices reflect the present value of the cash flows (dividends) that will be paid to the owners. As explained by SFG, there are potentially alternative versions of the DDM, reflecting different assumptions that can be made regarding the transition to long-term parameter estimates. SFG recommends a "three-stage version" of the DDM, under which parameter estimates gradually revert to long-term estimates over an eight-year transition period.[32] The DDM can also be implemented at the market level (to estimate the required return on the market portfolio) or at the individual stock level.	As noted, the core assumption of the DDM is that stock prices reflect the present value of the cash flows (dividends) that will be paid to the owners. The DDM does not require the same assumptions as the asset pricing models described above.	When implemented at an individual stock level, risk is accounted for through the process for estimating likely future growth of dividends on that stock.	Market conditions are accounted for by simple observation of the current stock price, and through the process for estimating likely future growth of dividends.	The empirical performance of this model depends on the way in future dividends are forecast. If a robust method for forecasting dividends is employed, the return on equity estimates produced by the model will be similarly robust. SFG adopts an approach which mitigates the need for assumptions about long-term growth assumptions. SFG's approach involves estimating the return on equity simultaneously with long-term growth. SFG considers that this approach leads to results that are more empirically robust.

31 For further discussion of these studies, refer to: SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [100]–[102], appendix 9.4.

32 SFG, *Alternative versions of the dividend discount model and the implied cost of equity*, May 2014, section 3.1, appendix 9.8.

An approach that considers the strengths and weaknesses of each model is required

64. As can be seen, the particular design features of each model give rise to various strengths and weaknesses. For example, the critical assumption of the SL CAPM in relation to zero-beta stocks means that it is simple and produces a tighter range of estimates relative to other models, but also gives rise to a key weakness of this model—which is that it provides downwardly biased estimates of low-beta stocks (i.e., stocks with a beta of less than one). Another critical assumption is that the equity beta reflects all sources of risk, which again means the model is simple but this gives rise to another key weakness—which is that it also provides downwardly biased estimates of value stocks (i.e., stocks with a high book-to-market ratio).

65. It is therefore important to estimate the return on equity using an approach that properly considers all relevant models, and their respective strengths and weaknesses.

66. As noted above, the AEMC amended the NER and NGR for precisely this reason—ensuring that all relevant information is considered when developing (and adopting) an estimation methodology that is likely to provide the best estimate on the rate of return. This methodology could be a combination of estimation methods, financial models, market data and other evidence, if there are multiple methods that provide relevant information as to the required return on equity. One cannot assume that any one model will be superior (or inferior) to all others or a combination of them in all circumstances, or that one model incorporates all relevant information on the required return on equity.

3.3 RELEVANT EVIDENCE IN RELATION TO MODEL PARAMETERS

3.3.1 RISK-FREE RATE

67. Evidence of the risk-free rate of return is conventionally derived from observed yields on Commonwealth Government Securities (**CGS**).

68. As noted in section 9.4.5 of the AA information, JGN considers that CGS yields represent the best proxy for the risk-free rate of return in Australia, and is not aware of any other relevant source of evidence of the risk-free rate.

3.3.2 REQUIRED RETURN ON THE MARKET PORTFOLIO

69. An estimate of the current required return on the market portfolio is required for the SL CAPM, Black CAPM and FFM.

There are several potential sources of evidence on the required return on the market portfolio

70. JGN considers that there are several sources of evidence that may be relevant to estimating the current required return on the market portfolio, including:

- *historical excess returns*[33]—which may be relevant to the extent that current expectations of excess returns to equity reflect past returns
- *historical returns on the market*—which may also be relevant to the extent that current expectations of returns to equity reflect past returns
- *the DDM*[34]—which provides estimates of current required returns, based on forecasts of future dividends

[33] 'Excess returns' are returns in excess of the risk-free rate of interest.

- *evidence of market expectations of required returns*—which may be drawn from:
  - surveys of market practitioners, or
  - independent expert reports prepared for valuation purposes.

Each source has strengths and weaknesses, which should be reflected when estimating the required return on the market portfolio

71. Each of these sources of evidence has strengths and weaknesses. For example, the key weakness of historical excess returns is that they may not indicate current required returns to the extent that current market conditions do not reflect historical market conditions, or where investors' forward-looking expectations are otherwise not based on past returns. As the focal point of setting the return on equity is the prevailing conditions in the market for equity funds, it is forward-looking measures that are most relevant.

72. Therefore, each relevant source of evidence noted above should be considered along with its strengths and weaknesses in estimating the current required return on the market portfolio.

73. Section 5.2.1.3 sets out our proposed estimate of the current required return on the market portfolio, having regard to each of the above sources of evidence.

3.3.3 RISK PARAMETERS

74. We must estimate risk parameters for each relevant model. For the SL CAPM and Black CAPM it is only the equity beta that we must estimate, while for the FFM additional parameters require estimation. Additionally, for the Black CAPM an estimate of the zero-beta return is required.

75. Relevant evidence on each of these risk parameters comes from econometric estimation. While there are various econometric studies available, some of these studies provide more robust and reliable estimates than others, and accordingly should attract more weight. Section 5.2.1 further discusses the relevant econometric estimates of these risk parameters.

3.4 OTHER EVIDENCE REFERRED TO IN THE RATE OF RETURN GUIDELINE

76. The rate of return guideline refers to several other sources of evidence which the AER says will "inform the overall return on equity".[35] In particular the AER refers to:

- takeover/valuation reports
- brokers' return on equity estimates, and
- other regulators' return on equity estimates.

77. JGN does not propose considering this evidence when estimating the return on equity.[36] This evidence is of a secondary nature as it indicates another party's view of the return on equity for a particular business at a particular point in time, and in most cases relies on the same relevant return on equity models identified earlier.

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[34] As noted above, the DDM can be implemented either at the market level (to estimate the required return on the market portfolio) or at the individual stock level.

[35] AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, pp. 59–61.

[36] This proposal is consistent with the sample application of the rate of return guideline in the AER's explanatory statement, which does not place any weight on takeover / valuation reports, brokers' return on equity estimates, and other regulators' return on equity estimates.

It does not necessarily indicate the current required return on equity, having regard to prevailing conditions in the market for equity funds and the degree of risk faced by JGN when providing reference services.

78. As discussed further below, our approach involves using relevant financial models to estimate the current required return on equity, having regard to the best available evidence and market data on each model parameter. The secondary evidence as to the overall return on equity that is referred to in the rate of return guideline is not relevant for this purpose.

79. JGN notes that its proposed treatment of this other evidence appears consistent with recent decisions of the AER. In its transitional determinations for the NSW electricity distribution businesses the AER simply uses the output of its 'foundation model' as the return on equity estimate, and does not appear to give this other evidence any substantive role.[37]

[37] AER, *Ausgrid, Endeavour Energy, Essential Energy, ActewAGL – Transitional distribution decision 2014–15*, April 2014, pp. 34–38.

4. AER POSITION ON USE OF RELEVANT MODELS AND EVIDENCE IN THE RATE OF RETURN GUIDELINE

4.1 THE AER'S FOUNDATION MODEL APPROACH

80. The rate of return guideline sets out the AER's proposed approach to determining the return on equity. The AER's proposed approach involves the following steps:[38]

1. **identify** a 'foundation model' for estimating the return on equity, based on selection criteria defined by the AER
2. **identify** models, methods and other information to be used to populate the foundation model
3. **estimate** ranges for SL CAPM parameters and for the return on equity
4. **identify** other evidence on the return on equity to assist in determining an appropriate point estimate within the range produced by the foundation model.

4.1.1 AER'S IDENTIFICATION OF A 'FOUNDATION MODEL

SL CAPM set as primary model

81. The rate of return guideline identifies the SL CAPM as the AER's 'foundation model'. The AER says that the SL CAPM is superior to other potential foundation models, including because it:

- is relatively simple and transparent to implement
- is widely used by academics, market practitioners and other regulators, and
- can be used in a way that accords with the AER's proposed approach to the return on equity (i.e., it can be used to provide a range of estimates or a point estimate, and other material can be used to inform parameter estimates).[39]

DDM and Black CAPM inform inputs to the primary model

82. The AER states that it will use two of the other relevant return on equity models—the Black CAPM and DDM (applied at the market level)—to inform the determination of SL CAPM parameter estimates. These models are not used to provide estimates of the return on equity, but rather are used to determine point estimates for the equity beta and market risk premium (**MRP**) from within ranges for each of these parameters. The AER states that neither of these models can be used as a foundation model, including because they are both sensitive to input assumptions.[40]

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38 AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, pp. 56–62.

39 AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix A, pp. 13–14.

40 AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix A, pp. 15–18.

No role given to the FFM

83. Although the rate of return guideline identifies the FFM as a "relevant model", the FFM is not given any role in the determination of the return on equity.[41] The AER's reasons for this include that:[42]

- (in the AER's view) there is no clear theoretical foundation to identify the risk factors, if any, that the model captures
- the empirical patterns on which the model was developed may be variable over time, and may not apply in Australia
- it is more complex to implement as two additional parameters need to be estimated, and
- (to the AER's knowledge) the model is not used to estimate the return on equity in Australia.

4.1.2 APPLICATION OF THE 'FOUNDATION MODEL'

84. The AER indicates in its rate of return guideline that in implementing the SL CAPM (its foundation model) it will estimate the risk-free rate using 10 year CGS yields.[43]

85. The AER indicates that it will use a range of information to inform its estimates of the other two parameters in its foundation model. For the MRP, this includes DDM outputs (applied at the market level), as well as other evidence such as historical excess returns, survey evidence, implied volatility analysis, regulatory precedent, debt spreads and dividend yields. For the equity beta, the relevant evidence is said to include observed equity beta estimates and Black CAPM theory.

86. The AER rate of return guideline provides indicative ranges and point estimates for the MRP and equity beta by applying this approach at the time of publication (December 2013). The AER indicates a range for the MRP of 5.0 per cent to 7.5 per cent, and a point estimate of 6.5 per cent. For the equity beta, the AER indicates a range of 0.4 to 0.7, and a point estimate of 0.7.

4.2 JGN'S CONCERNS WITH THE FOUNDATION MODEL APPROACH

87. JGN has significant concerns with the AER's proposed foundation model approach. JGN is particularly concerned that if the AER were to apply its foundation model approach in JGN's AA review, it is likely to result in outcomes that are inconsistent with the rate of return objective and which do not promote the NGO.

4.2.1 THE FOUNDATION MODEL APPROACH GIVES PRIMACY TO THE AER'S OWN CRITERIA, OVER THE RATE OF RETURN OBJECTIVE

AER criteria given key role in setting the rate of return

88. In the explanatory statement the AER sets out the criteria that it uses in assessing what information should be used in determining the various rate of return parameters.

41 AER, *Rate of Return Guideline*, December 2013, p. 13.

42 AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix A, pp. 22-23.

43 AER, *Rate of Return Guideline*, December 2013, p. 15.

89. The AER says that decisions on the rate of return are more likely to achieve the allowed rate of return objective if they use estimation methods, financial models, market data and other evidence that are:

- where applicable, reflective of economic and finance principles and market information—i.e. estimation methods and financial models are consistent with well accepted economic and finance principles and informed by sound empirical analysis and robust data
- fit for purpose—use of estimation methods, financial models, market data and other evidence should be consistent with the original purpose for which it was compiled and have regard to the limitations of that purpose, and should promote simple over complex approaches where appropriate
- implemented in accordance with good practice—supported by robust, transparent and replicable analysis that is derived from available credible datasets
- where models of the return on equity and debt are used, these are based on quantitative modelling that is sufficiently robust as to not be unduly sensitive to errors in inputs estimation and based on quantitative modelling which avoids arbitrary filtering or adjustment of data, which does not have a sound rationale
- where market data and other information is used, this information is credible and verifiable, comparable and timely and clearly sourced, and
- sufficiently flexible as to allow changing market conditions and new information to be reflected in regulatory outcomes, as appropriate.[44]

90. The criteria applied by the AER are not set out in the NGR or the NGL. Rather, they were developed by the AER and set out in its rate of return guideline.

Criteria do not focus on the rate of return objective, and therefore risk undermining it

91. JGN's primary concern with the use of these criteria is that it means the AER's proposed approach to determining the return on equity is not focused on achieving the rate of return objective, as required by the NGR.

92. Rather, the AER's proposed approach is guided by these self-imposed criteria, some of which are simply unrelated to the achievement of the rate of return objective—for example, the promotion of simple over complex approaches. To the extent that there is a disconnect between the AER's criteria and achievement of the rate of return objective, this implies that the AER's approach will not help achieve the objective, as required by the NGR.

93. The clearest example of this is in the way the AER's criteria are applied to identify the foundation model. It appears that one of the AER's key reasons for preferring the SL CAPM over other models is that it is relatively simple and transparent. However, we consider that simplicity, in and of itself, does not indicate that a particular model will necessarily lead to outcomes that better promote the rate of return objective. Therefore, relying heavily on simplicity as a model selection criteria is likely to lead to outcomes that do not promote the rate of return objective.

[44] AER, *Rate of Return Guideline*, December 2013, p. 6; AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, pp. 23–24.

Some criteria do not align with the rate of return objective

94. JGN also considers that a number of the AER's criteria are not appropriate, and not aligned with the rate of return objective. For example:

- **Well accepted.** Requiring estimation methods and financial models to be consistent with "*well accepted*" economic and finance principles is not grounded in any requirement of the NGR or NGL. On the contrary, the requirement to use "*well accepted*" models in estimating the return on equity was recently (and explicitly) removed from the NGR—and the explanatory materials accompanying this rule change indicate a concern that this requirement had unduly limited the range of models which were being taken into account.[45] As noted above, recent changes to the NGR (which included repeal of the "well accepted" requirement) were directed at ensuring proper consideration of all relevant models and evidence.
- **Simple over complex.** Similarly there is no support in the NGR or NGL for the promotion of "*simple over complex approaches*". JGN considers that promoting simplicity over complexity is unlikely to lead to outcomes that promote the rate of return objective, except perhaps by chance. The simplest models and methodologies are often those with the most unrealistic simplifying assumptions, and therefore promoting these types of methodologies for the sake of simplicity is unlikely to produce the best estimate of the required return on equity that is consistent with the rate of return objective, and reflective of prevailing market conditions.

Criteria should not have primacy over the rate of return objective

95. JGN therefore considers that the AER's principles should not be given primacy when selecting return on equity models. Rather, the primary considerations should be the rate of return objective, evidence of prevailing market conditions, and the matters to which regard must be had under Rule 87(5). These primary considerations cannot be displaced by the AER's own criteria.

4.2.2 THE FOUNDATION MODEL GIVES UNDUE WEIGHT TO ONE MODEL, AT THE EXPENSE OF OTHER RELEVANT MODELS

No one model is superior to all others in all circumstances

96. The AER's proposed approach elevates one model to the status of 'foundation model' (i.e., the model used to estimate the return on equity), while other relevant models can only be used, along with other evidence, to inform parameter estimates. This approach of course assumes that one model is always superior to all others, or that one model contains all relevant information, such that it can be given foundation model status.

97. JGN considers that it is not appropriate to elevate any one model to the status of "foundation model" given that there are multiple models that are relevant to estimating the return on equity and each of these models has inherent strengths and weaknesses. Given these strengths and weaknesses, no one model can be assumed to be superior in all circumstances.

98. Even if one model were considered the best of all the relevant models, it should not be used to the exclusion of the others unless those other models collectively contribute no relevant information. There is no empirical evidence or theoretical justifications to support giving one model such status above others.

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[45] The AEMC noted during the rule change process that "the rate of return process should not be formulaic", and that "an example of an estimation process that has become formulaic is the mandatory use of the CAPM under the NER and the view that appears to be adopted in practice that the CAPM is the only "well accepted" model under the NGR…" (AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 47).

Selecting one model as a foundational model undermines flexibility

99. It is wrong to seek to 'lock in' any one model as a foundation model, given that that the approach to estimating the return on equity may need to change over time, to adapt to changing market conditions and/or developments in finance theory (as there have been in recent decades[46]). As noted above, the AEMC explicitly recognised this in designing the current rules framework, and rule 87 of the NGR was therefore designed to be flexible enough to allow for changes in approach between determinations.[47]

The SL CAPM is clearly not the superior model, in any case, given its known weaknesses

100. It is particularly inappropriate for the SL CAPM to be given the status of foundation model, given the known weaknesses of this model, and relative strengths of other available models.

101. In particular:

- **The SL CAPM produces biased estimates.** It is widely acknowledged by academics and market practitioners that the SL CAPM will tend to produce biased estimates of the required return on a low-beta or value stock, and may not fully capture all factors affecting stock returns. SFG note that it is generally accepted that the empirical implementation of the SL CAPM provides a poor fit to the observed data, and they refer to extensive empirical research in this respect, including the work of Black, Jensen and Scholes (1972), Friend and Blume (1970) and Fama and Macbeth (1973).[48]
- **This bias is overcome by other models.** Other models such as the Black CAPM and FFM were developed specifically to overcome these known weaknesses in the SL CAPM design.
- **Market practitioners adjust for bias even if they use the SL CAPM.** Where the SL CAPM is used by market practitioners, it is often used in combination with other adjustments or uplift factors, reflecting a recognition of the inherent biases and short comings in the model's design and empirical performance.[49]

102. Indeed, some of the other return on equity models were developed specifically to overcome the observed biases and anomalies in results produced by the SL CAPM. This history of testing the SL CAPM, and developing alternative models is explained at some length by the Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, in the explanatory material accompanying the award of the Nobel Prize for contributions to this field.[50]

Criteria are biased towards selecting the SL CAPM, without properly reflecting these weaknesses

103. The AER's elevation of the SL CAPM to 'foundation model' status illustrates the problem with its over-reliance on its own criteria. While it is certainly true that the SL CAPM is a relatively simple model, it also has very significant shortcomings—which in part arise due to its simplicity. However, because the AER defines simplicity as one of its criteria, the SL CAPM is elevated to foundation model status over other models that are not as

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46 An overview of developments in finance theory relating to asset pricing over recent decades is provided in the background paper released by the Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences at the time of awarding the Nobel Prize in Economic Sciences to Eugene Fama, Robert Schiller and Lars Peter Hansen (Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, *Understanding Asset Prices: Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2013*, 14 October 2013).

47 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, pp. 49–50.

48 For further discussion of these studies, refer to: SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [46]–[60], appendix 9.4.

49 Incenta, *Update of evidence on the required return on equity from independent expert reports*, May 2014, section 3.3. SFG, *Evidence on the required return on equity from independent expert reports: Report for the Energy Networks Association*, June 2013.

50 Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, *Understanding Asset Prices: Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2013*, 14 October 2013, section 7.

simple, but are at least as likely, if not more likely, to produce outcomes that promote the rate of return objective.

As such, the foundation model approach works against the AEMC intent

104. The AER's foundation model approach is at odds with the intent of the changes made to the rate of return rules in November 2012. The clear intent of these changes was to avoid the regulator being bound to any particular model.

105. In making these changes, the AEMC emphasised the need to strike an appropriate balance between certainty and flexibility in the rate of return framework, and noted that the previous NER frameworks—which prescribed use of the SL CAPM—did not provide an appropriate balance.[51] The AEMC therefore removed all references to particular models in the rate of return rules, and inserted an express requirement to consider relevant estimation methods, market data and other evidence.

The AEMC rule change recognised that no one model can provide the right answer, and so one must have regard to a range of models

106. As noted above, the AEMC observed that all financial models (including the SL CAPM) are based on certain theoretical assumptions and all have varying degrees of weaknesses, and as such, no one model alone can be said to provide the *right* answer.[52] The AEMC also noted that the SL CAPM in particular is criticised in the academic literature and that various limitations were identified with this model.[53]

107. The AEMC therefore considered that estimates are likely to be more robust and reliable if they are based on a range of estimation methods, financial models, market data and other evidence.[54] The changes made by the AEMC to the rate of return frameworks in the NER and NGR were specifically directed at broadening the range of models and evidence that must be considered, and avoiding a narrow focus on a single model and its component parameters.[55]

108. The changes made by the AEMC were in response to strong concerns being expressed by numerous experts and policy-makers regarding the status that was given to the SL CAPM under the previous rate of return rules. For example, the Expert Panel on Energy Merits Review stated, in relation to a decision of the Australian Competition Tribunal under the previous NGR:[56]

> *In the name of regulatory certainty, the decision appears to elevate the standing of the CAPM in the NGR to something akin to its standing in the NER. The Panel is concerned that binding regulatory decisions hand and foot to a financial model with known defects does not immediately commend itself as an approach that will advance the NEO and NGO.*

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51 AEMC, *Final Position Paper: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, November 2012, Chapter 4.

52 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 48.

53 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 47.

54 AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 48.

55 In particular, rule 87(5) sets out the range of matters to which regard must be had. This includes "all relevant models, market data and other evidence".

56 Professor George Yarrow, The Hon Michael Egan, Dr John Tamblyn, *Review of the Limited Merits Review Regime: Stage One Report*, p. 42.

But, by selecting the SL CAPM as the primary model, the foundation model approach, in effect, reverses the AEMC rule change

109. Despite very significant changes being made to the rate of return rules designed to avoid the types of outcomes referred to by the Expert Panel, the AER now appears intent on continuing to bind itself to the SL CAPM through its foundation model approach. If the AER seeks to apply the 'foundation model approach' (as set out in its guideline) in individual determinations, the practical effect will be a reversion to outcomes under the old rules frameworks.

110. Through its guideline (if applied in individual determinations), the AER will revert to a formulaic approach to estimating the return on equity driven by a single financial model, which is precisely the type of outcome that the AEMC sought to avoid.[57]

4.2.3 SOME RELEVANT MATERIAL IS GIVEN NO WEIGHT BY THE AER

Criteria lead to no weight being applied to relevant evidence, namely the FFM

111. For similar reasons, the AER's proposed approach does not allow all relevant evidence to be fully taken into account, or to be given the weight that it should be. By defining simplicity as one of its key criteria, the AER diminishes the role of more complex, but potentially more robust models and methodologies.

112. This is most clearly the case in relation to the FFM. Despite identifying this model as relevant to the determination of the return on equity, the AER gave it no role based on its own criteria—at least one of the reasons for the AER declining to use this model is that it is more complex to implement. This is despite evidence that the FFM is likely to have some advantages over other models because it can account for a wider range of factors affecting stock returns.[58] Thus, information that is potentially relevant to determining a return on equity that would promote the rate of return objective is jettisoned in the name of consistency with the AER's own criteria.

113. JGN considers that the FFM should be given real weight. As observed by SFG, the FFM—like the other three relevant models—is designed to estimate the return on equity, has a sound theoretical basis, and is commonly used in practice.[59]

114. The relevance of the FFM to modern finance theory and practice was recently recognised by the Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, in deciding to award the Nobel Prize to Eugene Fama, one the founders of this model. In its explanatory material accompanying the decision to award the Nobel Prize, the Committee outlined the significant contributions made by Fama and others to the development of asset pricing models.

115. As noted by the Committee, much of this work was directed at overcoming limitations of earlier models, particularly the simple SL CAPM. The Committee then explained how this work led to the development of the FFM by Fama and French:[60]

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57 As noted above, the AEMC explicitly stated that the rate of return estimation should not be formulaic or driven by a single financial model or estimation method (AEMC, *Draft Rule Determinations: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012; National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, August 2012, p. 47).

58 For example: NERA, *Review of Cost of Equity Models: A Report for the Energy Networks Association*, June 2013. SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

59 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

60 Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, *Understanding Asset Prices: Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2013*, 14 October 2013, p. 39.

> *The body of work discussed above was synthesized into the three-factor model of Fama and French (1993). Building on the rejection of the simple version of CAPM in their earlier paper (Fama and French, 1992), the paper presented a model which added two new factors to CAPM and suggested a methodology for constructing and testing such factors, building on Fama and Macbeth (1973). The two factors, "small-minus-big" market value (SMB) and "high-minus-low" book-to-market ratio (HML), are based on portfolios of stocks sorted according to the two characteristics that had been found to correlate with expected returns, size and book-to-market value. Each factor is equivalent to a zero-cost arbitrage portfolio that takes a long position in high book-to-market (small-size) stocks and finances this with a short position in low book-to-market (large-size) stocks. Fama and French showed that the SMB and HML factors, apart from explaining differences in expected returns across stocks, also explain a significant amount of variation in the time-series, i.e., stocks with a similar exposure to these factors move together. Hence, they argued, SMB and HML are priced risk factors and the three-factor model should be interpreted as a multi-factor model in the sense of Merton (1973) and Ross (1976).*

116. The Committee then went on to note that:[61]

> *Empirically, the Fama-French approach has provided an effective way to simplify and unify the vast literature on the cross section of stock returns, and their method has been widely used both as a reference model for academic research and as a practical guide for professional investors.*

117. JGN also notes that its proposal to take into account the FFM is not new or novel. JGN proposed using the FFM to estimate the return on equity as part of its last AA proposal.

Criteria also lead to limited weight being given to other evidence, namely the Black CAPM and DDM

118. Similarly, the Black CAPM and DDM—which are relevant and useful return on equity models in their own right—are assigned only marginal roles in informing parameter estimates within the foundation model. The demotion of these models to a secondary role is justified by the AER by reference to its criteria (particularly the desire for simplicity) rather than by reference to the rate of return objective itself.

119. This once again illustrates the problem created by the AER's over-reliance on its own criteria, rather than considering what outcomes will best promote the legislated objectives.

4.2.4 APPROACH TO DETERMINING PARAMETER ESTIMATES FOR THE FOUNDATION MODEL

120. We are also concerned about the way that the AER determined indicative values for SL CAPM parameters in the rate of return guideline.

121. The AER states in its rate of return guideline that it will use two return on equity models—the Black CAPM and DDM—to inform its parameter estimates for the SL CAPM. The AER says that the Black CAPM is used to inform its estimate of the equity beta, while the DDM informs its estimate of the MRP.

122. JGN's concern is that the AER is not using these relevant return on equity models for the purpose that they were intended. Rather than using these models to estimate the return on equity, the AER is using them for a narrow purpose of selecting point estimates for SL CAPM parameters from within a pre-determined range. As discussed further below, our approach sets each model free to estimate the return on equity, rather than using some models for a secondary purpose of informing parameter estimates in the primary model.

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[61] Economic Sciences Prize Committee of the Royal Swedish Academy of Sciences, *Understanding Asset Prices: Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2013*, 14 October 2013, p. 40.

123. JGN is also concerned about the evidence relied on by the AER to derive point estimates for the SL CAPM parameters, and the way that this evidence is weighted. These issues are discussed further in section 5.2.1.

5. JGN'S PROPOSED APPROACH

5.1 OUTLINE OF APPROACH

Our proposed five steps

124. JGN's proposed approach to determining the required return on equity involves five steps:

1. **identify** relevant return on equity models
2. **identify** relevant evidence which may be used to estimate parameters within each of the relevant return on equity models
3. **estimate** model parameters for each relevant return on equity model, based on relevant market data and other evidence
4. separately **estimate** the required return on equity using each of the relevant models
5. **synthesise** model results to derive an estimate of the required return on equity for JGN.

Our approach considers relevant models and evidence

125. JGN's preferred approach has regard to all relevant models and evidence, and uses this material for its proper purpose. Each of the relevant return on equity models is independently used to derive an estimate of the required return on equity, while other relevant evidence is used to determine the best estimate of each parameter within these models.

Our approach should deliver the best estimate and is supported by expert advice

126. JGN considers that this approach will deliver the best estimate of the return required by equity-holders in a benchmark efficient entity, with a similar degree of risk as that which applies to JGN in respect of the provision of reference services, having regard to prevailing conditions in the market for equity funds. JGN also considers that this approach is consistent with the intent of the new rate of return rules framework.

127. This approach is based on expert advice, from SFG. SFG states that this approach will deliver the best estimate of the required return on equity for JGN, having regard to prevailing market conditions.[62]

5.2 APPLICATION OF JGN'S PREFERRED APPROACH

5.2.1 ESTIMATION OF MODEL PARAMETERS FOR RELEVANT RETURN ON EQUITY MODELS

128. The relevant models for estimating the required return on equity are identified above and in the AER's rate of return guideline. Below are our positions on the best estimates of each parameter within these models.

[62] SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

5.2.1.1 Risk-free rate (for SL CAPM and FFM)

129. JGN proposes using a conventional approach to estimating the risk-free rate. JGN will estimate the risk-free rate as the average annualised yield on 10-year CGS over the 20-day averaging period agreed with the AER. As per the rate of return guideline, we propose keeping this period confidential until it has passed. See appendix 9.02.

130. For the purposes of this submission, JGN estimates the risk-free rate based on an indicative (or sample) averaging period, being the 20 business days ending 12 February 2014 (inclusive). Based on this indicative averaging period, the risk-free rate is 4.12 per cent.

5.2.1.2 Return on the zero-beta asset (for Black CAPM)

131. The Black CAPM requires an estimate of the required return on a zero-beta asset.

132. The required return on the zero-beta asset can be estimated empirically, using data on historical returns for different classes of stock. For different time periods, stocks are divided into portfolios, with each portfolio having a different average beta, but similar other characteristics. The zero-beta return can then be estimated by comparing the portfolio returns and the return that would be expected, given the portfolio's average beta and what happens to the market return.

133. SFG Consulting recently analysed the zero-beta return, relying on data for three stock portfolios over 258 four-week periods. The three portfolios comprise stocks with approximately the same industry, size and book-to-market ratio, but which have high, medium or low beta estimates. This allowed SFG to estimate the zero-beta return, while controlling for other characteristics that have been shown to impact stock returns.

134. SFG estimates that over the period it used for estimation, the **return on the zero-beta asset was 9.36 per cent per annum**. Over the same period, the average yield on 10-year government bonds was 6.02 per cent. This implies a **premium of 3.34 per cent to the risk-free rate over the sample period**.

135. Further detail on SFG's methodology is provided in the accompanying expert report.[63]

5.2.1.3 Market return (for SL CAPM, Black CAPM and FFM)

136. Each of the SL CAPM, Black CAPM and FFM require an estimate of the required return on the market portfolio of risky assets.

Guideline provides an estimate of the MRP

137. JGN notes that the AER's rate of return guideline does not include estimates of the market return, and instead includes an indicative point estimate for the MRP.

138. However the MRP is not a parameter in its own right in either the SL CAPM, the Black CAPM or the FFM. Rather, the MRP represents the difference between two independent parameters. The MRP is simply the difference between the expected market return and the risk-free rate (or zero-beta return, in the case of the Black CAPM) at any point in time.

We focus on the required return on the market portfolio, consistent with the relevant return on equity models

139. JGN estimated the required return on the market portfolio (not the MRP), since this is what the relevant models require. However, we note that much of the evidence required to estimate the market return is similar to that

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63 SFG, *Cost of equity in the Black Capital Asset Pricing Model*, May 2014, appendix 9.6.

used by the AER to estimate the MRP. This is because, as noted above, the MRP is a function of the market return and the risk-free rate (or zero-beta return, in the case of the Black CAPM).

140. Therefore the discussion below refers to the AER's treatment of certain evidence in relation to the MRP in its rate of return guideline, insofar as this same (or similar) evidence is relevant to estimation of the market return.

There is a range of relevant sources of evidence

141. JGN considers that the three most relevant sources of evidence on the required market return are:

- historical market returns—both as an absolute and relative to the risk-free rate
- forward-looking estimates of the required market return, using the DDM, and
- evidence of market expectations of required returns—which may be drawn from independent expert reports prepared for valuation purposes.

142. Table 5-1 shows current estimates of the required return on the market portfolio from each of the relevant sources of evidence referred to above.

Table 5-1: Current estimates of the required market return, from relevant evidence

Evidence source	Estimate	Notes
Historical average excess return (over the risk-free rate), added to the prevailing risk-free rate	10.75%	Recent analysis by SFG, based on historical data compiled by NERA indicates a range for the historical average excess return of 6.1–6.8 per cent, grossed up based on a theta value of 0.7 (per the AER rate of return guideline).[64] The estimate depends on the time period used for estimation of the excess return. SFG recommends using a longer time period for estimation (period from 1883 to 2013, inclusive), and recommends grossing up the estimate based on a theta value of 0.35 (the lower theta value reduces the grossed up value). On this basis, SFG estimates the historic average excess return to be 6.63 per cent.[65] Adding SFG's estimate of the historic average excess return to the prevailing risk free rate of 4.12 per cent results in an estimate of the overall market return of 10.75 per cent.
Historic average market return (Wright approach)	11.71%	Recent analysis by SFG, based on historical data compiled by NERA indicates a value for the historical average market return of 11.71 per cent.[66] As for SFG's estimates of the historic excess return, this is based on a longer time period for estimation (period from 1883 to 2013, inclusive) and grossing up based on a theta value of 0.35 (the lower theta value reduces the grossed up value).

64 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [191], appendix 9.4; NERA, *The Market Risk Premium: Analysis in Response to the AER's Draft Rate of Return Guidelines: A report for the Energy Networks Association*, October 2013.

65 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [204], appendix 9.4.

66 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [233], appendix 9.4; NERA, *The Market Risk Premium: Analysis in Response to the AER's Draft Rate of Return Guidelines: A report for the Energy Networks Association*, October 2013.

Evidence source	Estimate	Notes
DDM estimate of required market return	11.42%	Recent analysis conducted by SFG indicates the current required return on the market to be 11.42 per cent (grossed up for the value of imputation credits, assuming a theta value of 0.35).[67] The methodology employed by SFG in this report is state-of-the-art, and has recently been published in a peer reviewed journal.[68] The SFG methodology overcomes many of the perceived shortcomings in previous DDM analyses. In particular, this methodology avoids the need to make any assumption regarding future growth in dividends, as it instead draws on analyst forecasts of earnings, dividends and price targets to derive estimates of long-term growth that reflect independent analysts' views. SFG also conduct their analysis on the basis of both constant growth assumptions and mean reversion assumptions (addressing one the key concerns expressed by Associate Professor Lally regarding the reasonableness of the constant growth assumptions implicit in earlier analyses). The AER conducts its own DDM analysis, which indicates a range for the MRP as at December 2013 of 6.1–7.5 per cent, which implies a range for the market return of 10.2–11.6 per cent (based on prevailing risk-free rate over that period of approximately 4.12 per cent).[69] However, JGN notes that SFG has conducted a thorough reconciliation of the AER method with its own methodology, and has identified weaknesses in the AER method.[70] Therefore, JGN proposes placing greater weight on the results of the SFG analysis.
Independent expert valuation reports	11.2%	In a review of independent expert reports conducted in 2013, SFG finds that the average market return on equity in independent expert reports since 2008 is 11.2 per cent.[71] Based on an updated review by Incenta[72], SFG concludes that the best estimate of the required market return from independent expert report continues to be 11.2 per cent.[73] This is based on grossing up an MRP value of 6 per cent (which SFG considers to be conservative) for imputation credits based on theta of 0.35, and adding the prevailing risk-free rate.

143. Based on the above evidence, JGN considers that **the best estimate of the required market return at the current time is 11.33 per cent**. This is the estimate recommended by SFG based on its review of the available evidence.[74]

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67 SFG, *Alternative versions of the dividend discount model and the implied cost of equity*, May 2014, appendix 9.8.

68 Fitzgerald, Gray, Hall, Jeyaraj, '*Unconstrained estimates of the equity risk premium*', *Rev Account Stud* (2013) 18:560–639.

69 AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix E, p. 119.

70 SFG, *Reconciliation of dividend discount model estimates with those compiled by the AER*, 10 October 2013.

71 SFG, *Evidence on the required return on equity from independent expert reports: Report for the Energy Networks Association*, 24 June 2013.

72 Incenta, *Update of evidence on the required return on equity from independent expert reports*, May 2014, appendix 9.9.

73 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [321], appendix 9.4.

74 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [335], appendix 9.4.

144. The proposed estimate is approximately halfway between the estimates produced by each of the approaches based on historical data. The proposed estimate is also relatively close to each of the estimates that are based on forward-looking evidence (i.e., the DDM estimate and evidence from recent independent expert valuation reports).

145. JGN notes that the AER also refers to three other potential sources of evidence in its rate of return guideline—survey evidence, 'conditioning variables' such as credit spreads and dividend yields, and other regulators' estimates of the MRP.[75] In relation to these other forms of evidence:

- **Survey evidence**. None of the survey evidence currently available is sufficiently reliable for it to be given any weight. As noted by SFG, none of the available surveys fare well against the criteria that have been set out by Tribunal for use of this type of evidence[76], and therefore it would be dangerous to place any determinative weight on the results of these surveys.[77]
- **Conditioning variables.** JGN does not propose to give conditioning variables any weight in estimating the current market return for two reasons. Firstly, at the current time, how information from these variables could be used to inform market return estimates is unclear, and the rate of return guideline does not clarify how information from these variables is intended to be or could be used. Secondly, the information provided by these variables may be captured in other measures that JGN proposes to take into account in any event (e.g. in DDM estimates of the required market return), meaning that these conditioning variables may provide no new information.[78]
- **Other regulators' estimates.** Other regulators' past estimates of the MRP are not relevant when estimating the current required return on the market portfolio. These estimates reflect past market conditions (not prevailing market conditions) and other regulators' views of relevant evidence at those points in time. To the extent that market conditions have changed or new evidence has emerged, these past decisions will not be relevant.

146. As JGN does not consider any of these sources of evidence to be relevant, they are not given any weight in formulating the proposed estimate of the market return.

5.2.1.4 CAPM equity beta (for SL CAPM and Black CAPM)

Best estimate across energy network businesses is 0.82, based on expert advice

147. JGN proposes a value for the CAPM equity beta (to be used in the SL CAPM and Black CAPM) of 0.82. This proposal is based on expert advice from Professor Stephen Gray, who has conducted a thorough empirical analysis of equity betas for energy network businesses.[79]

Estimate in guideline (of 0.7) is flawed

148. JGN does not agree with the approach taken to estimate the equity beta in the AER's rate of return guideline. This analysis is flawed in a number of respects, including:

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75 AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, p. 97.

76 For example: *Application by Envestra Limited (No 2)* [2012] ACompT 3, [162]–[163].

77 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [294], appendix 9.4.

78 For example, NERA notes that it is unclear whether implied volatility provides any information not already contained in DGM estimates of the MRP (NERA, *The Market Risk Premium: Analysis in Response to the AER's Draft Rate of Return Guidelines: A report for the Energy Networks Association*, October 2013, pp. 35–36).

79 SFG, *Equity beta: Report for Jemena Gas Networks, ActewAGL, TransGrid and Networks NSW*, May 2014, appendix 9.5.

- **Narrow sample of firms.** The sample of businesses used to derive the AER's equity beta range of 0.4–0.7 is too small. The sample used currently contains only five businesses, and as a result the statistical precision and reliability of the AER's beta estimates is compromised.
- **Variable estimate.** The estimates produced by the AER's analysis are highly variable and sensitive to methodological choices (e.g., choices as to regression technique and sampling period). This may be in part due to the very small sample size.
- **International evidence ignored.** In constructing its sample, the AER ignores relevant evidence from international energy businesses. SFG advises that international energy businesses should be included in the sample, in order to increase the sample size and improve the statistical robustness of estimates.
- **Evidence from water networks is irrelevant.** In determining its range for the equity beta for energy networks the AER takes into account irrelevant evidence from water businesses.

149. Each of these issues is discussed in greater detail in the accompanying expert report of Professor Stephen Gray.[80]

Correcting the flaws in the guideline leads to best estimate across energy network businesses of 0.82

150. Professor Gray conducts his own empirical analysis, which corrects for each of the shortcomings in the AER's analysis. In particular, Professor Gray broadens the sample of businesses to include a selection of international energy businesses, selected on the basis of their comparability to the benchmark firm.

151. Professor Gray concludes that **the best estimate of the CAPM equity beta for energy network businesses is 0.82**.[81]

Applying beta of 0.82 for JGN is conservative, as JGN's exposure to risk is likely to be higher

152. As Professor Gray's estimate of the equity beta is based on a broad sample of energy network businesses—including both gas and electricity businesses—applying it to JGN without adjustment would be highly conservative. If anything, using this estimate for JGN (a gas network business) would likely under-estimate the required return on equity for JGN. This is because gas businesses such as JGN are generally more risk-exposed than electricity businesses, and would therefore be expected to have a higher equity beta.

153. Gas distribution network businesses are generally more risk-exposed for a number of reasons, including:

- **Demand risk.** Gas distribution businesses such as JGN are generally subject to price cap regulation and are therefore more exposed to demand risk, compared to electricity network businesses, many of which are subject to revenue cap regulation. Demand risk is affected by a number of factors, including economic conditions. In a recent Discussion Paper, the Queensland Competition Authority (**QCA**) noted that for regulated businesses, the form of regulation that applies (including whether price or revenue cap applies) can significantly impact on their exposure to risk. The QCA notes that theoretical and empirical research demonstrates that, under a variety of conditions, the form of regulation and ancillary mechanisms affect the regulated firm's revenues and costs, and exposure of revenues and costs to risk factors.[82]

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80 SFG, *Equity beta: Report for Jemena Gas Networks, ActewAGL, TransGrid and Networks NSW*, May 2014, appendix 9.5.

81 SFG, *Equity beta: Report for Jemena Gas Networks, ActewAGL, TransGrid and Networks NSW*, May 2014, appendix 9.5.

82 QCA, *Discussion Paper: Risk and the Form of Regulation*, November 2012, p. vi.

- **Sensitivity to other risk factors.** Demand for capacity on gas distribution networks is directly related to demand from end-users, which can fluctuate depending on various factors, including weather, the final delivered price of gas, economic conditions, and availability and price of substitute fuels (unlike capacity on gas transmission pipelines, which in some cases is fully contracted and not subject to short-term fluctuations). Core Energy notes that the customer and demand forecasts it prepared for the next AA period are subject to a significant degree of uncertainty due the various factors that can influence demand for gas.[83] As noted above, gas distribution businesses are typically more exposed to demand fluctuations, compared to many electricity businesses, due to differences in the form of regulation (price cap vs. revenue cap).

- **Fuel of choice risk.** Gas in NSW, unlike electricity, is a fuel of choice which means that consumers can (and do) switch away from using gas if wholesale prices are too high. Core Energy notes that there is evidence of substitution away from gas to alternative fuels in a number of applications, including in relation to hot water heating and air conditioning.[84] Given that gas end-users have a choice in terms of their energy fuel, demand for capacity on gas distribution networks is likely to be more sensitive to changes in economic conditions.

- **Wholesale price risk.** Gas wholesale prices are expected to rise over the near and medium term, raising demand (and therefore cash flow) uncertainty. This is principally due to the linking of domestic and international markets, and the associated alignment of domestic prices with international market prices. For example the Grattan Institute forecasts increases in the wholesale domestic gas price of more than 80 per cent nationally over the next several years.[85] The potential for significant increases in wholesale gas prices further increases the degree of uncertainty around future demand on gas distribution networks. As gas is considered a fuel of choice, these wholesale price increases are likely to lead to further substitution away from gas to alternative fuels in many applications, thus reducing demand on gas distribution networks. There is therefore considerable uncertainty around future returns for investors (both debt and equity-holders) in gas distribution network infrastructure.

- **Supply shortfall risk.** There is also potential for gas supply shortfalls in NSW over the next AA period, particularly if production in Queensland and South Australia is prioritised for export.[86] The potential gas supply shortfalls similarly increases the degree of uncertainty around future demand on gas distribution networks.

154. For all of these reasons, we expect that gas distribution businesses such as JGN would be relatively more exposed to movements in the broad economy compared to other energy network businesses. Given this higher risk exposure, application of an equity beta and other measures of risk based on a broad sample of energy businesses is likely to be highly conservative (i.e., understate the equity beta and other risk measures for a gas distribution network like JGN).

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83 Core Energy, *Demand and Customer Forecasts – Jemena Gas Networks NSW Gas Access Arrangement 2015-2020*, April 2014, p. 10, appendix 5.1.

84 Core Energy, *Demand and Customer Forecasts – Jemena Gas Networks NSW Gas Access Arrangement 2015-2020*, April 2014, p. 34, appendix 5.1.

85 Tony Wood and Lucy Carter (Grattan Institute), *Getting gas right: Australia's energy challenge*, June 2013, p. 9.

86 The potential for gas supply shortages has been noted by AEMO. See: AEMO, *Gas Statement of Opportunities for eastern and south-eastern Australia* 2013, p. iv.

See also: P Simshauser, T Nelson, *Solving for 'x' – the New South Wales Gas Supply Cliff*, Working Paper No. 40, February 2014.

5.2.1.5 FFM coefficients

155. The FFM requires estimates of three coefficients—the FFM beta, the FFM size (SMB) coefficient and the FFM book-to-market ratio (HML) coefficient—as well as estimates of the SMB and HML factors. Each of these coefficients and factors can be estimated empirically using regression techniques and data on historical stock returns.

Recent evidence finds that the HML factor is priced in Australia and that the FFM is superior to the CAPM

156. A recent paper by Brailsford, Gaunt and O'Brien (2012) provides estimates of the factor coefficients computed monthly over a 25 year period from 1982 to 2006. This paper concludes that the HML factor is material and statistically significant. The authors state that their findings support the superiority of the FFM, relative to the CAPM.[87]

SFG report confirms that the HML factor is priced

157. SFG has extended the analysis by Brailsford et al (2012) to cover a longer period, from 1985 to February 2014. Based on analysis of this extended sample, SFG estimate:

- a market exposure factor of 4.74 per cent
- a size exposure factor of -0.19 per cent, and
- a book-to-market exposure factor of 1.15 per cent.

158. These estimates of the FFM factors are based on the extended dataset compiled by SFG, and weighting of estimates from Australian-listed firms and US-listed firms. As explained by SFG, double the weight is placed on Australian observations, compared to US observations. [88]

159. A detailed explanation of SFG's methodology is set out in the accompanying expert report of Professor Stephen Gray and Dr Jason Hall.[89]

5.2.1.6 DDM estimates of required return on equity

160. The DDM can derive an estimate of the required return on equity for the benchmark firm, as well as for the wider market.

SFG approach is state-of-the-art

161. SFG provided estimates for the benchmark firm, using the same methodology it used to derive estimates for the wider market. As noted in Table 3-1, this methodology is state-of-the-art, and was recently published in a peer reviewed journal.[90] The SFG methodology overcomes many of the perceived shortcomings in previous DDM analyses, including in relation to future growth assumptions and mean reversion.

162. An important aspect of the SFG methodology is the incorporation of an eight-year transition period over which parameter inputs gradually revert to long-term estimates. This transition approach is consistent with the AER's

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87 Brialsford, Gaunt, O'Brien, '*Size and book-to-market factors in Australia*', *Australian Journal of Management*, 37(2) 261–281.

88 SFG, *The Fama-French model: Report for Jemena Gas Networks, ActewAGL, Ergon, Transend, TransGrid, and SA Power Networks*, May 2014, pp. 42–43, appendix 9.7.

89 SFG, *The Fama-French model: Report for Jemena Gas Networks, ActewAGL, Ergon, Transend, TransGrid, and SA Power Networks*, May 2014, appendix 9.7.

90 Fitzgerald, Gray, Hall, Jeyaraj, '*Unconstrained estimates of the equity risk premium*', *Rev Account Stud* (2013) 18:560–639.

three-stage DDM, and SFG considers it superior to the AER's two-stage model. SFG considers that this approach will lead to the most reliable return on equity estimates.[91]

163. This methodology is described in greater detail in the accompanying expert report of Professor Stephen Gray and Dr Jason Hall.[92]

AER concerns are overstated

164. JGN does not share the AER's concerns with the use of the DDM to estimate the required return on equity for the benchmark firm, as expressed in the rate of return guideline Explanatory Statement.[93] SFG's analysis considers each of the concerns raised by the AER, and reviewed its own methodology and amended it where necessary to address these concerns.[94]

Best DDM estimate of the return on equity is 10.91 per cent

165. Based on its state-of-the-art DDM methodology, SFG estimates the current required return on equity for the benchmark firm to be 10.91 per cent**.**[95]

5.2.2 ESTIMATION OF THE REQUIRED RETURN ON EQUITY USING RELEVANT MODELS

166. Using the above parameter estimates, each of the relevant return on equity models can be populated and used to calculate a required return on equity for JGN. These estimates are set out in Table 5-2.

Table 5-2: Required return on equity indicated by relevant models

Parameter	SL CAPM	Black CAPM	FFM	DDM
Risk-free rate	4.12%		4.12%	
Return on zero-beta asset		7.46%		
Market return (incl. imputation)	11.32%	11.32%		
CAPM equity beta	0.82	0.82		
FFM market factor			4.74%	
FFM size factor			-0.19%	
FFM book-to-market factor			1.15%	
FFM imputation adjustment[96]			1.05%	

91 SFG, *Alternative versions of the dividend discount model and the implied cost of equity: Report for Jemena Gas Networks, ActewAGL, APA, Ergon, Networks NSW, Transend and TransGrid*, May 2014, p. 7, appendix 9.8.

92 SFG, *Alternative versions of the dividend discount model and the implied cost of equity: Report for Jemena Gas Networks, ActewAGL, APA, Ergon, Networks NSW, Transend and TransGrid*, May 2014, appendix 9.8.

93 AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix E, pp. 119-125.

94 SFG, *Alternative versions of the dividend discount model and the implied cost of equity: Report for Jemena Gas Networks, ActewAGL, APA, Ergon, Networks NSW, Transend and TransGrid*, May 2014, appendix 9.8.

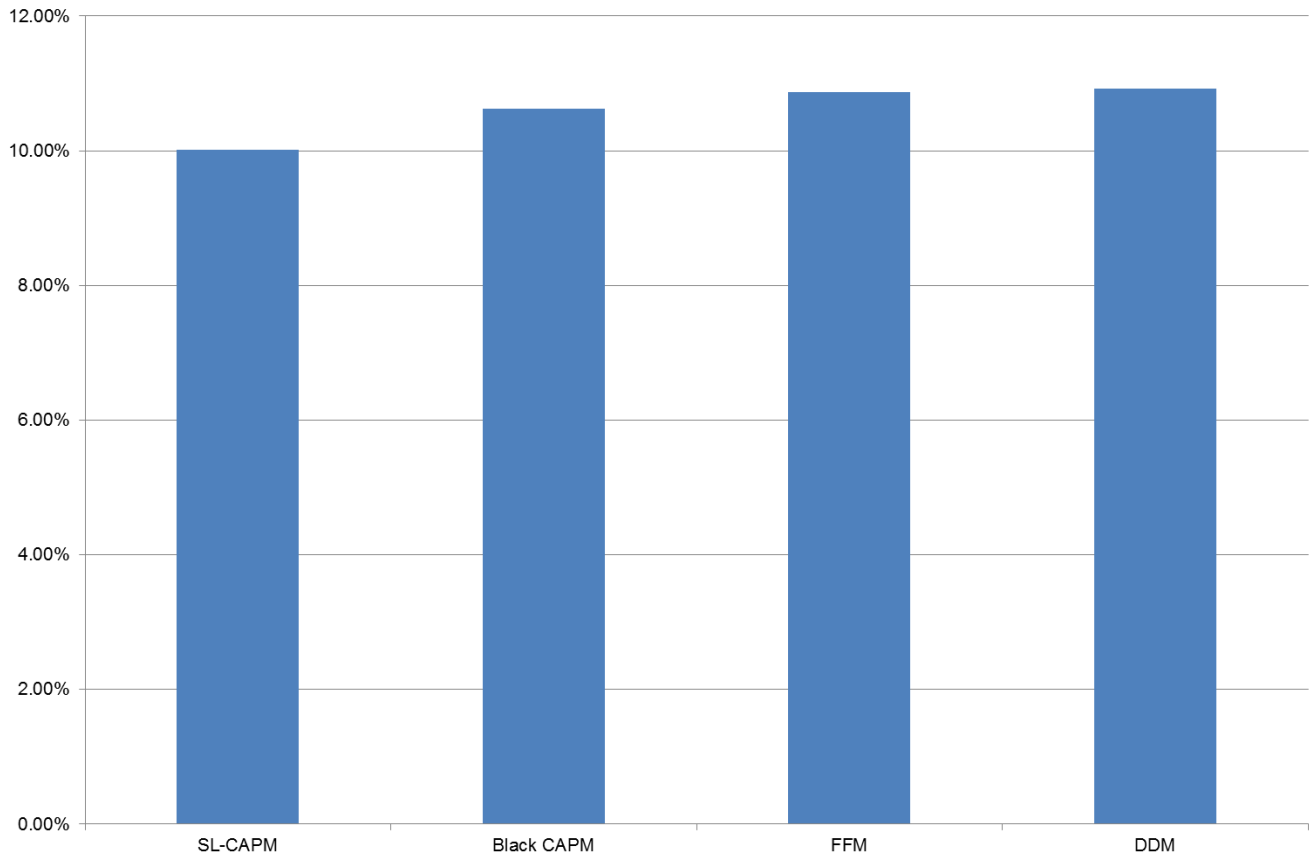
95 SFG, *Alternative versions of the dividend discount model and the implied cost of equity: Report for Jemena Gas Networks, ActewAGL, APA, Ergon, Networks NSW, Transend and TransGrid*, May 2014, appendix 9.8.

96 The imputation adjustment refers to the grossing up of the final estimate from the FFM for the value of imputation credits. This is only required for the FFM, because this models relies on an ex imputation estimate of the market return. The imputation adjustment is

Parameter	SL CAPM	Black CAPM	FFM	DDM
Required return on equity	**10.01%**	**10.62%**	**10.87%**	**10.92%**

167. Figure 5-1 compares the return on equity estimates produced by each of the relevant models. As can be seen, the estimate produced by the SL CAPM is significantly lower than the estimates produced by each of the other models, which suggests it is an outlier. The estimates produced by the Black CAPM, FFM and DDM are relatively similar (within 0.3 percentage points).

Figure 5-1: Return on equity estimates from relevant models



Source: Data extracted from SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

5.2.3 SYNTHESIS OF MODEL OUTPUTS

Each model is relevant for estimating the return on equity, but each has its own strengths and weaknesses

168. Professor Gray considers that all of these models provide evidence that is relevant to estimation of the return on equity, including because:[97]

explained in: SFG, *The Fama-French model: Report for Jemena Gas Networks, ActewAGL, Ergon, Transend, TransGrid, and SA Power Networks*, May 2014, p. 43, appendix 9.7.

[97] SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [9], appendix 9.4.

- all four models have a sound theoretical basis
- all four models have the purpose of estimating the required return on equity as part of the estimation of the cost of capital
- all four models can be implemented in practice, and
- all four models are commonly used in practice.

169. As noted above, each of the available models has well-recognised strengths and weaknesses. In particular the SL CAPM, while relatively simple, is shown to perform poorly empirically due to the constraining assumptions of the model itself. Therefore, it cannot be said that any one model is clearly superior (or inferior) to others or that only one model provides all relevant information on required return on equity.

Given there is no clearly superior or inferior model (in terms of the relevant information provided), positive weight must apply to each

170. In circumstances where there are multiple models or methodologies that are all directed at a common objective—but which all have similar degrees of strengths and weaknesses along different dimensions—it is appropriate to assign some positive weight to each one. Put another way, if there is no clear basis to distinguish one method or model over others in terms of its likelihood of producing outcomes that contribute to the rate of return objective, it is appropriate to give some weight to each model or method. JGN notes that this is consistent with the approach previously taken by the Tribunal to deciding between alternative models or methods.[98]

171. In the current circumstances there is no evidence to demonstrate that any one model is clearly superior to others, or that one model contains all relevant information. On the contrary, the expert evidence demonstrates that there are multiple models that provide relevant information as to the required return on equity, and that each of the models has strengths and weaknesses.[99] The recommendation of JGN's expert, Professor Stephen Gray and Dr Jason Hall, is that all of the relevant models should be given some weight.[100]

172. Certainly, it cannot be said that the SL CAPM is so superior to the other models, such that it deserves to be given 100 per cent weight. The SL CAPM has a number of well-recognised limitations, and is known to perform poorly against empirical data. It is for this reason that other models—notably the Black CAPM and FFM—were developed to overcome these known limitations. JGN considers that in light of current evidence as to the limitations of the SL CAPM (and the availability of other models designed to overcome these limitations) it is unreasonable to assign 100 per cent weight to this model when estimating the return on equity.

173. JGN therefore proposes an approach to estimating the return on equity that gives real weight to each of the relevant models. JGN considers that this approach is more like to produce a return on equity that contributes to the achievement of the allowed rate of return objective, and reflects prevailing conditions in the market for equity funds.

We propose a return on equity of 10.71 per cent

174. JGN proposes weighting the output of each of the relevant models, based on expert advice from Professor Stephen Gray and Dr Jason Hall.

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98 Application by ActewAGL Distribution [2010] ACompT 4, [78]. In that case, the Tribunal was considering alternative methods for estimating the return on debt. The Tribunal noted that if there was no basis to distinguish the alternative methods, then taking an average would be appropriate.

99 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, [359], appendix 9.4.

100 SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

175. Professor Gray and Dr Hall recommend weights to be assigned to the outputs of each model, based on their relative strengths and weaknesses. The recommended weights are set out in Table 5-3 below, and detailed explanation for these weightings is provided in the accompanying expert report of Professor Gray and Dr Hall.[101]

Table 5-3: Return on equity estimates and weightings

Model	Return on equity estimate	Weighting
Sharpe-Lintner CAPM	10.01%	12.5%
Black CAPM	10.62%	25.0%
Fama-French three-factor model	10.87%	37.5%
Dividend discount model	10.92%	25.0%
Weighted average	**10.71%**	**100.0%**

Source: SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

176. On this basis, JGN proposes a return on equity of 10.71 per cent for the purposes of estimating the required rate of return. JGN considers that this is the best estimate of the return that required by equity-holders in a benchmark efficient entity, with a similar degree of risk as that applies to JGN when providing reference services and having regard to prevailing conditions in the market for equity funds.

[101] SFG, *The required return on equity for regulated gas and electricity network businesses*, June 2014, appendix 9.4.

6. JGN'S ALTERNATIVE POSITION—AMENDED APPLICATION OF THE FOUNDATION MODEL APPROACH

177. We explain above why we do not agree with the AER's 'foundation model' approach to estimating the return on equity. JGN therefore proposed an alternative approach that better considers all relevant evidence, models and methods, and which is more likely to produce a return on equity that promotes the rate of return objective.

178. However, in the event that the AER is minded to maintain its foundation model approach when estimating a return on equity for JGN, there are certain minimum amendments needed for this approach to produce a return on equity that promotes the rate of return objective. These are set out below.

179. Importantly, this approach (of making minimum amendments to the foundational model approach) is not recommended by Professor Gray, or any other expert that we are aware of. Rather, this represents JGN's view as to the 'second best' alternative to our proposed method above.

6.1 MINIMUM AMENDMENTS REQUIRED TO THE FOUNDATION MODEL APPROACH

6.1.1 ADJUSTMENT TO CAPM EQUITY BETA

Should adjust the SL CAPM parameters if it is to be used as the only model

180. If the SL CAPM is used as the only model for estimating the required return on equity, adjustments are needed to the CAPM equity beta to account for the implicit bias in this model.

181. As noted above, it is widely recognised by academics and market practitioners that the SL CAPM produces downwardly biased estimates of the return on equity for low beta stocks. This is in part due to the assumption underpinning the SL CAPM that the return on a zero-beta stock equals the risk-free rate. The SL CAPM has also been shown to under estimate the required return on value stocks.

182. To account for these biases a number of adjustments to the SL CAPM have been proposed and applied in practice and alternative models have been developed. These include adjustments for low beta bias (as overcome in the Black CAPM) and for value bias (as overcome in the FFM).

AER recognises limitations with the SL CAPM, but adjusts for these incorrectly

183. The AER recognise limitations of the SL CAPM and accounts for this in its rate of return guideline by having regard to evidence from the Black CAPM in determining its point estimate for the equity beta.[102]

184. However, the way in which the AER does this means that all of the limitations of the SL CAPM cannot be fully accounted for. The Black CAPM is only used to inform the selection of a point estimate from within a range of SL CAPM betas that was pre-determined by the AER—and therefore even the selection of an estimate at the top of the range will lead to estimates that are afflicted by the inherent methodological shortcomings of the SL CAPM.

[102] AER, *Explanatory Statement: Rate of Return Guideline*, December 2013, p. 86. The AER states that one of its reasons for adopting a point estimate for beta at the upper end of its range is that the theoretical principles underpinning the Black CAPM suggest that the SL CAPM may underestimate the return on equity for firms with equity betas below 1.

SFG overcomes these limitations by correctly adjusting the equity beta

185. SFG takes an alternative approach to accounting for the known limitations in the SL CAPM.

186. SFG separately estimates the CAPM equity beta which, if applied in the SL CAPM, would produce the same estimate of the return on equity as each of the other return on equity models.[103] In effect, SFG adjusts the equity beta so that the limitations of the SL CAPM are accounted for in the same way as in the other relevant models.

187. In this way, SFG produces:

- an equity beta estimate that is adjusted for the low-beta bias in the SL CAPM, in the same way as the Black CAPM accounts for this
- an equity beta estimate that is adjusted for evidence of a value premium, in the same way as the FFM accounts for this, and
- an equity beta that is adjusted to account for contemporaneous evidence from the DDM.

188. SFG then takes a weighted average of these adjusted equity beta estimated, and on this basis calculates an adjusted SL CAPM equity beta of 0.91.[104]

6.1.2 USE OF UPDATED EVIDENCE ON MARKET RETURN

189. As noted above, the SL CAPM (like the Black CAPM and FFM) requires an estimate of the required market return. This must be an estimate of the *current* market return, in order for the return on equity to reflect prevailing market conditions.

Best estimate of the required return on the market is 11.32 per cent

190. Based on the above evidence, JGN considers that **the best estimate of the required market return at the current time is 11.32 per cent**.

191. This is the estimate recommended by Professor Gray and Dr Hall based on their updated DDM analysis, and it is also well within the range indicated by the AER's DDM analysis. This estimate is also within the range of historical market returns indicated by the AER's analysis (albeit towards the lower end of this range) and slightly below the range indicated by NERA's analysis of the historical returns data. Our proposed estimate is also very close to average market expectations of forward-looking returns, as indicated by SFG's recent review of independent expert reports.

6.2 RETURN ON EQUITY FOR JGN, BASED ON AMENDED FOUNDATION MODEL APPROACH

192. Applying a CAPM equity beta of 0.91, market return estimate of 11.32 per cent and risk free rate of 4.12 per cent, the SL CAPM produces a return on equity estimate of 10.71 per cent.

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103 SFG, *Equity beta: Report for Jemena Gas Networks, ActewAGL and Networks NSW*, May 2014, [376]–[382], appendix 9.5.

104 SFG, *Equity beta: Report for Jemena Gas Networks, ActewAGL and Networks NSW*, May 2014, [383], appendix 9.5.